

(No Model.)

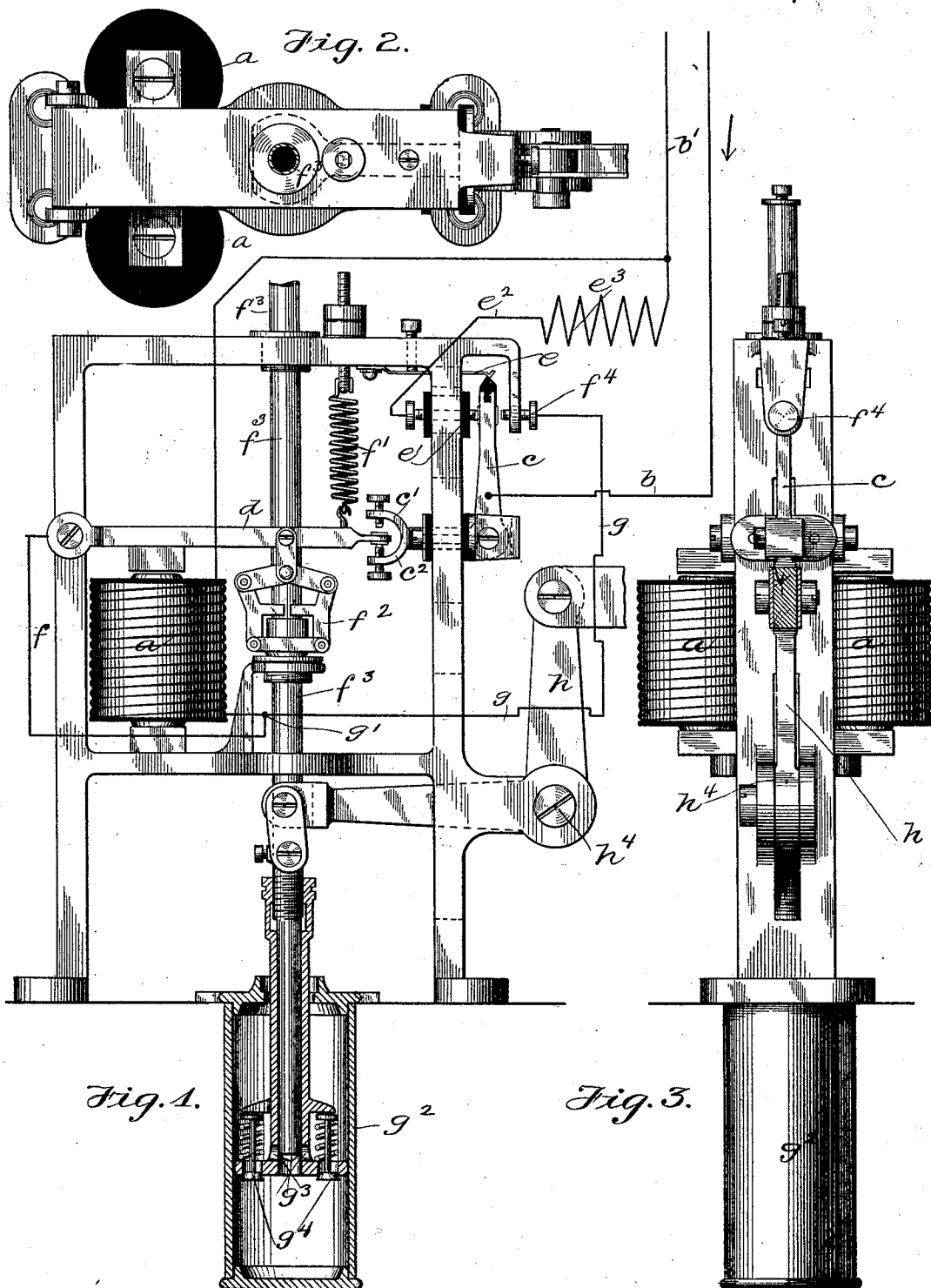
2 Sheets—Sheet 1.

C. E. SCRIBNER.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 509,953.

Patented Dec. 5, 1893.



