

(No Model.)

S. D. MOTT.
ELECTRIC METER.

No. 381,480.

Patented Apr. 17, 1888.

Fig. I

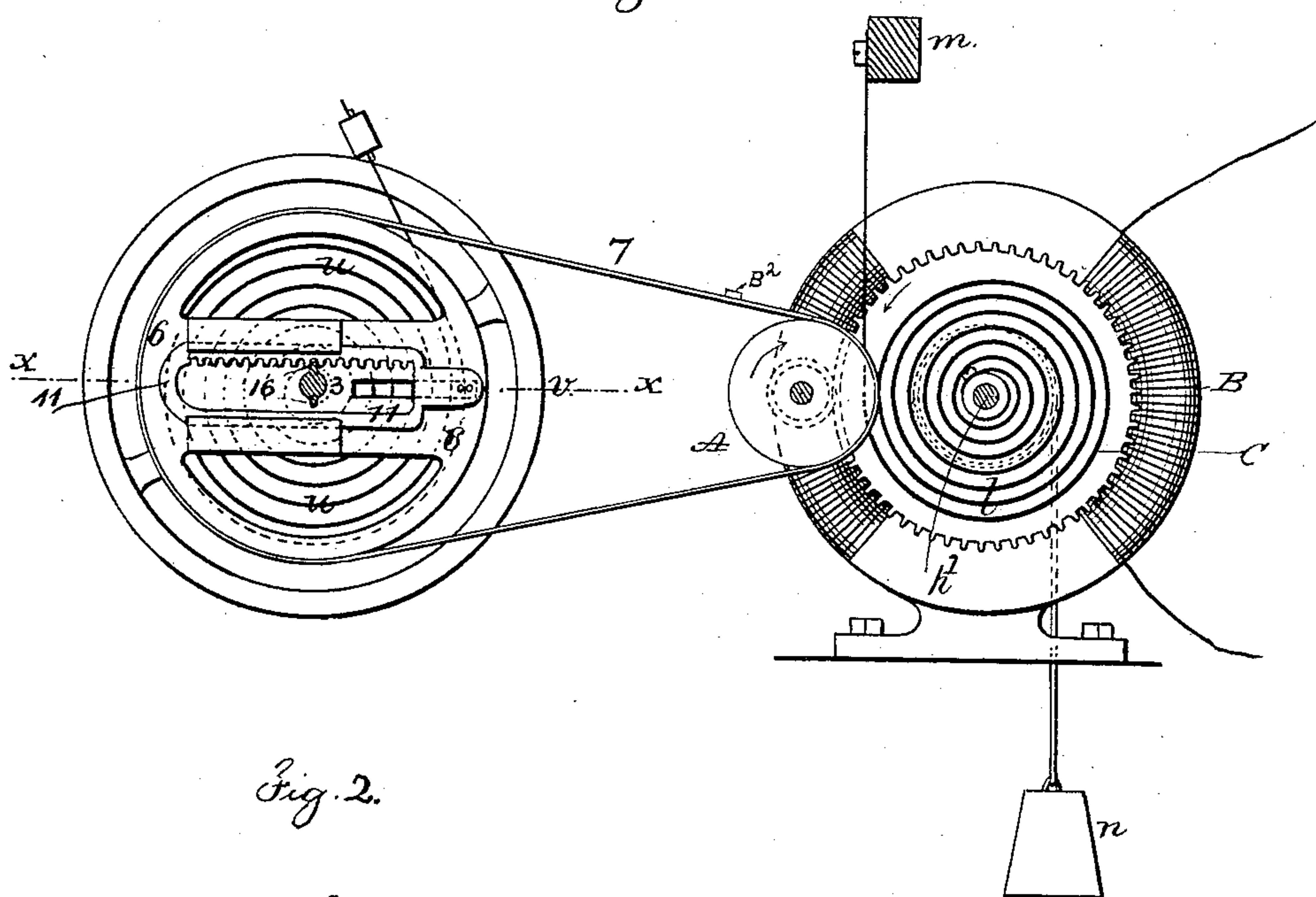
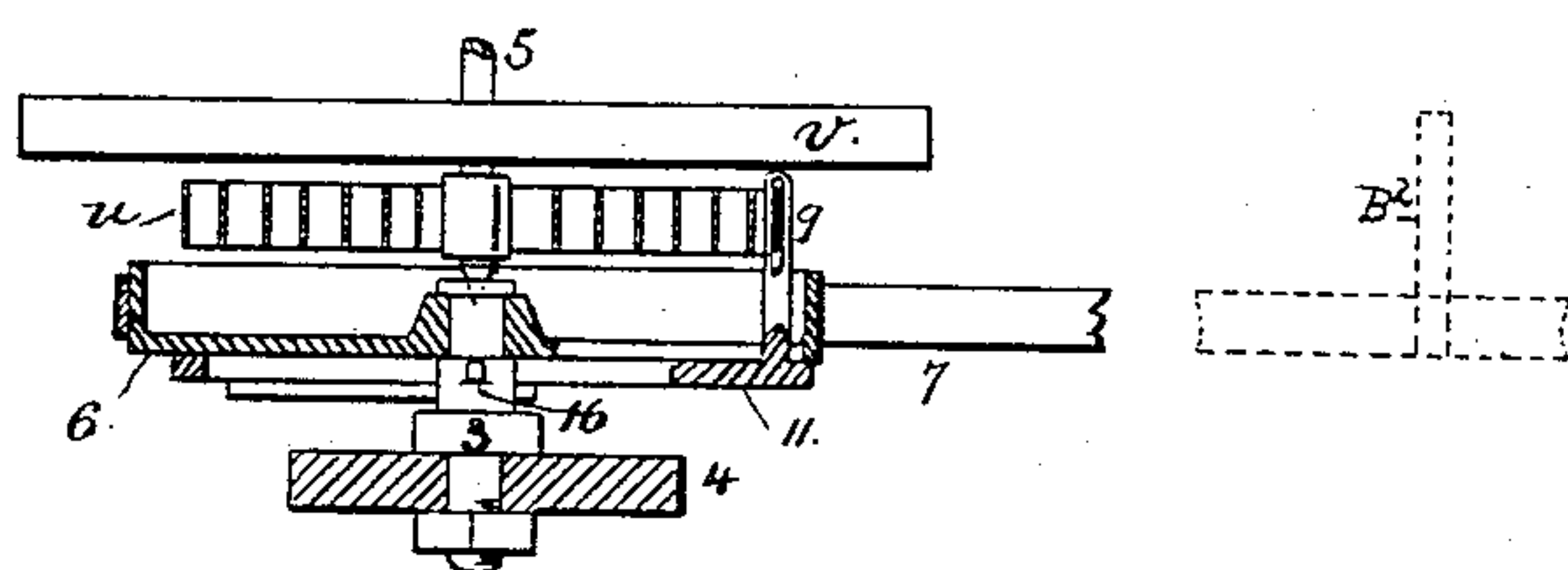


