Oct. 10, 1933. W. R. WALKER 1,930,435

MERCURY SWITCH

Filed July 26, 1929

Fig. 1

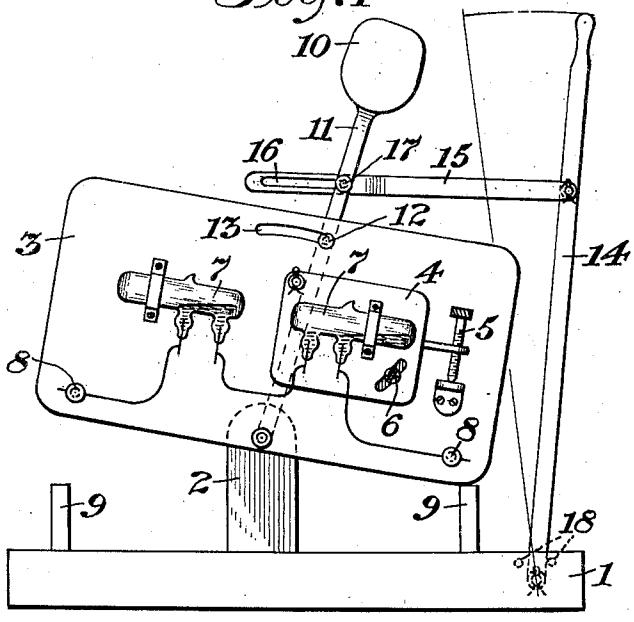


Fig. 3

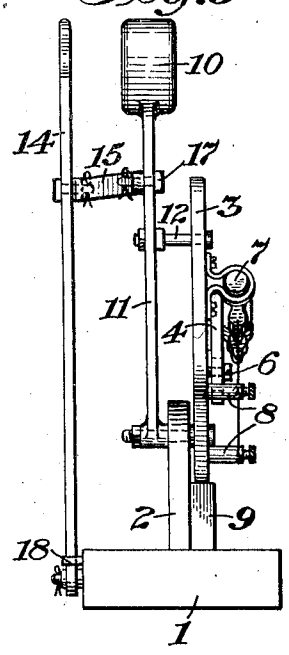
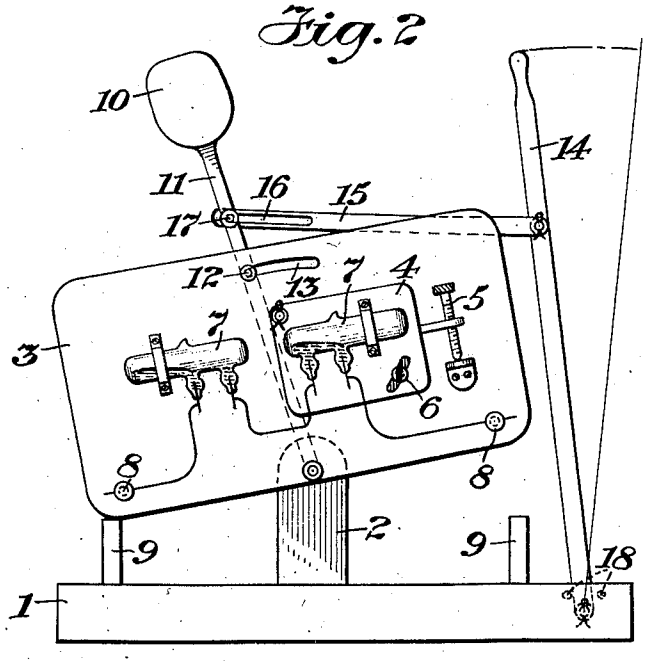


Fig. 2



INVENTOR
Warren R. Walker
BY
Thos. H. Brown
HIS ATTORNEY

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MERCURY SWITCH

Warren R. Walker, Short Hills, N. J., assignor to General Electric Vapor Lamp Company, a corporation of New Jersey

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12 Claims. (Cl. 200—33)

The present invention relates to electric switches, and particularly to a combination of switches of the liquid flow type.

A particular object of the invention is to provide apparatus for momentarily closing an electrical circuit. A further object of the invention is to provide means whereby the momentary interval may be varied as desired. Other objects and advantages of the invention will appear from the following detailed description or from an inspection of the accompanying drawing.

The invention consists in a new and novel combination of parts as hereinafter set forth and claimed.

