(No Model.)

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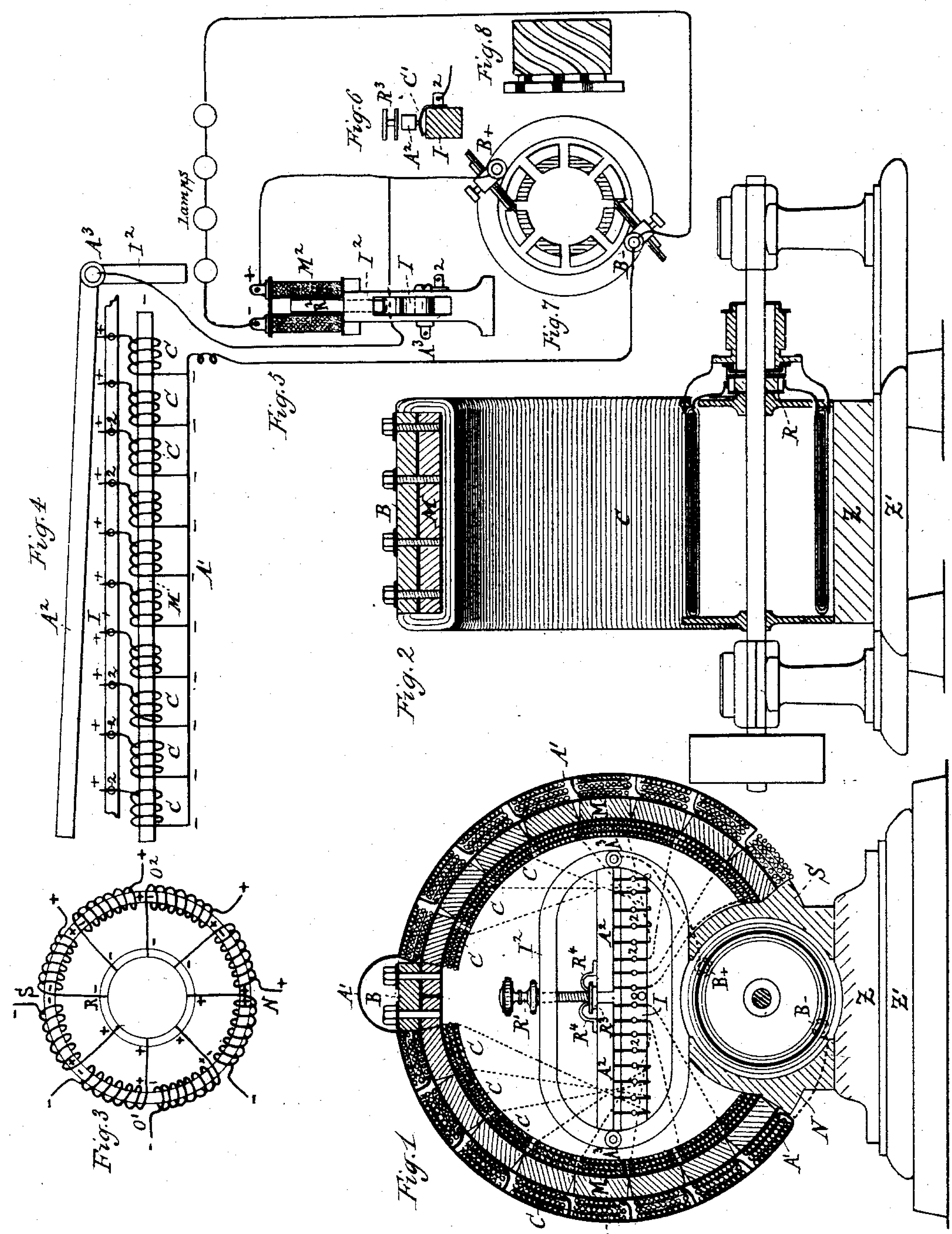
REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 287,343. Patented Oct. 23, 1883.



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REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 287,343, dated October 23, 1883.

