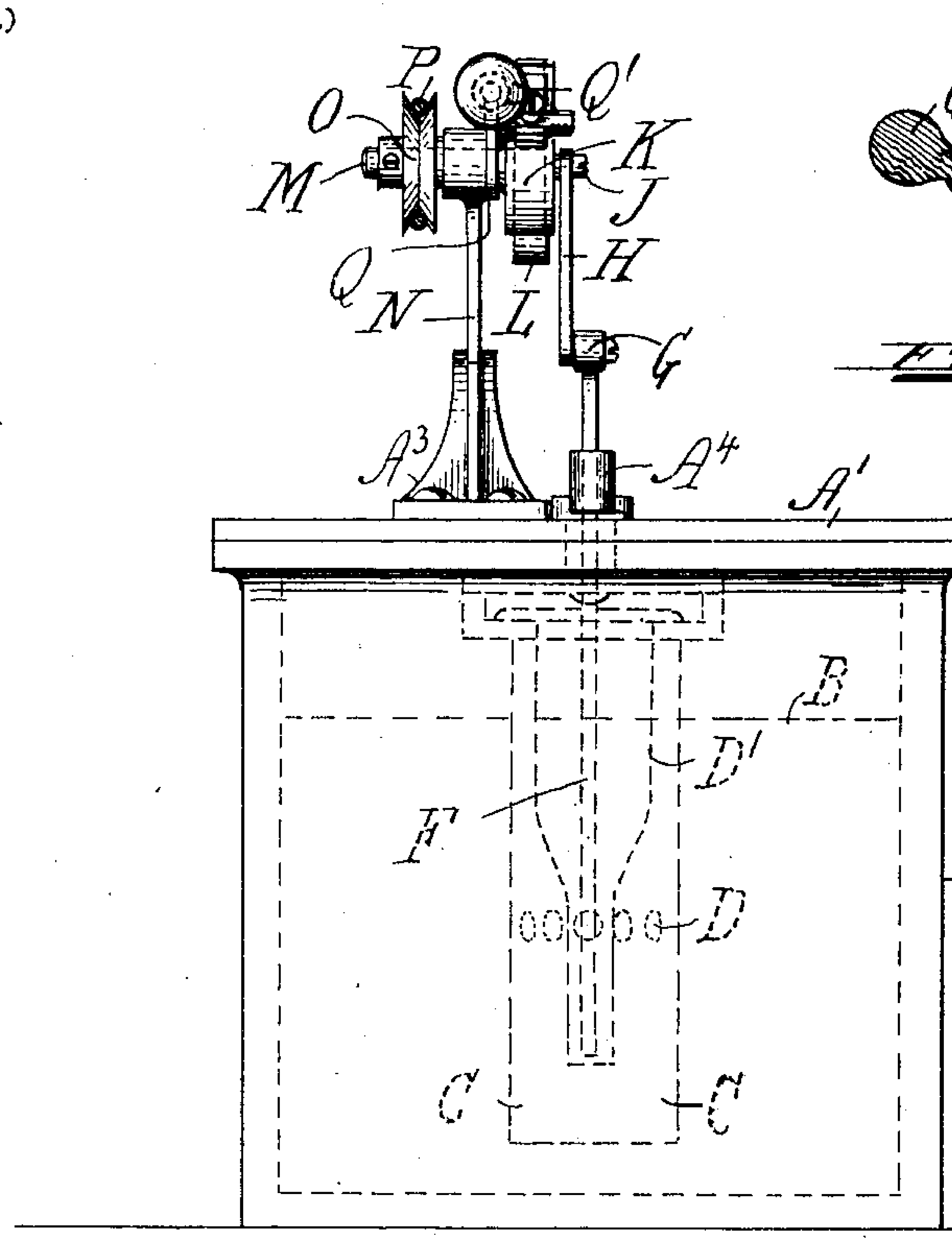
No. 686,295. Patented Nov. 12, 1901.

