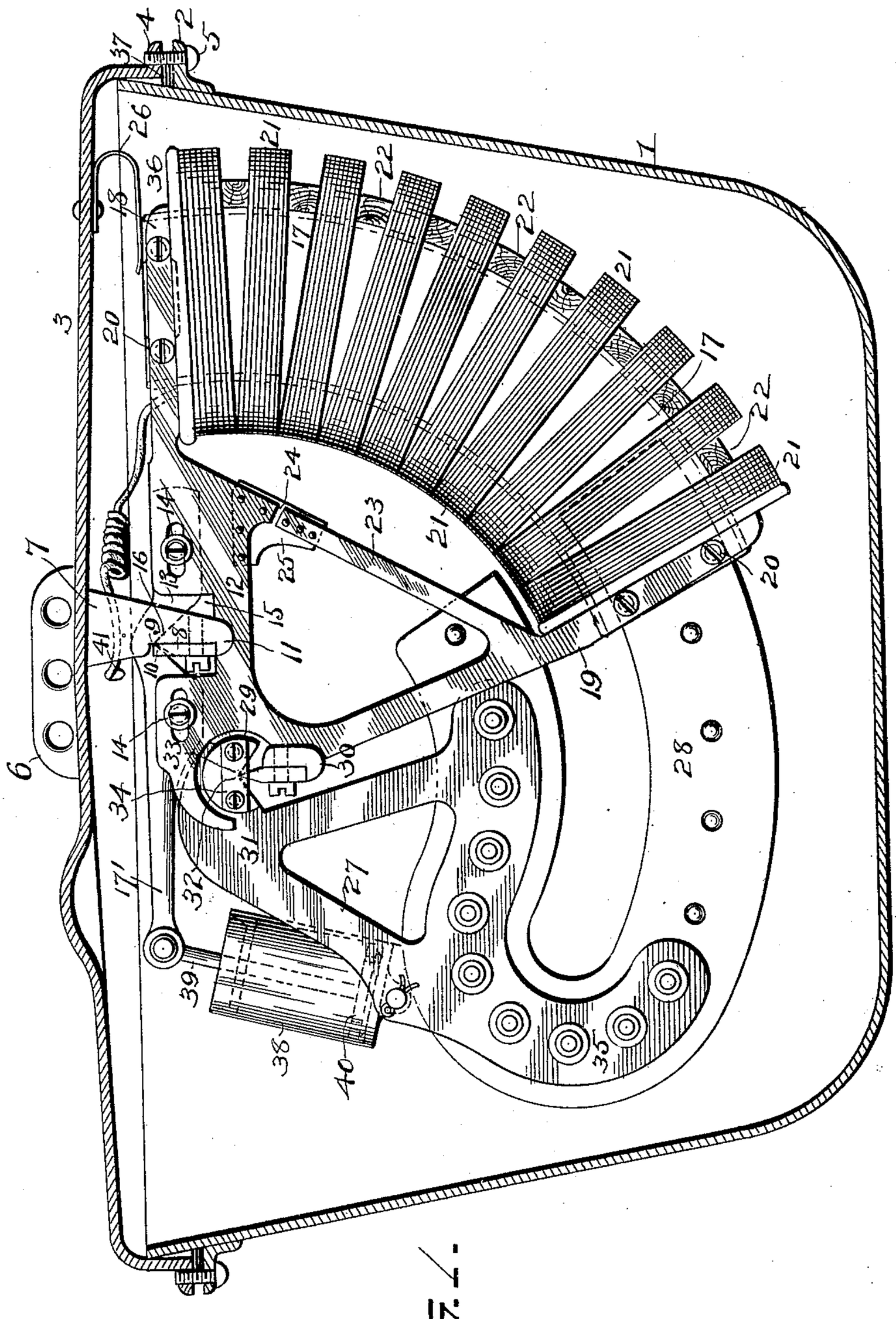
No. 699,055. Patented Apr. 29, 1902.

T. E. ADAMS.

ALTERNATING CURRENT REGULATOR.

