

E. A. SPERRY.
REGULATING APPARATUS.
APPLICATION FILED JUNE 6, 1905.

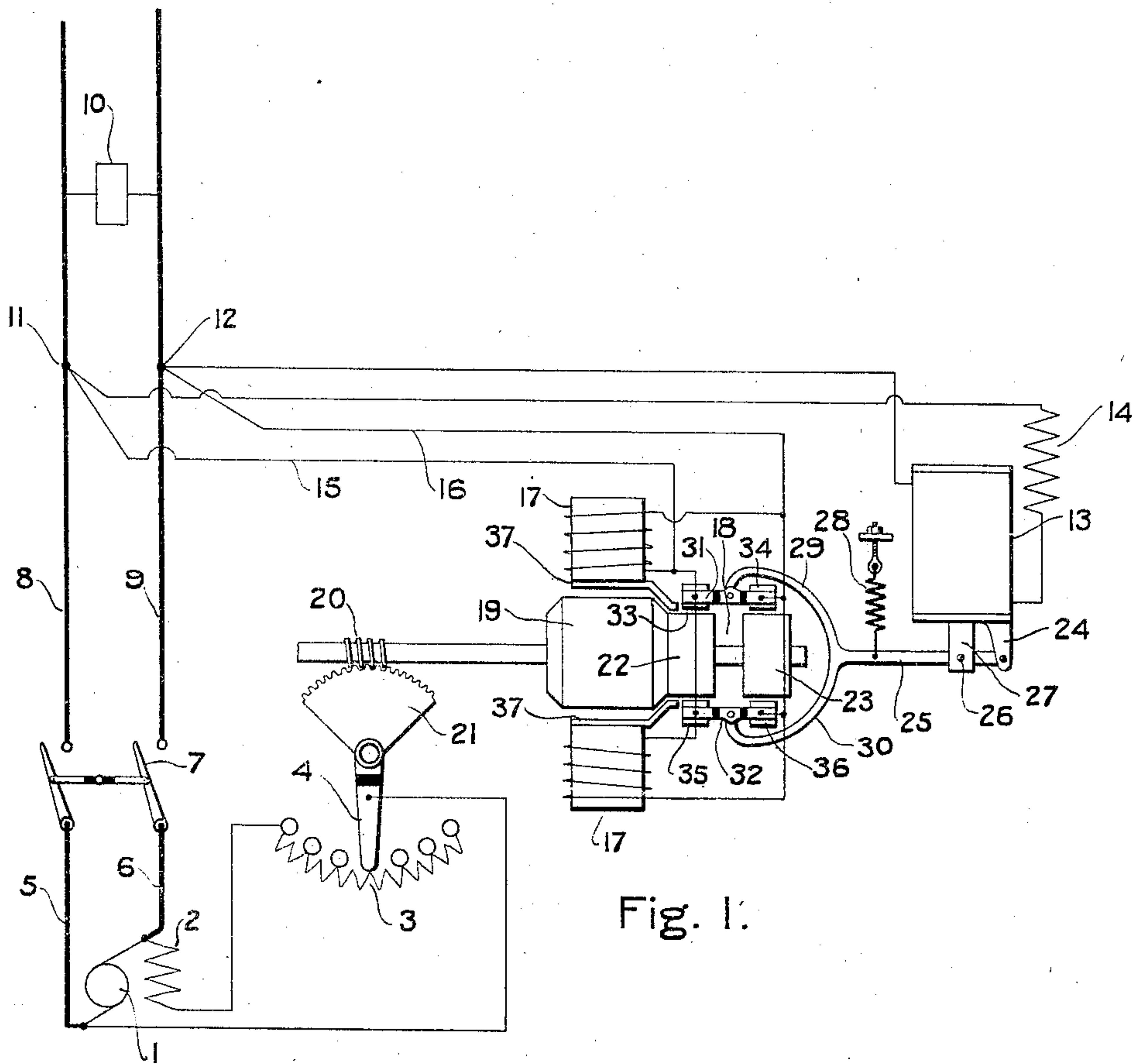


Fig. 1.

