(No Model.)

C. J. VAN DEPOELE.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 325,133. Patented Aug. 25, 1885.

Fig. 1

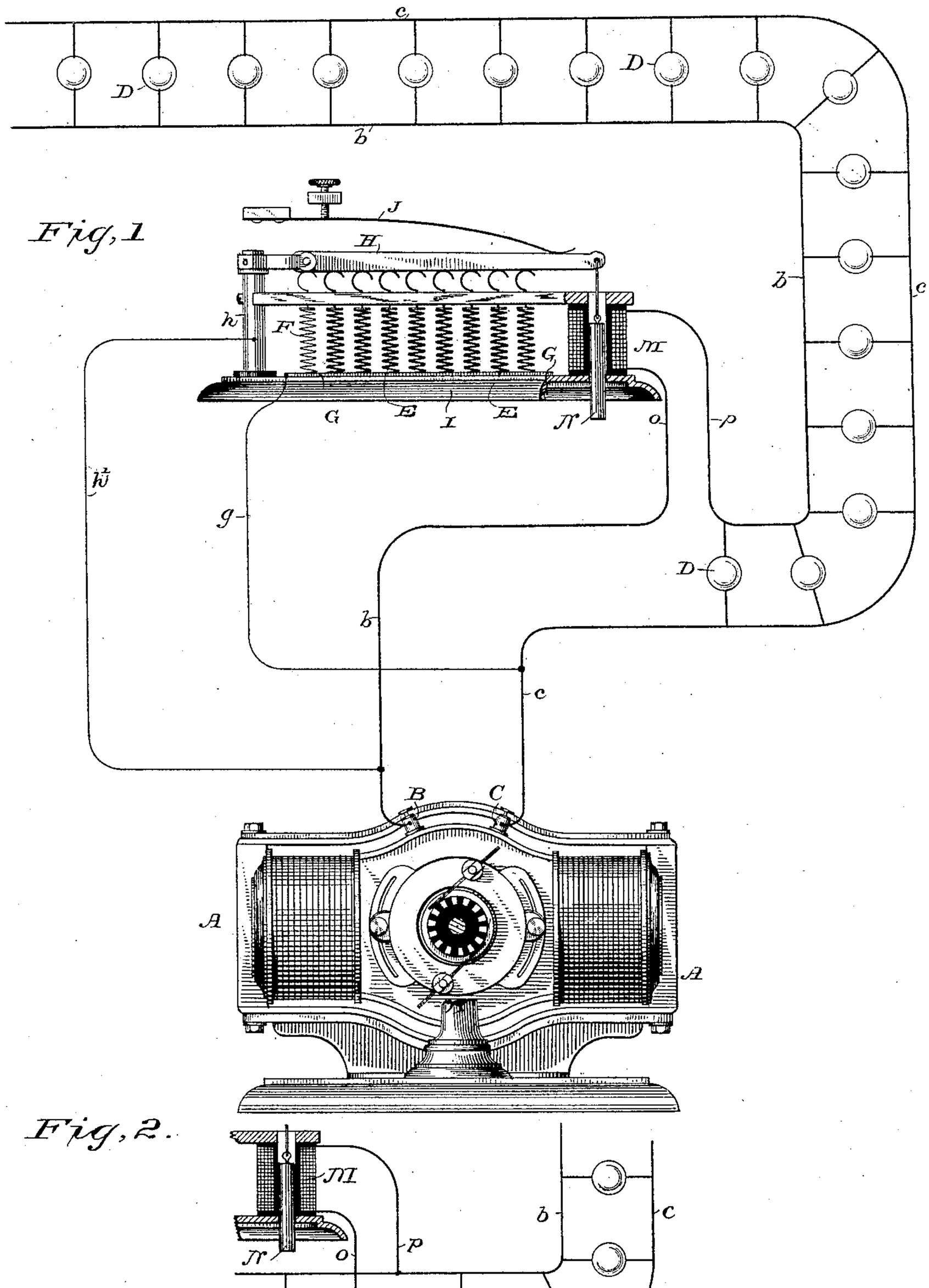

Fig. 2.

Witnesses

Lew W. Young

N. L. Callamer.

Inventor

Charles J. Van Depoele.

By his Attorneys

Jarvis & Kinkle.

UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF CHICAGO, ILLINOIS.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 325,133, dated August 25, 1885.

Application filed November 15, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Systems of Regulation for Dynamo-Electric Machines of Constant Electro-Motive Force, of which the following is a specification, reference being had to the accompanying drawings.

