(No Model.)

M. WADDELL.

DYNAMO ELECTRIC MACHINE.

No. 388,093. Patented Aug. 21, 1888.

Fig. 1.

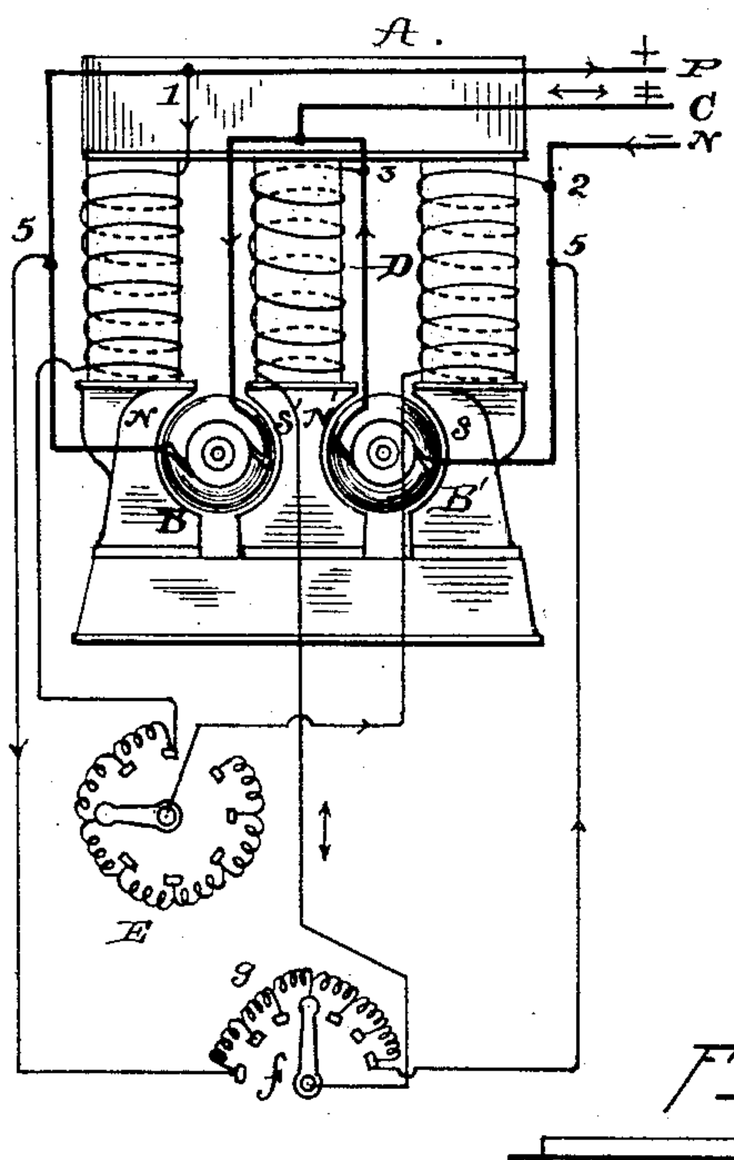


Fig. 2.

