

No. 612,426.

Patented Oct. 18, 1898.

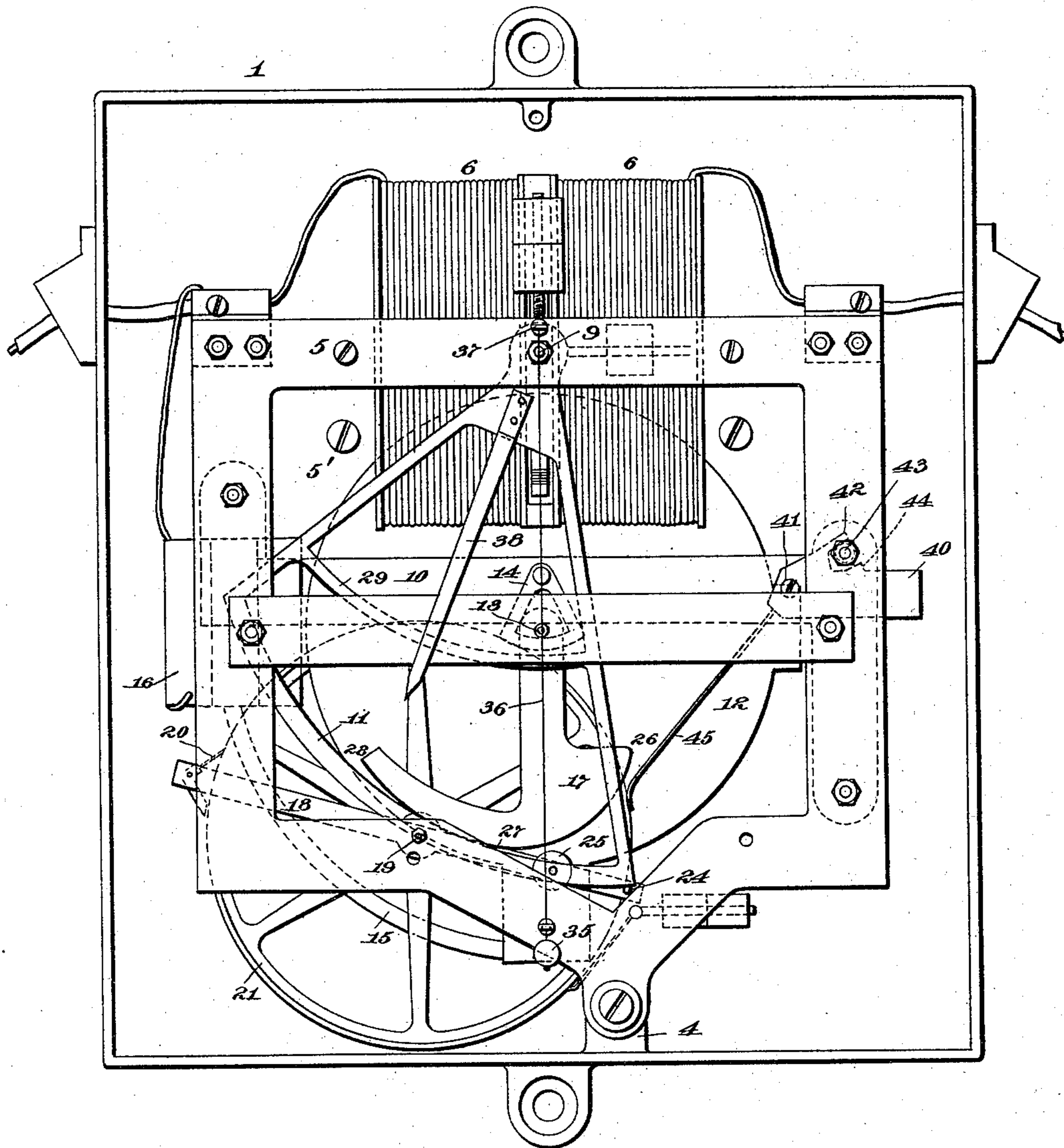
W. D. MARKS & G. R. GREEN.
ELECTRIC METER.

(No Model.)

(Application filed Jan. 10, 1898.)