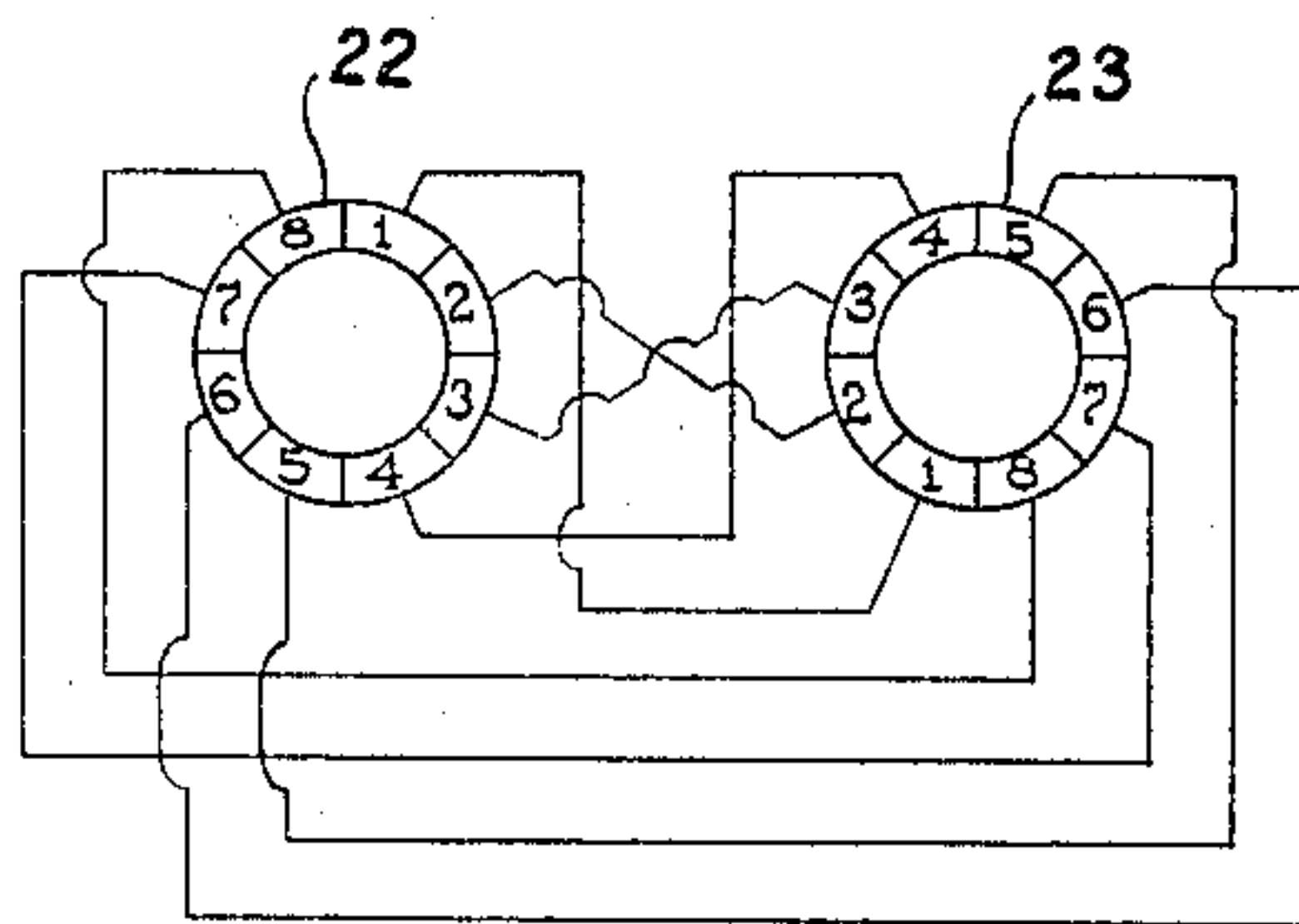


Fig. 2.

WITNESSES:

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UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CLEVELAND, OHIO, ASSIGNOR TO THE SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

REGULATING APPARATUS.

No. 833,760.

Specification of Letters Patent.

Patented Oct. 23, 1906.

Application filed June 6, 1905. Serial No. 263,957.

