T. SPENCER.

REGULATOR FOR ELECTRIC CURRENTS.

APPLICATION FILED NOV. 25, 1905.

922,057. **Patented May 18, 1909.**

FIG. III.

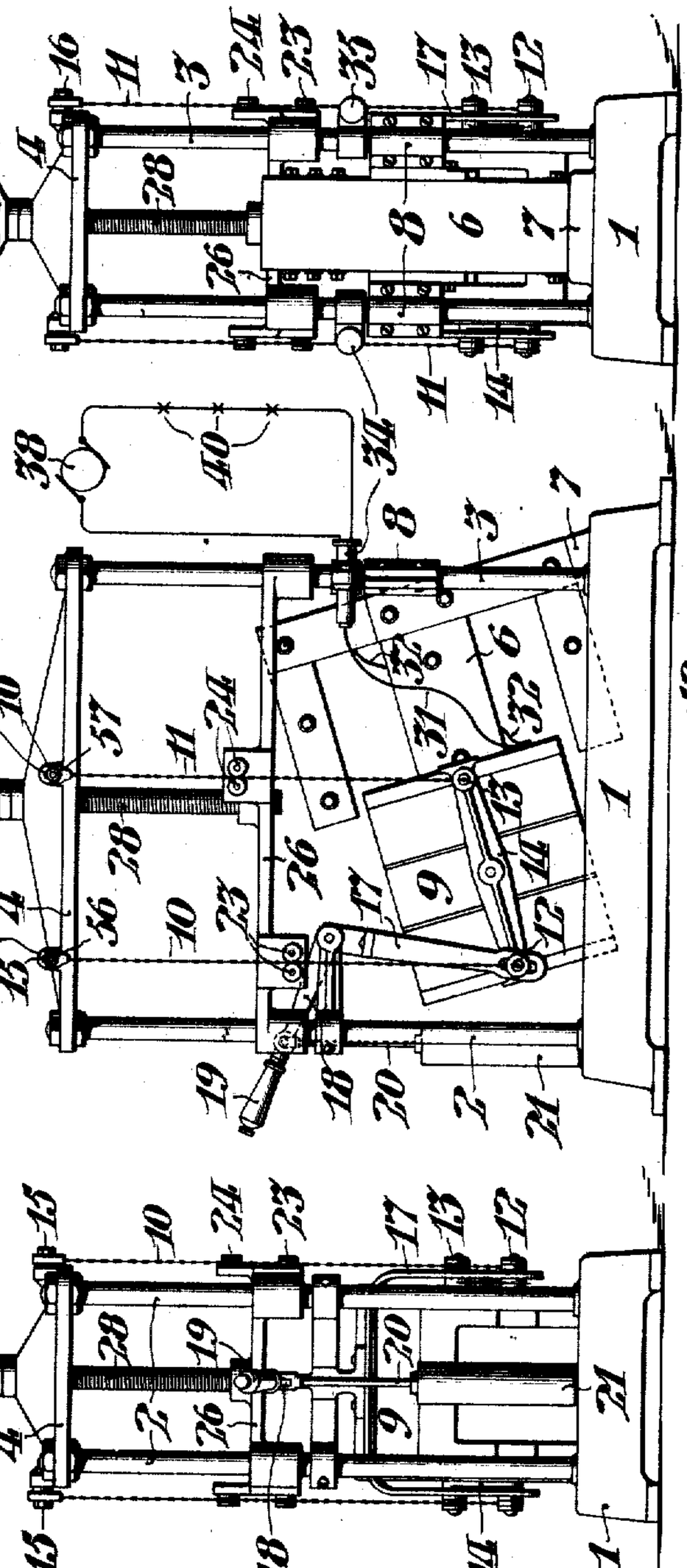

FIG. I.

FIG. II.

FIG. IV.

WITNESSES:

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REGULATOR FOR ELECTRIC CURRENTS.

No. 922,057. Specification of Letters Patent. Patented May 18, 1909.

Application filed November 25, 1905. Serial No. 288,995.