(Application filed Dec. 2, 1901.)

(No Model.) 2 Sheets—Sheet 1.



WITNESSES
E. L. Nottingham
G. F. Downing.

INVENTOR
T. E. Adams
By K. G. Seymour
Attorney

No. 699,055. Patented Apr. 29, 1902.

T. E. ADAMS.

ALTERNATING CURRENT REGULATOR.

(Application filed Dec. 2, 1901.)

(No Model.) 2 Sheets—Sheet 2.

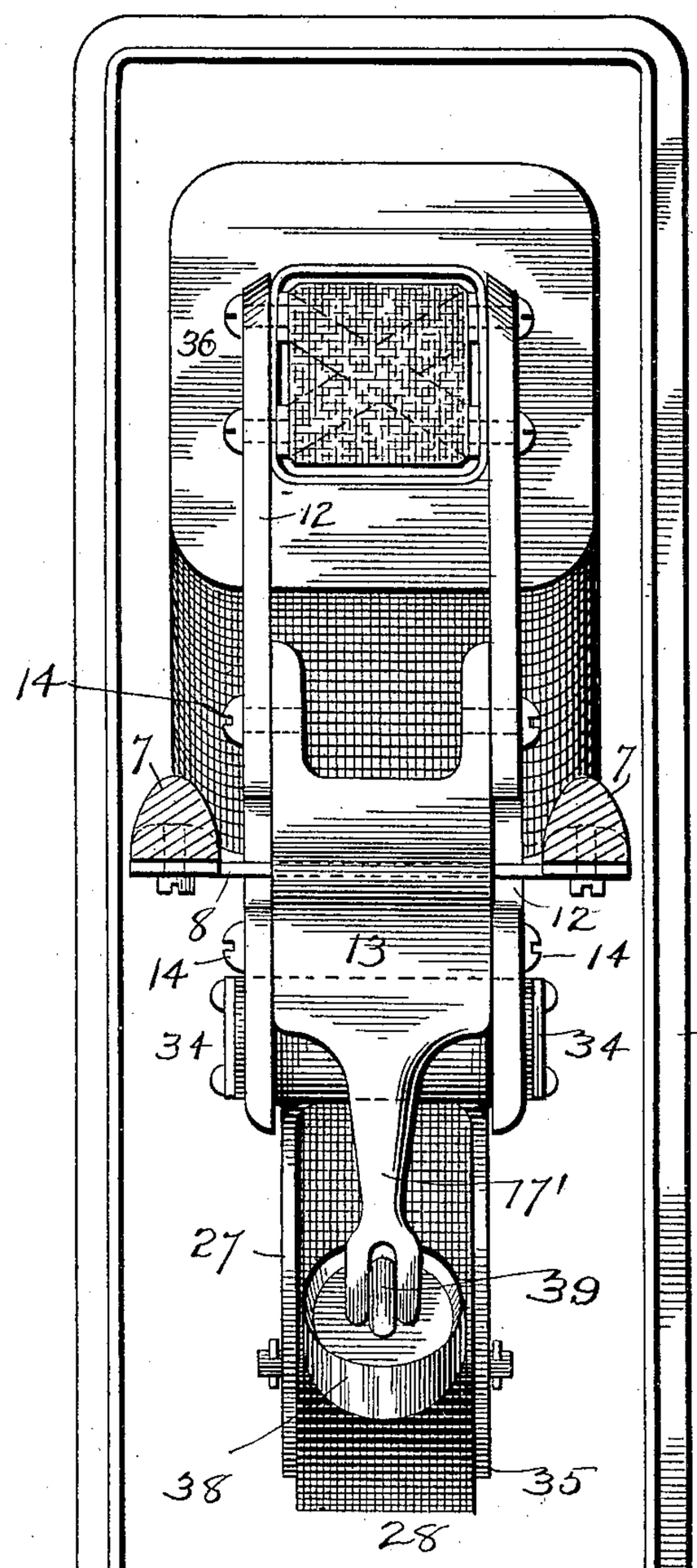


FIG. 2.