Application filed December 23, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, of Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Dynamo-Electric Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

The nature of this invention relates to certain new and useful improvements in the construction of dynamo-electric machines, and in the novel ways of regulating and controlling the currents produced by such machines, the whole being combined in one device.

The invention consists in the peculiar construction of the various parts, their combinations, and operation, as more fully hereinafter described.

Figure 1 is a vertical central cross-section through the body of the machine, showing the magnetic core, the coils, and their connections, and also the regulating arrangement for varying the strength in the magnetic field. Fig. 2 is a longitudinal central section through the axis of the machine. Fig. 3 is a diagram section, showing the mode of winding and connecting the helices of the armature. Fig. 4 shows in a diagram the electric circuit around the magnetic core of the field-magnet. Fig. 5 is an end view of the regulating devices. Fig. 6 is a cross-section of the regulator. Fig. 7 is an end elevation, showing the commutator and brushes, B+ being the positive and B— the negative pole. Fig. 8 is a side elevation of the commutator, which is so constructed as to bring three or more of the sections in contact with the brushes on either side.

In the accompanying drawings, M is the magnetic core, consisting of two parts of semicircular form, secured together by an iron bar, B, and screws passing through the same, as shown in Fig. 1. The pole-pieces N and S are also cast onto the circular bands, thus forming a perfect and plain magnet, with no consequent points, having simply a long flat bar bent so as to approach the free ends N S, between which the armature is to revolve. The lower parts of the parts N and S are secured to a base, Z, which, as a matter of course, is made of some known non-magnetic substance, either wood or metal. This base Z is secured by strong bolts to a cast-iron base, Z′. C are the helices of the field-magnet, and are distributed over the whole surface of the core M. These helices are each wound independently before being placed around the core. All the inside terminals of these helices are connected together by means of a conductor, A′, while all the outside terminals are connected to insulated binding-posts (marked 2) arranged upon the bar I, which is made of some non-conducting material, and in order to bring all the outside (+) wires together, the metallic bars A^2 A^2 are hinged at A^3, and these bars, being divided in the center and being brought down on the contacts 2, afford the means for the current to pass through more or less of said helices, which in turn act upon the magnetic field to regulate its strength.

I^2 is a frame made of some non-conducting substance, and supports the regulating devices above described. The bar I, carrying the binding-posts 2, has arranged upon it the contact-springs C′, as shown in Fig. 6.

R^3 is a disk, upon which the metallic contacts R^4 press, thereby insuring electric communication between the bars A^2 A^2.

At A^3 A^3 are shown binding-posts, from one of which the current is conveyed by the usual connection to the brush B+, while the conductor A′ is brought into electrical contact with the brush B—.

R′ is a thumb-screw, which may, if desired, be substituted by a movable magnet-core, as shown in Fig. 5. The armature is wound as shown in Fig. 3. All the inside terminals are connected to the insulated ring R, while all the outside terminals are connected to corresponding sections of the commutator. The magnetic core may be made continuous, as in the Pacinotti ring; or it may be composed of separate bars, as described in my Letters Patent of September 21, 1880, and June 6, 1882. As will be seen, the wire around the whole armature is wound in the same direction; but instead of being connected, the inside of one section to the outside of the next section, as in the Gramme or Pacinotti armature, the inside terminals are connected to one common ring, R, while all the outside ends of said wires are connected to corresponding sections in the commutator, which is so constructed as to bring one half of these sections in contact with one brush, B+, and the other half in contact with the brush B—. Thus the current enters all the sections connected with the brush B+, and passes through the ring R to the sections connected with the brush B—, by means of said commutator-sections, as shown in Fig. 8. The current thus flowing through said helices will produce in the armature-core a north pole at N, and a south pole at S, while the neutral points are at O′ and O^2, or in the same relative positions, as shown in Fig. 3.

In Fig. 4 I show in diagram the electric circuit around the magnetic core M of the field-magnet, wherein M represents the magnet, and, as before stated, all the inside ends of the helices are in common contact by the conductor A′, while all the opposite ends are connected to the binding-posts 2. (See Figs. 1, 4, and 6.) Said binding-posts are electrically connected to springs C′, which springs are provided with platinum contacts. Thus by pressing down the bars A^2 A^2 upon said contacts more or less of the helices are brought into action upon the core of the field-magnet.

