No. 712,134. Patented Oct. 28, 1902.

M. R. HUTCHISON.

ELECTRIC TIME SWITCH.

(Application filed Nov. 22, 1901.)

(No Model.) 2 Sheets—Sheet 1.

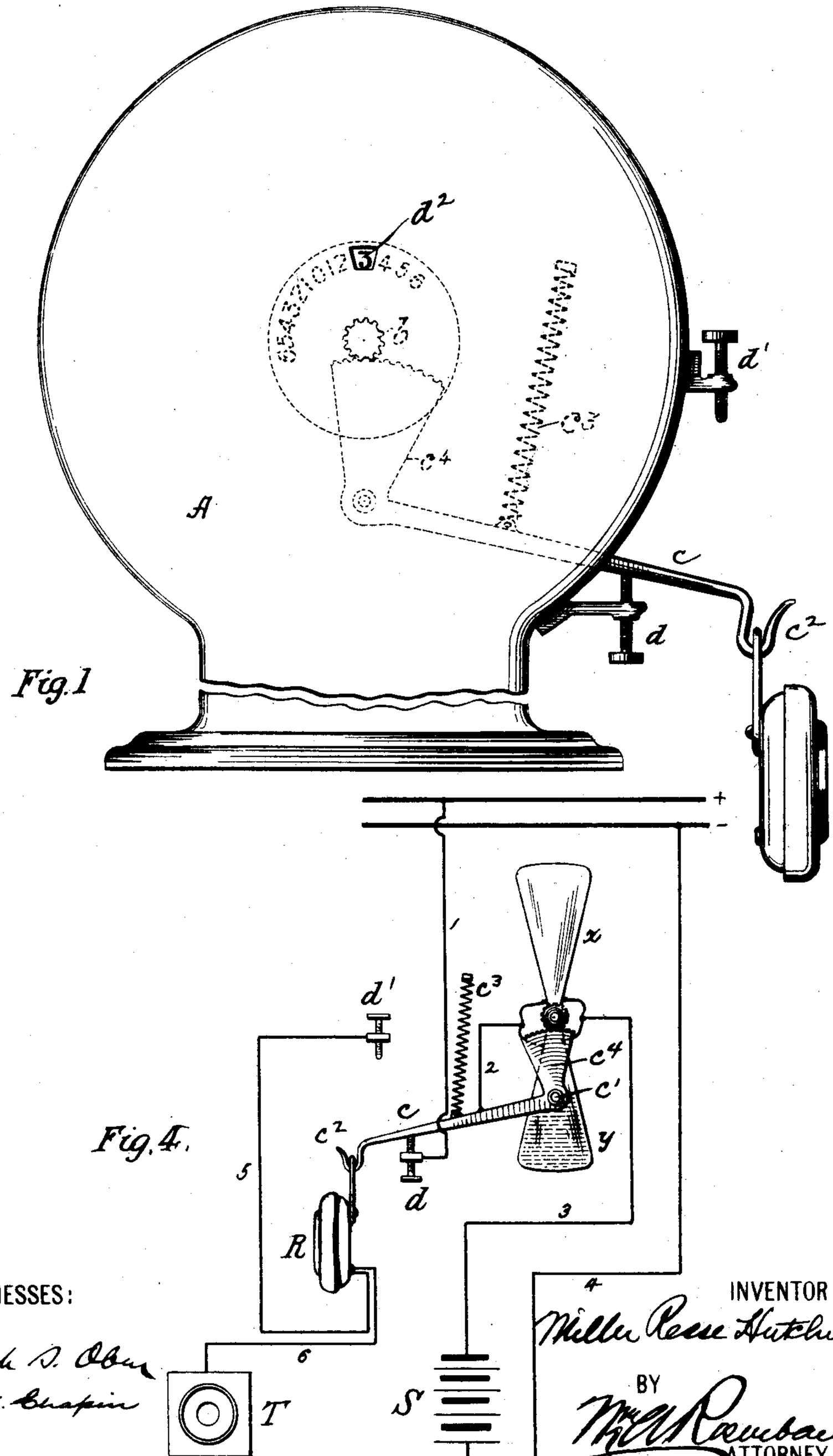

Fig. 1

Fig. 4.