J. O. HEINZE, Jr.

LIQUID INTERRUPTER FOR ELECTRIC CURRENTS.

(Application filed Apr. 24, 1901.)

(No Model.)



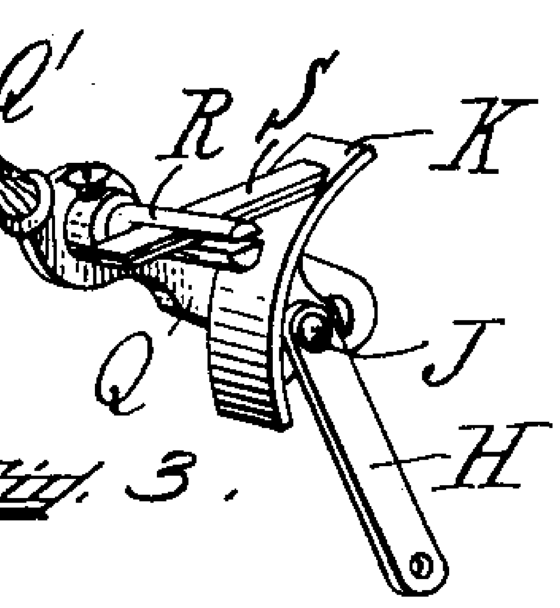


Fig. 3.

Fig. 1.

