No. 669,291. Patented Mar. 5, 1901.

E. THOMSON.

CURRENT INTERRUPTER.

(Application filed Dec. 26, 1899.)

(No Model.)

Fig. 1.

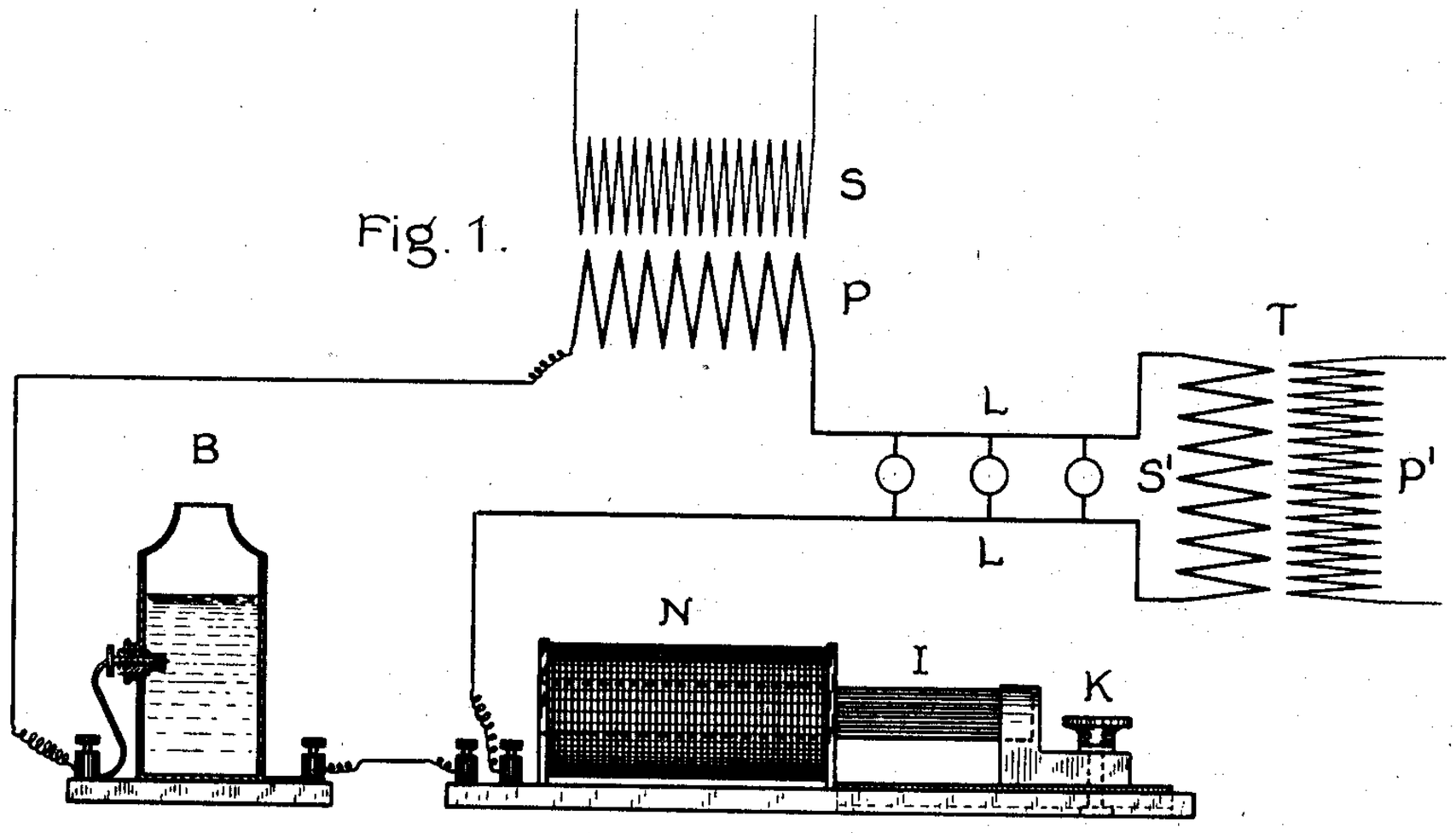


Fig. 2.

