No. 703,340. Patented June 24, 1902.

E. C. FELLOWS.

ELECTRIC CONTROLLER.

(Application filed Apr. 4, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

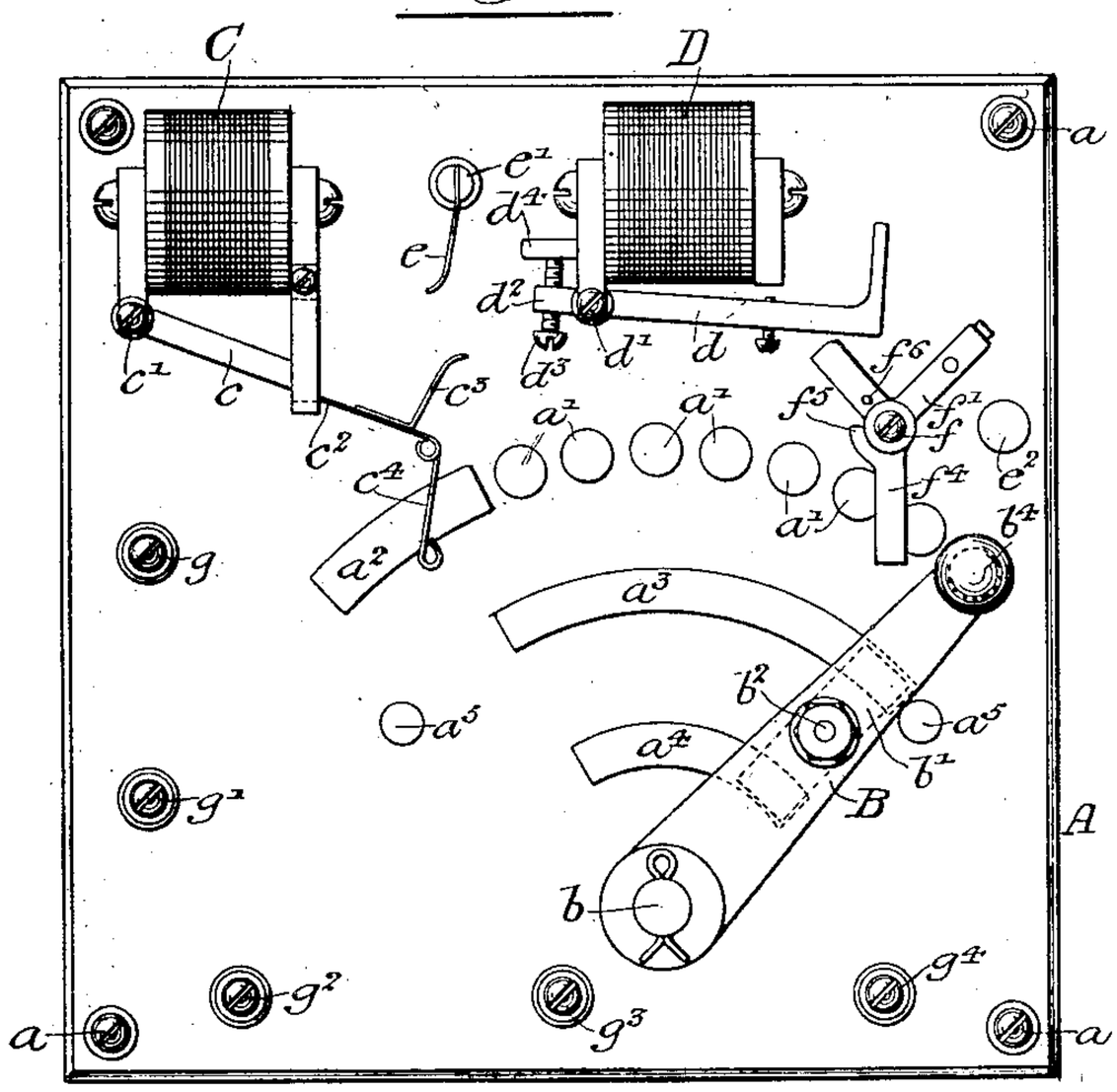

Fig. 2.

