(No Model.)

E. THOMSON.

ALTERNATING CURRENT MOTIVE AND REGULATING DEVICE.

No. 377,217. Patented Jan. 31, 1888.

Fig. 1.

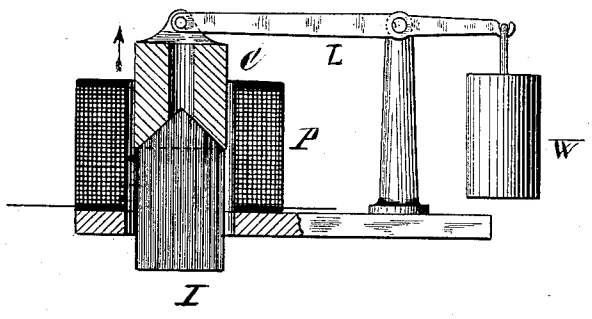


Fig. 3.

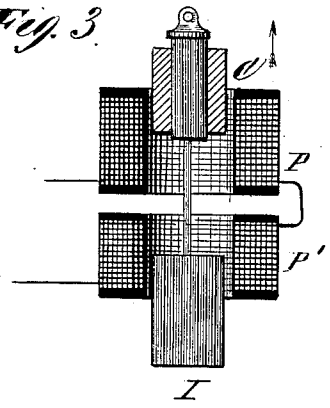


Fig. 2.

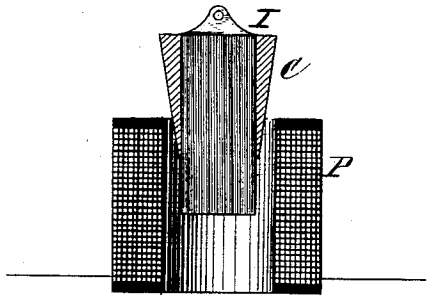


Fig. 4.

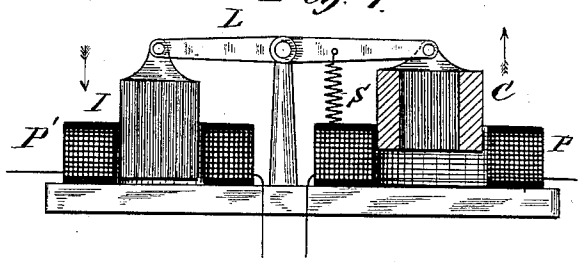


Fig. 5.

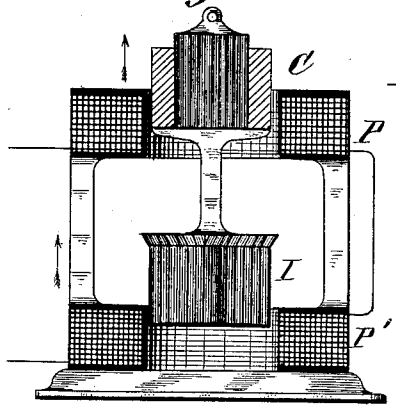


Fig. 6

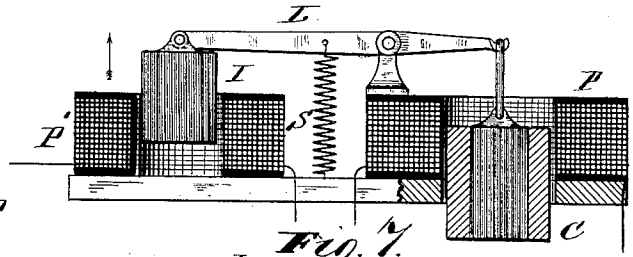
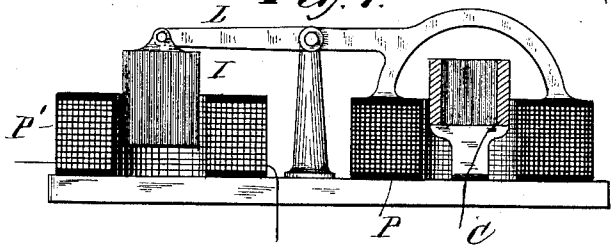


Fig. 7.



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS.

ALTERNATING-CURRENT MOTIVE AND REGULATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 377,217, dated January 31, 1888.

Application filed March 30, 1887. Serial No. 232,940. (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 certain new and useful Alternating-Current Motive and Regulating Devices, of which the following is a specification.

