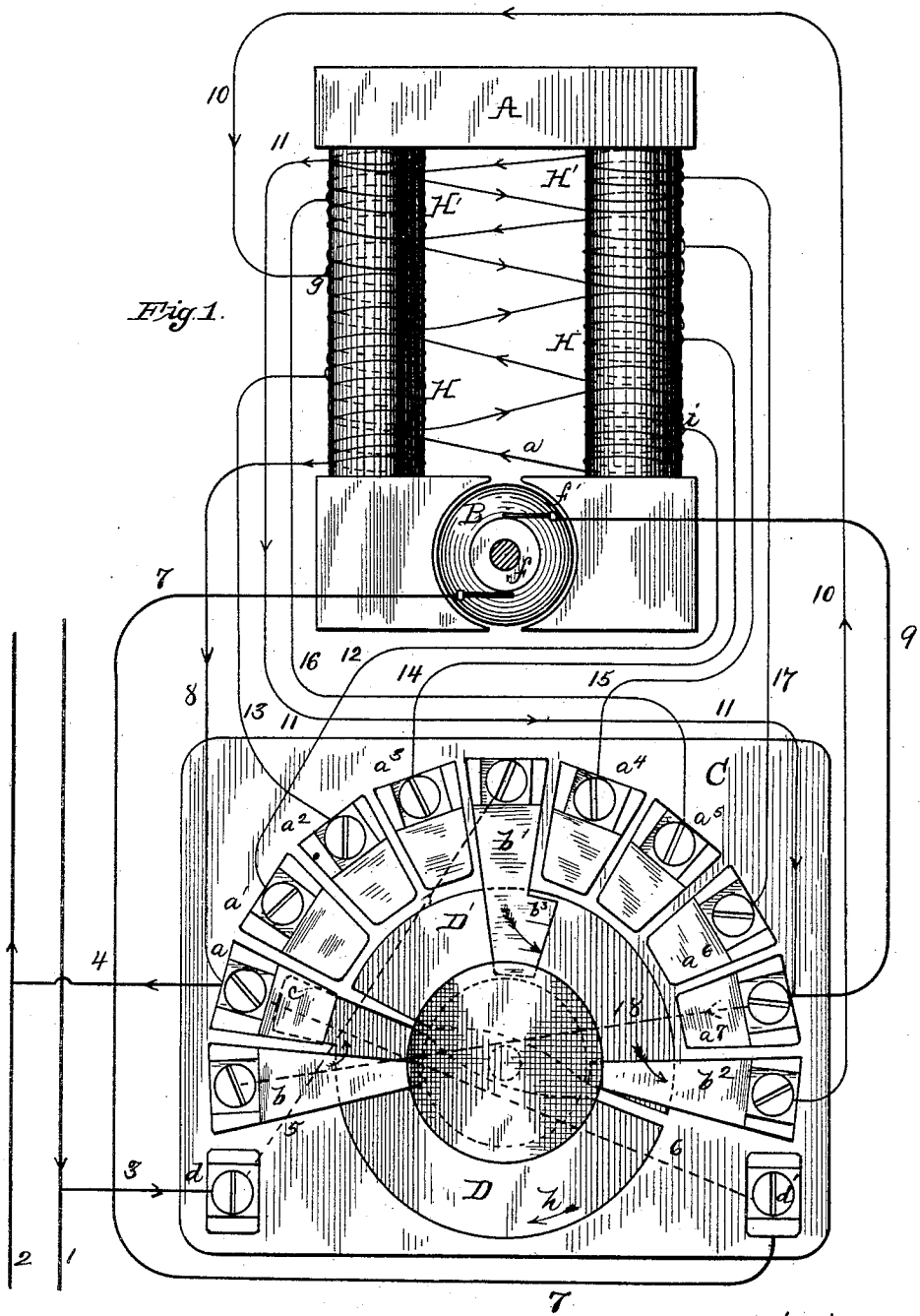
(No Model.) 2 Sheets—Sheet 1.

F. J. SPRAGUE.

ELECTRO DYNAMIC MOTOR.

No. 337,794. Patented Mar. 9, 1886.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig 2