2 Sheets—Sheet 1.

Fig. 1



Witnesses:

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2 Sheets—Sheet 2.

Fig. 2.

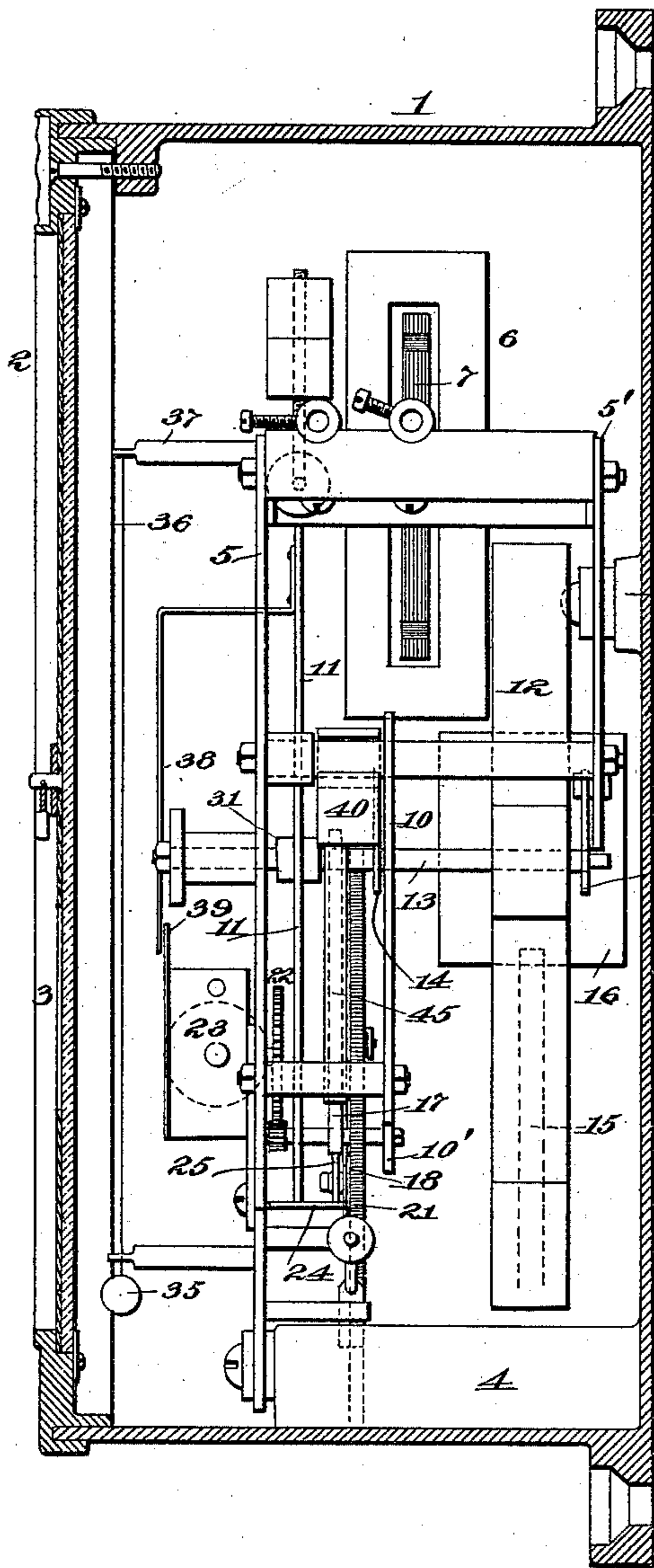


Fig. 3.

