(No Model.)

F. G. WATERHOUSE.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 313,561. Patented Mar. 10, 1885.

Fig. 1.

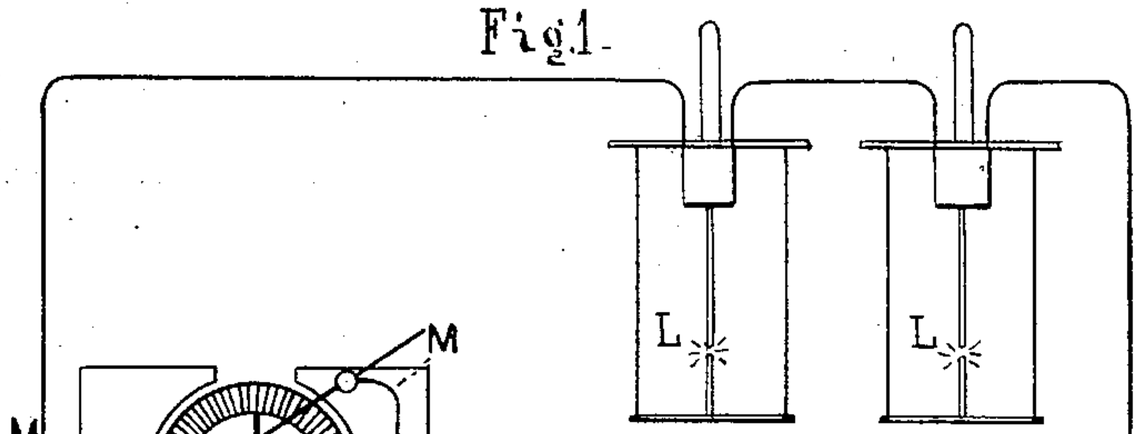


Fig. 3.

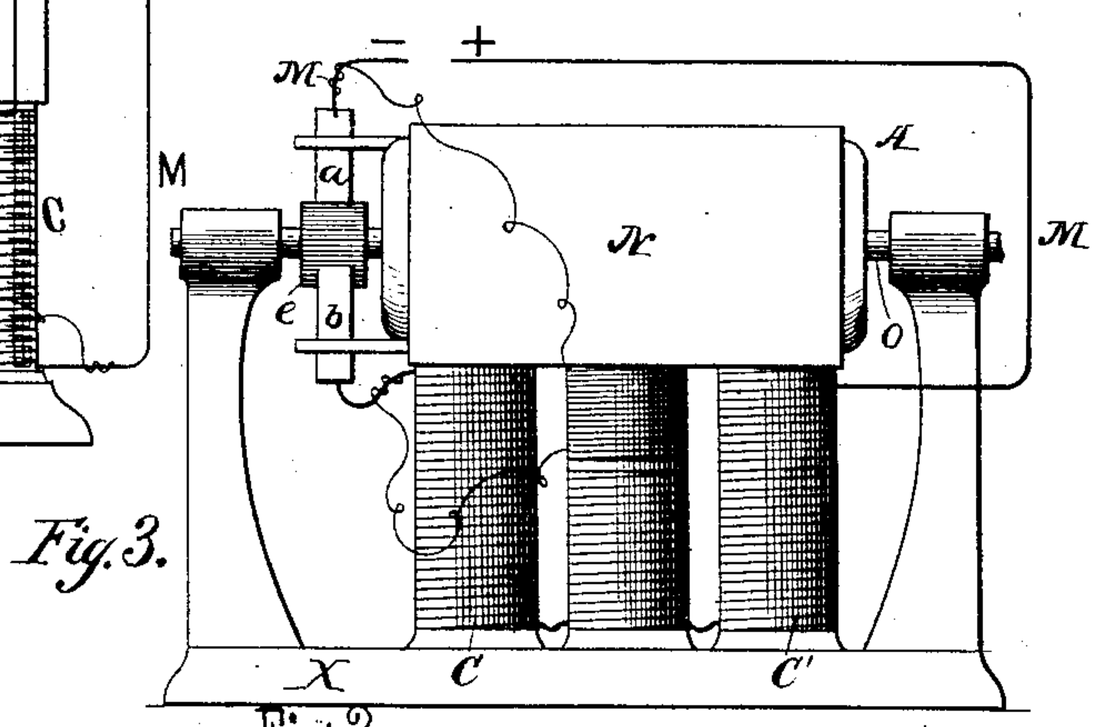
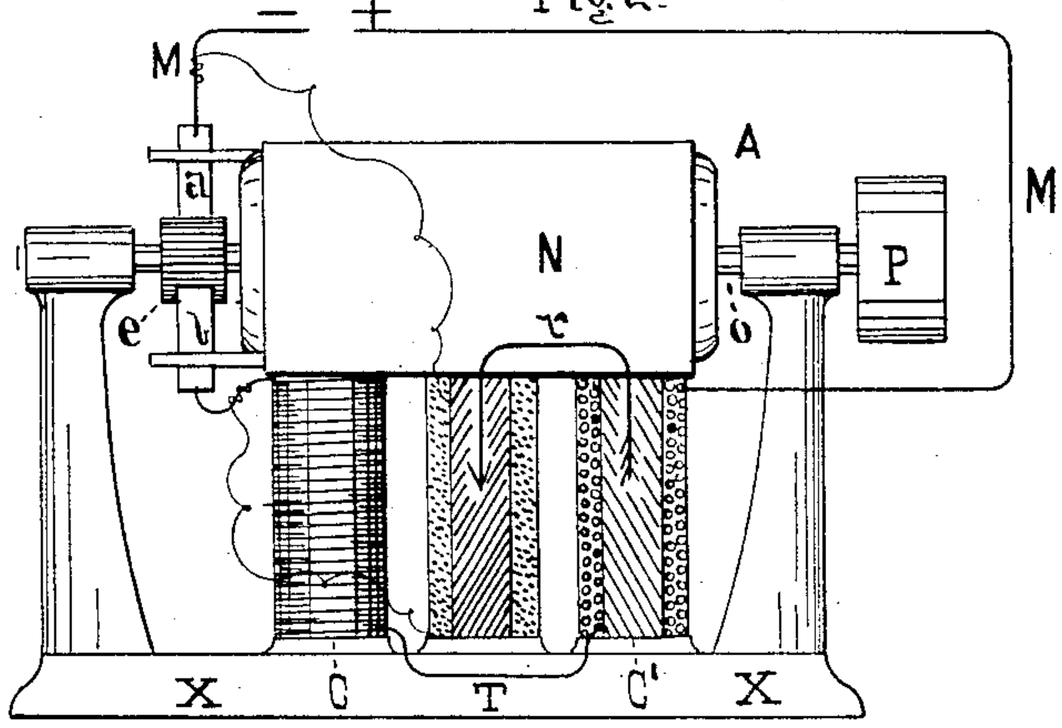


