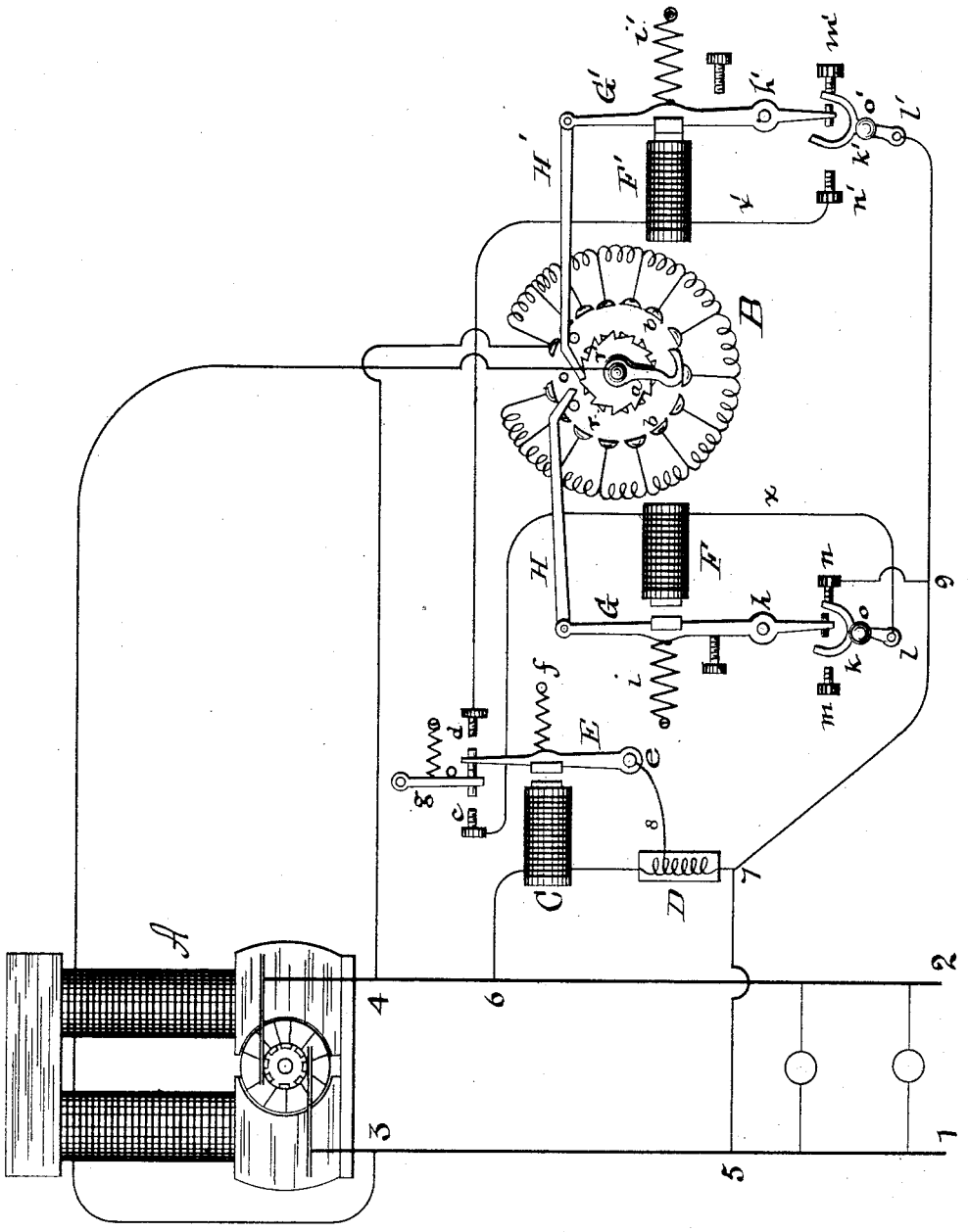
(No Model.)

T. A. EDISON.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 264,660. Patented Sept. 19, 1882.



WITNESSES:

D. D. Mott

Thomas E. Birch.

INVENTOR:

T. A. Edison

BY Richd. N. Dyer,

ATTORNEY.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 264,660, dated September 19, 1882.