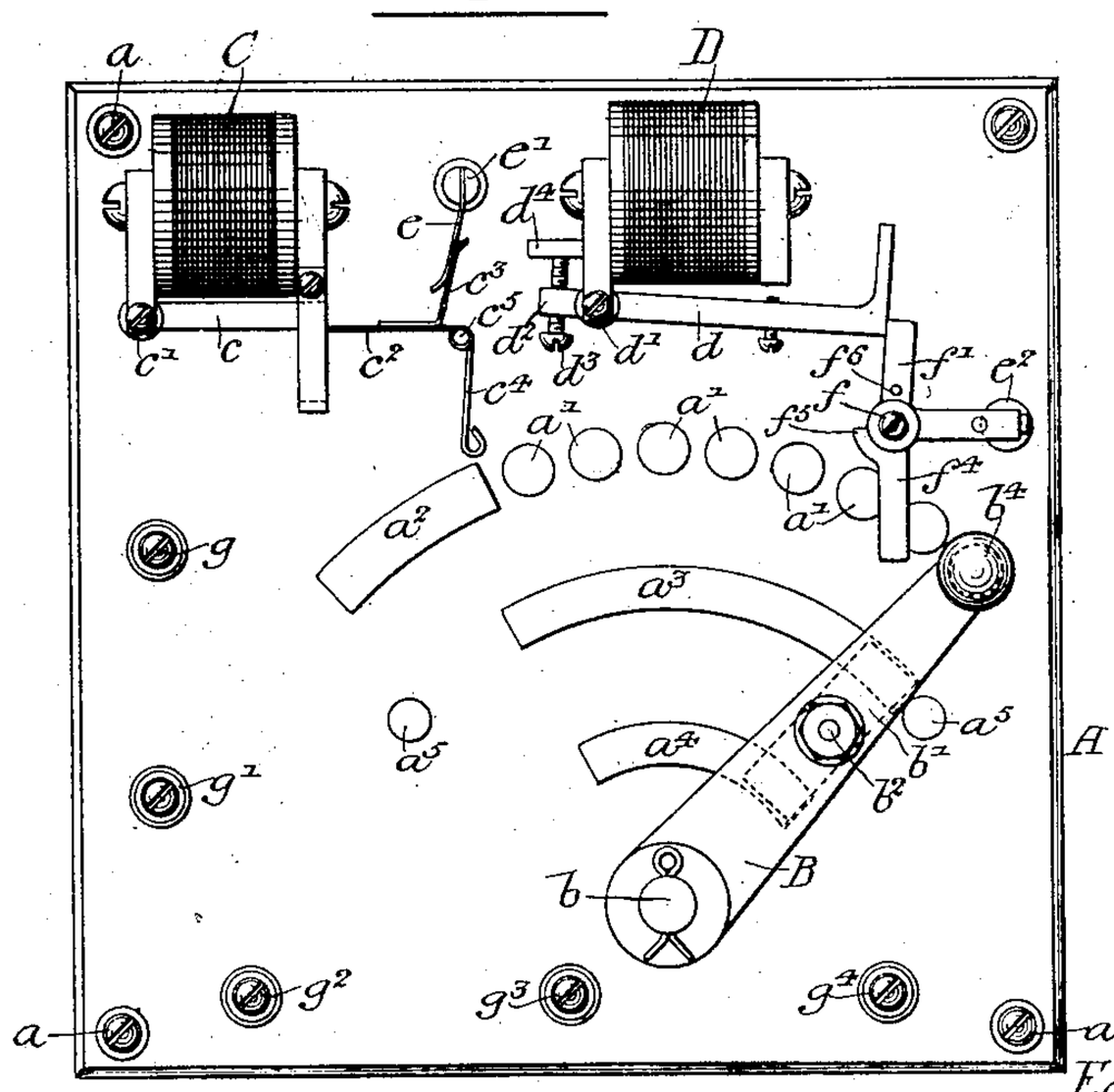

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Fig. 3.