The object of my invention is to provide an improved device adapted for use on alternating-current circuits, either as a motive device which may be used for any of the purposes for which electro-magnets are ordinarily employed on continuous-current circuits, or for use as a regulating device to vary or control the counter electro-motive force or reaction at a point on an alternating-current circuit, or for other purposes.

My invention consists of a novel device employing, in combination, a closed conducting-circuit of low resistance and high self-induction in which rapidly-alternating currents are produced by an alternating-current coil or alternating magnetic field, with a core of iron—such as a bundle of iron wires—which forms the core of the same alternating-current coil, or of another coil in which alternating currents flow, the two parts—to wit, the magnetic core and that forming the closed conducting-circuit in which the alternating induced currents are set up—being combined with one another or with the coil or coils acting on them, or the two coils themselves (if two coils be employed) being so combined or mechanically connected that a change in the relation of the closed induced circuit with relation to its inducing agent shall be accompanied by a simultaneous change in the magnetic relation of the core to its alternating-current coil.

The closed conducting-circuit, which may be of any form, is of sufficiently low resistance and high self-induction to cause a continuous repulsion between the conductor forming the circuit and the inducing agent or coil when the latter is subjected to alternations of current or magnetic condition at the rate of, say, one hundred times per second. Various devices of such a nature are set forth in a prior application for patent filed by me, and depend upon the apparent principle that the self-induction of the alternating induced currents is sufficient to cause them to be prolonged to a point where the next alternating inducing current will be sufficiently established to produce the effect of continuous repulsion.

Some of the various forms of device in which my invention may be embodied are shown in the accompanying seven (7) figures of drawings in vertical cross-section.

Referring to Figure 1, P indicates a coil or wire in which alternating currents flow from any source, while I indicates a core for said coil, consisting, preferably, of a bundle of iron wires connected to a cylinder, C, of copper or other good conducting material, which forms the path for alternating induced currents of high self-induction set up by the influence of the alternating currents in the coil P. The conductor and core may be supported, if desired, on a lever, L, provided with a counterpoise-weight, W. Any other device may be employed to support and guide the parts so that they may move together. The alternating currents passing in coil P will tend to pull the core I into the coil, and at the same time will tend, through the presence of the induced electric currents in the conductor C, to repel the latter out of the coils, the resulting force being summative in character, and exerting a push or pull tending to move two parts together in an upward direction. This movement or tendency to movement may be utilized in any desired manner. There will also result from such a movement an increase of reaction or counter electro-motive force in the coils P, which will tend to cut down the current in said coils. This is due to the fact that the magnetic core I is moved farther into the coils, while the closed conducting mass of C is moved farther away from the inducing field or coils, so that less of the current in coil P is expended in the inductive action of setting up currents in said conductor. So long as the conductor C remains in the coil the current in the coil (in part) spends its inductive action in setting up currents in the conductor instead of counter electro-motive force or reaction by self-induction.

In the form of my device shown in Fig. 2 the closed conductor is made as a tapering band which surrounds the upper part of the iron core I. The alternating current in coil P will in this arrangement of the devices tend to draw the core I into the coils, thus causing

an increased reaction or kick, while at the same time, through the simultaneous and gradual insertion of the conductor C, the tendency to kick or reaction is diminished through the expenditure of the alternating currents in inducing currents in the conductor C.

Fig. 3 shows a variation in which the closed conductor or circuit is repelled from one coil, while at the same time the coil connected to or combined therewith is attracted into the same coil or another coil, P′, connected with that which acts on conductor C. If the coils P P′ are in the same alternating-current circuit, the effects will be the same as in the case of the devices shown in Fig. 1—to wit, a motion due to the combined attractive and repulsive effects of the coils on the parts C and I, and an accompanying increased reactive effect in the circuit including the coils.

In Fig. 4 a substantially similar arrangement is shown, the parts C and I being in this case, however, mechanically connected and combined through a lever, L. The coil P repels the conductor C, while the coil P′ attracts the core I, and thus causes increased reaction in both coils, in company with a movement of the parts in the direction shown by the arrow. Coils P and P′, Figs. 3 and 4, may be in separate circuits or parts of a circuit, and an increase of current in coil P would then be followed by the introduction of the core I into the coil P, so as to cause an increased reaction or counter electro-motive tendency to the alternating currents in the coil P′, owing to the repulsion of the conductor C, and the consequent introduction of the core I farther into the coils P′. A spring, S, adjustable or otherwise, may act against the repelling force existing between the conductor C and its inducing coil or agent.

