

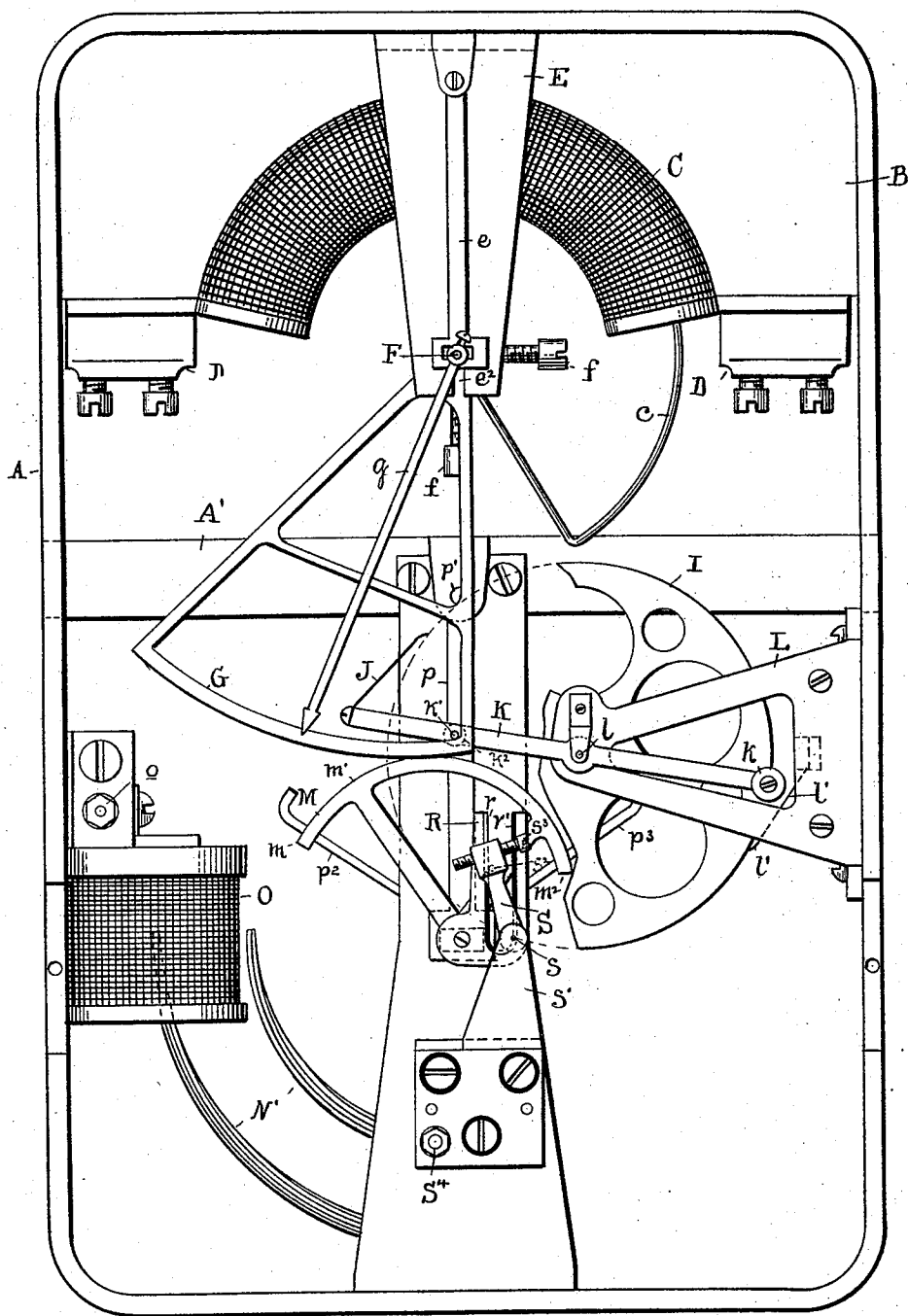
(No Model.)

