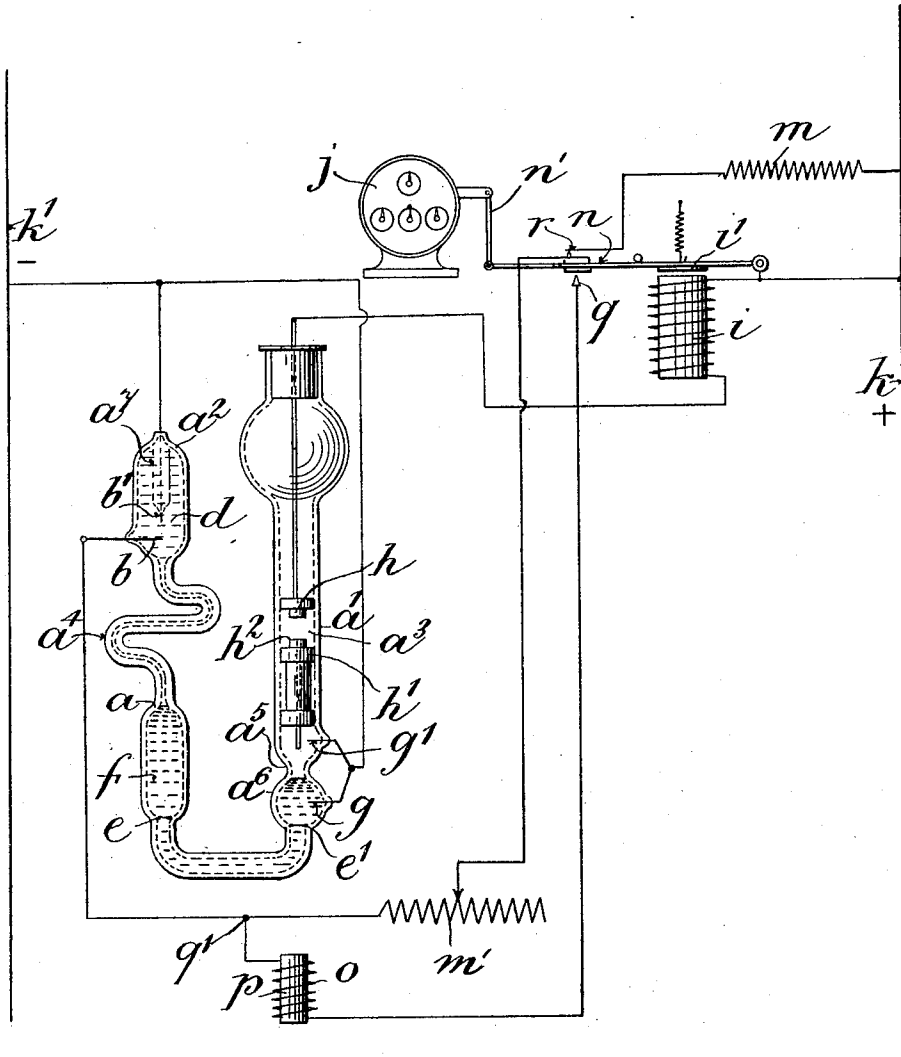


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ELECTROLYTIC APPARATUS.
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1,005,672.

Patented Oct. 10, 1911.



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ELECTROLYTIC APPARATUS.

1,005,672.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILFRED BERTRAM THORPE, a subject of the King of Great Britain and Ireland, residing at Balham, in the county of London, England, have invented Improvements in Electrolytic Apparatus, of which the following is a specification.

This invention has reference to that kind of electrolytic apparatus suitable for use as or in the construction of meters, time and other switches, and other devices, wherein an electric current passed through an electrolytic cell causes electrolysis of a liquid, for example acidulated water or an alkali, and the evolution of gases, for example oxygen and hydrogen, which are utilized to produce movement of a body, for example a column of mercury, which upon the passage of a definite quantity of electricity through the cell, is utilized to perform some useful purpose, as for example to close an electric circuit for bringing about the operation of an electro-magnetic device for operating registering or switch mechanism, or the operation of igniting means for causing the ignition and recombination of the evolved gases to reconstitute the electrolyte decomposed, the various operations being repeated from time to time so long as the electrolytic device continues in use.

This type of electrolytic apparatus is known as the recombining gas type, as distinguished from electrolytic apparatus of the depositing type in which a metal is deposited on the negative electrode.

