(No Model.) 4 Sheets—Sheet 1.

C. E. SCRIBNER.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 435,526. Patented Sept. 2, 1890.

Fig. 2.

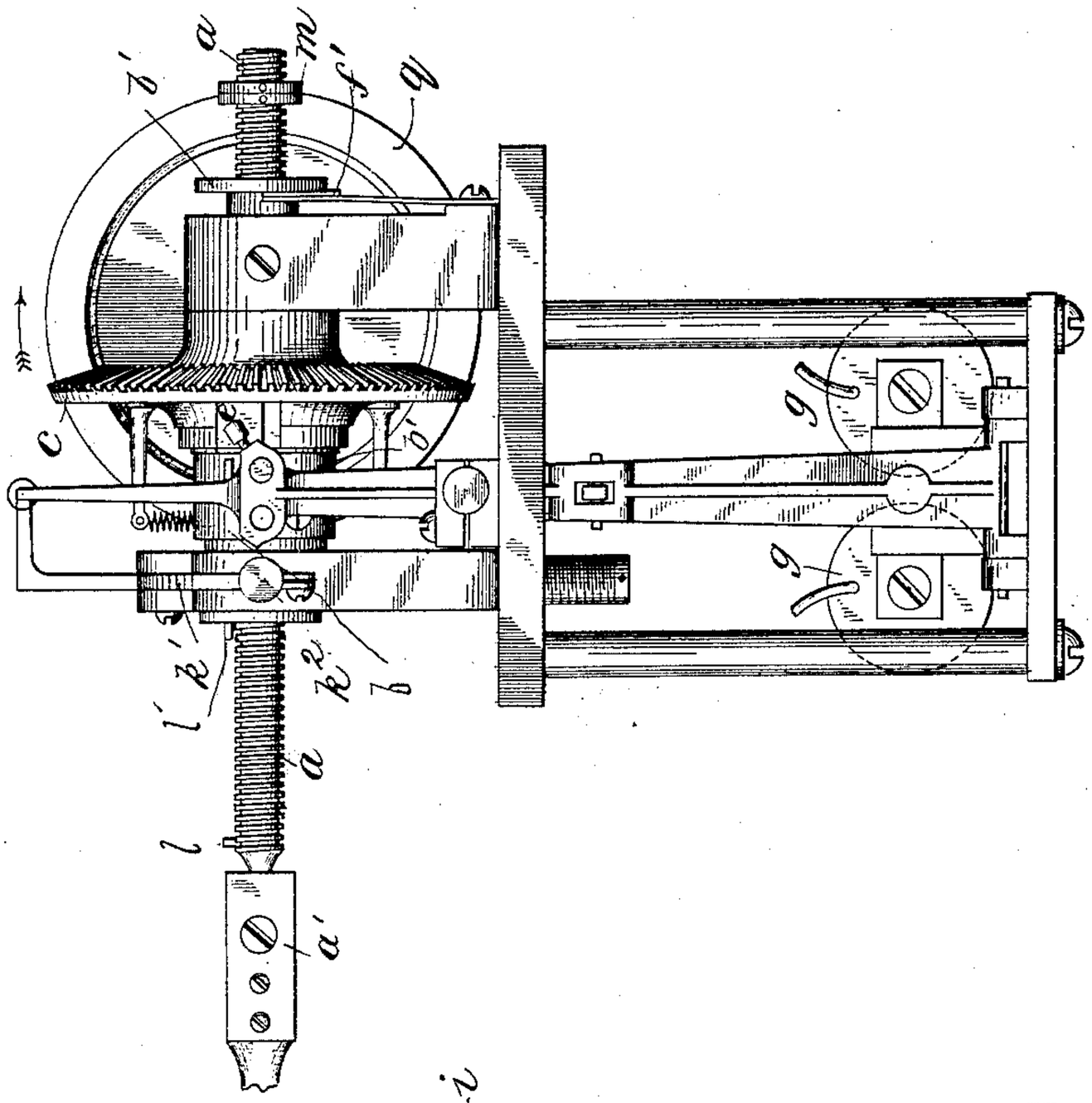
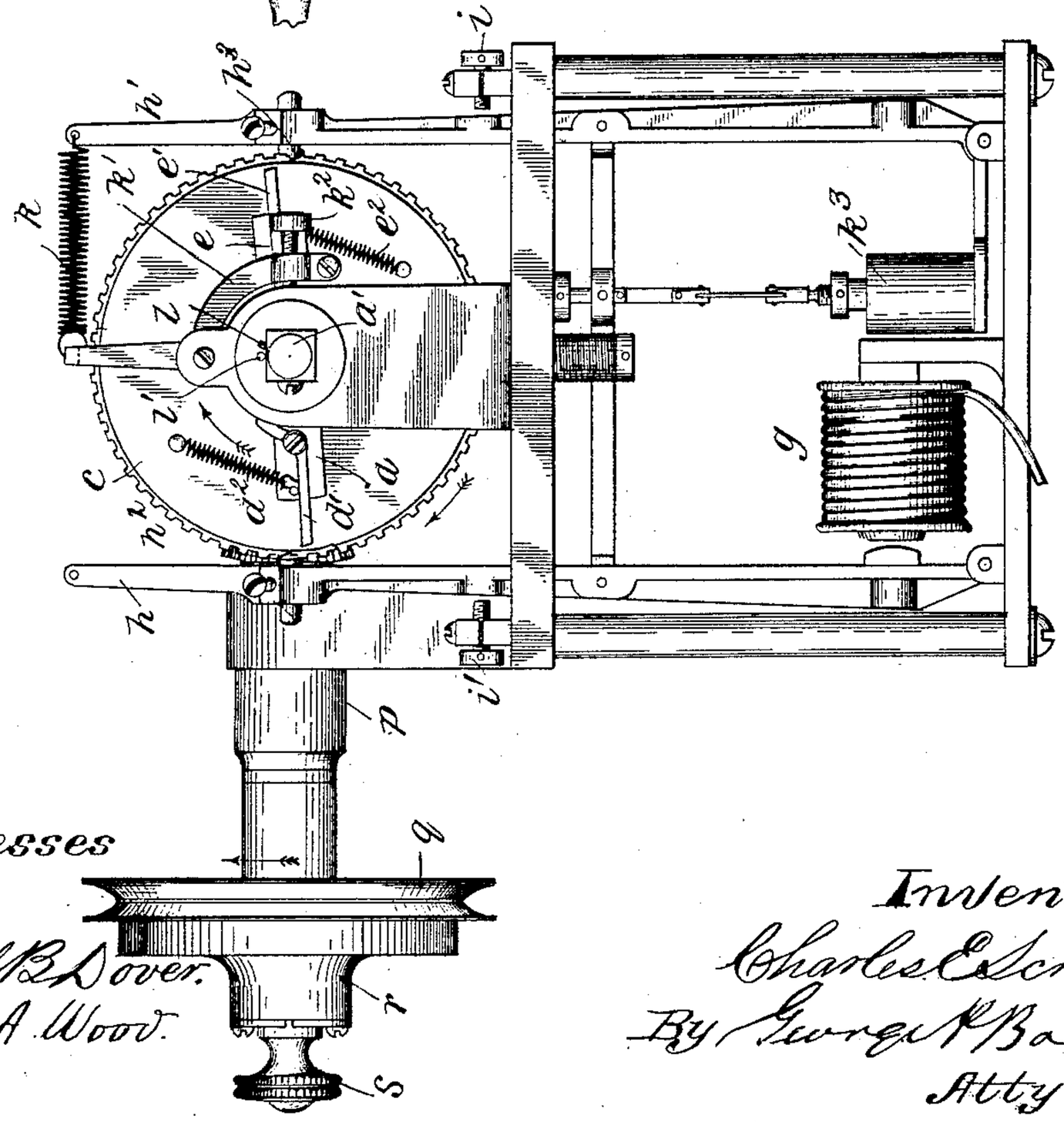


