(No Model.) 4 Sheets—Sheet 1.

C. W. HOLTZER & G. E. CABOT.

ELECTRIC REGULATOR.

No. 464,136. Patented Dec. 1, 1891.

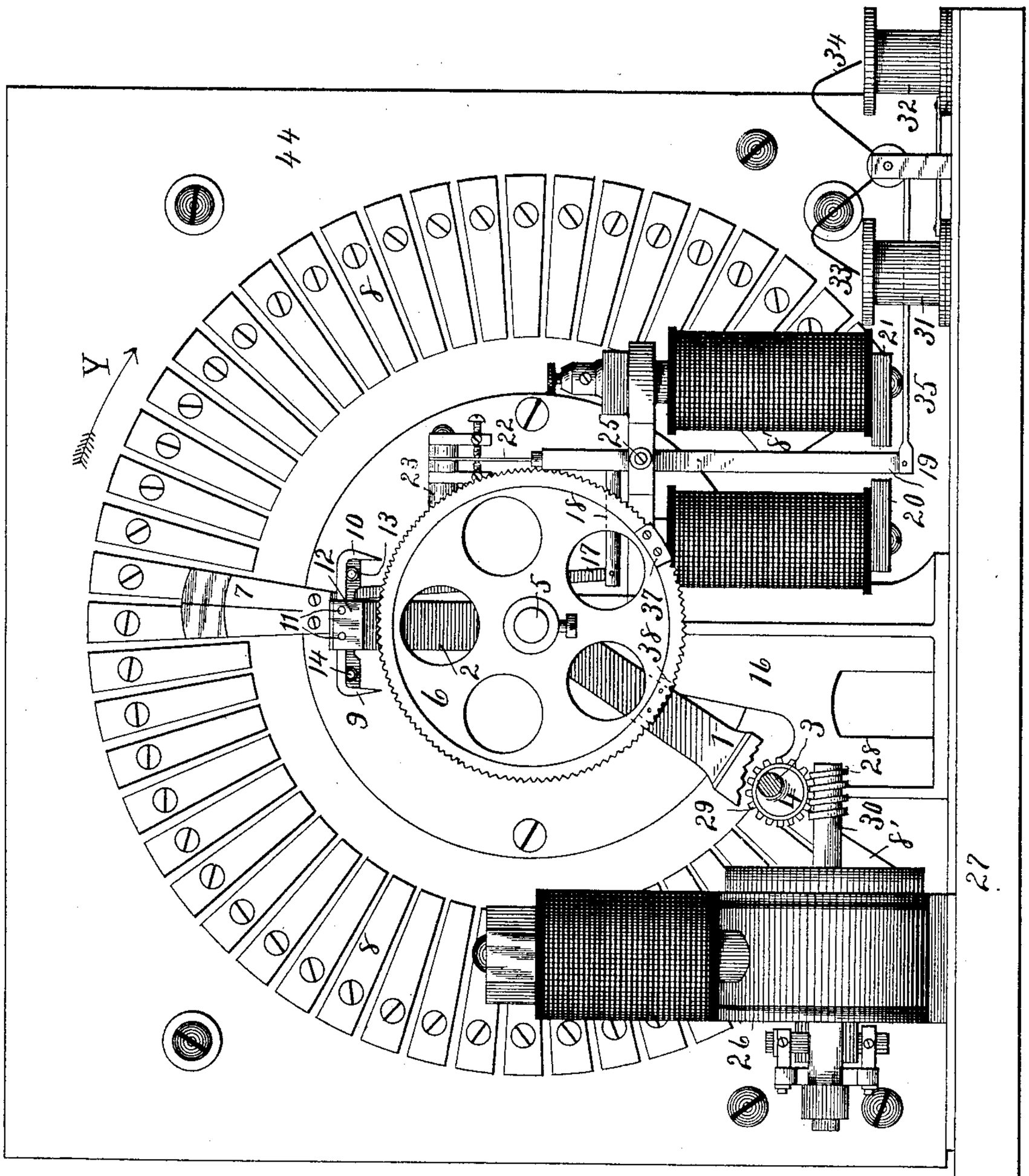

Fig. 1.