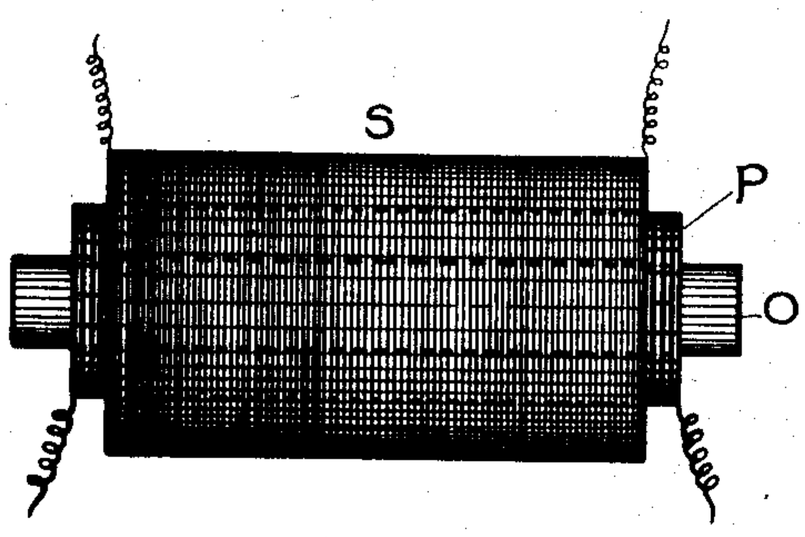
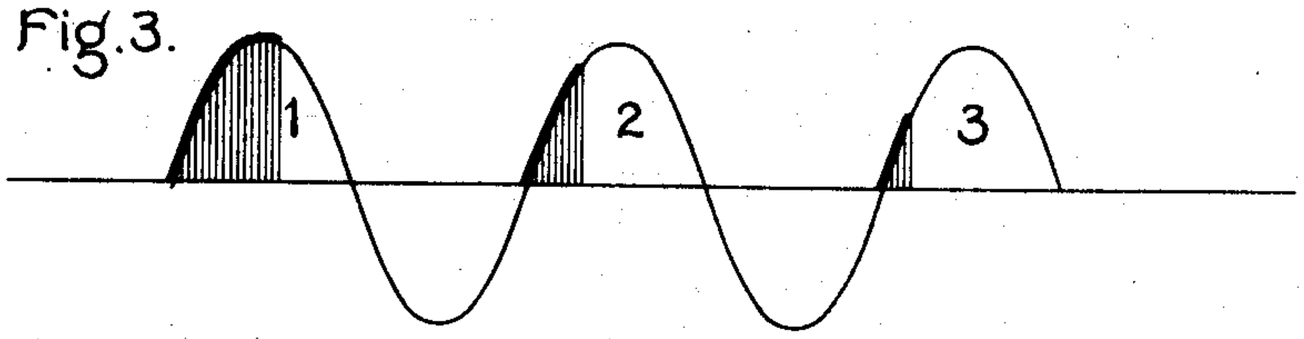


Fig. 3.



WITNESSES.
Harry C. Westendarp
Benjamin B. Hull

INVENTOR.
Elihu Thomson.
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

CURRENT-INTERRUPTER.

SPECIFICATION forming part of Letters Patent No. 669,291, dated March 5, 1901.

Application filed December 26, 1899. Serial No. 741,542. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing in Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Current-Interrupters, (Case No. 1,239,) of which the following is a specification.