In the specification of another application for Letters Patent No. 471,936, I have described constructions of electrolytic apparatus of the kind referred to whereby such apparatus is rendered practically available for use as or in the construction of meters, switches and other apparatus.

In the electrolytic apparatus of the kind referred to, as heretofore constructed, the ignition and recombination of the evolved gases has been effected either by means of a conductor arranged in the electrolytic cell and heated at the required times to a suitable degree by the passage of an electric current therethrough, or by an electric spark formed between metallic sparking contacts moved apart at the required times by electro-magnetic devices.

Now the present invention has for object to effect the ignition of the evolved gases in

a simpler and more certain and advantageous manner than heretofore. For this purpose, the gases evolved in the electrolytic cell of electrolytic apparatus of the kind referred to, are ignited by an electric spark produced between the surface of the electrolyte and a terminal that is preferably connected to the negative supply conductor, and which is so arranged that the electrolyte can fall below its extreme free end to allow of the formation of a spark between these parts. The arrangement may advantageously be such that when the predetermined volume of gases has been evolved by the passage of a given quantity of electricity through the cell, the resulting movement of the mercury column or other body will cause an electro-magnetic device, which may be that used for operating recording or other mechanism, to close an electric circuit through the electrolyte and negative terminal so as to decompose the former at a quick rate and evolve gases that will quickly depress the surface of the electrolyte until it falls below the negative terminal and causes a spark to be produced between it and the terminal so as to ignite and recombine the gases and allow the mercury and other parts to return to their normal position.

The circuit including the electrolyte and terminal may advantageously be made through the winding of an inductive device so that when the circuit is broken and a spark thereby produced, such spark will be reinforced by the inductive action of the inductive device.

The negative or firing terminal may conveniently be formed by the negative electrode of the electrolytic cell but not necessarily so.

The accompanying diagrammatic drawing shows electrolytic apparatus of the kind referred to embodying the present invention.

In this example the electrolytic apparatus comprises a bent glass tube having two legs a , a^1 closed at their upper ends, the leg a , having a part a^2 adapted to form an electrolytic cell provided with electrodes b , b^1 and charged with electrolyte d , and leg a^1 forming a contact chamber a^3 provided with a contact h , the two legs having contracted portions a^4 , a^5 that serve to confine a column of mercury f in place within the lower portion of the tube and one of which, viz. a^4 ,

serves to contain electrolyte to form a high resistance between the mercury f and electrodes b , b^1 , the portion of the tube containing the mercury f being provided with rings e , e^1 of metal, such as platinum, that always makes a fluid tight joint with the mercury, and also with a contact g for connection to the negative pole of a source of electricity, or to the negative electrode b^1 , so that the mercury is always negative to the device, all as and for the purposes described in my said former specification. k , k^1 are respectively positive and negative supply mains to which the electrolytic apparatus is connected for use.

In the improved electrolytic apparatus shown, one of the electrodes viz. b^1 , is also adapted to be used as the terminal between which and the surface of the electrolyte d the igniting spark is produced according to the present invention, such electrode b^1 being connected to the negative main k^1 and arranged vertically above the positive electrode b which is connected to the positive main k through a high resistance coil m . This shunt circuit between the mains k , k^1 is the main circuit. The negative contact g extends into a bulb a^6 that always contains mercury f and is separated by the contracted part a^5 from the contact chamber a^3 which contains a float h^1 carrying a contact h^2 which, upon being raised by the mercury, completes a second circuit between the mains k , k^1 through the stationary contact h and the winding of an electro-magnet i . g^1 is a second negative contact connected to contact g and extending into the contact chamber a^3 so as to provide a second connection to the mercury when entering that chamber. The magnet armature i^1 , when attracted, completes through a switch arm n and a fixed contact q , a direct circuit between the main k and positive electrode b through an inductive device comprising a coil o and iron core p , the connection of this circuit to the main circuit being at a point q^1 between the cell a^2 and resistance m . In action, when the predetermined volume of gases has been evolved in the electrolytic cell a^2 by the passage of a given quantity of electricity between electrodes b , b^1 , through the main shunt circuit, the resulting movement of the mercury column f closes the circuit of magnet i through contacts g , h^2 , h . The armature i^1 consequently causes the lever n to close the circuit between b , b^1 through the inductive device o , p so as to shunt the resistance m and cause decomposition of the electrolyte d in cell a^2 to take place at a quicker rate than before, so that the gases evolved will then quickly depress the surface of the electrolyte until it falls below the negative electrode b^1 and breaks the circuit of the inductive device o , p . An electric spark is thereby produced between the

surface of the electrolyte d and electrode b^1 so as to ignite and recombine the gases and allow the mercury f to return to its normal position, the spark being reinforced by the inductive action of the inductive device o , p . The circuit of magnet i is thereby broken and the armature i^1 with lever n returns to its normal position and opens the circuit of the inductive device o , p at contact q . The action of the electrolytic device then recommences.

