

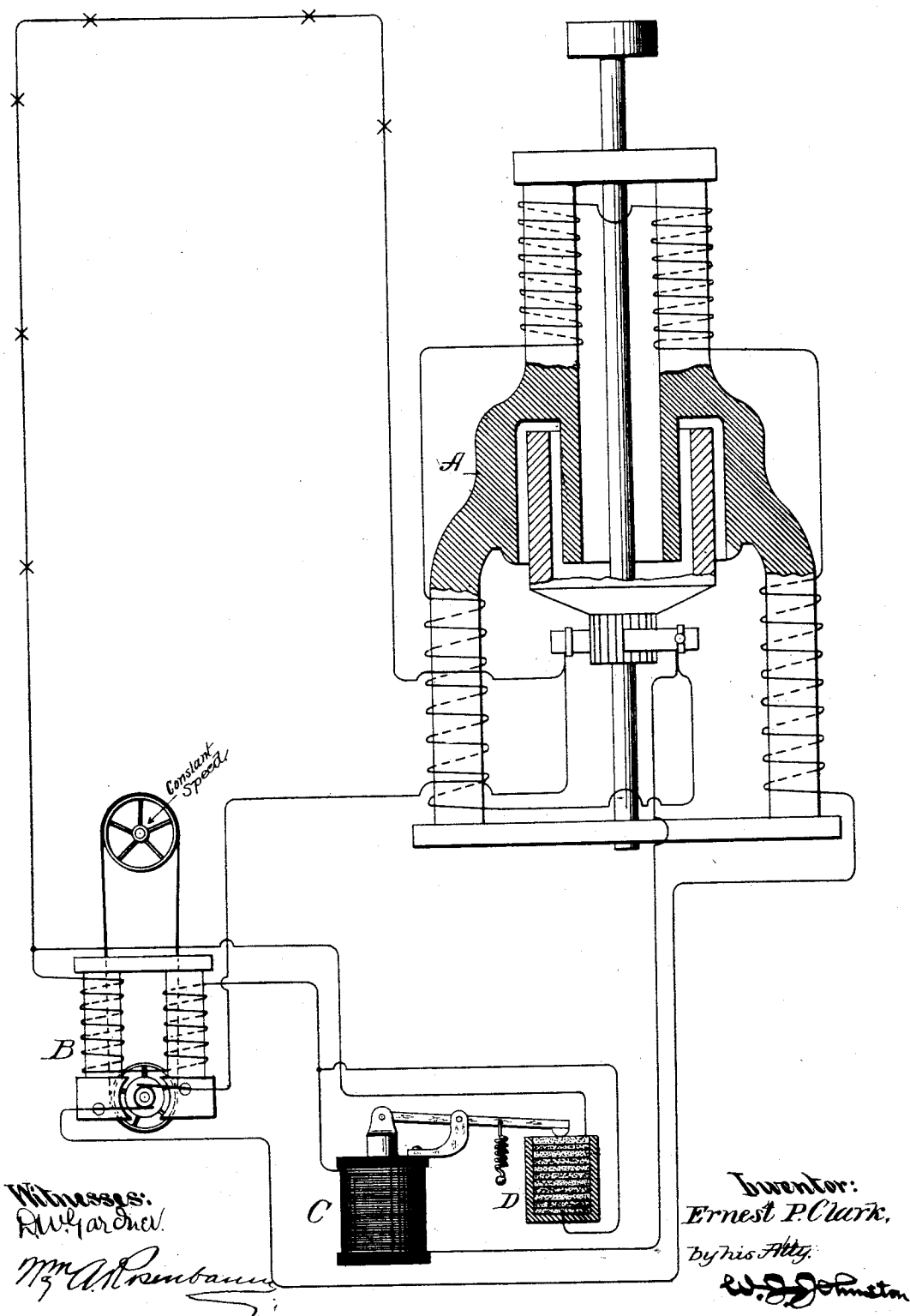
(No Model.)

E. P. CLARK.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 404,602.

Patented June 4, 1889.



UNITED STATES PATENT OFFICE.

ERNEST P. CLARK, OF NEW YORK, N. Y., ASSIGNOR TO THE CLARK ELECTRIC COMPANY, OF SAME PLACE.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 404,602, dated June 4, 1889.

Application filed October 8, 1888. Serial No. 287,498. (No model.)

To all whom it may concern:

Be it known that I, ERNEST P. CLARK, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Regulators for Dynamo-Electric Machines, of which the following is a specification.

My invention relates to the automatic regulation of dynamo-electric machines. It is designed for the regulation of the constant-current shunt-wound machine; and it consists of a small electromotor having its field-magnets in the main circuit of the dynamo and its armature in the shunt-circuit, which also includes the field-coils of the dynamo. The counter electro-motive force of this motor is the regulating power.

In this apparatus the actions are practically instantaneous, but are found in practice not to be sufficient in range to meet all the requirements of perfect regulation, and for this reason another piece of apparatus is combined with the motor to assist its action. This consists of a variable resistance arranged as a shunt to the field-coils of the motor and operated by an electro magnet or solenoid located in the main circuit.

Referring to the accompanying drawing, the figure represents a diagrammatical view of a generator, the regulating mechanism, and the circuits.

A represents the generator, and B the regulating-motor. The field-magnets of the motor B are in the main circuit of the generator A, while the armature of the motor is in the shunt-circuit with the field of the generator. The armature of the motor is wound with a large number of turns of fine wire in order to obtain a large counter electro-motive force. The main circuit also includes a solenoid C, and this solenoid controls a variable resistance D in a shunt to the field-coils of the motor.