3 Sheets—Sheet 1.

C. WIRT, G. R. GREEN & H. BURGER.
ELECTRIC METER.

No. 571,032.

Patented Nov. 10, 1896.



Witnesses
 Morris A. Clark.
 John R. Taylor.

*Charles Wirt
Geo. Ross Green
Herman Burger* } Inventors.
By their Attorneys.

Byer & Whipple

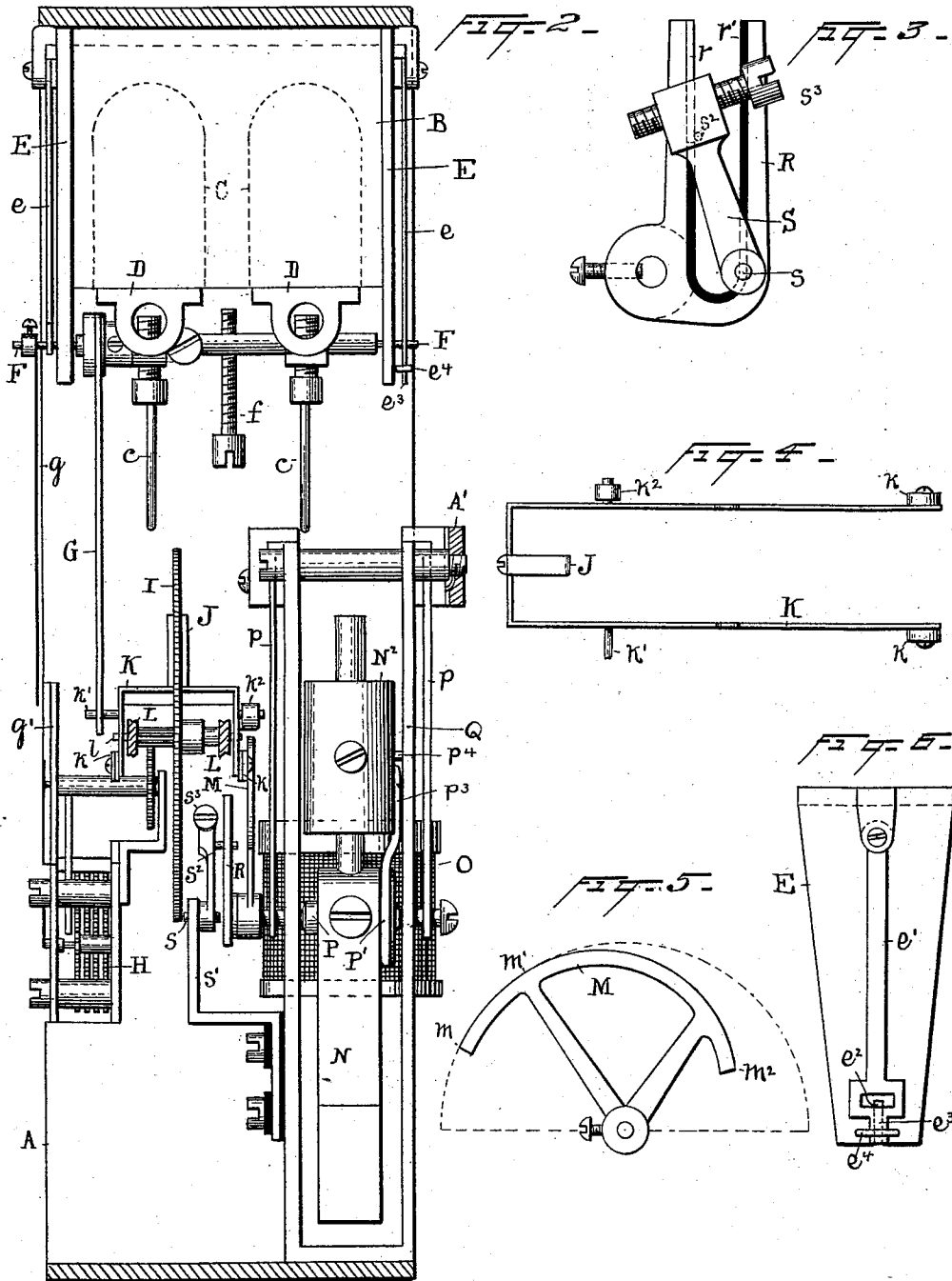
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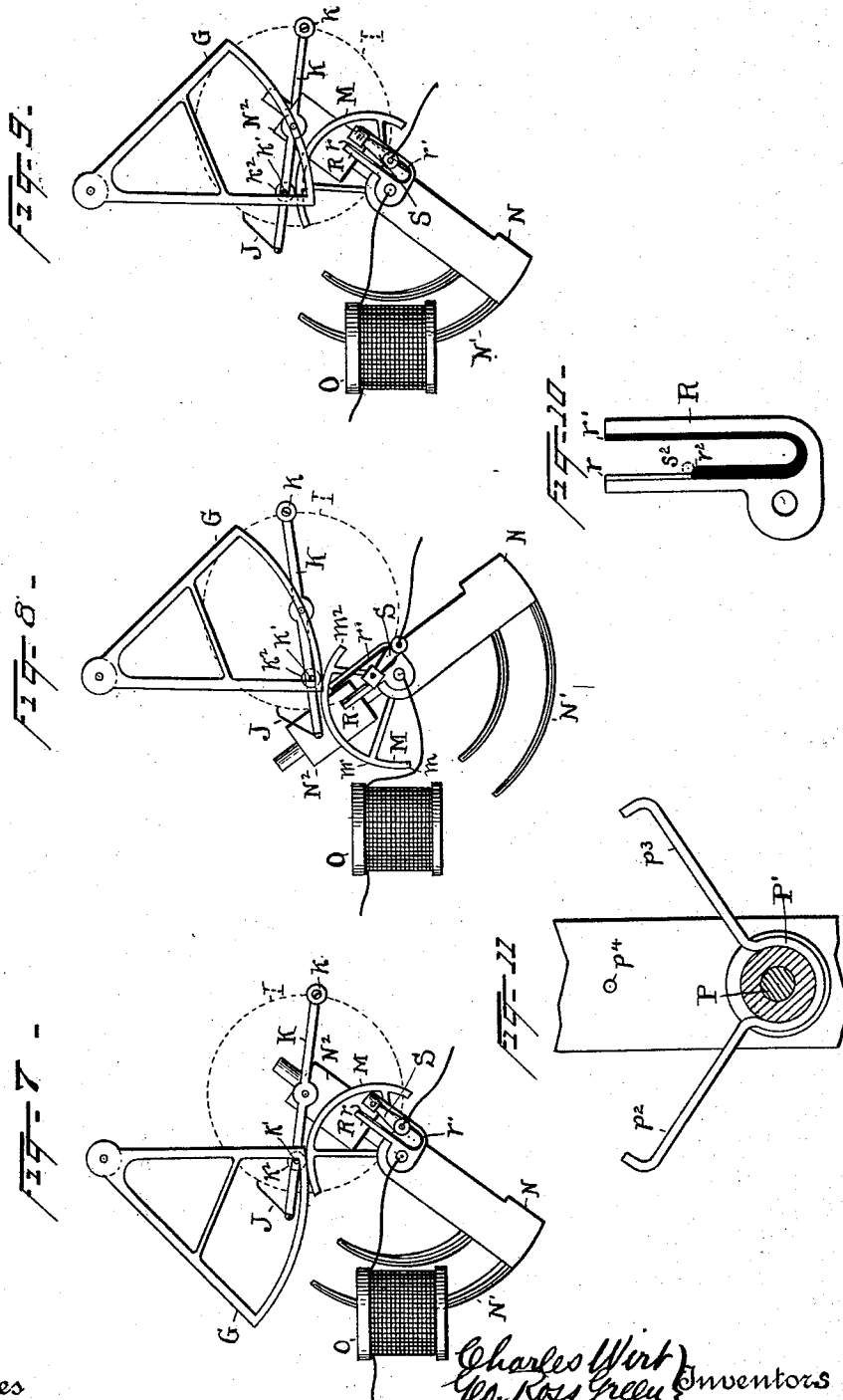
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UNITED STATES PATENT OFFICE.

