

(No Model.)

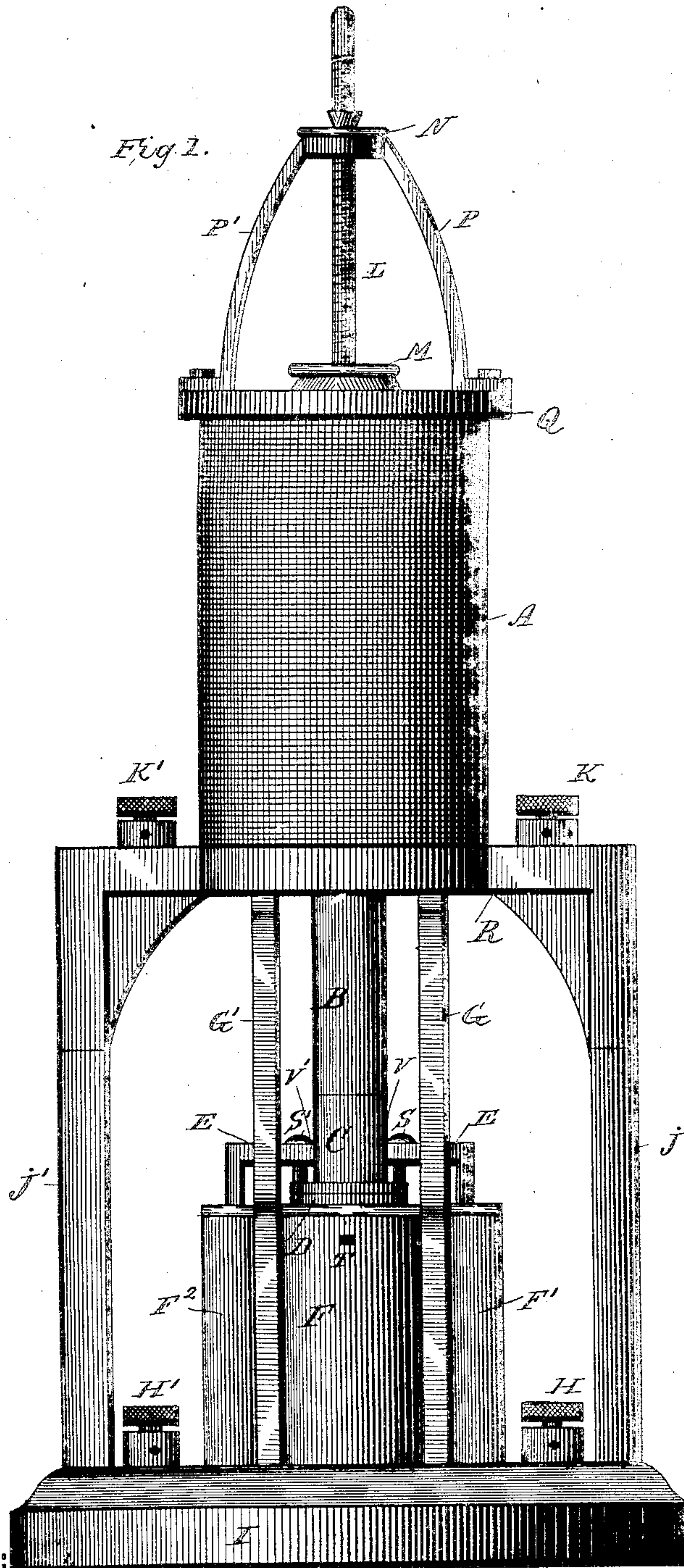
3 Sheets—Sheet 1.

G. J. MURDOCK.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 287,565.

Patented Oct. 30, 1883.



WITNESSES:

INVENTOR.

Wm. H. Dietrich
J. G. Hinkel

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by *Louis Bagger & Co.*
ATTORNEYS

(No Model.)

