(No Model.)

J. A. WILLIAMS.

ELECTRIC CURRENT REGULATOR.

No. 450,985. Patented Apr. 21, 1891.

Fig. 1.

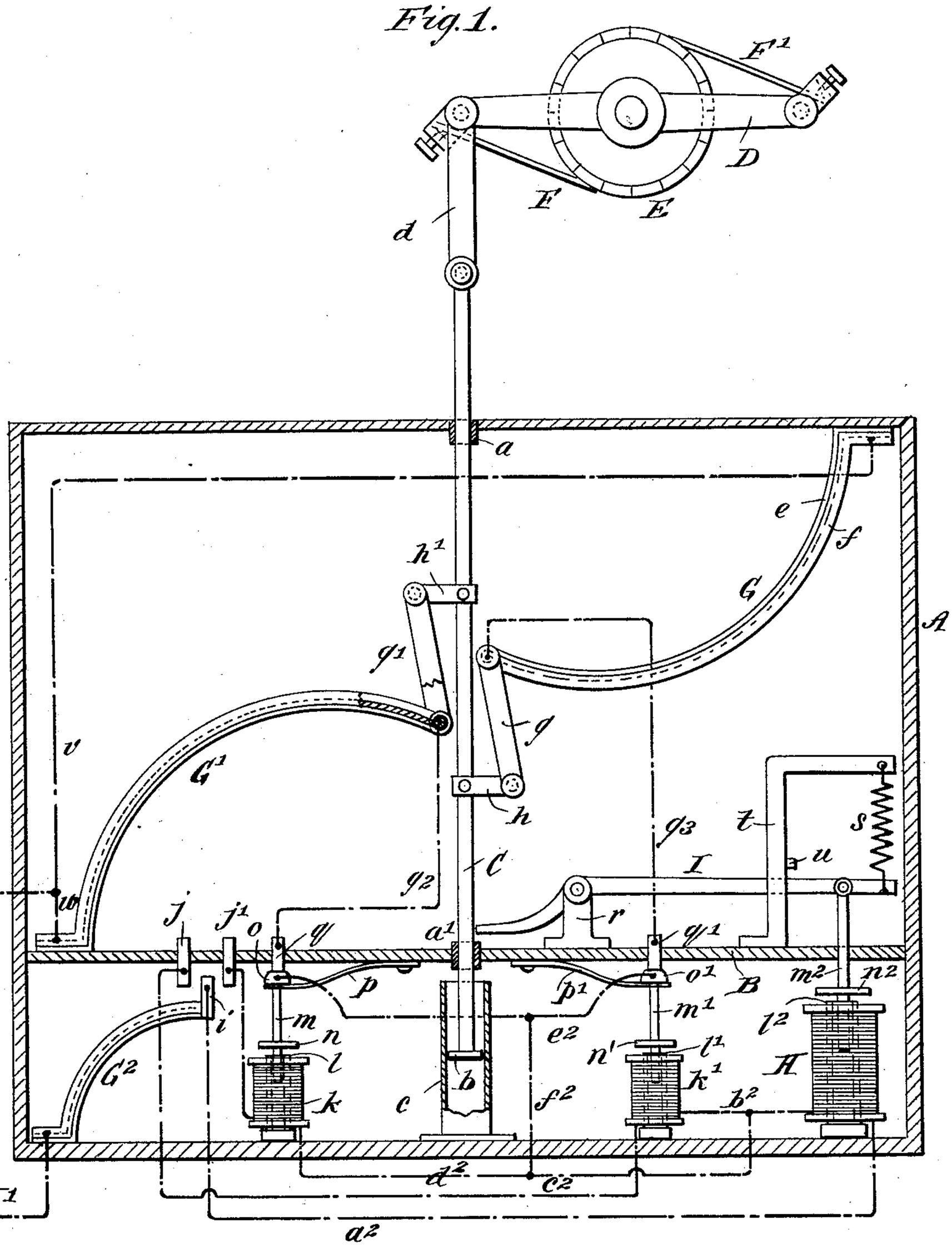
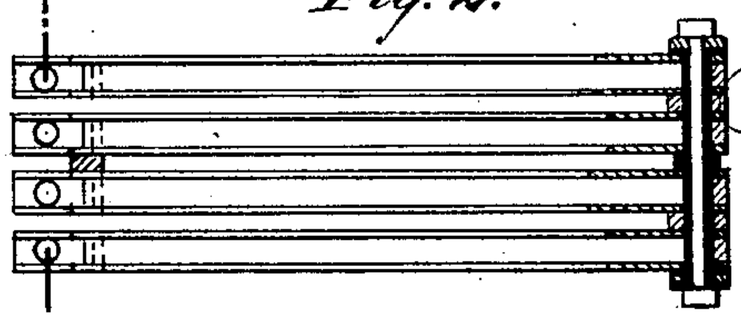


Fig. 2.