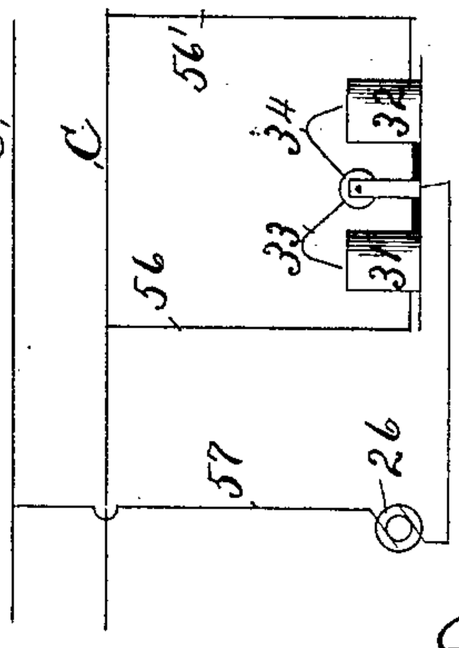

Fig. 1a.

Witnesses

W. F. Courtland

Nellie L. Pope

Inventors

C. W. HOLTZER

G. E. CABOT

BY THEIR ATTORNEY

Edward P. Thompson.

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Fig. 2.

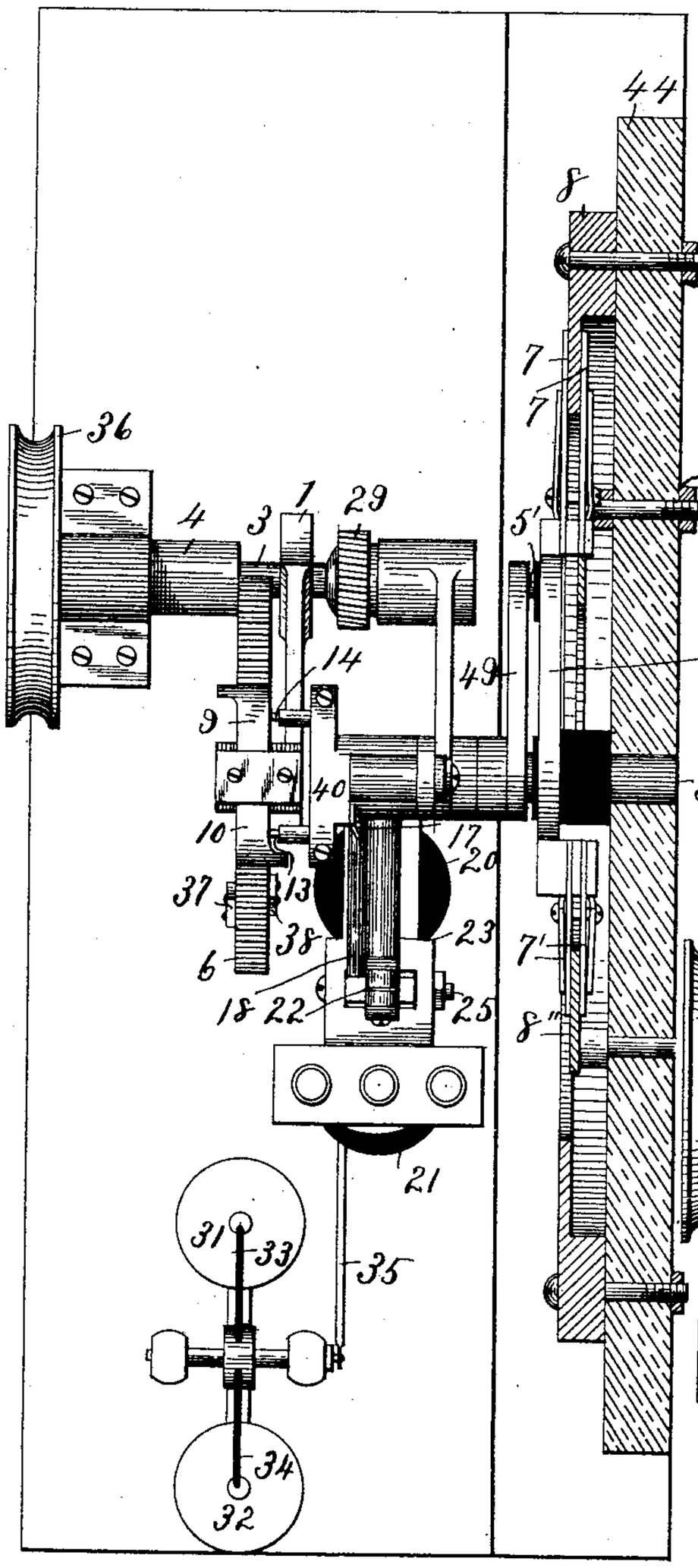
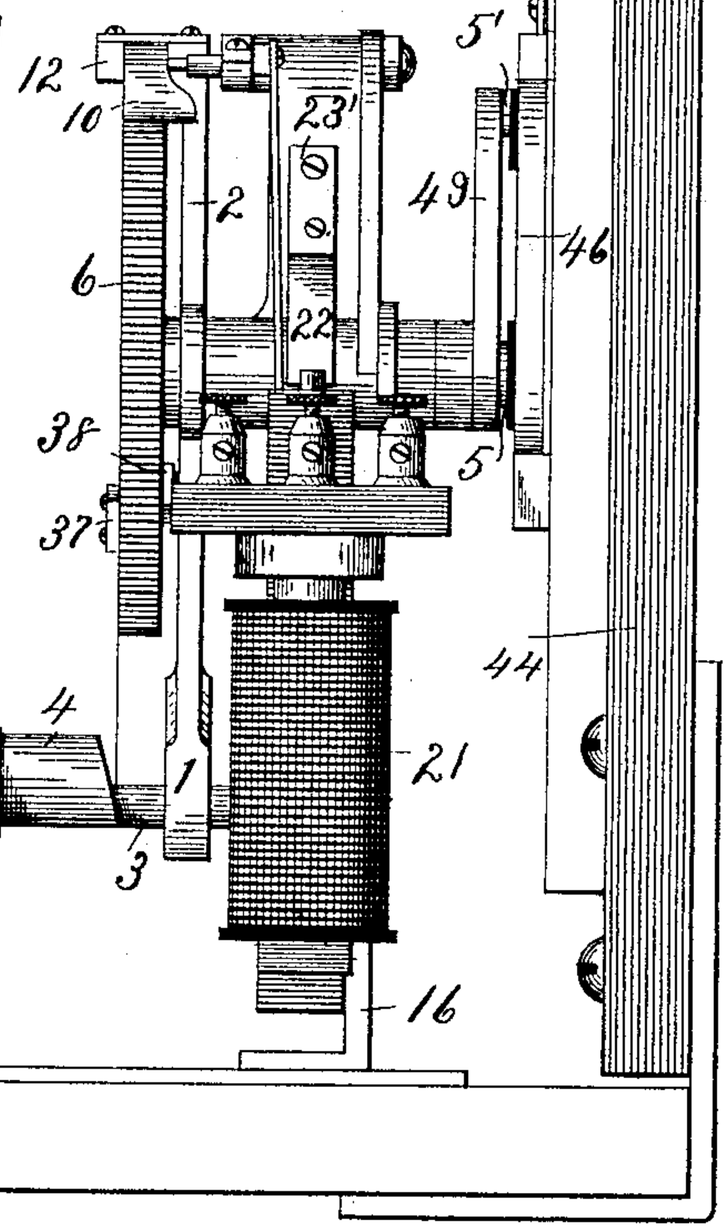