The actions described may be reversed, as shown in Figs. 5 and 6, where the parts are shown so arranged and combined that the core I is withdrawn from its coil when the current increases in the coil P, which acts on the closed-circuit conductor C, so as to repel the latter from said coil; hence by the device Fig. 5 the increased reaction caused by the movement of closed-circuit conductor C out of its coil P may be made to produce or be accompanied by a decreased reaction in the coil P′ through the withdrawal of the iron core I. If, therefore, coils P and P′ be joined as one, the change of reactive effect due to the movement of one may be compensated by the change in relation of the other to its coil or portion of coil, so that the resultant reactive effect of both coils will remain practically the same for the different positions of the two parts. This particular combination is useful where it is desired to obtain movement of the parts by the action of alternating currents, without, however, changing the electrical relation of the coils to the circuit in which they are placed.

In Fig. 6 the parts C I are joined by a lever, and a spring, S, tends to hold the parts in a position shown against the repulsive tendency existing between the conductor C and the coil P. If the coils are separate coils in different circuits, or in different parts of the same circuit, an increase of current in the coil P will, as before, by withdrawing the core I, cause the coil P′ to oppose a decreased reactive effect to the alternating impulses, which latter would meet with less counter electro-motive force or tendency due to the self-induction of the coils P′, and the current in the circuit of said coils would therefore tend to increase.

I have described the combined action of the core and inducing-conductor as being produced by making said parts movable, the coil P being stationary; but it is quite obvious that the same effects can be produced by moving the coils with relation to the core or the conductor.

Fig. 7 illustrates a modification of this nature in which the same action is produced as in the case of the devices Fig. 6, the coils P being mounted on the lever L and arranged with relation to the conductor C, which is stationary, in such way that the mutual repulsion existing will tend to depress the one end and raise the opposite end of the lever.

My invention is particularly applicable to the construction of instruments for indicating the force of alternating currents, for regulating such currents, for prime motive or controlling devices on alternating-current circuits, and for other uses which will readily occur to electricians.

What I claim as my invention is—

1. A motive or regulating device for alternating-current circuits, consisting of a closed conducting-circuit in which currents of high self-induction are inductively generated, combined with a mass of magnetic material, preferably subdivided, serving as the core of an alternating-current coil with relation to the magnetic field of which the core varies magnetically simultaneously with a change in the inductive relation of the conducting-circuit and its inducing agent.

2. The combination, substantially as described, of a closed conducting-band or conductor, an alternating-current coil which sets up currents of high self-induction in said conductor, and an iron core or mass, preferably subdivided, whose magnetic relation with reference to the magnetic field of the same or a different alternating-current coil varies simultaneously with a change in the relation of the closed conductor and its inducing agent, as and for the purpose described.

3. A motive or regulating device for alternating-current circuits, consisting, essentially, of one or more alternating-current coils, a closed-circuit conductor adapted to carry induced currents of high self-induction, and an iron core connected to said conductor and movable with the same into different positions in the magnetic field, as and for the purpose described.

4. The combination, substantially as described, of an alternating-current coil or coils, a closed conducting-circuit in which currents

are set up by induction, a core for an alternating-current coil, and means whereby the inductive relation of both core and conductor to the coil or coils may be simultaneously varied.

5. The combination, with one or more alternating-current coils, of a movable conductor in which currents of high self-induction are set up, and a connected core adapted to have a movement of translation in the field of the conductor, whereby a movement of the conductor may be accompanied by a change in the reactive capacity of the coil due to the presence of the core.

6. The combination, on an alternating-current circuit, of a coil or coils, a core for one or both of said coils, and a closed-circuit conductor, said elements being connected in the manner described, so that a movement producing a change in the inductive relation of one of the parts with reference to the coil will impart movement to another part in the proper manner to produce a compensation by changing the inductive relation of said latter part to the coil in the circuit.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 23d day of March, A. D. 1887.

ELIHU THOMSON.

Witnesses:
E. WILBUR RICE, Jr.,
J. W. GIBBONEY.