FIG. 3.

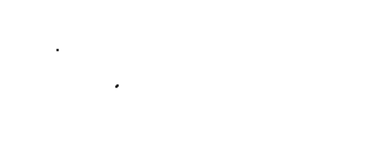


FIG. 4.

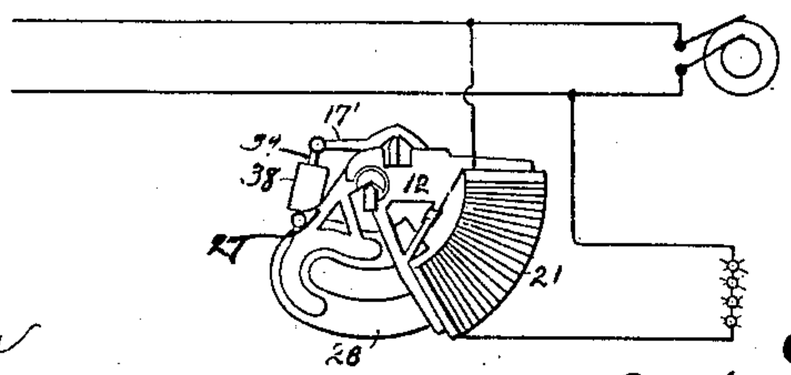


FIG. 5.

WITNESSES

E. L. Nottingham

G. F. Downing.

INVENTOR

T. E. Adams

By H. A. Seymour

Attorney

UNITED STATES PATENT OFFICE.

THOMAS EDGAR ADAMS, OF CLEVELAND, OHIO.

ALTERNATING-CURRENT REGULATOR.

SPECIFICATION forming part of Letters Patent No. 699,055, dated April 29, 1902.

Application filed December 2, 1901. Serial No. 84,368. (No model.)

To all whom it may concern:

Be it known that I, THOMAS EDGAR ADAMS, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Alternating-Current Regulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in electrical regulators, and more particularly to such as are adapted by inductive resistance to regulate the current on alternating-current circuits.

One object of the invention is to construct a regulator of the type specified in such manner that the use of counterbalancing weights or springs independent of the weight of the coils and core and the frames which carry them shall be avoided and so that the mechanical resistance offered by the core to the pull of the coil shall be commensurate with and vary in proportion to the varying choking effect in the coil.

A further object is to produce a regulator that may be hung on a line-pole or wherever it may be desired to use a series of lamps.

A further object is to so construct the apparatus that it will be waterproof and permit of the pole or other support moving without affecting the accuracy of regulation.

A further object is to so construct the regulator that it will respond quickly to changes in current strength.

A further object is to produce a regulator for the purpose stated which shall combine durability, reliability, and which shall effectually perform its functions.

With these objects in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation, partly in section, illustrating my invention. Fig. 2 is a plan view with the cover removed. Figs. 3 and 4 are detail views. Fig. 5 is a diagrammatical view.

1 represents a water-tight casing, made of non-magnetic material—such as copper, zinc, indurated fiber, &c.—and provided near its upper open end with a ring 2, which constitutes, in effect, a flange projecting outwardly from the casing, or, if desired, the upper edge of the casing may be made with an integral outwardly-projecting flange. A cover 3 closes the open upper end or top of the casing and is provided with a flange 4 to lie parallel with the flange or ring 2 on the casing. Screws 5 are passed through the flanges 2 4 for securing the casing and its cover together, and between said flanges a packing-ring 37 is inserted to prevent the entrance of dust and moisture or the escape of oil. The cover 3 supports the mechanism of the regulator within the casing, and said cover is suspended (preferably so as to permit more or less swinging movement) by any suitable devices attached to a perforated flange 6 on said cover. The cover 3 sustains all the working parts of the regulator, and the case 1 serves to inclose said working parts, so that should it become necessary to have access to the mechanism for making repairs or for purpose of adjustment it is simply necessary to remove the case.

