(No Model.) 2 Sheets—Sheet 1.

E. THOMSON.

REGULATING AND MOTIVE DEVICE FOR ALTERNATING CURRENTS.

No. 397,616. Patented Feb. 12, 1889.

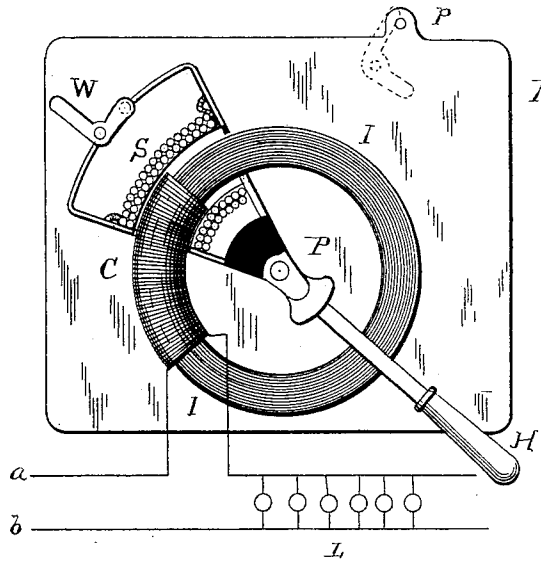


Fig. 1.

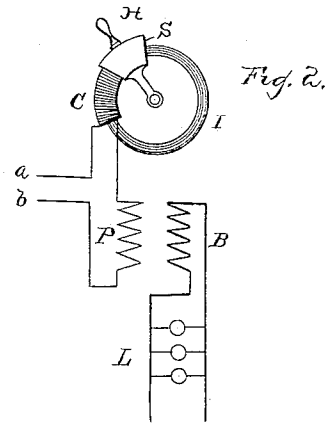


Fig. 2.

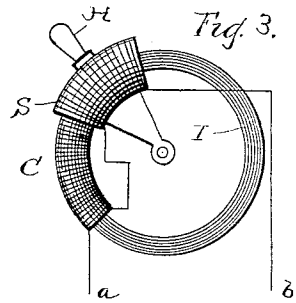


Fig. 3.

Fig. 4.

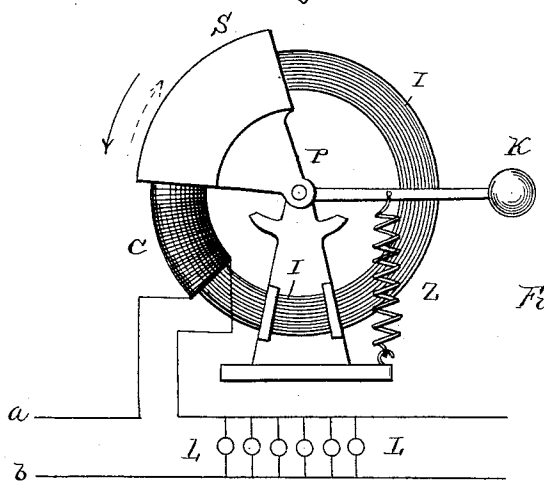
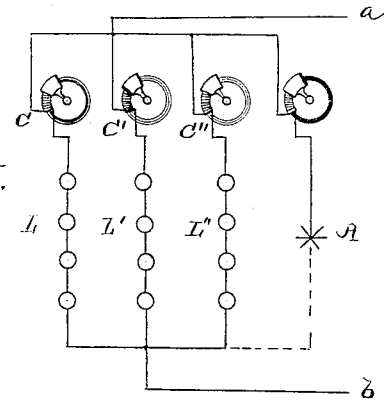


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

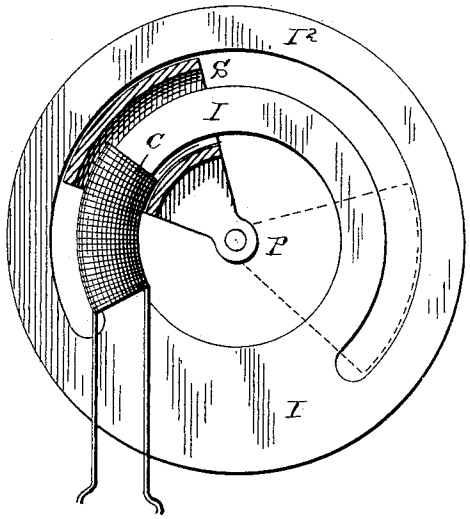


Fig. 7.

