No. 897,147. PATENTED AUG. 25, 1908.

T. M. PUSEY.

ELECTRIC REGULATOR.

APPLICATION FILED NOV. 21, 1907.

2 SHEETS—SHEET 1.

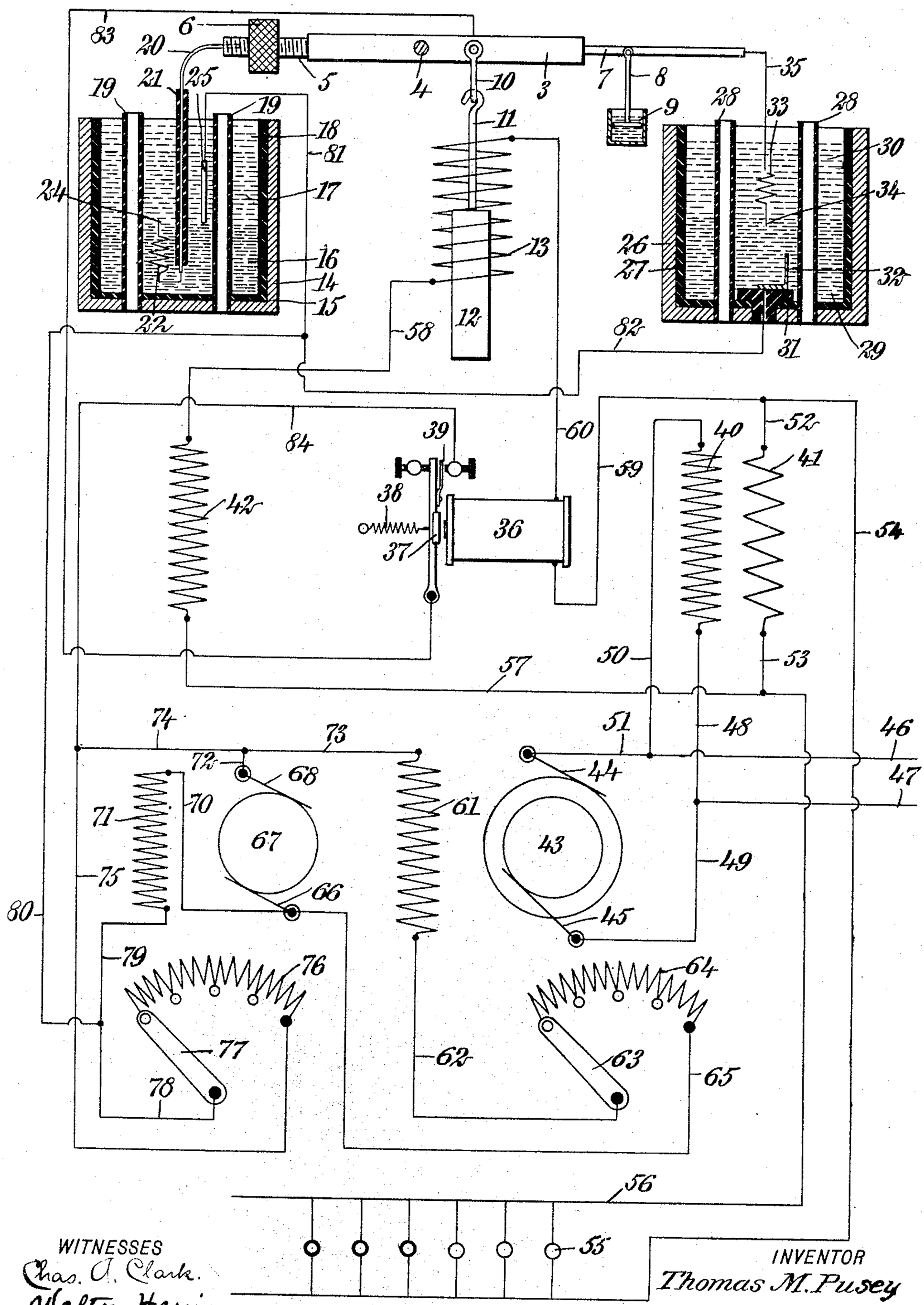

Fig. 1.