Fig. 2.



Witnesses,
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UNITED STATES PATENT OFFICE.

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REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 313,561, dated March 10, 1885.

Application filed May 17, 1884. (No model.)

To all whom it may concern:

Be it known that I, FRANK G. WATERHOUSE, a citizen of the United States, residing at Sacramento, in the county of Sacramento and State of California, have invented certain new and useful Improvements in Dynamo-Electric Machines and Motors, of which the following is a description.

My invention relates to improvements in dynamo-electric machines and motors in which the volume of electric current generated is regulated by the resistance in the line which the current has to overcome; and it consists in the manner of winding the electrical wires upon the field-magnets, so that any variation in the volume of current can be used to regulate the volume being generated. I accomplish this result by the means illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation of a generator, showing the two field-magnet cores F and C, the two pole-pieces N and S, the armature A, the commutator *e*, and two contact-brushes for taking the current from the commutator, the bed *x*, upon which the generator rests, and which forms the neutral yoke of the magnets F and C. There is also shown the main wire M, which conducts the main current around one of the field-magnet cores, C, to the lamps L L, then back to the commutator *e*. There is also shown a shunt-wire, *s*, which is electrically connected to the main-current wire M in two places, so as to form a shunt around the total resistance of the external line. This shunt-wire *s* is used to form the coil of one of the field-magnet cores, F.

Fig. 2 shows a side elevation of a generator placed upon the bed *x*, and in which are shown three of the field-magnet cores, C, T, and C′, also one of the pole-pieces, N, the commutator *e*, contact-brushes *a b*, with wires leading therefrom, the armature A, shaft *o*, and pulley P, also the shunt-wire *s*, beginning at brush *b* and forming the coil of magnet-core T, and then terminating at its connection with brush *a*.

Similar letters refer to similar parts in both of the views.