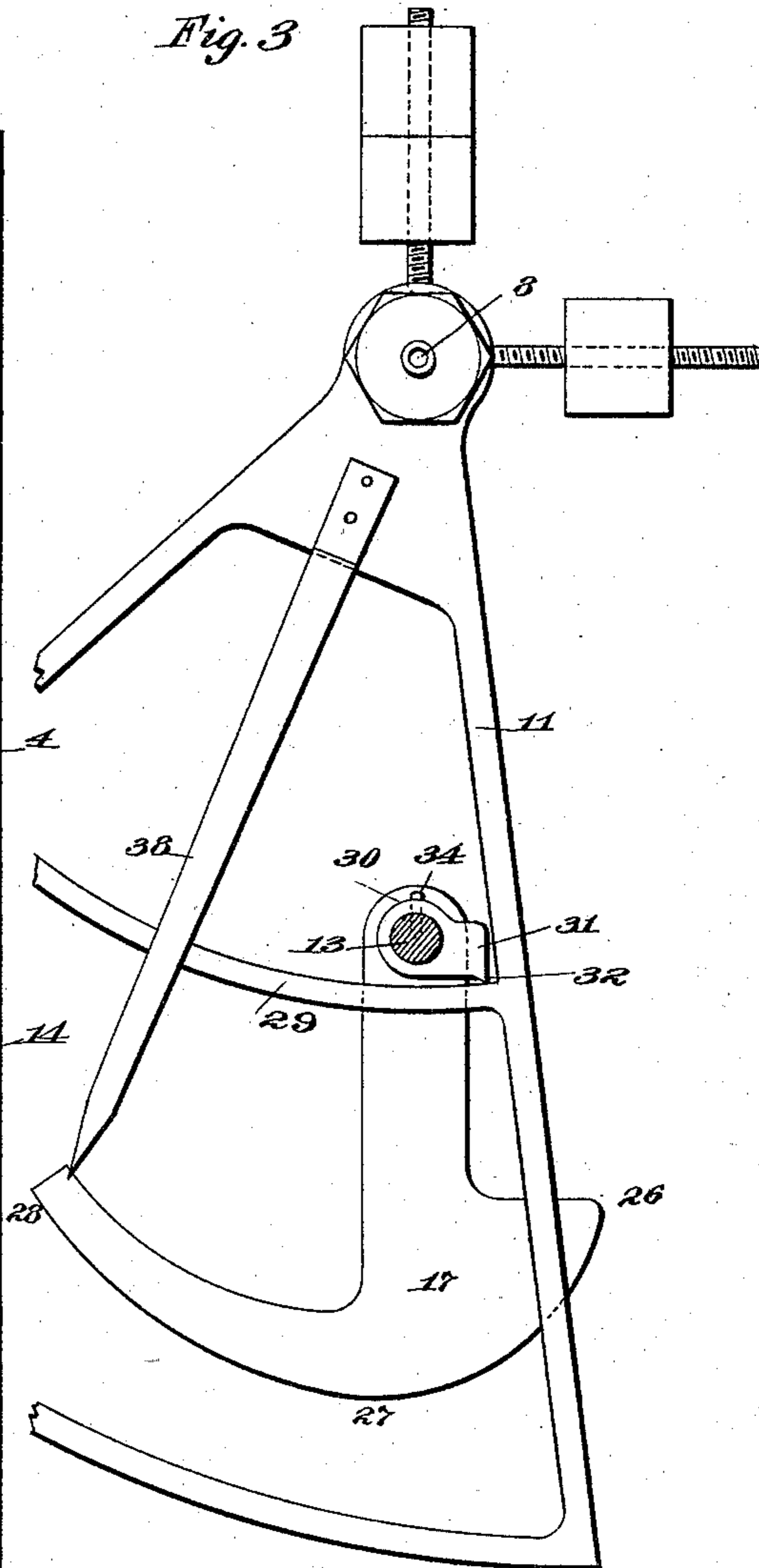