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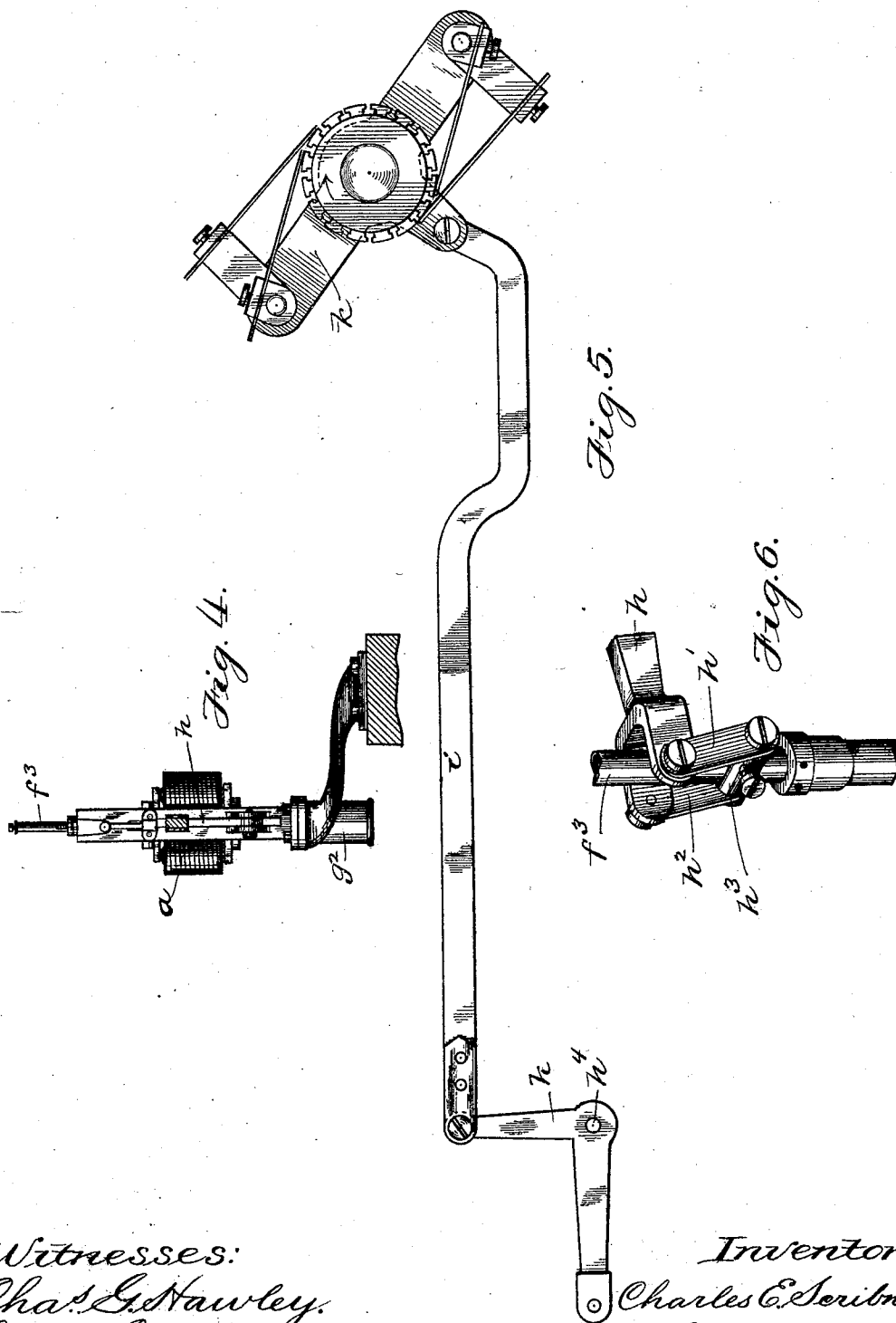
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Witnesses:
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UNITED STATES PATENT OFFICE.

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

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 509,953, dated December 5, 1893.

Application filed December 10, 1888. Serial No. 293,166. (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 Automatic Regulators for Dynamo-Electric Machines, (Case No. 182) 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.

My invention relates to that class of automatic regulators for dynamo electric machines in which the brushes upon the commutator are caused to move back and forth upon the commutator, by means of an electro magnetic device connected with the circuit of the machine, an increase of the current strength when the number of translating devices in the circuit are diminished, resulting in a movement of the brushes forward to correspondingly diminish the electro motive force; in case the resistance of the circuit which is being supplied is increased by including additional translating devices in the circuit, the electro magnetic device operates to move the brushes back upon the commutator, thereby increasing the electro motive force or voltage sufficiently to maintain the current strength.

