(No Model.)

3 Sheets—Sheet 1.

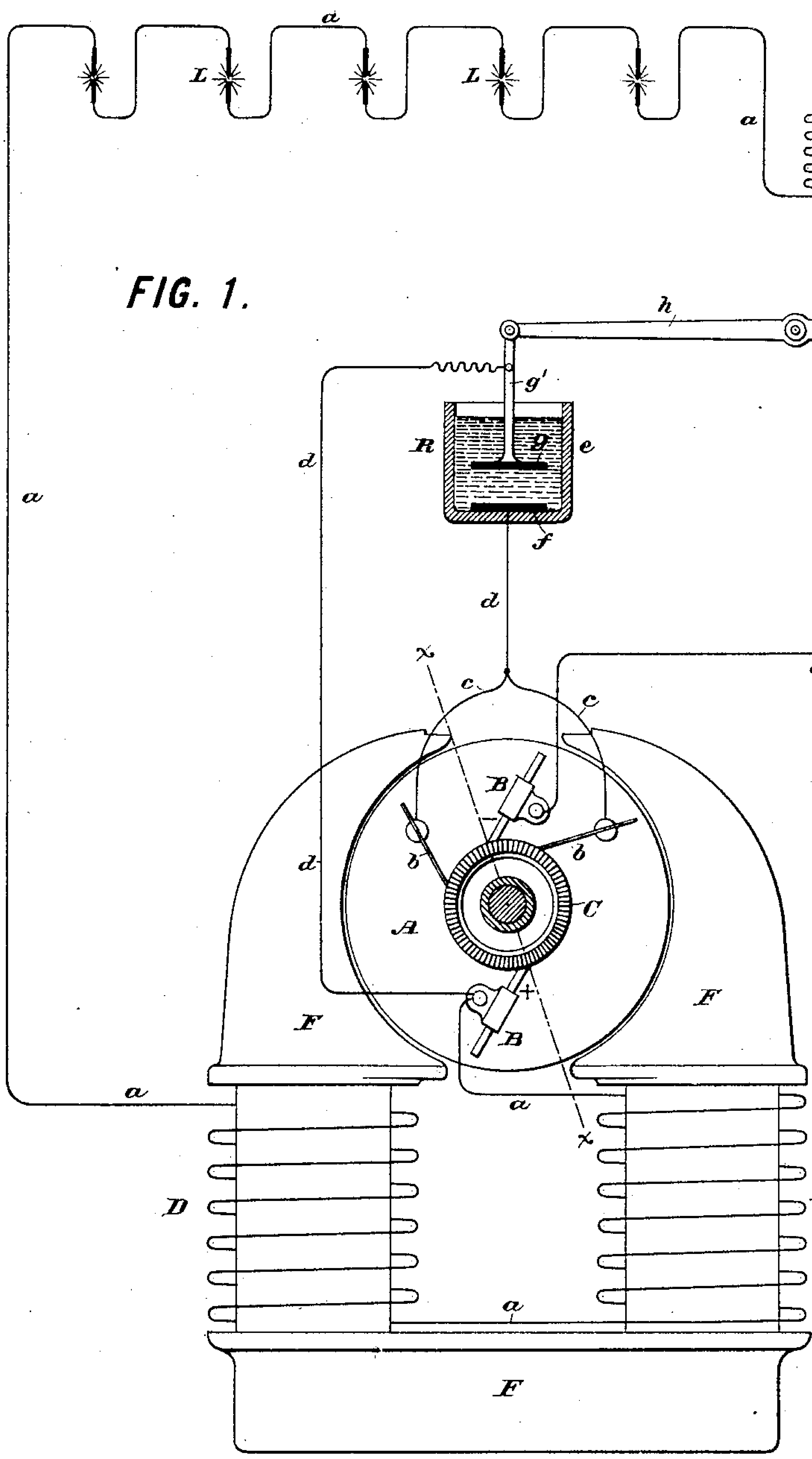
J. J. WOOD.

REGULATOR FOR DYNAMOS.

No. 426,699.

Patented Apr. 29, 1890.

FIG. 1.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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FIG. 2.

