No. 664,087. Patented Dec. 18, 1900.

E. M. HEWLETT.

AUTOMATIC RHEOSTAT.

(Application filed Nov. 7, 1898.)

(No Model.)

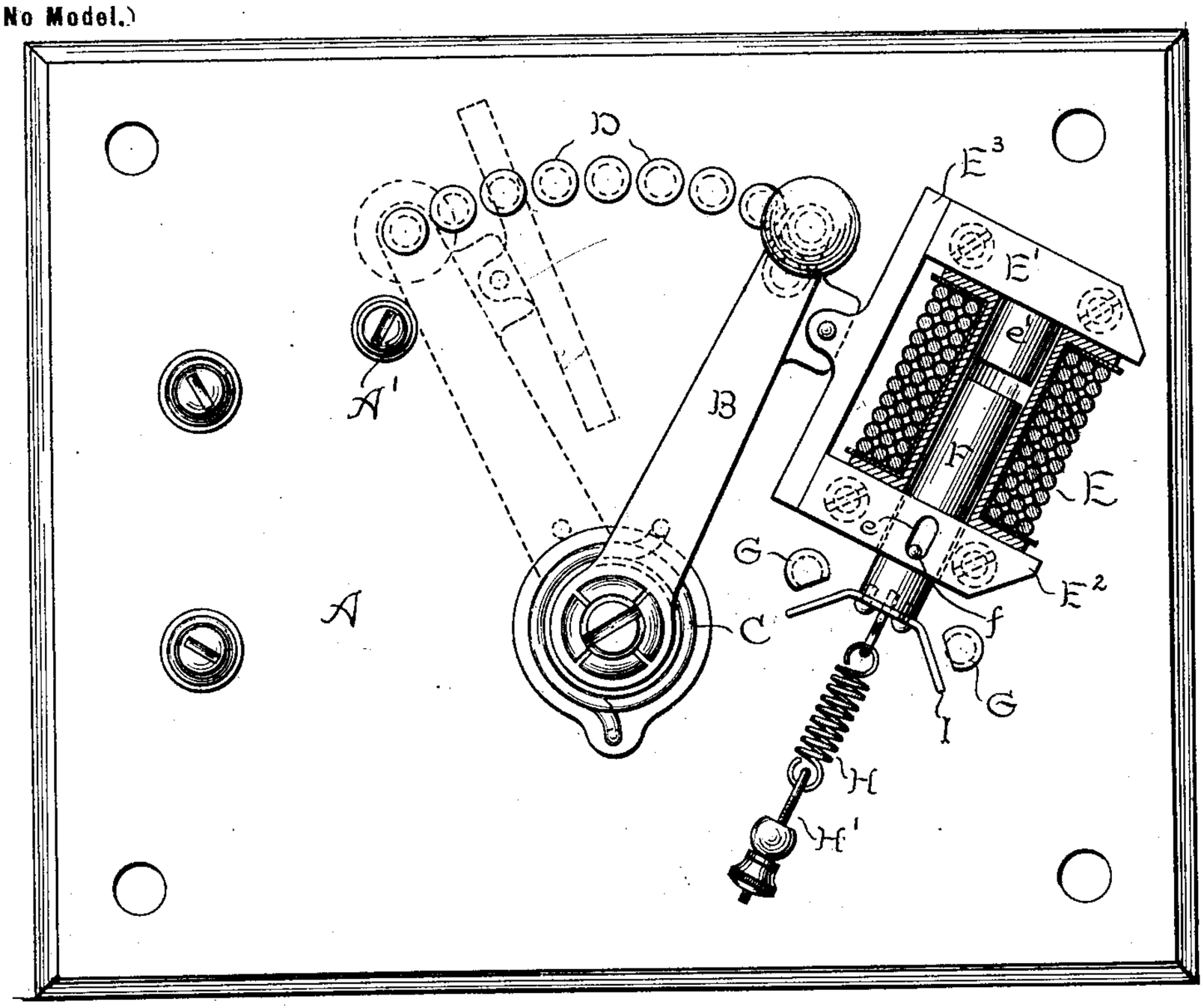

FIG. 1.