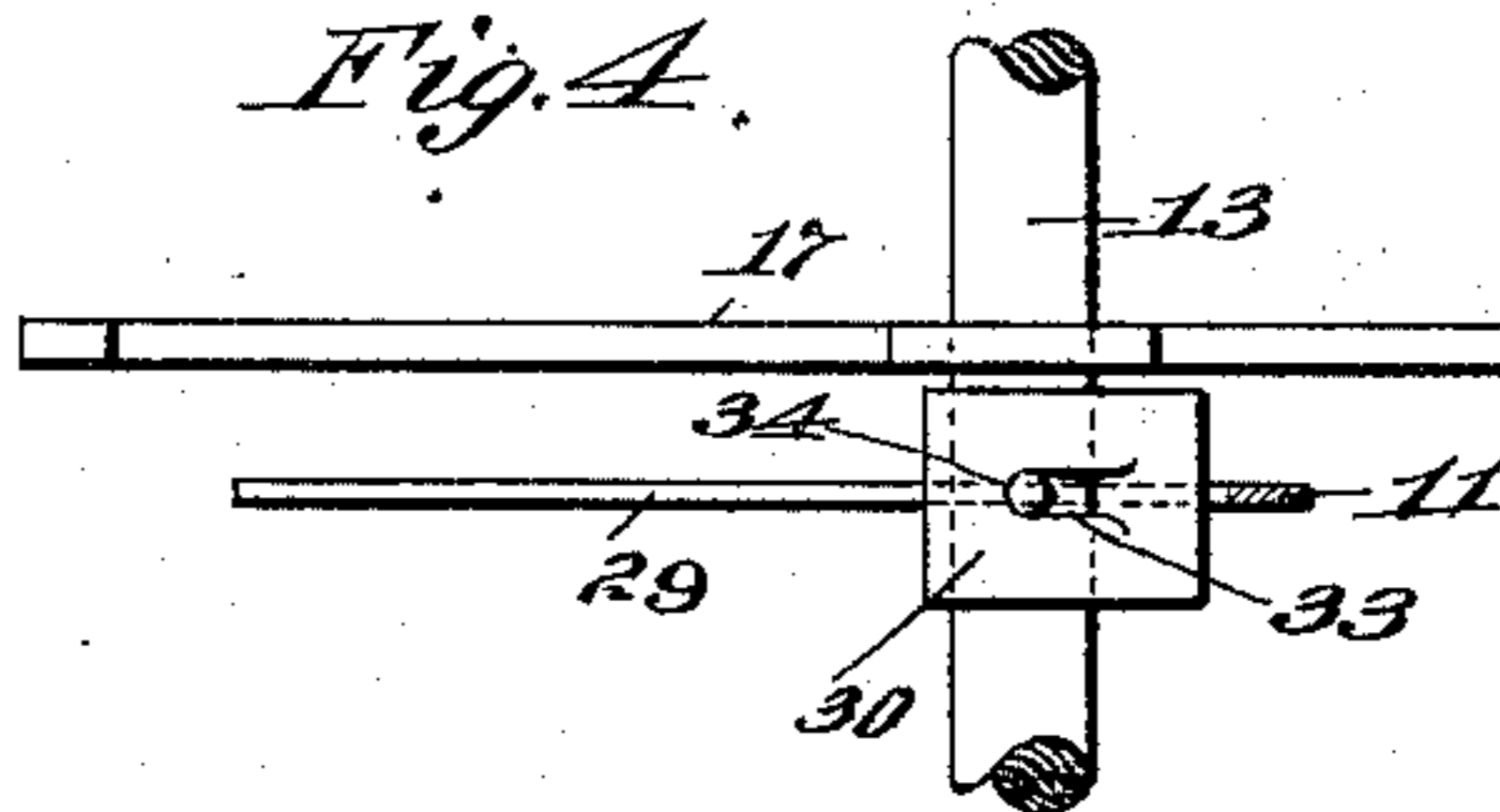