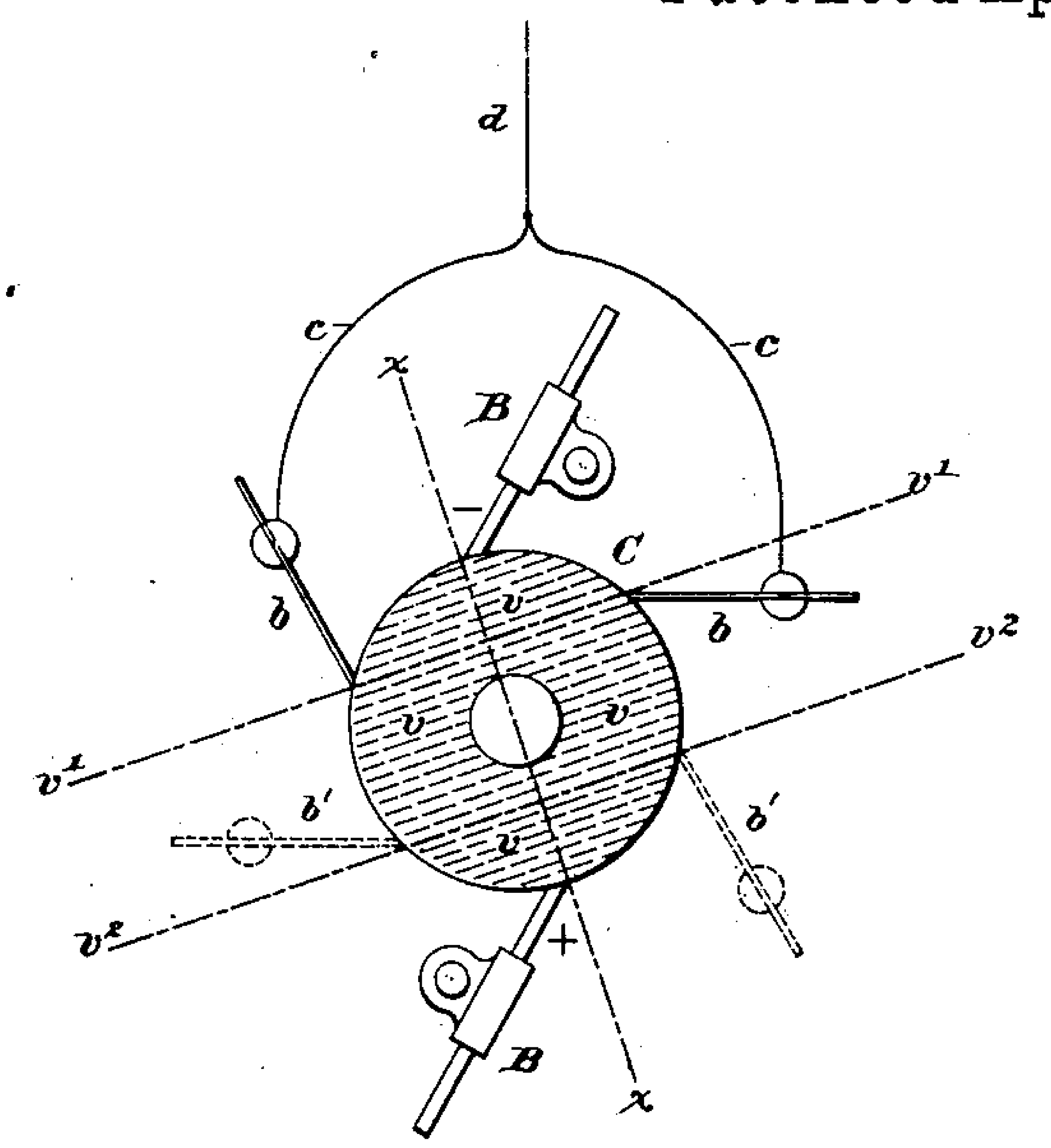

FIG. 3.

