(No Model.)

J. F. McELROY.

CURRENT REGULATOR.

No. 486,644. Patented Nov. 22, 1892.

Fig. 1.

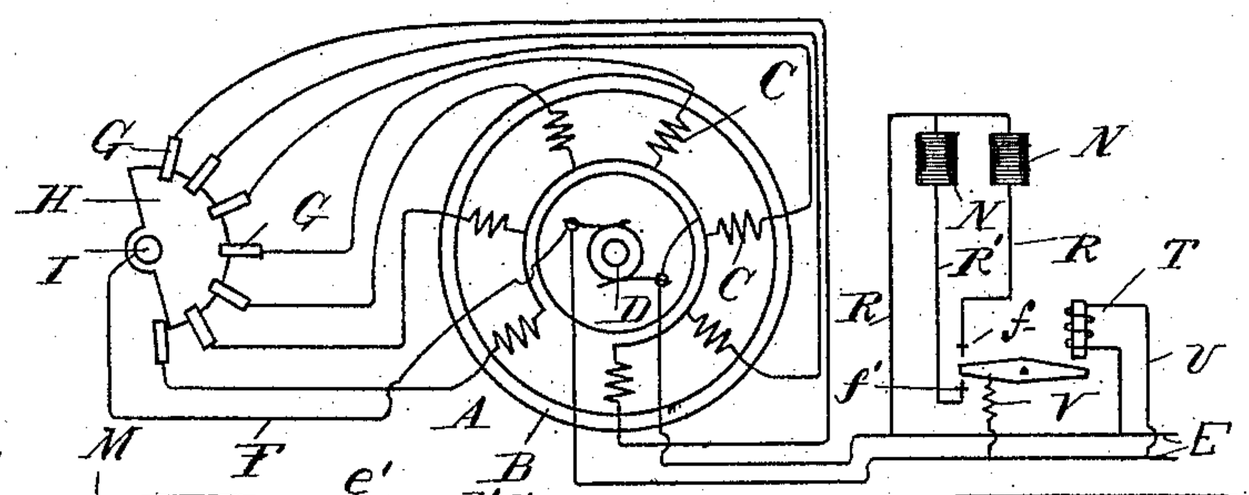


Fig 2.