CHARLES WIRT, GEORGE ROSS GREEN, AND HERMAN BURGER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE AMERICAN ELECTRIC METER COMPANY, OF SAME PLACE.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 571,032, dated November 10, 1896.

Application filed March 7, 1896. Serial No. 582,295. (No model.)

To all whom it may concern:

Be it known that we, CHARLES WIRT, GEORGE ROSS GREEN, and HERMAN BURGER, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Electric Meters, of which the following is a specification.

The object we have in view is to produce an electric meter of the character described in the application for patent filed by Charles Wirt, November 30, 1894, Serial No. 530,365, wherein a register is operated by an oscillating electric motor, the movement of the register produced by each oscillation of the motor being varied and controlled by a cam, whose position is adjusted by a current-indicator affected by the current to be measured. The object of our invention is to simplify the construction of such a meter and to increase its durability and the certainty of its operation.

Our invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the meter mechanism and its supporting-frame, the register train and dials and the meter-case being omitted; Fig. 2, a side view looking from the right of Fig. 1, the supporting-frame being shown in section and the register-train being shown in position; Fig. 3, a detail view of the circuit-controller for the oscillating motor; Fig. 4, a detail view of the pivoted frame which carries the pawl for actuating the register-train; Fig. 5, a detail view of a cam driven by the oscillating motor for operating the actuating-pawl shown in Fig. 4; Fig. 6, a detail view of one of the pivoted stirrups in which the spindles of the current-indicator and the oscillating motor are carried to give a rolling bearing. Figs. 7, 8, and 9 are diagrammatic views showing three different working positions of the principal parts of the meter. Fig. 10 is a view illustrating another and preferred form of circuit-controller; and Fig. 11 is a section through the motor-shaft, showing the retarding device.

Referring to the drawings, A is the frame, within which the meter mechanism is mounted.

At the top of this frame is secured a wooden block B, which carries the two semi-circular solenoids C, arching upwardly, and the circuit-terminals or binding-posts D. Over the block B, at the center, is placed a saddle E, from which two stirrups $e e'$ are suspended and which support the spindle F, carrying the two solenoid-cores $c c$ and the counterbalancing-weights f . The spindle F, is carried by the stirrups $e e'$ in order to provide a roller or antifriction bearing for the spindle. The spindle is held against lateral movement by the saddle E, which has slots e^2 , through which the spindle passes. The edge of the stirrups upon which the spindle rests is curved, the center from which the curve is struck being the pivot-point of the stirrups, so that as the spindle rotates in either direction the stirrups move to and fro, which action greatly reduces the friction. Stirrup e' is provided with a projection e^3 , which projects into a loop e^4 on the saddle and prevents the stirrups from being thrown too far to either side of its pivot. Spindle F, in addition to the solenoid-cores, also carries a cam G, which is in the form of an inverted arch. This cam is adjusted by the attraction of the cores c by the solenoids C, and this adjustment controls the angle through which the primary wheel of the register-train moves at each forward stroke of the actuating device, as will be hereinafter more fully described. The spindle F also carries a pointer g , which moves over a graduated plate g' , Fig. 2.