Fig. 3.



Witnesses:

W. A. Courtland

Nellie L. Pope.

Inventors

C. W. HOLTZER

G. E CABOT

BY THEIR ATTORNEY

Edward P. Thompson

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C. W. HOLTZER & G. E. CABOT.

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Fig. 4.

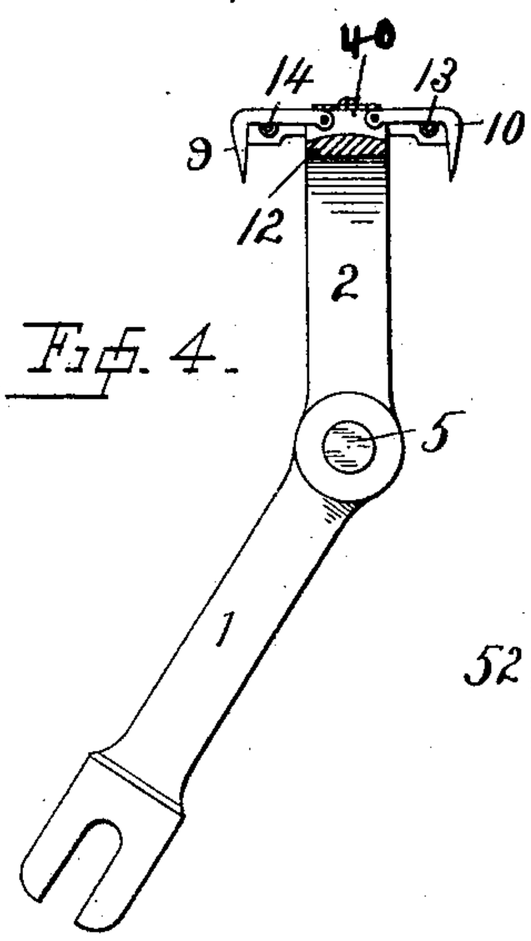


Fig. 5.