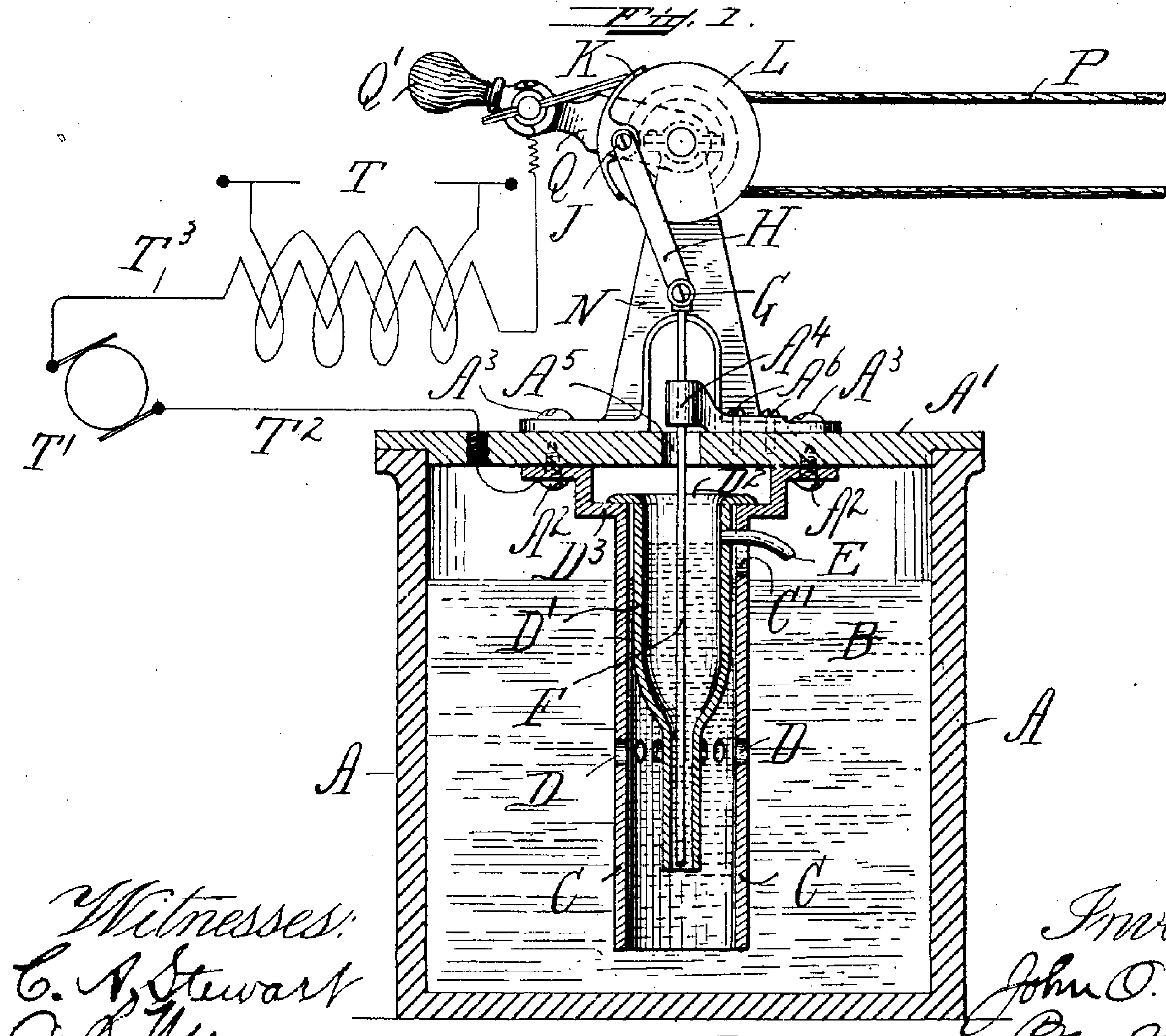


Fig. 2.

Witnesses:
C. A. Stewart
A. R. Messer

Inventor:
John O. Heinze, Jr.
By J. S. Rusk
Atty

UNITED STATES PATENT OFFICE.

JOHN O. HEINZE, JR., OF REVERE, MASSACHUSETTS.

LIQUID INTERRUPTER FOR ELECTRIC CURRENTS.

SPECIFICATION forming part of Letters Patent No. 686,295, dated November 12, 1901.

Application filed April 24, 1901. Serial No. 57,180. (No model.)

To all whom it may concern:

Be it known that I, JOHN O. HEINZE, Jr., of Revere, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Liquid Interrupters for Electric Currents, of which the following is a specification.

My invention relates to new and useful improvements in liquid interrupters adapted to interrupt currents for induction-coils or transformers; and its object is to vary the strength of electric currents.

My invention consists of certain novel features hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which illustrate a construction embodying my invention, Figure 1 is an end view of my improved liquid interrupter. Fig. 2 is a vertical sectional view through Fig. 1. Fig. 3 is a detail in perspective hereinafter described.

Like letters of reference refer to like parts throughout the several views.

Within the jar A of any suitable material is contained an acidulated solution B of acid and water. Closing the top of said jar is a cover A′, to which is secured by screws A^2 the lead cylinder C, provided with suitable openings D, which provide a freer circulation of the solution. Located within said lead cylinder and supported therein near its top is a glass tube D′, having a circular flange D^2, which rests in the upper portion of the lead cylinder C on the shoulder D^3. Located centrally within said glass tube D′ is a platinum wire F, which extends upwardly through the opening A^5 in the cover A′ and through the guide A^4, secured to the cover A′ by the screws A^6, and at its upper end is pivotally connected at G to the link H, which in turn is pivotally connected to the crank-pin J on the metallic segment K, secured on a portion of the circumference of the drum L of insulating material. This drum in turn is secured fast to the shaft M, mounted in the support N, secured to the cover A′ by the screws A^3, and secured fast to said shaft M at the opposite end is a driving-pulley O, adapted to receive power from the driving-belt P. Freely mounted on the shaft M is an arm Q, having a handle Q′ and adapted to carry the brush-holder R, in which is secured the brush S, suitably insulated from the arm Q. The diagram at the left of Fig. 2 shows the windings of an ordinary induction-coil T and the current produced by the dynamo T′, to which are connected the wires T^2 T^3, and, as shown in the drawings, the interrupter is connected in series with the primary circuit of the coil.