The register-train is shown at H, Fig. 2, and I is the primary wheel of the train, which wheel is actuated by a pawl J, carried by a pivoted frame K. This frame and primary wheel are pivoted at l to the frame L, which frame is secured to one side of the casing A. The wheel I is a large ratchet-wheel cut with exceedingly-fine teeth, and the actuating-pawl J is preferably a blade of spring metal. A spring-metal dog l' , carried by the frame L, engages with the wheel I to prevent backlash. The frame K is provided with weights k , which nearly balance the frame K, the end carrying the pawl J being slightly overbalanced in order that the pawl will assume its original position after each forward stroke. The original

position of the pawl J is controlled by the cam G, and for this purpose the frame K is provided with a pin k' , which strikes the cam G at each backward stroke of the pawl J. The original position of pawl J will vary according to the amount of current passing through the indicator, which, as before stated, controls the movement of the cam G, and as the cam G moves to the right of its pivot-point the pawl J will fall a greater distance on its return stroke, and hence as the amount of current passing through the indicator increases the angle through which the wheel I moves increases correspondingly, due to the longer stroke which the pawl J will receive from the actuating device M, which is driven by an oscillating motor consisting of a pendulum N, having armatures N' and a counterbalancing-weight N^2 , and the solenoid O. By a proper calibration of the working surface of the cam G the movement which will thus be given to the wheel I will be proportional to the current flowing through the solenoids C.

The actuating device M is a cam whose working surface has a concentric portion between the points m and m' and an eccentric portion from the point m' to the end of the cam at m^2 , as most clearly shown in Fig. 5. This cam is arranged to engage with the roller k^2 , carried by the frame K, and at each forward stroke of the pendulum the cam M gives a forward stroke of gradually decreasing speed to the pawl J. The oscillating motor is designed to have, under maintained conditions of potential, a constant rate of movement, or, in other words, to make a definite number of oscillations per minute, as distinguished from the oscillating motor described in the application of Charles Wirt, before referred to, in which the arc of vibration of the motor is varied by closing a shunt-circuit around the motor by means of a cam adjusted by the current-indicator. In that construction the forward stroke of the oscillating shaft, which is flexibly connected to the oscillating motor, was suddenly arrested at each forward stroke by the cam adjusted by the current-indicator. This is an objectionable feature, because it results in an overthrow of the registering mechanism. To overcome this difficulty, we employ the cam M, above referred to. It will be readily seen that by imparting to the pawl J a forward stroke of gradually decreasing speed all overthrow of the register-wheel I is guarded against and the point to which the cam M moves the pawl J in its forward stroke is limited by reason of the concentric portion of the cam, and hence there is no necessity for providing a stopping device for arresting the forward movement. This form of actuating device permits of the employment of the motor having a constant arc of vibration, the length of each forward stroke of the pawl J being controlled entirely by the cam G. This arrangement conduces to simplicity and certainty of operation. To prevent the hammering of the motor at the ex-

treme limits of its stroke when it is doing little or no work on the register-train, a retarding device is employed, consisting of a frictional spring P', surrounding and grasping the shaft P of the motor, Fig. 11. This spring has arms $p^2 p^3$, which strike a pin p^4 as the pendulum reaches the extreme limits of its swing and turn the spring P' on the shaft P, thus giving a frictional retardation at these points.

The shaft P, which carries the pendulum N and the cam M, is carried by two stirrups p , pivoted at p' to a frame Q, which is secured between the bottom of the frame A and the cross-bar A', extending across the rear of the frame A. The stirrups p are similar in construction to the stirrups e and e' , above referred to.

