(No Model.)

J. F. MEHREN.

ELECTRIC METER.

No. 428,280. Patented May 20, 1890.

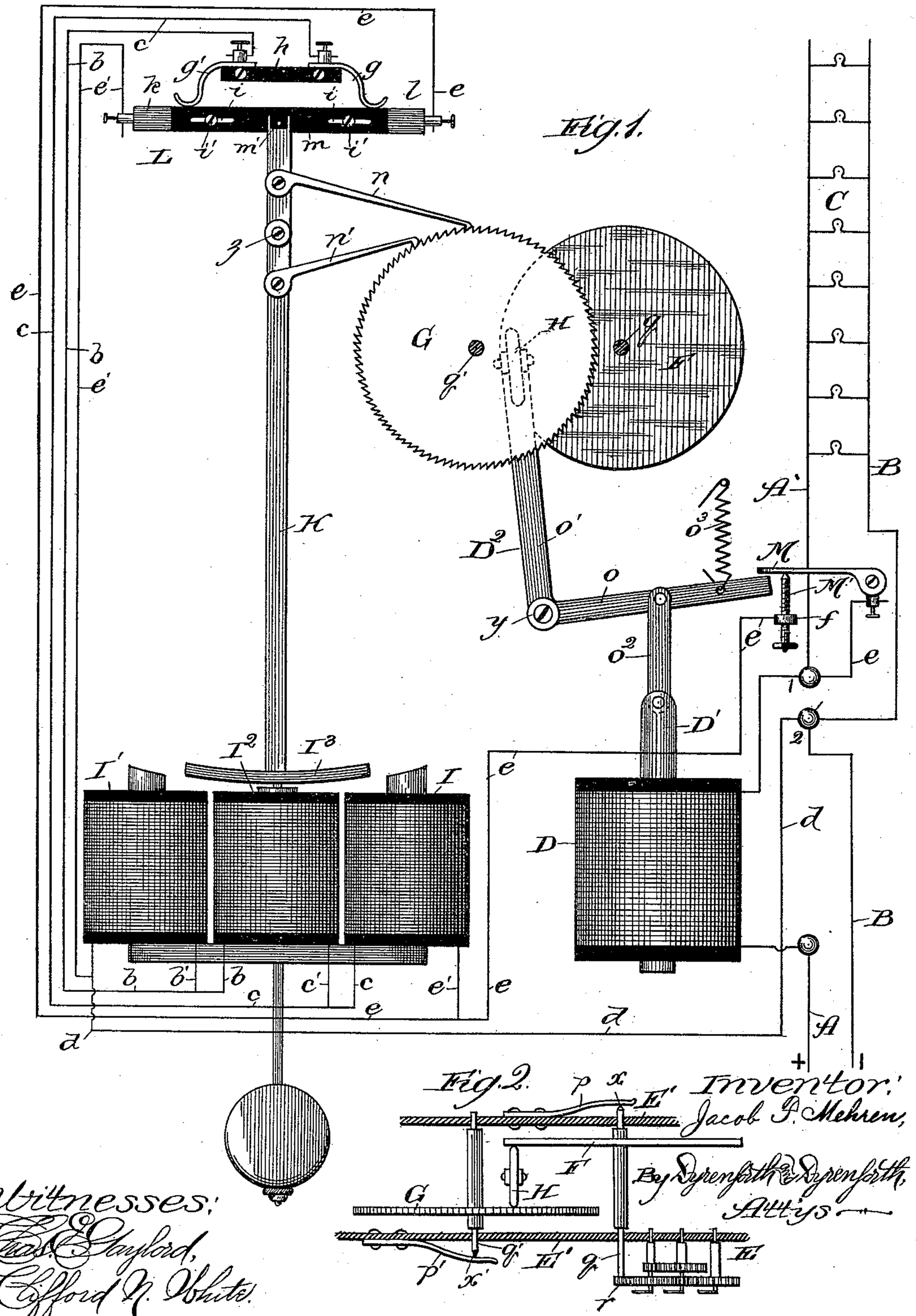

Fig. 1.