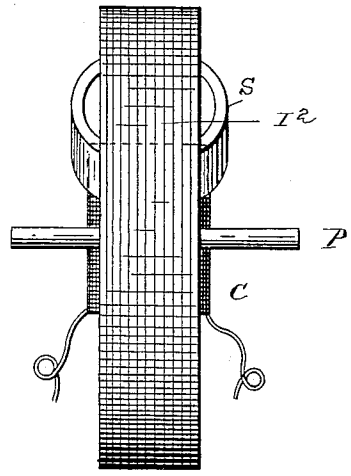


Fig. 8.

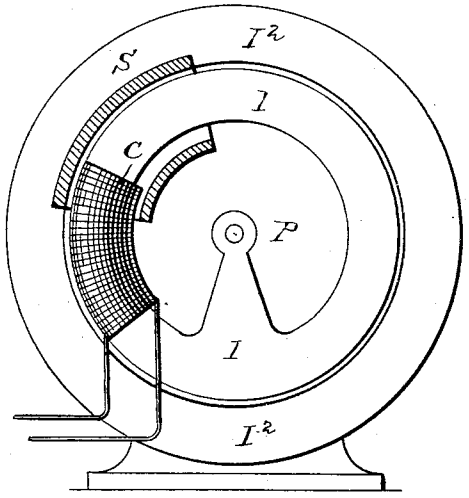


Fig. 9.

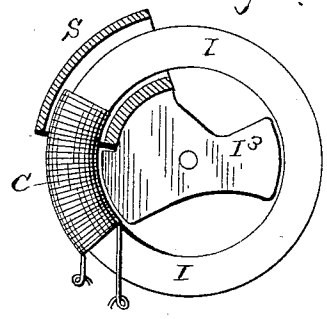


Fig. 10.

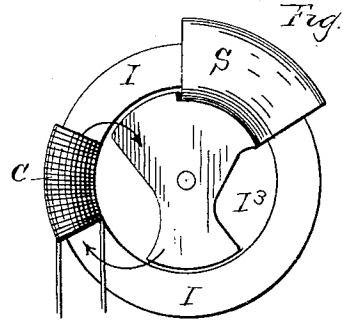
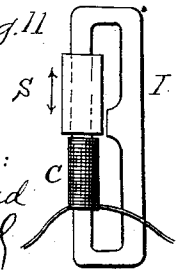


Fig. 11.



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UNITED STATES PATENT OFFICE.

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REGULATING AND MOTIVE DEVICE FOR ALTERNATING CURRENTS.

SPECIFICATION forming part of Letters Patent No. 397,616, dated February 12, 1889.

Application filed July 26, 1888. Serial No. 281,248. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Regulating and Motive Device for Alternating Currents, of which the following is a specification.

The present invention relates to a means for varying the self-induction or reaction exerted by a coil in an alternating-current circuit either in series with lamps or other energy-users or in circuit with primary or secondary coils in a system of induction transfer.

My invention also provides a simple and powerful motive device giving mechanical movement from alternating currents to be utilized in various ways.

My invention is applied either to regulate a current or to vary its amount or to obtain motion therefrom. In certain of its aspects the present invention is similar in principle to other motive and regulating devices for which I have previously made application and in some instances obtained patents, as, for instance, to the devices of Patent No. 363,186.

The variation of induction or reaction is in my invention obtained without contacts and switches passing over them, and in a smooth and gradual manner giving great advantages.

In the accompanying drawings, Figure 1 shows a plan and partial section of a device embodying my invention. Fig. 2 illustrates one of the applications of the device. Fig. 3 illustrates in plan a modification in the connections of one of the coils of the device. Fig. 4 illustrates a further modification of the invention adapted to a special use. Fig. 5 is a diagram illustrating one of the applications of my invention. Fig. 6 is a view in elevation, and Fig. 7 an edge view, of another modification, in which a mass of iron is applied to increase the effects. Fig. 8 is an elevation of still another modification. Figs. 9 and 10 show in plan or elevation the two positions of a form of the invention in which an armature is applied after the manner hereinafter described. Fig. 11 illustrates a modification in the form of the iron core to which the two conductors are applied.

