

(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.

CURRENT REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 514,504.

Patented Feb. 13, 1894.

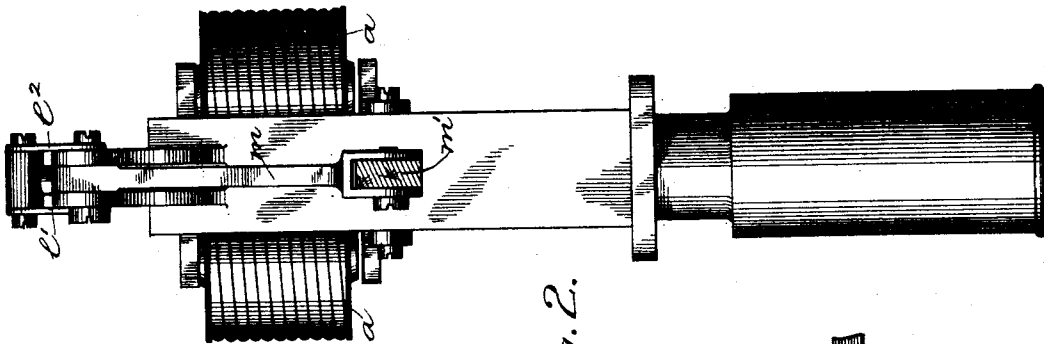


Fig. 2.

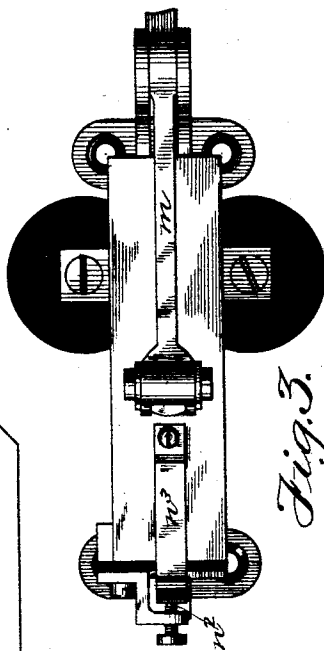
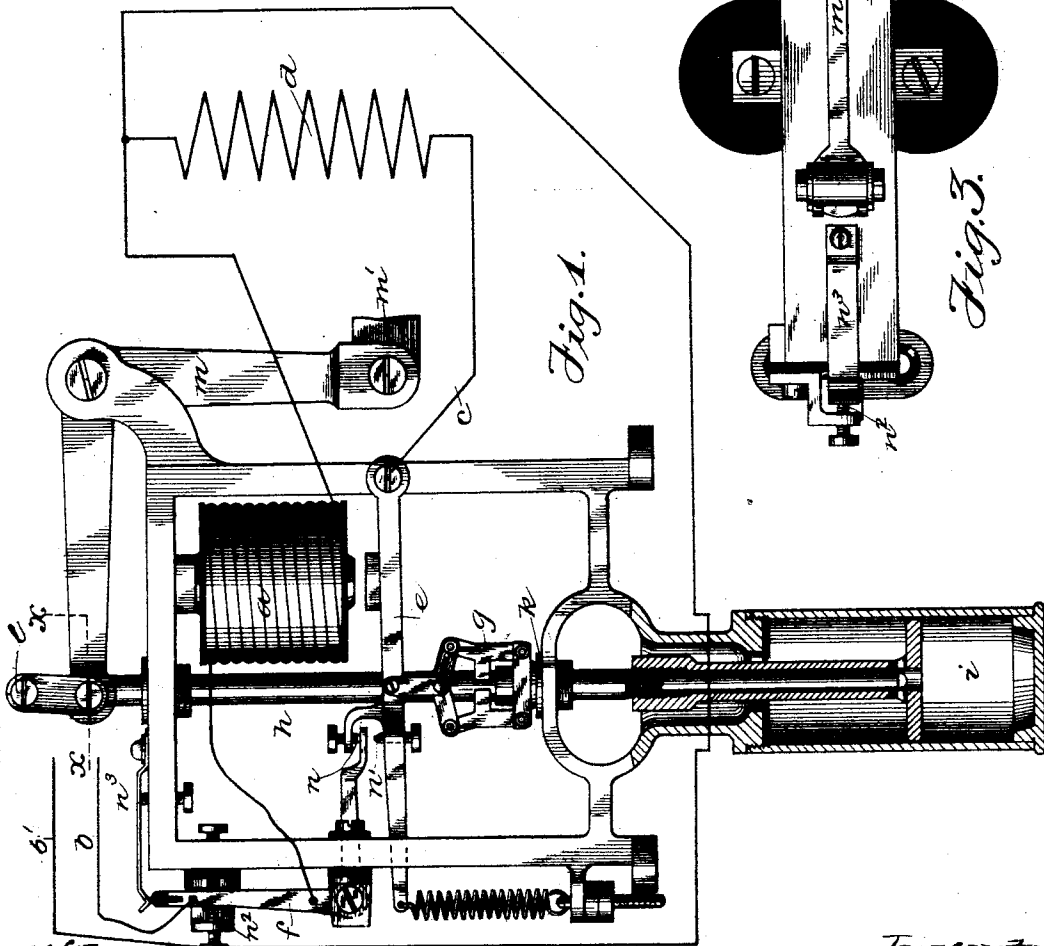


