No. 757,302. PATENTED APR. 12, 1904.

N. HARRISON.

ELECTRIC CURRENT REGULATOR.

APPLICATION FILED APR. 21, 1903.

NO MODEL.

FIG. 1

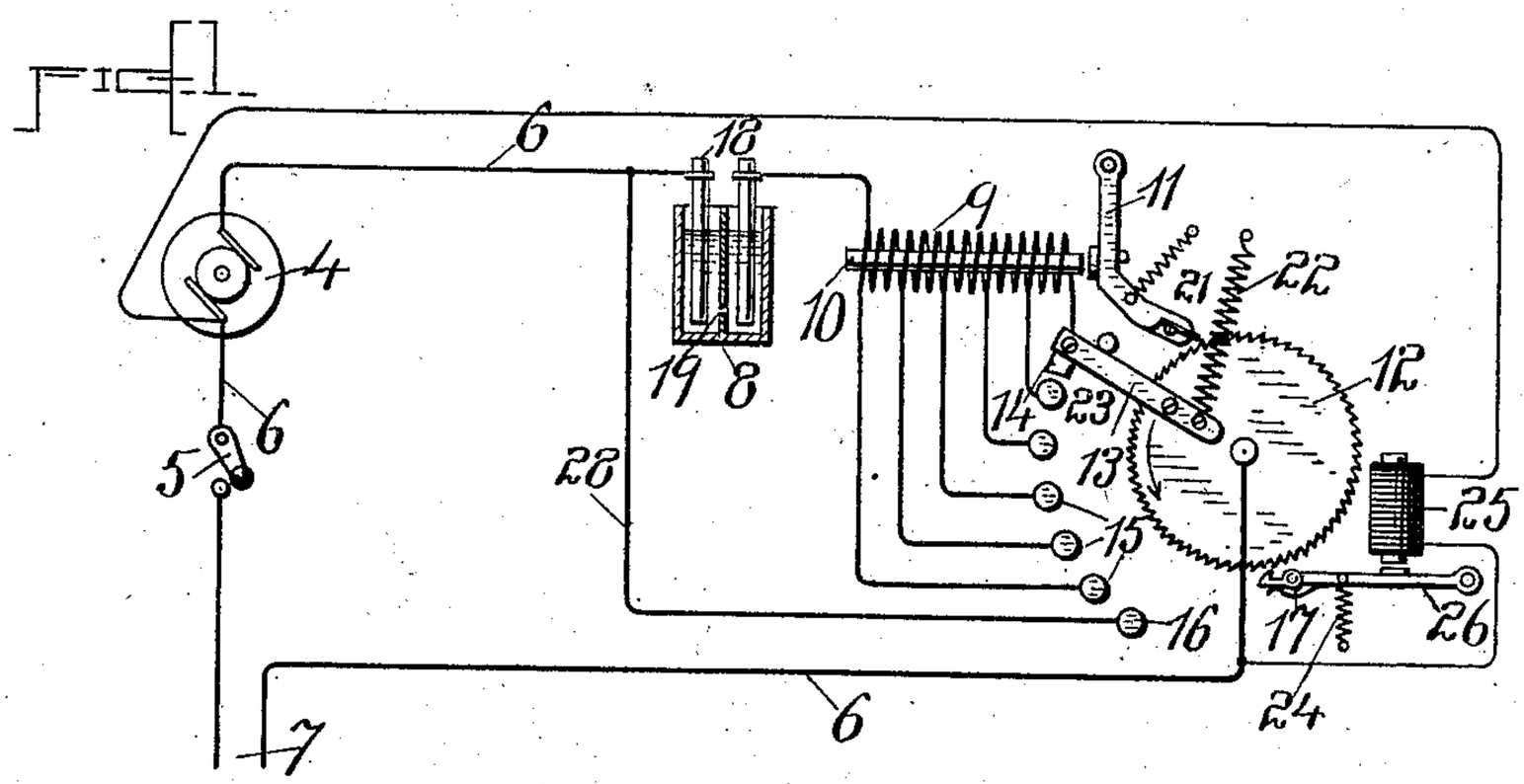



FIG. 2

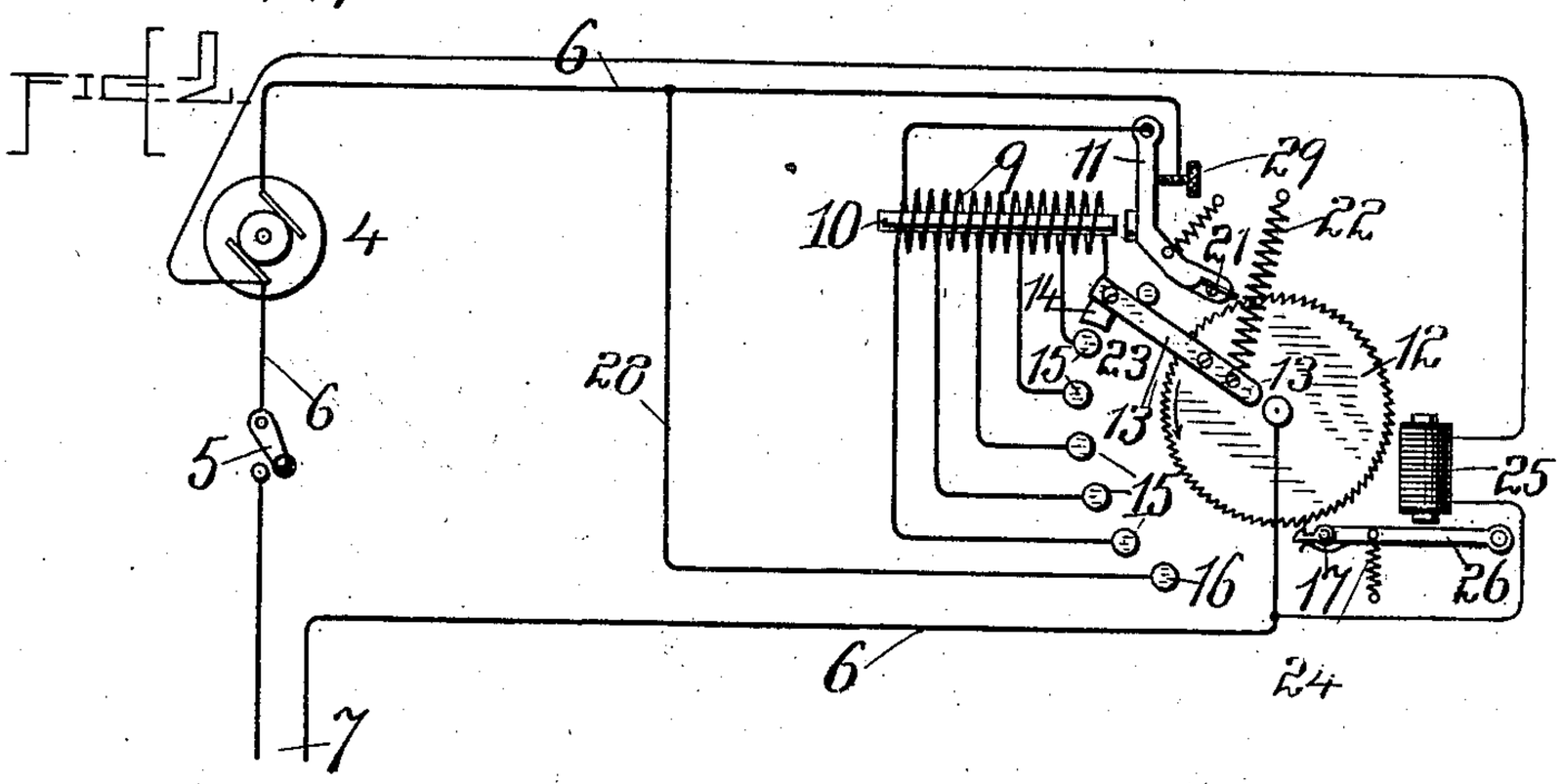
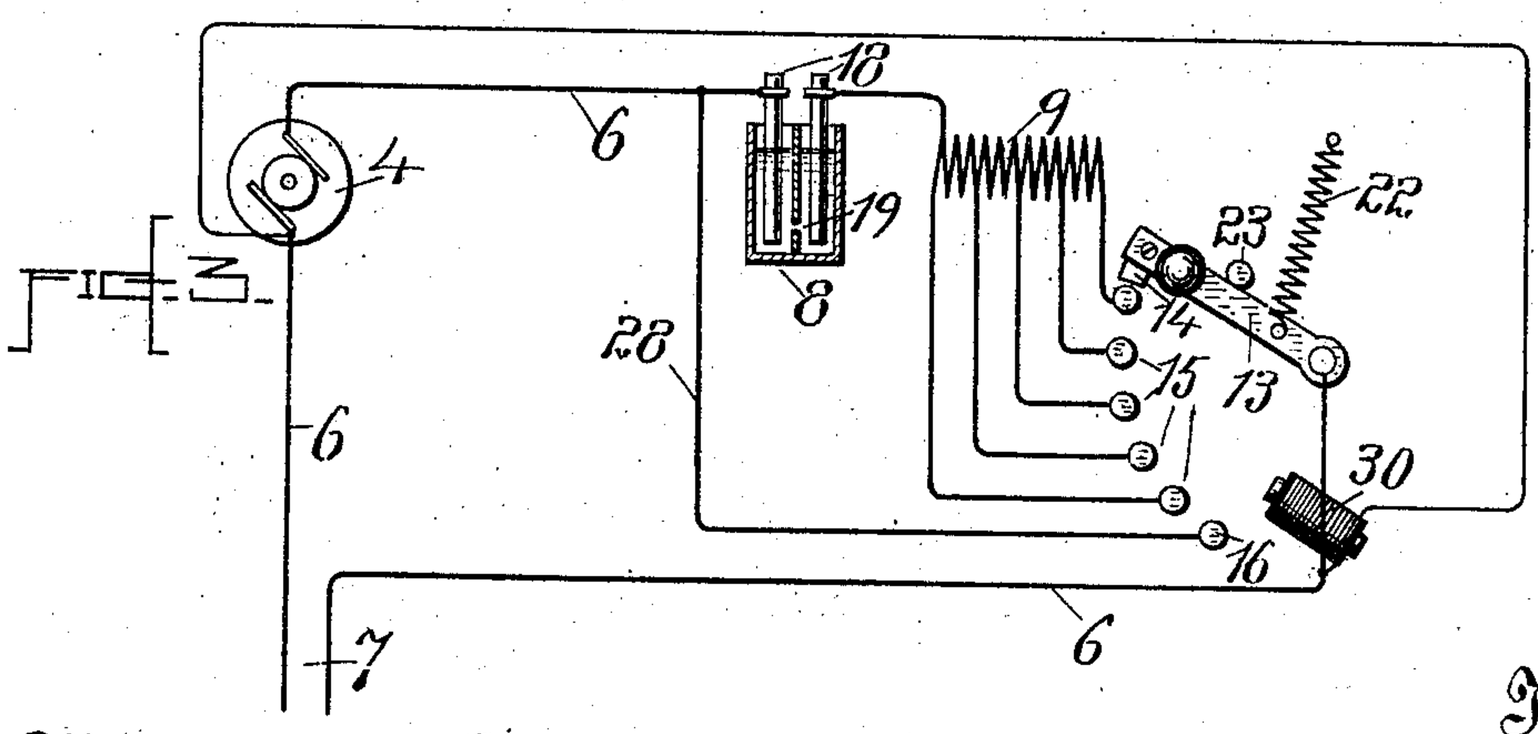