Fig. 2.

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ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 428,280, dated May 20, 1890.

Application filed October 7, 1889. Serial No. 326,184. (No model.)

To all whom it may concern:

Be it known that I, JACOB F. MEHREN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Electric Meters, of which the following is a specification.

My invention relates to an improvement in the class of apparatus for registering the amount consumed of current delivered on a circuit, as registering such amount in lamp-hours on a circuit containing incandescent electric lamps; and it relates particularly to improvements upon the species in the foregoing class involving a prime motor in the main circuit actuated by variation in the current to control, according to such variation, the registering mechanism, which is actuated through the oscillations of a pendulum controlled from a derived circuit.

The object of my invention is to provide a generally improved apparatus, both as to construction and efficiency, for the purpose stated; and to this end my invention consists in the general as well as the more specific construction of my improved meter.

In the accompanying drawings, Figure 1 is a view in the nature of a diagram, showing my improved apparatus in elevation, partly sectional; and Fig. 2, a broken plan view showing details of construction of the registering apparatus and of the mechanism for varying the speed or extent of registration, according to the variation in effect upon the prime motor of the current on the main circuit.

A denotes the outgoing, and B the return wire of a main circuit shown to contain, as the current-consuming medium, incandescent electric lamps C, and the wire A includes the prime motor D, which may be a solenoid, as illustrated, though I do not limit the use of my improved mechanisms hereinafter described, to connection with a solenoid as the prime motor, since they may be employed with advantage in connection with other forms of motor D.

E, Fig. 2, denotes the train of gear-wheels carrying index-fingers on their shafts and extending over the surfaces of suitable dials, the whole constituting an ordinary or suitable form of mechanism to be actuated from the main current through intermediate regulating and propelling devices, hereinafter described, to indicate the consumption of the current, and the parts of the mechanism E are supported, as usual, in suitable framework E′, which is merely indicated in Fig. 2, because well understood and involving no features of novelty.

The immediate medium for imparting motion to the train E is a pinion r on a shaft q, journaled in the frame and having limited play in its bearings, and one projecting end of which should be pointed, as shown at x, to reduce the frictional bearing against it of a spring p, extending from the adjacent side of the frame. The shaft q carries to revolve with it a plain disk F.

G is a disk like the disk F, except that its periphery is provided with teeth; and it is supported on a shaft q', journaled in the frame, like the shaft q, and in position to cause the disks G and F to overlap each other, the shaft being, for the same reason as the shaft q, pointed at one end, as shown at x' in Fig. 2, and having a spring p' bearing against its pointed extremity. The core D′ of the solenoid, which should be sufficiently long to extend normally through the spool, is connected by a link o^2, to an arm o of a bell-crank lever D^2, fulcrumed at its angle y, and controlled by a spring o^3, connected with the arm o, and which serves to counterbalance the core. The other arm o' of the bell-crank carries at its extremity, which should be bifurcated, and extends between the disks F and G, a friction-roller H, formed preferably of soft rubber, and the periphery of which is normally in contact with the opposing surfaces of the two disks. According as the distance from the shaft q' at which the roller H is caused to have contact with the disk G, it will inversely vary the distance from the shaft q of its contact with the disk F, turning the latter faster the nearer it approaches its shaft and slower the farther it is removed therefrom; and, as will hereinafter be explained, variation in such distance is automatically produced through the medium of the solenoid core in accordance with the variation to which the solenoid may be subjected in the current.

I and I′ are stationary electro-magnets having similar polarity, and between them is an electro-magnet I^2, having the opposite polarity, the circuit, including the motor afforded by the electro-magnets to produce the opposite polarities, being hereinafter described.