Fig. 1.



Witnesses

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REGULATOR FOR DYNAMO ELECTRIC MACHINES.

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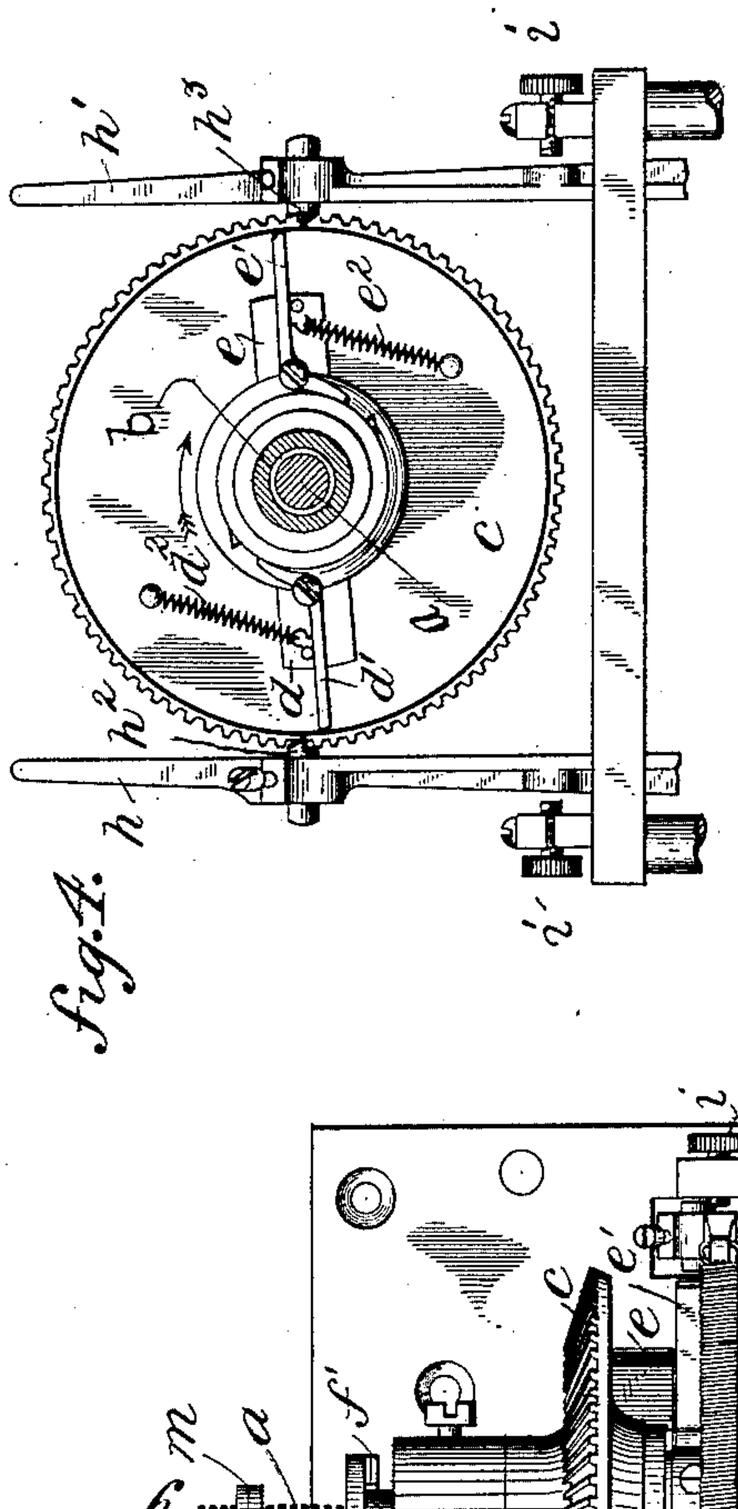

Fig. 4.

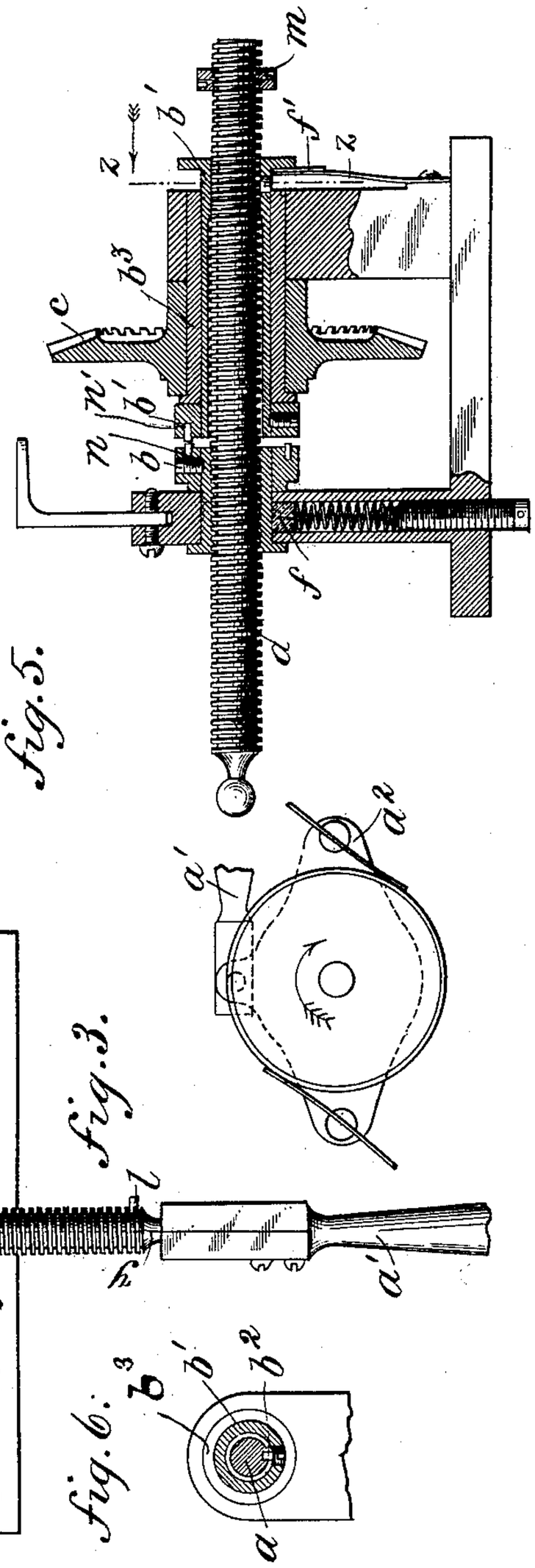

Fig. 5.

