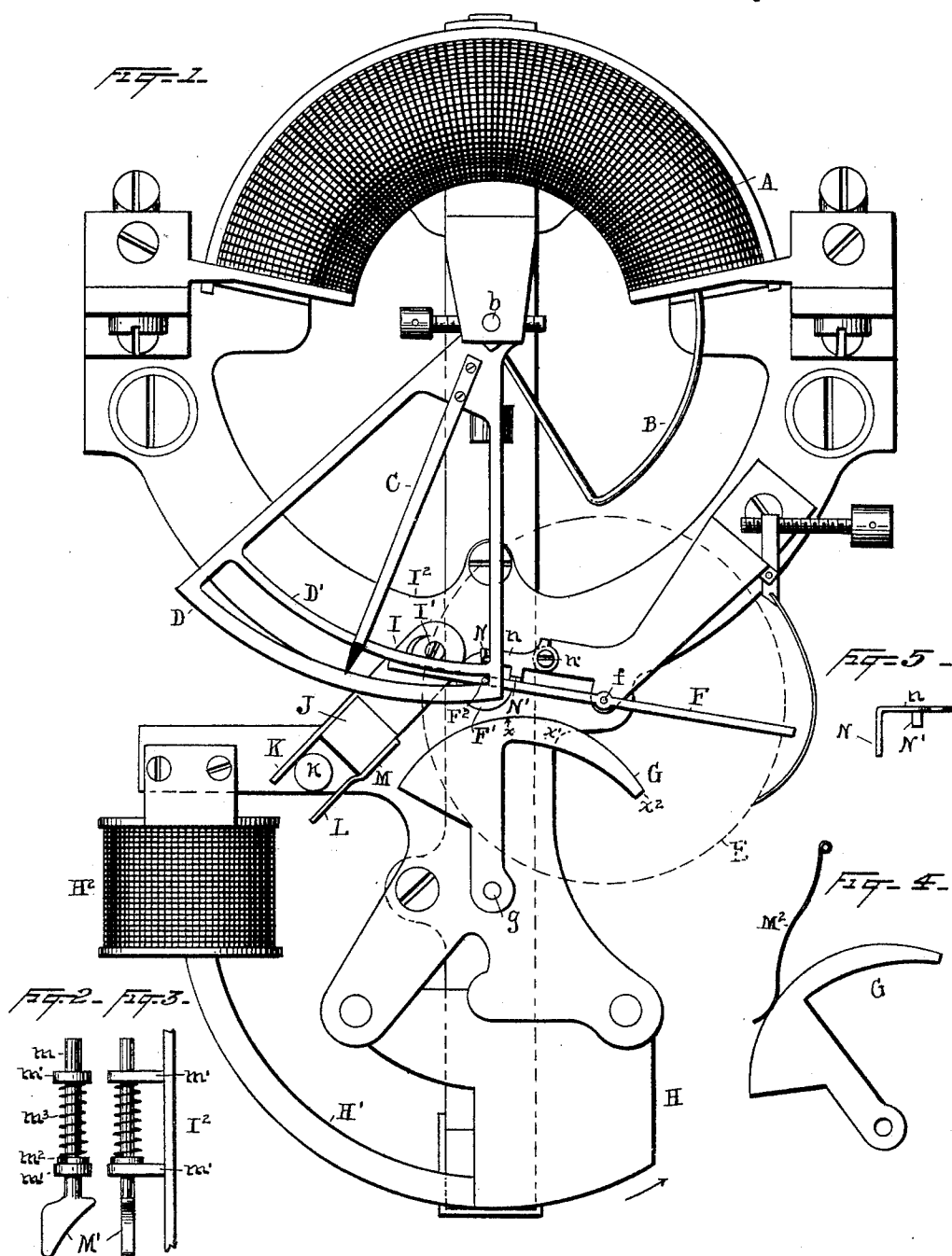


(No Model.)

W. D. MARKS & G. R. GREEN.
ELECTRIC METER.

No. 586,560.

Patented July 20, 1897.



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ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 586,560, dated July 20, 1897.

Application filed May 29, 1897. Serial No. 638,682. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM D. MARKS and GEORGE ROSS GREEN, citizens of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Electric Meters, of which the following is a specification.

The first object of our invention is to provide a retarding device or brake for the driving member of registering-meters such as described in Letters Patent No. 571,032, issued November 10, 1896, wherein an oscillating motor or pendulum is employed to operate a registering mechanism. In registering-meters of the character referred to the pendulum is liable to swing through too great an angle and strike other parts of the meter mechanism or framework. This action occurs when, for instance, the pressure on the electric light or power circuit rises, and hence more current passes through the motor-winding, thus producing a stronger pull on the pendulum and causing it to swing through a greater angle.