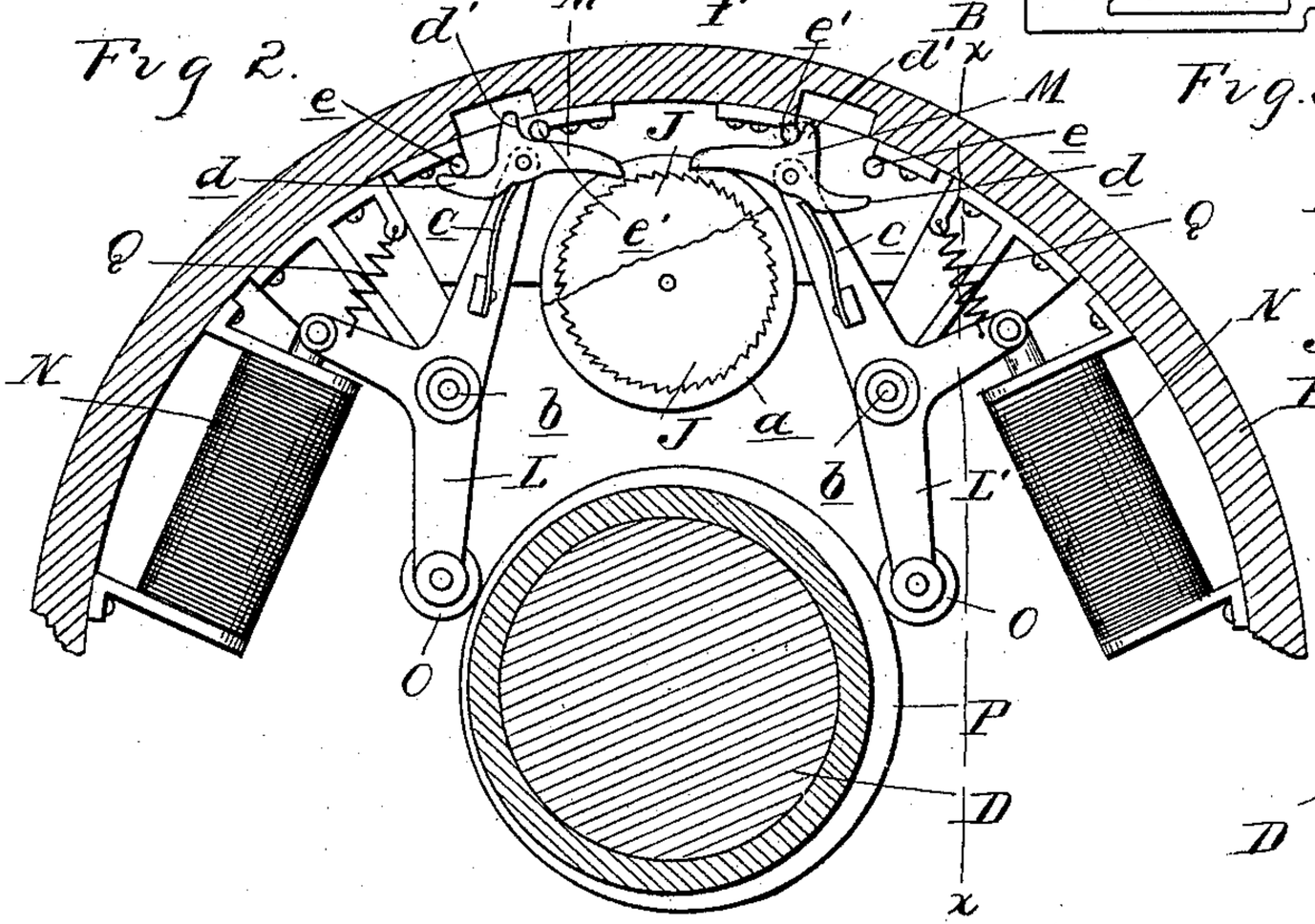


Fig. 3.

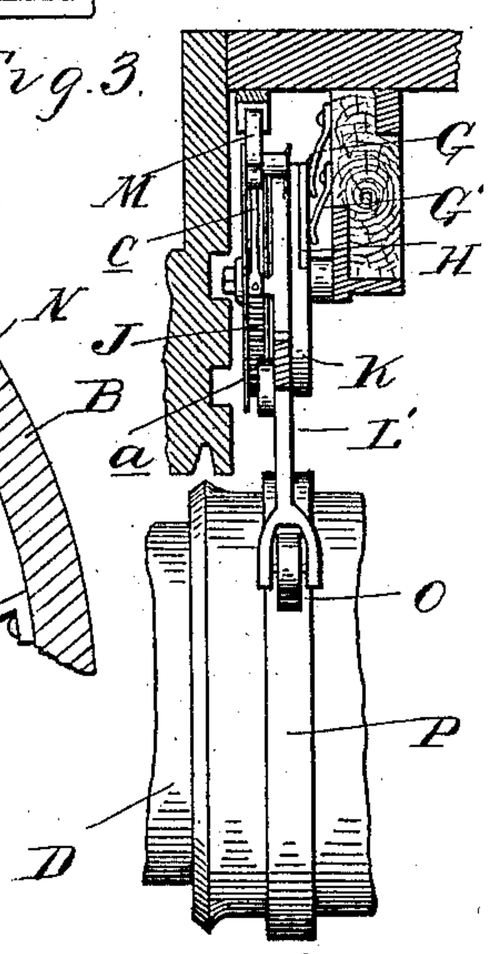


Fig. 4.

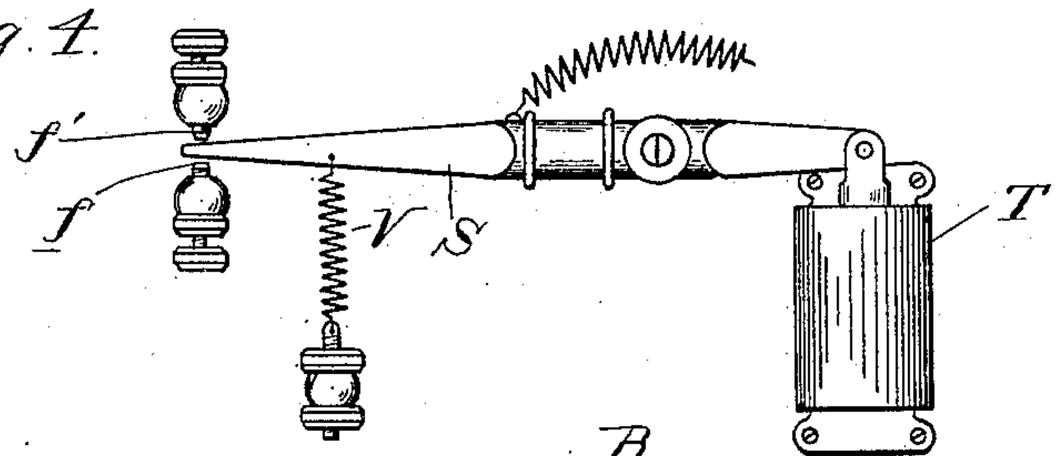


Fig. 5.