I will now describe my regulator in connection with a dynamo of the form described in United States Letters Patent No. 346,665, granted to Ernest P. Warner August 10, 1886, for armature for dynamo electric machines, which form of machine is especially designed for supplying electricity to arc lamp circuits upon which the number of lamps may vary at different hours from the full capacity of the machine to any less number. The friction of the commutator upon the brushes tends to carry the brushes forward constantly, that is to say, to rotate the brush carrier about the axle of the machine in the same direction in which the armature revolves. The construction of my regulator is such that whenever the brushes are thus moved forward sufficiently to begin to reduce the current below the normal, for example, eighteen amperes, the attractive force of the electro magnet connected with this circuit will be so dimin-

ished that its armature lever will be drawn away by the force of a retractile spring. The initial movement of the armature serves to cut out the electro magnet whereupon the retractile spring, unopposed, through suitable instrumentalities, acts upon the brush carrier to rotate the same back a short distance upon the axle; thereupon the electro magnet is again brought into circuit in position to either oppose the retractile spring or to permit the same to again draw the armature lever away according to the strength of the current. As will be hereinafter more fully described the friction of the commutator upon the brushes serves to move the brushes forward positively, so as to diminish the current strength to the normal current to which the regulator is adjusted, the principal adjustment of the regulator being between the electro magnet, and the retractile spring connected with the armature lever thereof in opposition to the force or attraction of the magnet.

One feature of my invention is a piston and a dash pot for retarding the downward movement of the piston, the valves of the dash pot being so arranged that the piston will not be retarded substantially in its upward movement, that is to say, when moved by the retractile spring acting through the armature lever and a clutch linked thereto; the downward movement of the piston which is accelerated or aided by the forward movement of the brushes is retarded by the dash pot.

My invention will be more readily understood by reference to the accompanying drawings in which—

Figure 1 is a front elevation partially in section of my regulator and the circuit connections thereof. Fig. 2 is a plan view of the regulator. Fig. 3 is an elevation as seen from the side nearest the commutator. Fig. 4 is a view showing the manner of mounting the regulator upon the frame of the dynamo. Fig. 5 shows the connecting rod between the brush carrier on the commutator and the bell crank of the regulator. Fig. 6 is a detailed view showing the manner of connecting the bell crank with the piston rod.

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

As shown in Fig. 5 the friction of the brushes upon the commutator tends to carry the brushes forward, that is, to move the brush carrier forward. The constant tendency of the commutator when revolving, is thus to bring the brushes to the positions of least electro motive force.

The construction of my regulator is such that when the current falls below that to which the regulator is adjusted, a counter force acts upon the brush carrier to carry the brush carrier back far enough to increase the electro motive force sufficiently to maintain the current strength. An increase of current above the normal removes this counter force and permits the brushes to be moved forward by the friction of the commutator.

Referring now to Fig. 1, the electro magnet *a* is connected with the circuit *b'* of the machine. The portion *b* of the circuit as shown in the drawings is connected with the lever *c*, pivoted as shown, one end of the lever *c* being bifurcated and provided with adjustable contacts *c'*, *c''*, placed on opposite sides of the end of the armature lever *d*. The friction spring *e* rests upon the other end of said lever *c*; the lever *c* is shown resting against the contact or terminal *e'* of the shunt circuit *e''* including the resistance *e''*; the resistance *e''* may be of any amount sufficient to effect the desired results, for example, it may be equal to the resistance of the electro magnet *a*; thus the circuit of wire *b* may be traced to lever *c* and in one direction through the shunt *e''* to wire *b'*; tracing in another direction we find the circuit through contact *c''* to armature lever *d* and thence by wire *f* through electro magnet *a* and thence to wire *b'*. We will suppose the current desired to be eighteen ampères and that the resistance of the shunt or portion *e''* of the circuit is the same as that of the portion or side *f* of the circuit which includes the electro magnet *a*; we should then have a nine ampère current through the electro-magnet and the adjustment of the retractile spring *f'* and the windings of the electro-magnet *a* should be such relatively that a current of nine ampères through the magnet will be sufficient to retain the armature in the position shown against contact *c''*; decrease of the current in the slightest degree below eighteen ampères would diminish the current through the electro magnet below nine ampères. As soon as such a decrease or weakening occurs, spring *f'* will be sufficient to draw armature *d* away from contact *c''*. There being a little lost motion in the clutch the armature lever *d* will be separated from contact *c''* before the clutch *f''* linked to the lever *d* engages with the piston rod *f''*. The circuit of wire *f* being thus broken at contact *c''*, electro magnet *a* loses its power and spring *f''* acts, unopposed, upon the lever *d*, raising the same and with it the clutch *f''* and the piston *f''*. The lever *d* is thus brought against contact *c'* and the lever *c*, by the pressure of lever