The lead cylinder forms one part of an electric circuit and the platinum wire forms the other part. The electric current passes to the lead cylinder through the liquid, to the platinum wire, and to the primary of the coil, returning to the main line. As the wire moves through the glass tube into the liquid and out again it makes and breaks the electric circuit. The size of the platinum wire and the length of its insertion into the liquid and the resistance of the solution and the surface of the lead cylinder determine the amount of current which may pass through the interrupter. The platinum wire is connected to the crank-disk and crank-pin, which in its revolution upon the shaft moves the platinum wire vertically up and down, and by the great number of oscillations of this platinum wire the current becomes steady or uniform—that is, practically continuous in its effect. Attached to the shaft is a drum of insulating material having upon its circumference a metallic segment, and mounted free on the same shaft upon which this drum and segment rotate is an arm which may be moved by hand upon the same axis and carries a brush which is insulated from this arm. One end of the electric circuit is connected to this brush. The action of this brush is that as the segment rotates it comes in contact with the brush and so completes the electric circuit through the platinum wire. As the brush is moved around the circumference by hand it comes in contact with the segment when the platinum wire projects variable lengths out of the glass tube, and by this action the current is changed in intensity—that is, when the platinum wire is farthest in the solution the current is the strongest and as it recedes it becomes weaker, so that by the movement of this handle and brush the amount of current thus sent through the primary is varied. The action of this interrupter is that the induced currents by the movement of the brush become stronger or weaker, and so in the manipulation of the X-ray tubes in which this interrupter can play a part the current can be made stronger or weaker, according to the amount of light desired from the tube.

With the machine in its normal position, as shown in Figs. 1 and 2, with the belt running, the current is in its weakest condition, and as the brush-holder is moved to the left the current becomes stronger because the brush makes contact with the segment in the position when the platinum wire is inserted into the liquid to a greater or less degree beyond the tube. A number of these platinum wires, with the coöperating elements, can be arranged in the same jar, so that a greater number of interruptions can be produced without any more speed than that of a single one. With two platinum wires connected to the same shaft and so arranged that one is out of the solution and the other is in, with the same number of revolutions of the shaft, the double arrangement would give twice as many interruptions as a single one.

The platinum wire moves up and down through a hole in an insulating material, preferably in the form of a glass tube, as shown, immersed in conducting solution. The brush-holder carrying the brush which bears on the drum has a segment covering part of its circumference. As the handle of the brush-holder is moved from right to left the brush makes contact with the segment which carries the platinum wire in positions to which the platinum wire may be in the solution or drawn into the glass tube and so switches the current onto the mechanism at different lengths of insertion of the platinum wire beyond the glass tube. After the brush makes contact with the segment when the wire is at its deepest point the strongest current is obtained; but after it contacts with the segment as the platinum wire is at different points above this lowest point then a correspondingly-decreased intensity of current is obtained.

In the mechanism as shown, with the segment covering one part of the circumference, the brush as it leaves the segment never interrupts the current, as this is accomplished by the platinum as it pulls up into the glass tube, so that the action of the interrupter is that the brush as it comes in contact with the segment completes the circuit through the solution and the platinum wire, and as the platinum wire pulls up into the glass tube it breaks the circuit or interrupts it. The brush is a secondary device for switching on the current; but it never interrupts the circuit. This is accomplished by the platinum wire as it pulls up into the glass tube, so that the wire makes and breaks the circuit, and the brush simply makes the circuit, but does not break it.

The pipe E establishes communication between the upper part of the glass tube D′ and the jar A to prevent the solution rising to the top in the glass tube and flowing over and making contact, and thus causing short-circuiting and making the device inoperative. The opening C′ provides communication between the interior of the lead cylinder C and the glass jar A to maintain a common level of the solution.