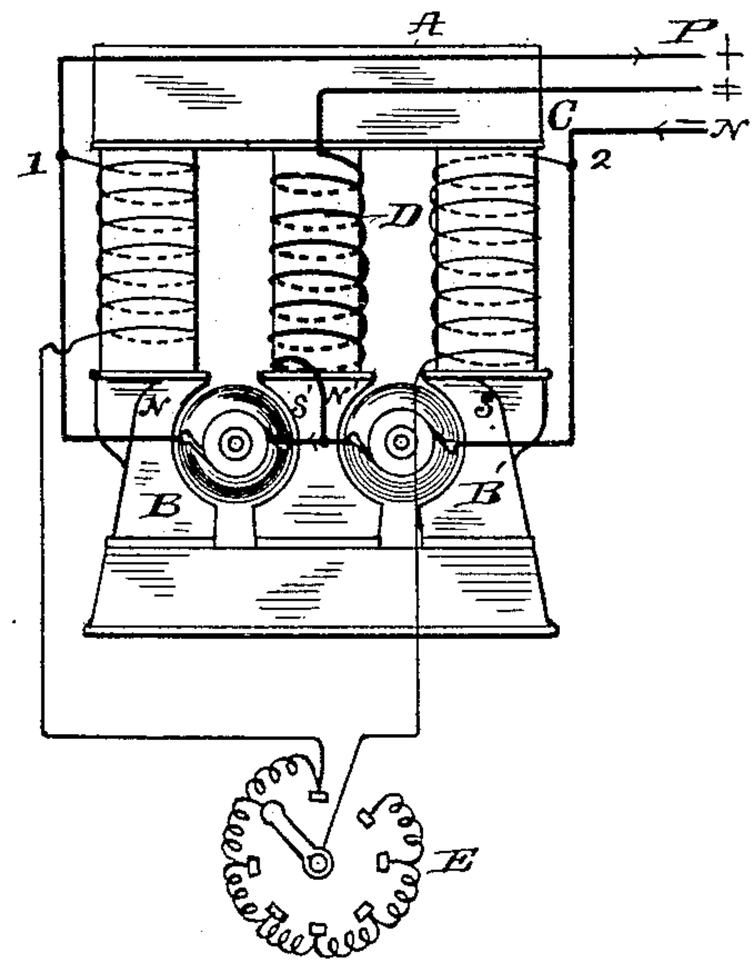
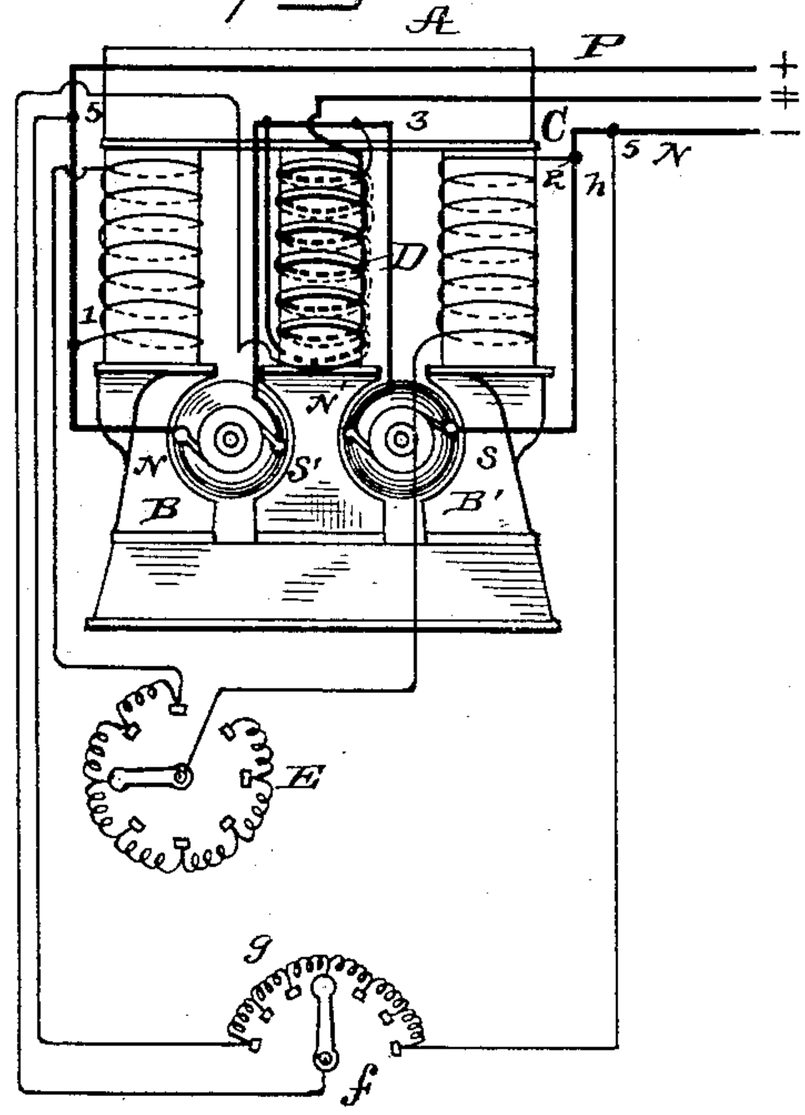


Fig. 3.