Fig. 3.

Fig. 6.

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Fig. 7.

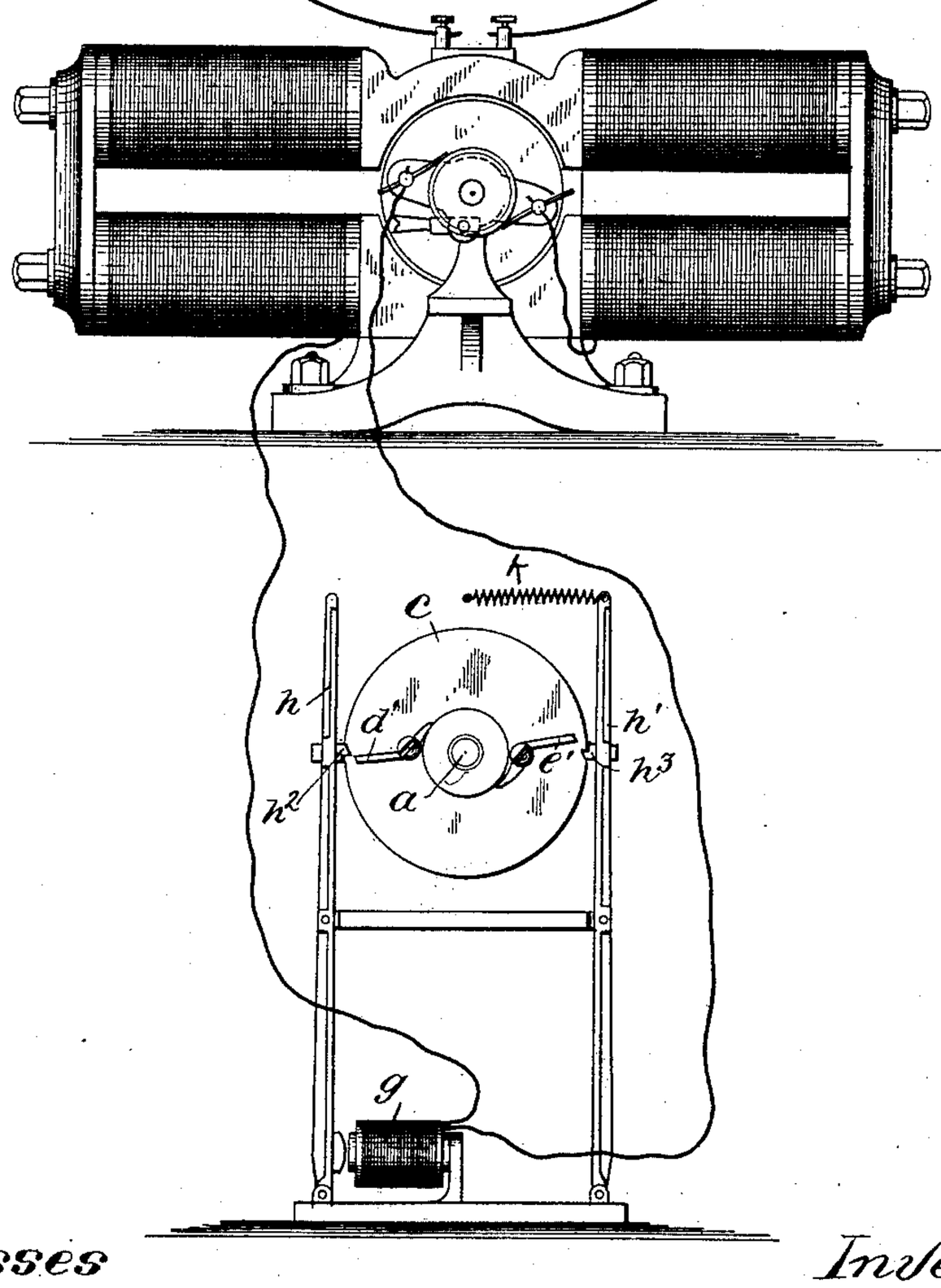

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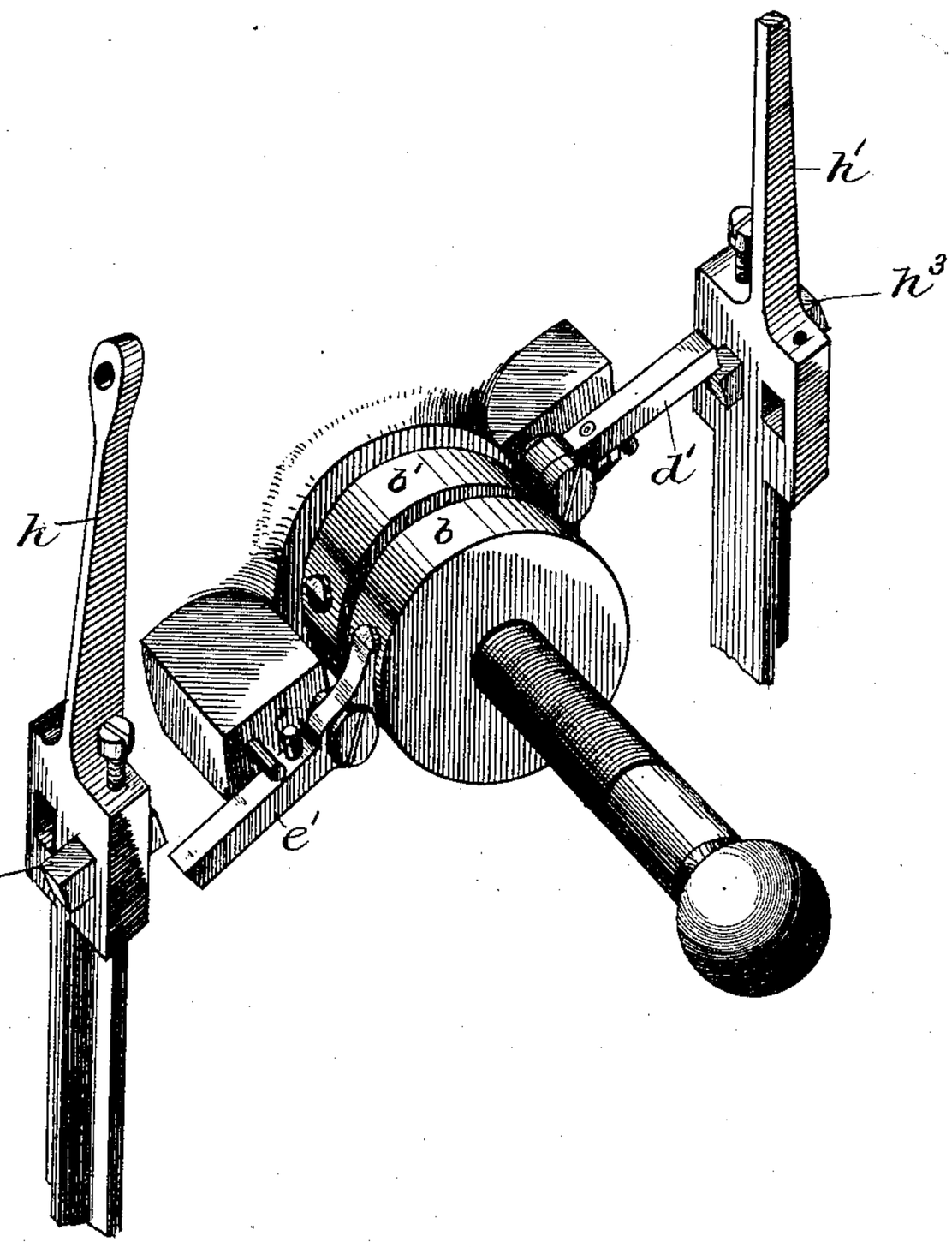
Fig. 8.



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UNITED STATES PATENT OFFICE.

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REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 435,526, dated September 2, 1890.

Application filed March 8, 1886. Serial No. 194,369. (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 102,) 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 regulators for dynamo-electric machines, and is designed to maintain the current at approximately a given strength, though the resistance of the circuit may change.

The regulator which I have invented consists of a screw, a nut upon the screw, and mechanism for driving the screw and nut alternately or both together in the same direction, whereby the brushes upon the commutator are moved back and forth or held at rest in response to the variations in the resistance of the lamp-circuit.

My invention further consists in certain details and combinations, which will be hereinafter pointed out.