K is a pendulum pivotally supported at *z*—a point perpendicularly above the core of the magnet I^2—and carrying an armature I^3, the ends of which, when the pendulum is in its normal perpendicular or substantially perpendicular position, extend short of the cores of the magnets I and I′. On opposite sides of the pivotal point *z* the pendulum has pivoted to it the pawls *n* and *n*′, extending one beyond the other into engagement with the teeth on the periphery of the disk G, whereby each stroke of the pendulum in its vibratory movement, produced as hereinafter described, effects a partial turn of the disk. I do not, however, necessarily limit my construction to the use of the two pawls, though the latter are preferred, for a single pawl on one side of the fulcrum of the pendulum would be operative.

The upper end of the pendulum engages with a commutator L, comprising a bar *m*, of insulating material, having metallic contact-pieces *l* and *k* at opposite ends and supported in a manner to permit it to be readily shifted lengthwise, as by means of bolts or screws *i*′, passed into the support through slots *i* in the part *m* near its opposite ends, simple means for producing the desired engagement being the bifurcated end of the pendulum embracing a stud *m*′ on the bar *m*, as shown, and adjacent to the bar *m*, preferably above it, as shown, is secured a supporting-strip *h*, of insulating material, having springs *g* and *g*′ extending from it, both being normally in contact with only the bar *m* of insulating material and close to the metallic contacts *l* and *k*, whereby when the bar *m* is shifted from its normal position in either direction one spring will bear against an end contact, while the other will bear against the insulating portion of the bar.

The electro-magnets I, I′, and I^2 and the commutator L are included in a derived circuit branching on a wire *e* from the conductor A at the binding-post 1 to a pivotal contact-finger M, which overlaps the adjacent end of the arm *o* of the bell-crank and extends across a contact M′, which I prefer to provide in the form of a set-screw supported in a suitable bearing *f*, whence a continuation of the conductor *e* leads to the contact *l* of the commutator L, and a branch *e*′ thereof leads to the magnet I. The return-wire B of the main circuit branches from the binding-post 2 by a conductor *d*, connecting with the magnet I′. The contact *k* of the commutator is connected by a conductor *e*′ with the branch *d*. The spring *g* is connected by a conductor *c* with one end of the magnet I and by a branch *c*′ of the conductor *c* with one end of the magnet I^2, and the spring *g*′ is connected by a conductor *b* with one end of the magnet I^2, and by a branch *b*′ of the conductor *b* with one end of the magnet I′.

The operation is as follows: Current on the main circuit energizes the solenoid and draws the core D into the coil thereof, according to the amount of current, thereby closing the derived circuit by producing contact between the finger M and screw M′, as shown, and moving the friction-wheel H on its pivotal axis *y* toward the center of the disk F and away from that of the disk G, according to the amount of current. The disks are yieldingly maintained contiguous to the periphery of the friction-wheel against any distortion or departure of the latter from a true circle by the springs *p* and *p*′. Obviously as the energizing effect of the current on the solenoid weakens or strengthens the friction-wheel will be moved farther from or nearer toward the center *q*. The current which passes on the derived circuit *e d* energizes the magnets I, I′, and I^2, and toward whichever of the two outermost magnets the pendulum happens to incline that magnet will exert its attraction effect upon the armature I^3, and is re-enforced by the action of the central magnet I^2, since the lines of force between the latter and the other outermost or non-attracting magnet are practically *nil*.

