

No. 619,735.

Patented Feb. 21, 1899.

T. DUNCAN.

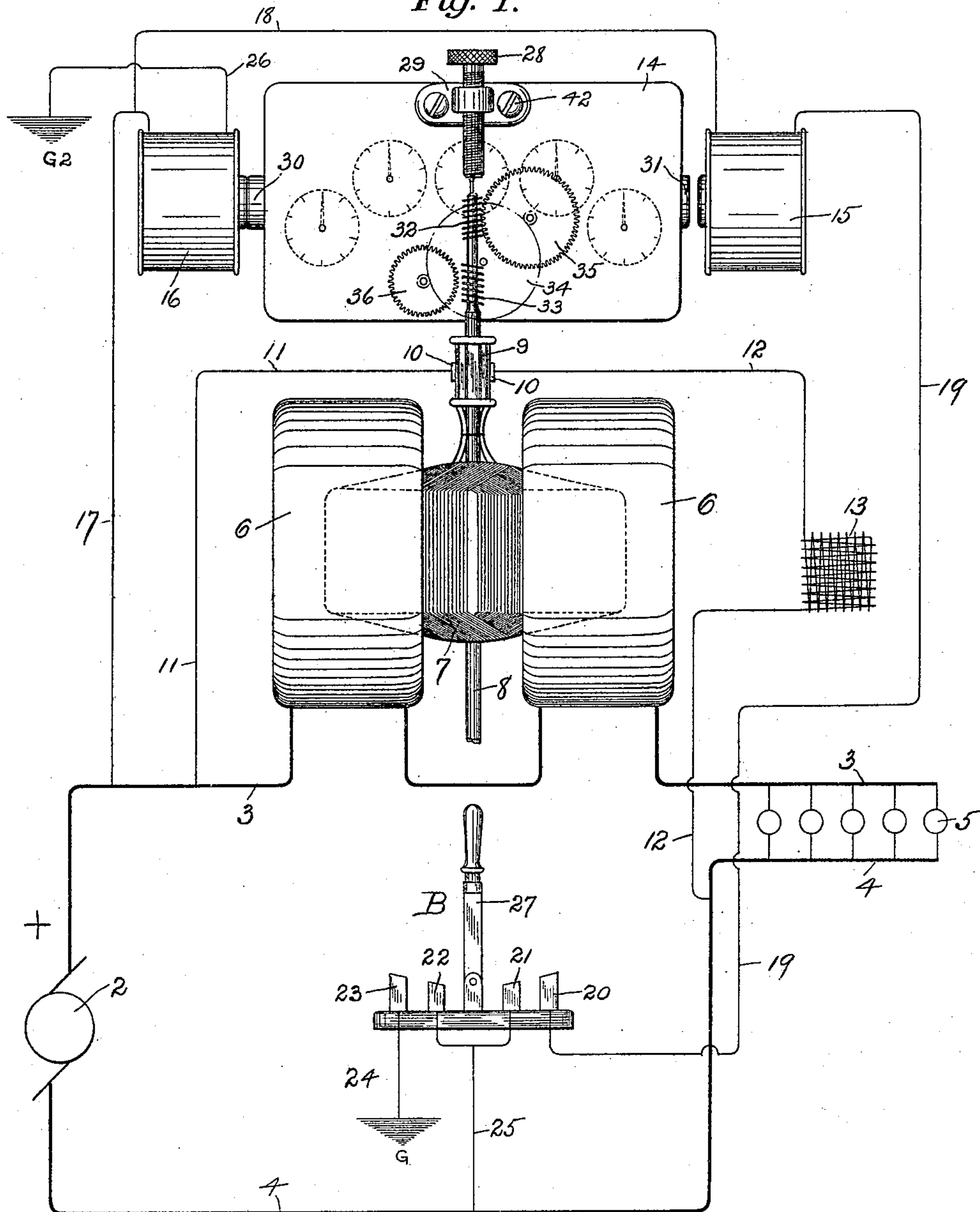
MULTIPLE RATE ELECTRIC METER.

(Application filed June 11, 1898.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



Witnesses
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Fig. 2.