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain
5 new and useful Improvements in Regulating Apparatus, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

10 This invention relates to electrical apparatus. One of the objects thereof is to provide circuit breaking and making means of increased simplicity and efficiency.

Another object is to provide means of the
15 above type for reversing the connections of an external circuit with a dynamo.

Another object is to provide means for utilizing the functions of the above means.

Another object is to provide voltage-regulating means of simple construction and
20 efficient action.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the
25 features of construction, combinations of elements, and arrangements of parts which will be exemplified in the apparatus and devices hereinafter described and the scope of the application of which will be indicated in
30 the following claims.

In the accompanying drawings, wherein is shown one of various possible embodiments of my invention, Figure 1 is a diagrammatic view of the same. Fig. 2 is a diagrammatic view of the connections between certain parts shown in Fig. 1.
35

Similar reference characters refer to similar parts throughout both views.

As conducing to a better understanding of
40 certain features of my invention, it may here be noted that if a circuit be completed and broken upon a metallic surface there is a tendency to burn and pit this surface on account of the small arc which forms upon
45 the making, and more particularly upon the breaking, of a circuit at this point. This action tends to injure the parts exposed thereto and gradually to increase the resistance of the circuit at this point, and in certain forms of electrical apparatus wherein
50 the circuits are frequently opened and closed the effects thereof are correspondingly promi-

nent. The above and other defects are remedied in constructions of the nature of that hereinafter described.

Referring now to the drawings, there is
55 shown at 1 a generator having in series with its shunt-field 2 a variable resistance 3, the field-circuit being completed through a pivoted arm 4, hereinafter referred to. Generator-leads 5 and 6 terminate in a double-
60 pole switch 7, adapted to make and break circuit with the mains 8 and 9, across which are bridged any desired form of current-utilizing devices 10. At certain points 11
65 and 12 between which it is assumed that it is desired to maintain a substantially constant potential there is bridged across the mains a magnet 13 in series with a resistance 14 of
70 such magnitude as to cause the field of the magnet to be substantially proportionate to the voltage between these points. Likewise leading from points 11 and 12 are conductors 15 and 16, across which are shunted
75 the field-magnets 17 of a dynamo 18. It may here be noted that the term "dynamo" is used throughout this specification and the following claims in its generally accepted
80 broad sense as denoting either a motor or a generator, although in the illustrative embodiment herein set forth the former only is shown. Between fields 17 is positioned an
85 armature 19, controlling, by means of a worm 20 and toothed sector 21, the position of the arm 4 above referred to.

Upon the shaft of dynamo 18 are commutating means, preferably comprising a pair of commutators 22 and 23, the segments of which are interconnected, preferably as indicated in Fig. 2 of the drawings. By reference to this figure it will be seen that in this
90 illustrative embodiment each segment of commutator 22 is in electrical connection with the diametrically opposite segment of commutator 23, the connected segments
95 being denoted by similar characters upon the drawings.

Recurring to Fig. 1 of the drawings, there is shown pivotally mounted adjacent magnet 13 upon a lug 24 an arm or lever 25, having
100 articulated thereto at the point 26 the movable core 27 of the magnet. An adjustable spring 28 is arranged so as normally to compensate for the weight of the arm 25 and

parts associated therewith, thus adapting the same to be controlled in position in accordance with the field of the magnet 13. The free end of pivoted lever 25 terminates in a pair of arms 29 and 30, upon which are respectively pivoted the cross-bars 31 and 32. Affixed to cross-bar 31 are relatively insulated brushes 33 and 34, electrically connected with the conductors 15 and 16 and adapted to coact, respectively, with the commutators 22 and 23. Likewise mounted upon cross-bar 32 are brushes 35 and 36, connected in a similar manner to conductors 15 and 16, respectively, and adapted to be swung into operative engagement with the neighboring commutators 22 and 23. The brushes 33 and 35, and likewise brushes 34 and 36, are, however, so spaced from one another as to position them, with the lever 25 in its normal intermediate position, out of contact with either commutator, this position being shown in the drawings. Formed upon the field-magnets 17 or magnetically connected therewith are projections 37, positioned closely adjacent the commutators and brushes and adapted to act as magnetic blow-outs for the slight arc which might be formed upon the breaking of the circuits between these parts. Owing to the peculiar brush arrangement shown, these projections are positioned with respect to the corresponding brushes upon what is termed the "leaving side," or that side of the brushes from which the coacting surfaces of the corresponding commutators rotate, thus rendering their action more effective. These projections may be of any desired shape, the precise construction not being here shown, as this feature of my invention lies principally in the broad idea, it being necessary only to avoid a material distortion of the dynamo-field and an undue shunting of the magnetic flux about the armature.