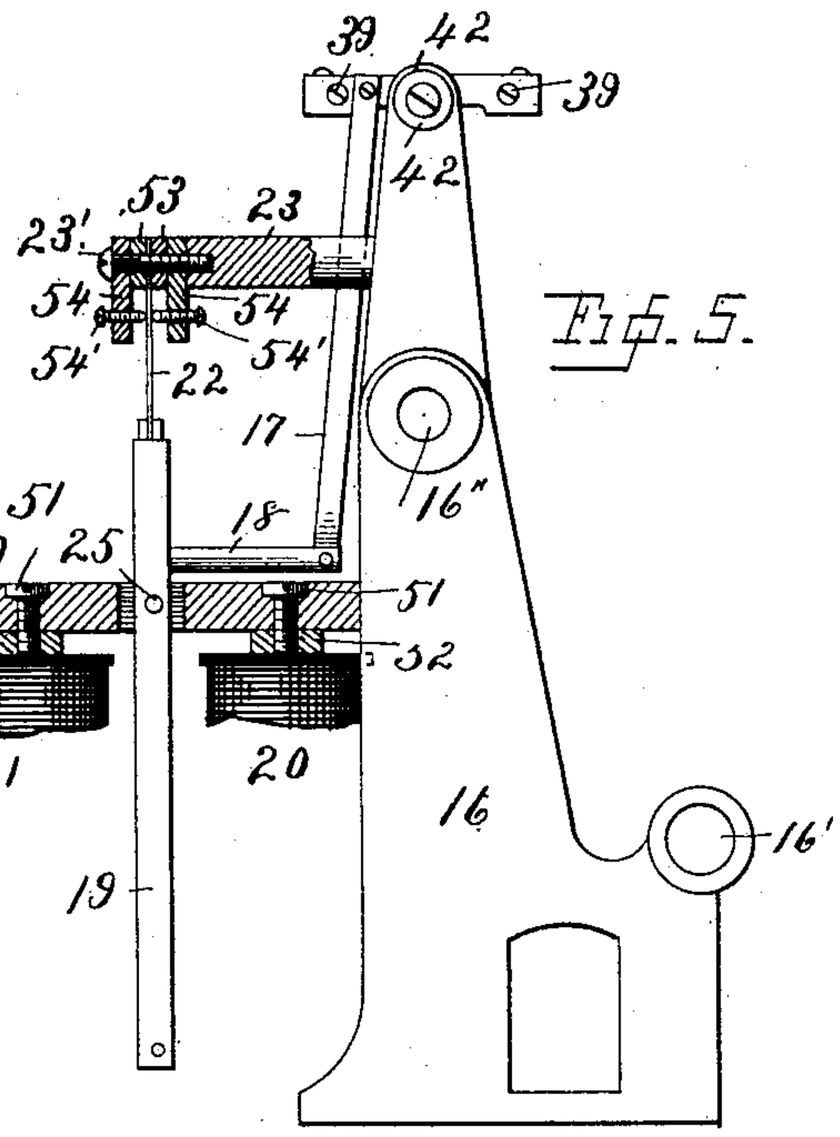


Fig. 6.

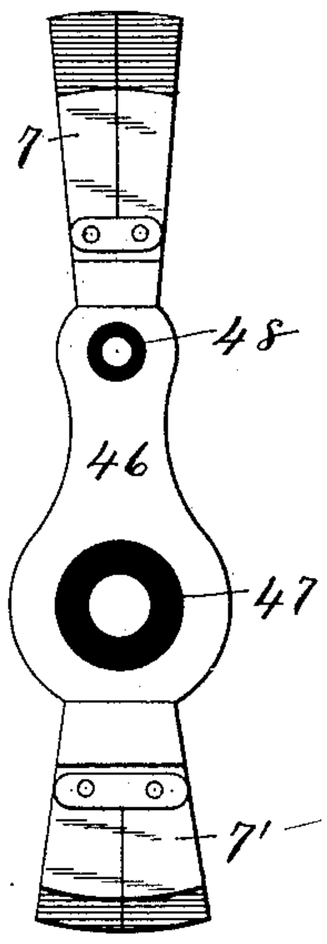
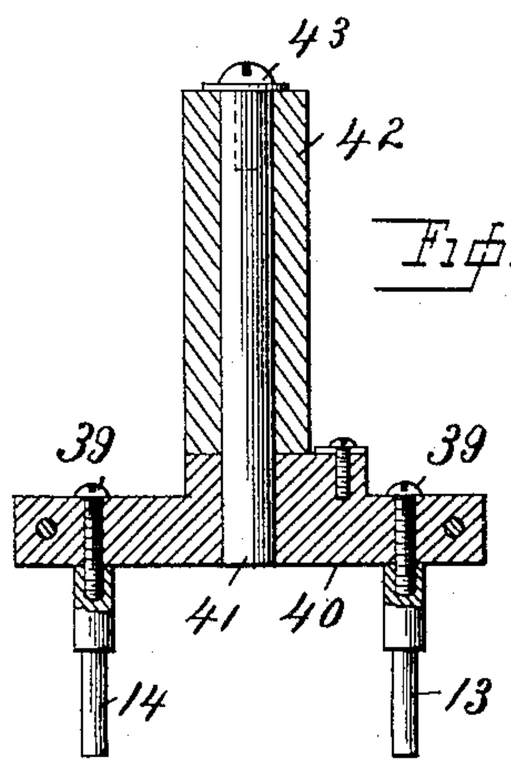


