(No Model.) 3 Sheets—Sheet 1.

C. L. BUCKINGHAM & H. LEMP.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 387,853. Patented Aug. 14, 1888.

Fig. 1.

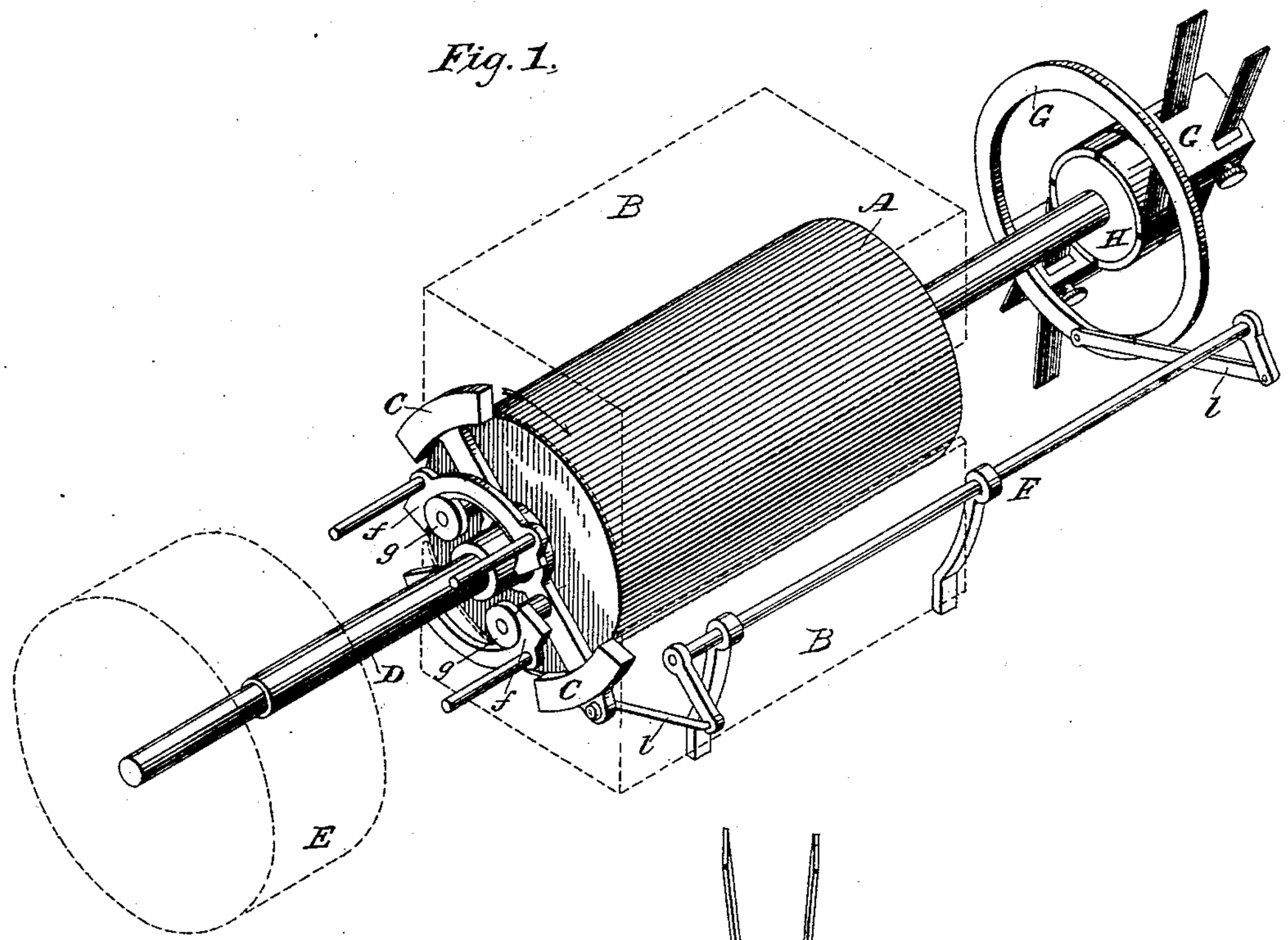
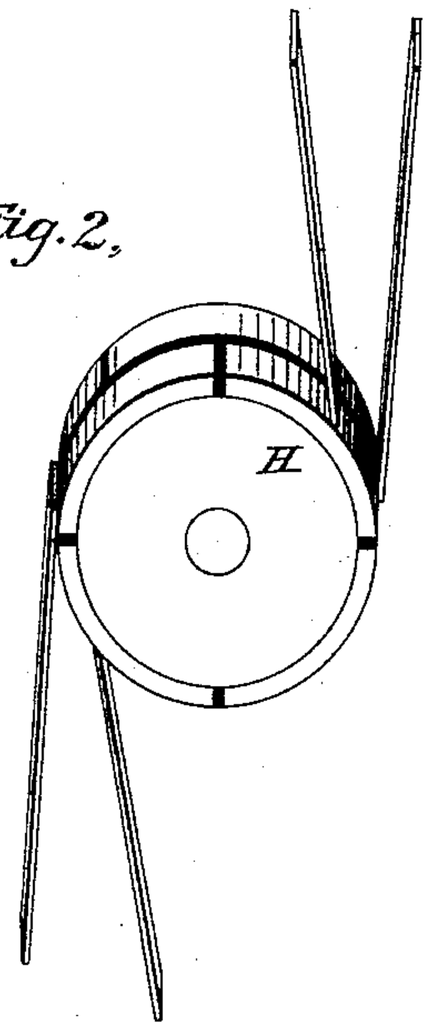