The mode of operation of the above-described embodiment of my invention is substantially as follows: Assuming the double-pole switch 7 to be closed and the generator 1 to be running under normal conditions, the resistance 14 is of such proportions as to hold the pivoted lever 25 in an intermediate position, with the several brushes above described out of contact with the corresponding commutators. If, however, as on account of an increase in load between the mains, there is a tendency toward a drop in voltage, the field of magnet 13 will be correspondingly weakened, permitting the brushes 33 and 34 to fall into contact with the corresponding commutators, the pressures of each of these brushes against the commutators being equalized, owing to the pivotal connection of the cross-bar 31. The windings are so arranged as to cause the armature of dynamo 18 upon the above operation taking place to rotate in such direction as to cause

the arm 4 to cut resistance out of the field of generator 1, thus resulting in a stronger field for the generator and enabling the same to maintain the desired potential between points 11 and 12. When this voltage has been reached, the field of magnet 13 is correspondingly strengthened, the brushes 33 and 34 drawn from their commutators, and the dynamo 18 stopped. If, on the other hand, the potential between the points 11 and 12 tends to rise above the desired standard, the abnormally powerful field of magnet 13 causes, through the raising of core 27, an engagement of brushes 35 and 36 with the adjacent commutators. This action relative to that above described, as will be seen from an inspection of the connections set forth in the drawings, is equivalent, in effect, to a rotation of the brushes throughout an angle of one hundred and eighty degrees with the bipolar dynamo herein shown, or, in other words, a reversal of the connections between the leads 15 and 16 and the armature. The dynamo-armature is thus caused to rotate in the opposite direction, resulting in the arm 4 cutting additional resistance into the field of generator 1 and reducing the voltage to the desired standard. When this state of equilibrium has been reached, the brushes 35 and 36 fall away from the corresponding commutators, due to the weakening of the field of magnet 13, and the dynamo-armature ceases to rotate.

Owing to the fact that the circuit is broken when the dynamo is stopped at the sliding contact formed by the commutators and coacting brushes, any slight burning of the parts which may take place at this point is rendered insignificant because it is distributed over a number of segments or considerable surface and by reason of the considerable grinding and burnishing to which the meeting surfaces are exposed.

It will thus be seen that I have provided means well adapted to accomplish the objects of my invention and which possess many advantages, some of which will be clearly apparent from the above description and some of which can be appreciated only by those having an intimate understanding of the practical difficulties to be met. The voltage between the mains is maintained substantially constant owing to the sensitive and yet positively-acting arrangement of the controlling apparatus above described. The dynamo reversing feature, moreover, possesses in itself many advantages, owing to the direct control at the brushes as well as the general efficiency and simplicity of its action. The contacting surfaces, moreover, as above indicated, tend automatically to maintain themselves in a highly efficient state, owing to the constant grinding and rubbing to which they are exposed during the action of the dynamo. Also the magnetic blow-out, in which the use of

uncertain "permanent" magnets is avoided and yet a powerful field is developed at the point at which the circuit is broken, possesses features of marked advantage, many of which will be readily apparent. In brief, the entire construction is simple, the action thereof efficient, the expense both as to first cost and the cost of maintenance is low, and the field of application broad.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention could be made without departing from the scope thereof, I intend that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. I desire it also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

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

1. In combination, a dynamo, a pair of commutators driven therewith, each of the segments of one of said commutators being connected with a segment of the other thereof angularly spaced with reference thereto, a pair of brushes adapted to coact simultaneously with both of said commutators, a second pair of brushes adapted simultaneously to coact with both of said commutators and angularly spaced from said first pair of brushes, and means adapted automatically to throw said pairs of brushes alternately into operative relation to said commutators.