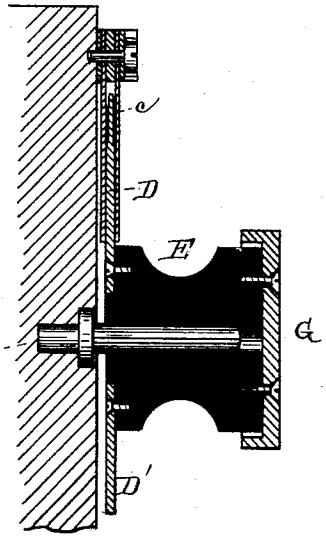


Fig 3

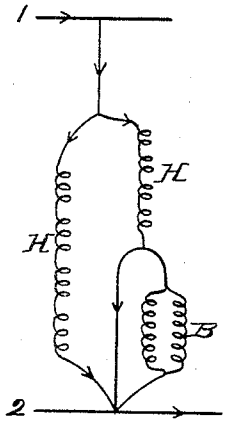


Fig 4

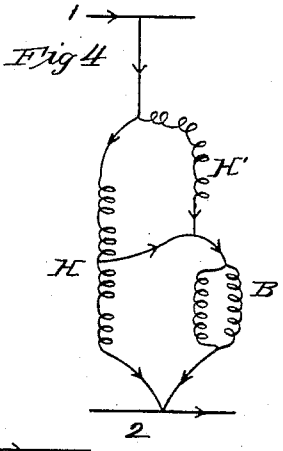


Fig 5.

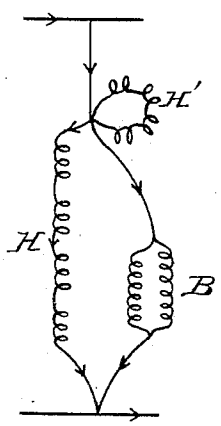


Fig 6

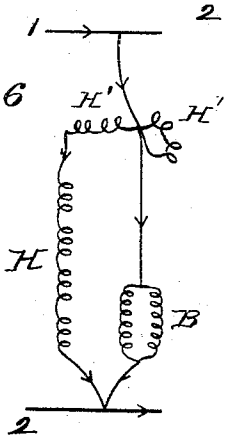
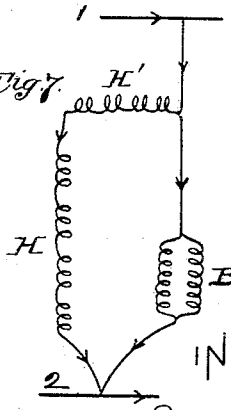


Fig 7.



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UNITED STATES PATENT OFFICE.

FRANK J. SPRAGUE, OF NEW YORK, N. Y.

ELECTRO-DYNAMIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 337,794, dated March 9, 1886.

Application filed July 6, 1885. Serial No. 170,725. (No model.)

To all whom it may concern:

Be it known that I, FRANK J. SPRAGUE, of New York, in the county and State of New York, have invented a certain new and useful Improvement in Electro-Dynamic Motors, of which the following is a specification.

The object of this invention is to provide a simple switch, by means of which all the different operations requisite in the regulation of electro-dynamic motors upon constant potential circuits may be readily performed—that is, the motor may be placed in circuit with low potential at the armature-terminals and strong field-magnet. The potential at the armature-terminals may then be gradually raised, and the field-magnet strength may then be weakened to increase the speed of the motor, or the field varied in one way or the other to properly regulate the speed, all these operations being performed without the use of any external resistance, but simply by changing the connections of the armature and field-magnet terminals.

My invention is illustrated in the accompanying drawings, in which Figure 1 is a view of the motor in elevation, with a plan view of the switch and diagram of the connections; Fig. 2, a section of the switch; and Figs. 3, 4, 5, 6, and 7 are diagrams illustrating the operations effected by the movement of the switch.

A is the field-magnet, and B the armature, of a shunt-wound electro-dynamic motor.

The regulating-switch consists of a base, C, of insulating material, on which are mounted a number of short contact-blocks, a a' a^2, &c., and three longer blocks, b, b', and b^2, situated one at each end and one in the middle of the series of short blocks. Contact b' has an extension or shoulder, b^3. The moving portion of the switch is a two-part metal disk, D D', the two parts being joined together mechanically, but divided electrically by a knob or block, E, of suitable insulating material carried on a spindle, F. This knob or block preferably has a metal cap, G, and it forms a handle for turning the disk. Part D of the disk has a projecting finger, c, of such length as to engage with the short contacts a a', &c. The long contacts b, b', and b^2 engage with the body of the disk. 1 2 are the main conductors of the constant potential circuit. Wire 3 leads to a binding-post, d, of the switch, which is one terminal of the motor, being connected by a wire, 5, passing underneath base C, with long contact b', which rests on the movable disk, and wire 4 from conductor 2 is connected with short contact a, from which wire 6 goes to binding-post d', which is connected by wire 7 with commutator-brush f, and from contact a also a wire, 8, extends to the beginning of the main field-coils H. Contact a thus forms a terminal of the armature and main field-shunts. The other armature-terminal is contact a^7, to which wire 9 extends from commutator-brush f', and the other terminal of field-coils H is long contact b^2, the connection being by wire 10. There is also a series of field-coils, H', the connection of one of whose terminals is changed to regulate the field. This terminal is block b^2 connected through wire 10, which extends from point g, where the two field-coil sets are joined. The other terminal of coils H' is block a^7 through wire 11. Each set of field-coils is connected at intervals with the intermediate short contact-blocks by wires 12 to 17, as will be explained. Blocks b and a^7 are connected together by wire 18.