Fig. 2.



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(No Model.)

3 Sheets—Sheet 2.

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Fig. 3.

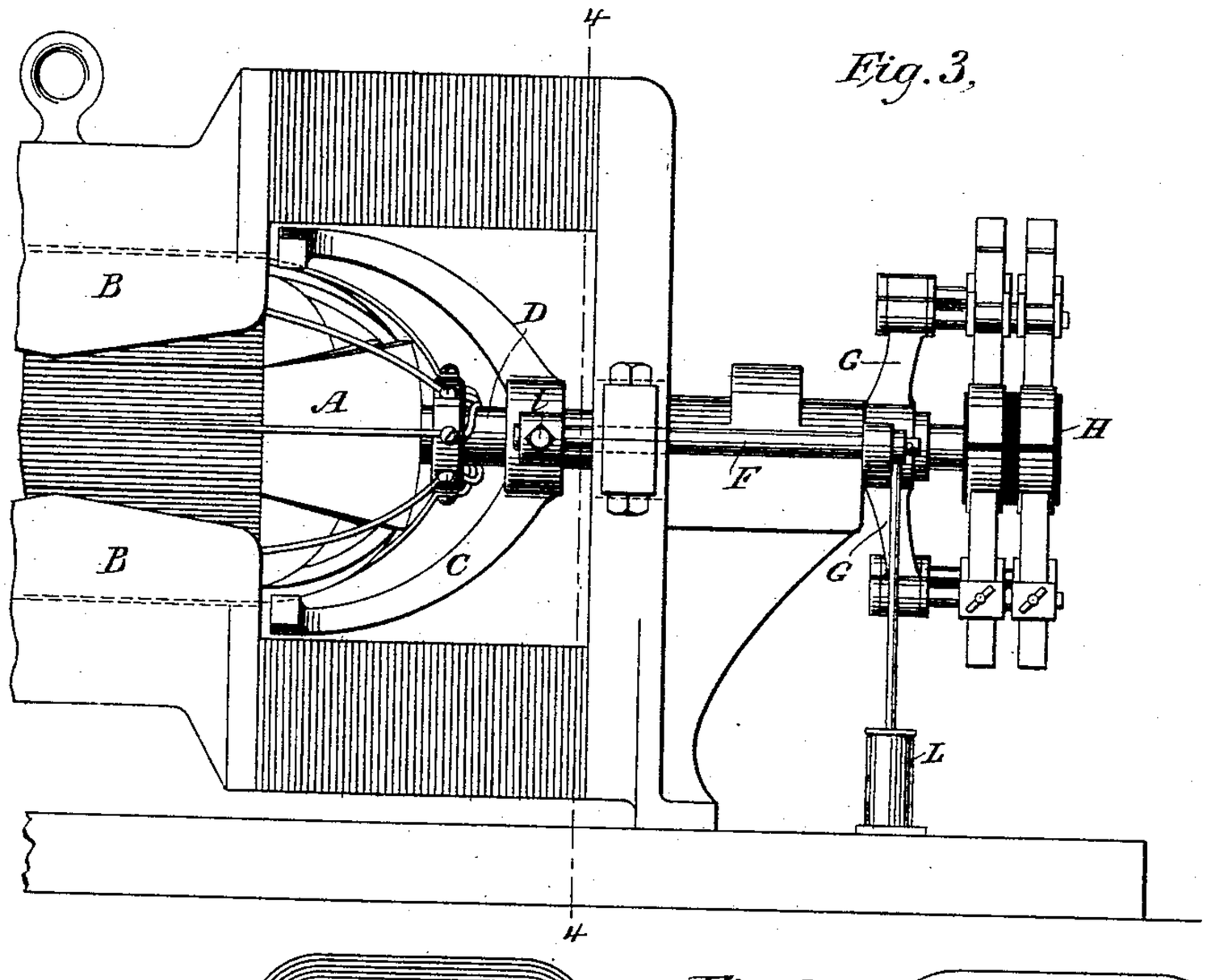

Fig. 4.

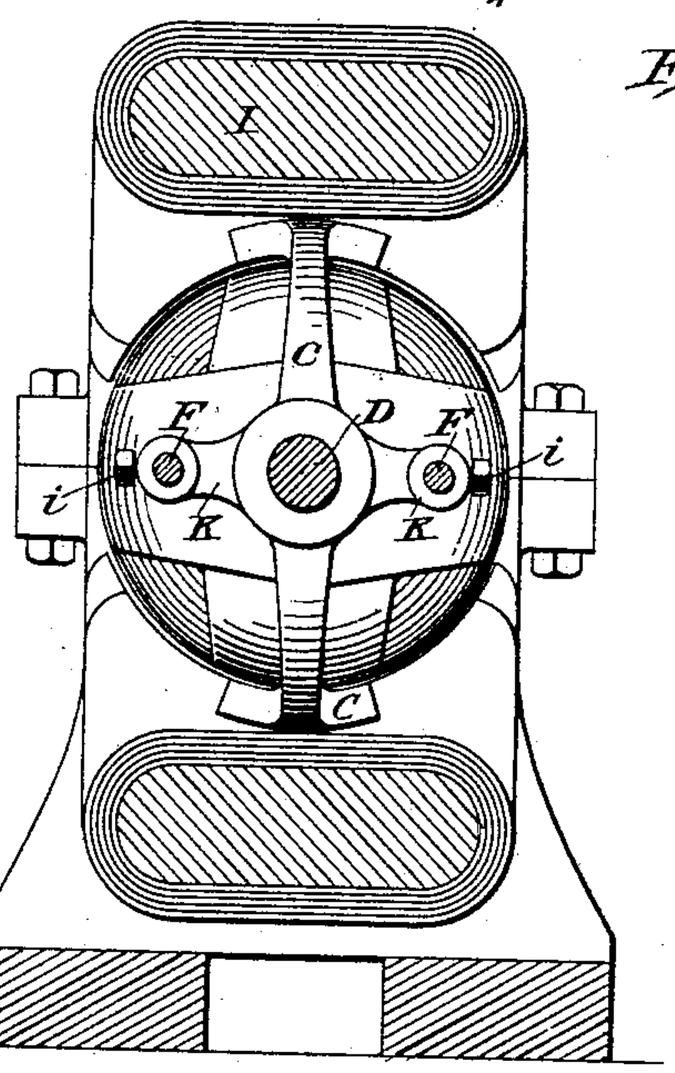

Fig. 5.