Two arms or hangers 7 7 depend from the cover 3 and have secured to them a transversely-disposed plate 8, a portion of one edge of which is beveled to form a knife-edge 9, and the parts of the plate at the ends of this knife-edge constitute shoulders 10 10 to prevent lateral displacement of a frame 11, sustained by the knife-edge. The frame 11 comprises two plates or spiders 12, approximately A-shaped in form and preferably made of brass, and a block 13, disposed between and adjustably connected to said plates by means of screws 14, passing through elongated slots in the plates and entering sockets in the block. Each plate 12 is notched or recessed, as at 15, for the accommodation of the plate 8, and the block 13 is made with a notch 16 to form a bearing for the knife-edge 9, and the block is provided with an arm 17′ for a purpose hereinafter explained.

A hollow spool 17, of leatheroid or other non-conducting material and made in the form of the segment of a circle, is secured at its respective ends between the arms 18 19 of the plates of the frame by means of screws 20 or other fastening devices. Several coils 21 are disposed on the spool 17 and separated by

wooden spacing-blocks 22, said coils being included in series with each other and in series with the line containing translating devices. The diagonal arms or braces 23 of the frame 11, which are disposed near the coils, are split at 24 and secured together by leatheroid blocks 25 for the purpose of opening the local circuit in the brass frame. The frame 11 constitutes an A-shaped lever carrying the coils of the regulator, and upon the end of the long arm of this lever (at the upper end of the series coils) a buffing-spring 26 bears, one end of this spring being secured to the cover 3. At the free end of the short arm of the lever formed by the frame 11 and at a point in a plane below that of the fulcrum of said lever a brass frame 27, carrying a core 28, is pivotally supported. In making this pivotal support the plates 12 of the frame or lever 11 are recessed at their apices, as shown at 29, and at the base of each recess 29 an enlargement 30 is made on the respective plates 12, to which a transversely-disposed plate 31, having a knife-edge 32, is secured. The plates comprising the frame 27 are made hook-shaped at their upper ends and recessed to form a bearing 33 upon the knife-edge 32, and steel disks 34 are secured to the outer faces of the frame 27 to prevent lateral displacement thereof on the knife-edge. The lower end of the plates comprising the frame 27 are made with hook-shaped arms 35, between which the laminated core 28 is secured. This core has a general U shape; but each arm is curved to mark the segment of a circle concentric with the fulcrum of the frame 27, which carries said core, so that as the frame 27 turns on the knife-edge 32 one arm of the core can move freely in the spool 17, (which spool marks the arc of a circle concentric with the fulcrum at the knife-edge 32,) and the other arm of the core will move parallel with the arc of a circle marked by the curved series of coils. A fibrous or spring buffer 36 for the core may be arranged at the upper end of the spool 17, or this buffer may be attached to the end of the core, if desired.

From the construction and arrangement of parts above described it will be readily seen that under normal conditions of current strength in the circuit the weight of the core will be counterbalanced by the weight of the coils, with the core ready to enter the coils or entering the coils more or less, according to the predetermined current strength on the line. The normal relative positions of the coils and core must of course be adjusted in accordance with a predetermined current strength on the line. Thus if the current strength on the line happens to be higher than it may be desired it should be under normal conditions, the parts may be so adjusted that the core will normally enter the coils a short distance, so that a comparatively small counter electromotive force or inductive resistance will be set up in the coils to counteract or dam the current on the line sufficiently to insure a predetermined current strength. My improved regulator can thus be readily adjusted for current strength on the line by altering the leverage until an ammeter included in the circuit shall indicate the current strength desired. This adjustment of leverage can be accomplished by moving the block in one direction or the other between the plates 12 or, more properly speaking, adjusting the plates 12 on the block 13, so as to alter the fulcrum of the frame or lever 11 with respect to the ends thereof until the core will bear the proper normal relation to the coils to insure the proper current strength on the line, as above explained.