The circuit to the solenoid O is opened near the end of each forward stroke of the pendulum and is closed again at a point about midway of its full forward stroke by a circuit-controlling device consisting of two members, one a fork R, carried by the shaft P and oscillating therewith, and the other a pivoted weighted arm S, pivoted independently of the fork R. The fork R is provided with a platinum strip r and a strip of insulating material r' . (See Fig. 3.) The arm S is pivoted at s to a bracket s' , which is secured to the frame Q, but insulated therefrom, and is provided with a contact-finger s^2 , which plays between the fork R and is adapted to make contact with the platinum strip r . A weight s^3 , in the form of a screw, is carried by the arm S, which tilts the arm to open and close the motor-circuit as the arm is carried over its dead-center through the oscillation of the fork R. The positions of the various parts of the meter illustrated in Fig. 1 show the position of rest, the finger s^2 being in contact with the platinum strip r . When the current is sent through the meter, the solenoid will draw its armature N' upward, which action swings the fork R and arm S to the right, the circuit being maintained at the controller by the rubbing action of the platinum strip r and finger s^2 . When the arm S is moved over its dead-center through the movement of the fork R, weight s^3 causes the arm S to topple over, breaking the circuit at the strip r and finger s^2 , and in falling over the finger s^2 rests against the insulation r' on the opposite side. On the backward swing of the pendulum the fork R is moved in the opposite direction, carrying the arm S with it, and as the arm S is moved over its dead-center again the weight s^3 causes it to topple over to the left of its pivot; but before the finger s^2 strikes on the opposite side the fork will have moved some distance and the finger s^2 will rest on the insulation below the platinum r . As the pendulum continues its forward swing the finger s^2 rides upward on the insulation, and when the pendulum reaches the position of Fig. 1 the finger will be in contact again with platinum r , completing the circuit to the solenoid, which draws

the armatures upward again. The circuit remains closed at the circuit-controller for a short interval only, which results in a slight pull on the armatures at each forward stroke of the pendulum to maintain a uniform rate of movement. To receive the discharge and lessen the spark when the circuit is broken at r and s^2 , the spool of the solenoid O is made of a non-magnetic metal, such as copper, or it may be of iron covered (as by electroplating) with copper, and the armatures N' are also preferably electroplated with copper. We prefer to construct the circuit-controller so as to give a variable length of contact, as illustrated in Fig. 10, by providing a shoulder r^2 on the insulation r at the point where it joins the platinum strip r . In passing from the insulation to the metal the finger s^3 will strike the metal at a point more or less removed from its junction with the insulation, according to the speed of movement. The faster the movement the greater will be the length of the platinum strip which will thus be passed over without contact and the less will be the length of the contact between the platinum strip and the finger s^3 .

In a meter of this character while the number of beats per minute of the pendulum remains the same the amplitude of swing may change, due to the friction and to the fall in pressure of the current. The pendulum may thus move faster or slower through an angle near the vertical line, and the object of this special arrangement of the circuit-controller is to provide a variable automatic length of contact, thus providing less current when the pendulum is doing no work and more current as the swing of the pendulum becomes less.

It is desirable to separate the magnetic parts of the apparatus as far as practicable in order to avoid disturbance of one by the other, and it is for that reason that the solenoids C are placed at the top and the armatures N' at the bottom of the casing. The solenoid O is preferably provided with sufficient resistance to take the full difference of potential and without the need of additional resistances.

In connecting the meter in circuit the solenoids C of the indicator are placed directly in the line, and the solenoid O is placed in a multiple arc across the circuit. This circuit is connected to the binding-post o of the solenoid, and from the solenoid the circuit leads to the shaft P of the pendulum, which includes the fork R, and the other end of the circuit is connected to the binding-post s^4 , carried by the frame S', and leads through the arm S to the finger s^2 , the circuit being completed at the platinum strip r .

The operation of the meter is as follows: When the circuit to the solenoid O is closed, the pendulum N is caused to oscillate, the circuit-controller R S opening and closing the motor-circuit, as above explained; but so long as lamps or other translating devices