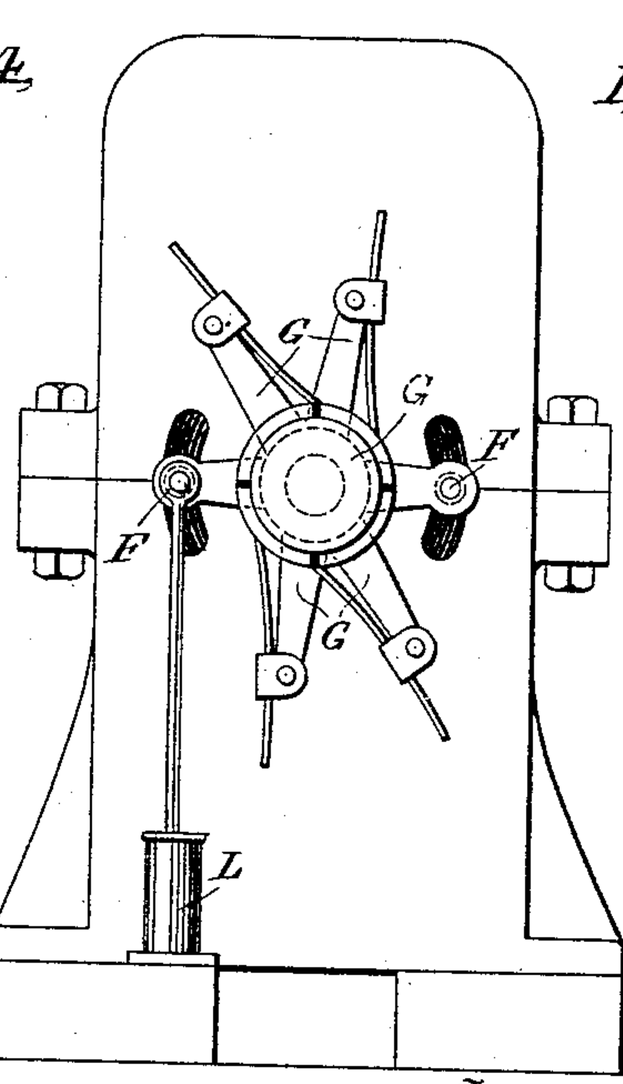

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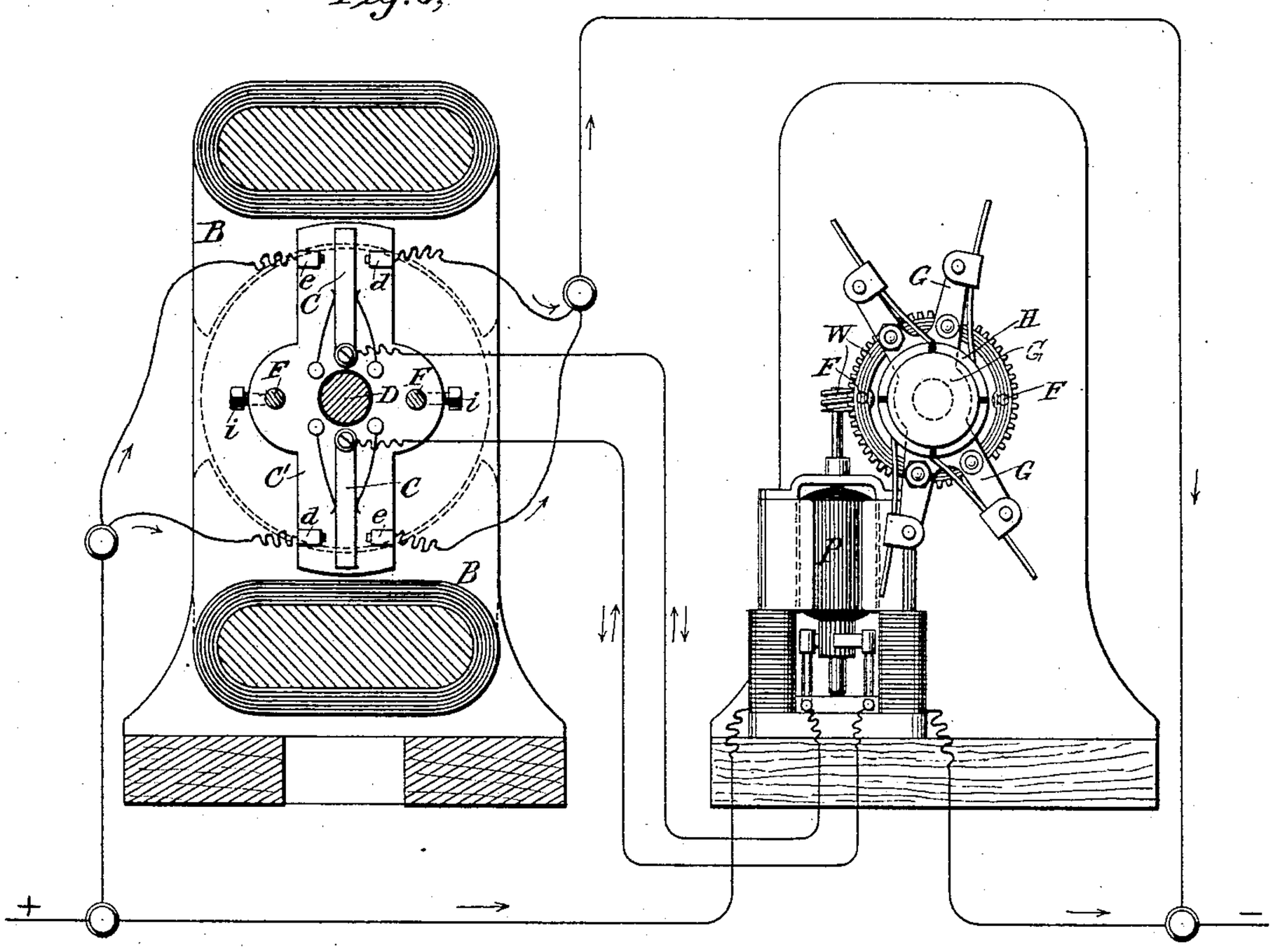
Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF NEW YORK, N. Y., AND HERMANN LEMP, OF HARTFORD, CONNECTICUT.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 387,853, dated August 14, 1888.