My present invention relates to improved means for controlling the production of current in the generator supplying any system of transmission of power requiring a current of practically constant electro-motive force, but varying in intensity according to the amount of working resistances in circuit.

The preferred arrangement consists, generally, in interposing a variable auxiliary resistance between the main conductors leading from a dynamo-electric generator wound in series, said resistance to be automatically controlled by a solenoid the coils of which are included in the main circuit, or in a derivation from the same. This resistance operates to produce the required current strength, which for the purpose illustrated may be one hundred volts. After the electro-motive force has reached this point, as the working resistances—such as lamps, motors, &c.—are placed in circuit, the artificial resistance is gradually and automatically withdrawn until sufficient of the working resistances are in operation to afford passage to the amount of current required to maintain the magnetic field and the initial potential, as will hereinafter be fully described and set forth.

Figure 1 of the accompanying drawings is a diagrammatic view, showing an arrangement of circuits and apparatus embodying my invention. Fig. 2 is a detail showing a modification thereof.

A represents a "series-wound" dynamo-electric machine, the armature and field-magnet coils thereof being in circuit in the well-known manner.

B C are the binding-posts from which the main conductors *b c* extend, and between which can be arranged in multiple arc a number of incandescent electric lamps or other translating devices up to the full capacity of the generator or any fraction thereof.

E F are a series of resistance coils, which may be all of the same capacity, (resistance,) except the first one, F, which is to be always in circuit, so as to prevent sparking whenever the coils are cut out, and to have higher resistance than any of the remainder of the coils, so as to avoid unnecessary loss of current through it when all the rest are cut out. This last resistance or path will also help to keep up the magnetic field by diverting a portion of the main current through the coils of the same. The resistances E and F are arranged in multiple arc, being all mounted upon or connected at their lower ends to the base-piece G, which is of conducting material, and is connected through suitable wire, *g*, with the main conductor *c*.

H is a bar of conducting material, which is suitably pivoted to a post, *h*, also a conductor, which post is supported upon an insulated base, I, and connected with the main line by wire *h'* at any convenient point, so that the regulating-resistances are in parallel circuit with the working resistances or translating devices.

J is an adjustable tension-spring, which bears upon the bar H with sufficient force to hold it down upon the contact-surfaces of all the resistances when no other force is opposed to its action, thus connecting the entire group of resistances in multiple arc.

M is a solenoid, also supported upon the base I, and through it moves an iron plunger, N, which is suspended from the free end of the bar H, but magnetically insulated therefrom. The coils of the solenoid M are included in the main circuit through conductors O P, which are connected to the mains at any convenient point more remote from the generator. In some cases it will be advisable to place the solenoid in a derivation from the main circuit, or parallel with the working resistances.

As shown in the drawings, the apparatus is at rest, the bar H in contact with all the resistances, and all the working resistances or lamps D may be cut out. When the armature of the generator is put in motion, there then being sufficient passage to the current, a current will be generated and flow through the resistances in the regulator and the coils of the field-magnets sufficient to elevate their magnetism to a point that, reacting upon the

armature, will cause it to produce a current of the initial potential required to operate the system, which being effected the circuit is ready for use. As shown, the solenoid M, being unaffected by the current flowing in the resistances E F, has no effect upon their contacts until some of the lamps D are switched into circuit; but as the entire current passing through the working resistances traverses its coils the strength of the solenoid will increase in proportion to the increased volume of current that passes through its coils as the lamps are added, thereby raising the plunger, and with it the contact-bar H, which, moving in proportion to the strength of the current traversing the solenoid, this motion being regulated by the tension of the spring J, will cut in or remove resistances from the multiple-arc group sufficient to compensate for any changes that may be made in the number of lamps in circuit up to or below the capacity of the regulator.

As stated, the conductivity of the entire group of resistances constituting the regulator must be sufficient to carry the current necessary to so energize the field-magnets that the current sent to line will be of the initial potential. When such a portion of the working-resistances as equal the conductivity of the regulator have been put in circuit, the said regulator will be cut out, except its last coil, which is left in to prevent sparking and help the field-magnets, as above stated.

The armature of the generator is rotated at substantially a constant speed. The regulator automatically compensates for the cutting out or in of any lamps below the number that equal its conductive capacity. Beyond or above this point the regulator is itself cut out, and lamps can be added to or removed from the general circuit without affecting the brilliancy of those remaining, the current flowing through them and through the field-magnets of the generator raising or lowering their magnetism, and thereby diminishing or increasing the volume of current produced. This action takes place in proportion to the number of lamps in operation without materially affecting the electro-motive force of the current, and until the conductivity of the external circuit equals that to which the generator has been proportioned and the capacity of the system is reached.