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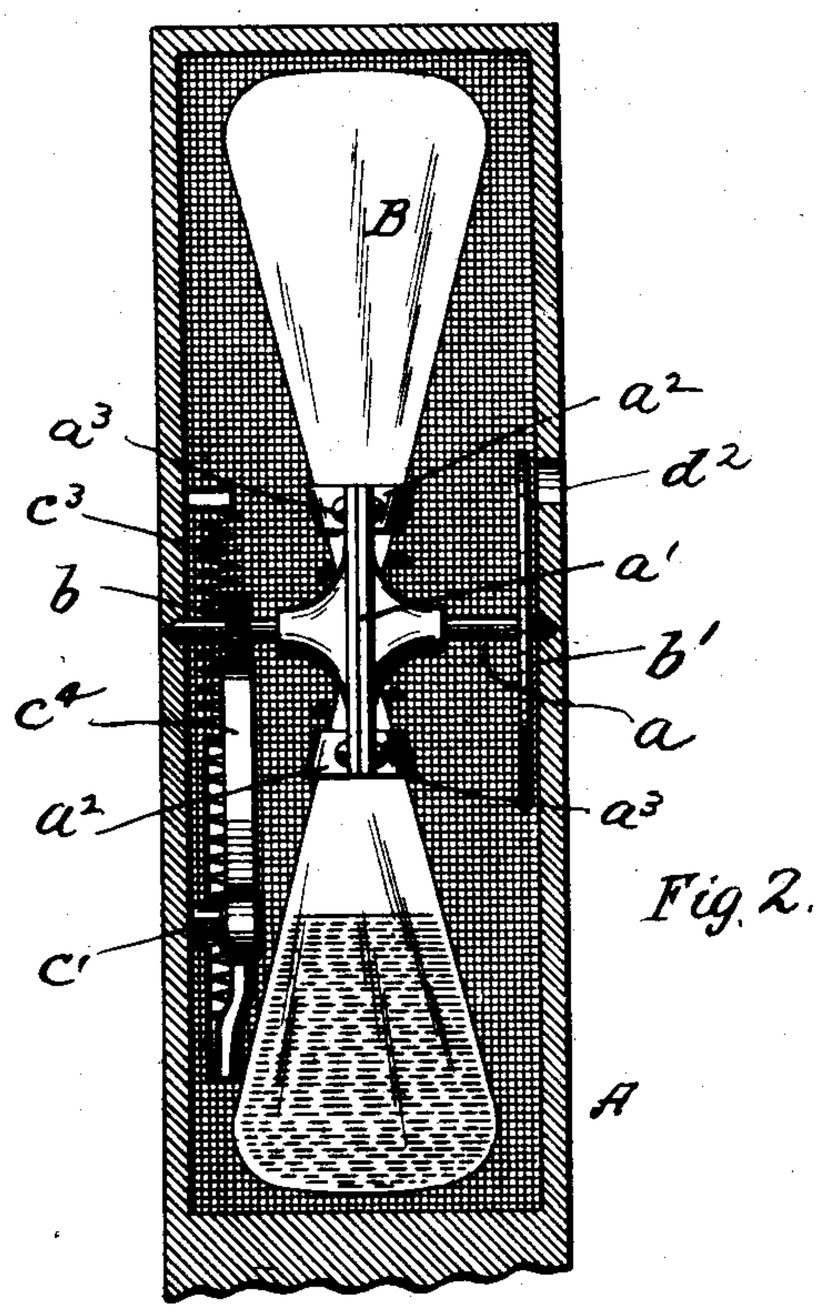

Fig. 2.