2. In combination, a dynamo, a pair of commutators driven therewith, each of the segments of one of said commutators being connected with a segment of the other thereof angularly spaced with reference thereto, a pair of brushes adapted to coact simultaneously with both of said commutators, a second pair of brushes adapted simultaneously to coact with both of said commutators and angularly spaced from said first pair of brushes, and means adapted automatically to throw said pairs of brushes alternatively into operative relation to said commutators, the angular spacing of said commutators and of said pairs of brushes being equal.

3. In combination, a dynamo, a pair of cylindrical commutators driven therewith, each of the segments of one of said commutators being connected with a diametrically opposite segment of the other thereof, a pair of brushes adapted to coact with both of said commutators upon one side thereof, a pair of brushes adapted to coact with both of said commutators upon the diametrically opposite side thereof, and means adapted auto-

matically to throw said pairs of brushes alternatively into operative relation to said commutators.

4. In combination, a dynamo, a pair of cylindrical commutators driven therewith, each of the segments of one of said commutators being connected with a diametrically opposite segment of the other thereof, a pair of brushes adapted to coact with both of said commutators upon one side thereof, a pair of brushes adapted to coact with both of said commutators upon the diametrically opposite side thereof, separate means connecting the brushes of each pair, and means pivotally connected with each of said connections adapted alternatively to throw said pairs of brushes into operative relation to said commutators.

5. In combination, an armature, commutating means connected therewith, a pair of brushes adapted to contact said commutating means upon the same side thereof and complete a circuit through said armature, and means adapted to equalize the pressures of said brushes upon said commutating means.

6. In combination, an armature, a pair of commutators connected therewith, each segment of one of said commutators being connected with a segment of the other thereof angularly spaced with reference thereto, a pair of brushes adapted to contact said commutators and complete a circuit through said armature, a member connecting said brushes, and means pivotally connected with said member adapted to force said brushes into engagement with the corresponding commutators.

7. In combination, a dynamo, commutating means connected therewith, a plurality of sets of brushes adapted to coact with said commutating means, a single means adapted to throw one of said sets out of operative relation to said commutating means and another of said sets into such relation, conductors connected with said brushes, and an electromagnet bridged across said conductors having a portion adjacent the meeting surfaces of said brushes and said commutating means.

8. In combination, a dynamo, a pair of commutators driven therewith, each of the segments of one of said commutators being connected with a segment of the other thereof angularly spaced with reference thereto, a pair of brushes each of which is adapted to coact with one of said commutators, and means adapted to equalize the pressures of said brushes upon said commutators.

9. In combination, a dynamo, commutating means connected therewith, a plurality of sets of brushes adapted to coact therewith, means adapted to throw said brushes into and out of circuit with said dynamo in sets, and means adapted to equalize the

pressures of the brushes of each set against said commutating means.

10. In combination, a dynamo, commutating means connected therewith, brushes
5 adapted to coact with said commutating means and serially complete a circuit through said dynamo, means adapted simultaneously to throw said brushes into and out of engagement with said commutating means, and
10 means adapted to equalize the pressures of said brushes against said commutating means.

11. In combination, a dynamo, commutating means connected therewith, a plurality
15 of sets of brushes adapted to coact with said commutating means, a single means adapted

to throw one of said sets out of operative relation to said commutating means and another of said sets into such relation, means adapted to equalize the pressures of the
20 brushes of each of said sets against said commutating means, and means adapted to develop a magnetic field adjacent the meeting surfaces of said brushes and said commutating means.

In testimony whereof I affix my signature
25 in the presence of two witnesses.

ELMER A. SPERRY.

Witnesses:

C. H. WARFIELD,
C. H. WILSON.

Correction in Letters Patent No. 833,760.

It is hereby certified that in Letters Patent No. 833,760, granted October 23, 1906, upon the application of Elmer A. Sperry, of Cleveland, Ohio, for an improvement in "Regulating Apparatus," an error occurs in the printed specification requiring correction, as follows: In line 39, page 3, the word "alternately" should read *alternatively*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of November, A. D., 1906.

[SEAL.]

E. B. MOORE,

Acting Commissioner of Patents.