Application filed June 21, 1887. Serial No. 241,964. (No model.)

To all whom it may concern:

Be it known that we, CHARLES L. BUCKINGHAM and HERMANN LEMP, citizens of the United States, residing, respectively, at New York, in the county and State of New York, and at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Magneto-Electric Machines, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

Our invention relates to the method and means of shifting the commutator-brushes to correspond with the shifting of the polar line in the above-mentioned class of machines.

In dynamo-electric machines it is well known that the lines of magnetic force extending from the poles of the field-magnets to the adjacent armature are not straight, but are much distorted, and that such distortion is undergoing change with every variation of magnetic condition in the machine. Thus the maximum lines of magnetic force extending from the field-poles to the armature while nearly straight under one condition are made to assume a pronounced curve under another condition. A magnetic bar of iron when free to move if placed in proximity to such lines of force would place itself in the lines of maximum intensity and would move with every displacement of the resultant of such lines.

The object of our invention is to employ the movement of a magnetic bar placed under the control of these lines of magnetic force to shift or adjust the commutator-brushes to a non-sparking position. The brushes are first properly adjusted for a certain electrical condition of the machine, when the magnetic bar is mechanically joined to said brushes. Thereafter, with each displacement of the magnetic bar, the brushes will be correspondingly changed and adjusted to a non-sparking position.

The invention consists, also, in the method of accomplishing this and the details of construction hereinafter to be described, and which will be pointed out in the claims.

In the accompanying drawings the same letters of reference have been used throughout the various views to represent the same or corresponding parts.

Figure 1 shows a perspective view of an apparatus embodying our invention; Fig. 2, a view of the commutator and its brushes; Fig. 3, an apparatus embodying our invention applied to a magneto-electric machine known as the "Schuyler dynamo;" Fig. 4, a sectional view on the line 4 4, looking toward the left hand; Fig. 5, an end view of the apparatus shown in Fig. 3; and Fig. 6, a sectional view, with a diagram of the circuits, of another apparatus embodying our invention, the same being a modification of the devices shown in the previous figures.

We will first describe our invention with reference to Fig. 1. In this figure the letter A represents the armature of a dynamo upon a shaft, D, with a drive-pulley, E, for rotating the same. The pole-pieces of the field-of-force magnets are shown in dotted lines, as well as the drive-pulley before mentioned, for the sake of clearness. At one end of the armature and loosely about the shaft D is arranged a magnetic bar, C, upon a sleeve surrounding said shaft, and having pole-shoes at its end. This magnetic bar is free to turn in either direction, and has connected with it a connecting-rod, *l*, rigidly affixed to a rock-shaft, F, which is suitably supported, and has at its other end another rod, *l*, connected with a ring, G, or other means, which sustain the commutator-brushes of the commutator H. In order to eliminate the friction between the rotating shaft D and the sleeve upon which the magnetic bar is mounted, so as to place the latter entirely under the influence of the magnetic forces, we provide sectors *f*, suitably supported by rods extending therefrom, the sectors supporting guide-wheels *g g*, journaled upon extensions from the magnetic bar, as clearly shown in Fig. 1. These devices are made of non-magnetic material, so as not to interfere with the operation of the apparatus. It will be observed that by the construction shown the bar C is supported entirely by the means described, and the rotation of the armature will not affect the bar.

