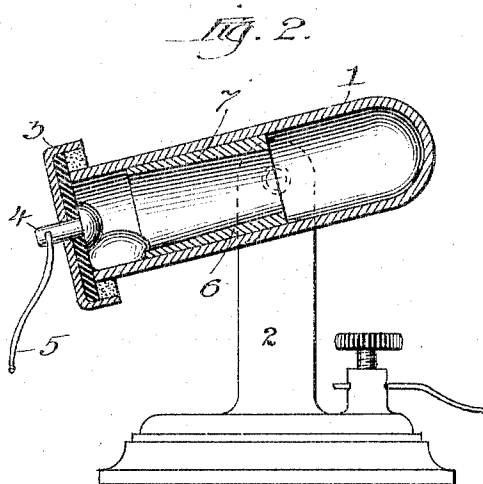
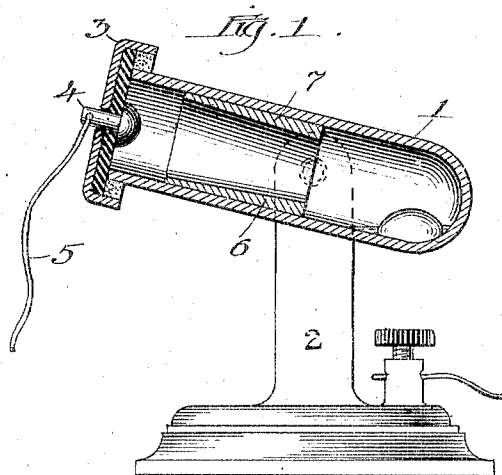


No. 788,612.

PATENTED FEB. 28, 1905.

P. L. CLARK.
ELECTRIC SWITCH.
APPLICATION FILED JUNE 23, 1904.



Witnesses:
Frank S. Blanchard
Fred S. Fischer

Inventor:
Percy L. Clark
By Burton & Burton
Attorneys.

UNITED STATES PATENT OFFICE.

PERCY L. CLARK, OF BRISTOL, CONNECTICUT, ASSIGNOR TO A. L. CLARK,
OF ELGIN, ILLINOIS.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 783,612, dated February 28, 1905.

Application filed June 23, 1904. Serial No. 213,751.

To all whom it may concern:

Be it known that I, PERCY L. CLARK, a citizen of the United States, residing at Bristol, in the county of Hartford and State of Connecticut, have invented new and useful Improvements in Electric Switches, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved construction of an electric switch of the class in which the circuit-closing element is a liquid—mercury, for example—which connects the electrodes in a chamber in which such liquid is contained when the circuit is to be closed and in which relative movement occurs between the liquid and one or both of the electrodes for breaking the circuit. It consists of the features of construction set out in the claims.

In the drawings I have shown a liquid-contact chamber of a familiar form, Figure 1 being a side elevation of the same, and Fig. 2 a vertical longitudinal section.

This liquid-contact device comprises an iron or steel chamber 1, pivotally mounted upon a carrier or standard 2 at a line transverse to the axis of the cylindrical chamber, so that as the chamber rocks or is tilted over its pivot the mercury which is contained in the chamber is caused to flow or roll from one end to the other of the chamber. Preferably when such a switch is used to control a winding device for a train operated in the running down of the motor which is wound the liquid-contact chamber is constructed and its pivot is located so that it is practically balanced when the mercury is at the end opposite the contact end—that is, when the switch is open—that end, however, being lower than the opposite end at that position. When thus constructed and mounted, the power exerted during the running down of the motor for tilting the chamber to position to cause the mercury to flow to the contact end is only that which is necessary to overcome the negligible resistance from the friction and inertia—that is, no weight has to be lifted—and this is therefore