Fig. 7.



Witnesses

W. H. Courtland

Nellie L. Pope.

Inventors
C. W. HOLTZER
G. E. CABOT
BY THEIR ATTORNEY
Edward P. Thompson

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C. W. HOLTZER & G. E. CABOT.

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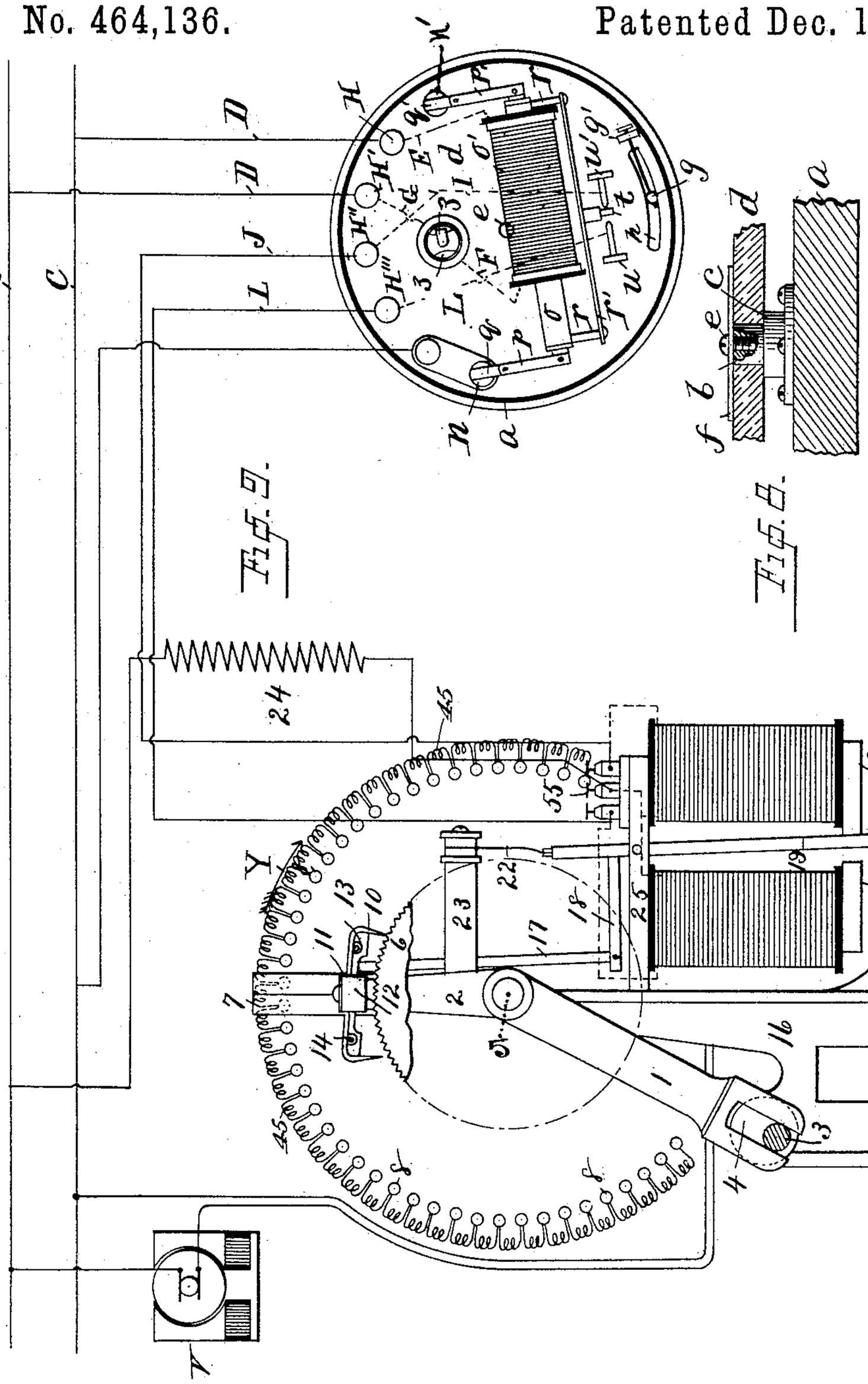