3 Sheets—Sheet 3.

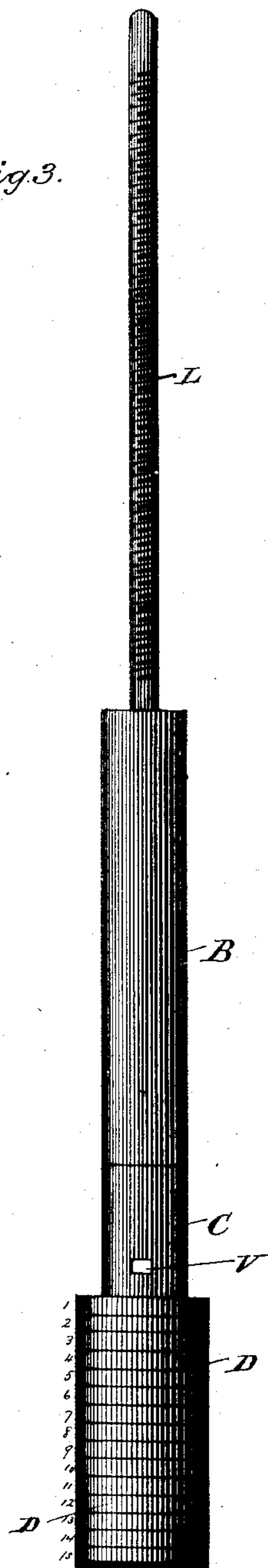
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Fig 3.



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UNITED STATES PATENT OFFICE.

GEORGE J. MURDOCK, OF BINGHAMTON, NEW YORK.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 287,565, dated October 30, 1883.

Application filed January 8, 1883. (No model.)

To all whom it may concern:

Be it known that I, GEORGE J. MURDOCK, of Binghamton, in the county of Broome and State of New York, have invented certain new and useful Improvements in Regulators for Dynamo-Electric Machines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention has relation to dynamo-electric machines, and has for its object the adaptation of such machines to variable external conditions without variation of the speed at which their armatures are rotated, but by variation of the intensity of the field-of-force or inducing magnets.

As is well known, this class of machines as now perfected are usually constructed on the principle of accumulation of electric energy by "mutual action"—*i. e.*, the currents induced in the armatures are made to circulate through the coils or helices of the inducing or field-of-force magnets which induced them. The residual magnetism in the iron of the electro-magnets induces at first a weak current in the helices of the armatures, and this being returned to the field-of-force magnets increases their power and induces in the armature-helices a correspondingly powerful current, which is again returned to the field-of-force magnets, and this mutual accumulation will continue until a point of magnetic saturation is obtained. Any interruption of or variation in the resistance of the external or "working" circuit will be attended by a corresponding fluctuation of the current. In other words, any addition to the work to be performed by the machine, or any increase of external resistance—*i. e.*, resistance in the working circuit—is attended by a diminution of the current strength, while, conversely, any decrease in the resistance of the external circuit is productive of an increased volume of current—that is to say, the current produced by these machines varies inversely as the work they are called upon to perform. A current of uniform strength may be obtained

either by varying the speed at which the armatures of the current-producing machine are rotated in a ratio corresponding to the ratio of resistance in the external circuit, or by variation of the intensity of the magnetic field; and my invention has relation to apparatus or "current-governors" of the last-named class—that is to say, my invention consists in the construction and combination of parts of an apparatus which, without affecting the speed at which the dynamo-electric machine is driven, will automatically lower the electro-motive force of the current in circulation—*i. e.*, working current—by diminishing the intensity of the field-of-force of the machine proportionate to the diminished external resistance, while, conversely, it will automatically raise the electro-motive force of the current in circulation by increasing the intensity of the field-of-force at a ratio proportionate to the increase of resistance in the external circuit.

In the accompanying three sheets of drawings, Figure 1 represents a front elevation of my apparatus. Fig. 2 is a vertical sectional view of the same, and Fig. 3 is a side elevation of the resistance device which forms part of my apparatus.

Corresponding parts in the several figures are denoted by like letters of reference.

A is a solenoid or helix, composed of a suitable number of coils or layers of insulated copper wire wound upon a tubular bobbin of wood or gutta-percha.

B is an iron core, so adjusted inside of the tubular bobbin as to be drawn upward within the same by the axial magnetism of the helix.

F is a chamber of iron containing mercury.

F' is a smaller chamber of iron, containing mercury, and insulated from the central chamber, F, on the other side of which there is another small chamber, F², also of iron, insulated from chamber F, and similar in construction to chamber F', with which it is in electric connection by a wire, X. This chamber also contains mercury.

G and G' are guide-bars, of hard rubber, which insulate the chambers or reservoirs F, F', and F² from one another.