In practice the motor-winding is connected across the circuit and will actuate the pendulum continuously regardless of whether or not current is passing through the meter-solenoids, and as the pendulum is adjusted to make a certain number of oscillations per minute when actuating the registering mechanism it will be seen that when no current is passing through the meter the pendulum will be caused to swing through a greater angle because the registering mechanism is not actuated thereby.

If the pendulum strikes any parts of the meter, it will be brought to rest suddenly, and the blow will cause the pendulum to swing in the opposite direction with increased speed, and hence increase the number of oscillations per minute, and resulting in a constant hammering of the pendulum while no current is passing through the ampere-indicator. If the oscillations of the pendulum are adjusted so as to prevent hammering while the pendulum is doing no work, it may not swing through a sufficient angle to register the full load when it is doing work. Such irregularities in the amplitude of oscillation of the pendu-

lum result in an incorrect registration of the registering mechanism per minute, and hence the register or counter will not show correctly the amount of energy consumed. A device for guarding against this objection is shown in the patent above referred to, and also in Patent No. 571,037, issued November 10, 1896. In both these patents the brake is carried by and acts upon the shaft or hub of the pendulum by the engagement of one member of the brake with a rigid stop. While those devices prevent the hammering of the pendulum, they both tend to accelerate the swing of the pendulum. This tendency is avoided in our improved brake, wherein the brake is pivoted to or is mounted or works upon a stationary support and acts upon a movable member of the pendulum or motor or upon a device oscillated thereby. The brake is preferably arranged to engage the oscillating member periodically during the latter part of the swing of the oscillating member in one direction and during a period of the first part of the swing in the opposite direction. The period of engagement may be varied to adjust the oscillations of the pendulum or motor or the device oscillated thereby.

In electric meters of the character referred to we find that our object is best accomplished by applying the brake to the working surface of the pendulum-cam which drives the register or counter.

The second object of our invention is to provide a device which will render "dead-beat" the controlling cam or arch which is adjusted by the ampere-indicator of the meter and at the same time prevent any swing of the arch due to the energizing of the cores of the ampere-indicator when the circuit-breaker is in contact.

Our invention is illustrated in the accompanying drawings.

Figure 1 is an elevation of the essential parts of the meter, showing the preferred form of brake and the device for rendering the controlling cam or arch "dead-beat." Figs. 2 and 3 are respectively front and side elevations of a modified form of brake; Fig. 4, a view illustrating a spring engaging the driving-cam of the oscillating motor and acting as a brake, and Fig. 5 is an edge view of the

device for rendering the controlling cam or arch of the ampere-meter "dead-beat."

Referring to the drawings, A is the ampere-indicator solenoid; B, the core carried by a shaft pivoted at *b*; C, the pointer of the ampere-indicator, and D the controlling cam or arch, the pointer C and the arch D being also carried by the shaft of the core B. The controlling-cam, as is now well understood, controls the rate of registration. The primary wheel of the register or counter is indicated by the dotted circle E. A frame F, pivoted at *f*, carries the pawl for driving the wheel E. The frame F is actuated by the driving-cam G, which cam is mounted upon a shaft *g*, upon which shaft is also mounted the pendulum H. The pendulum is provided with a core H², which is actuated by the motor-solenoid H². In practice an automatic circuit-breaker of the character described in Patent No. 571,032, above referred to, is provided to periodically open and close the circuit to the motor-solenoid H²; but to avoid confusion in the drawings this circuit-breaker is omitted.

The brake comprises a plate I, which is pivoted at I' to the central frame-plate I², a weight J, secured to the plate I, a finger K, which rests on a pin *k*, projecting from an arm of the frame-plate I², and which finger holds the brake in its normal position, and a spring-finger L, which strikes the pin *k* when the pendulum is near the end of its stroke in the direction of the arrow.

The positions of the parts indicate the meter at rest—that is, with no current passing through either the motor-solenoid or the ampere-indicator solenoid. When the circuit is closed to the motor-solenoid, the pendulum will oscillate, but the driving-cam G will not actuate the pawl-frame F, due to the controlling-arch D being at the zero position. When the pendulum swings in the direction of the arrow, (which is the unattracted swing,) the brake-surface M will engage with the driving-cam G at or before the point *x* of the cam-surface, and the engagement of the driving-cam with the brake M will continue to the end of the stroke.