Fig. 3.



Witnesses:

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Ella Edler

Inventor:

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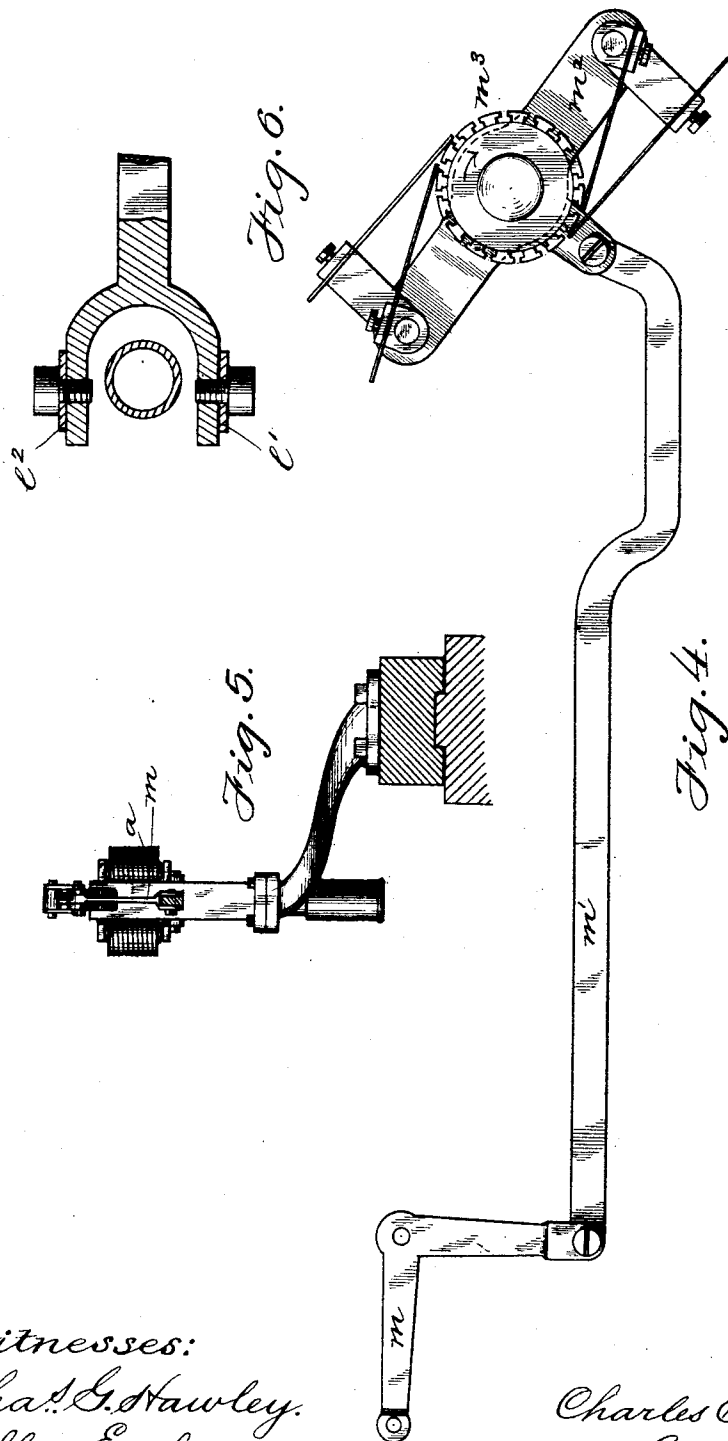
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Attorney.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN
ELECTRIC COMPANY, OF SAME PLACE.

CURRENT-REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 514,504, dated February 13, 1894.