This invention relates to automatic interrupters for electric currents, being particularly designed for employment with sources of alternating current. I have discovered that that type of interrupter in which the current is forced to flow through a fluid conductor, such as an electrolyte, at an anode of limited area, with an inductance included in the circuit, by which an automatic interruption of the current takes place at the anode, may be successfully used with alternating currents by suitably varying the inductance or the exposed area of the anode, or both, to effect an interruption of the circuit during successive pulses of the alternating current of like sign. The instant of interruption depends upon the value of the inductance, the voltage of the circuit, and the area of exposure of the anode-surface or the accompanying variation of current density at that point.

In carrying out the invention I provide an adjustable inductance in circuit with the anode and cathode of the interrupting device and apply to this circuit a moderate potential—such, for example, as that commonly employed in operating incandescent lamps—which may be derived from a distributing system of higher potential by means of a transformer in the usual manner. In this circuit I include the primary of an induction-coil, the secondary of which is wound for step-up transformation, in which the rapid interruptions created by the interrupter may be rendered useful for operating any translating devices for which high-frequency high-potential currents are available. While I prefer to employ an auxiliary variable inductance in circuit with the interrupter, the induction-coil or transformer in which the step-up transformation is effected may be used, providing it with a movable core or other means of varying the inductance of its primary circuit. With such an organization the impulses of the alternating current of such a sign as to pass through the liquid conductor from the anode to the cathode are suddenly interrupted, producing sharp fluctuations of electromotive force in the translating-circuit, and the alternating impulses of opposite sign pass through the apparatus without interruption and are practically eliminated so far as any material reaction on the step-up transformer is concerned. By means of this organization an alternating current may be employed with equal facility with continuous current for all purposes for which this type of interrupter has heretofore been proposed.

My invention therefore comprises an automatic circuit-interrupter consisting of a source of alternating current, an electrolytic interrupter, and an adjustable inductance or anode for the interrupter (either or both) of such range of adjustment as to effect the interruption of the current during a half-wave or period of the applied electromotive force.

It comprises also other features, which will be more particularly hereinafter described and will be definitely indicated in the appended claims.

In the accompanying drawings, which illustrate the invention, Figure 1 is a diagram showing the arrangement of the parts. Fig. 2 is a detail view of the step-up transformer or induction-coil for supplying high-potential currents, and Fig. 3 is a diagram illustrating the action of the interrupter upon the alternating current.

Referring first to Fig. 1, P′ S′ represent, respectively, the primary and secondary coils of a transformer T, such as is commonly employed in systems of distribution to convert high-potential currents sent from a supply-station into currents of lower potential for operating translating devices in a consumption plant, and L L represent a number of translating devices, as lamps, supplied by such circuit. The terminals of the circuit L L, in other words, are such as are available in all buildings lighted by alternating current, and my invention renders it possible to utilize the potential and currents in such buildings for the operation of Roentgen-ray apparatus or other apparatus where high potentials and high frequencies are desirable.

In series relation to these terminals I place an adjustable inductance N, the core I of which may be connected with an adjustable slide K and liquid interrupter, such as shown at B. As commonly constructed this interrupter comprises a containing vessel in which is an electrolytic conductor, such as a dilute solution of sulfuric acid, and two electrodes, the anode being of very small exposure and the cathode of relatively much greater exposure to the electrolyte. In fact, the anode commonly consists of a platinum wire arranged so that its tip only is exposed to the electrolyte. As shown in the drawings, the cathode is constituted of the body of the containing vessel, which is made of metal. This, however, is a matter of choice, and it might be a lead plate or other conductor of large surface confronting the anode. I prefer to make the anode adjustable, so that more or less of its surface may be exposed to the fluid conductor, and where the latter is an electrolyte it may project directly into the body of the same, as indicated in the drawings, its area of exposure being varied by inserting a greater or lesser length thereof into the electrolyte. It may be introduced into the side of the vessel through a liquid-tight joint and its position controlled by an adjustment-screw, as indicated. In circuit with these two devices is included the primary P of a local transformer, the secondary S of which is wound for such increase of potential as may be desired in the use for which it is employed. A type of this transformer is shown in Fig. 2, in which the core O is mounted so that it may be moved within the coils and the inductance of the system varied by partially withdrawing the core from the coils. The rate of interruption depends upon a number of factors—the voltage applied at the anode, the area of exposed surface of the anode, and the value of the inductance of the circuit. By graduating the inductance and the surface exposure of the anode the apparatus may be accommodated to any desired frequency of the alternating source and may be caused to interrupt at any desired point of the alternating curve.