To illustrate further the operation, suppose the poles of the magnet I I^2 to be the first to attract the armature under the influence of the current on the derived circuit. This will draw the pendulum toward the magnet I, causing the pawl *n* to turn the disk G, which will, through the medium of the friction-wheel H, turn the wheel F around at a rate of speed according to the location, with reference to the center of the latter wheel, of the friction-wheel, under the influence of the main current, and the wheel F drives the train E, causing it to produce corresponding registration of the amount of current passed through the solenoid. By moving toward its lower end in the direction of the magnet I, the pendulum K moves toward its upper end in the opposite direction, and by the resultant engagement of its forked extremity with the stud *m*′ shifts the commutator in the direction of its movement, thereby producing contact of the conducting end *l* and spring *g*, causing the derived circuit to close through the conductors *e* and *c*, and thereby cut out or shunt the magnet I, which, being thereby de-energized, will release the armature and permit it to be attracted by the magnet I′ I^2. Then the upper end of the pendulum shifts the commutator toward the right, breaking the contact between the end *l* and spring *g* and producing contact between the end *k* and spring *g*′, thereby cutting out or shunting the magnet I′, and thus loosening its hold on the armature, which is then again attracted by the magnet I I^2. As will readily be seen, the pendulum, under the alternate attraction of the magnets I I^2 and I′ I^2 on the armature,

vibrates regularly, and each stroke, with the provision of the two pawls n and n', turns the disk G around the same distance, which turns the disk F around at the same or at a greater or less rate of speed, according to the position of the wheel H with reference to the center q, and the dial-fingers are thereby caused to indicate upon the dials, suitably marked for the purpose, the amount of current consumed by the number of lamp-hours. It will of course be understood that when the lamps C are all cut out, the current on the derived circuit being insufficient to affect the core D', it will rise, and thus separate the contact between the finger M and screw M', thereby opening the derived circuit and stopping the vibration of the pendulum.

The intermediate mechanism between the prime motor D and apparatus E may, to permit the application of my improved mechanism for holding the disks F and G yieldingly against the interposed friction-roller H, involve other and old forms of friction-gear connected with a motor D, and the registering apparatus for varying the speed of the latter by variation in the influence of the current on the former; hence I do not intend to be understood as limiting the application of the said yielding holding mechanism to disks as such, but intend that in the claims hereinafter stated, which refer specifically to the said mechanism, the terms "disk" and "friction-roller" shall be sufficiently generic to include all analogous friction-gear.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric meter, the combination, with a suitable registering apparatus E, of a prime motor D in the main circuit, intermediate mechanism connected with the said registering apparatus and controlled from the prime motor to regulate the speed of registration according to variation in the current on the main circuit, a normally-open derived circuit, a pendulum K, connected with the said intermediate mechanism, an electric motor for the pendulum in the derived circuit, and a commutator in the said derived circuit actuated by the vibrations of the pendulum alternately to shunt portions of the said electric motor, substantially as and for the purpose set forth.

2. In an electric meter, the combination, with a suitable registering apparatus E, of a prime motor D in the main circuit, a disk F, geared to the said registering apparatus, a rotary toothed disk G, and a friction-wheel H, pivotally supported to extend between and in contact with the said disks and oscillated on its pivotal support between the centers of the disks by the action of the prime motor under variation in the current on the main circuit, a pendulum K, engaging with the disk G, a normally-open derived circuit, and an electric motor for the pendulum in the derived circuit, substantially as described.

3. In an electric meter, the combination, with a suitable registering apparatus E, of a prime motor D in the main circuit, a disk F, geared to the said registering apparatus, a rotary toothed disk G, and a friction-wheel H, pivotally supported to extend between and in contact with the said disks and oscillated on its pivotal support between the centers of the disks by the action of the prime motor under variation in the current on the main circuit, a pendulum K, pivotally supported between its ends and having pawls n and n' at opposite sides of its pivot extending into engagement with the teeth of the disk G, a normally-open derived circuit, and an electric motor for the pendulum in the derived circuit, substantially as described.

4. In an electric meter, the combination, with a suitable registering apparatus E, supported in a frame, a prime motor D in the main circuit, and a pendulum K, oscillated by a suitable motor in a derived circuit, of a disk F on a rotary shaft q, supported in the frame and movable in its bearings and geared to the apparatus E, a spring p, bearing against an end of the shaft q, a toothed disk G, connected with the pendulum and supported on a shaft q' in the frame and movable in its bearings, a spring p', bearing against an end of the shaft q', and a friction-wheel H on a pivotal support connected with the said prime motor and extending between and in contact with the disks F and G, substantially as and for the purpose set forth.