Witnesses

W. F. Courtland

Nellie L. Pope

Inventors

C. W. HOLTZER

G. E. CABOT

THEIR ATTORNEY

Edward P. Thompson

UNITED STATES PATENT OFFICE.

CHARLES W. HOLTZER AND GEORGE E. CABOT, OF BROOKLINE, ASSIGNORS TO THE HOLTZER-CABOT ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

ELECTRIC REGULATOR.

SPECIFICATION forming part of Letters Patent No. 464,136, dated December 1, 1891.

Application filed April 3, 1891. Serial No. 387,492. (No model.)

To all whom it may concern:

Be it known that we, CHARLES W. HOLTZER and GEORGE E. CABOT, citizens of the United States of America, and residents of Brookline, county of Norfolk, and State of Massachusetts, have invented certain new and useful Improvements in Electric Regulators, (Case 5,) of which the following is a specification.

Our invention relates to a device for operating a rheostat in an electric light or power station in such a manner as to maintain a uniform electro-motive force in the current on the main line by including and excluding resistances, according to the nature of the variation of the electro-motive force.

The object of the invention is to obtain not only a practical but commercially efficient and durable and positively automatic regulator.

The full working device as constructed by us is represented in every detail in the accompanying drawings, and the manner of operating it is explained.

Figure 1 is a front elevation, Fig. 2 a plan partly in section, and Fig. 3 a side elevation, of the device. Fig. 1^a is a diagram of the electrical connections of the small motor forming an adjunct to the regulator. Figs. 4, 5, 6, and 7 are details, Fig. 4 being the bent lever in front elevation with certain parts attached thereto, partly in section; Fig. 5, a front elevation of the standard for holding the mechanism together, with other elements, partly in section, showing what is not conveniently brought out in the other figures; Fig. 6, the brush-holder for the rheostat in front elevation, shown entirely by itself, but partly hidden in the other figures; and Fig. 7, a horizontal section of the means for adjusting the brushes. Fig. 8 is a section of the pivot and certain adjuncts forming a part of the device at the right part of Fig. 9, which is a diagram for the purpose of explaining the operation of the device.

V is a dynamo in circuit with the main line C C'. It is in circuit with the resistances 45. A bent lever has arms 1 and 2, the former being the longer and provided with a slot in its end fitting loosely over a crank-pin 3 on the rotary shaft 4. The fulcrum of the lever is the rotary arbor 5, which is fixed to the ratchet-wheel 6, while the lever is loose upon said shaft. The brush 7 for cutting in and out resistances, whose terminals are 8, is also fixed upon the arbor 5, so as to be rotary therewith. The outer or upper end of the lever-arm 2 carries ratchets 9 and 10, pivoted thereto by pivots 11. Upon the standard 12 is a rocking beam 40, carrying stops 14 13, upon which rest, respectively, the ratchets 9 and 10. The pivot 41 serves to support the rocking beam 40 upon the standard 16. These details are shown plainly and enlarged in Fig. 7. The bearing 42, which holds the pivot or arbor 41, is carried on top of the standard 16, as shown in Fig. 5. There is a connecting-rod 17 from the beam 13 to an arm 18, projecting at right angles to the pivoted armature 19, located between the independent magnets 20 and 21. The armature has a retractile spring 22 connected to the standard 23. One of the magnets is connected in circuit with terminals t and u and the others with terminals t' and u'. In either case the armature 19 is drawn to one side or the other. As shown, the magnet 21 has attracted the armature, whereby the ratchet 10 is allowed to fall between the teeth on the ratchet-wheel 6. As the shaft 4 has continuous rotation, the vibratory motion of the lever-arm 2, and therefore of the ratchet 10, causes the ratchet-wheel 6 to rotate and the brush 7 to move in the direction of the arrow Y intermittently, but quite rapidly. If the magnet 20 attracts the armature, the brush will move in the opposite direction. If both magnets are out of circuit the ratchets 9 and 10 clear the teeth and the brush 7 does not move. The terminals 8 may be connected to resistances as in any rheostat.