In a prior application, Serial No. 163,777, filed April 28, 1885, I have described, illustrated, and claimed certain features of the invention set forth in this application. The brushes, as is well known, are placed so as to draw off the current from opposite sides of the commutator, and any change in the position of the brushes varies the electro-motive force of the dynamo. In order to keep the strength of the current uniform it is necessary to move the brushes back as the resistance of the circuit is increased, and vice versa. Heretofore various devices have been used for automatically doing this work, but owing to various defects in the methods and mechanism the results have not been as satisfactory as required, especially in electric lighting, where many lamps are placed in the same circuit. By the use of my invention as hereinafter described I am enabled to maintain the current in an electric-arc circuit more nearly at a uniform strength than is possible by the use of any devices heretofore known.

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

Figure 1 is a front elevation of my regulator. Fig. 2 is a side elevation thereof. Fig. 3 is a top view, partially in section, showing the means for driving the regulator and the reciprocating screw, which connects with the brush-carrier. Fig. 4 is a sectional view as seen from line $x\,x$ of Fig. 3, showing the tripping mechanism. Fig. 5 is a detailed sectional view upon line $y\,y$ of Fig. 3, showing the screw, the screw-carrier, the pin-feather of the screw-carrier resting in the longitudinal groove in the screw, the nut upon the screw and friction devices, which tend to hold the screw-carrier and the nut at rest. Fig. 6 is a detailed sectional view of the screw upon line $z\,z$ of Fig. 5. Fig. 7 is a diagram illustrative of the circuit. Fig. 8 is a perspective view illustrative of the manner of changing the position of the stops which engage with the triggers to reverse the direction of the screw with a given change in current.

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

As will be readily understood by reference to Fig. 3, the screw a is connected by the rod or pitman a' with the brush-carrier a^2, and longitudinal motion of the screw in either direction is communicated to the brush-carrier, and the brushes are thus carried back and forth upon the commutator. The nut b is threaded upon the screw. Moving the nut in one direction upon the screw without revolving the screw drives the screw longitudinally in one direction, while driving the screw within the nut in the same direction while the nut is held at rest drives the screw longitudinally in the opposite direction. On the other hand, if both nut and screw are revolved together in the same direction no longitudinal motion will be imparted to the screw.

The screw-carrier b' is in the form of a sleeve provided with a collar or flange next to a similar collar or flange forming a part of nut b. This carrier is connected with the screw by means of a spline or feather b^2, fitted into a longitudinal groove in the screw. The carrier b', when revolved within the bearing b^3, carries the screw by means of the spline

b^2, but, as the spline is fitted to the groove in the screw, the screw may be carried longitudinally back and forth within the carrier.

The driving-gear c is provided with two longitudinally-projecting lugs d e, to which are pivoted the triggers d' and e', respectively. Trigger d' is normally held by the tension of spring d^2 in the position shown in Figs. 3 and 4, against the periphery of nut b. The trigger e' is held in like manner against the collar or enlarged portion of the carrier b' by spring e^2. A lug or catch is provided upon the periphery of the nut and a similar lug or catch upon the carrier. Now, as the driving-gear carries the triggers around they engage with these catches respectively, and the nut and carrier are thus revolved together at the same rate of speed as long as the triggers remain in engagement therewith. As before described, the carrier in its revolutions carries the screw, and hence the screw and nut will revolve together and there will be no longitudinal movement of the screw as long as both triggers are in engagement with their catches respectively. Now, if one of the triggers be tripped so as to pass over its catch while the other trigger remains in engagement with its catch, longitudinal motion will be imparted to the screw in one direction or the other, according as one trigger or the other is tripped. Suppose, for example, trigger d' is tripped while trigger e' remains in engagement with the carrier. The carrier will be revolved, and with it the screw within the nut, which nut will be held from turning by the friction device f. (Shown in Fig. 5.) The turning of the screw within the nut will give longitudinal motion to the screw and the brushes will be carried forward and the current will be thereby weakened. If, however, the trigger e' is tripped while the other trigger d' remains in engagement with the nut, the nut will be carried around upon the screw, while the screw will be held from turning by the friction device f', (shown in Fig. 5,) which presses against the flange provided upon the outer end of the screw carrier, as shown, and, the nut being thus revolved upon the screw, the screw will be drawn longitudinally in a direction opposite to the direction given when the trigger d' is tripped and the brushes will be moved backward upon the commutator, thus increasing the strength of the current.