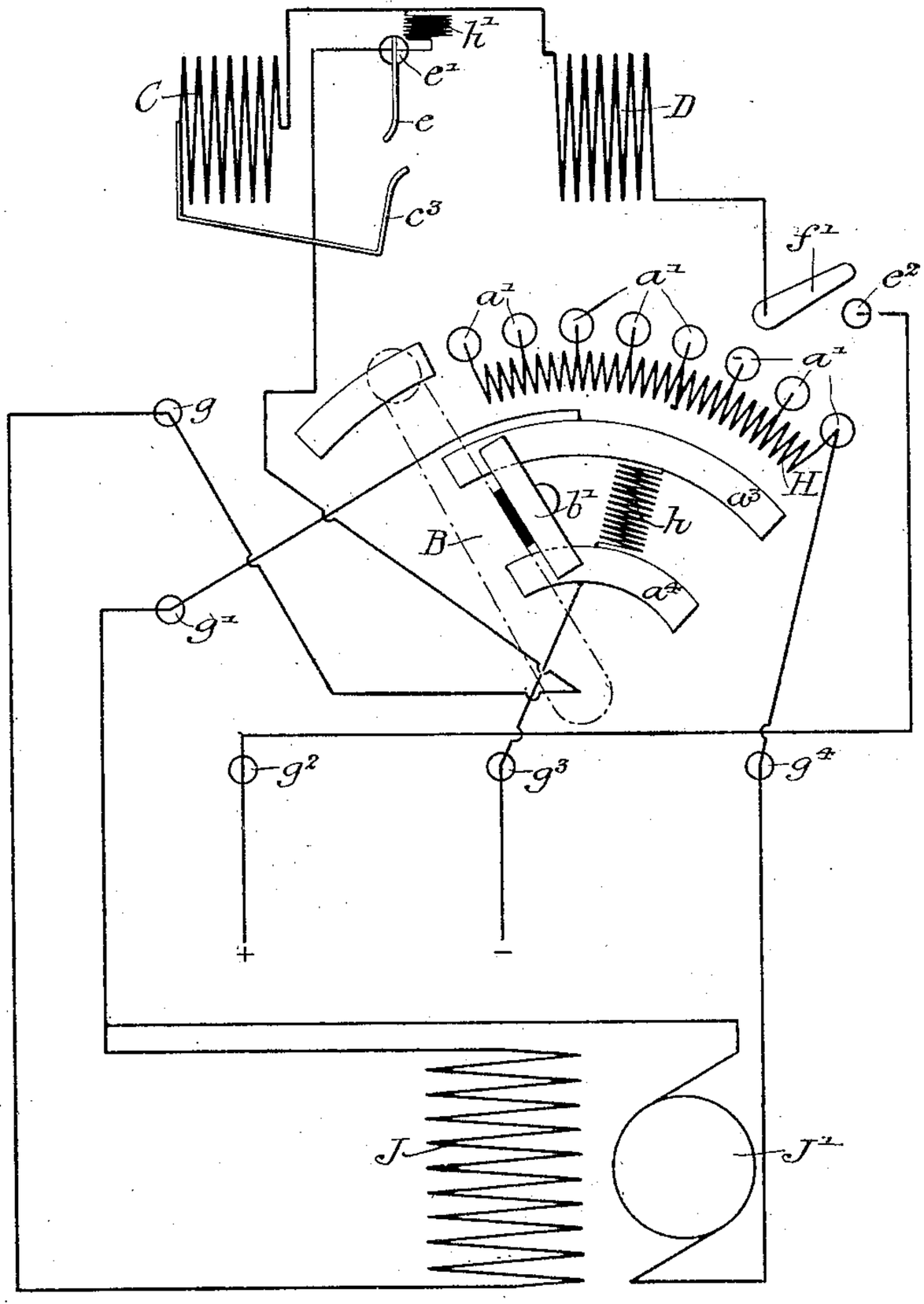
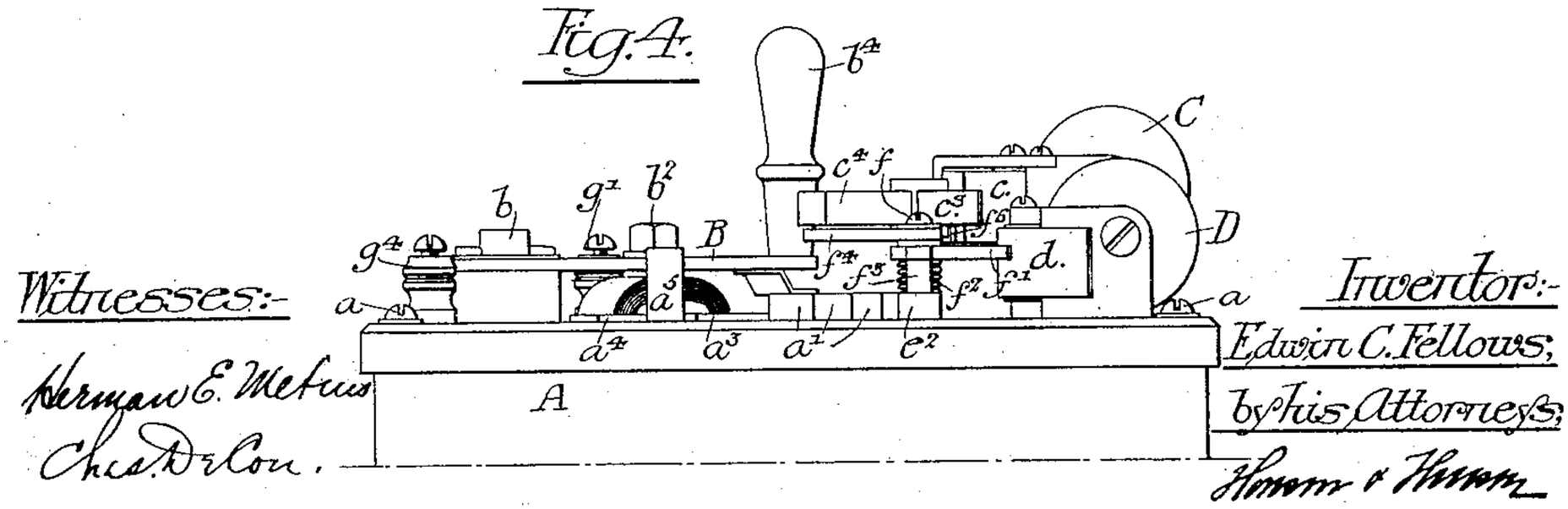