24 is a resistance in circuit with the magnets, whereby the magnets may not receive an injurious current.

25 is a pivot for the armature 19.

26 is an electric motor mounted upon the base-plate of the device 27 and geared to the shaft 4 by screw-gearing, of which the two gears are 28 and 29, the former being on the shaft 30 of the motor and the latter on the shaft 4.

31 and 32 are mercury-cups, and 33 and 34 are pivoted electric contacts connected by a connecting-rod 35 to the armature 19.

In Figs. 2 and 3 the motor is omitted, being replaced by a pulley 36, which may be driven by a belt.

37 and 38 are stops mounted upon the wheel 6 in order to prevent complete rotation thereof. They are placed about the same angle apart as the end terminals 8′ of the rheostat, so that the brush 7 may not move too far. The stops 13 and 14 are fastened by screws 39 to beam 40, which is mounted upon and fastened to the arbor 41, rotary in the bearing 42, being prevented from longitudinal motion by the screw-head 43. The bearing 42 is carried at the top of the standard 16. The brush 7 presses upon one set of rheostat-terminals 8, while the brush 7′ is in contact with the other pole 8′ of the rheostat. The brushes 7 and 7′ are in duplicate, resting upon opposite surfaces of the terminals 8 and 8″, which stand out at a distance from the insulating-plate 44, which carries said terminals, which are electrically connected to the resistances 45 in the manner usually adopted in the construction of rheostats. The brush-holder 46 has two insulating-rings 47 and 48, through which pass, respectively, the arbor 5 and the pin 5′, which projects from the crank-arm 49, the same being fixed to the shaft 5. The projecting pin 5′ extends partly through the ring 48, but is out of contact with any metallic part of the brush-holder, and so is the shaft 5. The magnets 20 and 12 are suspended from a cross-bar 50, in which there is an aperture for the passage of the armature 19 and to which is pivoted said armature. Screws 51 pass down through the cross-bar and screw into the cores 52 of the magnets. The retractile spring 22 is permanently secured to the projection 23 by a screw 23′ between plates 53. Upon opposite sides of the said spring are projections 54′, pointing toward each other and toward the spring 22, whereby the armature may be adjusted by the proper manipulation of the screws 54′. If these screws are brought with pressure against the spring 22, they form a point as a fulcrum for the spring. A standard or frame 16 has a hole 16′, forming a bearing for the shaft 4, a bearing 16″ for the shaft 5, and a bearing 42.

The device in circuit with the electric regulator and represented at the right hand of Fig. 9 and in Fig. 8 is described as follows, the same consisting of a base-plate *a*, the said base-plate having a cylindrical bearing formed therein; a journal *b*, attached centrally to the said base within said basin and having a shoulder *c* at the foot of said journal; a circular insulator or insulating-plate *d*, fitting loosely in said base-plate, resting upon said shoulder and rotary upon said journal, the said plate having a central hole in which fits loosely said journal, which has a screw *e* screwed into itself and through a washer *f*, resting upon the top of the plate *d*; a post *g*, standing upon the base *a* within the basin at a suitable distance from the center thereof and passing through an arc-shaped slot *h*; a post *g′*, mounted upon the plate *d* near said slot and provided with a circular hole, through which passes a screw *i*, which is pivoted to the upper end of the post *g*; posts *n* and *n′*, perpendicular to and mounted upon the rotary plate *b* in the chord of a circle bounding the plate *d*, said chord being located above the center of the plate *d*. A solenoid-core *o* is suspended from the posts *n* and *n′* by suspending-rods *p* and *p′*, built up of parallel plates whose ends are pivoted, respectively, to said core and to projections *q q′*, which extend downward from said posts *n n′*. Surrounding the core *o* is a solenoid *o′*, whose axis is coincident with or parallel to that of the core *o*. Upon each end of the core *o* is a post *r*, which carries a projection *t*, having contact-surfaces. The projection is between two contact-screws *u u′*, which are thumb-screws.

z z′ are the terminals of an electric-lamp socket, which may hold a lamp to serve as a resistance to lessen the current passing through the solenoid from the main lines C C′, the former being connected by wire D to the binding-post H, which is connected by wire E to one terminal of the solenoid *o′*. The other terminal is connected by wire F to the terminal *z* of the socket. The terminal *z′* is connected by wire D′ to the main line C′ through the binding-post H′. The screw *u′* is connected by wire I to the binding-post H″, which is connected by wire J to the magnet 21. Similarly the screw *u′* is connected by wire L to the binding-post H‴ and to the magnet 20, the common terminal 55 of the magnets being connected to resistance 24 and to the main line C.