For certain purposes, such as the electrical welding of small articles, it is necessary to pass a current of short duration through an electrical circuit. These intervals are frequently very short, so that automatic means for determining the interval is essential to avoid great irregularities. Various suggestions have been made for apparatus to produce the desired momentary contact, some of them involving the use of special types of fluid flow switches. These switches have been so designed as to cause a conducting fluid body to move across two electrical contacts under the influence of gravity, the circuit being momentarily closed by the moving fluid. Since it is impossible to greatly vary the duration of the contact in such a switch, once the switch is made, it has been necessary to especially design a switch for each time interval required, an inherent disadvantage which has seriously impaired the usefulness of this type of switch. In endeavoring to overcome this difficulty while still retaining the many advantages of fluid flow switches I have discovered that the desired momentary contact may be attained by mounting two fluid flow switches of any standard type in such relation to each other that any movement which tends to close the circuit in one will tend to open the circuit in the other, and that by varying the angular relationship of the switches any desired variation in the circuit making period may be obtained. This combination of switches may be operated by any of the means which have been utilized for the specially designed switch which it is designed to supplant. For best results, however, it is essential that these switches should be operated in a manner which can be readily duplicated at each actuation thereof, since the speed with which the switches are moved will vary the contact making interval to some extent. I have, therefore, devised a simple mechanism in which the switches are operated by a suitable means, such as a falling weight, which is so arranged as to be independent of the operator in so far as rate of movement of the switches is concerned.

For purposes of illustration I have shown one form of my novel switch combination, with a preferred type of actuating means therefor, in the accompanying drawing, in which

Fig. 1 is a front elevation, showing the switch combination in one position of rest,

Fig. 2 is a similar view to Fig. 1, but showing the switch combination at its other position of rest, and

Fig. 3 is a side elevation of the apparatus, in the position shown in Fig. 1.

In the drawing a base member 1 has mounted thereon a standard 2 which pivotally supports the rectangular plate 3 at a point considerably below the center of gravity of said plate. A smaller rectangular plate 4 is pivotally mounted on this plate 3, its relative position thereto being fixed by the adjusting screw 5 and the clamping screw 6. A mercury switch 7 of a well known commercial type is mounted on this plate 4, while a similar switch 7 is mounted in a reverse manner directly on the plate 3, said switches 7 being connected in series between the binding posts 8, to which the external leads are to be connected. At either of the limits of travel of the plate 3, which are fixed by the stops 9 mounted on the base 1, one of the switches 7 is in an open circuit position, so that the circuit between the binding posts 8 is interrupted.

Uniform actuation of the plate 3 from one position of rest to the other is conveniently obtained by the utilization of gravity, acting upon a weight 10 at the upper end of an arm 11 which is pivotally supported at its lower end by the standard 2. At an intermediate point said arm 11 carries a pin 12 which engages an arcuate slot 13 in the plate 3, said slot being so designed as to allow free movement of the pin 12 therein while the weight 10 is being moved upward from either position of rest, but engaging said pin as the weight 10 passes dead center, so as to cause actuation of said plate 3 to its other position of rest by the falling weight 10. An operating lever 14 is pivoted at its lower end to the base member 1. A link member 15 is connected to an intermediate point on the lever 14, a slot 16 in the other end thereof engaging a pin 17 on the arm 11. Said slot 16 is so designed as to engage the pin 17 as the operating lever is moved from one position of rest toward the other, thus raising the weight 10, until said weight 10 begins

to fall of its own weight, said slot then allowing free movement of said pin 17 to the limit of travel, as determined by the stops 9, without further movement of the lever 14. Stops 18 are arranged on the base 1 to arrest movement of the lever 14 at this point for each direction of travel.

In the use and operation of this device to allow a momentary flow of current through any apparatus which may be associated therewith by connection to the binding posts 8, with the parts in the various positions of rest shown in Fig. 1, the complete operation is produced by moving the operating lever 14 to the left against the opposite stop 18. As said lever 14 is thus moved the near end of the slot 16 engages the pin 17 on the arm 11, raising the weight 10 until said weight passes the dead center, the pin 17 then moving freely to the far end of the slot 16 as the weight 10 carries the arm 11 to its other limit of travel. The plate 3 does not follow this movement of the arm 11 at first since the pin 12 is moving freely in the slot 13, but as the weight 10 passes dead center the pin 12 engages the far end of said slot 13, allowing the weight 10 to carry the plate 3 to its other position of rest, as shown in Fig. 2. As the plate 3 is thus moved the mercury in the switches 7 is caused to flow from one end thereof to the other. If the relative angular position of said switches is correct the flow of mercury in the right hand switch 7 will close the circuit through said switch a moment before the flow of mercury in the left hand switch 7 opens the circuit therein, so that the circuit is momentarily closed between the binding posts 8. The duration of this circuit making interval may be easily adjusted by rotation of the plate 4, so as to cause the make and break in the switch 7 carried thereby to occur at an earlier or later time with respect to the break and make in the other switch 7. The timing may also be varied by changing the weight 10 or the length of the arm 11. It is, however, reasonably independent of variations in the speed of movement of the operating lever 14.

When the arm 14 is returned from the position shown in Fig. 2 to that shown in Fig. 1 the circuit between the binding posts 8 is again momentarily made, the movements being similar to those in the reverse direction. The far end of the slot 16 in this case engages the pin 17, moving the arm 11 and weight 10 to a point just over the dead center position, the pin 12 at this moment engaging the right hand end of the slot 13, allowing the weight 10 to move the plate 3 into the other position of rest, as shown in Fig. 1. The mercury in the switches 7 thus flows back to the right hand end thereof, first closing the circuit in the left hand switch 7, and then opening it in the right hand switch 7, so that the circuit between the binding posts 8 is again momentarily closed.