In Fig. 1, I I is an iron core, preferably of ring or endless form, made of wire or laminæ, suitably piled and insulated to avoid Foucault currents. C is a coil of insulated wire wound on the core, as shown. S is a closed band or coil around the ring, and arranged to be moved over the coil C by a handle, H, and pivoted at P when preferred, though it could simply be slipped along in some cases. Let now an alternating current of fairly-constant potential be feeding lamps L L from *a* to *b*, with the coil C in circuit. If the closed coil or band S be brought down over the coil C, very little reaction or self-induction will exist in the coil C, and if its resistance be low the lights L L will be given their full brilliancy. If the coils S and C be now separated more and more by moving one away from the other around the ring, the self-induction of coil C progressively rises and becomes greatest when coil S is farthest removed from it. The lights are now dimmed as far as possible, any gradation being obtained by setting the coil S in a position with respect to coil C corresponding to the desired effect. The action is smooth and very effective. If a switch, W, be placed in circuit with said coil, so as to be opened when it strikes a pin, *p*, suitably placed, and after the coils C and S have been widely separated, the effect of coil C is further enhanced in dimming the lights or in exerting a self-induction, which checks the current in any device with which the apparatus may be put in circuit.

In Fig. 2 the devices described are shown placed in series, with a primary coil, P, of a transformer, whose secondary B feeds the lights L or other devices with current. A very smooth and powerful resisting effect may thus be obtained with moderate sizes of apparatus.

If the directions of windings are made opposite, the two coils C and S, as in Fig. 3, may be connected in series or multiple arc and the current led from *a* to *b* through them. They should in such case be wound to have equal ampère turns' capacity in magnetizing the core I. When the coils are superposed, they will neutralize one another's self-induction; but as they are separated the self-inductive kick or reaction will gradually increase. Wherever, then, in this description I have or shall de-

scribe a closed band or circuit it is to be understood that its place may be taken by an arrangement such as is referred to in Fig. 3, both coils being fed from the circuit itself. For evident simplicity, however, the closed band or circuit of Fig. 1 and other figures is to be preferred.

I have thus far shown how my invention may be used as a variable self-inductive coil or device movable by hand. The same device, however, if the parts are relatively free to move, gives out from alternating currents a mechanical power or pressure which may repel the coils apart. To obtain a movement of coil S or pressure tending to move it, coil C has only to be put into an alternating-current circuit. Further, however, I utilize this repulsive power to make the self-induction self-adjusting, whereby I can obtain a constant current on the circuit of a set of lamps or the like, even though variations of volts fed to them may occur. Thus, as in Fig. 4, the source *a b* of current may be one which varies in potential, the coil C being put in series with a group of lamps, L L. In this case the copper band or closed circuit S is pivoted freely at P and counterpoised to a certain extent by a lever and weight, K, or other device, whose effect may be varied, if need be. Sometimes a spring, Z, may be used in addition (or even alone if of proper retractile effect) and suitable stops may be provided to limit the range of movement. Suppose that the coil S is set and so balanced that, with a given current in coil C, it is repelled, so as to about half cover the coil C, (or less if the counter-forces K Z are properly adjusted,) and that an increase of current, due to increased potential, takes place in the circuit. Coil C will more strongly repel circuit or band S, and it will move partly up and away, with the result of increased self-induction in coil C, which self-induction, if the parts are suitably adjusted, will approximately restore the current strength to what it was before the change. A fall of potential corrects itself by working in the reverse direction.

My invention in this self-regulating or automatic form is used in such circuits as are represented in Fig. 5, where wires *a b* of constant or even somewhat variable potential difference feed in multiple several series of lights, L L′ L^2, such as incandescent or arc lights with alternating currents. Each series, circuit, or branch requires a constant current, and to insure this, even though a light be cut out in any series, I place my automatic self-inductors, Fig. 4, in each branch or series at C C′ C^2, where it acts, as described, in connection with Fig. 4, to preserve the current strength. Of course the group L, Fig. 4, or series L L′ L^2 may be replaced by a single light or translating device—such as an arc lamp—without affecting the result. This has been indicated at A, Fig. 5, always assuming the potentials to be not so excessive or so feeble as to exhaust the capacity for regulation to be found in the device.

To enhance the effect of my apparatus, I sometimes construct it as in Figs. 6 and 7, (Fig. 7 being an edge view of Fig. 6.) I place outside the ring I an extension, I^2, or accessory magnetic circuit or mass of iron, between which and ring I the coil or closed band S moves. The iron of I is also extended outward as near to I^2 as will permit coil S free movement. The effects are the same as in Fig. 1, only that the self-induction of coil C when coil S is moved to the position shown in dotted lines is much greater proportionately than in Fig. 1.

As shown in Fig 8, the outer iron ring, I^2, may be stationary and the inner ring, I I, movable around pivot P. Ring I I carries coil C wound thereon, and ring I^2 I^2 carries coil or band S, as shown. The coil C is let into a notch in the outer edge of core I, and band S into the inner edge of outer iron ring or core, I^2 I^2; hence the iron of the two rings can almost touch or be very close together. This enhances the effects when the part S is removed from over the part C by affording an outside closed magnetic circuit irrespectively of the part of the ring I which is always inclosed by the band S.