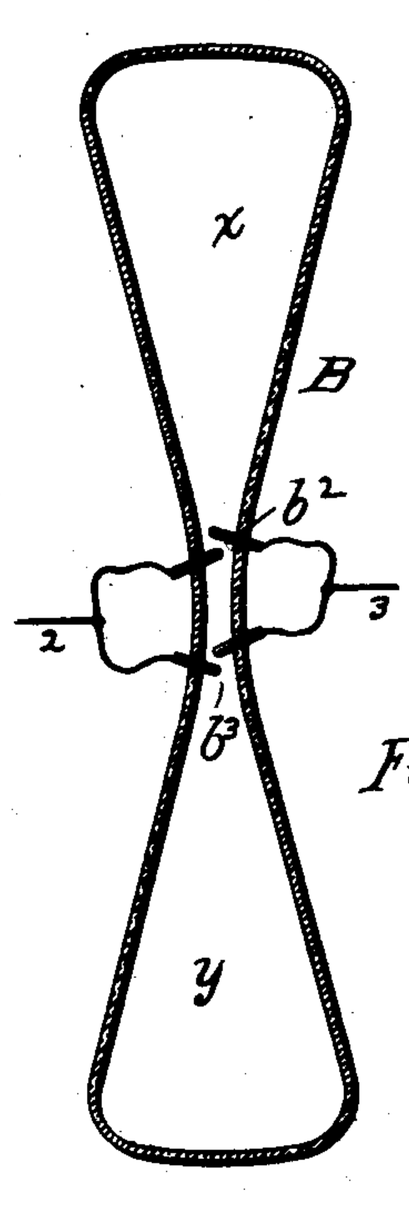

Fig. 3.

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ELECTRIC TIME-SWITCH.

SPECIFICATION forming part of Letters Patent No. 712,134, dated October 28, 1902.

Application filed November 22, 1901. Serial No. 83,287. (No model.)

To all whom it may concern:

Be it known that I, MILLER REESE HUTCHISON, a citizen of the United States, residing at Upper Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Time-Switches, of which the following is a full, clear, and exact description.

This invention is an automatic switch for use in charging and discharging storage batteries and is intended for the convenience of persons who find it necessary to continually use small electrical apparatus supplied by a storage battery. An outfit of the kind referred to might consist of a telephone transmitter and receiver, a storage battery, a source of electricity for charging the battery, and a time-switch constituting the invention herein referred to for automatically charging the battery to a limited extent when the instruments are not in use and for discharging the battery to a limited extent when the instruments are in use.

The switch constituting my invention comprises a two-part liquid-containing vessel and is so constructed that when the telephone instrument—the receiver, for instance—is in use and not hanging upon a hook, also forming a part of the switch, the switch is thereby set so that the battery will discharge for service. This setting of the switch consists in tipping the vessel of liquid to such an angle that the liquid will all run out of one part of the vessel, if allowed to do so, and into the other part. On the other hand, when the instruments are not in use and the receiver is hanging on the hook the vessel is thereby reversed, so that the portion of liquid which before ran out of one part will flow back; but this time the angle will be such that said portion will all be returned in the time required to charge the battery to the extent of the previous discharge with the given amperage of the charging source. The charging and discharging circuits are completed by the flowing liquid, and when the contents of one chamber of the vessel has completely passed into the other the circuit is opened. It will thus be seen that by tipping the vessel at the proper angles respectively for the discharging and charging a given quantity of liquid will charge or discharge an equal number of ampere hours.

In the accompanying drawings, illustrating my invention, Figure 1 is a side elevation of the box containing the automatic switch. Fig. 2 is a vertical section thereof. Fig. 3 is a section of the liquid vessel, and Fig. 4 is a side elevation of the apparatus of the switch with a diagram of the circuits.

