(No Model.)

# E. P. SHARP.

## STARTING DEVICE FOR ELECTRIC MOTORS.

No. 445,907. Patented Feb. 3, 1891.

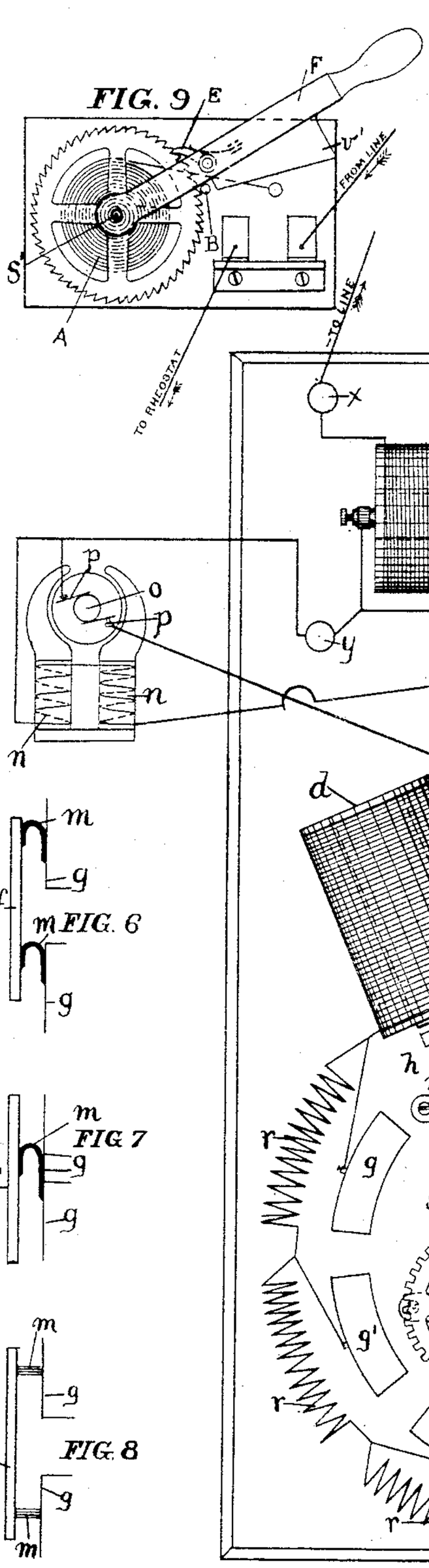


FIG. 1

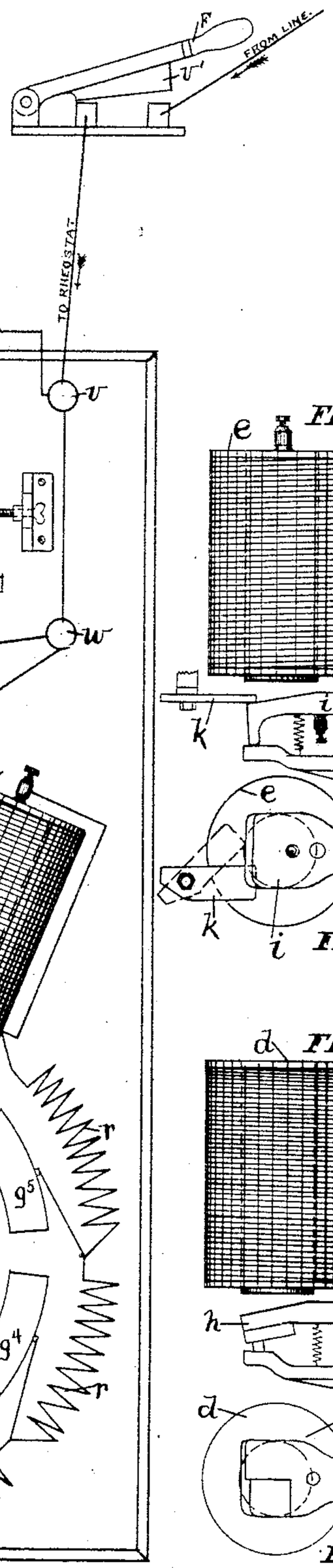


FIG. 2




FIG. 3




FIG. 4

FIG. 5







FIG. 6




FIG. 7




FIG. 8

**WITNESSES:**

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# UNITED STATES PATENT OFFICE.