With this construction it is obvious that the duration of the circuit making interval through the combined apparatus is independent of the mode of operation of the lever 14, and that various other operating controls, such as push button mechanism or chain pull and ratchet mechanism, may be substituted therefor. It is also obvious that other types of mercury or other fluid switches may be used in place of those used for purposes of illustration. Various other changes, omissions and substitutions, within the scope of the appended claims, may also be made by those skilled in the art without departing from the spirit of my invention.

I claim:

1. Electric circuit making and breaking apparatus comprising a pivoted support having two fluid flow switches mounted thereon, the relative position of said switches being adjustable, said switches being connected in series and so arranged with respect to each other that the fluid in one switch tends to move to a circuit making position when the fluid in the other tends to move to a circuit breaking position, whereby said switches cooperate when said support is tilted to permit current flow for a predetermined time interval.

2. Electric circuit making and breaking apparatus comprising a pivoted support having two fluid flow switches mounted thereon, the relative position of said switches being adjustable, said switches being connected in series and so arranged with respect to each other that movement of said support causes a circuit to be made through one of said switches while a circuit is maintained in the other of said switches, further movement of said support causing the circuit to be opened in last said switch, whereby said switches cooperate when said support is tilted to permit current flow for a predetermined time interval.

3. In electric circuit making and breaking apparatus, in combination, a pivoted support having two fluid flow switches mounted thereon, the relative position of said switches being adjustable, said switches being connected in series and so arranged with respect to each other that the fluid in one switch tends to move to a circuit making position when the fluid in the other switch tends to move to a circuit breaking position, means to move said support in a predetermined manner and means, whereby said switches cooperate when said support is tilted to permit current flow for a predetermined time interval to actuate last said means.

4. In electric circuit making and breaking apparatus, in combination, a pivoted support having two fluid flow switches mounted thereon, said switches being connected in series and so arranged with respect to each other that the fluid in one switch tends to move to a circuit making position when the fluid in the other switch tends to move to a circuit breaking position, means independent of said support to store a predetermined amount of energy and means to apply said stored energy to move said support, whereby said switches cooperate when said support is tilted to permit current flow for a predetermined time interval.

5. In an electric circuit making and breaking apparatus in combination, a pivoted support having two fluid flow switches mounted thereon, said switches being connected in series and so arranged with respect to each other that the fluid in one switch tends to move to a circuit making position when the fluid in the other switch tends to move to a circuit breaking position, means to move said support comprising a weight, means to raise said weight and means to release said weight after raising it a predetermined distance.

6. In electric circuit making and breaking apparatus, in combination, a pivoted support, means to move said support from one position of rest to another, the rate of movement of said support therebetween being independent of the rate of movement of said moving means and two fluid switches on said support, said switches being con-

nected in series and so arranged with respect to said support that movement thereof in either direction causes a circuit to be made in one switch and to be broken in the other.

7. In combination in apparatus for making and breaking an electric circuit, a liquid flow switch, a pivoted support therefor, means independent of said support to store a predetermined amount of energy, means to apply said stored energy to move said support as soon as said energy storage is complete, and means to prevent further energy input to said storing means during the movement of said support, whereby said support is moved solely by said stored energy.

8. In combination in apparatus for making and breaking an electric circuit, a liquid flow switch, a pivotal support therefor, and means to move said switch comprising a weight, means to raise said weight, means to release said weight after raising it a predetermined distance and means connecting said switch and said weight for simultaneous movement thereof after release of said weight.

9. In electric circuit making and breaking apparatus, in combination, a pivotal support, a fluid flow switch on said support, and operating means therefor comprising a movable member, means to connect said member to an energy storing means, means independent of movement of said movable member to disengage last said means from said movable member after a predetermined movement thereof and means to apply said stored energy to move said switch after said energy storing means and said movable member are disengaged.

10. In electric circuit making and breaking apparatus, in combination, a pivoted support, a fluid flow switch on said support, a weight pivoted at a point below its center of gravity, means to lift said weight to substantially dead center, means to allow free fall of said weight therefrom and means to engage said weight with said pivoted support for movement therewith as said weight starts to fall.

11. In electric circuit making and breaking apparatus, in combination, a pivotally mounted liquid flow switch and means to move said switch comprising an energy storing means tending to move to positions of rest on either side of a neutral position, means to move said means independently of said switch from either position of rest toward said neutral position, means to disengage said last mentioned means from said energy storing means as the latter passes said neutral position, and means to connect said switch to said energy storing means for movement therewith immediately after said energy storing means is disengaged from said moving means.

12. In electric circuit making and breaking apparatus, in combination, a pivotally mounted liquid flow switch and means to move said switch comprising a weight pivoted to fall either side of dead center, means to lift said weight from either side to substantially dead center, means to disengage said last mentioned means from said weight when said weight passes dead center, and means to engage said switch and said weight for simultaneous movement as said weight starts to fall in either direction and to disengage said switch and said weight when said weight is being raised.

WARREN R. WALKER.