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM D. MARKS AND GEORGE ROSS GREEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO THE AMERICAN ELECTRIC METER COMPANY, OF SAME PLACE.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 612,426, dated October 18, 1898.

Application filed January 10, 1898. Serial No. 666,170. (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 at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electric Meters, of which the following is a specification.

Our invention relates to various new and useful improvements in electric meters of the type heretofore patented by us and wherein an oscillating motor or pendulum is employed to operate the registering mechanism. With such meters an ampere-indicator is used to control the position of a cam or arch, which constitutes a variable limiting-stop for one direction of movement of a pawl-carrying arm coöperating with the registering mechanism, and which is actuated always to the same extent in the other direction by the oscillating motor or pendulum. Heretofore the elements comprising and immediately connected with the ampere-indicator have been mounted above the elements connected with and comprising the oscillating motor or pendulum.

The first object of our present invention is to construct a more compact meter of the type than has heretofore been suggested, which object we accomplish by placing the oscillating motor or pendulum behind the controlling cam or arch, the shaft for said oscillating motor or pendulum extending through the open portion of said arch; by inverting the position of the driving-cam from that heretofore used, so that it will operate above instead of below the arm or lever carrying the actuating-pawl, and by arranging the registering mechanism and devices partly in front of and partly immediately below the controlling-arch, all as we will more fully hereinafter describe. These rearrangements of the operative elements of a meter of the type referred to result in greater compactness, so that a relatively smaller inclosing casing may be employed and the device will present a neater appearance.

A second object of our invention is to provide improved "dead-beat" mechanism for

the controlling cam or arch, which is adjusted by the ampere-indicator of the meter, such mechanism normally locking the controlling cam or arch, but periodically releasing the same so that it may adjust itself to changes of current. A dead-beat mechanism is especially desirable with meters of this type, as it prevents excessive movements of the controlling-arch, due to sudden fluctuations in the current, and therefore largely overcomes the possibility of false registration due to overthrow of the controlling-arch by its inertia. When the ampere-indicator is provided with a pointer coöperating with a scale, so that the amperes of current affecting the meter at any time may be determined, as is common, a dead-beat device is of value, since by its use rapid vibrations of the pointer will be overcome. A dead-beat device is also of importance with meters of this type employing an additional winding on the core or cores of the ampere-indicator for the purpose of overcoming magnetic and frictional lag therein, such as is described in Letters Patent No. 586,559, dated July 20, 1897, granted to William D. Marks. With meters employing such additional winding there is danger, unless a suitable dead-beat device is used, of the arch being given an excessive movement by reason of the attraction of the additional winding, thereby causing false registration.

A further object of the invention is to provide means for use with an electric meter of this type by which any frictional lag in the ampere-indicator will be overcome.

A final object is to provide an improved braking device which will enable a motor to be employed for driving the pawl-carrying arm or lever, said motor having a surplus of power, whereby certainty of operation will be obtained, said braking device serving to retard movement of the motor after the pawl-carrying arm or lever has been moved to its maximum extent at each oscillation.

In order that our invention may be better understood, attention is directed to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a front elevation of our improved meter with the outer cap or plate and the registering mechanism removed; Fig. 2, a side elevation with the casing and ampere-indicating coils in section and illustrating the registering mechanism; Fig. 3, an enlarged detail view of the controlling-arch, showing particularly the improved dead-beat device; and Fig. 4, a detached plan of a portion of the main shaft of the oscillating motor or pendulum, showing also the dead-beat device.

In all of the above views corresponding parts are represented by the same numerals of reference.

1 represents the inclosing case of the meter, which may be cast in one piece and which is provided with a removable front 2. This front is provided with an opening 3 therein, covered with glass and through which the register and ampere-scale may be inspected. Cast with the back wall of the case 1 are suitable pedestals or bosses 4, which carry the meter mechanism.

6 6 are the ampere-indicator coils, which are supported near the top of the case 1, between the front plate 5 and the back plate 5' of the frame. The needle or armature 7 of said ampere-indicator is carried by a shaft 8, mounted in pivot-bearings 9, between said front and back plates. Carried by the shaft 8 is the controlling-arch 11, which extends vertically downward, behind and parallel with the front frame 5. Said controlling-arch is provided with an eccentric bottom working face, as in meters of this type, which, as heretofore, acts as a variable stop for one direction of movement of a pawl-carrying arm or lever for actuating the registering mechanism.

12 represents the pendulum of the oscillating motor, which pendulum is carried on a shaft 13, mounted in stirrups 14 14, pivoted to the back plate 5' and to an intermediate plate 10, respectively, whereby said pendulum may operate with a minimum of friction. In practice we have found that the pendulum should possess considerable inertia, and it may, therefore, be conveniently made in the form of a disk of lead or other metal, as shown, so adjusted as to occupy a normal position by gravity. By constructing the pendulum so that it will be relatively heavy we find that it works with greater uniformity of movement without requiring additional power to operate it. The pendulum carries a curved core 15, secured to its lower portion, and which coöperates with the solenoid 16, the latter being adapted to be periodically excited by a suitable contact-making device included in a shunt across the line, whereby the pendulum will be given a constant and uniform rate of oscillation.