5. In an electric meter, the combination, with a suitable registering apparatus E, supported in a frame, a prime motor D in the main circuit, and a pendulum K, oscillated by a suitable motor in a derived circuit, of a contact M' and a pivotal finger M in the derived circuit, a pivotal bell-crank D^2, controlled from its arm o by the prime motor and yieldingly sustained against the finger M to maintain the derived circuit normally open, a disk F on a rotary shaft q, supported in the said frame and movable in its bearings and geared to the apparatus E, a spring p, bearing against an end of the shaft q, a toothed disk G, connected with the pendulum and supported on a shaft q' in the frame and movable in its bearings, a spring p', bearing against an end of the shaft q', and a rotary friction-wheel H, supported on the arm o' of the bell-crank D^2 between and in contact with the disks F and G, substantially as and for the purpose set forth.

6. In an electric meter, the combination, with a suitable registering apparatus E, of a prime motor D in the main circuit, intermediate mechanism connected with the said registering apparatus and controlled from the prime motor to regulate the speed of registration according to variation in the current on the main circuit, a pendulum K, carrying an armature I^3 and connected with the said intermediate mechanism, a normally-open derived circuit closed by the prime motor under the influence of the main current and

a commutator L, and a motor for the pendulum in the derived circuit, the motor comprising the electro-magnets I I′ of similar polarity and I² of the opposite polarity, substantially as and for the purpose set forth,

7. In an electric meter, the combination, with a suitable registering apparatus E, of a prime motor D in the main circuit, intermediate mechanism connected with the said registering apparatus and controlled from the prime motor to regulate the speed of registration according to variation in the current on the main circuit, a pendulum K, pivotally supported between its ends and carrying an armature I³ and connected with the said intermediate mechanism, a normally-open derived circuit closed by the prime motor under the influence of the main current, a motor for the pendulum in the derived circuit, comprising electro-magnets I I′ of similar polarity and I² of the opposite polarity, and a commutator L, comprising the longitudinally-movable insulating portion *m*, having contacts *l* and *k* at its opposite ends and engaged by the adjacent end of the pendulum in its vibratory movement, and springs *g* and *g′*, normally in contact with the said insulating portion *m* near the contacts *l* and *k*, the whole being constructed and arranged to operate substantially as and for the purpose set forth.

8. An electric meter comprising, in combination, a registering apparatus E in a frame E′, a solenoid D in the main circuit, a derived circuit containing a pivotal finger M and a contact M′, a pivotally-supported bell-crank D², having its arm *o* linked to the solenoid-core, a spring *o*³, normally holding the arm *o* against the finger M to separate it from the contact M′, a disk F on a rotary shaft *q*, normally supported in the frame and geared to the apparatus E, a spring *p*, bearing against an end of the shaft *q*, a toothed disk G on a shaft *q′*, movably supported in the frame, a spring *p′*, bearing against an end of the shaft *q′*, a friction-roller H, journaled in the end of the arm *o′* of the bell-crank extending between the disks F and G, a pendulum K, pivotally supported between its extremities and having pawls *n* and *n′* extending from opposite sides of its pivot into engagement with the teeth on the disk G, an armature I³ on the pendulum, a motor in the derived circuit comprising electro-magnets I I′ of similar polarity and I² of opposite polarity, a commutator L in the said derived circuit comprising a shifting-bar *m*, of insulating material, engaged by the adjacent end of the pendulum and provided with contacts *l* and *k* at its opposite ends, and springs *g* and *g′*, normally in contact with the bar *m* near its opposite ends, the whole being constructed and arranged to operate substantially as and for the purpose set forth.

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In presence of—
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