FIG. 3

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No. 757,302. Patented April 12, 1904.

# UNITED STATES PATENT OFFICE.

NEWTON HARRISON, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO WILLIAM HENRY LAIRD, OF NEW YORK, N. Y.

## ELECTRIC-CURRENT REGULATOR.

SPECIFICATION forming part of Letters Patent No. 757,302, dated April 12, 1904.

Application filed April 21, 1903. Serial No. 153,718. (No model.)

*To all whom it may concern:*

Be it known that I, NEWTON HARRISON, a subject of the King of Great Britain, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Electric-Current Regulators, of which the following is a specification.

This invention relates to electromechanical contrivances employed to start electrically-operated apparatus wherein a gradual increase in the intensity of the current is essential or desirable at the start, as exemplified in motor-starters, to which this invention is chiefly applicable.

The objects of this invention are to obviate the necessity of using resistances and its consequent objectionable heating, to economize in current, to cheapen the cost of construction, economize in space occupied by apparatus of this class, and provide the same with means whereby it may automatically perform the operations necessary to gradually increase the current strength. These objects are accomplished by substituting a self-induction coil for that of the resistances used heretofore and introducing an interrupter in the circuit to set up self-induction in the coil, and thereby limit the impressed electromotive force entering the motor. The amount of self-induction is gradually reduced by cutting out sections of the coil, and ultimately the whole coil, together with the interrupter, is cut out of the circuit by a multiple-contact switch operated by a vibrating armature actuated by the core of the induction-coil.

The accompanying drawings, forming a part of this specification, show a number of methods for embodying my invention and auxiliary devices that may be employed in connection therewith. It is obvious that the circuit and apparatus may be differently arranged and connected without departing from the spirit of the invention.

Figure 1 is a conventional illustration of my automatic motor-starter wherein a chemical interrupter is used and showing the motor to be started in the circuit, the current-supply not being shown. Fig. 2 is the same as Fig. 1, but instead of employing a chemical interrupter the make and break is made by a binding-post and vibrating armature. Fig. 3 shows a modification wherein the sections of the induction-coil are cut out of circuit by the hand of the operator.

A motor 4, a switch 5, and a motor-starting apparatus forming the subject-matter of my invention are inserted in the circuit 6, leading from the terminals 7 of any suitable source of direct current.