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRIC CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 703,340, dated June 24, 1902.

Application filed April 4, 1902. Serial No. 101,421. (No model.)

To all whom it may concern:

Be it known that I, EDWIN C. FELLOWS, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Electric Controllers, of which the following is a specification.

My invention consists of certain improvements in electric controllers and more particularly to an improved protective device for automatically opening an electric circuit in which said controller is placed whenever the flow of current ceases or whenever it increases over a certain predetermined point.

The object of my invention is to provide an electric controller with automatic underload and overload switches, which shall be closed by movement of the operating-arm of said controller. This object I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a front view of an electric controller, showing my improved protective mechanism applied thereto and with various parts in the position they would occupy when both switches are open and the controller-handle placed so that there is no resistance in circuit with the motor. Fig. 2 is a view of the controller shown in Fig. 1, showing both switches closed and the operating-arm in the same position as before. Fig. 3 is a diagrammatic view of the connections between the various portions of the controller and the motor in circuit therewith, and Fig. 4 is a side view of the controller.

In the above drawings, A is a slab or plate of slate, marble, or other non-conducting material held to an iron casing by screws a upon coils of resistance of the well-known form and which has been omitted from the drawings for the sake of clearness. The coils in this casing are electrically connected to a contact-plate a', which are arranged on the arc of a circle at the center of which is pivotally supported an operating-arm B, made long enough to bear upon the various contact-plates a'.

At the extreme left-hand end of the line of contact-plates a' is an elongated plate a^2, which acts as a dead-point in being connected to the resistances. In addition to the above there are two other contact-plates a^3 and a^4, arranged concentrically to the pivot b of the operating-arm B, and which are designed to be electrically connected by a laminated U-shaped contact-piece b', held to the under side of the operating-arm B by means of a bolt b^2 and insulated from said arm in any suitable manner. Stops a^5 limit the movement of the operating-arm B in both directions.