Application filed August 7, 1882. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Means for Regulating the Generative Capacity of Dynamo or Magneto Electric Machines, (Case No. 375;) and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to means for automatically varying the resistance of the field-circuit of a dynamo or magneto electric machine for the purpose of regulating the generation of current by the machine, the object I have in view being to produce a continuously-acting mechanism for this purpose, and one in which the increase or decrease of resistance is not limited by the movement (necessarily small) of the armatures of electro-magnets, and which mechanism, further, will be efficient in operation, will maintain the lamps at a practically-constant candle-power, and prevent the light from flickering.

Generally speaking, my arrangement is as follows: In the field-circuit of a dynamo-machine is placed a circular adjustable resistance, having its contact-points arranged inside, portions of the resistance being cut in and out by a contact-arm forming part of the circuit and pivoted in the center of the resistance. The contact-arm is turned by ratchet-wheels, one adapted to be moved by a pawl in one direction, the other by another pawl in the opposite direction, so that resistance is placed in or thrown out of circuit as one or the other pawl is in operation. Each of these pawls is moved by the vibrating armature of an electro-magnet. To effect the make and break of circuit which causes the vibration of the armature, one end of the latter extends between the sides of a pivoted U-shaped piece, which is driven by the movement of the armature in one direction to complete the circuit and in the other direction to break it, the U-piece being weighted, so that its motion is assisted by gravity; or a spring may be used for this purpose. Each of the electro-magnets operating these vibrating armatures is placed in a circuit which is a division of a shunt-circuit from a multiple-arc circuit, the last containing an electro-magnet and a resistance for turning current into the shunt. The pivoted spring-armature of this magnet forms a part of the shunt-circuit, and its free end is placed between contact-points. A pivoted spring-arm is also placed between these contact-points in such manner that the forward movement of the armature forces it against one of them and completes one of the divisions of the shunt-circuit, while the armature, when drawn back a sufficient distance, strikes the other contact-point and completes the other division. Normally, however, the armature and spring-arm are held by the resilience of their springs and by a properly-placed stop midway between the contact-points, and either circuit is completed only by an increase or decrease in the force of the electro-magnet. When too much current is in the main circuit it is desirable to decrease the generative capacity of the machine by placing more resistance in the field-circuit. The magnet in the multiple-arc circuit of course has its energy increased by the excessive quantity of current in the main line, and attracts its armature, which pushes the spring-arm against a contact-point, thus closing a division of the shunt, including one of the first-mentioned electro-magnets, whose vibrating armature is set in motion, moving the pawl and turning the ratchet-wheel and contact-arm in such a direction that more resistance is placed in the field circuit. The current in the main circuit then decreases, and the magnet in the multiple-arc circuit weakens in power until the armature is drawn away by the spring and the circuit of the electro-magnet which actuates the contact-arm is broken; but if the current is very much decreased, so that it becomes necessary to throw out resistance, the first armature-lever is drawn back by its spring and closes the other division of the shunt-circuit through the other electro-magnet, whose pawl-arm turns the contact-arm in the opposite direction and throws out a portion of the resistance.

The controlling electro-magnet of the mechanism, as before explained, is placed in a multiple-arc circuit. In this location it is effected, exactly as is a lamp, by variations caused by changes in the number of translating devices and in the speed of the engine. To prevent

the light from flickering it is necessary to provide means for determining the central position of the armature-lever of the controlling electro-magnet. This is done by the spring-arm, against which the armature-lever strikes, the armature-lever bearing normally against this arm with such pressure that it is not affected by small magnetic changes. The two magnets, vibrating armature-levers, and circuit-controllers for working the contact-arm of the resistance form two electro-motors, which act appositely upon the resistance, and are brought into action separately by the controlling-magnet.

The accompanying drawing is a diagram showing an appropriate manner of carrying out my invention.

A is a dynamo-electric machine, from which lead the main conductors 1 2 of a multiple-arc system.

3 4 is a multiple-arc circuit, including the field-magnets of the dynamo. The wire 4 includes the circular adjustable resistance B, while the wire 3 terminates in a pivoted contact-arm, *a*, adapted to make contact with the points *b b* of the resistance B.