The starting apparatus consists, primarily, of an interrupter 8, a coil 9, wound to produce self-induction, provided with a core 10 to vibrate an armature 11, which engages a ratchet 12, a contact-arm 13, and brush 14, contact-points 15 and 16, and an electromagnetically-controlled dog 17 to engage the said ratchet.

The interrupter employed is preferably a chemical interrupter of any well-known type, such as shown in Figs. 1 and 3 at 8. This interrupter consists of a partitioned bath containing an electrolyte and electrodes 18, wherein a small hole 19 in the partition establishes electrolytic communication between the two cells and causes interruptions in the flow of current.

The self-induction coil 9, wound on the core 10, consists of a number of sections each connected to a contact-point 15 in the order shown.

The armature 11 is provided with an escapement-spring 21 to engage the ratchet 12 so as to move it step by step whenever the armature is actuated by the interrupted current.

The ratchet 12, which is included in the circuit, carries the contact-arm 13, provided with a brush 14. The brush normally rests on the first contact-point, held there by the pull of the spring 22 on the arm 13 against the lug 23. The dog 17 is normally held out of engagement with the ratchet by its spring 24, but which when pulled up by the electromagnet 25 will retain the ratchet and arm 13 in its position against the tension of the spring 24. The electromagnet 25 is of sufficiently high resistance as not to short-circuit the coil 9 and capable of sufficient magnetization. However, the main circuit may be arranged to retain the dog 17 engaged with the ratchet.

On closing the switch 5 a circuit is established through the ratchet 12 and arm 13 through the first contact-point 15 on which

the brush 14 rests, through all the sections of the self-induction coil 9, then through the interrupter 8 and motor 4 and return. The vibrations of the armature 11 will revolve the ratchet and move the arm 13 and its brush 14 over the contact-points 15 in the direction indicated by the arrow, cutting out more and more coil-sections from the circuit, resulting in a corresponding decrease in the self-induction, until finally the brush 14 leaves these contact-points and rests on the last contact-point 16. A short circuit through the wire 28 is thus established and the interrupter and coil cut out and rendered inactive, so that the ratchet will no longer revolve. The magnet 25, arranged in shunt, as shown, will become energized at the very start and remain so until the circuit is broken, whereat the armature 26 and pawl 17 will be drawn down and release the ratchet, allowing the spring 22 to pull the arm 13 to its initial position. It will be noticed that the arm 13 will return to this initial position even though the break in the circuit occurs when it is on one of the intermediate contact-points, making it impossible to start the motor except from the first contact-point.

In Fig. 2 a modification is shown wherein an adjustable screw contact-point 29 and a slight change of the circuit to produce a make and break is substituted for the chemical interrupter.

In Fig. 3 the arm 13 is to be turned by hand both to establish the circuit and to cut out the sections of the coil and interrupter, as shown. The arm 13 will be retained on the contact 16 by the attraction of the magnet 30; but when a break in the circuit occurs it will be pulled back to its initial position out of circuit by the spring 22.

I claim—

1. The combination with a motor, a generator, and switch, of a chemical interrupter and a self-induction coil provided with means whereby the sections of the self-induction coil may be thrown into and out of the circuit to vary the self-induction in the motor-circuit, substantially as described.

2. The combination with a generator, and an electrically-operated device, of a chemical interrupter and a self-induction coil provided with means whereby sections of the self-induction coil may be thrown into and out of the circuit to vary the self-induction, and whereby the self-induction coil and the interrupter may also be cut out of the circuit, substantially as described.

3. The combination with a generator and a motor of means for interrupting the circuit, and a self-induction coil divided into sections in said circuit, and means for cutting said sections out of the circuit to vary the self-induction, substantially as described.

4. The combination with a source of an electric current, and an electrically-actuated device, of means for interrupting the circuit, a self-induction coil divided into sections in said circuit, and means for cutting sections out of the circuit to vary the self-induction, substantially as described.

5. The combination with a generator and a motor, of a chemical interrupter and a self-induction coil in said circuit to set up self-induction in the said circuit, substantially as described.

6. The combination with a source of an electric current and an electrically-operated device, of means for interrupting the circuit, means for cutting the said interrupting means out of the circuit and a self-induction coil in said circuit to set up self-induction in the said circuit, substantially as described.

7. In the main circuit of an electric system the combination with a source of direct electric current and an electrically-actuated device, of means for interrupting the said direct current and means for producing self-induction to reduce the impressed electromotive force flowing through the said electrically-actuated device.

Signed at New York, N. Y., this 17th day of April, 1903.

NEWTON HARRISON.

Witnesses:

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