WITNESSES
Chas. A. Clark.
Walton Harrison.

INVENTOR
Thomas M. Pusey
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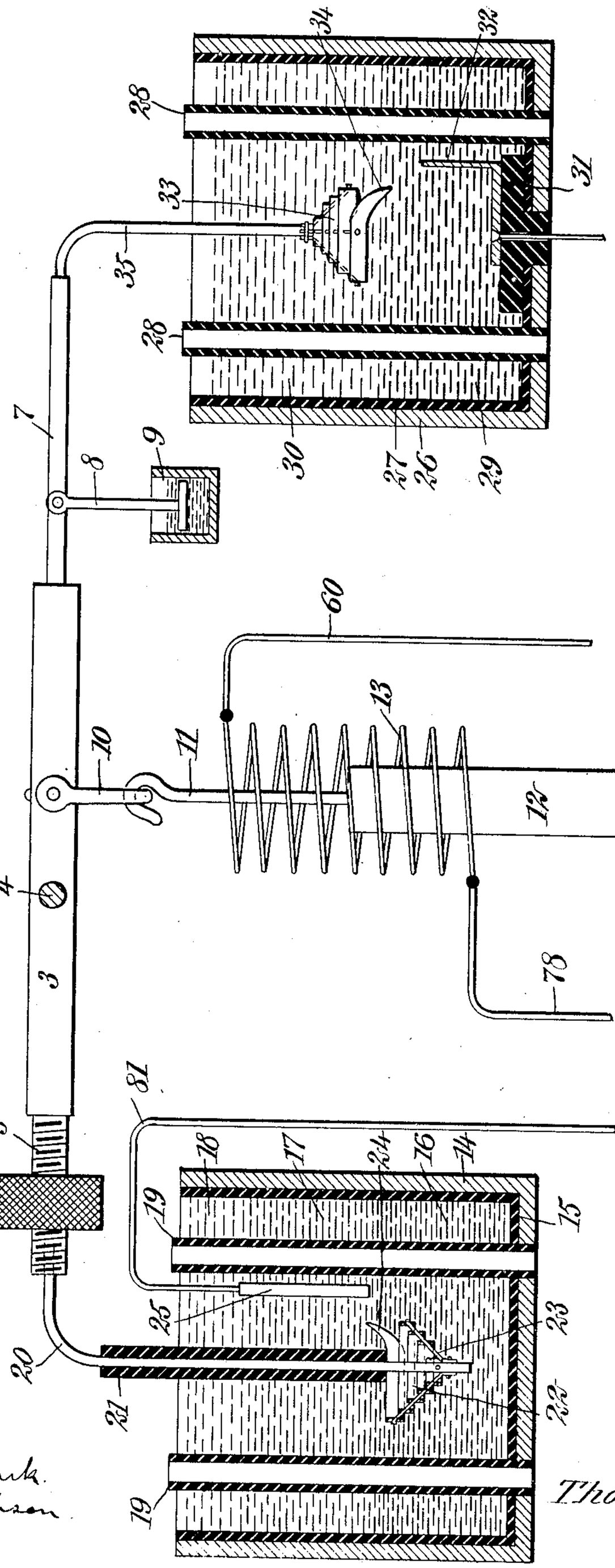

Fig. 2.

WITNESSES
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UNITED STATES PATENT OFFICE.

THOMAS M. PUSEY, OF KENNETT SQUARE, PENNSYLVANIA.

ELECTRIC REGULATOR.

No. 897,147. Specification of Letters Patent. Patented Aug. 25, 1908.

Application filed November 21, 1907. Serial No. 403,179.

To all whom it may concern:

Be it known that I, THOMAS M. PUSEY, a citizen of the United States, and a resident of Kennett Square, in the county of Chester and State of Pennsylvania, have invented a new and Improved Electric Regulator, of which the following is a full, clear, and exact description.