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UNITED STATES PATENT OFFICE.

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DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 388,093, dated August 21, 1888.

Application filed February 27, 1888. Serial No. 265,491. (No model.)

To all whom it may concern:

Be it known that I, MONTGOMERY WADDELL, a subject of the Queen of Great Britain, residing at New York city, in the county and State of New York, have invented a certain new and useful Improvement in Dynamo-Electric Machines, of which the following is a specification.

My invention relates to a dynamo-electric machine especially intended for use with the three-wire or compensating system of electrical distribution, my object being to enable a single machine to be used as the source of current for both sides of such a system, and to have the same capable of effective regulation, either automatically or by hand, so as to maintain the required electro-motive force on each side of the system as the load on either side varies.

To this end my invention consists, mainly, in a dynamo-electric machine having two armatures revolving between opposite poles of a field-magnet and a central regulating-magnet whose pole is between the two magnets, and whose inductive effect is reversible and variable, whereby it may be made to exert a greater or less effect on either of the armatures. Thus, if the middle pole is magnetized with a north polarity, the electro-motive force of one of the armatures is increased, while with a south polarity for the central magnet this effect is reversed. This arrangement and the different modes of regulation embodying the above idea are illustrated in the accompanying drawings.

Figure 1 is a view, partly in diagram, illustrating a form of my invention in which the central magnet-circuit is a differential shunt between the two sides of the system and the regulation thereof is partly by hand and partly automatic; Fig. 2, a similar view of a form in which the winding of the central magnet is in series in the third or neutral wire and the regulation of the central magnet is wholly automatic, and Fig. 3 a similar view of a form in which the central magnet is wound partly in series and partly in shunt.

The arrows show direction of current, double-headed arrows indicating that the current may be in either direction.

The principle of the invention may be most readily understood by referring to Fig. 2.

A represents the yoke of an electro-magnet, having its pole-pieces N S situated so far apart as to accommodate between them two armatures, B and B', and between the two armatures a central pole-piece, (marked N' S',) which is the extension of a core, D, extending from the yoke A between the cores of the main magnet. The two armatures are joined in series between the main circuit-wires P N, and from between them extends the neutral or compensating wire C, so that the two armatures form the divided source of a three-wire or compensating system. The main field-magnet is wound in a shunt-circuit, 1 2, between the conductors P N, such field-circuit having an adjustable resistance, E, for regulating the whole current of the machine. The middle magnet in this form is wound directly in the neutral wire C. It will be understood that the current in this neutral wire varies in quantity and in direction as the number of translating devices and the electro-motive force of each side of the system vary. Thus if the number of translating devices and the pressure on the two sides are equal, then there will be no current on the middle wire and no magnetization of the central magnet; but if on the positive side of system translating devices are added current will flow back toward the machine on the middle wire, and this current will give such a polarity to the middle pole-piece as will increase the electro-motive force of the positive armature B and the current on the positive side of the system, while the main magnetism, which is not affected, maintains the electro-motive force of armature B'.

If the number of translating devices on the negative side of the system becomes larger, the current in the middle wire, C, will flow away from the machine and the polarity of the middle pole-piece will be reversed, so that its magnetism will assist the negative armature B' and give an increased electro-motive force to the negative side of the system. The degree of magnetization of the middle pole-piece and its effect on either armature of course varies with the amount of current in wire C, and so is proportional to the requirements of the system. Thus an automatic regulation for each side of the circuit is secured in accordance with the requirements of the system, while to meet

changes in the whole number of translating devices the regulating-resistance E is used, affecting both armatures alike.

In the arrangement shown in Fig. 1 the construction of the machine and the main circuit-connections are the same as before described, and the main field-magnet windings are, as before, in a shunt, 1 2, provided with an adjustable resistance, E; but the middle magnet-coils, instead of being directly in the third wire, are in a shunt between the middle point of the wire connecting the two armatures in series and the two outer wires, P N, of the system. This shunt 3 5, starting at the said middle point, 3, includes the coils of the middle magnet and extends to the pivoted switch-arm *f*, traveling on the contacts connected with resistance-coils *g g*. The terminals of these resistance-coils are connected, respectively, by wires 5 5 with the outer conductors, P N, of the system.