If the armature 19 is moved to the right, the contact 33 enters the mercury in the cup 31 and closes a circuit through the motor 26 by passing through wires 56 and 57. If the armature is attracted to the magnet 20, the contact 34 enters the mercury in the cup 32, so that the motor 26 is also included in circuit through wires 56′ and 57, so that the bent lever, of which the arms are 1 and 2, will vibrate as soon as the core *o* is influenced by an abnormal current, and at the same time one of the ratchets 9 or 10 will feed the wheel 6 and move the brush 7 to vary the number of resistances 45 in the proper manner. The brush 7 has a motion made up of intermittent motions and is of such a width as to compass two terminals 8. The spring 22 serves to maintain the armature 19 in a vertical position in addition to the force of gravitation, which evidently forms the greater portion of the retractile force.

The shaft 4 should be made to rotate at the rate of about two hundred revolutions per minute. The teeth on the wheel 6 are shown pointed; but we prefer in practice to use ordinary gear-wheel teeth. It does no harm,

but is even advantageous for quicker action to rotate the shaft 4 without interruption.

We claim as our invention—

1. The combination, with a dynamo or electric motor, of a rheostat in circuit therewith, adjustable contacts or brushes in circuit with more or less of the terminals of said rheostat, an armature controlling the movement of said brushes, magnets for said armature included in independent electric circuits normally open, a solenoid in circuit with said dynamo or motor, a pivoted core in said solenoid and carrying a circuit-closer for said magnets, and a vertical rotary base-plate carrying said solenoid and adjustable at different angles in the plane of said plate, for the purpose set forth.

2. The combination, with the brushes of a rheostat, of a rotary arbor attached thereto, a vibratory bent lever pivoted upon said arbor, a ratchet-wheel fixed upon said arbor, ratchets normally out of gear with said wheel and resting upon movable stops, magnets provided with a common pivoted armature, a connecting-rod joining said armature to said stops, an electric motor engaging with said bent lever, and a circuit-closer for the motor, engaged with the said armature.

3. The combination, with the brushes of a rheostat, of a rotary arbor attached thereto, a vibratory bent lever pivoted upon said arbor, a ratchet-wheel fixed upon said arbor, ratchets normally out of gear with said wheel and resting upon movable stops, magnets provided with a common pivoted armature, a connecting-rod joining said armature to said stops, an electric motor engaging with said bent lever, a circuit-closer for the motor, engaged with the said armature, and means for closing an electric circuit through one or the other of said magnets upon a predetermined variation of electro-motive force in the main circuit.

4. The combination of an electric motor provided with worm-gearing, a shaft engaged therewith and having a crank, a lever having arms 1 and 2, and a slot in the end of the arm 1, fitting over said crank, an arbor 5, forming a bearing for said lever and carrying a ratchet-wheel and a pair of brushes which are in contact with circularly-arranged rheostat-terminals, ratchets 9 and 10, pivoted independently of each other upon the upper end of the arm 2 and pointing in opposite directions and normally out of engagement with said wheel, stops 13 and 14 under said rheostats and holding them out of gear with said wheel and carried by a pivoted lever, an armature common to two magnets pivoted to said beam, a circuit-closer controlled by said armature and in circuit with the said motor, and an electric detector consisting, substantially, of a solenoid and core which is provided with a contact-terminal balanced between contact-terminals of opposite polarity, which form, respectively, the terminals of the said two magnets, while the contact-terminal on the core forms the remaining terminals of the said magnets.

5. The combination, with the brushes of a rheostat, of a rotary arbor attached thereto, a vibratory bent lever pivoted upon said arbor, a ratchet-wheel fixed upon said arbor, ratchets normally out of gear with said wheel and resting upon movable stops, magnets provided with a common pivoted armature, a connecting-rod joining said armature to said stops, an electric motor engaging with said bent lever, and means for adjusting said armature, consisting of a sheet-metal spring connecting the end thereof to a stationary arm 23, projections 54 upon said arm, and screws 54′, passing through said projections, pointing toward each other, and pressing upon opposite sides of said spring.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two witnesses.

CHARLES W. HOLTZER.
GEORGE E. CABOT.

Witnesses:
W. C. VAN DERLIP,
IRA A. FOSTER.