d against contact *c'* is separated from contact *e'* and closed upon contact *f''*. The circuit is thus re-established through the electro-magnet *a*, that is to say, the circuit of wire *b* may be traced to lever *c*, thence to contact *f''* and thence by wire *g* to point *g'* of wire *f*, thence through the electro magnet *a* as shown to wire *b'*; also at the sametime from contact *c'* of lever *c* to lever *d* and thence by wire *f* to point *g'* and thence through electro-magnet *a* by the continuation of wire *f* to wire *b'*. Electro magnet *a* is thus energized by the entire current and is excited sufficiently to bring armature lever *d* back against contact *c''* with sufficient force to move the lever *c* away from contact *f''* and back to the position shown in contact with contact point *e'* of shunt circuit *e''*. While lever *d* is thus in contact with point *e'* and lever *c* in contact with point *e'* the clutch *f''* will be resting upon its stops and hence will be out of engagement with piston rod *f''* and the piston rod *f''* may move downwardly retarded by the dash pot *g''*. In the dash pot, besides the usual small opening *g''*, I provide valves *g''*, arranged as shown so that the movement of the piston in one direction will be practically without retardation by the glycerine or other liquid contained in the barrel of the dash pot. When, however, the piston is moved in the other direction, that is, downwardly, when the dash pot is of the construction shown, the valves *g''* will be closed immediately on the commencement of said downward movement and the amount of retardation being determined by the size of the orifice *g''*.

The manner of connecting the bell crank lever *h* with the piston *f''* is illustrated in perspective in Fig. 6. The end of said lever is bifurcated and the links *h'*, *h''*, connecting with the different sides thereof respectively, are pivoted to the yoke *h''* which is secured to the rod by a set screw. Thus when the piston rod is raised the bell crank is moved upon its pivot *h'* and the connecting rod *i* is thrust forward so as to turn the brush carrier *k* backward a short distance upon the commutator. This action is repeated stroke by stroke until the voltage is increased sufficiently to maintain the current strength. 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 designate an intermittent reciprocating device. When the current is thus raised to its predetermined normal strength, the counteraction begins, the friction of the commutator upon the brushes tending to carry the brushes forward, thus thrusting connecting rod *i* back, so as to move the bell crank *h* in a direction to force the piston *f''* positively downwardly.

In the operation of my regulator, a change in the resistance or work to be done in the circuit results in a movement of the brushes upon the commutator to increase or decrease

the electro-motive force correspondingly; that is to say, the electrical energy is automatically controlled, so that the energy of the machine is always just sufficient and no more than sufficient, to do the work required.

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

1. The combination with the brushes upon the brush carrier of a dynamo machine, of an electro-magnetic device connected in the circuit of the machine, a clutch carried by the armature lever of said device and a rod with which the clutch is adapted to engage a dash-pot having the small openings g^3 and the valves g^4 or their equivalents, connected with said rod and adapted to retard the movement thereof in one direction only, and mechanism connecting said rod with the brush carrier, whereby the brushes are moved in response to changes in the circuit resistance to maintain the current strength constant; substantially as described.

2. In a current regulator the combination with the electro-magnet connected in the circuit of the dynamo machine, of the armature lever thereof in the circuit, with said electro-magnet the lever c with the bifurcated end provided with contact points, one on each side of the armature lever, said armature lever according to the strength of the current being adapted to close upon one or the other of said contact points to close an electric circuit therethrough and vibrate the lever c 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, whereby the current of the machine is regulated automatically to maintain an approximately uniform strength.

3. The brush carrier and brushes mounted thereon, said brushes resting upon the revolving commutator and adapted to be moved forward by the friction between the said brushes and commutator, in combination with an electro-magnetic device placed in the circuit of the machine, said electro-magnetic device being mechanically connected with the brush carrier and adapted to be set in operation on

the currents falling below the predetermined normal strength, to move the brush carrier backwardly, step by step, against the force of the friction of the commutator to increase the electro motive force sufficiently to maintain the current strength.

4. In a current regulator the combination with an electro-magnetic device adapted to be set in operation on the falling of the current below the predetermined strength to which the device is adjusted, of a rod provided with a piston having valves, placed in a dash pot, a clutch connecting said rod with said armature lever, whereby the rod is lifted without retardation when the current through the electro-magnetic device falls below the normal, while on the current becoming stronger than the normal the rod is released by the clutch and descends, retarded, by the dash pot.

5. The combination with a dynamo electric machine, of an electro-magnet in the main circuit thereof, an armature for said magnet, a retractile spring acting upon said armature, a clutch connected with said armature and a clutch rod therefor connected with the brush carriers of said dynamo, to shift them backward when moved by the clutch, and contact points upon said armature adapted to open the circuit of said magnet when the armature moves away from it, and other contact points adapted to close said circuit when the armature is fully retracted; substantially as described.

6. The combination with the commutator of a dynamo electric machine, of a brush carrier, brushes mounted thereon and bearing upon said commutator with force, whereby they are constantly impelled by friction in the direction of rotation of the armature, an intermittent reciprocating electro-magnetic device placed in the circuit of said machine, said device responding to currents below the normal, whereby the brushes are moved against said frictional impelling force to maintain the current strength; substantially as described.

In witness whereof I hereunto subscribe my name this 1st day of December, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,
ELLA EDLER.

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