In the regulating device already partially described, and of which an end view is shown in Fig. 5, I^2 is the frame carrying the parts already described. M^2 is an electro-magnet intended to actuate the bars A^2. R^2 is the magnet-core which works the contacts, and A^3 are the binding-posts electrically connected to the bars A^2, whence the current is led to the commutator-brush B+.

In the cross-section shown in Fig. 6 A^2 is the contact-bar, already described. C′ is one of the contact-springs. 2 is one of the binding-posts. I is the bar carrying the binding-posts and contacts.

Having described the different parts of the machine, I will now proceed to explain the same when in operation.

By referring to the diagram Fig. 4 it will be seen that the machine is arranged to charge or excite the field-magnet by derivation, one part of the current being used to magnetize the field-magnet, while the other part is used outside for light or for whatever the current may be wanted. It is well known that in order to produce a good dynamo which does not heat and does good work, certain proportions have to be observed, especially in the copper conductor of the field-magnet, in relation to the armature. These proportions I observe as strictly as practice teaches; but I differ from what has been done heretofore in making up these proportions. Instead of using a single conductor of proper resistance, I use multiple-conductors around the field of force so proportioned that when the current is passing through all the helices in multiple arc, then I have exactly the same resistance as I would have in a single conductor, which resistance should be about one hundred times greater than that of the armature. This arrangement will be readily understood by referring to Fig. 4, which is a diagram of my system. As will be seen, all the inside terminals of the wires around the field M are connected together by a conductor, while the free outside terminals can be put in contact by the movable bar A^2, placing one helix in circuit after the other as the bar is moved downward. I have adopted this system of winding and connecting so as to be able to regulate the current of a dynamo in proportion to the work demanded from the same, and at the same time to diminish the power required for driving said dynamo when the number of lights in the circuit is decreased. In all systems until now in vogue rheostats have been interposed either between the work to be done and the dynamo or in the exciting-circuit, or by putting a resistance between the two poles of the armature, &c. I consider that all these systems are wrong and wasteful, since, as all these appliances are outside of the machine, the heat developed in such rheostats is a total loss of energy, whereas in my system every wire is wound upon the field-magnet. Thus the current, which in rheostats is entirely lost, acts upon my field-magnet, keeping up the magnetism of the same. Thus every inch of the circuit and current is made useful, and consequently when the field is too strongly magnetized more coils or helices can be cut out, thus increasing the resistance in the field-magnet coils with regard to the armature; and since the proportions are such that when all the helices are in operation the current can pass without heating the machine or sparking at the commutator, then by taking any number of helices out of circuit I modify proportionately the intensity of the magnetic field, and neither heating of the machine or of the remaining helices nor sparking at the commutator can occur. Thus it will be understood that the dynamo takes power according to the work it is doing.

To understand how the magnet helices are worked, let us refer to Figs. 4, 5, and 7. The lamp-circuit starts from B+, passes to magnet M^2, in at +, and out at —, thence to lamps, and from lamps back to B—, completing the circuit through the armature. The circuit of the field-magnet runs as follows: starts at B+, passes over to the bar (or bars) A^2, and by pressing said bar down upon all the contacts C′ C′ C′ C′, &c., the current will circulate through all the helices, coming out at A′, whence it is carried to B—, and completes also the circuit through the armature. Now, let us suppose that the machine will run twenty lamps normally, and thus do its maximum work. The power of the magnet M^2 is so proportioned with regard to the weight of the bars A^2 that when some lamps are cut out the magnet-core R^2 will be drawn in, thus lifting the bars A^2 from some of the contacts C′. If more lamps are cut out, the magnet will draw in deeper its core and lift still higher the bars A^2, thus cutting out more of the magnet-helices, and so diminish the intensity of the field of force. If, now, we turn on the lamps, we decrease the current in magnet M^2, and the core R^2 will sink correspondingly and place more helices in circuit until all the lamps have been turned on and the magnet M^2 has let down the bars A^2, when the current is again maximum. It will be readily understood that since the lamp-circuit is flowing through the magnet M^2, any change in the lamps will be felt by said magnet, and it will either let down the bars A^2 or lift up the same in proportion to its strength, and thus regulate the intensity of the magnetic field by leaving more or less of the helices in circuit. The resistances of the magnet coils or helices are all exactly the same, and are consequently all receiving the same amount of current. The total resistance of all the helices connected up in multiple arc is the same as if a single-wire helix were used. I do not propose to use this mode of winding in dynamos made on the principle of derivation alone; but the same may be applied to the class of dynamos where the field-magnet coils are in the general circuit, (called "in series.") This system of winding and connecting I employ also in the construction of electric motors, which can thus be perfectly regulated.