To all whom it may concern:

Be it known that I, THOMAS SPENCER, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Regulators for Electric Currents, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to that class of regulators wherein a solenoid coil is included in the circuit to be regulated in such relation to an iron core that relative movement of the coil and core is effected in accordance with variations in the resistance in the circuit, with consequent variations in the impedance of the coil which compensate for said variations in the resistance. For instance, such a regulator may be included in an alternating current circuit with arc lamps arranged in series, so as to maintain the current substantially constant in said circuit regardless of variations in the resistance of the circuit consequent upon variations in the number of said lamps in operation.

My improvements comprise means to suspend either the relatively movable coil or core, with the weight of the movable element opposed to the magnetic stress between said elements, so that a characteristic curve indicating the gravitative force acting on the suspended mass shall substantially coincide with a characteristic curve indicating said magnetic stress throughout the range of movement for which the regulator is designed.

In the form of my invention hereinafter described, the core is stationary and the coil is suspended by a flexible medium, comprising chains disposed in parallel relation, so that throughout the range of movement of the coil, its axis is maintained substantially parallel with the common tangent of the arcs traversed by the points of said flexible connectors attached to the coil.

My invention comprises the various novel features of construction and arrangement hereinafter more definitely specified and claimed.

In the drawings, Figure I, is a side elevation of a regulator embodying my improvements, with a diagrammatic indication of the circuit in which it is comprised. Fig. II, is an elevation of the left hand end of said regulator as shown in Fig. I. Fig. III, is an elevation of the right hand end of said regulator as shown in Fig. I. Fig. IV, is a diagram indicating the approximate characteristic curve of the opposed forces in the regulator.

In said drawings, 1, is the base plate of the frame comprising the standards 2, and 3, and the cap plate 4. The solenoid core 6, is conveniently supported by the boss 7, on said base plate 1, and by the brackets 8, which respectively embrace the opposite standards 3. The solenoid coil 9, is suspended in operative relation with the core 6, by the two pairs of flexible connectors 10, and 11, which are conveniently made of chains, the lower ends of which respectively engage the studs 12, and 13, on the coil bands 14, and the upper ends of which respectively engage the studs 15, and 16, on said cap plate 4. Said coil 9, may be oscillated by the lever comprising the arms 17, which engage said studs 12, and the arm 18, provided with the handle 19. Said lever arm 18, is operatively connected with the plunger 20, arranged to reciprocate in the dash pot 21, so as to prevent sudden movement of said coil 9. Said flexible connectors 10, and 11, being disposed in parallel relation, throughout the range of movement of said coil 9, its axis is maintained substantially parallel with the common tangent of the arcs traversed by the points of the respective connectors, attached to said coil, and as the effective gravitative force acting on the coil 9, thus suspended, varies in accordance with the effective length of said connectors 10, and 11, I find it convenient to vary such length by changing the position of the fulcrum bearing rollers 23, and 24, longitudinally with respect to said connectors. Said rollers 23, and 24, are conveniently carried by the fulcrum bearing plate 26, which is supported by the standards 2, and 3, and arranged to be longitudinally shifted thereon by the screw 28, which is journaled in the cap plate 4, and provided with the hand wheel 29. Said coil 9, is provided with the flexible leads 31, and 32, extending to the respective terminals 34, and 35, supported by the standards 3, and, as diagrammatically indicated in Fig. I, said coil may be included in a circuit with a generator 38, and a series of arc lamps 40.

Referring to Fig. IV, and assuming that the base line 42, of a system of coördinates, is equal in length to the coil 9; the distance from 43 to 45 represents a distance which the core 6, has entered said coil, and, with a current of given amperage, the vertical distance

45 to 46, indicates the magnitude of the magnetic stress between said elements at that point. A characteristic curve, for that amperage, may be thus produced by a succession of determined points represented by the line 43, to 48, which approximates very closely to the straight line 43, to 49, and, for a current of greater amperage a corresponding curve may be similarly produced, indicated by the line 43, to 50, closely approximating to the straight line 43, to 52.

