

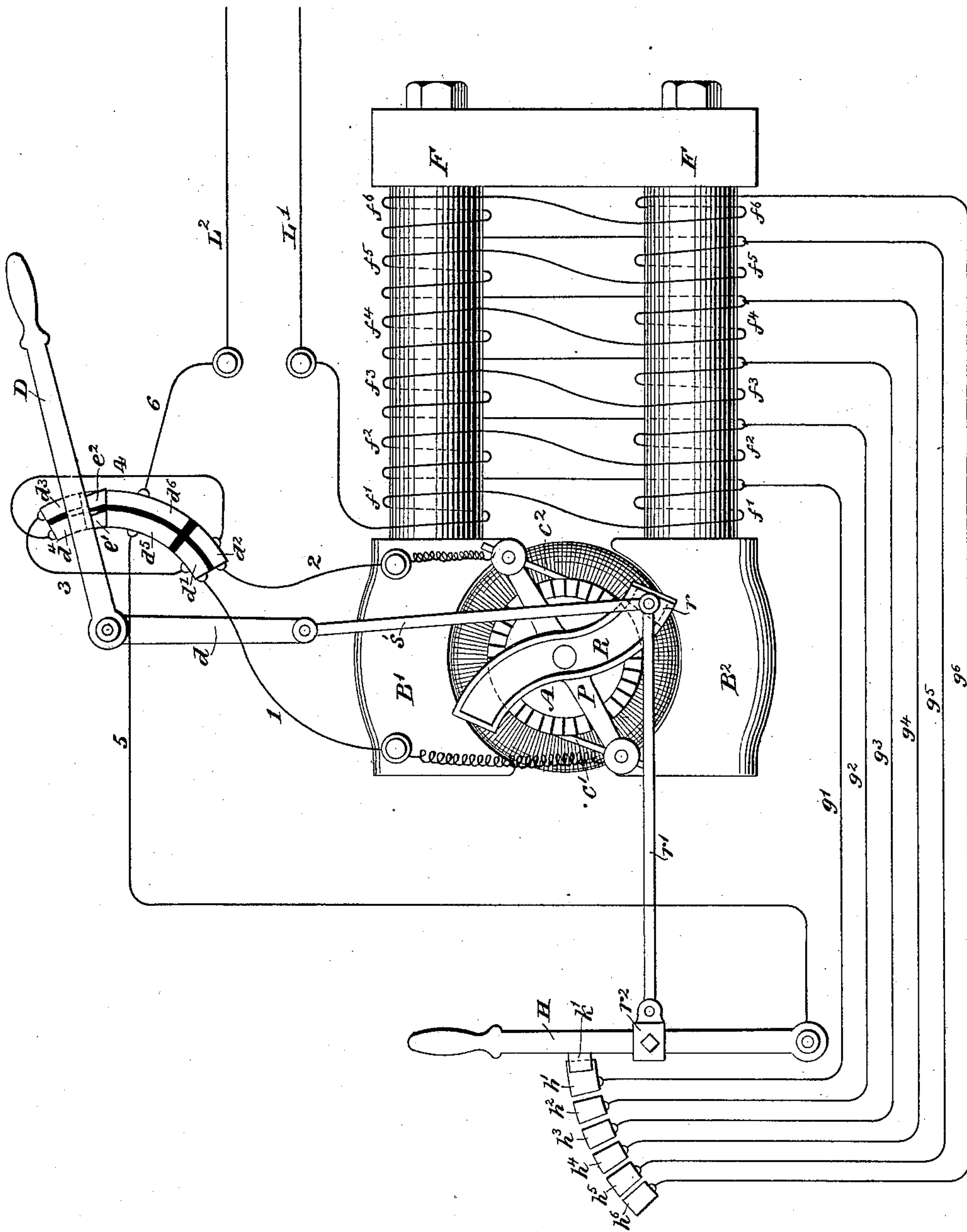
(No Model.)

S. D. FIELD.

REGULATION OF ELECTRIC MOTORS.

No. 381,768.

Patented Apr. 24, 1888.



Witnesses

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# UNITED STATES PATENT OFFICE.

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## REGULATION OF ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 381,768, dated April 24, 1888.

Application filed August 13, 1887. Serial No. 246,836. (No model.)

*To all whom it may concern:*

Be it known that I, STEPHEN DUDLEY FIELD, a citizen of the United States, residing in Yonkers, Westchester county, and State of New York, have invented certain new and useful Improvements in Regulation of Electric Motors, of which the following is a specification.

The invention relates to certain improvements in apparatus for and a method of regulating and controlling electric motors.

The object of the invention is to provide a convenient and economical method of producing all the various modifications in speed, power, and direction which are necessary in the operation of electric motors, and to accomplish this without the aid of artificial resistances.

In carrying out the invention the field-magnet is constructed with separate coils, more or less of which may be included in circuit at will, and the armature is provided with adjustable commutator-brushes, the positions of which are dependent upon and determined by the amount of field-magnet coils in circuit. A single lever serves to change the circuit-connections of the field-magnet coils and the position of the brushes. A second lever serves to reverse the connections of the circuit through the armature, and at the same time to so change the relations of the brushes and the controlling-lever that the cutting out of the field-magnet coils will be accomplished by a movement of the commutator-brushes in the proper direction.

The accompanying drawing is a view, partly in diagram, of such parts of a motor with the regulating devices applied as are required to illustrate the invention.