The better form of adjustment will be such a relation of the parts that the interruption will occur when the wave of definite sign reaches the maximum electromotive force. This condition is depicted in the wave marked 1 of Fig. 3, where the brisk interruption of the circuit at the moment of maximum potential produces a maximum effect in the supplied circuit. By reducing the inductance—as, for example, by sliding out the core I—the interruption may be made to occur at an earlier point in the wave period and at a point of lower electromotive force. Such a condition is depicted in the wave marked 2 in Fig. 3 and yields good results, though not such wide changes of potential as that shown in wave 1. In wave 3 of Fig. 3 the interruption occurs at a still earlier period of the wave and is not adapted for satisfactory results where a high potential is desired in the consumption-circuit and is further unsatisfactory as being liable to produce a second interruption within the same half-wave and conducing to an irregular action of the transformer P S. It will be noted that interruptions occur only on the waves of similar sign, as shown in Fig. 3 only the positive waves, or those above the zero-line, and, in general, only impulses of such sign as enter the interrupter at the anode. The negative waves are transmitted through the interrupter without interruption of the circuit, the anode during that period acting as a cathode, the only effect of such transmission being to produce slight fluctuations of electromotive force at the terminals of the transformer P, having no considerable effect on the ultimate translating-circuit.

I prefer to provide means for adjusting both the anode-surface and the inductance, thus admitting a smaller range of either and the transmission of lower current densities through the anode, thereby reducing the amount of wear.

While I have described my improvements in connection with the type of liquid interrupter shown, I desire to have it understood that my invention is not restricted in application to this particular type nor by any particular theory of operation, whether electrolytic or thermal in character. The action is best maintained where the current is led through an electrolyte, but is possible with conductors of other character in which at an interrupting-electrode a progressively-increasing force of current disruption proceeds when currents of determinate value are transmitted.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An automatic interrupter for alternating currents, comprising a source of alternating current, a rupture-point for a circuit supplied thereby responsive to a determinate current density, and means for graduating said current density to effect rupture of the circuit within a half-wave or alternation.

2. An automatic interrupter for alternating currents, comprising a source of alternating current, a liquid interrupter supplied thereby, and means for adjusting its rate to effect interruption of the circuit within a half-wave or alternation.

3. An automatic interrupter for alternating currents, comprising a source of alternating current, a liquid interrupter supplied thereby, and means for adjusting the current density to effect interruption of the circuit at the anode within each half-wave or alternation entering said anode.

4. An automatic interrupter for alternating currents, comprising a source of alternating current, an anode and cathode separated by a conducting liquid supplied thereby, an inductance in circuit, and means for varying

the latter to effect circuit interruption within a half-wave or alternation.

5. An automatic interrupter for alternating currents, comprising a source of alternating current, an electrolyte in circuit including an anode of small exposure to the electrolyte, and means for adjusting the current density to rupture the circuit at the anode within a fractional part of a wave or alternation.

6. An automatic interrupter for alternating currents, comprising a source of alternating current, a liquid interrupter, and a step-up transformer in circuit, the inductance of the circuit being adjusted to effect circuit disruption at a determinate point of each half-wave of like sign.

In witness whereof I have hereunto set my hand this 22d day of December, 1899.

ELIHU THOMSON.

Witnesses:
DUGALD MCKILLOP,
HENRY O. WESTENDARP.