It is apparent that if the resistance on the line be reduced by the removal of one or more translating devices (such as lamps) the current strength will immediately increase, and consequently the core will be drawn into the coils of the regulator, causing the generation of increased counter electromotive force or inductive resistance in the coils to compensate for the decreased resistance by the removal of the lamps, and the current will be thus choked to an extent sufficient to promptly reduce the amperage on the line to or, in effect, retain it at normal, and a further removal of resistance from the line will cause a further choking effect in the coils, as will be readily understood, until finally when the load on the line shall have been reduced to a maximum extent the core will have entered the coils to the fullest extent.

As has been before stated, I avoid the use of weights and springs to counterbalance the moving part of a regulator; but I construct the device in such manner that both parts—viz., the coils and the core—shall be movable and so relatively arranged that the weight of one will act against the weight of the other. With the core and coils suspended in the relation to each other hereinbefore described the mechanical resistance offered by the weight of the core to the pull of the coils will gradually increase as the core progresses into the coils, and this increase of mechanical resistance offered by the core will be approximately commensurate with the varying choking effect of the coils as the core moves in one direction or the other through the same, and thus by my improvements the current strength on the line will be maintained practically constant.

If desired, the well-known means of adjustment—such as changing the number of turns in the coils, tapering the core, increasing the air-gap, &c.—may be resorted to so long as the weight of the necessary core acting against the weight of the necessary coils for a given circuit only be preserved instead of using some additional or supplemental weight or spring.

It is of more or less importance that the movements of the core and coils relatively to

each other shall not be too sudden, and to check any unduly sudden movements of the parts the case 1 may be filled with oil, glycerin, or similar liquid, so that the working parts will be immersed therein. If desired, however, a dash-pot may be used to regulate the movements of the parts. In such case the dash-pot cylinder 38 may be pivotally attached to the frame 27, which carries the core 17, and the plunger-rod 39 will be pivotally attached to the arm 17′ on the block 13.

The plunger 40 of the dash-pot is provided with a suitable valve to permit the easy entering of the core, but cause it to be slowly withdrawn from the coils. The cylinder of the dash-pot may contain oil or similar liquid.

The leading-in wires pass through a hole 41 in close proximity to the pivotal support of the frame or lever 11, and these wires being very flexible and entering at a point in close proximity to the practically frictionless knife-edge support of the frame or lever 11 the chances of irregularity of performance of the apparatus is reduced to a minimum. While proper freedom is permitted at the knife-edges, yet the extent of motion is so limited and the parts are all so strong that great durability is assured.

Various changes might be made in the details of construction of my invention without departing from the spirit thereof or limiting its scope, and hence I do not wish to limit myself to the precise details herein set forth.

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

1. In a regulator, the combination of a solenoid, and means pivotally supporting the relative members of said solenoid with the weight of one part opposed to the weight of the other part.

2. A regulator, comprising an inductive-resistance device having its parts relatively arranged to constitute mechanical resistance, one to the other.

3. A regulator, comprising a coil having its frame pivotally supported, and a core pivotally supported by the frame of the coil and adapted to enter the latter.

4. A regulator comprising a lever pivotally supported between its ends, a coil secured to one arm of said lever and a core pivotally supported by the other arm of the lever and adapted to enter the coil.

5. A regulator, comprising a lever pivotally supported between its ends, a coil carried by one arm of said lever, and a core adapted to enter the coil, said core pivotally suspended from the other arm of said lever at a point below the plane of the pivotal support of said lever.

6. The combination in an electric circuit, of translating devices included in said circuit, and an inductive-resistance device having its coils included in said circuit, the parts of said inductive resistance so relatively arranged that the mechanical resistance of one part to the pull of the other part will vary in proportion to the choking effect of the other part.

7. In an alternating-current regulator, the combination of a coil, a core to enter the coil, and means for causing one of said parts to exert a mechanical resistance to the pull of the other part commensurate with the choking effect produced in the coil when the resistance of an alternating-current circuit including said coil is varied.

8. In an electric regulator, the combination with a lever pivotally supported between its ends, of a segmental spool secured to one arm of said lever, a coil wound on said spool, and a core pivotally supported by the other arm of the lever and adapted to enter said spool.