Referring to the drawing, A represents the armature, and B' B<sup>2</sup> the field-magnet of the motor. The armature is wound in the usual manner, with its coils connected with the commutator C. Two commutator-brushes, c' and c<sup>2</sup>, are respectively connected by conductors 1 and 2 with the contact-plates d' and d<sup>2</sup> of a reversing-lever, D. These two plates are further, respectively, connected by conductors 3 and 4 with other similar insulated contact-plates, d<sup>3</sup> and d<sup>4</sup>. These pairs of plates are arranged in the arc of a circle, and between the two pairs intervene two other insulated plates,

d<sup>5</sup> and d<sup>6</sup>. Two contact-plates, e' and e<sup>2</sup>, upon the lever D serve, when the lever is in one position, to bridge from the central plates, d<sup>5</sup> and d<sup>6</sup>, to the plates d<sup>1</sup> and d<sup>3</sup>, respectively. When the lever is moved to the opposite limit, the plates e' and e<sup>2</sup> are moved first out of contact with the plates d<sup>1</sup> and d<sup>3</sup>, and then into contact with the plates d' and d<sup>2</sup>, respectively, the intermediate plates being of sufficient length to permit the interruption of one circuit before the closing of the other. The plate d<sup>5</sup> constitutes the terminal of a conductor, 5, leading from the field-magnet coils, and the plate d<sup>6</sup> is the terminal of a conductor, 6, connected with the supply-conductor L<sup>2</sup>. It will be readily understood thus that the movement of the lever D will serve to reverse the connections of the armature without changing the connections of the field-magnet coils.

The field-magnet coils F are arranged in sections f' f<sup>2</sup> f<sup>3</sup>, &c., wound in continuous series. Conductors g' g<sup>2</sup> g<sup>3</sup>, &c., lead from the sections f' f<sup>2</sup> f<sup>3</sup>, &c., to contact-plates h' h<sup>2</sup> h<sup>3</sup>, &c., of a circuit-controlling lever, H. A brush, k', upon this lever is moved along the series of plates, as it is desired to include more or less sections in circuit. The conductor 5, before referred to, is connected with the lever H. The free terminal of the coil f' is connected with the main line L'. When, therefore, the lever H is in the position shown, the brush k' being in contact with the plate h', then the coils f' alone will be in circuit; but as the lever is moved toward the left hand the successive coils f<sup>2</sup> f<sup>3</sup>, &c., will be included.

It remains now to describe the method of adjusting the position of the commutator-brushes to meet the requirements of the different strengths of the field-magnet. In a motor having a very strong field as compared with the armature, the proper position for the brushes will be very nearly at right angles to the pole-pieces of the field-magnets, with a slight backward lead. If, however, the magnetic influence of the field and armature be equal, then the backward lead will be nearly forty-five degrees. Therefore it becomes necessary for economical working to shift the brushes as the strength of the field-magnet increases or decreases. To accomplish this the brushes c' and c<sup>2</sup> are carried upon a lever, P, which turns about the armature-shaft. A frame or track,



R, is rigidly secured to this lever. In the frame is placed a sliding block,  $r$ , to which is pivoted a link,  $r'$ . The other end of this link is pivoted to a block,  $r^2$ , capable of adjustment along the lever H to modify its stroke. This block is preferably insulated from the lever. A second link,  $s'$ , couples the block  $r$  with an extension,  $d$ , of the lever D. This link  $s'$  will prevent the block  $r$  from sliding in the frame or track R when the lever H is operated; but when the lever H is moved to place the additional field-magnet coils in circuit the frame R will be moved, thus adjusting the brushes. It will be understood, however, that the direction of adjustment should be reversed when the direction of revolution is reversed. When, therefore, the lever D is operated to reverse the direction of revolution, the block  $r$  will be moved to the opposite end of the frame or track R, and then the subsequent movement of the lever H will move the brushes in the direction required.

It will be noticed that the frame R is curved slightly in opposite directions upon the opposite sides of its support. This serves to give the brushes a slight movement when the circuit is being reversed, and thus adjust them to the positions of best advantage.

Instead of adjusting the commutator-brushes, the commutator itself may be adjusted to the brushes.

I claim as my invention—

1. The combination, with an electric motor having field-magnet coils of variable active length, of a circuit-controller determining the amount of said coils in action, a current-reverser for the armature, a commutator adjustment, a mechanical connection between the latter and the circuit-controller, and means for reversing the said mechanical connection by the operation of the current-reverser.

2. The combination of an electric motor, means for modifying the strength of the field-magnet of the same and simultaneously modifying the relative positions of the commutator

and commutator-brushes, a current-reverser for the armature, and a mechanical connection between the current-reverser and the commutator adjustment, substantially as described.

3. The combination, with an electric motor and a circuit-controlling lever for modifying the field-magnet strength, of a movable support for the commutator brushes, a frame secured thereto, a block sliding in said frame and mechanically connected with the lever, and a second lever for determining the position of said block in said frame.

4. The combination of an electric motor, the lever H, for determining the field-magnet strength of the same, the frame R, secured to the commutator-brush support, the block  $r$ , sliding in said frame, the link  $r'$ , extending from the lever to said block, the lever D, and the links  $s'$ , coupling said block with said lever D.

5. The combination, with an electric motor and a commutator-adjusting device and a lever for operating the same, of a movable connection between said lever and said device, a current-reverser for changing the direction of motion of the motor, and a mechanical connection between the said movable connection and said reverser, whereby the operation of the latter reverses the direction of movement of the commutator-adjusting device relative to its lever.

6. The combination of an electric motor, the adjustable commutator, the lever H, controlling the same and having a reversible coupling therewith, the current-reversing lever D, and the mechanical connection between the same and the coupling, whereby the movements of the reversing-lever reverse the connection between the commutator and its lever.

In testimony whereof I have hereunto subscribed my name this 29th day of July, A. D. 1887.

STEPHEN DUDLEY FIELD.

Witnesses:

CHAS. E. EVANS,  
CHAS. T. BRITTON.