We have shown and described the devices of Fig. 1 as a means of carrying out our invention; but we do not wish to confine ourselves to any specific means, as our invention consists, broadly, in a magnetic body controlled by the polar line, which magnetic body in turn controls the commutator-brushes. We are aware that other means have been devised for this purpose; but the means heretofore used operate upon principles widely different from the principle of operation of our invention.

In Figs. 3, 4, and 5 we have shown our invention applied to a Schuyler dynamo. In these figures the same letters are employed to indicate the parts corresponding to the parts shown in Fig. 1.

The bar C in the Schuyler dynamo is curved, as shown in Fig. 3, and is upon a sleeve around the shaft, which sleeve has arms K K extending therefrom, into which may be slid rods F, corresponding to the rock-shaft F of Fig. 1, and which are rigidly connected with arms extending from the commutator-support G. To allow the shifting of the brushes the yoke-piece of the field-of-force magnets is slotted, as shown in Fig. 5. The arms K K are provided with set-screws *i i*, which bite upon the rods F, by which means the bar C may be adjusted toward or from the armature and its pole-pieces. For the purpose of steadying the movements of the apparatus a dash-pot, L, is provided, with its plunger attached to the outer end of either of the rods F.

In Fig. 6 is illustrated electrical means for shifting the commutator-brushes instead of the mechanical means heretofore described. C′ in this figure is a bar of non-magnetic material, through which the shaft D passes, and which is arranged between the field-of-force magnets and adjacent to the pole-pieces and armature, as before. Upon the bar C′ is pivoted two tongues, C C, held in position by two springs on each side of each tongue. These tongues correspond to the magnetic bar described before, and are arranged to co-operate with electrical terminals *e e* and *d d*, mounted upon the non-magnetic bar C′. The commutator-brushes in the present case are shifted by an electrical motor by means of a worm and worm-wheel, which latter is connected to the brush-carrying device G. The field-magnets of this motor are in the main circuit, and the armature-coils in a derived circuit of the main, which derived circuit is controlled by the tongues C C. When these tongues are in the position shown in the figure, no current will pass through the armature-coils of the motor P, so that the latter will remain stationary. When, however, the tongues are in contact with *e e* or *d d*, the current will be sent in one or the other direction through the armature-coils of the motor and actuate it in one direction or the other, depending upon which branch of the derived circuit is completed by the tongues C C. The diagram and arrows will show the direction of the current without further description. The bar C′ is connected by the rods F F and set-screws *i i* with the worm-wheel W, governed by the motor. As the motor shifts the brushes, therefore, the bar C′, carrying the tongues, will be shifted also and in the same direction with the brushes.

The operation of this part of our apparatus is as follows: Suppose the polar line to shift in the directions of the hands of a watch. The tongues C C will be attracted by the polar line and contact with the terminals *d* and *d*, and the current will be sent through the armature-coils of the motor in a direction to operate the motor, so as to shift the commutator-brushes by the rotation of the worm-wheel W in the same direction, which will also shift the bar C′, by means of the rods F F, connected therewith, until the bar C′ is in the direction of the polar line, when the tongues C C, by the attraction of the polar line, also will assume a position midway of the contacts and the circuit of the armature-coils of the motor will be broken and it will fail to act. The springs to the tongues will hold them in their position midway of the contact until the polar line shifts again in one or the other direction, when the tongues C C will follow the attraction of the polar line and complete the circuit of one or the other branches of the derived circuit. Should the polar line shift in a direction reversed to the movements of the hands of a watch, the tongues C C will make contact with the terminals *e e*, and the current will be sent through the armature-coils of the motor in an opposite direction, as will appear from an inspection of the diagram, and the non-magnetic bar C′ will be shifted in this direction until the tongues C C coincide with the polar line.

The operation of the apparatus of the other figures will be evident from the foregoing, and therefore need no further description.

Having now fully set forth our invention, we desire to have it known that we do not wish to confine ourselves to the construction shown, as the same may be varied in many ways without departing from the spirit of our invention, and we reserve the right in practice to make all those changes that fall within the scope of what we desire to claim and secure by Letters Patent, which is—

1. The combination, with a rotating armature and its field-of-force magnets, of a magnetic body arranged adjacent thereto within the magnetic field of the armature and field-of-force magnets, and controlled by the resultant of the forces of the armature and field-magnets, and connections for shifting the commutator-brushes, through the instrumentality of said magnetic body, to correspond with the shifting of said resultant.