WITNESSES:

Donn Twitchell

C. Sedgwick

INVENTOR:

J. A. Williams

BY

Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOSEPH ARCHIBALD WILLIAMS, OF CLEVELAND, OHIO.

ELECTRIC-CURRENT REGULATOR.

SPECIFICATION forming part of Letters Patent No. 450,985, dated April 21, 1891.

Application filed November 15, 1890. Serial No. 371,560. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH ARCHIBALD WILLIAMS, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and Improved Current-Regulator, of which the following is a specification, reference being had to the annexed drawings, forming a part thereof, in which—

Figure 1 is a side sectional elevation of my improved current-regulator; and Fig. 2 is a side elevation, partly in section, of a series of connected compound bars.

Similar letters of reference indicate corresponding parts in both views.

The object of my invention is to construct a current-regulator for attachment to dynamos for regulating the current by moving the brushes toward or away from the neutral line.

My invention consists in the combination of a compound thermostatic bar with the circuit-wires of a dynamo, a pair of compound thermostatic bars oppositely arranged with respect to each other, connected with the movable brush-holding bar, and current-shifting devices arranged to throw the current into one or the other of the secondary compound thermostatic bars.

The casing A, which contains the working parts of my improved regulator, is provided with a horizontal partition B, which, together with the casing, is preferably made of insulating material. At or near the center of the casing there are guides *a a'*, through which passes the rod C. The lower end of the rod C is provided with a piston *b*, fitted to a dash-pot *c*, secured to the bottom of the casing A. The upper end of the rod C is connected by a link *d* with the movable brush-holding bar D, the pivotal point of which is coincident with the axis of the commutator-cylinder E. The bar D carries the brushes F F', which bear upon the periphery of the commutator-cylinder E.

To the top of the casing A is attached a curved compound thermostatic bar G, formed of two bars of metal of unequal expansibility, preferably of a bar *e* of iron and a bar *f* of brass, fastened together by brazing or riveting. To the free end of the compound thermostatic bar G is pivoted a link *g*, which is pivotally connected with an arm *h*, attached to the rod C. To the horizontal partition B is secured a compound thermostatic bar G', like that already described, but oppositely arranged in respect to its position in the casing. The free end of the thermostatic bar G' is connected by a link *g'* with an arm *h'*, attached to the rod C.

To the floor of the casing A is attached a curved compound thermostatic bar G^2, similar to those already described, but made smaller and provided at its free extremity with a contact-piece *i*, which projects upwardly between two contacts *j* and *j'*, held by the horizontal partition B in the path of the said contact *i*.

To the floor of the casing A at one side of the dash-pot *c* is secured an electro-magnet *k*, provided with a tubular core *l*, to which is fitted the rod *m*, provided with the armature *n*. The upper end of the rod *m* is furnished with a head *o*, which rests upon a curved spring *p*, attached to the under surface of the horizontal partition B. In the said horizontal partition, above the head *o*, is arranged a contact-piece *q*. On the opposite side of the dash-pot *c* is arranged a magnet *k'*, which is provided with the tubular core *l'*, to which is fitted the rod *m'*, carrying the armature *n'* and head *o'*, as in the other case, which is forced by the spring *p'* against the contact-piece *q'*.

The larger magnet H, secured to the floor of the casing A, is furnished with a tubular core l^2, to which is fitted a rod m^2, carrying an armature n^2, and the rod m^2 extends up through an aperture in the horizontal partition B, and is pivotally connected with the lever I, fulcrumed in the standard *r*, attached to the top of the horizontal partition B. The shorter arm of the lever I is curved downwardly and extends toward the rod C, while the longer arm, to which the rod m^2 is pivoted, is connected with the lower end of a spring *s*, the upper end of which is attached to a bracket *t*, secured to the horizontal partition B. The said bracket is provided with a stop *u* for limiting the upward movement of the longer arm of the lever I.

The wire J from the dynamo is connected with the compound thermostatic bars G G' by the wires *v w*. The wire J' from the dynamo is connected with the fixed end of the com-

pound thermostatic bar G^2, and the free end of the said compound thermostatic bar is connected by a wire a^2 with one terminal of the magnet H. The remaining terminal of the magnet H is connected by a wire b^2 with one terminal of the magnet k', the other terminal of which is connected by the wire c^2 with the contact-piece j. The contact-piece j' is connected with one terminal of the magnet k, and the remaining terminal is connected by the wire d^2 with the wire b^2, connected with the magnets H k'. The heads o o' of the rods m m' are connected by the wire e^2, and the wire e^2 is connected with the wire d^2 by the wire f^2. The contact-piece q is connected by a wire g^2 with the free end of the compound thermostatic bar G', and the contact-piece q' is connected by a wire g^3 with the free end of the compound thermostatic bar G.