It is to be understood that by adjustment of the effective length of the flexible connectors 10, and 11, (by rotation of the screw 28, and consequent change in the position of the fulcrum bearing rollers 23, and 24, as above described) the effective gravitative force acting on the suspended coil 9, can be determined to substantially coincide with either of the characteristic curves 43 to 48, or 43 to 50 aforesaid, or any other curve characteristic of a current within the range of regulation for which the apparatus is designed. Although I find it convenient to make said connectors 10, and 11, of equal effective length, it may be observed that the upper ends of said connectors are provided with slotted plates 54, and 55 so that said connectors may be adjustably secured on the respective studs 15, and 16, by the nuts 56, and 57, with the effective length of said connectors 10, and 11, (extending below the fulcrum bearing rollers 23 and 24) equal or unequal, as desired.

It is to be understood that I do not desire to limit myself to the precise construction and proportion of the parts which I have illustrated, as it is obvious that various modifications may be made therein without departing from the essential features of my invention.

I claim:—

1. In a reactance regulator for an alternating current circuit, the combination with a straight core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance with variations in the magnetic stress between said core and coil; and a flexible medium supporting said coil in such relation to the core, that the weight of the coil is opposed to the magnetic stress which effects its movement, and its axis is maintained parallel with said core, while it moves in an arc.

2. In a reactance regulator for an alternating current circuit, the combination with a straight core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance with variations in the magnetic stress between said core and coil; and, flexible chains supporting said coil, in such relation to the core that its weight is opposed to the magnetic stress which effects its movement, and its axis, is maintained parallel with said core, while it moves in an arc.

3. In a reactance regulator for an alternating current circuit, the combination with a core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance with variations in the magnetic stress between said core and coil; and, a plurality of chains supporting said coil, at different points, arranged to maintain its axis substantially parallel with the common tangent of the arcs traversed by the points of said flexible connectors attached to the coil, said coil being supported by said chains in such relation to said core that the weight of said coil is opposed to the magnetic stress which effects its movement.

4. In a reactance regulator for an alternating current circuit, the combination with a core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it in accordance with variations in the magnetic stress between said core and coil; a flexible medium supporting said coil in such relation to the core that the weight of the coil is opposed to the magnetic stress which effects its movement; and, means adjustable to vary the effective length of said flexible medium, substantially as set forth.

5. In a reactance regulator for an alternating current circuit, the combination with a core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance, with variations in the magnetic stress between said core and coil; and, a plurality of parallel pivoted supports for said coil maintaining said axis substantially parallel with the common tangent of the arcs traversed by the points of said supports attached to the coil, while moving with respect to said core.

6. In a reactance regulator for an alternating current circuit, the combination with a straight core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance with variations in the magnetic stress between said core and coil; and, a plurality of parallel pivoted chains supporting said coil with its axis maintained parallel with respect to said core, and in such relation to said core that the weight of said coil is opposed by the magnetic stress which effects its movement.

7. In a reactance regulator for an alternating current circuit the combination with a core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it in accordance with variations in the magnetic stress between said core and coil; a flexible chain forming an oscillatory support for said coil

in such relation to the core that the weight of the coil is opposed to the magnetic stress which effects its movement; and, means adjustable to vary the center of oscillation of said coil on said chain, substantially as set forth.

8. In a reactance regulator for an alternating current circuit, the combination with a core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it in accordance with variations in the magnetic stress between said core and coil; a frame; a flexible medium suspending said coil from said frame, so that the weight of said coil is opposed to the magnetic stress which effects its movement; and, means to vary the effective length of said flexible medium, comprising a fulcrum bearing supported by said frame and adjustable longitudinally with respect to said medium, substantially as set forth.

9. In a reactance regulator for an alternating current circuit, the combination with a straight core; of a tubular coil included in the circuit to be regulated and adapted to inclose more or less of said core within it, in accordance with variations in the magnetic stress between said core and coil; and, means suspending said coil for oscillatory movement, maintaining its axis obliquely transverse with respect to said suspending means.

In testimony whereof, I have hereunto signed my name, at Philadelphia, Pennsylvania, this 23rd day of November 1905.

THOMAS SPENCER.

Witnesses:

HARRY HUSKEY,

FRANK W. BRADDOCK.