are not receiving current the indicator and cam G will remain at their idle positions, the cam G, through pin k' , holding frame K, which carries the actuating-pawl J, at a position where the actuating-cam M cannot impart a stroke to the pawl. This position of the parts is shown in Fig. 7. When lamps or other translating devices are taking current from the line, the solenoids C will draw in their armatures, causing cam G to assume a new position, and, supposing this position to be that of the full capacity of the meter, the cam G will be in the position illustrated in Figs. 8 and 9. In this position of the cam G the pawl J is in position to receive its maximum length of stroke. In Fig. 8 pendulum N is shown on its forward swing and before the motor-circuit is restored at the circuit-controller, and cam M is in the position where it begins to impart a forward stroke to the pawl J. In Fig. 9 the pendulum is shown at the end of its forward swing, the motor-circuit having been opened at the controller R S, and the concentric portion of cam M is in engagement with roller k^2 of the pawl-frame K. The angle through which wheel I is moved under these conditions is such as is due to the raising of frame K from the position of Fig. 8 to that of Fig. 9. As the pendulum swings backward from the position of Fig. 9 to that of Fig. 8 the pawl J descends again, due to the overbalancing of the frame K, and pin k' again rests on cam G, the parts being again in the position of Fig. 8. If the quantity of current taken from the line decreases, the armatures of solenoids C will recede, and the cam G will receive a new position intermediate that of Fig. 7 and that of Fig. 8, which will result in a decreased length of stroke to pawl J.

What we claim as our invention is—

1. In an electric meter, the combination with a pendulum, an actuating-solenoid and an overbalanced circuit-controller, forming an oscillating electric motor having a uniform rate of oscillation, of a register-train, a driving device actuated by said motor and adapted to intermittently drive said register-train, a current-indicator, and a cam whose position is controlled by said current-indicator and varying the extent of movement of said driving device, substantially as set forth.

2. In an electric meter, the combination with an oscillating motor having an overbalanced circuit-controller for controlling its circuit, whereby its rate of oscillation is made uniform, of a register-train, a driving device for said train, an oscillating cam carried by the motor and moving said registering device in one direction with a gradually-diminishing rate of movement, and a cam moved by the current-indicator and controlling the extent of movement of the register-driving device in the other direction, substantially as set forth.

3. In an electric meter, the combination of a current-indicator, a register, an actuating

- device for said register, means controlled by said current-indicator for limiting the movement of said actuating device in one direction, a motor for driving said actuating device, and a circuit-controller for said motor, comprising an oscillating fork and a weighted arm carrying a contact device, said arm being pivoted eccentrically to said fork, whereby the motor-circuit is opened and closed at predetermined points, substantially as set forth.
4. In an electric meter, the combination with the oscillating motor, of the circuit-controller, comprising the independently-pivoted arm S and the fork R carried by the motor-shaft, having conducting and insulating surfaces, substantially as set forth.
5. In an electric meter, the combination with an oscillating electric motor, of an overbalanced circuit-controller having a variable length of contact controlled by the speed of the movement, substantially as set forth.
6. In an electric meter, the combination of an oscillating electric motor, a register-train, a driving device actuated by said motor and adapted to intermittently drive said register-train, means controlled by a current-indicator for varying the extent of movement of said driving device, and an overbalanced circuit-controller having a length of contact varying with the speed of movement of the motor, substantially as set forth.
7. In an electric meter, the combination

with a pendulum, of a solenoid operating the pendulum, and a circuit-controller moved by the pendulum and closing the circuit on its forward swing, said solenoid being associated with a body of non-magnetic metal which receives the discharge and lessens the spark, substantially as set forth.

8. In an electric meter, the combination with an oscillating electric motor, of a retarding device retarding the movement of the motor at the extreme limits of the swing, substantially as set forth.

9. In an electric meter, the combination with an oscillating electric motor, of a frictional retarding device retarding the movement of the motor at the extreme limits of the swing, substantially as set forth.

10. In an electric meter, the combination of the oscillating motor, the controlling-solenoids, and the counter, the motor-armatures and the controlling-solenoids being located at opposite ends of the case and the mechanism of the meter being located between them, substantially as set forth.

This specification signed and witnessed this 23d day of January, 1896.

CHARLES WIRT.
GEO. ROSS GREEN.
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Witnesses:

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WM. B. JONES.