9. In an electric regulator, the combination with a lever pivotally supported between its ends, a coil carried by one arm of said lever, a core pivotally supported by the other arm of said lever and adapted to enter said coil, and means for adjusting the fulcrum of said lever.

10. In an electric regulator, the combination with a lever pivoted between its ends, of a coil carried by one arm of said lever, a core pivotally supported by the other arm of the lever and adapted to enter the coil and a buffing-spring bearing against the arm of the lever carrying the coil.

11. In an electric regulator, the combination with a lever pivoted between its ends, a segmental spool secured to one arm of said lever, a series of coils on said spool and electrically connected together, spacing-blocks between the coils and a core supported by the other arm of said lever and adapted to enter the coils.

12. In an electric regulator, the combination with hangers or supports, a lever, a knife-edge bearing for the lever, secured to said supports, a coil carried by one arm of said lever, a core to enter the coil, a frame secured to said core, and a knife-edge bearing secured to the other arm of the lever, for said frame.

13. In an electric regulator, the combination with a support and a lever, of a plate secured to the support and having a knife-edge bearing for the lever, shoulders at the ends of said knife-edge for preventing lateral displacement of the lever, a coil carried by one arm of the lever, a core to enter the coil, a knife-edge bearing on the other arm of the lever for supporting said core and means for preventing lateral displacement of the core relatively to its bearing.

14. In an electric regulator, the combination of a lever comprising two plates and a block secured to and separating said plates, a knife-edge bearing for the block for pivotally supporting the lever, a coil carried by one arm of the lever, a knife-edge bearing secured to the ends of the plates constituting

the other arm of the lever, and a core supported by said last-mentioned knife-edge bearing and adapted to enter the coil.

15. In an electric regulator, the combination of a lever comprising two plates and a block separating said plates, a pivotal support for said block means for adjusting the block to change the fulcrum of the lever, a coil carried by one arm of the lever and a core for the coil pivotally supported by the other arm of the lever.

16. In an electric regulator, the combination of a frame or lever having divergent members, a spool secured between said divergent members, a coil on said spool, means for pivotally supporting said frame or lever between the ends of one of its members, a frame or arm pivotally supported by said frame or lever at a point farthest removed from the spool and coil, and a core secured to said frame or arm and adapted to enter the coil.

17. In an electric regulator, the combination with a lever pivotally supported between its ends, of a segmental spool carried by one arm of said lever, a coil on said spool, and a core pivotally supported by the other arm of said lever, said core having two curved members, one to enter the spool and the other to move alongside the coil.

18. In a regulator, the combination of a frame or lever comprising two A-shaped plates and a block separating them, a spool secured at its ends to the convergent members of said plates, a coil on said spool, the cross-bar of said frames being split and connected together by insulating material to open the local circuit of the frame or lever, means engaging said block to pivotally support the frame or lever between its ends, and a core pivotally supported by said lever at a point farthest removed from the coil.

19. In an electric regulator, the combination with a non-magnetic case and a cover therefor, of an inductive-resistance device supported by the cover and depending within the case, and means on the cover for attaching suspending means.

20. In an electric regulator, the combination with a non-magnetic case containing oil, a cover on said case and a water-tight connection between the case and cover, of an inductive-resistance device supported by said cover and immersed in the oil in the case.

21. In an electric regulator, the combination with a case and cover therefor, of a lever pivotally supported between its ends at the center of the cover, a coil carried by one arm of said lever, and a core for the coil supported by the other arm of the lever, said cover having a hole for leading-in wire in close proximity to the pivotal support of said lever.

22. In an electric regulator, the combination with a lever pivotally supported between its ends, of a coil supported by one arm of said lever, a core pivotally supported by the other arm of the lever and adapted to enter said coil, an arm projecting from the lever, a dash-pot cylinder attached to the core, a valved plunger in said cylinder and a plunger-rod attached to said plunger and to the arm projecting from the lever.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THOMAS EDGAR ADAMS.

Witnesses:
JOHN D. ERTEL,
C. L. CLARK.