Fig. 2.



Witnesses,
Geo. Montague.
Thos. Torrey.

Inventor
D. D. Mott-
per H. B. Townsend
att'y

UNITED STATES PATENT OFFICE.

SAMUEL D. MOTT, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE SCHUYLER ELECTRIC COMPANY, OF MIDDLETOWN, CONNECTICUT.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 381,480, dated April 17, 1888.

Application filed August 24, 1883. Serial No. 104,642. (No model.) Patented in England September 29, 1882, No. 4,646.

To all whom it may concern:

Be it known that I, SAMUEL D. MOTT, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Meters, (for which I have obtained Letters Patent of Great Britain, September 29, 1882, No. 4,646,) of which the following is a specification.

My invention relates to instruments for recording or registering the flow of electric currents, and more especially to the class of such instruments heretofore patented to me, (United States Letters Patent No. 267,445,) in which a register mechanism is driven by a constant power, and the retarding action of a retarding device for such power-driven mechanism is automatically adjusted by the varying strength of the current to be registered in such way that if the current increase, the retarder will interpose less obstacle to the free movement of the power-driven mechanism, and said mechanism will therefore move faster, while, vice versa, if the current decrease, the retarder will be adjusted so as to lessen the movement of the power-driven mechanism in a given period of time.

My present invention consists in the combination, with a balance-wheel such as is used with watches and clocks and a register mechanism driven by a constant power, to which latter the balance-wheel and its escapement are designed to act as a retarding device, of suitable means for adjusting the rate of oscillation of said balance-wheel, controlled by the action of the electric current to be registered. The most obvious and the usual method of adjusting or regulating the rate of oscillation of the balance-wheel is by shortening or lengthening the hair-spring; but I do not limit myself to the employment of such means, and may employ other means known in the clock and watch maker's art for this purpose.

To impart the required movement to the regulating or adjusting mechanism, an electro-magnet, electric motor, or other device that will respond to variations in the current to be registered may be employed. The electro-magnetic action of the current is the most re-

liable, and I therefore prefer to employ electro-magnets in some simple form for adjusting the regulating devices of the balance-wheel. In the present instance I employ a simple form of electro-magnetic motor traversed by the current to be registered, and connect said motor with the device by which the hair-spring of the balance is shortened or lengthened. A suitable retracting device is used in connection with the motor, and is so constructed or adjusted as to exert a greater retracting influence as the strength of the motor increases with an increased current, so that the motor may assume a definite position according to the strength of current affecting it, and may hold the regulating device in one position so long as that strength of current continues.

For a retractor I prefer to employ a spiral or conical drum and a weight and cord, the cone or spiral of the drum being suitably formed, having regard to the various and well-known conditions controlling the rate of oscillation of the balance-wheel, so that the rate of movement of the register under the action of the constant driving-power shall be proportional to the strength of the current. I may, however, employ a retracting-spring. As the range of adjustment of the hair-spring is large, I also propose to employ a peculiar device, whereby the stud or pin that shortens the hair-spring may follow the convolutions of the same in a spiral line. This device consists of a sliding piece mounted on a revolving support, and carrying the adjusting stud or pin, in combination with a suitable device, whereby at every complete revolution of the support the sliding piece may be moved radially inward or outward across the convolutions of the hair-spring.

Having set forth the general principles of my invention, I will proceed to describe one of the forms that the invention may take in practice.

Figure 1 shows in detail the parts to which my present invention more particularly relates, the power-driven train, register, &c., being omitted for the sake of simplicity. Fig. 2 is a cross-section on the line *x x* of Fig. 1.

Referring to Fig. 2, *v* indicates the balance-

wheel of an ordinary clock or watch escapement, which balance-wheel may be suitably connected with a gear-train or other mechanism driven by a constant power, said gear-train constituting itself the register, or serving to impart movement to a suitable registering-train in any proper manner, as is now well understood in the art.

At *u* is indicated the usual hair-spring, which is embraced near one end by an encompassing pin or stud of any ordinary construction, (indicated at 9,) said pin serving, when adjusted in a circular line, to lengthen or shorten the hair-spring, and to thus vary the effective rate of oscillation of the balance-wheel and the consequent speed with which the driving-power may move the register. The pin or stud 9 is mounted upon a radially-movable slide, 11, which is itself suitably mounted on a rotary support, 6, that may be rotated by means of a belt, 7, or otherwise, through the agency of an electric motor, electro-magnets, or other suitable device responsive to changes in an electric current. The slide 11 is shown as having a longitudinal opening at its central portion provided with a rack, with which studs 16, mounted on a fixed standard, 3, engage, so that at every whole revolution of the support 6 the slide 11 is moved backward or forward two teeth, or approximately a distance equal to the space between two convolutions of the hair-spring.

The belt 7 passes over a pulley-wheel, A, driven by an electric motor consisting, preferably, of an ordinary Gramme electro-magnetic motor, the field-magnet of which latter is indicated at B. The armature-shaft of said motor is indicated at *h'*; but the armature itself and the commutator are not seen, being of the ordinary construction and hidden by a cogged disk, C, which serves to impart movement to the wheel A.