My invention relates to electric regulators of the kind used for automatically regulating the voltage and amperage of currents employed for various commercial purposes.

My invention further relates to certain details of construction and the relative arrangement of the various parts, whereby the efficiency of the apparatus is greatly increased and the mechanism greatly simplified.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in both the views.

Figure 1 is a diagrammatic view, parts being in section, showing the regulator complete, including the liquid resistance, the solenoid and relay associated therewith, and the various transformers, stationary resistances, adjustable resistances, alternating generator, exciter for the same, and various electric connections; and Fig. 2 is a section through the liquid resistance and balanced beam and solenoid for controlling the same, this view showing how variations in one of the currents control the flow of electricity to connections leading to the field of the exciter.

A rocking beam is shown at 3 and is mounted upon a pin 4, and this beam is provided with a threaded stem 5 upon which is mounted a revoluble weight 6. By turning this weight the center of gravity of the beam may be moved to the right or left, so as to cause the beam to normally occupy a predetermined position.

Mounted upon the beam 3 is a stem 7 from which hangs a plunger 8 of a dash pot 9, the purpose of the dash pot being to prevent undue and sudden movements of the beam. A clevis 10 depends from the beam 3 and is engaged by a hook 11, the latter supporting an armature 12 having the form of a swinging core, and encircling this core is a solenoid 13. A containing vessel 14 is provided internally with a lining 15 of insulating material. The vessel contains a quantity 16 of oil heavier than water, such, for instance, as oil of birch or oil of wintergreen. Above this oil 16 is a volume of acidulated water 17, and resting upon this water is a quantity 18 of oil lighter then water, the oils 16 and 18 being insulating in character. Tubes 19 are mounted within the vessel 14, and serve to promote a circulation of air in close proximity to the liquids, for the purpose of keeping them cool during the passage of electricity through the water.

A wire 20 is mounted upon the stem 5 and is bent downwardly, and this wire extends through a tube 21 of insulating material. A spiral 22 of platinum is mounted upon the lower end of the wire 20, and projects upwardly therefrom, as indicated in Fig. 2, and this spiral of platinum is held firmly in position by braces 23, also of platinum, and is provided with a pointed end 24, which normally extends upwardly from the heavy oil 16 into the water 17. A plate 25 of platinum is mounted within the water 17.

The other containing vessel 26 is provided with a lining 27 of insulating material, and mounted within this vessel are ventilation tubes 28. A quantity of acidulated water 29 is contained within this vessel, and resting upon this water is a quantity of oil 30, the oil having insulating qualities. A plate 31 of insulating material, is mounted centrally within the bottom of the vessel 26, and supported upon this plate of insulating material is a plate 32 of platinum. A platinum spiral 33, is provided with a downwardly projecting point 34. This platinum spiral has substantially the same general construction as the platinum spiral 22 above described, but occupies a so-called inverted position relatively to the same.

A thick wire 35 supports the spiral 33 and may be of platinum or other material not easily corroded. The magnet relay 36, see Fig. 1, is provided with a rocking armature 37, which is retracted by a spring 38. The armature 37 opens and closes a spring contact 39, when the magnet 36 is energized and deënergized.

A primary winding 40 and a secondary winding 41, together constitute a step-down transformer, and a constant resistance is shown at 42. At 43 is an alternating current generator, which is provided with brushes 44 and 45, which communicate with mains 46, 47, through which the main alternating current is supplied to any point or points which may be desired. Connected