In the position of the switch shown in Fig. 1 the interval circuits of the motor are as follows: from binding-post d by wire 5 to long contact b', part D' of the disk, contact b^2, wire 10 to g, where the current divides, part passing through all the coils H, and by wire 8 to block a, and thence to conductor 2, while the other part passes from g through all the coils H', and by wire 11 to block a^7, wire 18 to block b, to D, by finger c to block a, and to conductor 2. There is also a connection between blocks a^7 and a through the armature by means of wires 9, 7, and 6; but practically no current passes here, the armature being short-circuited by the direct connection across the regulating-switch. This is the condition proper when the motor is started, there being low difference of potential at the armature-terminals and a strong field, as all the field-coils are arranged to act together when their terminals are in this position. Turning the disk D D' in the direction shown by the arrow h (all the other arrows indicate direction of current) first brings the finger c' into contact with block a. The circuit is then as follows: from d *via*

5 b' D' b^2 10 to g, where it divides, part going *via* all of H' to 11 a^7 9, the armature B 7 d' 6 a 4, the other part from g by H to i, where this part is subdivided, part going by 12 to a' c D b 18 a^7, where it joins the current of coils H' and direct by 8 to a. The circuits then are as in Fig. 4, the difference of potential at the armature-circuit terminals being raised by shunting it upon a portion of field-coils H, while the strength of the field-magnet remains nearly the same. By moving the finger c along the successive contact-blocks the armature is progressively shunted upon all the coils H, while the connections of the field-coils remain unchanged, and thus the difference of potential at the armature-terminals is increased to the desired point. When the finger c reaches long block b', the circuits are as seen in Fig. 5, the coils H' being short-circuited. It is not thought necessary to particularly describe the circuits in all the different positions of the contact-finger. The cutting out of coils H' weakens the field—after full potential is attained at the armature-circuit terminals—so as to increase the speed of the motor. The extension b^3 permits contact a^4 to be made before contact b' D' is broken. When c reaches a^4, it will be seen that the first connection is by wire 15, which extends to a point between certain sections of H'. The current thus has two paths in opposite directions in H', and therefore the magnetizing effect of certain of said coils is reversed, as seen in Fig. 6, and thereby the field is additionally weakened. The further movement of the disk reverses the current in additional coils H' until long block b^2 is reached by finger c, when all the coils H' are reversed and the field is at its weakest point. While the motor is running, the regulation is accomplished by moving finger c along blocks b' to b^2, and thereby increasing or decreasing the magnetizing effect of coils H'.

What I claim is—

1. The combination, with an electro-dynamic motor, of a regulating-switch having contacts for short-circuiting the armature, contacts for shunting the armature upon more or less of the field-coils, and contacts for reversing the current in more or less of the field-coils, substantially as set forth.

2. The combination, in an electro-dynamic motor, of field-coils in shunt relation to the armature, field-coils in series with the armature, and means for reversing the current in more or less of said series coils, substantially as set forth.

3. In an electro-dynamic motor, the combination of main field-coils, the armature shunted upon a variable number of said main field-coils, other field-coils in series with the armature, and means for reversing the current in more or less of said series coils, substantially as set forth.

4. In an electro-dynamic motor, the combination of the armature, main field-coils, other field-coils in series with the armature, and a conductor extending from between the armature and the series field-coils, and having a movable terminal, whereby said conductor may be made to short-circuit the armature or to shunt the armature upon more or less of the main field-coils, substantially as set forth.

5. In an electro-dynamic motor, the combination of the armature, main field-coils, other field-coils in series with the armature, and a movable terminal of said series coils adapted to short-circuit them or to reverse the current in more or less of them, substantially as set forth.

6. In an electro-dynamic motor, the combination of the armature, main field-coils, other field-coils in series with the armature, a conductor extending from between the armature and the series field-coils, and having a movable terminal, whereby said conductor may be made to short-circuit the armature or to shunt the armature upon more or less of the main field-coils, and a movable terminal of said series coils adapted to short-circuit them or to reverse the current in more or less of them, substantially as set forth.

7. The combination, with an electro-dynamic motor having two sets of field-coils, of means for changing one set from shunt to series relation with the other, substantially as set forth.

8. The combination, with an electro-dynamic motor having two sets of field-coils, of means for changing one set from shunt to series relation with the other, and for reversing the current in the set so changed, substantially as set forth.

9. In a regulating-switch, the combination, with the long and short contacts, of the revolving two-part disk, one part having a contact-finger adapted to engage with said short contacts, substantially as set forth.

This specification signed and witnessed this 2d day of May, 1885.

FRANK J. SPRAGUE.

Witnesses:
A. W. KIDDLE,
E. C. ROWLAND.