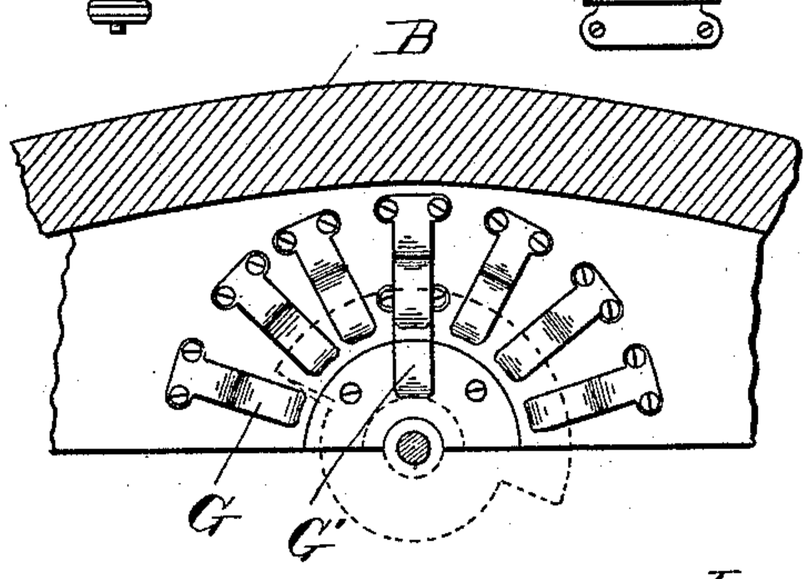
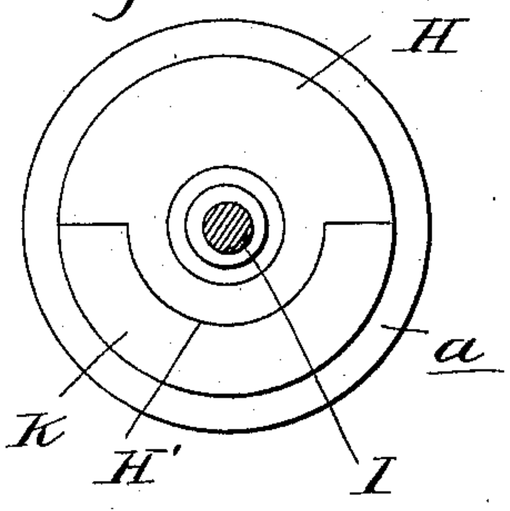


Fig. 6



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UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO THE CONSOLIDATED CAR HEATING COMPANY, OF WHEELING, WEST VIRGINIA.

CURRENT-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 486,644, dated November 22, 1892.

Application filed March 21, 1892. Serial No. 425,754. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. MCELROY, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Current-Regulators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention refers to that class of dynamo-regulating devices in which the electromotive force is kept constant, while the strength of the current is varied by regulating the intensity of the magnetic field in which the armature revolves according to the requirements.

To this end the invention consists in an improved construction and arrangement of parts whereby the number of active field-coils is increased or decreased as the strength of the current in the outer circuit increases or decreases above or below the required strength. This is effected by having the terminals of the field-coils secured to fixed contacts and connected into circuit by a movable segmental contact-plate, so that by adjusting this contact-plate on its pivot the number of active field-coils may be varied. This is done automatically by two pawl-and-ratchet devices adapted to turn, respectively, the contact-plate in opposite directions, so as to lessen or increase the number of active field-coils, according to the requirement. Each pawl-and-ratchet device has a controlling electro-magnet adapted to throw the device into operation upon becoming active by the operation of a regulating electro-magnet, which is effected by the current changes in the circuit which it is intended to regulate.