C and D are magnets connected in series with each other and so connected that all current passing through the controller passes through them. The magnet C has an armature c, pivotally attached to one of the pole-pieces of said magnet at c' and provided at its other end with a spring-piece c^2, preferably of brass. Either formed integral with or rigidly fixed to this spring-piece is an upwardly-extending piece c^3, slightly bent at the end and so placed as to form a rubbing contact with a spring-contact e, carried by a metallic post e'. Hinged or pivoted to the piece c^2 near its end is a downwardly-extending piece c^4, which, while free to swing to the left-hand side of a perpendicular through its pivot c^5, is so constructed that it cannot swing to the other side of said perpendicular. The result of this construction is that as the operating-arm is turned from the position shown in Figs. 1 and 2 to its extreme left-hand position the arm c^4 swings on its pivot to allow it to pass without motion being imparted to the armature c. When, however, the operating-arm is moved from its off position to the right, it immediately engages the arm c^4 and swings the armature c on its pivot, as set forth hereinafter. The magnet D similarly has an armature d pivoted to the magnet pole-piece b', being provided, however, with an extension d^2. Beyond said pivotal point, however, it passes a screw d^3 and then is in engagement with a post or stud d^4, by which undue motion of the armature d upon the pivot is prevented.

Pivotally carried on a stud f is an L-shaped metallic arm f', normally retained in the position shown in Fig. 1 by means of a spiral spring f^2, mounted upon the said stud f. The contact-brush f^3 is carried on one arm of this piece f', and when said piece is in the

position shown in Fig. 2 this brush bears upon the contact-plate e^2. When the piece f' has been turned on its pivot against the action of the spring f^2 to the position shown in Fig. 2, it may be retained in said position by means of the armature d, which engages one of its arms. The said armature is movable upon its pivot sufficiently to disengage this arm and allow the piece f' to turn on its pivot under the influence of the spring f^2 and break contact with the plate e^2.

f^4 is a freely-movable depending arm also carried on a pivot f, having a projection f^5 from its head placed so as to engage a pin f^6 in one of the arms of the piece f', the relative positions of the various parts being such that when the operating-arm B is turned on its pivot b from the position shown in Fig. 1 it engages the depending arm f^4, whose projections f^5 shortly come in contact with the pin f, thus swinging the piece f' on its pivot against the spring f^2, and causes the arm of the said piece to pass under and raise the armature d and the other arm to contact with the plate e through its brush f^3. When, however, the arm B is moved in a contrary direction, its engagement with the depending arm f^4 merely swings this latter upon its pivot without in any way tending to move the piece f'.

g, g', g^2, g^3, and g^4 are binding-posts, two of these—viz., g^2 and g^3—being designed for connection to the current-supplying means, while the remaining three are connected to the motor, as shown in Fig. 3.

H represents the resistance connected to the contact-plates a', and it is to be noted that there is a very high resistance h, permanently connected between the two contact-plates a^3 and a^4, and also a second high resistance h', permanently connected between the posts e' and one terminal of the magnet C. This latter resistance serves to prevent the injurious and destructive flashing or "kick" which follows breaking of the connection between the plates a^3 and a^4 and between the spring-contacts e and c^3, respectively.

Tracing the course of the current through the apparatus it will be seen that from the terminal g^2, connected to the positive feeder, it passes to the contact-plate e^2, and thence when the switches are closed through the piece f', the armature d, the magnet D, magnet C, armature c, spring-contact piece c^3, and into the spring-contact e. From here it passes to the stud e', to the pivot of the operating-handle B, at which point it divides, a portion flowing to the binding-post g and thence through the field-coil J of the motor to the binding-post g' and into the curved contact-plate a^3. From here it passes through the contact arm or brush b', to the second curved contact-plate a^4, to the binding-post g^3, and the negative feed-wire. The rest of the current flowing to the pivot of the operating-arm B passes through this arm, and when the controller is in operation through more or less of the resistance H and to the binding-post of the terminal g^4. From here it passes through the armature J' of the motor and joins with the wire from the field-coils J, going to the binding-post g', the contact-plate a^3, arm b', contact-plate a^4, and to the negative feed-wire.