the most economical construction of such a device, and the drawings are intended to show it in this form. The chamber 1 is constructed so as to be integrally inclosed at one end, and it is closed at the other end by a cap 3, through which an electrode 4, insulated from the chamber, protrudes thereinto, such electrode being connected at the outer end, by means of a wire 5, with the circuit which is to be closed and opened by the tilting of the chamber, the other end of the circuit-wire being connected to the standard on which the chamber tilts, thus causing the chamber itself to become the other electrode. The chamber is preferably provided with a dam or partial obstruction 6 intermediate the ends of the cavity. This dam is preferably formed, as illustrated by a sleeve 7, interiorly tapered conically from a feather-edge to a reduced aperture at the opposite end, the same being fitted tightly within the chamber 1, with the end having the smaller aperture forming an abrupt shoulder facing away from the end at which the insulated electrode enters, so that the sloping inner face of the sleeve faces toward said electrode. The purpose of this is set out in my pending application, Serial No. 183,451, filed December 2, 1903, to arrest the mercury when the chamber is tilted in direction to cause the mercury to flow toward the contact end—the end having the insulated electrode—by causing it to accumulate behind the abrupt shoulder of the dam until the chamber is tilted far enough to cause the globule thus accumulated to rise over the shoulder, so that it will pass quickly and in a body down the incline to the contact end, thus rendering the contact as complete and as nearly instantaneous as possible. This feature of the construction is not claimed in this application, being part of the subject-matter of my said former application, Serial No. 183,451.

In the construction of these liquid-contact devices the chamber may be exhausted of air as perfectly as possible, and the cap is sealed on it, so as to retain the vacuum as perfectly as possible, this being desirable in order to prevent the oxidation of the mercury upon

the passing of the spark between the same and the insulated electrode at each tilting of the chamber to circuit-closing position; but notwithstanding the most perfect vacuum and the most perfect means for retaining such vacuum it is a matter of experience in the use of these devices heretofore that there is formed gradually in the chamber some substance which after a short time materially interferes with the contact and in a longer or shorter time so impairs it that the device becomes ineffective for the purpose of closing the circuit. It is probable that the substance thus formed is black oxid of mercury; but whether it be this or some other or amorphous form of mercury, possibly due to crystallization resultant from the repeated electric shocks, I have not been able to determine; but in any event it is a very fine, almost invisible, and utterly impalpable powder, and its presence in any visible quantity is fatal to the effective operation of the device. To overcome this difficulty and defect in all former devices of this sort, I place in the chamber with the mercury a quantity of other liquid. I have used with success a very fine quality of clock-oil in small quantity. The amount of such oil present in the chamber may be so small as to be almost invisible. It need be enough merely to slightly smear the inner surface of the chamber 1. Such liquid is shown in the drawings in a quantity large enough to be visible; but this is not to be taken as indicating the necessity for any such quantity, though in the case of some liquids—as benzin, for example—I have obtained the desired effect as to preventing deterioration of the action when the chamber has been substantially filled with the liquid. The effect of this substance when in small quantity is to agglutinate the impalpable powder referred to, causing it to be retained at the heel of the chamber—that is, the end opposite the contact end, or at least behind the dam—leaving the mercury bright and clean for making contact when it falls to the other end. When the larger quantity of liquid is employed, it apparently operates as a flushing element, either floating the residuum which causes the difficulty away from the surface of the mercury or causing it to be so widely distributed as to not exist at any one point in sufficient quantity to cause damage. Such addition to the structural elements of the device maintains its efficiency as long as the amount of said oil or other suitable liquid in the chamber is adequate to take up the powder which is formed. For example, in using this expedient in an electric clock the same liquid-contact chamber which without the use of the oil or other neutral liquid in addition to the mercury in the chamber could be made to operate for winding the clock a number of times, equivalent to, say, two years running of the clock, I have found apparently unimpaired in

its action for opening and closing the circuit and transmitting the necessary energy for winding after a number of actions equivalent to twenty-five years running of the clock. I judge that enough oil may be placed in the chamber to take up the powder which will be formed in the operation of the device until the bulk of this powder, agglutinated by the liquid, becomes enough to impede the movement of the mercury, and practically the operativeness of the device is by this means prolonged to the full limit of its natural duration as a mechanical movement—that is to say, as long as the pivots will continue to carry it—so that practically the presence of the agglutinating liquid obviates entirely the defect arising from the formation of the impalpable powder mentioned.