17 is the driving-cam carried by the shaft 13, extending downward behind and parallel with the controlling-arch 11. Said controlling-arch is preferably skeletoned, as shown, so that it will be very light and will in its

movements clear the shaft 13 of the oscillating motor, which shaft, as will be seen, extends through said arch instead of beneath the same, as heretofore. If the arch 11 is made of a plate of sheet metal, as is possible, it will be provided with a concentric slot therein, within which the said shaft will work, as will be understood.

18 represents a pawl-carrying lever loosely mounted on a shaft 19, carried between the front plate 5 and an arm 10', projecting downward from the intermediate plate 10. This pawl-carrying lever is overbalanced and carries at its heavier end a weighted spring-pawl 20, engaging with and driving a toothed wheel 21 of a suitable train 22 for actuating a counter 23, arranged in any suitable way. The toothed wheel 21 is mounted behind the driving-cam 17 and extends parallel therewith. Return movement of the toothed wheel 21 is prevented by a suitable locking-pawl of any desired type, but preferably a weighted pivoted spring-pawl is employed, pressing with sufficient contact upon the periphery of the toothed wheel 21 as to prevent overthrow of said wheel during the operation thereof. The other end of the lever 18 carries a pin 24, which engages the working surface of the arch 11 on each return movement of the pawl-carrying lever 18. Said lever also is provided between its pivot and the pin 24 with a wheel 25, arranged in the path of movement of the driving-cam 17.

With the meter which is now being described registration is effected on the unattracted swing of the pendulum 12, and therefore the driving-cam 17 is constructed, as shown in Fig. 1, with an eccentric portion extending from one end 26 to about its center 27 and with a concentric portion extending from said center to the other end 28, whereby the roller 25 will be engaged by said cam and depressed to the extent of its eccentricity until the central point 27 is reached, after which the plane of said roller will remain unchanged, as will be evident. By employing a cam of this form slight variations in the extent of movement of the pendulum will not affect the extent of depression of the pawl-carrying arm.

The elements described will preferably be so proportioned that when the arch 11 is in the zero position illustrated in Fig. 1 the concentric part of the driving-cam will only lightly engage or be slightly out of contact with the roller 25, so that the oscillations of the pendulum will not affect the lever 18. When, however, the arch 11 is moved from the zero position under the effect of current passing through the ampere-indicator coils and the lever 18 is moved downward by the driving-cam, the pin 24 on the return movement of said lever will strike the arch so as to slightly disturb its bearings and thereby overcome any frictional lag.

The register of the meter herein described

is actuated, as stated, by the driving-cam during the unattracted or backward swing of the pendulum, and the circuit of the motor-coil 16 is closed for a short period during the forward swing of the pendulum.

In order to prevent excessive movement of the controlling-arch, due to sudden variations in the current, and thereby prevent false registration, and to otherwise improve the operation of the device, we employ dead-beat mechanism coöperating with said arch and by reason of which the said arch will be free to adjust itself to changes in the current only for a short time in each oscillation of the pendulum. We do not claim, broadly, such a dead-beat mechanism, because a device for the same purpose is described in Letters Patent No. 586,560, dated July 20, 1897, granted to ourselves. Our present dead-beat mechanism is designed as an improvement over that covered by said patent. The arch 11 is provided immediately below the shaft 13 of the oscillating motor with a concentric arc 29, as shown more clearly in Figs. 1 and 3. Mounted upon the shaft 13, immediately above the arc 29, is a sleeve 30, which is free to turn on said shaft and which carries a weighted brake-shoe 31, having a wedge-shaped or pointed lower edge 32, which engages the arc 29. The sleeve 30 is cut away for a portion of its diameter at 33, and a pin 34, carried by the shaft 13, works within said cut-away portion. The parts referred to are preferably so proportioned that the pin 34 engages the end of the cut-away portion of the sleeve 30, so as to cause said sleeve to partially rotate with the shaft 13, and therefore elevate the brake-shoe from the arc 29 immediately after the concentric portion of the driving-cam engages the roller 25, so that the brake will remain elevated from the arc 29 during the short periods of the unattracted and attracted strokes of the pendulum in which the concentric portion of the driving-cam is in engagement with the roller 25. During this time, therefore, the arch will be free to adjust itself to the effect of the current; but at all other times the brake-shoe will be in engagement with the arc 29, so that movement of said arch will be prevented. By thus allowing movement of the controlling-arch during only portions of the time in which the meter is operated we prevent sudden fluctuations of said controlling-arch, due to abnormal conditions of the current, and overcome the possibility of false registration arising from overthrow of said arch.