5 6 is another multiple-arc circuit, including an electro-magnet, C, and a resistance, D. Around the latter is formed a shunt-circuit, 7 8, which is divided into two circuits, 9 *x c* and 9 *x' d*, *c* and *a* being contact-points. Either or both of the wires 7 8 may, if desired, be made adjustable, so that they may be connected with different parts of the resistance D, and thus shunt more or less current into the circuit 7 8.

The magnet C is provided with an armature, E, pivoted at *e* and forming part of the circuit 7 8. At its free end it is provided with two contact-points, one on each side. The armature has also a spring, *f*, whose tendency is to withdraw it from the magnet C. A pivoted spring-arm, *g*, is so placed that normally it is midway between *c* and *d*, but may be pressed over by the armature, so as to contact with *c* and close the circuit 9 *x c*. When the pressure is removed the circuit is broken until the magnet becomes so weak that the armature is drawn back againt *d* and closes the circuit 9 *x' d*. The spring-arm *g* determines the central position of the armature-lever E, as before explained, and prevents the lever E from being vibrated by small magnetic changes in C.

The circuit 9 *c* includes a magnet, F, having an armature, G, pivoted at *h*, and having a spring, *i*. The lower end of the armature enters between the sides of the U-shaped metal piece *k*, which is pivoted at *l* and placed between stops *m n*. The wire *x* is attached at *l* and the wire 9 to the stop *n*, so that when *k* is thrown against *n* the circuit 9 *x c* is closed at this point and when it is thrown against *m* the circuit 9 *x c* is opened. A ball or weight, *o*, assists the motion of the piece *k*. Thus the movement of the armature G causes the make and break of the circuit, and the armature is made to vibrate. At the other end of the armature G is pivoted a pawl, H, which, when the armature G vibrates, moves the ratchet-wheel *r* and turns the contact-arm *a*, so that it places more of the resistance B in the circuit 3 4. A similar arrangement is placed on the opposite side of the resistance, F' being the magnet, G' its armature, *k'* the U-shaped circuit-reverser, and H' the pawl actuating the ratchet-wheel *r'*, so that the contact-arm *a* is turned in the opposite direction and cuts out instead of putting in resistance.

It is evident that this invention is applicable to magneto-electric machines as well as to dynamos, and to a battery as well as to a single machine.

What I claim is—

1. The combination, with a dynamo or magneto electric machine and translating devices arranged in multiple arc, of an adjustable resistance in the field-circuit of such machine, an electrically-operated mechanism for adjusting said resistance, and an electro-magnet located in a multiple-arc circuit and controlling such electrically-operated mechanism, substantially as set forth.

2. The combination, with a dynamo or magneto electric machine and translating devices arranged in multiple arc, of a mechanism for regulating such machine, an electro-magnet located in a multiple arc circuit, and closing-circuits at the contacts of its armature-lever for controlling such regulating mechanism, and means for determining the central position of the armature-lever of said controlling electro-magnet, substantially as set forth.

3. The combination, with a dynamo or magneto electric machine and translating devices arranged in multiple arc, of an adjustable resistance in the field-circuit of such machine, a mechanism for adjusting such resistance, an electro-magnet located in a multiple-arc circuit and controlling such adjusting mechanism by closing-circuits at the contact of its armature-lever, and means for determining the central position of the armature-lever of said controlling electro-magnet, substantially as set forth.

4. The combination, with an electro-magnet energized by the current generated by a dynamo or magneto electric machine or battery thereof, of an armature-lever adapted to close by its forward and backward movement the branches of a divided shunt, which contain mechanism for varying the resistance of the field-circuit of the generator, substantially as set forth.

5. The combination, with a multiple-arc circuit, of a divided shunt therefrom, each division containing an electro-magnet provided with a vibrating armature, said vibrating armature being adapted to operate a pawl and a ratchet-wheel, substantially as set forth.

This specification signed and witnessed this 5th day of December, 1881.

T. A. EDISON.

Witnesses:
H. W. SEELY,
WM. H. MEADOWCROFT.