A indicates a casing containing the switch. At the center of the casing is mounted a horizontal shaft a, made in two parts joined together at the middle by a coupling a', forming a kind of cage through which can pass the middle portion of a closed vessel B. This vessel is in the form of an hour-glass, having a restricted passage at the middle and chambers x and y converging thereto at each end. Vessel B is secured to the shaft a by means of the split collars a^2, forming a part of the coupling a'. The parts of the collars and of the coupling are brought together at each side of the vessel and clamped around the same by the screws a^3. Thus the vessel is caused to rotate with the shaft. On the shaft is also located a pinion b and an indicator-disk b'. The chamber B is sealed and contains a body of mercury or other conducting liquid or flowing material. At the throat or restricted passage are located two pairs of electrodes or contacts. One pair b^2 is at the point where one of the chambers leads into the throat, while the other pair b^3 is at the point where the other chamber leads into the throat. These contacts are sealed into the glass and are so arranged that while the mercury is passing from one chamber to the other the circuit is closed through the mercury from contact to contact. One contact of each pair is connected to one side of the circuit, while the other two contacts are connected to the other side of the circuit. c is a lever pivoted at c' and extending to the outside of the case, where it is formed into a hook c^2. This lever plays between two adjustable contact-screws d and d' and is acted upon by the spring c^3, tending to lift it against the upper contact d'. At the pivotal end of the lever there is attached to it a gear-segment c^4 in

mesh with the pinion *b* and having sufficient teeth to rotate said pinion the necessary portion of a rotation. The vessel B, the gearing, and the lever are so adjusted that when the lever is horizontal the mercury vessel is also horizontal, so that movement of the lever toward the lower adjustable stop *d* will cause the mercury-chamber to approach the vertical position to an extent depending upon the position of the stop. Likewise a movement of the lever against the upper stop *d'* will cause the vessel to swing in the opposite direction to a position approaching the vertical, depending upon the position of the stop. Hence by properly setting the stops the vessel can be set so that when one of its end chambers is at the top the mercury in it will flow out in a given time, while when the other chamber is at the top the mercury in it will flow out in the same or a different time.

The indicating-disk *b'* carries on its face two scales of figures, which as the vessel B is rotated are carried past a window d^2 in the casing A. The figures of these scales indicate hours and are referred to when adjusting the stops *d* and *d'*. Thus if a given source of electricity will charge a given battery in two hours the lower stop is to be set so that the figure "2" on the charging-scale will appear at the window when lever *c* is against the stop. When this is done, the vessel B will be at the correct angle to empty all of the mercury from the upper to the lower chamber of the vessel in two hours. The adjustment for the discharge is accomplished in a similar manner.

R represents a telephone-receiver adapted to be suspended upon the hook c^2.

T is a telephone-transmitter.

S is a storage battery, and the plus and minus signs indicate a source of electricity for charging the battery. The electrical connections are established for charging the battery when the receiver R is upon the hook c^2. Thus a circuit is established, as shown in Fig. 4, from the plus side of the source by wire 1 to the stop *d*, thence to lever *c*, thence by wire 2 across the contacts in the mercury-chamber and wire 3 to the battery, and from the battery by wire 4 to the minus side of the source. If we now assume that the entire quantity of mercury is in the lower end of the chamber, it will be understood that the battery has been fully charged and that no more current can flow through it, because the mercury has ceased to flow past the contacts in the throat of the mercury-chamber. When the instruments are put into use, the receiver R is lifted from the hook and the latter immediately rises against the stop *d'*. This places the instrument in circuit with the battery and cuts off the source, while at the same time swinging the vessel B on its axis, so that the end *y* is carried to the top, and the mercury therein immediately commences to flow into the empty end. The discharge-circuit then in operation is as follows: From the battery by wire 3 across the contacts in the mercury-chamber, wire 2, lever *c*, stop *d'*, wire 5, receiver R, wire 6, transmitter T, and wire 7 to battery. The instruments can thus be continued in use until all of the mercury has flowed into the lower chamber, or the receiver R can be returned to the hook at any time, whereupon the charging of the battery will be renewed and continued as long as there is any mercury in the upper end of the chamber.