I do not limit myself to the use of oil nor to the mechanical characteristics or qualities of the liquid employed for the purpose of taking up the objectionable product resulting in the chamber; but it will be manifest that for acting in either of the ways above suggested—that is, either by agglutination or by flowing or diluting said objectionable product—said liquid need not and probably preferably should not be such as to act chemically either upon the mercury or upon the substance of which the chamber is composed or upon the electrode or electrodes between which the mercury establishes connection; but this consideration does not exclude capacity of said liquid to act chemically upon the said objectionable product in certain ways. Whether such chemical action occurs with materials which I have used I am not able to say. Also when the liquid is employed in any considerable quantity it probably should not be liable to decomposition by the passage of electric current, though if the change thus produced did not deprive it of the capacity of agglutinating the pulverulent product of electrical action upon the mercury or electrodes its adaptation to the function necessary to be performed in this invention might not be impaired by its decomposition under the action of the current. When the liquid employed is such in quantity and character as to operate by its viscosity or tendency to make the pulverulent material to cohere or adhere, the obstruction or dam formed by the abrupt shoulder of the sleeve 7 coöperates with the remaining elements of the structure with some value for the purpose in view by holding back any accumulated agglutination of the objectionable material and preventing it from going with the mercury over the dam to the contact end, because in the partial holding of the mercury as it piles up behind the dam the agglutinated material which may have been involved with the mercury in its flow or rolling to this point is likely to adhere for the instant to the back of the dam while the mercury plunges over it. At least I judge this

to be the mechanical effect, because I find the agglutinated material in question does not pass the dam in distinguishable quantity and because, furthermore, I find when the quantity of neutral liquid is slight, as above explained, that the entire inner surface of the chamber becomes coated or lined with it, leaving the mercury clear and bright and "live." The method or physical operation by which the liquid in question renders the product which results from the passage of electric current harmless so far as affecting the capacity of the switch for its purpose is in part at least obviously, as above pointed out, either agglutination by reason of the viscosity or other physical product of the liquid adapting it to cause the pulverulent material to cohere or adhere, or the capacity when present in larger volume or preventing such adhesion or coherence, in which case it may be said to act by diluting said product and preventing it from existing at any one point in sufficient quantity to be harmful; but it is possible that the result is assisted and might in case of certain liquids be caused entirely by the chemical effect of the liquid upon said product. I do not design to limit myself to any one of these, and all of these forms of action, or such of them as may actually occur, I intend to include under the phrase "take up" as applied to the action of the liquid in my claims.

I claim—

1. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, and a quantity of other liquid contained in said chamber adapted to take up the circuit-interrupting products.

2. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, and a quantity of other liquid contained in said chamber adapted to take up the product which results from the passage of the electric current.

3. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, and a neutral liquid contained

in said chamber adapted to take up the circuit-interrupting products.

4. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, and a slightly viscid liquid contained in said chamber.

5. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, and a neutral slightly-viscid liquid also contained in said chamber.

6. An electric switch comprising a chamber mounted for alternately raising and lowering the contact end; an electrically-conductive liquid therein for effecting contact by the gravitation of said liquid to the contact end when the latter is depressed, and a quantity of other liquid contained in said chamber adapted to take up the circuit-interrupting products.

7. An electric switch comprising a chamber containing an electrically-conductive liquid and electrodes between which such liquid effects electrical connection when lodged in contact therewith, said chamber being adapted to be tilted to cause the conducting liquid to move into and out of circuit-closing position, and a quantity of other liquid contained in said chamber adapted to take up the circuit-interrupting products.

8. An electric switch comprising, in combination with a chamber mounted for alternately raising and lowering the contact end, a globule of mercury in such chamber and a small quantity of viscid neutral liquid therein.

9. An electric switch comprising, in combination with a chamber mounted for alternately raising and lowering the contact end and having intermediate its ends an obstruction or dam to retard flow therethrough from end to end; a quantity of electrically-conductive liquid in such chamber and a small quantity of slightly-viscid liquid also contained therein.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 14th day of June, 1904.

PERCY L. CLARK.

In presence of—

FRED G. FISCHER,
J. S. ABBOTT.