The armature, as above stated, either consists of an iron drum, as in the Pacinotti or Gramme, or may be composed of a number of iron bars running parallel with the axis of rotation. The mode of connecting up is, however, different from anything heretofore done. By referring to Fig. 3 we will see that all the coils are wound in the same direction and connected up as follows: All the inside ends of each individual section are connected to a brass ring insulated from the rest of the machine, while all the free ends or outside wires are connected to a commutator having a like number of sections to correspond with the sections in the armature. This construction allows me to use two single brushes, one brush making contact with four sections on one side of the commutator, while the second brush makes contact with the four opposite sections, thus making the current to flow through the armature-coils in multiple arc.

The development of magnetism in the armature will be understood by referring to Fig. 3, as already stated.

Having explained the different parts of my dynamo, and also its operation, what I claim as new, and desire to secure by Letters Patent, is—

1. In a dynamo-electric machine, a field-magnet wound with a number of separate helices of equal resistance, arranged to be successively connected in multiple arc, and forming a derived circuit normally closed upon the armature, and means for automatically throwing more or fewer of the said coils into or out of circuit, whereby the field-magnet is energized to a greater or less degree by varying the internal resistance of its conductor, as set forth.

2. In a dynamo-electric machine, a copper conductor around the field-magnet, composed of a number of separate and independent conductors of equal (or similar) resistance, adapted to be successively connected in multiple arc, substantially as described.

3. In a dynamo-electric machine, a field-magnet the helices of which are composed of a number of separate coils of equal high resistance, located in a derived circuit normally closed upon the armature, and adapted to be successively connected in multiple arc, and when all are connected to form a proper working-resistance with relation to the armature when the machine is doing its maximum duty, and means adapted to be operated by a single main current or circuit, substantially as described, for cutting out a greater or smaller number of said coils to alter the resistance of the derived circuit, and thereby to modify the intensity of the magnetic field, as set forth.

4. In a dynamo-electric machine, the bars A^2, in combination with contacts C' and the field-magnet coils C of the electro-magnets M^2, located in the lamp-circuit, and operating through the varying resistance of said circuit to switch more or fewer of the field-magnet coils into or out of action, and thereby regulate the power of the machine to the work.

5. In a dynamo-electric machine having its field-magnet wound with separate coils of equal resistance, all in derivation from the armature, and adapted to be successively connected in multiple arc, and devices, substantially as described, whereby the resistance of said field-coils can be altered as desired without the interposition of resistances external to the machine, substantially as set forth.

6. In a dynamo-electric machine, the helices of the field-magnet, composed of a number of coils of equal high resistance, located in a derivation from the armature, and having all the inner ends thereof connected to a common conductor, and all of the outer ends to separate insulated binding-posts and contact-points, in combination with a metallic bar or bars or their equivalent, and means for bringing a larger or smaller number of said coils into circuit through the said bars, whereby the magnetism of the field-magnets and the electro-motive force of the machine are controlled, as set forth.

Dated Chicago, Illinois, October 20, A. D. 1882.

CHARLES J. VAN DEPOELE.

Witnesses:
W. H. BANKS,
ALBERT WAHL.