At *l* is indicated a spiral retracting-spring connected at one end to the armature-shaft and at the other to a fixed support, *m*, in such way that when the motor rotates by the action of the current the spring will be wound up, and will assist in returning the motor to a normal position when the current diminishes or ceases. Said spring also serves as a means of opposing the motor, as it is operated by an increased current with a force increasing in proportion to the current.

At *n* is indicated a retracting-weight supported by a cord that passes over a spiral or conical drum upon the armature-shaft. This drum is so constructed or arranged that with an increased movement of the armature-shaft, owing to an increased current, the weight shall exert an increased retracting influence, proportionate, however, to the movement necessary to be given to the adjusting mechanism for the balance-wheel, in order to allow an increased movement of the registering mechanism proportionate to such increased current.

Suitable stop mechanism is employed, so as to bring the gear-train to rest whenever cur-

rent ceases to flow in the electric motor. Such mechanism may be moved by the motor or other portion of the devices, and may be arranged so that when the parts come to rest or to a position caused by the cessation of current the stop will be in the path of a part of the register mechanism, as in my prior patent, so as to bring said mechanism to rest. A device suitable for this purpose consists of a stop-arm, B², applied to the belt 7, so as to be carried by said belt against the balance-wheel *v* and stop the oscillation of the same when current is turned off, and the retracting-weight reverses the movement.

The general operation is as follows: When no current is passing, the retractors for the motor hold the armature in such position that the stud 9 will be near the end of the hair-spring and the latter will be at its longest. When the current begins to flow, the stop is withdrawn from the gear-train, and the motor moves the stud 9 to a position corresponding to the strength of current, and thus determines the rate at which the balance-wheel shall oscillate and the registering mechanism shall be moved. With an increase or decrease of the current the balance-wheel is correspondingly adjusted, so as to produce the proper corresponding variation in the rate at which the constant power may move the register.

I do not limit myself to any particular kind of electro-magnetic operating mechanism for adjusting the mechanism that regulates the hair-spring of the balance-wheel, as many others might obviously be used in place of a Gramme electric motor for imparting the desired movement to said regulating mechanism. Either one of the retracting devices here shown for the motor may be used without the other, or other kinds of retractors may be employed.

What I claim as my invention is—

1. The combination, in an electric meter, of a balance-wheel, a mechanical adjusting or regulating mechanism that may be set or adjusted to determine the natural rate of vibration or oscillation of said balance-wheel, and an electro-responsive device such as an electro-magnet placed in the circuit of the current to be registered for setting or moving the adjusting or regulating mechanism to a point in its range of adjustment depending upon the strength of the electric current, as and for the purpose described.

2. The combination, substantially as described, of a retarder consisting of an ordinary balance-wheel and escapement, and means for lengthening or shortening the hair-spring of the balance-wheel, controlled by the electric current to be registered.

3. The combination, as and for the purpose described, of the balance-wheel, the mechanism for regulating the length of the hair-spring, and electro-magnetic actuating devices for operating said regulating mechanism.

4. The combination, in an electric meter, of a balance-wheel for a train of wheels, driven by a constant power and connected with or

forming a registering-train, a mechanism for adjusting or regulating the oscillations of said balance-wheel, and an electro-magnetic motor energized by the current to be registered and
5 connected with the regulating or adjusting mechanism and serving to adjust the position of the same.

10 5. The combination, in an electric meter, of the balance-wheel, the radially and circumferentially movable adjusting-stud for varying the effective length of the hair-spring, and means for moving said stud circumferentially in accordance with the variations in the strength of the current to be registered.

6. The combination of the adjusting-stud 9, 15 mounted on a sliding piece provided with rack-bar, fixed studs for engaging with said rack-bar, and a rotating support for the sliding piece adjusted by mechanism controlled by variations in an electric current. 20

Signed at New York, in the county of New York and State of New York, this 21st day of June, A. D. 1883.

SAMUEL D. MOTT.

Witnesses:

THOS. TOOMEY,
M. M. FRIEND.