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## STARTING DEVICE FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 445,907, dated February 3, 1891.

Application filed March 18, 1890. Serial No. 344,402. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD PEARCE SHARP, of the city of Boston, county of Suffolk, and State of Massachusetts, have invented certain new and useful Improvements in Automatic Rheostats or Safety-Starters for Electric Motors, of which the following is a full and exact description, reference being had to the accompanying drawings, which form a part of this specification, and to the letters of reference marked thereon.

In the drawings, Figure 1 is an elevation comprising a general illustration of my improvements and their connections and relation to the motor. Fig. 2 is a side elevation of electro-magnet *e*, its armature *i*, latch *k*, &c. Fig. 3 is a corresponding end elevation. Fig. 4 is a side view in elevation of electro-magnet *d*. Fig. 5 is a corresponding end elevation. Fig. 6 is a side elevation illustrating the contact of arm *f* with the contact-plates *g* by means of its brushes *m*. Similar views are Figs. 7 and 8, the construction therein being slightly varied in the matter of the brushes. Fig. 9 illustrates the winding up of the spring *s'* by the movement of lever F in operating the switch. This is a substitute switch.

Like letters refer to the same or corresponding parts in all the figures.

The nature of my invention relates to the mechanism devised for controlling and graduating the amount of electrical current passing to the motor and indicating promptly any inefficiency or failure of said control or graduating of the amount of electrical current, whether arising from accidental or other causes.

The invention consists in the employment of a rotary mechanism combined with a series of resistance-coils and contact-plates, whereby one after another of the resistances are cut out from a circuit until, when the motor is fully at work, the circuit becomes direct; also, in the employment of an electric lamp or other signal placed in or closely connected to the circuit, so as to be brought into action by any abnormal increase of electrical current, together with various devices, arrangements, connections, and combinations hereinafter more fully set forth.

The object, as already apparent, is to prevent or obviate the danger of injury to the motor and various parts and connections by any abnormal or excessive current.

Referring to the drawings, *s* is a spindle which carries the rheostat-arm *f*. This spindle is supported in any suitable bearings and is electrically connected to the binding-post *t*. The contact-plates *g* are arranged in a circle around spindle *s*, and each is connected to a resistance-coil *r*. The arm *f* is provided with a brush or brushes suitable to insure electrical connection between arm *f* and each contact-plate *g* while the arm *f* is passing over it in its rotary movement around the axis of spindle *s*.

The electro-magnets *d* and *e* are arranged conveniently for connecting substantially as shown, and are provided with suitable pivoted or movable armatures *h* and *i*. These armatures have springs holding them or drawing them back out of contact or away from their respective magnets and against any suitable stop. The armature *i* is electrically connected to post *t*, and is also held positively away from its magnet by means of a tilting latch *k* or equivalent device until the arm *f* in passing tilts it and so unlocks or unlatches the armature and leaves it free to be attracted to the magnet *e*. The armature *h* serves as a stop to arm *f*, preventing its rotary movement toward the left, as shown, until the magnet *d* becomes active and attracts it to itself, and so releases arm *f*. The resistance-coils are electrically connected from magnet *e* to magnet *d*, and these, respectively, to binding-posts *u* and *t*. Armature *i* is electrically connected to binding-post *t*. An electrical lamp or other equivalent device susceptible to operation by means of an electric current passing through it is electrically connected to the line leading to the motor, as seen at binding-post *v*. This connection passing through the lamp is also connected to an armature *b* in movable relation to electro-magnet *a*, said armature being pivoted similarly to *h* and *i* and held by a spring away from magnet *a* against a suitable stop *c*. Binding-post *w* is electrically connected to *u* and *v*. Electro-magnet *d* is connected to the line through binding-post *x;* also, as shown, to binding-post *y*. The motor is connected, as shown, to posts *t*, *y*, and *w*, and all parts of the mechanism not electrically connected of

course should be properly insulated with respect to each other.

The spring I have shown for operating with a circular movement the arm *f* by means of gears is marked A. This spring may be wound up by an arrangement combining it with the switch-lever F.