Before the highest point of the cam-surface, which is at *x'*, approaches the brake-surface M the spring-finger L will have been forced against post *k*, and thus the cam will be subjected to additional pressure, which gradually increases until the highest point on the cam is in contact with the brake-surface M. The driving-cam is not subjected to increasing pressure beyond the point *x'* to the end *x²*, because that portion of the cam G is concentric with the shaft *g*. On the swing of the pendulum in the direction opposite to the arrow it is slightly accelerated by the pull of the solenoid H². Thus the pendulum is alternately retarded and accelerated and a uniform rate of oscillation of the pendulum is maintained.

Instead of the brake shown in Fig. 1, the device shown in Figs. 2 and 3 may be em-

ployed. This device consists of a brake-shoe M', carried by a shank *m*, which works through two bearings *m'*, projecting from the frame-plate I². The downward movement of the brake-shoe is limited by the collar *m²* on the shank *m*, and between this collar and the upper bearing *m'* is a spiral spring *m³* for giving the proper pressure to the brake.

In the form shown in Fig. 4 a simple blade-spring M² is shown as the brake. This spring may be arranged to be always in contact with the driving-cam G or only at intervals, as is the case with the constructions of Figs. 1 and 2. With this arrangement of Fig. 4 the spring will act upon the cam G with a gradually-increasing pressure until it reaches the highest point of the cam.

In the form of brake shown in Figs. 2 and 4 the friction is due practically to the spring-pressure alone, while in the preferred form shown in Fig. 1 the brake acts first by gravity and then by spring-pressure. In practice we prefer to have the brake engage the driving-cam at a certain point during its swing in the direction of the arrow, and the brake in Fig. 1 is located so that it will engage the driving-cam only after the highest point *x'* of the cam has passed under the wheel F', or, in other words, the brake is so located that the cam will register the full capacity of the meter before it strikes the brake.

From the foregoing it will be seen that with either form of brake shown the pendulum will not be arrested suddenly, nor will the brake have any tendency to accelerate the swing of the pendulum in the opposite direction, as is the case with the brakes shown in the patents above referred to.

It will be understood that our form of brake may be applied to any form of oscillating or chrono-electric motor without departing from the spirit of our invention, and that its application is not limited to oscillating motors employed in meters, since it is evident that our brake may be equally as well applied to clocks and other apparatus employing oscillating motors or pendulums.

In an application filed by William D. Marks January 23, 1897, Serial No. 620,312, is described an arrangement for overcoming magnetic and frictional lag in the ampere-indicator by means of an additional winding. When the current through this winding is controlled by the automatic circuit-breaker for the oscillating-motor coil, a slight oscillation of the controlling-arch is produced, thus overcoming frictional lag. The register of the meter herein described is actuated by a driving-cam during the unattracted swing of the pendulum and the circuit to the motor-coil is closed for a short period during the attracted swing of the pendulum. The closure of the circuit to the motor-coil takes place while the driving-cam G is still in engagement with the wheel F' of the frame F, and hence the controlling-arch is free to move, due to the pull of the ampere-indicator coils,

Thus it will be seen that upon the closure of the circuit to the motor-coil an additional movement is given to the controlling-arch due to the increased pull on the core B through the additional winding above referred to. This is objectionable for the reason that should the pin F^2 , carried by the frame F, strike the arch D while this additional movement is given to the arch the arch is liable to be held at that point, and upon the next swing of the pendulum in the direction of the arrow the pawl engaging the wheel E will be moved through a greater distance than it should be, for the reason that the increased movement of the controlling-arch permitted the frame F and the wheel F' to drop a greater distance, and hence the advancement of the wheel E will be correspondingly increased, although the amount of current flowing through the ampere-indicator coils may not have increased. To prevent this action, we provide the device illustrated in Figs. 1 and 5. This device has a knife-edge N, which engages with the concentric arch D' to hold the controlling-arch against movement while the circuit to the motor-coil is closed. The knife-edge N is carried by an arm n , pivoted at n' to an extension of the arm upon which the frame F is pivoted. The arm n is provided with a foot N' , adapted to engage with the upper side of the frame F, and whereby the knife-edge is raised from the arch D'. The positions of the parts in Fig. 1 represent the relative positions when no current is passing through the ampere-indicator, the knife-edge N holding the controlling-arch against movement. As the cam G oscillates it strikes the wheel F', but the height of this wheel, due to the zero position of the arch D, prevents the cam actuating the counter. However, the cam is enabled to give a sufficient movement to the frame to raise the pin F^2 from the arch D and the knife-edge N from the arch D', thus releasing the arch D and permitting it to adjust itself in case any current should be flowing through the ampere-indicator. Assuming now that current is flowing through the ampere-indicator and that the controlling-arch is moved to a position beyond the zero-point, the frame F will drop a corresponding distance. As the cam G engages the wheel F' on the unattracted swing of the pendulum the frame F will be moved upward until the pin F^2 strikes the arch D', which will be the proper length of movement for the amount of current flowing through the ampere-indicator. As the pin F^2 approaches the arch D' the frame F will strike the foot N' and raise the knife-edge N from the arch D', the proportions of the parts n , N, and N' being such that the knife-edge will be disengaged from the arch D' before the pin F^2 strikes the arch D', and hence the controlling-arch is released and is free to adjust itself to the amount of current flowing through the ampere-indicator before the frame reaches the limit of its upward