with the primary winding 40 is a wire 48, and from the latter a wire 49 leads to the brush 45. A wire 50 is also connected with the primary winding 40, and a wire 51 connects the wire 50 with the brush 44. Wires 52, 53, are connected with the secondary winding 41. A wire 54 is connected with the wire 52 and leads to a number of incandescent lamps 55, and connected with the latter is a wire 56. A wire 57 is connected with the wires 53 and 56, and is connected with the constant resistance 42. A wire 58 connects this resistance with the solenoid 13. A wire 59 is connected with the relay magnet 36 and also with the wire 52, and leading from the magnet relay 36 to the solenoid 13 is a wire 60. The field winding of the generator 43 is shown at 61, and from this field winding a wire 62 leads to an arm 63, upon the rheostat winding 64, and from this rheostat winding a wire 65 leads to a brush 66 of an exciter 67. The field winding of the exciter is shown at 71 and is connected by a wire 70 with the brush 66. A wire 72 is connected with the brush 68, and from the wire 72 a wire 73 leads to the field winding 61 of the generator 43. Connected with wires 72 and 73 is a wire 74 which joins a wire 75, the latter leading to a rheostat winding 76. The arm 77 of this rheostat is connected by wires 78 and 79 to the field winding 71 of the exciter 67.

Connected with the wires 78, 79 is a wire 80, and joining the latter are wires 81, 82, the wire 81 being connected with the platinum plate 25 in the vessel 14, and the wire 82 leading to platinum plate 32 in the vessel 26. The platinum spirals 22 and 33 may be used together, as shown, or either of them may be discarded, the action not being materially different whether one or both be employed.

When the beam 3 is rocked in a clockwise direction, according to Figs. 1 and 2, the point 24 is raised further into the acidulated water 17, and consequently out of the heavy oil 16, and this exposes more of the point 24 to the action of the acidulated water. When this occurs, if the platinum spiral 33 is in position, the point 34 thereof dips more deeply into the acidulated water 29, and thus diminishes the resistance between the platinum spiral 33 and the water below it. When, therefore, the rocking beam 3 is turned in a counterclockwise direction, according to the views shown, the ohmic resistance of the path from the platinum spirals 22, 33, or either of them, through the acidulated water associated with them, is increased.

The operation of my device is as follows: The parts being in proper position and adjusted, we will say that the generator 43 and the exciter 67 are in action. Alternating current from the generator 43 flows through the mains 46, 47, and is used up in the ordinary manner. The primary transformer winding 40, being in parallel with the main current, is energized through the following circuit: generator 43, brush 44, wire 51, wire 50, primary winding 40, wire 48, wire 49, brush 45, back to the generator 43. The primary winding 40 acts inductively upon the secondary winding 41, thereby completing a circuit through the incandescent lamps 55 as follows: secondary winding 41, wire 52, wire 54, lamps 55, wire 56, wire 53, back to the secondary winding 41. A shunt circuit is also completed as follows: wire 52, wire 59, magnet 36, wire 60, solenoid 13, wire 58, constant resistance 42, wire 57, and wire 53, back to the secondary winding 41. This energizes both the relay magnet 36 and the solenoid 13. In energizing the solenoid 13 the core 12 is raised slightly, thereby causing the beam 3 to turn slightly in a counterclockwise direction. The weight 6 is now adjusted if its adjustment be necessary, so as to hold the beam in proper position for the voltage and load to be normally employed. The magnet relay 36 being normally energized, the following circuit is completed: exciter 67, brush 68, wire 72, wire 74, wire 84, spring contact 39, armature 37, wire 83, beam 3, wires 20, 35, platinum spirals 22, 33, acidulated water 17 and 30, platinum plates 25 and 32, wires 81 and 82, to wire 80, thence through wire 79, field winding 71, and brush 66 back to the exciter 67. It will be noted that the circuit through the spring contact 39 divides and passes through the two vessels 14 and 26. If, however, either of the platinum spirals 22 or 33 be removed, the entire current will pass through one vessel.