In Figs. 9 and 10 the part I^3 is of iron, as shown, and carries coil or band S. When the coils or circuits S and C are separated, as in Fig. 10, a closed iron path for the core I, as indicated by the arrows, is afforded the iron I^3, operating after the manner of an armature, and comes into play to increase the effective self-induction of the coil C.

I have in the preceding figures shown my invention with a movement of the parts around an axis. This is not essential.

In Fig. 11 the part S is shown as having up-and-down vertical movement, the iron part I being shaped accordingly.

While I have described my invention as adapted for use peculiarly with alternating currents, it is to be understood that I do not confine myself to alternating currents, since similar effects may be obtained with intermittent or pulsatory currents or other characters of current where the electric energy is constantly and rapidly varied.

What I claim as my invention is—

1. An alternating-current motive or regulating device consisting of an iron core of endless form or inclosed magnetic circuit and two electric conductors encircling the same, the parts being properly mounted, as described, to permit change in the inductive relation of the two circuits or conductors, as and for the purpose set forth.

2. The herein-described device for use on alternating-current circuits, consisting of two or more circuits placed on a core whose magnetic circuit is closed and movable to a greater or less extent from the position where one is superposed upon another.

3. As a means of varying the self-inductive resistance in an alternating-current circuit, a closed coil or band adjustable over or under another coil or band placed on a core of iron of endless form included in the circuit whose self-induction resistance is to be varied.

4. The herein-described alternating-current motive or regulating device, consisting of a core on closed magnetic circuit, a coil or conductor on said core placed in an alternating-current circuit, and a second coil, conductor, or band movable over the same core or closed magnetic circuit and having its electric circuit closed on itself, as and for the purpose described.

5. The alternating or varying current motive or regulating device herein described, consisting of two or more conductors encircling a closed-circuit core and movable with relation to one another, as described, so that they may either produce a neutralization of one another's magnetic effects, or when removed from proximity may have each a self-induction due to their magnetizing action on the core.

6. The combination, with an alternating-current circuit containing translating devices—such, for instance, as incandescent lamps—of an adjustable reactive device consisting of a coil on a closed-circuit magnetic core, and a closed-circuit conductor applied to the same core and adjustable with relation to the coil.

7. The combination, with translating devices in an alternating-current circuit, of a regulator of the current flowing to the translating devices, consisting of a reactive coil connected to the circuit of said translating devices and placed on an iron core, and a coil or band on closed circuit and inductively related to the first-named coil, one or the other of said coils being partially counterbalanced and movable with relation to the other under the repulsive action to positions where a balance of repulsive and counterbalancing action may be established.

8. The combination, with the coil placed in an alternating-current circuit and surrounding an iron core, of a second closed band or coil whose inductive relation to the first is variable or adjustable, and an electric switch connected to the circuit of the closed band or coil, as and for the purpose described.

9. The combination, with a reactive coil in an alternating-current circuit, of a second adjustable closed-circuit conductor in inductive relation to the core for the first coil, and an electric switch for interrupting the circuit of the adjustable conductor on a movement thereof to a predetermined extent.

10. The combination, with the core and coil in an alternating-current circuit, of a second conductor or band through and beyond which the said core or the magnetic extension thereof passes and adjustable in its inductive relation to the alternating-current coil, and a mass of iron external to both coils or conductors and parallel to or in close proximity to the portion of core beyond the second coil.

11. The combination, with the two coils or conductors movable with relation to one another on the same core, of an armature for one coil connected or movable with the other coil, as and for the purpose described.

12. The combination, with two or more circuits in parallel and each containing one or more translating devices, of a self-adjustable reactive coil in each branch and in the circuit with the translating device or devices of said branch, for the purpose described.

13. The combination, with a core and coil, I C, of a closed-circuit band or conductor let into a notch or depression in the iron mass parallel to said core, so as to bring the core and the part of the iron mass to either side of the closed-circuit band or conductor into close proximity.

14. The combination, with the coil in one alternating-current circuit, of an iron core having a recess or depression to receive the coil, and a second circuit band or conductor encircling said core and adjustable in its inductive relation to the first, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 21st day of July A. D. 1888.

ELIHU THOMSON.

Witnesses:

E. WILBUR RICE, Jr.,

MERLE J. WIGHTMAN.