It is evident that when the arm *f* is, as shown, at the middle point of the resistance series, and when the electro-motive forces of the two sides of the system are equal, there will be no current in either direction in wire 3; but variations in electro-motive force between the two sides of the circuit will cause current to flow in said wire 3 in one direction or the other, whereby the middle pole-piece will receive magnetism of one or the other polarity, and the automatic regulation of each armature to give the right electro-motive force to each side of the circuit will result.

To produce greater changes in the electro-motive force of the armatures, the hand-switch *f* may be used. It will be seen that by moving this switch in one direction or the other upon the resistance-coils current will be caused to flow in one direction or the other through the wire 3, whereby the desired polarity can be given to the middle pole-piece, and the degree of magnetization thereof will be varied by moving the switch-arm a greater or less distance along the resistance-coils, so as to put more or less resistance in the shunt. I may also wind the middle magnet both in series and in shunt, as is illustrated in Fig. 3. Here the coarse series winding forms part of the third wire, C, and the fine shunt winding is in the circuit 3 5, and includes the regulating-switch *f* and resistance *g*, as before. The main field-magnet circuit 1 2 has also its adjustable resistance E.

It will be seen that here the shunt and series windings of the middle magnet act together to magnetize the middle pole-piece in the right direction to give the desired electro-motive force to each armature, the amount of magnetization in either direction being dependent on the difference of electro-motive force between the two sides and the amount of current flowing in conductor C. The regulation may also be performed by hand, as before explained, by manipulating the switch *f*.

While I have shown my invention in connection with a dynamo of the Edison type, it is evident that it is as well adapted to other types of bipolar machines. It is evident that the main field-magnets may be "compounded" or wound so as to maintain a constant potential, if desired.

What I claim is—

1. In a dynamo-electric machine, the combination of a field-magnet, two armatures between the poles of said magnet, and a central regulating-pole between the armatures, substantially as set forth.

2. In a dynamo-electric machine, the combination of a field-magnet, two armatures between the poles of said magnet, a central magnet whose pole is between the armatures, and means for reversing the magnetism of said central magnet, substantially as set forth.

3. In a dynamo-electric machine, the combination of a field-magnet, two armatures between the poles of said magnet, a central magnet whose pole is between the armatures, and means for varying the magnetism of said central magnet, substantially as set forth.

4. In a dynamo-electric machine, the combination of a field-magnet, two armatures between the poles of said magnet, a central magnet whose pole is between the armatures, and means for varying and reversing the magnetism of said central magnet, substantially as set forth.

5. In a dynamo-electric machine, the combination of a field-magnet, two armatures between the poles of said magnet, the same being electrically connected in series, and a regulating-pole between the armatures, substantially as set forth.

6. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors extending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, and a central regulating-pole between the armatures, substantially as set forth.

7. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors extending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, and a central regulating-magnet between the armatures, provided with means for varying and reversing its magnetism, substantially as set forth.

8. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors extending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, and a central magnet between the armatures, having coils included in said compensating conductor, substantially as set forth.

9. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors ex-

tending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, a central magnet between the armatures, a shunt between the two main conductors, and a conductor extending from at or near the point of connection of the compensating conductor to a point on said shunt and including coils of said central magnet, substantially as set forth.

10. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors extending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, a central magnet between the armatures, a shunt between the two main conductors, resistance-coils in said shunt, and a conductor extending from at or near the point of connection of the compensating conductor, including coils of said central magnet, and terminating in an arm adjustable along said resistance-coils, substantially as set forth.

11. The combination of a field-magnet, two armatures connected in series between the poles of said magnet, two main conductors extending from opposite terminals of the series, a compensating conductor extending from the conductor joining the armatures, a central magnet between the armatures, a shunt between the two main conductors, resistance-coils in said shunt, a conductor extending from at or near the point of connection of the compensating conductor, including coils of said central magnet, and terminating in an arm adjustable along said resistance-coils, and coils on said central magnet included in said compensating-conductor, substantially as set forth.

This specification signed and witnessed this 22d day of February, 1888.

MONTGOMERY WADDELL.

Witnesses:
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