2. The combination, in an electrical machine, with its rotating armature and field-of-force magnets, of a magnetic bar arranged adjacent thereto about the armature-shaft within the magnetic field of the armature and field-of-force magnets, and controlled by the result-

ant of the magnetic forces of the armature and field-magnets, connections for shifting the commutator-brushes, through the instrumentality of said bar, to correspond with the shifting of said resultant, and means for supporting said bar independently of the rotating armature-shaft, eliminating the friction between the two, so as to place said bar entirely under the influence of the magnetic resultant.

3. The combination, in an electrical machine, with its rotating armature and field-of-force magnets, of a magnetic bar arranged adjacent thereto, within the magnetic field of the armature and field-of-force magnets, and controlled by the resultant of the forces of the armature and field-magnets, and a rock-shaft and connecting-rods for connecting said magnetic bar with the commutator-brushes for shifting them, through the instrumentality of said bar, to correspond with the shifting of said resultant.

4. The combinatien, in an electrical machine, with its rotating armature and field-of-force magnets, of a magnetic bar arranged adjacent thereto and controlled by the resultant of the forces of the armature and field-magnets, devices for shifting the commutator-brushes, through the instrumentality of said bar, to correspond with the shifting of said resultant, and means for adjusting said bar to or from the armature and the pole-pieces of the field-of-force magnets.

5. The combination, in an electrical machine, with its rotating armature and field-of-force magnets, of a magnetic bar arranged adjacent thereto, within the magnetic field of the armature and field-of-force magnets, and controlled by the resultant of the forces of the armature and field-magnets, intermediate connections for shifting the commutator-brushes, through the instrumentality of said bar, to correspond with the shifting of said resultant, and a dash-pot or other means for steadying the movements of the aforesaid parts, as set forth.

6. The combination, in an electrical machine, with its rotating armature and field-of-force magnets, of a magnetic bar arranged adjacent thereto and controlled by the resultant of the forces of the armature and field-magnets, devices for shifting the commutator-brushes, through the instrumentality of said bar, to correspond with the shifting of said resultant, means for adjusting said bar to or from the armature and the pole-pieces of the field-of-force magnets, and a dash-pot or other means for steadying the movements of the aforesaid parts, as set forth.

7. An apparatus for controlling the commutator-brushes in an electrical machine to keep the same at the maximum point and to prevent sparking, consisting of a magnetic body arranged within the magnetic field of the armature, and field-of-force magnets to follow the polar line and intermediate devices between the said magnetic body and commutator-brushes for effecting the above purpose by the movements of said magnetic body.

8. The method of regulating the position of the commutator-brushes to keep the same at the maximum point in an electrical machine, thereby securing efficiency and preventing sparking, consisting of causing a magnetic body to be governed by the varying resultant of the magnetism of the armature and field-magnets, and thereby controlling the position of the commutator-brushes.

9. In an electrical machine having an armature and field-of-force magnets therefor, the combination of a magnetic bar, as C, arranged adjacent to and within the magnetic field of said armature and the pole-pieces of said field-of-force magnets, and disposed about the armature-shaft, non-magnetic sectors, as *f f*, suitably supported, and guide-wheels, as *g g*, journaled upon extensions from said bar, for supporting said bar independently of the armature-shaft, and intermediate devices between the aforesaid bar and the commutator-brushes for shifting the same in accordance with the movements of the bar.

10. In an electrical machine having an armature and field-of-force magnets therefor, the combination of a magnetic bar, as C, arranged adjacent thereto, a rock-shaft, F, and connecting-links *l* intermediate of said bar and the commutator-brushes and connected therewith for shifting said brushes in accordance with the movements of the bar C.

11. In an electrical machine having an armature and field-of-force magnets therefor, the combination of a magnetic bar, as C, arranged adjacent thereto and upon a sleeve about the armature-shaft, sectors, as *f f*, suitably supported, and guide-wheels, as *g g*, journaled upon extensions from said bar for sustaining said bar independently of the armature-shaft, and connecting-rods, as *l l*, and a rock-shaft, as F, intermediate of said bar, and the commutator-brushes for shifting the same in accordance with the movements of said bar C to correspond with the shifting of the polar line.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

CHARLES L. BUCKINGHAM.
HERMANN LEMP.

Witnesses for said Buckingham:
A. C. FOWLER,
WM. ARNOUX.

Witnesses for said Lemp:
L. R. DENNIS,
OSCAR URBAN.