Application filed December 10, 1888. Serial No. 293,164. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Current-Regulators for Dynamo-Machines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Heretofore different forms of apparatus have been used for automatically changing the position of the brushes upon the commutator to those points from which constant current may be obtained, thus compensating for variations in the resistance of the circuit which is being supplied. Such automatic regulation has been effected heretofore in various ways.

The object of my invention is to provide a regulator whereby the current may be maintained constant by moving the brushes upon the commutator, no matter how the resistance of the circuit may vary within the capacity of the machine.

My invention consists in an electro-magnet included in the main circuit, a low resistance shunt or derived circuit around said electro magnet, a rod operated by the action of said electro-magnet, said rod being connected with lever mechanism extending to the brush carrier and circuit making and breaking devices for opening and closing said shunt or short circuit and momentarily shunting the electro-magnet as hereinafter described. The end in view is to move the brushes back and forth upon the commutator directly in response to variations in the strength of the current. In case the resistance of the circuit is increased the brushes must be moved back in order that the electro-motive force may be increased correspondingly. On the other hand if the resistance of the circuit is diminished the brushes must be moved forward upon the commutator so as to decrease the electro motive force. This I accomplish by means of an electro magnetic device having its electro-magnet included in the circuit as herein described.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front view partially in section

of my regulator and the circuit connections thereof. Fig. 2 is an elevation of the side thereof nearest the commutator of the machine. Fig. 3 is a plan view. Fig. 4 is a detailed view showing the connecting rod connected with the brush carrier. Fig. 5 is a view showing the preferable manner of supporting the regulator upon the frame of the dynamo. Fig. 6 is an enlarged sectional view upon line X—X of Fig. 1.

Like parts are indicated by similar letters of reference throughout the different figures.

The electro magnet *a* is connected in the circuit *b b'* of the machine. Around this electro-magnet is placed the shunt *c* of low resistance, say of one half the resistance of the electro-magnet. Thus starting from one side of the machine at wire *b* and going through the regulator to the wire *b'*, which connects with the other side of the machine, I have the parallel or multiple circuit, one side of which includes the electro-magnet *a* while the other side includes the resistance *d*, the armature lever *e* and the shunt lever *f* operated by the armature lever as will be hereinafter described.

The clutch *g* is carried with the armature lever *e*. This clutch is adapted to grasp the rod *h* when the magnet *a* is sufficiently excited to move the armature lever *e*. When the electro-magnet is demagnetized, armature lever *e* descends and with it the clutch, and the clutch coming against the stop *k* opens, thus releasing the rod *h* which, when thus released, descends by gravity, the rod being preferably retarded in its movements or steadied by the dash pot *i*. The clutch shown is one of the well known forms used in arc lamps.

In the upper end of the rod *h* is placed the bolt *l*. From this bolt, as a pivot, are suspended the links *l'*, *l''*, which links carry the bifurcated end of bell crank lever *m* as shown more clearly in Fig. 6. Rod *m'* serves to connect the other end of the bell crank with the brush carrier *m''* as shown more clearly in Fig. 4.

The direction of the revolution of the commutator is indicated in Fig. 4.

The brush carrier is adapted to be moved about the axle of the commutator to bring

the brushes to different positions upon the commutator. Movement of the brushes backward increases the electro-motive force, while movement of the brushes forward decreases the electro-motive force.

By including the electro-magnet *a* in the circuit of the machine as described, any substantial change in the current is compensated for by movement of the brushes upon the commutator so that the current strength is maintained approximately uniform, the electro-motive force being increased when the resistance of the circuit to be supplied is increased and diminished when the resistance is diminished by the action of said electro-magnet and the other instrumentalities co-operating therewith. When armature lever *e* is first raised contact point *n* carried thereby is lifted from contact with shunting lever *f*, thus interrupting or opening the side *c* of the multiple circuit. The stud *n'* thereupon comes against the shunting lever *f* and forces the same against the contact *n*², thus connecting the wires *b*, *b'* directly together and cutting out completely the electro-magnet *a*. We have then this action: First, on increase of current, the armature lever *e* is moved to open the shunt *c* at contact *n*. Thus all current of the circuit is sent through magnet *a*, which is thus strengthened. The armature lever moves then farther and moves the shunting lever against the friction of spring *n*³ to close on contact *n*². Thereupon the magnet is cut out and the lever *e* is free to descend, actuated by its retractile spring until contact *n* closes again upon the shunting lever and the shunting lever is brought back to the position shown, again establishing the circuit through the electro-magnet and through the shunt *c* as shown. Whenever the current is below the normal the piston descends in the dash pot until the brushes are moved backward and until the voltage is increased sufficiently to bring the current up to the strength required, the clutch in the meantime resting against the stop *h*. The instant the current reaches its maximum, the electro magnet *a* is excited sufficiently to attract its armature and raise lever *e*, closing clutch *g* upon the rod or piston *h* and opening the shunt *c* at contact *n*. Thereupon, as before described, the attractive force of magnet *a* is still further increased, that is to say, by the increased current sent through its coils, and also by the increasing nearness of its armature to its poles. The clutch thus having grasped the piston, now raises it until the magnet *a* is cut out at *n*².