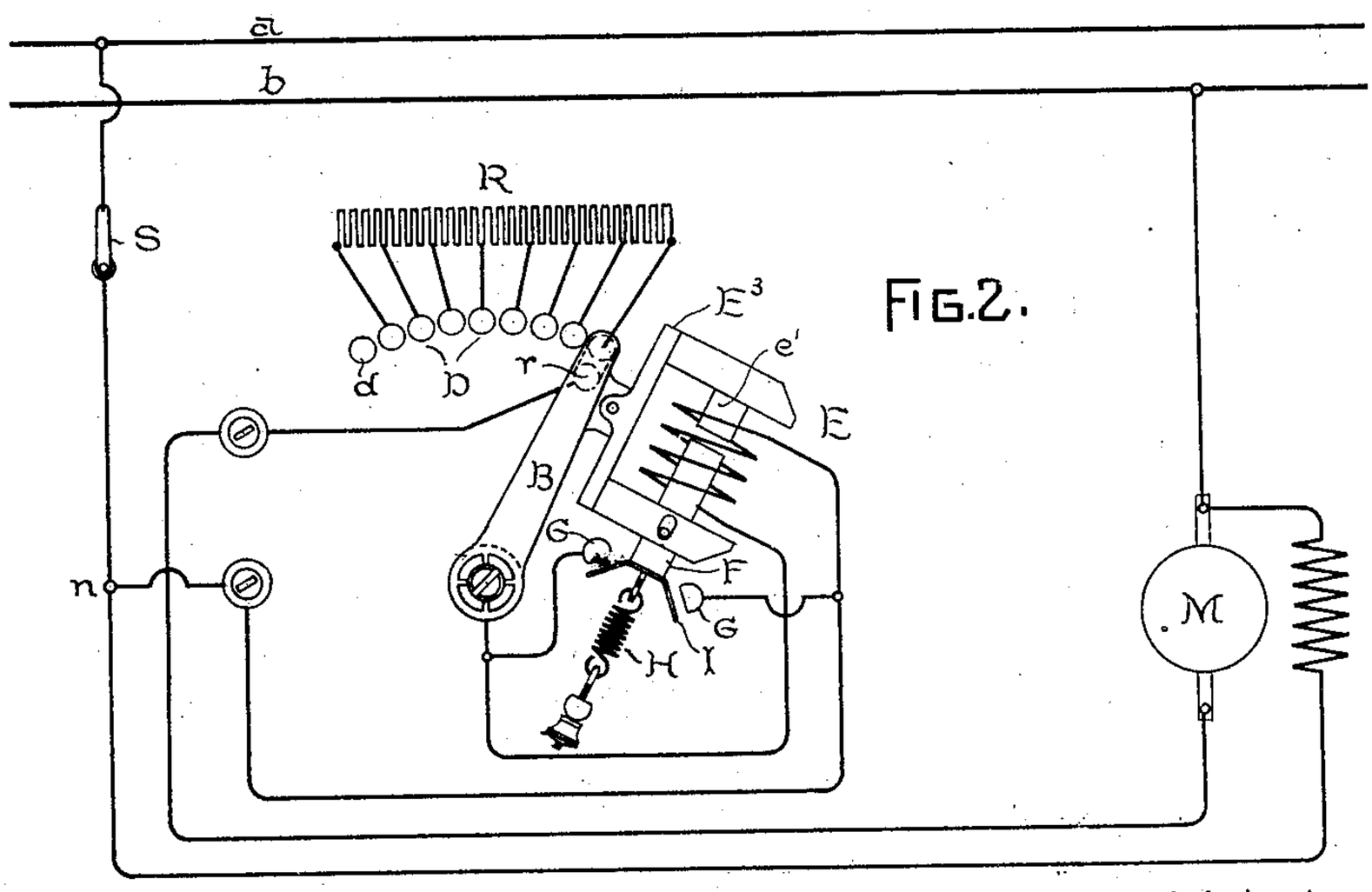

FIG. 2.

WITNESSES.

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UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

AUTOMATIC RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 664,087, dated December 18, 1900.

Application filed November 7, 1898. Serial No. 695,670. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Automatic Rheostats, (Case No. 857,) of which the following is a specification.

My present invention relates to automatic rheostats or starting-boxes particularly useful in connection with electric motors, although the device may be used in any relation in which a rheostat of this description is useful or desirable. In general such devices have been employed in the art where motors have been run on constant-potential circuits and have been so arranged that they will open the circuit upon a determinate overload where the current in the motor-circuit rises beyond that which the apparatus can stand with safety. Other arrangements have also been used in which there has been embodied what is called an "underload" release. It is well known that ordinary electric motors cannot be safely started at full potential, but that a resistance must be included in their circuit until the counter electromotive force runs up sufficiently to prevent a dangerous current passing through the armature, so that if for any reason the current fails, as by the opening of the circuit-breaker at the station, and remains off long enough to allow the motor to come to a stand or to diminish very much its speed and the current be then thrown on abruptly, as by closing the station circuit-breaker, the motor may be burned out before it attains sufficient speed to protect its armature. In all the devices of this class with which I am familiar there have been separate attachments for the underload and overload release.

It is the aim of the present invention to embody in a single attachment to the rheostat both the overload and underload protection above briefly described. In the particular embodiment of the invention here illustrated this is effected by a spring-actuated switch, which passes over the rheostat-contacts and controls the armature-circuit, and an "electromagnet," in which term I of course mean to include a solenoid or other equivalent device the yoke-piece of which is attached to the spring-actuated arm. The armature-circuit passes through the coil of the electromagnet and the armature of the electromagnet carries contacts which may short-circuit the coil. With this arrangement when the resistance is all cut out of circuit the magnet-poles attract the yoke with sufficient force to overcome the power of the spring on the switch-arm and to hold the switch closed in that position. If the current fails, it is manifest that the magnet becomes deënergized and the circuit is opened. Similarly if the current rises to an undue degree it will close the short-circuiting contacts of the magnet-coil against the resistance of a suitable adjustable spring, and thus the same result will be reached. I thus combine in a single piece of apparatus of simple and effective construction all the functions of the best starting-boxes heretofore designed, which are provided with two attachments for fulfilling these different offices. The broadest aspect of my invention is therefore seen to be the combination of a switch with a coil and means controlled by the current in the coil for opening the switch whenever the current rises to a certain determinate maximum or falls to or passes a determined minimum.