In Fig. 1 is shown that part of the field-magnets that are excited by the main current M and part excited by the shunt-current *s;* but it is supposed that core F is one of several arms that excite the pole-piece S, while C is one of the several arms that excite the pole-piece N, and part of the arms of S are excited by the main current and part by the shunt-current, and the arms of the pole N are also magnetized by the two currents in the same manner, as will be more fully shown in Fig. 2, in which two of the magnetic arms or cores, T and C, are made sectional, showing that the arm T is wound and excited by the shunt-wire *s*, while the arm C is wound and excited by the main wire M, which is also the case with the magnetic arm C. The three arms C, T, and C′ are excited by the currents which flow in a direction so as to make the upper end or pole-piece, N, of a north polarity, while the lower end would be of a south polarity. If the arm C were removed and the two arms T and C′ left and a current passed around each, as stated, the pole N would be magnetized with a force equal to the force of the two arms T and C′; but if the current that magnetizes arm T should be broken the magnet caused by the arm C′ would not terminate in the pole N, but would return in the direction of the arrow, so that the two arms T and C′, with the pole N and bed *x*, would form a closed magnetic circuit, so that none of the magnetic lines of force would escape or pass through the armature to the opposite pole-piece. The result would be that as soon as the current in any one of the arms would cease there would be a return-passage opened for the magnetism produced by the other arm or arms belonging to the same pole-piece, and the magnetism created in such pole would be destroyed or returned without passing through the armature, and as such would be the case if the current in one of the arms should entirely cease the same would occur in various degrees as the current in one of the arms were lowered or decreased. So by decreasing the current that magnetizes any one of two or more arms that belong to a single pole I decrease the magnetic effect of the other arms upon the pole. In order to make use of this fact in producing a self-regulating generator, I use the shunt-wire *s* to excite the arm T. As the resistance in the outer circuit is increased, more current is forced through the shunt *s*, which increases the magnetism in T, so as to balance the magnetism produced in the other arms and cause it to terminate in the pole N; but as soon as the resistance in the outer circuit is decreased less current flows

through *s* and the magnetism in N is decreased, so that in that way the magnetic strength of the field of force in a generator is decreased or increased, so as to enable the generator to produce a given current through the varying resistance of the external circuit of a line. Instead of using the shunt-wire *s* to excite one or part of the arms shown, the main current may be used to excite all the arms, and the current or part of the current may be shunted around part of the arm, so as to produce the same magnetic changes as shown in Fig. 3. In shunting the current from around the arms the same may be accomplished by any of the known means.

I am aware that prior to my invention dynamo-electric machines have been regulated by varying volumes of electrical currents passing around the field-magnets. I therefore do not claim such a means, broadly; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A dynamo-electric machine or motor in which one or both of the pole-pieces of a field-magnet are connected to the neutral part of the yoke of the field-magnets by means of a set of two or more parallel magnetic arms carrying exciting-coils, so that the magnetic strength of each pole piece will be equal to the aggregate strength of all the arms, and means for varying the current in one or more coils, so that if the magnetism of any one arm is lowered or destroyed it will weaken the magnetism in the pole-piece by offering a return magnetic path from the pole-piece back to the neutral part of the magnet, through which the magnetism caused by the other arms in the same set may pass without passing through the armature, substantially as described.

2. A dynamo-electric machine or motor in which the pole-pieces are connected to the neutral part or parts of the field-magnet by means of a set of magnetic arms, consisting of two or more in each set, with means for varying the magnetic strength of one or part of the arms in each set, so that the magnetic strength of the pole-piece to which they are connected will be raised or lowered, substantially as and for the purposes set forth.

3. A dynamo-electric machine or motor in which the pole-pieces are united to the neutral parts of the field-magnets by sets of magnetic arms having two or more arms in each set, part of the arms of each set being magnetized with one branch of the main current, while the other part of the arms of the same set are magnetized by the other branch of the main current, with means for reducing the current in one branch, so that the magnetism of part of the arms is decreased, and with it the magnetic strength of the pole-piece to which they are united, substantially as and for the purposes set forth.

4. A dynamo-electric machine or motor in which the field-magnets are composed of the pole-pieces, one of which is marked N, the bed *x*, composing the neutral part of the magnets, and the set of magnetic arms C, T, and C′, which connect the bed *x* and pole N together, the arms C C′ being magnetized by the main current or a branch of the main current, and the arm T being magnetized by a shunt-current or a branch of the main current, substantially as and for the purposes set forth.

5. A dynamo-electric machine or motor the field-magnets of which consist of the pole-pieces N and S, the bed *x*, and two sets of magnetic arms, F and C, composed of two or more arms in each set provided with exciting-coils, in combination with means for shifting or changing the amount of current in part of the coils in a set, substantially as and for the purposes set forth.

FRANK G. WATERHOUSE.

Witnesses:
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