For the purpose of illustrating the combination I have shown a substitute switch in Fig. 9. A glance at this view will make the operation apparent. When the lever F is moved toward the observer to close the switch, the pawl E drags over the notches in the wheel connected with the spring's barrel and is held up by pin B. On moving the handle reversely to open the switch the pawl takes hold, turns the wheel, and winds the spring.

The operation is as follows: The electrical circuit being completed by the closing of the switch *v'*, it passes through magnet *e* and the resistance-coils *r* to magnet *d*, thence through binding-post *t* and line to motor, post *y*, coil *a*, post *x*, and line. Magnet *d* thus becomes active and attracts armature *h* to itself, and so unlocks arm *f*, which begins to rotate, passing first to the left. Coming into contact with plate *g*, connection is made through *g*, arm *f*, and spindle *s* to post *t* and the motor, cutting out magnet *d* and allowing armature *h* to be drawn back out of contact by its spring. The arm *f*, still moving on, comes in contact with plate *g'*, by which contact plate *g* and its resistance-coil are cut out of the circuit. Arm *f*, still passing on around the circle, makes contact with plate $g^2$, whereby plate *g'* and its resistance-coil are cut out of the circuit, and so on until the arm *f*, making contact with $g^3$, $g^4$, and $g^5$, so leaves out of the circuit, successively each resistance-coil and comes in contact with and tilts the latch *k*, so releasing armature *i*, which immediately is attracted to and makes connection by contact with magnet *e*. The resistances have now been, one after another, all cut out, and the current passes through coil and core of magnet *e* and armature *i* direct to *t*, and thence to the motor and the line. In case of any sudden stopping and starting of the current—as, for instance, in case of a break in the circuit on the line—magnet *e* will cease to be a magnet, and so allow armature *i* to be drawn out of contact by its spring, where it will be automatically held by latch *k* until again released by arm *f*, as described. If by any chance or otherwise the described operation has in any case failed, and an abnormal amount of electrical current is flowing through the motor, the magnet *a* will become active, and, according to the previous proper adjustment of the tension of spring *z*, will draw armature *b* into contact with itself, (overcoming the said tension of spring *z*.) The current is thus allowed to flow through armature *b* to and through the lamp *q* or equivalent electrical signal, so giving suitable notice or alarm.

The parts may be constructed of the materials common to the art or others suited to the described conditions and operations.

Any suitable power, as a spring or weight with suitable wheels and regulating device, may be used to rotate the arm *f*. I have shown a spring and ordinary clock-work.

I claim—

1. In a rheostat or starter for electric motors, the combination of magnet *d* in the line, its armature-releasing latch and stop *h*, the automatically-rotatory contact-arm carrying brushes, a circular series of contact-plates over which said brushes move with resistance-coils connected to said plates, the line-magnet *e*, its circuit-closing armature *i*, and latch *k*, operated by said contact-arm to release said armature *i*, so closing the short circuit, substantially as described.

2. The combination of the line-magnet *d*, its releasing-armature *h*, the automatically-rotatory contact-arm, its brushes, contact-plates, and resistances, line short-circuiting magnet and armature *e i*, and latch *k*, operated by said contact-arm, substantially as described.

3. The combination of the latch *k*, armature *i*, magnet *e* in the line, the automatically-rotatory contact-arm, and its series of contact-plates and resistances for the purpose of short-circuiting the current when the resistances are cut out, substantially as described.

4. The combination of the magnet *d* in the line, its armature latch and stop *h* for releasing and stopping the contact-arm, the automatically-rotatory contact-arm, its contact-plates, plate contact-brushes, resistances, and the circuit-closing armature *i*, line-magnet *e*, and armature-releasing latch *k*, operated to close the short circuit by the contact-arm, substantially as described.

5. The double-function hand-lever F, provided with contact-plate *v'* and pawl E, in combination with the contact binding-posts for connection to line and rheostat and the winding ratchet-wheel on the barrel or shaft giving motion to the rotatory contact-arm, substantially as described.

6. In a rheostat or starter for electric motors, the combination of an automatically-rotatory contact-arm, a retaining armature-latch *h*, a releasing line-magnet *d*, a circular series of contacts and connected resistances, a short-circuiting latch-holder armature *i*, and magnet *e* in the line, substantially as described.

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Witnesses:
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