It is a well-known fact that in a dynamo in which the armature and field coils are in series with each other the current strength will depend upon the external resistance, that the current will increase when said resistance decreases, and that likewise the current will decrease with the increase of resistance. Now, when such a generator is intended to furnish current to a number of translating devices requiring a current of constant electro-motive force, and all such devices being placed in parallel circuit between the main conductors, whenever the number of working devices thus placed or arranged afford passage of the current to such a degree as to allow sufficient current to flow through the working resistances and the generator, so as to energize the fields of the same, the current will remain constant as long as the external resistance remains constant; but the moment that some of the translating devices are cut out of circuit the resistance in the working-circuit will increase proportionately, and less current will flow through the machine, diminishing the magnetism of the field, and so diminish the production of the current; thus the greater the number of lamps, or other devices cut out of circuit the greater will be the resistance through which the current is flowing, thus diminishing correspondingly the production of current, until finally the resistance can be so much increased that not enough current will pass to energize the fields of the machine, when the latter will stop generating current altogether. It is now that the automatic regulating-resistance is called in operation until the field-magnets are energized sufficiently to produce the necessary electro-motive force to supply the system. Now, on inserting electric lights, motors, or other devices in circuit between the main conductors more and more current will flow through the system, and in proportion to the number of working devices put in circuit, until sufficient current is traversing the working resistances as to be able to keep up the field of the machine to the strength needed. At the same time the solenoid or regulating electro-magnet will be growing stronger, and will, as fast as work is inserted in the circuit, gradually and correspondingly lift the contact-bar of the resistance-coils, until the latter are all cut out of circuit, except the last one, which may be left in circuit, and can be of a resistance high enough so as not to take more than a small percentage of the main current. Thus as soon as enough current is passing through the translating devices so as to keep up the magnetism of the machine to its proper strength, then the regulating-resistances can be entirely withdrawn from the circuit. This happens, however, long before the maximum work of the machine is attained. The intensity of the generator will gradually increase as more working devices are put in circuit, without perceptibly increasing the electro-motive force. So it will be easily seen that by means of this system any number of lamps or other devices can be cut either out or in circuit without interfering with the lamps or other devices left in circuit, and that the dynamo will only take power according to the number of devices in actual operation—that is, as soon as the resistances are entirely cut out. With a small number of working devices in circuit there will be a certain amount of current spent through the resistance in order to magnetize the field.

In Fig. 1 of the annexed drawings the automatic regulator is operated by a solenoid or electro-magnet in the main working-circuit, although said solenoid or electro-magnet can

be placed in parallel circuit with the variable resistance and working devices, as shown in Fig. 2. In the case where the electro-magnet is placed in the main circuit a constant armature-speed is necessary, whereas in the second case the speed may vary some. In this way as soon as the potential is high enough the resistances will be correspondingly cut out of circuit.

Having thus described my invention, what I claim is—

1. The combination, with a dynamo-electric generator having its armature and field-magnet coils connected in series, of means for regulating the production of current of constant electro-motive force, said means consisting, essentially, of a group of resistances spanning the main conductors at starting, a movable contact adapted to connect more or fewer of said resistances in multiple arc between said main conductors, and a solenoid actuated by the main current, the armature or core of which is connected to and adapted to move said contacts, so as to increase or diminish the extent of said multiple-arc group of resistances, as more or less working-resistance is put into the circuit, substantially as described.

2. The combination, with a dynamo-electric generator having its armature and field-magnet coils connected in series, of a variable resistance spanning the main conductors at starting, the entire conductivity of all the coils of the rheostat being such as will allow sufficient current to pass around and magnetize the field-magnets of the machine to produce a current of predetermined tension for operating multiple-arc working resistances in the main circuit, a solenoid in series with the main conductors, and means operated by said solenoid for cutting out the variable resistance when a portion of the multiple-arc working resistances are brought into circuit, substantially as described.

3. In a system for regulating the production of current of constant electro-motive force, the combination, with a dynamo-electric generator, of a group of resistances spanning the main conductors at starting, a movable contact adapted to connect more or fewer of said resistances in multiple arc between said main conductors, a number of working resistances arranged in multiple arc, and a solenoid in the main circuit, the armature of said solenoid being connected to and adapted to move said contacts, so as to increase or diminish the extent of the said multiple-arc group of resistances, as more or fewer of the working resistances are placed in circuit, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES J. VAN DEPOELE.

Witnesses:
THEO. P. BAILEY,
W. S. STEARNS.