H and H' are binding-posts, the former of

which returns from the field-of-force magnets is connected to the binding-post H', this constituting what I call the "internal" or "shunt" circuit, in contradistinction to the external or working circuit—in other words, the shunt-circuit, which is used to charge up the field-of-force magnets, flows through the binding-post H, wire Y, mercury in chamber F, resistance-pile D, screws S and S', cross-bar E, arms E' and E'', mercury in chambers F' and F'', wire X, binding-post H', and through the coils of the field-magnets back to the commutator. As the strength of the current furnished by the machine for the external circuit increases, the axial magnetism induced in the iron core B by the excited helix A draws up core B, and with it the resistance-pile D, cross-bar E, and arms E' and E''. This causes the level of the mercury contained in chamber F to fall, so that by the combined operations of raising core B and lowering the level of the mercury, (which are simultaneous and dependent upon each other,) the resistance to the shunt-circuit is increased, and the amount or volume of current shunted to the field-of-force magnets reduced, in proportion to the extent to which the core B is lifted up within the helix—that is, in proportion to the electro-motive force of the external current fed from the machine. When this force is lowered through increase of the resistance in the external circuit, (such as the lighting of additional lamps,) the core B is also lowered, the resistance-pile is immersed to a greater depth into the mercury, and a correspondingly-larger volume of current is shunted off in the internal circuit to the field-of-force magnets, thus increasing their energy until counterbalanced by the increased volume of current flowing through the external circuit. Thus it will be seen that there is no break or interruption of the current, and that the apparatus is not liable to get into the condition of "unstable equilibrium."

As the speed of the generator is not affected by the operation of my regulator or current-governor, it is impossible for the engine to "run away" with the dynamo-electric machine or generator when the resistance in the external circuit is diminished by the cutting-out of lamps or from any other course.

Not the least advantage of the apparatus is its simplicity, both of construction and operation, which makes it very strong, durable, and not liable to get out of order.

Having thus described my invention, I claim and desire to secure by Letters Patent of the United States—

1. The combination, in a regulator or current-governor for dynamo-electric machines, of a single helix included within the external circuit, and a vertically-adjustable resistance device of variable conducting power inserted into the bobbin of the helix and operated by the axial electro-magnetism of the same, sub-

stantially as and for the purpose shown and set forth.

2. In a regulator or current-governor for dynamo-electric machines, an adjustable resistance-pile built up of rings or disks of varying conducting power, so arranged upon one another as to gradually diminish the resistance of the pile from an insulator at its bottom to a good conductor at its top, substantially as and for the purpose herein shown and set forth.

3. In a regulator or current-governor for dynamo-electric machines, an adjustable resistance-pile built up of rings of varying conducting power, so arranged upon one another between a top and bottom head or disk as to form an inclosed air-chamber within the pile, substantially as and for the purpose herein shown and set forth.

4. A regulator or current-governor for dynamo-electric machines, consisting, essentially, of the following elements, viz: a helix mounted upon a suitable support and having its terminals connected to opposite poles of the external current generated by the armatures of the machine, a movable iron core inserted vertically into the helix and provided with means for regulating its vertical play or motion, a resistance-pile connected to but insulated from the lower end of the core, which said pile is built up of rings and disks of varying conducting power, said power increasing in a regular ratio from the bottom to the top of the pile, an iron chamber encircling the resistance-pile and containing mercury to establish electrical connection between the chamber and the resistance-pile, two smaller chambers also containing mercury and connected electrically with each other and with a binding-post connecting with the wire which turns from the field-of-force magnets, a wire or conduit connecting the mercury-chamber, in which the resistance-pile works, with a binding-post connecting with the wire that leaves the commutator going toward the field-of-force magnets, and an electrical conduit attached to and moving with the movable iron core, but isolated therefrom, and maintaining electric connection, irrespective of the position of the core and resistance-pile, between the latter and the two smaller mercury-chambers, which are in electrical connection with each other and with the binding-posts of the shunt-circuit, all constructed, combined, and arranged to operate automatically, substantially in the manner and for the purpose herein shown and described.

In testimony that I claim the foregoing as my own I have hereunto affixed my signature in presence of two witnesses.

GEORGE J. MURDOCK.

Witnesses:

B. N. LOOMIS,
W. S. KNOX.

(No Model.)

G. H. REYNOLDS.
GAS ENGINE.

2 Sheets—Sheet 1.

No. 287,578.

Patented Oct. 30, 1883.