In the practical working of my regulator I find that while the lamps or other translating devices in the circuit, are working normally, the armature *e* will be working slowly, but so as to maintain a practically uniform current. If more lamps are brought into circuit the piston will descend until its lower position, required to increase the voltage, is reached. Thereupon the regulator resumes its usual

rate of vibration or stroke. Let several lamps or all the lamps be cut out and it is found that at once the number of strokes per second will be increased, the increased speed of vibration continuing until the piston is raised so as to move the brushes forward to properly decrease the voltage. This higher point or field of movement being reached, the normal rate of vibration is again resumed. Such a device acting by impulses and producing a reciprocating motion which is adapted to cause a step-by-step motion of mechanism with which it is connected, I would designate an intermittent reciprocating device.

I have shown a retardation or steadying device in the form of a dash pot in which a piston carried by the rod *h* is adapted to be moved up and down. It is evident that any other steadying device might be used and that its location is not material as long as it is so connected with the brush carrier as to prevent sudden or jerky movements of the brushes. A dash pot connected with the brush carrier of a dynamo machine is old in the art. I have shown the rod *h* connected in such manner with the brush carrier that by the action of gravity the brushes are moved backward upon the commutator as long as the current is below the normal. It is evident that the weight necessary to accomplish the desired result might be of various forms and arranged in many different ways. The electro-magnetic device is placed in such relation to the weight or force of gravity, that as soon as the brushes begin to be carried beyond the position of constant current, they will be moved in the other direction one step by the force of the electro-magnetic device exerted in opposition to the force of gravity. The electro-magnetic device immediately thereafter comes to its former position ready to move the brushes another step if necessary.

A single electro-magnetic device connected in the circuit of a dynamo machine and adapted to oppose any power, whether gravity or otherwise, constructed and arranged substantially as herein shown, for the regulation of the brushes to maintain a constant current strength I believe to be entirely new. The relative direction in which the power of the electro magnet is exerted as compared with the direction of the opposing force upon the brush carrier may be reversed if desired. In like manner the instrumentalities connecting the armature lever and the brush carrier may be of any conceivable form, shape or construction as long as the force of the magnet is transmitted or applied to the brush carrier to move the brushes, whatever the direction of the movement required may be.

The circuits through the electro-magnet may be varied without departing from my invention as broadly claimed. The principal feature of the circuit connections being that the electro magnet on being excited so as to move its armature is thereafter immediately

reinforced so as to cause a sudden increase of the force or power of the electro magnetic device, the electro magnetic device being in its action analogous to a relay.

5 It should be borne in mind that the regulation of the current automatically within the capacity of the machine is not possible with dynamos, unless specially designed to permit of such changes in the brushes. I refer to
10 the machine described in Patent No. 346,665, granted Ernest P. Warner, August 10, 1888, as one of those heretofore used capable of such complete automatic regulation.

Having thus described my invention, I
15 claim as new and desire to secure by Letters Patent--

1. In an electric current regulator the combination with the rod connected by lever mechanism with the brush carrier upon the
20 commutator, of a dash pot for retarding the movement of said rod, the main circuit divided into multiple arc branches, one branch or side thereof including an electro magnet and the other side including resistance, the
25 armature lever of said electro magnet and a shunting lever and a clutch linked to said armature lever and adapted to engage with and raise the rod, thereby moving the brushes forward on the commutator, substantially as
30 and for the purpose specified.

2. In a current regulator the combination with the rod *h*, of a dash pot connected therewith to retard the same, an electro-magnetic device provided with a clutch attached to an
35 armature reciprocating when the current is abnormal and controlling the current through the magnet, said clutch adapted to engage with said rod *h*, the brushes of a dynamo electric machine and connection between said
40 brushes and the rod *h*; substantially as described.