In the accompanying drawings, Figure 1 is a general diagram plan showing the arrangement of the circuits and the relative location of the different magnets. Fig. 2 is an elevation of the pawl-and-ratchet devices and their controlling-magnets. Fig. 3 is a cross-section on the line *x x* in Fig. 2. Fig. 4 is a detached detail elevation of the regulating-magnet. Fig. 5 is a detached elevation of the fixed contacts and showing the movable contact-plate in dotted lines. Fig. 6 is a detached rear elevation of the double ratchet, showing the contact-plate in elevation.

A represents a dynamo-electric generator; B, its casing or frame; C, its field-coils; D, the revolving shaft which carries the armature; E, the work-circuit of the dynamo; F, the shunt-circuit connecting the field-coils in parallel; G, a circular series of fixed contacts, to which one terminal of each field-coil is connected, and H is a movable contact-plate pivotally secured and adapted, by being turned on its pivot I, to vary the number of active field-coils.

The contact-plate H is secured to a double ratchet-wheel J J, provided with peripheral flanges *a* and with the disk K of insulating material, into which the contact-plate is let in flush, so as to insulate the same and form a smooth surface for the fixed contact-springs G to bear against. The contact-plate is segmental or half-circular with the contact-springs G grouped in relation thereto, so that in one position they all bear on the plate to complete the shunt-circuit through all the fixed coils by means of the contact-spring G′. This spring G′, connected with wire F, bears against a complete circular portion H′ of the contact-plate, whereby it is never thrown out of contact. On opposite sides of the double ratchet-wheel are pivotally secured at *b* the levers L L′, which have three arms and carry each at one arm a feed-pawl M, at another arm the movable core of an electro-magnet N, and at the third arm a loose roller O. The feed-pawl of one lever is adapted to engage into one of the ratchet-wheels and the other is adapted to engage into the other, so as to impart motion in opposite directions thereto by the operation of the levers. Each feed-pawl has a spring *c*, adapted to hold it into gear with the ratchet-wheel, and two projections *d d′* are provided on each pawl, which are adapted to engage with fixed stops *e e′*, whereby the pawls are held out of engagement with the ratchet-wheels in the extreme positions of the levers.

The arm of the levers, which carries the roller O, is adapted to bear and travel on a cam or eccentric P, formed or secured on the shaft D, and the arm which carries the mov-

able core of the electro-magnet is provided with a spring Q, the tension of which is opposed to the attraction of the coil upon the core when the latter becomes magnetic.

The coils of the two magnets N are respectively included in two branches R′ of a branch circuit R. The branches have breaks formed at the adjustable contact-screws *f f′*, to which one terminal of each branch is secured, respectively. Between these contact-screws is located the free end of the armature-lever S, to which is secured the movable core of the regulating-magnet T.

The regulating-magnet T has its coil located in a branch U of the main circuit, and is thereby affected by the current changes in said main circuit. A potential spring V, the tension of which is adjustable, is secured to the armature-lever S to oppose the magnetic attraction of the core.

The armature-lever S is located in a branch of the main circuit, whereby the circuit in R is closed through either one of the two branches R R′ whenever the armature-lever S contacts with either one of the contact-screws *f f′*.

In practice, the parts being arranged as described and shown, they are intended to operate as follows: As long as the current in the outer circuit is of the required strength, the attraction of the movable core of the regulating-magnet T is just balanced by the potential spring V, so that the armature-lever S does not touch either one of the contacts *f f′*. In this condition all the field-coils are active and no current flows through the magnets N. Therefore the springs Q have their tension unopposed and hold both the levers L L′ in an inoperative position, as shown by the lever L′ in Fig. 2. In this position the pawls are also thrown out of contact with the ratchets by the stops *e′*. Now let us suppose the current strength increases sufficiently to overcome the counteracting force of the potential spring V. The break in the circuit R will then be closed at the contact *f′*, and the magnet N becoming energized overcomes the tension of the spring Q and presses the roller O of the lever L against the cam P, and as the cam revolves with the shaft D an oscillating movement will be imparted to the lever L. While the lever L is thus oscillated its pawl engages into the ratchet-wheel and turns it to the right—say, for instance, the width of a tooth—and as the ratchet-wheel carries the contact-plate the latter will gradually cut out one field-coil after another until the current again drops down to normal as a result of the decreased strength of the field. Should the current drop below its normal strength, the armature-lever S contacts with *f*, and as a result the lever L′ is thrown into gear and the ratchet-wheel and contact-plate are turned back, so as to cut in more field-coils until the current becomes again normal. The movement of the contact-plate is so gradual and step by step that it will not produce sudden fluctuation in the current, and as the revolving armature-shaft furnishes the power for actuating the device there can be no question of the prompt operation, which is a decided advantage over such regulating devices in which the current itself furnishes the motive power. It will also obviously be seen that if it should be desired, the range of regulation for each pawl-lever may be well defined by providing the ratchet-wheels only with teeth for that portion of their peripheries through which they have to turn to adjust the contact-plate within the limits required.