The action is as follows: A sudden increase of current from the dynamo from any cause increases the power of the field-magnets of the motor, and this increases the counter electro-motive force of its armature, (as the motor always runs at a certain unvarying speed,) which reduces the current flowing through it and the field-coils of the dynamo. This at

once reduces the power of the dynamo to generate current, and thus tends to restore the normal strength of current. A reduction of current-strength in the main circuit operates in exactly the opposite way and increases the capacity of the generating-dynamo. These actions are practically instantaneous, but are found in practice not to be sufficient in range to meet all the requirements of perfect regulation, and for this reason another piece of apparatus is added to assist the action of the motor, consisting of a variable resistance arranged as a shunt to its field-coils and operated by an electro magnet or solenoid located in the main circuit and so arranged as to increase the resistance of the variable shunt when the current in the main circuit increases, thus sending more of it through the field-coils of the motor, increasing their magnetizing-power, and consequently the counter electro-motive force of the motor, and to decrease the variable shunt when the current in the main decreases, thus shunting more of the current from the field-coils of the motor and decreasing its counter electro-motive force.

With this apparatus as described the results would be that when the dynamo was generating the proper current-strength with a certain electro-motive force the motor would run at a certain fixed speed; but if the electro-motive force of the dynamo were reduced materially from this point there would no longer be sufficient current sent through its field-coils and through the armature of the motor to produce enough rotary effort to maintain the speed of the motor. Consequently the speed of the motor would decrease, and its counter electro-motive force, decreasing as its speed decreased, would allow an increased current to flow through its armature-coils and the field-coils of the dynamo. A balance would quickly be reached again, owing to the increasing power of the field-magnet of the motor; but it would now be running at a reduced speed, and the current in the main circuit would be greater than is required. The opposite action will take place if the electro-motive force of the dynamo were increased, the motor in this case running too fast and the current in the main circuit becoming too small, in place of which the object

of this apparatus is to maintain a constant strength of current in the main circuit while the electro-motive force rises or falls through a long range of values to suit the varying resistance in the main circuit as the number of lamps or other translating devices is varied. To accomplish this it is found only to be necessary that the motor should run at a certain constant unvarying speed. This is best accomplished by the use of a belt or other equivalent device to connect the motor-shaft with the dynamo-shaft or with some other revolving shaft or pulley having a uniform speed. The action of the belt is thus to accelerate the velocity of the motor when the electro-motive force of the dynamo is low and to retard it when the electro-motive force is high.

I am aware that the idea of regulating a dynamo by means of counter electro-motive force of a motor is not new, having been shown in Edison's patents, Nos. 248,421 and 264,667; but in both cases the motor was a "series" motor, having both armature and field coils in the field-magnet circuit of the dynamo. In both cases the object sought was to maintain a constant potential with varying current-strength, which was accomplished by changing the counter electro-motive force of the motor by varying its speed. My invention consists of a motor the armature only of which is included in the field-magnet circuit of the dynamo, while the motor field-magnet coils are included in the main or line circuit, and the regulation is primarily accomplished by varying the counter electro-motive force of the motor without changing its speed. The object of the regulation is to obtain a uniform strength of current with a varying electro-motive force.

The most striking difference between my apparatus and the device of Edison is in the principles employed in obtaining the desired result. In the Edison apparatus the results are obtained by varying the speed of rotation of the motor and thus varying its counter electro-motive force, an operation which cannot be accomplished instantly, while in my apparatus the change in counter electro-motive force is obtained by the direct change in magnetic strength of the field-magnets of the motor or regulator, which, being included in the main circuit, must vary in power exactly as the main current increases or decreases in strength, thus affecting an instantaneous change in the counter electro-motive force of the motor, whose speed does not vary at all.

Having described my invention, I claim—

1. A regulator for a shunt-wound dynamo, consisting of an electro-motor whose armature is maintained at a constant speed and is included in the field-magnet circuit of the dynamo, and whose field-magnet coils are included in the main circuit of the dynamo for the purpose of varying the counter electro-motive force of the motor as the main current varies in strength.

2. A regulator for shunt-wound dynamo-electric machines, having its armature included in the field-magnet circuit of the dynamo and its field-magnet coils included in the main circuit, a variable resistance arranged as a shunt to the field-magnet coils of the regulator, and an electro-magnet in the main circuit arranged to control said variable resistance for the purpose of magnifying the variations in magnetic strength of the regulator field-magnets caused by changes in strength of the current in the main circuit.

3. The combination of a dynamo-electric machine having its field-magnet coils in shunt or derived circuit, an electromotor maintained at a certain unvarying speed and having its armature in circuit with the field-magnet coils of the dynamo and its field-magnet coils in circuit with the lamps or other translating devices, a variable resistance arranged as a shunt to the field-magnet coils of the regulating-motor, and an electro-magnet or solenoid located in the main circuit, controlling said variable resistance and so arranged as to intensify the variations in magnetism of the field-magnets of the regulator caused by variation in the main current for the purpose of maintaining a constant strength of current in the main or working circuit, notwithstanding variations in potential or a varying speed of the dynamo.

4. A regulator for a shunt-wound dynamo, consisting of an electromotor whose armature is included in the field-magnet circuit of the dynamo and whose field-magnet coils are arranged so that the full current on the main circuit of the dynamo will pass through them for the purpose of varying the counter electro-motive force of the motor as the main current varies in strength.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ERNEST P. CLARK.

Witnesses:

WM. A. ROSENBAUM,
JAMES H. SEYMOUR.