A useful feature of my invention resides in placing the release-magnet in series with the armature of the motor, so that it may be wound with coarse inexpensive wire.

In the accompanying drawings, which show an embodiment of my invention, Figure 1 is a front elevation of a starting-box or rheostat equipped with the invention, and Fig. 2 is a diagram of the circuits.

In Fig. 1, A is the base or cover for the resistance, formed usually of slate or any suitable non-combustible insulating material. The resistance is usually mounted below the base and may be of any preferred type. Upon the base is a stop A′ for the switch-arm B, the latter being provided with a spring C for opening the circuit. A row of contacts D, connected to the coils of the resistance, lies in the path of the switch-arm. E is the electromagnet, which in this case is in reality a solenoid provided with the pole-pieces E′ E^2 and the yoke E^3, the latter being pivotally attached

to the switch-arm B. A slight play is allowed, in order that the yoke or armature E^3 may set itself in such a way as to touch both the pole-pieces E′ and E^2. From the upper pole-piece E′ a projection *e′* enters the coil of the magnet. The core F, when attracted, touches this projection, sliding through a hole in the pole-piece E^2, and completes the magnetic circuit. A pin *f* acts as a stop for the core F and moves in the slot *e* in the lower pole-piece E^2. Contacts G G are capable of being bridged by a flexible contact I. A spring H and tension-screw H′ are provided, by the adjustment of which the amount of current needed to draw up the core or armature F may be regulated.

The connections of the apparatus are shown in Fig. 2. In this figure, *a b* are constant-potential mains feeding the motor M. The open-circuiting switch S cuts off the apparatus when desired. The other parts are as shown in Fig. 1. The motor illustrated is shunt-wound, and its circuit starts from the main *a*, one branch of the circuit passing directly to the field and thence to the main *b*, the other branch starting from the point *n* and passing around the coil of the electromagnet E to the switch-arm B. In the illustrated position the latter rests upon a contact *r*, at which point the entire resistance R is cut out of circuit; but it is manifest that as the arm moves to the left over the contacts D more and more of the resistance will be put in circuit until when it touches the contact *d* the circuit of the armature is opened. The yoke E^3 when applied to the pole-pieces E′ E^2 holds the switch-arm B in the illustrated position as long as current flows. Should the current exceed the limit determined by the tension of the spring H, the contacts G G will be bridged by the contact I, and the coil will be deënergized. The arm B will then fly to the left, urged by the spring, and will assume the position shown in dotted lines in Fig. 1. The core F will also fly back and will tend to open the shunt and to allow the magnet to energize; but by the time this effect takes place the arm B will have cut more or less resistance into the circuit and will be well out of reach of the magnetic attraction. In cutting in the motor the switch B is manually operated by means of the handle attached thereto and shifted over the range of contacts, gradually cutting out the resistance. Similarly, should the current in the mains *a b* fail for any reason the arm will be released and will open the circuit.

So far as I am aware I am the first to combine in a single coil both the overload and underload circuit-opening functions, and to this I aim to make broad claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An automatic rheostat for electric machinery, comprising a resistance with a switch for cutting sections out or in as may be desired, an electromagnet for holding the switch closed when the resistance is out of circuit, and a switch controlled by the magnet for shunting its winding when the current exceeds a determined maximum; whereby the same coil is employed to respond to both maximum and minimum current flow.

2. A rheostat, a spring-actuated switch for the rheostat, an electromagnet, a yoke for the magnet carried on the switch-arm, contacts shunting the magnet-coil, and an armature in inductive relation to the coil carrying the contacts; whereby, upon failure of current the resistance is cut in and the circuit opened by the release of the magnet-yoke, and upon excess of current the armature shunts the magnet-coil, also opening the circuit.

3. In a motor-starting box, a switch-arm movable over resistance-contacts, a magnet for holding the switch-arm in the "on" position, means tending to return it to the "off" position, and means for deënergizing the magnet set in action by a rise or fall of its own magnetism beyond predetermined limits.

4. In a motor-starting box, a switch-arm movable over resistance-contacts, a magnet for holding the switch-arm in one position, means tending to return it to the other position, and short-circuiting contacts for the controlling-coil of the magnet actuated by the magnet-core.

5. An electromagnet provided with pole-pieces and a yoke or armature forming a magnetic circuit open in the axis of the coil, and a core of magnetic material mounted to reciprocate in an opening in one of the pole-pieces.

6. An electromagnet provided with pole-pieces and a yoke or armature, and a core mounted to reciprocate in an opening in one of the pole-pieces against the action of an adjustable spring, and to operate shunting-contacts for the magnet.

In witness whereof I have hereunto set my hand this 5th day of November, 1898.

EDWARD M. HEWLETT.

Witnesses:
B. B. HULL,
M. H. EMERSON.