In some instances, as where the resistance of the main shunt circuit across the mains k , k^1 is not sufficiently high, it may be necessary to adapt the electro-magnetic device to open this circuit when it acts to close the circuit of the inductive device o , p . For this purpose the main circuit of the cell may be normally closed through a switch r controlled by the lever n of the electro-magnetic device i , so that when the lever moves to close the circuit through the inductive device o , p it opens the main circuit at the switch r .

The electrode b^1 may advantageously extend through the top of the cell a^2 and be led down to the requisite level. It may be covered with a suitable non-conductor of electricity, for example glass, as far as possible, so as to form a long leakage path around the interior of the cell between the electrolyte d and its lower free end which should preferably end in a point. The sharpness of this point is dependent on the amount of current used, the smaller the current the sharper should be the point and the greater the inductance of the device o , p in the firing circuit at the moment of firing. The exposed portions of the electrodes b , b^1 are preferably of nickel carried by platinum wires passing through the wall of the cell.

Electrolytic apparatus such as shown may be adapted for various useful purposes. In the example it is shown arranged to form part of a registering electricity meter such as described in the specification of another application for Letters Patent filed by me dated August 18th 1909, Serial No. 513479, the armature n of the electro-magnetic device i being arranged to operate counting or registering mechanism j through a rod n^1 . In this case an adjustable high resistance m^1 is included in series with the electrolytic cell a^2 and main resistance m in the shunt circuit between the electric supply mains k , k^1 and the circuit including the inductive device o , p is connected to the main circuit of the cell a^2 at the point q^1 between that cell and the resistance m^1 , as hereinbefore stated, so that when the circuit including the inductance device is closed, it will short circuit both resistances m and m^1 which may also be put out of action at this time by the switch r .

What I claim is:—

1. Electrolytic apparatus of the kind here-

in referred to, comprising an electrolytic cell closed in a gas tight manner at its upper end and adapted to admit of depression of the electrolyte therein under the action of the evolved and collected gases, and an electric terminal arranged to dip into said electrolyte and to form a spark gap therewith upon depression thereof below said terminal by the evolved gases.

2. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell closed in a gas tight manner at its upper end and adapted to admit of depression of the electrolyte therein under the action of the evolved and collected gases, a body arranged to be displaced by the pressure thereon of the electrolyte in said cell under the action of the evolved and collected gases, and a terminal arranged to dip into the electrolyte in said cell and to form a spark gap therewith upon depression thereof to a predetermined extent by said gases.

3. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell closed in a gas tight manner at its upper end and open at its lower end, an electric terminal arranged to dip into the electrolyte in said cell and to form a spark gap therewith upon depression thereof below said terminal, and means arranged to be actuated by the depression of the electrolyte in said cell and to cause the closing of an electric circuit.

4. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell closed in a gas tight manner at the top and open at bottom and terminals one of which is arranged to normally dip into the electrolyte but to form a spark gap therewith upon depression thereof below said terminal and the other of which is in permanent connection with said electrolyte.

5. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell the upper end of which is hermetically sealed and provided with a downwardly projecting inner extension of insulating material and the lower part of which is open for passage of liquid, and a terminal extending downward through said extension and having only its lower free end exposed to the electrolyte in said cell.

6. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell closed at its upper end for the collection of evolved gases and having a terminal extending downward into the electrolyte, and means for completing an electric circuit through said terminal and electrolyte after a definite volume of gases has been evolved in said cell.

7. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell closed in a gas tight manner at its upper end and adapted to admit of depression of the electrolyte therein under the ac-

tion of the evolved and collected gases, upper and lower terminals the lower of which is permanently in connection with the electrolyte and the upper of which is arranged to dip into said electrolyte and to form a spark gap therewith upon depression thereof below said terminal by pressure of the evolved and collected gases and a source of electric supply the positive pole of which is connected to the lower terminal and the negative pole of which is connected to the upper terminal.

8. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell having a terminal extending downward into the electrolyte so that the latter can fall below the free end of the terminal after a definite volume of gases has been evolved, an inductive device and means for placing said inductive device in the circuit of said terminal and electrolyte after a definite volume of gases has been evolved in the cell.