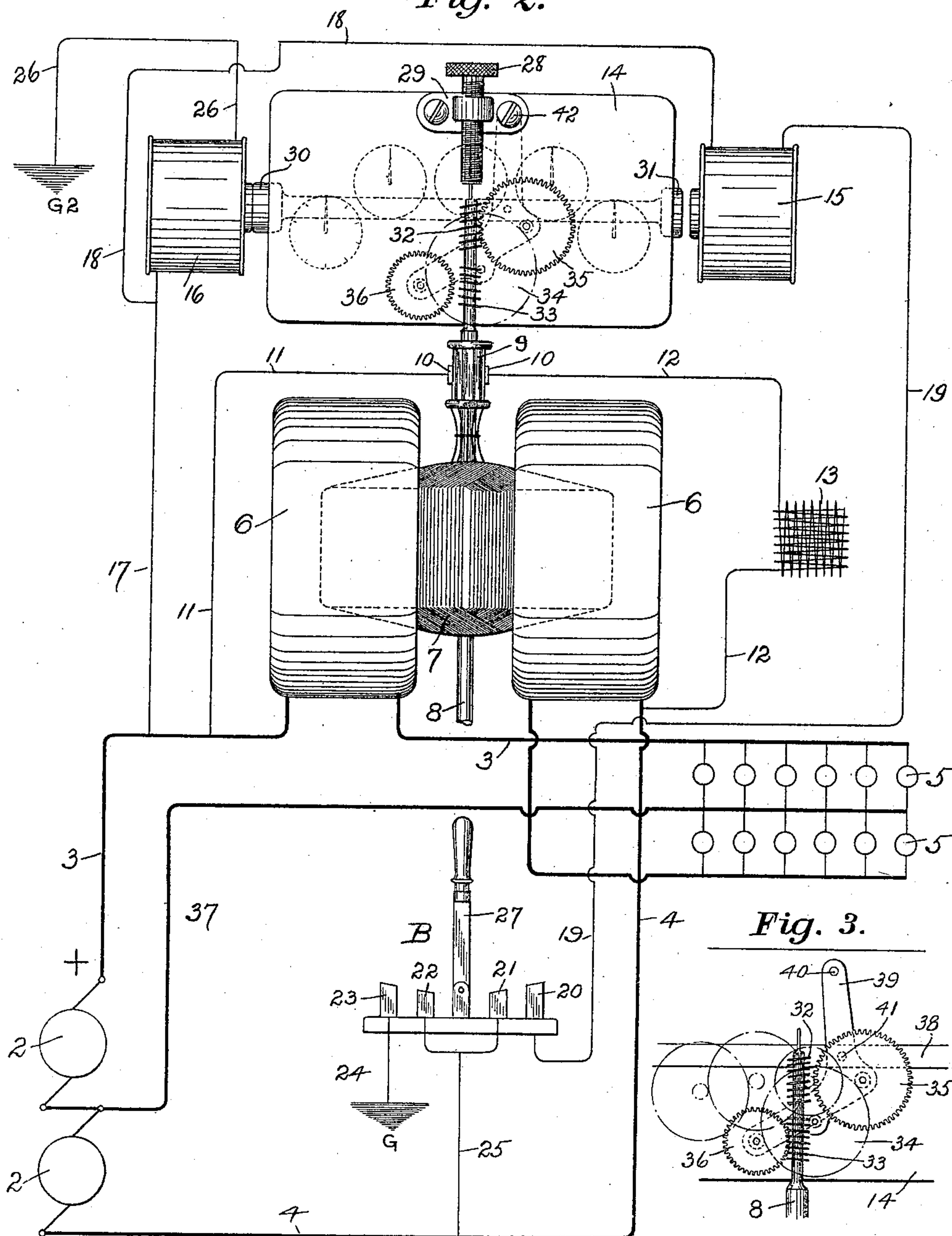
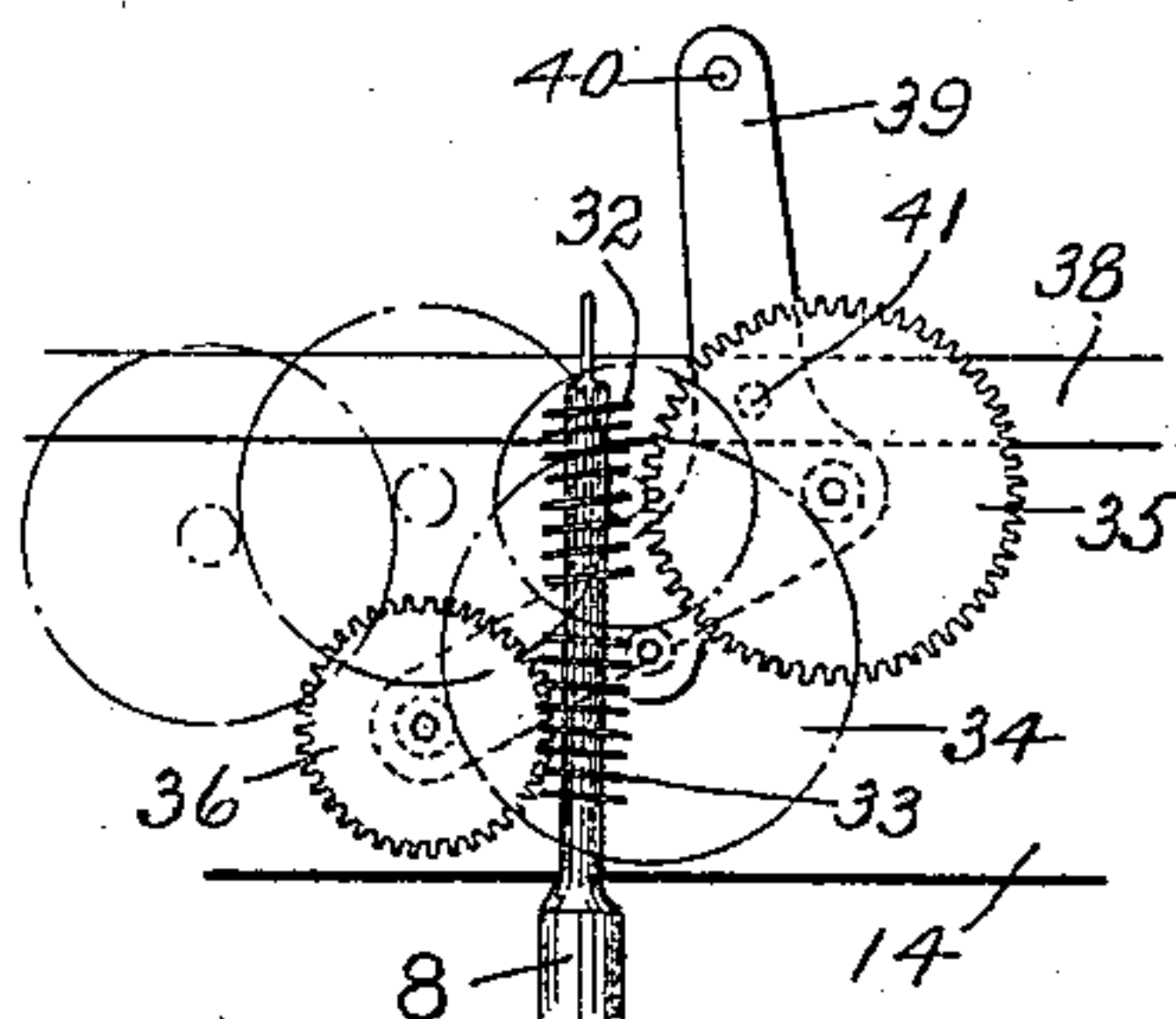