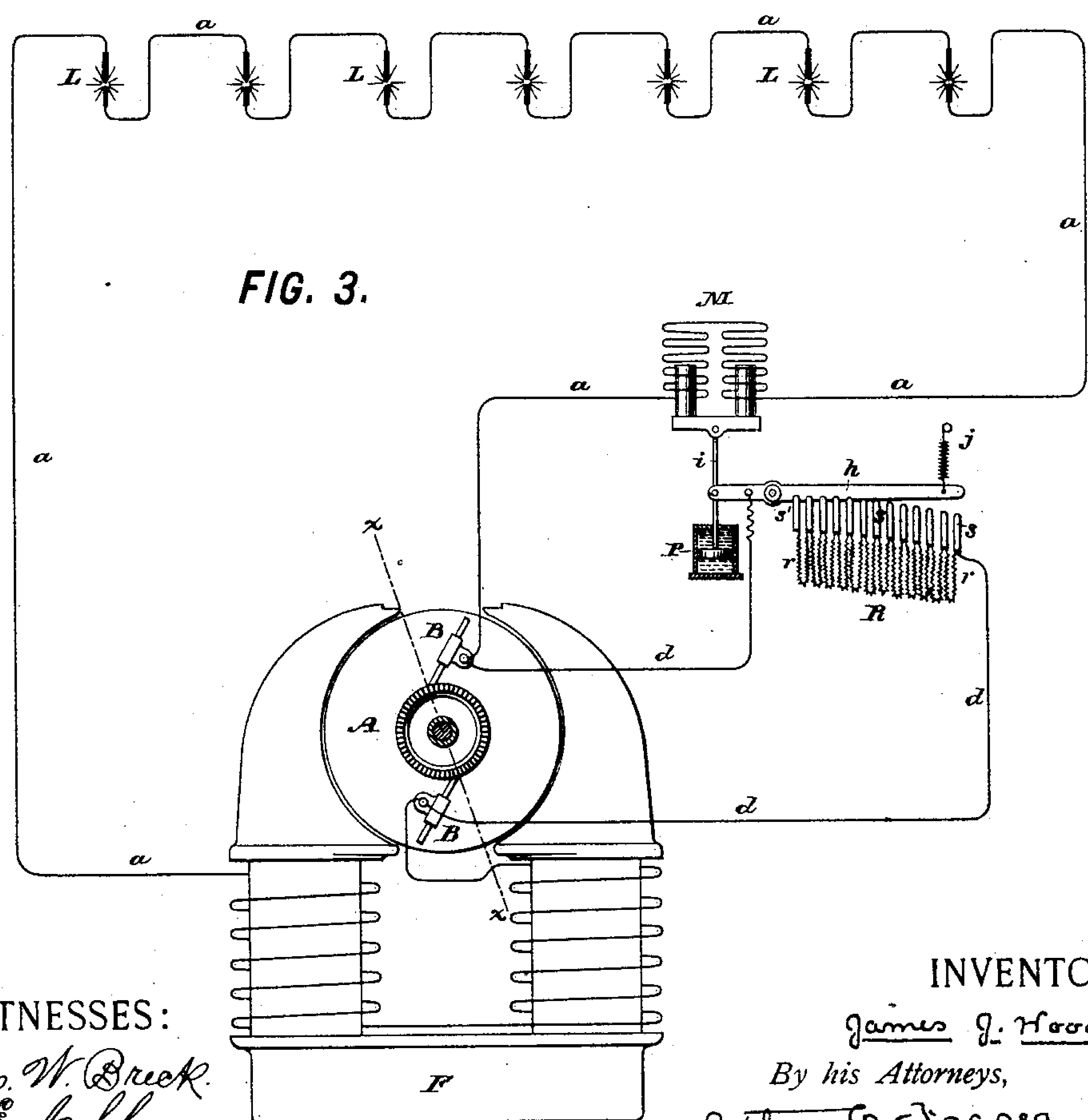

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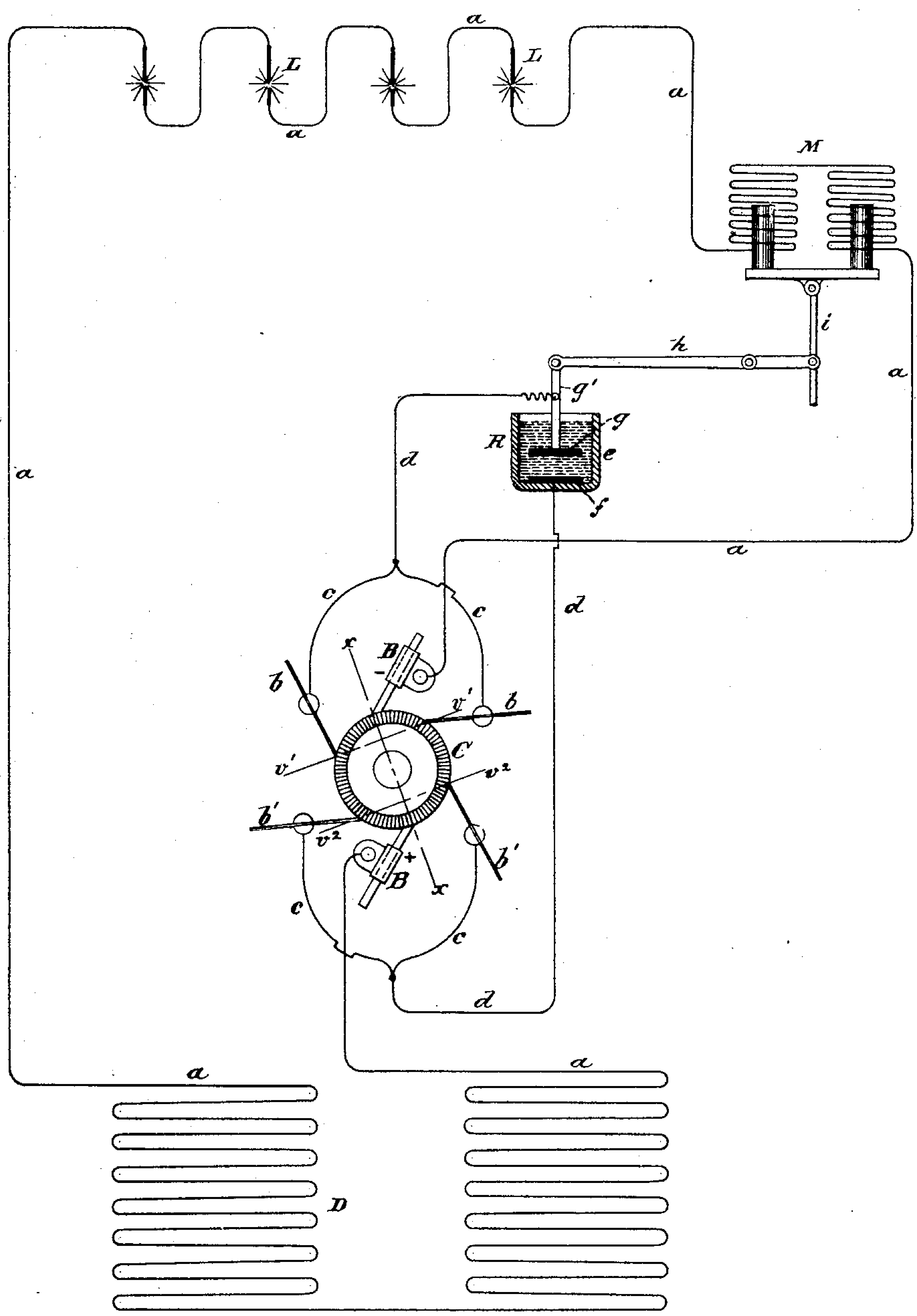
FIG. 4.



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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF BROOKLYN, NEW YORK.

REGULATOR FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 426,699, dated April 29, 1890.

Application filed August 20, 1889. Serial No. 321,343. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Regulators for Dynamo-Electric Machines, of which the following is a specification.

This invention relates to current-regulators for dynamo-electric machines of that class which maintains a constant current upon a circuit of varying resistance. Dynamos feeding arc lamps or electromotors in series are of this class. With the regulation of such dynamos it is essential to vary the electromotive force generated in proportion to the variations of resistance on the circuit, in order that when the resistance increases, and the current consequently is reduced, the electromotive force shall be increased sufficiently to restore the current to its normal volume, and, conversely, when the resistance decreases, and the current consequently is augmented, to proportionately diminish the electro-motive force generated, and thereby reduce the current to the normal. My invention provides a new means for accomplishing this result. In addition to the usual main commutator-brushes I provide a pair of auxiliary brushes which are placed on opposite sides of one of the main brushes, so as to make contact with segments of like and equal potential, so that no current flows through a bridge connecting the brushes. These brushes are connected by a shunt-circuit either with the opposite main brush or with a similar pair of auxiliary brushes, so that a current flows through this shunt. In this shunt is placed a variable rheostat, which is operated by a regulating-magnet included in the main circuit and the moving member of which is connected to the rheostat in such manner as to vary its resistance in an inverse proportion to the excitation of the magnet. Thus as the line-current increases the magnet becomes more excited, the resistance of the rheostat is reduced, and a leakage or escape of current is permitted through the shunt-circuit across from one side of the commutator to the other, whereby the difference of potentials at the main brushes is reduced, which results in a reduction of the electromotive force in the main circuit.