As my device dispenses with the bulky resistance-box, is perfectly automatic, and is a very simple and compact piece of machinery without delicate parts, and therefore does not require the constant care and attention which is found necessary in the case of electrically-operated pressure-regulators, it is especially well adapted and principally devised by me for certain applications—as, for instance, in connection with generators placed on the axle of a truck or below a car-body, as is the usual custom in electric train-lighting systems. In such application my device may be inclosed in and secured to the casing which incloses the generator, and I have shown it so arranged and secured in the drawings, which show it placed close to one head of the casing, where it requires but little room and may be readily examined by making said head removable or providing it with an opening having a removable cover.

It is obvious that the field-coils may be subdivided so as to fractionally cut the field-coils in and out of circuit, and it is also obvious that the motor devices described by me may be applied to other methods of regulations in which there are movable contacts.

What I claim as my invention is—

1. In a current-regulator having fixed contacts and a movable contact, the combination of a rachet-wheel carrying said movable contact, two pawls adapted to actuate the same in opposite directions, respectively, by the movement of the armature, a spring for each pawl, arranged to normally hold each pawl out of gear with the ratchet-wheel, an electro-magnet for each pawl, arranged to throw such pawl into gear upon becoming active, an electric circuit including said magnets in two normally-open branches thereof, means for moving the pawls, and means for closing said circuit through one or the other of said branches upon an increase or decrease from the normal strength in the circuit of the generator, substantially as described.

2. In a current-regulator having fixed and movable contacts, a ratchet-wheel carrying said movable contact, two oscillating levers carrying pawls adapted to engage with and turn said wheel in opposite directions, respectively, a cam on the shaft of the armature of the generator to actuate said levers, fixed stops arranged to throw the pawls out of gear in the extreme positions of their levers, springs to normally hold each lever in

its extreme position out of engagement with the cam, electro-magnets having movable cores attached to said levers to throw the same into position upon becoming energized, a circuit divided into two normally-open branches into which said magnets are included, and means for closing said circuit through one or the other of said branches, respectively, upon an increase or decrease from the normal current strength in the circuit of the generator, substantially as described.

3. In a current-regulator, the combination of the segmental circular series of fixed contact-springs, the contact-plate pivotally secured in the center of said series of field-contacts and provided with an outer segmental portion adapted to variably contact with said fixed contact-springs, an inner circular portion on said contact-plate, and a single contact-spring contacting therewith, substantially as described.

4. In a current-regulator, the combination, with an electric generator provided with field-coils in multiple shunt connection with the circuit of the dynamo, of fixed contacts, one for each field-coil, grouped in segmental circular series around a common center, a ratchet-wheel journaled in said center, an insulating-disk secured to said ratchet-wheel, a metallic contact-plate let into said insulating-disk flush therewith and provided with an outer segmental portion adapted to variably contact with the fixed contact-springs and the inner circular portion, a single contact-spring contacting with said circular portion, and means for actuating the ratchet-wheel step by step in one direction or the other by variations in the normal current strength of the dynamo, substantially as described.

5. The combination, with a generator provided with field-coils in multiple shunt connection with the circuit of the dynamo, of a current-regulating device actuated by the revolving shaft of the armature for varying the number of active field-coils and comprising the segmental circular series of fixed contacts G, and a segmental circular contact-plate H in said shunt-circuit, the double ratchet-wheel J, carrying said movable contact-plate, the oscillating levers L L′, carrying pawls M, adapted to engage with and turn said ratchet-wheel in opposite directions, respectively, the eccentric P on the shaft of the amature actuating said levers, the fixed stops E E′, the springs Q for throwing the levers out of gear, the electro-magnets N, having movable cores secured to the levers, the circuit R, having branches R′ in which said electro-magnets are located, and means for closing the circuit through one or the other of said branches by fluctuations in the current strength of the circuit of the dynamo, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES F. McELROY.

Witnesses:
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JOHN B. BRAIDWOOD.