If an electric meter is employed, using an additional winding on the core of the motor for the purpose of overcoming magnetic and frictional lag, as is described in the said patent referred to, the improved dead-beat device is of special utility, for the reason that by its use the controlling-arch will be locked during the period in which the circuit is closed by the circuit-breaker, and hence dur-

ing those times when the controlling-arch might be subject to improper movements due to the energization of such additional winding.

If desired, the improved meter may be provided with a plumb-bob 35, suspended from a fine cord or strand 36, secured to a post 37, and by which the proper vertical position of the meter may be obtained, and a pointer or index 38, registering with a scale 39, may also be used, as heretofore, for indicating the amperes, as in ordinary ampere-meters.

With meters of this type, especially when a driving-cam is used having an eccentric and a concentric portion, it is desirable in order that a certainty of operation may be secured that the motor for driving the pendulum should have a surplus of power and that a suitable braking apparatus should be used, coöperating with the driving-cam immediately before the concentric portion thereof engages the pawl-carrying arm and by which the subsequent movements of the pendulum will be gradually retarded until the pendulum on the attracted stroke is brought to rest. We illustrate with our present form of meter an improved brake device for this purpose, which we will specifically claim herein.

40 represents a suitable weight of the desired mass, which is generally rectangular in form and which is pivoted on the intermediate plate 10 of the frame by a screw 41. The weight 40 is provided on its upper side with a suitable finger 42, which normally coöperates with a bar or rod 43 forming one of the connections between the front and back plates of the main frame and by reason of which the weight 40 will be maintained in a normally horizontal position. 44 represents a stop on said weight which engages the bar or rod 43 when the weight is moved pivotally, as will be explained. Extending down from the weight 40 is a suitable leaf-spring 45, having a curved lower end which is arranged in the path of movement of the eccentric portion of the driving-cam. By means of this device a gradually-increasing retarding effect upon the driving-cam will be obtained, the operation being as follows: Immediately after the concentric portion of the driving-cam is brought into engagement with the friction-roller on the pawl-carrying arm the lower end of the spring 45 will be engaged by said cam, and the spring will be placed under gradual tension. The continued movement of the driving-cam produces such a degree of tension in the spring 45 that the weight 40 will be moved pivotally, whereby the retarding effect produced upon the driving-cam will be due to the combined action of the spring 45 and the weight 40. The final movements of the driving-cam cause the stop 44 to engage the bar or rod 43, whereby the final retardation of the driving-cam will be produced by the spring 45 until the tension of said spring is sufficient to arrest movement of said cam, whereupon the attracted stroke of the pendu-

lum commences, the parts returning to their normal positions.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is as follows:

1. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam carried by said shaft for actuating said pawl-carrying lever, and a motor for driving said shaft, substantially as set forth.

2. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam carried by said shaft for actuating said pawl-carrying lever, and an oscillating motor or pendulum for oscillating said shaft, substantially as set forth.

3. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam depending from said shaft and actuating said pawl-carrying arm or lever, a pendulum carried by said shaft, and a motor for actuating said pendulum, substantially as set forth.

4. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever mounted beneath said arch and cooperating with the same for effecting the registration, a shaft extending through said arch, a driving-cam depending from said shaft and actuating said pawl-carrying arm or lever, a pendulum carried by said shaft, and a motor for oscillating said pendulum, substantially as set forth.

5. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a driving-shaft, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an overweighted disk pendulum on said shaft, and a motor for oscillating said pendulum, substantially as set forth.

6. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a driving-shaft, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, and a dead-beat device mounted on said shaft for engaging periodically with said controlling-arch, substantially as set forth.

7. In an electric meter, the combination of

a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a driving-shaft, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, and a weighted dead-beat device mounted on said shaft for engaging periodically with said controlling-arch, substantially as set forth.

8. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a driving-shaft, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, a dead-beat device loosely mounted on said shaft and normally engaging said controlling-arch, and a pin carried by said shaft for engaging said dead-beat device periodically so as to lock the same to said shaft, substantially as set forth.

9. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, an arc carried by said arch below said shaft, and a dead-beat device carried by said shaft for periodically engaging said arc, substantially as set forth.

10. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, an arc carried by said arch below said shaft, and a weighted dead-beat device carried by said shaft for periodically engaging said arc, substantially as set forth.

11. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-carrying arm or lever cooperating with said arch and effecting the registration, a shaft extending through said arch, a driving-cam carried by said shaft for actuating said pawl-carrying lever, an oscillating motor or pendulum for oscillating said shaft, an arc carried by said arch below said shaft, a dead-beat device loosely mounted on said shaft and normally engaging said arc, and a pin carried by said shaft for periodically engaging said dead-beat device so as to elevate the same from said arc, substantially as set forth.

12. In an electric meter, the combination of a controlling-arch the position of which is determined by an ampere-indicator, a pawl-car-

5 rying arm or lever cooperating with said arch
and effecting the registration, a driving-shaft,
an oscillating motor or pendulum for oscillat-
ing said shaft, a driving-cam carried by said
10 shaft for actuating said pawl-carrying lever,
and a brake device cooperating with said driv-
ing-cam and comprising a pivoted weight and
a spring carried by said weight, whereby in
operation the said driving-cam will first place
15 said spring under tension and will subse-
quently elevate said weight, substantially as
set forth.

13. In an electric meter, the combination of
a controlling-arch the position of which is de-
15 termined by an ampere-indicator, a pawl-
carrying arm or lever cooperating with said
arch and effecting the registration, a driving-
shaft, an oscillating motor or pendulum for
oscillating said shaft, a driving-cam carried
20 by said shaft for actuating said pawl-carrying
lever, and a brake device cooperating with
said driving-cam and comprising a pivoted
weight, a spring carried by said weight, and
means for limiting the oscillations of said
25 weight, whereby the driving-cam will first
place said spring under tension, will then ele-
vate said weight, and will subsequently pro-
duce further movement of said spring, sub-
stantially as set forth.

30 14. In an electric meter, the combination of
a controlling-arch the position of which is de-
termined by an ampere-indicator, a pawl-
carrying arm or lever cooperating with said
arch and effecting the registration, a shaft
35 extending through said arch, a driving-cam
carried by said shaft for actuating said pawl-
carrying lever, an oscillating motor or pendu-
lum for oscillating said shaft, and a brake de-
vice cooperating with said driving-cam, sub-
40 stantially as set forth.

15. In an electric meter, the combination of
a controlling-arch the position of which is de-
termined by an ampere-indicator, a pawl-

carrying arm or lever mounted beneath said
arch and cooperating with the same to effect 45
the registration, and means for positively
moving said arm or lever intermittently away
from said arch, whereby upon its return move-
ment the said arm or lever will engage said
arch to disturb the bearings thereof and re- 50
duce frictional lag, substantially as set forth.

16. In an electric meter, the combination of
a controlling-arch the position of which is de-
termined by an ampere-indicator, a pawl-car-
rying arm or lever mounted beneath said 55
arch, a pin on said pawl-carrying arm or le-
ver for engaging said arch, and means for
positively moving said arm or lever intermit-
tently away from said arch, whereby upon its
return movement the said pin will engage 60
said arch to disturb the bearings thereof and
reduce frictional lag, substantially as set
forth.

17. In an electric meter, the combination of
a controlling-arch the position of which is de- 65
termined by an ampere-indicator, a pawl-car-
rying arm or lever mounted beneath said
arch, a pin on said pawl-carrying arm or le-
ver for engaging said arch, a main driving-
shaft extending through said arch, means for 70
oscillating said shaft, and a driving-cam de-
pending from said shaft and positively en-
gaging said arm or lever to move the same in-
termittently away from said arch, whereby
upon its return movement the said pin will 75
engage said arch to disturb the bearings there-
of and reduce frictional lag, substantially as
set forth.

This specification signed and witnessed this
27th day of December, 1897.

WM. D. MARKS.
GEO. ROSS GREEN.

Witnesses:

S. H. WILLIAMS,
H. R. BAREMORE.