Figure 1 of the accompanying drawings is a diagrammatic view of a dynamo and circuit to which my invention in its preferred form is applied. Fig. 2 is a diagrammatic elevation of the commutator, illustrating the positions of the respective brushes. Fig. 3 is a view similar to Fig. 1, but illustrating a modification.

Let A designate the armature of the dynamo, F F the field-magnet thereof, C the commutator, B B the main commutator-brushes, and D D the field-exciting coils. The main brushes B B and coils D D are connected, as usual, in series in the main circuit or line *a a*, in which are intercalated in series are lamps L L or electromotors or other so-called "translating" devices. A regulating-magnet M has its coils also connected serially in the line-circuit. This magnet may be of the ordinary type, but is preferably of the solenoid type, as shown. The main commutator-brushes B B are placed to touch the commutator on the neutral line *x x*, as usual—that is, in the position of maximum difference of potentials, and consequently of maximum current.

In addition to the main brushes there are applied to the commutator two auxiliary brushes *b b*, which are arranged to bear upon the commutator on opposite sides of the neutral line and at points equally distant therefrom, so that they touch segments the potentials of which are equal. If the curve of potentials of the commutator is abnormal or distorted, it will be necessary to place one of these brushes farther away from the neutral line than the other, in order that segments touched by both shall be of like and equal potential. The two auxiliary brushes *b b* are connected by a conducting bridge or circuit *c*, and this bridge forms part of a shunt-circuit *d d*, which extends thence through a rheostat or variable resistance R to one of the main brushes B. It is shown in Fig. 1 as extending to the lower or positive brush B; but it might extend instead to the upper or negative brush without changing the operation. We have thus a shunt-circuit of variable resistance interposed between the auxiliary brushes *b b* and the main brush B+.

The rheostat R, which may be of any suitable construction, is connected to the regulating-magnet M in such manner that as the excitation of the magnet increases the resistance of the rheostat is decreased. In Fig. 1 the rheostat is shown as consisting of a glass or earthenware jar *e*, filled with liquid, which may be acidulated water, and in which are two carbon plates *f g*, the former lying on the bottom of the jar and the latter being suspended above it through the medium of a stem *g'*, depending from one arm of a lever *h*, the other arm of which is connected through a rod *i* with the moving member of the regulating-magnet M. This magnet is provided with a dash-pot P to check sudden or excessive movements. The carbon plates *f g* are connected, respectively, with opposite wires of the shunt-circuit *d d*, as clearly shown. By reason of their separation the resistance of the intervening mass of liquid is interposed in the shunt-circuit. As the excitation of the magnet M increases the plate *g* is lowered or caused to approach the plate *f*, so that the intervening column of liquid is of less height, and consequently of less resistance. As the excitation of the magnet decreases the plate *g* rises, thereby increasing the resistance. During the normal running of the dynamo the resistance of the rheostat is so great that but very little current flows through the shunt *d d*. In case, however, the resistance of the circuit *a a* is reduced by the switching out of one or more lamps L L the consequent augmentation of the current excites the magnet M to above the normal and causes it to reduce the resistance of the rheostat R. Thereupon an increased current flows through the shunt *d d*, thereby to the extent of the reduction of the resistance in this shunt short-circuiting the armature-coils corresponding to the portion of the commutator intervening between the brushes *b b* and the brush B+. It results from this short-circuiting that the difference of potentials between the positive and negative main brushes is reduced, so that the electro-motive force of the line-current is diminished, and consequently the current falls until by its effect upon the magnet M the resistance of the rheostat R is increased to such an extent that an equilibrium is attained, whereby the current on the line is restored to the normal volume. The contrary result follows an increase of resistance on the line, the current being first diminished, resulting in an increase of resistance in the rheostat, a decreased short-circuit or leakage through the shunt *d d*, and a consequent increase in the electro-motive force developed until the current is restored to the normal.