Fig. 3.



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UNITED STATES PATENT OFFICE.

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MULTIPLE-RATE ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 619,735, dated February 21, 1899.

Application filed June 11, 1898. Serial No. 683,161. (No model.)

To all whom it may concern:

Be it known that I, THOMAS DUNCAN, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Multiple-Rate Electric Meters, of which the following is a full, clear, and exact description, which will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to electric meters, and particularly to the type known as "multiple-rate" motor-meters, by means of which it is possible to supply electrical energy at different times of the day at different rates—such, for example, as charging a less rate for energy used during the day or periods when the load of the central station is very light and charging more or the normal rate during the evening when the central-station load is heavy.

It is a fact that the earnings of a central station can be very materially increased if a demand for energy during the early morning and daylight hours can be created, thereby permitting the generators to be kept in operation and not allowed to stand idle during the major portion of the day. This demand can only be obtained by having a double or multiple system of metering, whereby a cheaper rate can be given during the early morning hours, thereby offering an inducement to multiply the application and use of electrical energy which in the absence of the cheaper rate would be very hard to introduce on a practical and successful basis. In doing this it becomes necessary to have a system of metering whereby the lower rate and its hours of use and the amount of energy consumed during this period can be integrated separately from the higher or normal rate and the amount of energy consumed during its period of registration. For the purpose of accomplishing this is the object of the present invention.

I am aware that a number of methods have been invented to supply this need—viz., by introducing a resistance into the armature-circuit of the motor and reducing the torque during the period of the day assigned for the lower rating; by employing a variable damping or retarding mechanism; by using two

separate registering trains, which represent the high or normal and the lower rate, respectively, and each being brought into meshing contact with the motor-spindle when its proper time arrives, and by the use of a single framework consisting of two registering-train outfits, one of which is continuously meshed with the spindle, while the other is operated only at such intervals as when the meter is measuring the energy during the reduced-rate hours.

In the present invention it is my purpose to simplify upon the foregoing methods, and in so doing I have herein shown a method which consists only of a single registering-train with two worm-wheels and which coöperate with two worms upon the motor-spindle.

In the drawings accompanying this specification and in which similar letters and numerals refer to like parts throughout, Figure 1 is a front elevation showing the motor part of the meter and the arrangement by means of which the double-rate registration is operated on a two-wire system. Fig. 2 is also a front elevation of a three-wire meter, showing the double-rate registering-train and the manner in which the worm-wheels are operated. Fig. 3 is a view of the double-rate mechanism proper, showing its construction in detail.