9. Electrolytic apparatus of the kind herein referred to, comprising an electrolytic cell having one electrode arranged above another with its free depending end arranged to admit of the electrolyte falling below it without leaving the other electrode, means for completing an electric circuit through said cell between said electrodes, and means for increasing the quantity of the current flowing through the said cell after a definite volume of gases have been electrolytically evolved, so as to then cause a quicker evolution of gases than before.

10. Electrolytic apparatus of the kind herein referred to, comprising a tube having an electrolytic cell one of the electrodes in which is arranged to depend into the electrolyte in said cell, and a liquid column arranged to be actuated by the gases evolved in said cell, circuit connections for causing current to flow through said cell, circuit closing means arranged to be closed by movement of said liquid column, and an inductive device and circuit arranged to be connected in circuit with said cell by said circuit closing means and cause a rapid evolution of gases in said cell after a definite volume of gases have been evolved therein by slower electrolysis.

11. Electrolytic apparatus comprising a tube having an electrolytic cell one of the electrodes of which is arranged to depend into the electrolyte, a mercury column arranged to be moved by the gases evolved, circuit connections including a high resistance for said cell, other circuit connections for said cell of less resistance than the first mentioned circuit connections, an inductive device in circuit with the second circuit connections and circuit closing means arranged to be operated by movement of said mercury column and to cause the closing of the secondly mentioned circuit connections.

12. Electrolytic apparatus comprising a tube having an electrolytic cell at one end, a contact chamber with stationary contact at the other end, an intermediate column of mercury adapted to be moved by the gases evolved in said cell and be thereby placed in electrical connection with said stationary contact and a negative contact connected to said mercury and to the negative electrode of said cell, said negative electrode depending into said cell so that the electrolyte therein can, by evolution of gases, fall below its free end, a high resistance in series with said cell and arranged to form a shunt circuit between electric supply mains, and an inductive device adapted to be connected in circuit with said cell independently of the said resistance, when the mercury is placed in electrical connection with said stationary contact.

13. Electrolytic apparatus comprising a tube having an electrolytic cell at one end, a contact chamber with stationary contact at the other end, an intermediate column of mercury adapted to be moved by the gases evolved in said cell and be thereby placed in electrical connection with said stationary contact, and a negative contact connected to said mercury and to the negative electrode of said cell, said negative electrode depending into said cell so that the electrolyte therein can, by evolution of gases, fall below its free end, a main high resistance and an adjustable high resistance in series with each other and with said cell, an electro-magnetic device arranged to be connected to a source of electric energy upon said mercury being placed in electrical connection with said stationary contact, mechanism adapted to be operated by said electro-magnetic device and an inductive device arranged to be connected across said source of electric energy through said cell independently of said resistances by said electro-magnetic device.

14. Electrolytic apparatus comprising a tube having an electrolytic cell at one end, a contact chamber with stationary contact at the other end, an intermediate column of mercury adapted to be moved by the gases

evolved in said cell and be thereby placed in electrical connection with said stationary contact, and a negative contact connected to said mercury and to the negative electrode of said cell, said negative electrode depending into said cell so that the electrolyte therein can, by evolution of gases, fall below its free end, a main high resistance and an adjustable high resistance in series with each other and with said cell, an electro-magnetic device arranged to be connected between electric supply mains upon said mercury being placed in electrical connection with said stationary contact, counting mechanism adapted to be operated by said electro-magnetic device, and an inductive device arranged to be connected across said supply mains through said cell independently of said resistances by said electro-magnetic device.

15. Electrolytic apparatus comprising a tube having an electrolytic cell at one end, a contact chamber with stationary contact at the other end, an intermediate column of mercury adapted to be moved by the gases evolved in said cell and be thereby placed in electrical connection with said stationary contact, and a negative contact connected to said mercury and to the negative electrode of said cell, so that the electrolyte therein can, by evolution of gases, fall below its free end, a main high resistance and an adjustable high resistance in series with each other and with said cell, an electro-magnetic device arranged to be connected between electric supply mains upon said mercury being placed in electrical connection with said stationary contact, a switch adapted to be operated by said electro-magnetic device and to open the circuit between said cell and resistance, and an inductive device arranged to be connected across said supply mains through the main cell by said electro-magnetic device.

Signed at London, England this 30th day of July 1909.

WILFRED BERTRAM THORPE.

Witnesses:

T. L. RAND,

R. I. WILLIAMS.