The position of the auxiliary brushes *b b* may be greatly varied. In the diagram, Fig. 2, they are shown as touching the commutator on segments intersected by an imaginary line *v'*, crossing the commutator perpendicularly to the neutral line *x x*. A number of other lines *v v* are drawn across the commutator parallel with this line *v'*. All of these lines are drawn across between commutator-segments of equal and like potentials. If the curve of potentials of the commutator be distorted, these lines *v v* will be more or less deflected from true perpendicularity to the neutral line *x x*.

The auxiliary brushes *b b* may be arranged to touch the respective segments intersected by any of the lines *v v*—that is to say, they may be placed at any part of the commutator, provided that they be on opposite sides of the neutral line and be arranged in positions of equal and like potentials. For example, if one of these brushes be placed on the left side of the neutral line in a position where it develops relatively to the negative main brush a positive potential of, say, one hundred and twenty-six volts, then the other brush *b* must be placed on the right-hand side of the neutral line and in such position that it also shall develop a positive potential of one hundred and twenty-six volts.

The two auxiliary brushes may be placed very close to one of the main brushes or midway between the main brushes, or close to the opposite main brush, or in any intermediate position. For example, they may be placed in the positions shown in dotted lines at *b' b'* in Fig. 2, where they touch the commutator on the line v^2. The nearer the auxiliary brushes are placed to the main brush which constitutes the opposite terminal of the shunt-circuit *d* the less will be the resistance of the rheostat R, and vice versa. Thus with a rheostat of given resistance it is easy to adjust the brushes *b b* until they develop such a potential relatively to the main brush B with which the opposite terminal of the shunt connects as to secure the proper proportions of resistance to potential for attaining the best results by this system of regulation.

Fig. 3 shows a different form of rheostat R, consisting of a series of resistance-coils *r r*, terminating in contact-springs *s s*, which are touched by the lever *h* as it is vibrated by the magnet M. When the magnet M is relaxed, the lever *h* is drawn up by the weight of the armature or by a spring *j*, so that it touches only the terminal contact-spring *s'*, or it may even break contact with this, thereby breaking the shunt-circuit *d*, and as the magnet M is excited the lever *h* is vibrated, so that it makes contact successively with the springs *s s*. In the former position all the coils *r r* are in series and the resistance in the shunt is at its maximum, while when the magnet M is fully excited all the coils *r r* are cut out and the resistance is reduced to the minimum. This form of rheostat is well known.

In Fig. 3 the terminals of the shunt-circuit *d* are shown as both connected to the respective main brushes B B, as has been heretofore proposed. This arrangement is inferior to the arrangement of the shunt between the auxiliary brushes and one of the main brushes, as introduced by my invention, for the reason that a very much higher resistance is required in the shunt-circuit, and also because of the inability to vary the electro-motive force in the shunt to adapt it to a rheostat of given resistance.

My improvement is characterized by short-circuiting through the shunt *d* only a portion of the armature, in contradistinction to short-circuiting the entire armature, as by the connection shown in Fig. 3. The former result may be accomplished by the use of two sets of auxiliary brushes, one end of the shunt being connected to the brushes *b b* in Fig. 2 and the other end to brushes set in other positions—as, for example, at *b′ b′*. This arrangement is shown in Fig. 4. In this case only the portion of the armature corresponding to the commutator-segments intervening between these two sets of brushes will be short-circuited through the shunt.

My invention provides a simple, cheap, and easily applied and adjusted means of regulation which is well adapted to small dynamos and may be made advantageously applicable to large machines of high voltage.

I claim as my invention the following-defined novel features or combination, substantially as hereinbefore specified, namely:

1. The combination, with a dynamo-electric machine, of a regulator therefor, consisting of two auxiliary brushes applied to opposite sides of the commutator in positions of like and equal potentials, a conducting-bridge connecting said brushes, a shunt from said brushes to a brush or brushes in contact with commutator-segments of opposite or different potential, and a variable rheostat in said shunt.

2. The combination, with a dynamo-electric machine, of a regulator therefor, consisting of two auxiliary brushes applied to opposite sides of the commutator in positions of like and equal potentials, a conducting-bridge connecting said brushes, a shunt from said brushes to one of the main brushes, and a variable rheostat in said shunt.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
ARTHUR C. FRASER,
JNO. E. GAVIN.