In order that the one or the other of the triggers may be tripped as the resistance of the arc varies, I have provided the electro-magnet g in the circuit of the machine, which magnet operates the balance-levers h and h', moving them back and forth into and out of the paths, respectively, of the outer ends of the triggers. Thus as the current through magnet g increases, its armature is attracted against the force of the retractile spring k and the levers h h' are moved with the armature to bring the point h^2 into the path of lever d' while point h^3 is carried outside the path of the trigger e'. The result is that the nut is driven upon the screw and the screw is carried back longitudinally and the brushes are adjusted forward upon the commutator, so as to weaken the current, as before described. Now the electro-motive force, and consequently the strength of the current, being reduced, the armature will recede from the poles of electro-magnet g, until finally the tripping of trigger d' will cease, and both triggers remaining in engagement with their respective catches the screw and nut will be carried together in the same direction and no longitudinal motion will be given to the screw, and the brushes will remain at rest. If, now, the resistance of the circuit be diminished the levers h and h' will be moved still farther and farther until point h^3 is brought into the path of trigger e', and said trigger e' will be tripped out of engagement with the catch upon the carrier. The nut will then be revolved upon the screw, while the screw, held from revolving, as before described, will be moved longitudially in the opposite direction from that given when the trigger d' is tripped, and the brushes being thus adjusted backward upon the commutator an increase of electro-motive force will be obtained, thereby increasing the strength of the current until the force of magnet g is sufficient to draw the armature toward its poles. The armature being thus moved the levers h h' will be carried with it until trigger e' is no longer tripped, and trigger e' will thus be brought into engagement with its catch upon the periphery of the collar of the screw-carrier. It will thus be seen that as the strength of the current through electro-magnet g increases the brushes are moved upon the commutator in a direction to reduce the electro-motive force of the current, and hence the strength of the current passing through said electro-magnet g. On the other hand, decrease in the strength of the current through electro-magnet g causes the brushes to move in a direction to draw off more current or increase the electro-motive force of the current and thus increase the strength of the current through the electro-magnet g. If, however, the current passing through the electro-magnet is of the desired strength, neither trigger will be tripped and the brushes will remain at rest until there is sufficient variation to move the balanced levers h h' in one direction or the other. The levers may be adjusted by means of the screws i i' or in any other suitable manner. It should be observed that the spring k is attached to the pivoted arm k'. This arm, and hence the tension of the spring, may be adjusted by means of the screw k^2.

The dash-pot k^3 is designed to steady the motion of the balanced levers.

The spring k being at so great a distance from the fulcrum may be adjusted so as to almost exactly counterbalance the action of the electro-magnet, which varies greatly according to the distance of the armature from the poles of the magnet.

In the foregoing description I have assumed,

which is ordinarily the case, that the variations in the resistance of the current may be compensated and controlled by changing the brushes back and forth between the points of maximum and minimum current upon the commutator. It may happen, however, that the change in the resistance of the circuit will be so great that a change between the maximum and minimum of electro-motive force of the machine will not be sufficient to compensate for the variation in resistance so as to bring the current to the strength required. In such case the regulator as above described would tend to carry the brushes back of or in front of the maximum or minimum points upon the commutator, as the case might be, thus making the strength of the current vary still more. In order to avoid this, I have provided for locking the screw and nut together before the brushes pass the minimum point on the commutator, and also means for locking the carrier and nut together before the brushes pass the maximum point upon the commutator. In either position the nut and screw will be revolved together in the same direction, and hence no longitudinal motion will be imparted to the screw.

As shown in Fig. 3, pins l and l' are provided upon the screw and nut, respectively. As the screw is moved longitudinally to bring the brushes toward the minimum point, these pins $l\ l'$ are brought nearer together and so adjusted that when the brushes reach the minimum point these pins will engage, so that the screw and nut will turn together, the friction of the piece f being overcome, and hence no longitudinal motion will be given to the screw and hence the brushes cannot pass beyond the minimum point. Suppose the screw moving in the opposite direction and carrying the brushes toward the maximum point of the commutator. The check-nut m will gradually approach the screw-carrier b' until it will press against the same. The screw-carrier will thus be forced longitudinally against the pressure of the friction device f' toward the nut b.

Upon the opposing ends of the carrier and nut, respectively, I have provided the pins or projections n and n', and as the brushes reach the maximum point the lugs or projections n and n' are brought into engagement. The carrier and nut, and hence the nut, the screw, and the carrier, are thus locked and turn together, the friction of friction-piece f and f' being overcome, and therefore no further longitudinal movement can be given to the screw, and the brushes will not pass the maximum point upon the commutator.

Through each lever two openings are provided for the adjustable dogs or stops which trip the triggers. By placing the stops into their opposite holes so that the stop h^2 in lever h is placed in the hole to trip trigger e' instead of trigger d', the other stop h^3 can then be placed in the hole of lever h', when it will come in the path of trigger d' instead of e', as shown in Fig. 8. The result of this change is to reverse the direction of the screw with a given change in current. To be more explicit, a strengthening of the electro-magnet g will attract its armature and move the balance-lever system against the force of the spring, bringing the stop h^2 into the path of trigger e', thus tripping the screw and permitting it to stand at rest while the nut continues to revolve, thereby moving the screw in a direction to move the pitman away from the regulator. The object of this reversibility is to permit the regulator to be used on a dynamo-machine whose armature may be revolved in either direction. These two levers operate together, and together may be termed a "tripping" mechanism.