When the current in the dynamo is normal, the contact i, carried by the end of the compound thermostatic bar G^2, occupies an approximately central position between the contact-pieces jj'; but when the current increases beyond the prescribed limit the compound thermostatic bar G^2 is heated and thrown over, so that the contact i touches the contact-piece j' and closes the circuit of the magnet k, thereby drawing down the armature n and breaking the circuit between the head o and contact q, thus causing the current to cease through the compound thermostatic bar G', and allowing the greater part of the current to flow through the magnet k and the wire d^2, and the whole current flows through the wires f^2 e^2, head o', contact q', and wire g^3 to the compound thermostatic bar G, thence through the wire v to the conductor J; and at the same time that the contact-piece i on the free end of the compound thermostatic bar G^2 is in contact with the piece j' the current divides at the points of contact in the ratio of the resistances of the magnet k and H, respectively, and as the whole current would be divided part would be shunted from the magnet H through the magnet k, which would reduce the power of the magnet H sufficiently to allow the tension of the spring s to raise the lever I and depress its shorter arm, thereby freeing or unclamping the rod C and leaving it free to move.

The current flowing through the compound thermostatic bar G will heat it, causing its free end to ascend, while the cessation of the current through the compound thermostatic bar G' will allow the bar to cool, contract, and curve upward, so as to act in conjunction with the bar G, thus moving upward the rod C, tilting the brush-arm D, and moving the brushes away from the neutral point or points of maximum current. The current being thus diminished, the compound thermostatic bar G^2 will cool down and break the electric contact between its free end and the contact j', when the rod m will be returned to its normal position and the whole current will flow through both thermostatic bars G G' alike. It will also flow through the magnet H, causing its armature n^2 to be drawn down, thus bringing the shorter arm of the lever I into contact with the rod C, binding it firmly in its position so long as the whole current flows through the magnet H.

When the current passes below the normal, the compound thermostatic bar G^2 cools and straightens more or less, bringing its free end into contact with the point j, when the current will pass through the magnet k', drawing down the armature n', thus breaking the circuit between the head o' and contact-point q', causing the current to pass through the compound thermostic bar G', and causing it to cease in the bar G, when the clamping device will now unclamp the rod C, and the said thermostatic bar G will cool, and its free end will move downward, while the thermostatic bar G' will heat and tend to curve in toward its fixed end, and both thermostatic bars together will move the rod C downward, thereby carrying the brushes toward the point of maximum current.

The operation of breaking the circuit at either contact-piece q or q' shunts the current partly from the magnet H and releases the rod C, thus allowing the spring s to lift the longer arm of the lever I, and whenever the current is restored by the head o or o' coming into contact with the contact-pieces q q' the whole current is restored in the magnet H and the rod C is again clamped in position.

Where a single compound thermostatic bar G or G' is insufficient for moving the brushes, or where the current does not produce in a single compound thermostatic bar sufficient heat for securing the required motion, a number of thermostatic bars G are arranged in series, as shown in Fig. 2, being connected electrically alternately at opposite ends, so that the current is compelled to pass up and down through the entire series.

In lieu of the curved compound thermostatic-bars G G', I may in some cases use curved bars of spring metal. Therefore I do not limit or confine myself to the exact construction herein shown.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric-current regulator, the combination, with the movable brush-holder of a dynamo, of two thermostatic bars oppositely arranged with respect to each other and connected with the brush-holder, and mechanism for shifting the current from one bar to the other, substantially as specified.

2. In an electric-current regulator, the combination, with the brush-holder of a dynamo, of two thermostatic bars oppositely arranged with respect to each other and connected with the brush-holder, and an auxiliary thermostatic bar for directing the current through either of the brush-moving bars, substantially as specified.

3. In an electric-current regulator, the com-

bination, with the brush-moving rod, of an electrically-operated clamping-lever for clamping the brush-moving rod when the current is normal, substantially as specified.

4. In an electric-current regulator, the combination, with the oppositely-arranged thermostatic brush-moving bars, of an auxiliary thermostatic bar for controlling the direction of the current in the regulator, and two circuit-breaking electro-magnets controlled by the auxiliary thermostatic-bar, substantially as specified.

5. In a current-regulator, the combination of the rod C, provided with the piston *b*, the dash-pot *c*, the compound thermostatic bars G G′, the auxiliary compound thermostatic bar G^2, the magnets *k k′*, rods *m m′*, provided with the armatures and head, as described, the springs *p p′*, and the electrical connections, substantially as specified.

6. In a current-regulator, the combination of the rod C, provided with the piston *b*, the dash-pot *c*, the bars G G′, the auxiliary compound thermostatic bars G^2, the magnets *k k′*, the rods *m m′*, provided with the armatures and head, as described, the springs *p p′*, the electrical connections, the magnet H, armature n^2, and the lever I, substantially as specified.

JOSEPH ARCHIBALD WILLIAMS.

Witnesses:
J. W. SMITH,
Z. M. HUBBELL.