In practice the lower end of the glass tube D′ is what is known as a "capillary," into which fits the platinum, so that while the liquid rises into it it moves by capillary attraction, and the platinum wire insulates itself from the outer liquid by the gas which is formed through electrolysis at the lower end of the capillary-tube upon the upper movement of the lower end of the wire up into the capillary-tube, and in this way interrupts the circuit, as it forms practically a seal to the lower end of the capillary-tube. It is possible that under certain conditions the platinum wire may move very slowly up and down, in which case the column of water may follow the platinum wire up through the small hole in the glass tube and not interrupt the current, in which case for the interruption of the current we would depend on the brush on the commutator. In this particular case the current would have to be very weak and the resistance of the liquid solution would have to be very great between the wire and the solution.

I do not limit myself to the arrangement and construction shown, as the same may be varied without departing from the spirit of my invention.

Having thus described the nature of my invention and set forth a construction embodying the same, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, means in said solution for closing the electric circuit through said solution, insulating means in said solution and around said closing means, and means for changing the relative positions of said insulating means and said closing means and to break the circuit.

2. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, movable means in said solution for closing the electric circuit through said solution, insulating means in said solution and around said closing means, and means for changing the relative positions of said insulating means and said closing means and to break the circuit.

3. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, a movable metallic wire in said solution for closing the electric circuit through said solution, insulating means in said solution and around said movable metallic wire, and means for changing the relative positions of said insulating means and said movable metallic wire and to break the circuit.

4. In an apparatus of the character described, a jar containing a conducting solu-

tion, a source of electrical energy, a movable metallic wire in said solution for closing the electric circuit through said solution, an insulating-tube in said solution and around said movable metallic wire, and means for changing the relative positions of the insulating-tube and the movable metallic wire and to break the circuit.

5. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, a movable metallic wire for closing the electric circuit through said solution, an insulating-tube in said solution and around said metallic wire, a drum of insulating material, a metallic segment secured to said drum, a link connecting said metallic wire, a crank-pin on said segment, a movable handle carrying a brush and adapted to be adjusted to contact with said metallic segment as the metallic wire moves down into the solution so that the circuit will be closed when the metallic wire is in the solution, and driving means for operating said drum to change the relative positions of the insulating-tube and the metallic wire and to break the circuit.

6. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, a movable metallic wire for closing the electric circuit through said solution, an insulating-tube in said solution and around said metallic wire, a lead cylinder surrounding and supporting said insulating-tube, a drum of insulating material, a metallic segment secured to said drum, a link connecting said metallic wire, a crank-pin on said segment, a movable handle carrying a brush and adapted to be adjusted to contact with said metallic segment as the metallic wire moves down into the solution so that the circuit will be closed when the metallic wire is in the solution, and driving means for operating said drum to change the relative positions of the insulating-tube and the metallic wire and to break the circuit.

7. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, an insulating-tube in said solution, a metallic wire located within said tube and movable therein, and means for changing the relative positions of the insulating-tube and the metallic wire and to break the circuit.

8. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, means for closing the electric circuit through said solution, insulating means located in said solution for varying the area of contact of said closing means with said solution, and means for changing the relative positions of the insulating-tube and the closing means and to break the circuit.

9. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, an electrode for closing the electric circuit through said solution, insulating means for varying the area of contact of said electrode with said solution, and means for changing the relative positions of the insulating means and electrode and to break the circuit.

10. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, an electrode for closing the electric circuit through said solution, an insulating-tube in which said electrode is located for varying the area of contact of said electrode with said solution, and means for changing the relative positions of the insulating-tube and electrode.

11. In an apparatus of the character described, a jar containing a conducting solution, a source of electrical energy, an electrode for closing the electric circuit through said solution, a stationary insulating-tube in which said electrode is located for varying the area of contact of said electrode with said solution, and means for changing the relative positions of the insulating-tube and electrode.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of April, A. D. 1901.

JOHN O. HEINZE, Jr.

Witnesses:

C. A. STEWART,

A. L. MESSER.