3. In an electric current regulator the combination with the electro magnet and its armature included in different sides respectively, of a multiple circuit, of a clutch connected with the armature, a clutch rod therein
45 of a retractile spring adjusted to oppose the attraction of the electro magnet, of a shunting lever with which the armature lever is connected when the force of the magnet is not sufficient to overcome the resistance of
50 the spring, said contact being broken when the attraction of the electro magnet is increased by current of greater strength than the normal, thereby opening that side of the multiple circuit which includes the said armature lever, to send the entire current through the electro magnet and excite the same sufficiently to raise the armature lever with the
55 clutch and rod and finally to move the shunting lever to short circuit the electro magnet, substantially as and for the purpose specified.

4. An electro magnet and its armature each
65 in a different side, of a multiple circuit, resistance included in the side containing the armature lever and a shunting lever with which

said armature lever is connected when the current through the electro magnet is not greater than the predetermined normal strength, said
70 shunting lever being adapted to vibrate between a stop and a contact connected with the circuit, whereby on increase of current through the magnet above the predetermined strength, said armature lever is separated from its electrical contact with the shunting lever, while
75 the shunting lever is vibrated to short circuit the electro magnet, substantially as and for the purpose specified.

5. The combination with an electro magnetic device connected with the circuit of a
80 dynamo electric machine, of an armature, a clutch carried by said armature, a piston rod controlled by said armature, a bell crank lever and a connecting rod linked to said piston-
85 rod and extending to the brush carrier, whereby the brushes are automatically moved upon the commutator to maintain the current strength approximately uniform, substantially as and for the purpose specified.

6. The combination with the brushes upon the brush carrier of a dynamo machine, said
90 brush carrier being constantly impelled in one direction, of an intermittent reciprocating electro-magnetic device included in the circuit of the machine and adapted to oppose
95 said constantly impelling force to move the brush carrier step by step when required to maintain the current strength.

7. The brushes upon the brush carrier of a
100 dynamo electric machine, said brush carrier being adapted to be moved by the force of gravity in a direction to increase the electro motive force of the current taken off by the brushes, in combination with an intermittent
105 reciprocating electro-magnetic device controlled by the current sent over the circuit of the machine, said electro magnetic device being constructed to move the brush carrier
110 step by step in a direction to decrease the electro motive force of the current taken off from the machine by the brushes upon the currents becoming more than the normal, substantially as and for the purpose specified.

8. The combination with the brush carrier
115 upon the shaft of a dynamo electric machine, adapted to rotate thereon to change the electro motive force of the current from the maximum capacity of the machine to the position of practically no current without objection-
120 able sparking, said brush carrier being constantly impelled in one direction, in combination with an intermittent reciprocating electro magnetic device included in the circuit of the machine, said electro-magnetic device being
125 connected with the said brush carrier and adapted to act in opposition to the constantly impelling force, whereby the brushes are moved step by step from time to time as the resistance of the circuit varies to maintain
130 an approximately uniform current strength automatically, substantially as and for the purpose specified.

9. The combination with the brush carrier

- said brush carrier being constantly impelled in one direction, of an electro-magnet in circuit with the dynamo electric machine, the armature of the electro-magnet engaging with the said brush carrier to move the same, and contact points operated by said armature to produce vibration of the armature, whereby the brushes are moved upon the commutator to effect current regulation.
10. The combination with a dynamo electric machine of an electro-magnet in the main circuit thereof, a movable armature for said magnet, a clutch attached to said armature, a clutch rod actuated by said clutch adapted when actuated to shift the brushes of said dynamo electric machine, and contact points controlled by said armature to close a short circuit about said electro-magnet when its armature has moved through a predetermined distance, substantially as described.
11. The combination with a dynamo electric machine of an electro-magnet in the main circuit thereof, a normally retracted armature therefor, contact points controlled by said armature to open a normally closed shunt about said magnet when said armature is attracted, and other normally open contact points controlled by said armature to close a short circuit about the said magnet when said armature has moved through a predeter-

mined distance, a clutch connected with said armature to be actuated thereby, and a clutch rod adapted to shift the brushes of said dynamo when actuated, substantially as described.

12. In a current regulator, the combination with the electro-magnet connected in the circuit of the dynamo machine, of the armature lever thereof in said circuit, contact points carried upon said armature lever, a second lever carrying contact points, said armature lever according to the strength of the current being adapted to close upon one or the other of said contact points to properly close the circuit or circuits and to vibrate the said second lever back and forth between a contact or terminal, of a shunt around the electro-magnet and a contact adapted to direct the entire current through said electro-magnet, a clutch rod linked to the brush carrier of the dynamo to control the position of the same upon the commutator, and a clutch attached to said armature lever, substantially as described.

In witness whereof I hereunto subscribe my name this 24th day of November, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,
ELLA EDLER.