In charging the ampere hours necessary to charge the battery must be divided by the number of amperes of current available from the charging source. The resulting number of hours is the time necessary to be taken by the entire body of mercury to flow from one end to the other of the vessel. The mercury flows most rapidly when the chamber is vertical, and the rate of flow decreases as the angle of the chamber approaches the horizontal. Thus when the battery is of large capacity and the current available from the source is small the angle of the mercury-chamber in charging is nearest the horizontal. On the discharge the rate, especially in apparatus of the character described, is usually slower than the rate of charge. Consequently the angle of the vessel should be greater when the lever is against the upper stop than when it is against the lower stop. With a source of current of a given value and a battery of a certain capacity these adjustments can be fixed at the outset and remain constant, so that in the use of the apparatus given portions of the mercury will either charge or discharge equal ampere hours of current and the battery will on the average remain constantly charged to its full capacity. It will be understood that the scales will be so placed on the disk with respect to the vessel that the efficiency of the battery will be allowed for in its indications.

Having described my invention, I claim—

1. An electric switch in combination with two circuits, either of which it is adapted to close, and having means whereby the periods of closure of the respective circuits can be predetermined.

2. An electric switch, comprising a double-compartment vessel containing a liquid, means for causing the liquid to flow from one compartment to the other, means whereby the rate of flow from each compartment to the other, can be predetermined, and two electric circuits respectively under control of the liquid flowing in the two directions, substantially as described.

3. An electric switch, comprising a vessel having a plurality of communicating compartments, a body of liquid in said vessel, electrical terminals exposed in the communicating passage, means for causing the liquid to flow from one compartment to the other and two circuits one of which is closed while the liquid flows from one compartment and the other while the liquid flows from the other compartment, substantially as described.

4. An electric switch comprising a vessel having a plurality of communicating compartments and mounted to turn on a substantially horizontal axis, a body of liquid in said vessel, electrical terminals exposed in the communicating passage, means for swinging the vessel on its axis to locate a particular compartment above the axis and two circuits one of which is closed while the liquid flows from one compartment and the other while the liquid flows from the other compartment, substantially as described.

5. An electric switch, comprising a vessel having a plurality of communicating compartments, a flowing material in said vessel, electric terminals exposed in the communicating passage, means for causing the material to flow from one compartment to the other, means for determining the rate of flow from each compartment, and two circuits one of which is closed while the liquid flows from one compartment and the other while the liquid flows from the other compartment.

6. An electric switch, comprising a vessel having a plurality of communicating compartments and mounted to turn on a substantially horizontal axis, a flowing material in said vessel, electrical terminals exposed in the communicating passage, means for swinging the vessel on its axis to locate a particular compartment above the axis, means for setting the upper compartment at a predetermined angle to effect a certain rate of flow of the material therefrom, and two circuits one of which is closed while the liquid flows from one compartment and the other while the liquid flows from the other compartment.

7. An electric switch, consisting of a sealed vessel mounted at the middle on a horizontal axis, the ends of said vessel communicating through a restricted passage, a body of mercury in said vessel, electric contacts exposed in said passage, a pivoted lever, gearing connecting the lever and vessel whereby the vessel will be moved around its axis when the lever is swung on its pivot, and adjustable stops limiting the movements of the lever.

8. An electric switch, consisting of a sealed vessel mounted at the middle on a horizontal axis, the ends of said vessel communicating through a restricted passage, a body of mercury in said vessel, electric contacts exposed in said passage, a pivoted lever, gearing connecting the lever and vessel whereby the vessel will be moved around its axis when the lever is swung on its pivot, adjustable stops limiting the movements of the lever, and two electric circuits, one of which includes said contacts, the lever and one stop, and the other, said contacts, the lever and the other stop, substantially as described.

In witness whereof I subscribe my signature in presence of two witnesses.

MILLER REESE HUTCHISON.

Witnesses:
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