movement. Upon the return swing of the pendulum—that is, in the direction opposite the arrow—the knife-edge N will reengage the arch D' before the circuit to the motor-coil is closed, and the controlling-arch will be again held against movement. Thus it will be seen that at a certain period during the unattracted swing of the pendulum the pin F^2 and the knife-edge N are removed from engagement with the arches D and D', respectively, and hence the controlling-arch is free to adjust itself accurately to the amount of current flowing through the ampere-indicator and insure a proper registration by the counter, while at all other times the controlling-arch is held stationary.

What we claim is—

1. The combination with an oscillating motor, of a brake carried by a stationary support and engaging periodically with a movable member of the motor, substantially as set forth.
2. The combination with an oscillating motor, of a brake engaging periodically with a movable member of the motor near one end of the swing of the motor and with a gradually-varying pressure, substantially as set forth.
3. The combination with an oscillating motor, of a gravity-brake periodically engaging the motor, substantially as set forth.
4. The combination with an oscillating motor, of a gravity-brake acting upon a movable member thereof, and means for increasing the pressure of the brake at a certain period, substantially as set forth.
5. The combination with an oscillating motor, of a brake comprising a pivoted body adapted to make contact with a movable member of the motor, and means for holding said brake out of contact with said movable member during a certain period, substantially as set forth.
6. The combination with an oscillating motor, of a brake comprising a pivoted weighted body adapted to make contact with a movable member of the motor, and means for holding said brake out of contact with said movable member during a certain period, substantially as set forth.
7. The combination with an oscillating motor, of a brake comprising a pivoted body adapted to make contact with a movable member of the motor, means for holding said brake out of contact with said movable member during a certain period, and a spring for increasing the pressure of the brake at a certain period, substantially as set forth.
8. The combination with an oscillating motor, of a brake comprising a pivoted weighted plate, a projection from said plate engaging a stud to hold said brake out of contact with a movable member of the motor during a certain period, and a spring projecting from said plate adapted to strike said stud at a certain period during the engagement of the brake

with said movable member and whereby the pressure of the brake is increased, substantially as set forth.

9. The combination of an oscillating motor, an actuating device oscillated thereby, and a brake engaging with said device for periodically retarding the oscillations, substantially as set forth.

10. The combination of an oscillating motor, a cam oscillated thereby, a device oscillated by said cam, and a brake engaging with said cam for periodically retarding the oscillations, substantially as set forth.

11. In a registering-meter, the combination with an oscillating motor and a counter driven thereby, of a brake carried by a stationary support and engaging periodically with a movable member of the motor, substantially as set forth.

12. In a registering-meter, the combination of an oscillating motor, a cam oscillated thereby, a counter driven by said cam, and a brake engaging periodically with said cam, substantially as set forth.

13. In a registering electric meter, the combination with a register, of a controlling device adjusted by an ampere-indicator for controlling the rate of registration, and a device for periodically holding said controlling de-

vice against movement, substantially as set forth.

14. In a registering electric meter, the combination with an oscillating motor for driving a register, of a controlling device adjusted by an ampere-indicator for controlling the rate of registration, a device for holding said controlling device against movement, and means actuated through the oscillations of the motor for periodically releasing said holding device, substantially as set forth.

15. In a registering electric meter, the combination of an oscillating motor, a register, an actuating device driven by said motor to actuate the register, a controlling-arch adjusted by an ampere-indicator for controlling the rate of registration, a device engaging with said controlling-arch to hold the same against movement, and which device is periodically actuated by the motor to release the controlling-arch, substantially as set forth.

This specification signed and witnessed this 26th day of May, 1897.

WM. D. MARKS.
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Witnesses:

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