In operating the device and starting with both the switches upon the operating-arm in the position indicated in Fig. 1 it will be seen that in order to close the switches and thereby properly start the motor it is necessary, first of all, to move the arm B to its extreme left-hand position. In doing this it will be seen that, as above described, the depending arm f^4 revolves the L-shaped contact-piece f' on its pivot, so that one of its arms passes under the armature d of the magnet D and remains in contact with the end of said armature, owing to the action of the spring f^2 this other arm at the same time resting upon the contact-plate e^2. The operating-arm in being moved to its starting-point further strikes the depending spring-piece c^4, carried at the end of the extension-armature c^3, but passes in this without altering the position of the said armature. It will be assumed that the main supply-switch is closed, so that now when the operating-arm B is moved so as to supply current to the motor it first comes in contact with the depending piece c^4, which is in the position shown in Fig. 1, and since this arm cannot be turned on its pivot c^5 further action of the operating-arm B swings the armature c upon its pivot c' and shortly brings the spring-piece c^3 into contact with the piece e. This action immediately allows current to flow to the fields of the motor energizing the magnet C, which attracts the armature and returns the two spring-pieces c^3 and e in contact with one another. The continued motion of the arm B brings it into contact with the first of the contact-plates a', thus permitting current to flow to the armature in the motor and supporting this in the customary well-known manner. As the arm B is further moved the motor is speeded up until as the said arm approaches its maximum right-handed position it comes in contact with the depending arm f^4, but since this is free to move on its pivot f in the direction which the arm B is moving such action does not affect the L-shaped piece f. If now from any cause the current is cut off even for a moment from the circuit, the magnet C releases its armature c, such action being materially assisted by the action of the two spring-pieces e and c^3. In order now to again start the motor, the operating-arm C must be moved to its off position at the extreme left of the controller and the motor brought up to speed as at the beginning. On the other hand should the motor for any reason become overloaded the magnet D will attract its armature d from its normal position, as shown in Figs. 1 and 2, thus allowing the L-shaped piece f' to turn

on its pivot and break the connection between said armature and contact-plate e^2. Such breaking of the connection only allows the magnet C to release its armature, this also breaking the connection between the spring-pieces e and c^3. As the arm B is moved to its zero position the piece f' is again moved so as to electrically connect the armature d and the contact-plate e^2, after which the connection is restored between the spring-contacts e and c^3 and the motor speeded up, as before.

It will be understood that under ordinary circumstances the face of this controller is completely inclosed, there being no part accessible except the handle b^4 of the operating-arm B. It will be noted that the piece f is set to connect the armature d and the plate e^2 by movement of the operating-arm B farther on to its off position, while the connection between the spring-plates e and c^3 of the underload-switch is made as the said arm is moved from its off to its on position. By means of the screw d^3 the distance of the armature d from the pole-piece of the magnet may be adjusted, thus regulating the line of overload which may be put on the motor without causing said armature to move, so as to release the arm f' and open the circuit.

I claim as my invention—

1. The combination with an electric controller having contact-plates and an operating-arm for the same, of an overload and an underload switch, both of said switches being constructed to be closed by motion of said arm, substantially as described.

2. An electric controller having contact-plates, an operating-arm for the same, an underload-switch and an overload-switch, one of said switches being operated by motion of the arm from its off to its on position and the other being operated by motion of said arm in the opposite direction, substantially as described.

3. The combination in an electric controller having contact-plates and an operating-arm, of two spring-controlled switches placed so as to be closed by motion of said operating-arm, one of said switches being provided with mechanism for automatically opening the controller-circuit when more than a predetermined quantity of current passes therethrough, the other having means for opening said current when the quantity of current in the same falls below a predetermined amount, substantially as described.

4. The combination with an electric controller having contact-plates and an operating-arm, of two manually-operated, mechanically-released switches, one of the same having means whereby it is closed by motion in one direction of the operating-arm and the other having means whereby it is closed by motion of said arm in the opposite direction, substantially as described.

5. The combination with an electric controller having contact-plates and an operating-arm, of an overload and an underload switch, the overload-switch having mechanism whereby it is closed when the operating-arm is moved from its on to its off position and the underload-switch having mechanism whereby it is closed when said arm is moved from its off to its on position, substantially as described.

6. The combination with an electric controller having contact-plates, and an operating-arm, of two switches each having operating-magnets, an arm pivoted to each of said switches and extending into the path of motion of the operating-arm, with means on each of said switches whereby said arm is permitted to close the same when said arm is moved in a definite direction, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWIN C. FELLOWS.

Witnesses:

WILLIAM E. BRADLEY,

JOS. H. KLEIN.