Any convenient means may be employed for furnishing power to drive my regulator. I preferably use, however, the belt and pulley devices shown in Figs. 1, 2, and 3, which I will now describe. The shaft o turns in its bearing p, and is provided with the piston, which meshes with the large gear-wheel c, as shown. The pulley q is loose upon the shaft and is driven by a belt or cord which is connected with the engine or motor. The clamp r may be adjusted longitudinally upon the shaft by means of the nut s. This clamp, when adjusted, as shown, against the pulley, is carried with the pulley, and the clamp being provided with a splice which fits the longitudinal groove in the shaft, as shown, the shaft will be revolved with the clamp. The regulator will thus be driven as long as the clamp and pulley thus remain in frictional engagement.

I believe myself to be the first to cause the variations in the strength of an electro-magnet in the circuit of the machine to operate an armature lever or levers, or other device, which is thus brought into and out of the path of a portion of the regulating mechanism.

Whatever the details of the device or devices that may be used for regulating the position of the brushes, I wish it to be understood that making the armature-lever, which is brought into and out of the path of the tripping or other adjusting portion of the regulating mechanism, free to move in response to the variations in the strength of the current without obstruction, as hereinbefore described, is in itself new and a principal feature of the invention herein described. By thus making the action of said armature-lever or other device free and unobstructed, it is evident that the most perfect, prompt, and delicate regulation of the brushes is secured, since the said armature-lever or other device is free to instantaneously change from one position to another at the slightest variation in the magnetic force of the electro-magnet.

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

1. The combination, with the brushes and commutator of a dynamo-electric machine, of an electro-magnet included in the circuit of the machine, the armature-lever of said electro-magnet, which directly responds to variations in the strength of the current of the machine, and the driven regulating mechanism, controlled by the position of said armature-lever, said armature-lever being in its movements unobstructed by the said regulating mechanism, and free to move into and out of the path of trigger mechanism forming a part of said regulating mechanism, whereby the brushes are moved backward and forward upon the commutator in response to variations in the strength of the current.

2. The combination, with an electro-magnet included in the circuit of a dynamo-electric machine, of the armature-lever of said electro-magnet, tripping mechanism into and out of the path of which the said armature-lever is free to vibrate in response to the variations in the magnetic force of its electro-magnet, the commutator of the machine, the brushes, and driven regulating mechanism intermediate of the tripping mechanism and brushes, whereby the current of the machine is maintained at approximately the same strength, though the resistance of the circuit may vary.

3. The combination, with a wheel and mechanism for driving the same, of triggers carried upon said wheel, screw mechanism controlled by said triggers and connected with the brush-carriers, the circuit of the machine including an electro-magnet, and the balanced armature-levers of said electro-magnet free to move into and out of the path of said triggers, respectively, whereby the brush-carrier is adjusted to move the brushes backward and forward upon the commutator in response to the variations in the strength of the said electro-magnet to maintain the current at approximately the same strength.

4. The dynamo-electric-machine regulator consisting of the combination, with an electro-magnet in the circuit of the machine, and the armature-lever of said electro-magnet, of tripping mechanism, into the path of which the said armature-lever is introduced and withdrawn by the action of said electro-magnet, constantly-driven screw mechanism connected with the said trigger mechanism and controlled thereby, and the commutator, brushes, and brush-carrier, to which said screw mechanism is connected, whereby the strength of the current of the machine is maintained approximately uniform.

5. A dynamo-regulator consisting of a screw, a nut upon the screw, a driver in constant motion, triggers or carriers moved by the said driver, the carriers or triggers respectively engaging with the screw and the nut, an electro-magnet in the circuit of the dynamo, its armature-lever placed with reference to the carriers to trip the one or the other, or neither, as it occupies a different position in its excursion to and from its electro-magnet, whereby the screw may be caused to move in one direction or the other to produce automatic regulation.

6. A screw mechanically connected with the brushes of a dynamo-electric machine, with a nut placed upon said screw, said screw and nut being revolved in the same direction, in combination with mechanism for driving the same, said mechanism being adapted for alternate engagement with the said screw and nut, respectively, whereby reciprocal longitudinal movement of the screw is effected to adjust the position of the brushes upon the commutator.

7. In an electric-current regulator, a screw with a nut placed thereon, said screw and nut being revolved in the same direction, in combination with mechanism adapted to engage alternately with said screw and nut, respectively, whereby the screw is driven in one direction or the other accordingly as the driving mechanism engages with said screw or said nut, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 1st day of March, A. D. 1886.

CHARLES E. SCRIBNER.

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