The switch arm 63 may be turned at will so as to regulate the current through the exciter 67 and the generator 43. So long as the voltage, and consequently the current for which the system is adapted and adjusted, is maintained, nothing unusual happens. Suppose that for some reason the voltage in the alternating current from the generator 43 should happen to rise. The primary winding 40, acting more energetically upon the secondary winding 41, increases the flow of alternating current through the secondary winding, and through the lamps 55. This, however, is not all that occurs. The solenoid 13 pulls more energetically upon its core 12, thus raising the latter and causing the beam 3 to turn slightly in a counterclockwise direction, as above described. This raises the platinum spiral 33 and lowers the platinum spiral 22, in both instances increasing the resistance offered to the flow of current through the vessels 14 and 26. The result is that the field 71 of the exciter receives less current than before, and consequently the current generated by the exciter and supplied thereby to the field winding 61 of the

alternating generator 43, is curtailed correspondingly. Hence, the generator 43, having its field correspondingly weakened, generates less current than before, for the reason that its voltage is reduced. Suppose, on the other hand, that for some reason, the voltage generated by the generator 43 should happen to decrease, owing to some change made in the state of mains 46, 47, or apparatus connected therewith. The reduction in voltage in the primary winding 40 causes it to act less energetically than before upon the secondary winding 41, and consequently the solenoid 13 receives less current than before. Its pull upon the core 12 is therefore weakened, and the beam 3 turned slightly in a clockwise direction. This submerges more of the platinum spiral 33 in the acidulated water 29 and raises a larger proportion of the platinum spiral 22 from the heavy oil 16, the result being that more current can now find its way through the vessels 14, 26 and the action of the field winding 71 is correspondingly increased in degree. Hence, the exciter 67 supplies more current to the field winding 61 of the generator and the latter increases its action. The system is thus self-regulating, when once adjusted, and admits of a wide range of adjustments.

My purpose in having the contact 39 as a spring contact, is to prevent the opening of the contact by the fact that current through the magnet 36 is alternated. That is to say, the current being alternating, it does not flow constantly and during the period when the magnet 36 is dead momentarily I do not wish the contact to be open.

Suppose, now, that the voltage produced by the generator 43 drops down in degree to such an extent that the magnet 36 is no longer energized. The spring contact 39 is thus opened and the circuit through the field winding 71 of the exciter is thus broken. This stops the action of the exciter and consequently the electric action of the generator.

While I prefer to move the beam 3 by aid of the solenoid 13 and core 12, it will be understood that I do not limit myself to this arrangement as any other magnetic mechanism may be employed for this purpose. Neither do I limit myself to the use of a magnet of the form shown at 36 for the purpose of controlling the contact 39; nor do I limit myself to the particular arrangement of the several parts, as various changes may be made therein without departing from the spirit of my invention.

My invention may be used for regulating direct current generators and storage batteries, as well as alternating current generators.

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

1. In an electric regulator, the combination of an insulating liquid, a conducting liquid lighter than said insulating liquid and resting thereupon, a conducting member disposed within said insulating liquid and having a portion projecting into said conducting liquid, and means controllable by an electric current for raising said member of conducting material so as to expose a larger surface thereof to said conducting liquid.

2. In an electric regulator, the combination of a heavy insulating liquid, a lighter conducting liquid resting thereupon, a vessel for containing said liquids, a conducting member normally submerged within said heavy liquid, and means controllable by an electric current for raising said conducting member.

3. In a current regulator, the combination of a containing vessel, an insulating liquid disposed therein, a conducting liquid disposed therein and in contact with said insulating liquid, means for sending a current through said conducting liquid, and a movable electrode located partially within said conducting liquid and extending into said insulating liquid.

4. A current regulator, comprising an insulating liquid, a conducting liquid, a spiral of conducting material provided with a point projecting therefrom, and means controllable by an electric current for varying the position of said spiral of conducting material relatively to both of said liquids.

5. In a current regulator, the combination of a relay provided with a contact, a generator provided with connections for energizing said relay, an exciter, connections from said contact to said exciter for the purpose of enabling said relay to control said exciter, and mechanism connected with said generator and controllable by currents therefrom for varying the flow of current through said contact to the field of said exciter.

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

THOMAS M. PUSEY.

Witnesses:
WM. O. WALTER,
E. M. SPENCER.