The principal elements entering into the construction of my invention are a motor, a special registering-train with two worm-wheels, and means for electromagnetically operating the said registering-train by means of suitable electromagnets contained within the meter and controlled by a simple switch at a distance—usually at the central station.

In describing my invention with reference to Fig. 2 it is to be understood that the generators 2 and the switch B are located at the central station, while the leads 3, 4, 19, and 37 represent the necessary conducting or distributing wires of the system.

In applying the present improvement I have shown a commutated motor-meter of the ordinary type, in which there are two series field-coils 6 and 6, that carry the main current supplying the translating devices 5. The armature 7 is connected in multiple to the leads 3 and 4 by the connecting-wires 11 and 12. A non-inductive resistance 13 is used in series with the armature to reduce the current

in the usual manner. To produce the proper commutation, the brushes 10 and commutator 9 are shown. The spindle 8, which carries the armature, also carries two worms 32 and 33, the upper of which is a right-handed and the lower a left-handed worm. The upper end of the spindle 8 is held in position by an adjustable screw 28 and its support 29, the latter part being screwed to the back frame of the registering-train 14. At two diametric points of the spindle and placed in the registering mechanism are two worm-wheels secured to a movable lever 39, which is connected to a movable bar 38, placed at the back of the train of gears. These worm-wheels are numbered, respectively, 35 and 36, and of which the upper one, 35, is right-handed and meshes with the right-handed worm 32 when the lever-bar 38 is moved to the left, so as to make the worm 32 and worm-wheel 35 mesh. In like manner the worm-wheel 36 is cut to mesh with the left-handed worm 33. The lever 39 is suspended at the hole 40 and the set-screw 42 and is moved laterally by being connected to the bar 38 at the point 41. From the foregoing it is obvious that if the bar 38 is moved to the left-hand side it will draw the worm-wheel 35 into meshing relation with the worm 32 and at the same time release the worm-wheel 36 from the worm 33. If the lever be moved to the right, the reverse takes place.

The object of having one of the worms and its connecting-wheel right-handed and the other worm with its connecting-wheel left-handed is to enable both the registering-train and the spindle to have a constant direction of rotation and operation as follows: If we assume that the direction of rotation of the armature and spindle is counter-clockwise when looking down upon them from the top of the meter, the worm-wheel, Fig. 2, will also travel counter-clockwise, thereby causing the intermediate gear-wheel 34 to move clockwise, and since the said wheel 34 is the one that actuates the remaining wheels of the registering-train it must always rotate in the same direction—i. e., clockwise. Now if the lever-bar 38 is moved to the right, Fig. 3, the worm-wheel 35 is disengaged from its worm 32 and the worm-wheel 36 engages with the worm 33, when the said worm-wheel 36 will also revolve in a counter-clockwise direction, thereby revolving the intermediate wheel 34 in a clockwise direction as required. If the worm-wheels 35 and 36 have the same number of teeth, then both will drive the registering-train alike; but when 36, for instance, has only half the number of teeth it will drive the mechanism twice as quickly as 35 will with the same number of revolutions of the armature-spindle 8. Obviously if a given amount of energy is passing through the meter and supplying the lamps 5 and the large wheel 35 is meshing with the worm 32 the amount being registered will be exactly one-half of what it would be if the wheel 36

had been meshing with the worm 33 and the speed of the motor the same in both cases. Hence if in the idle hours of the day the rate for energy is only one-half of what it is normally, or in the evening, the bar 38 is moved to the left and the worm 32 is engaged with the worm-wheel 35, and when the hour arrives for making the normal rate of charge the bar 38 is moved to the right. The operation must of course be conducted from the central station, where a suitable and simple switch B is located and which consists of a series of contacts 20, 21, 22, and 23 and a contact-bar 27. If it is the early morning hours and the cheaper rate is in operation, the switch-handle and contact-bar 27 are closed down upon the contacts 22 and 23, which immediately establishes a current from the + terminal of 2 up by the wire 17 through the electromagnet 16 and by means of the wire 26 and the grounded connection G 2 back to the generator by way of the earth, G 24, 23, 27, 22, 25, and 4. By doing this the electromagnet 16 attracts the iron pole-piece 30 of the bar 38 and causes the worm 32 to mesh with the wheel 35. When the time arrives for the normal rate, the switch-handle and contact-bar 27 are closed down upon the contacts 20 and 21, and the current starts from the + terminal of 2, and along 3 17 18, through 15 and by the wire 19 to the switch-contact 20, when it completes its course or circuit through 27, 21, 25, and 4. In this operation the pole-piece 31 will be attracted by the electromagnet 15 and the bar 38 will be moved to the right, thereby meshing the wheel 36 with the worm 33, as shown in Fig. 3.

By the foregoing arrangement I am enabled to operate a single or any number of double-rate meters from a central point by the use of a single registering-train with two worm-wheels in coöperative relation with two worms upon the motor-spindle.

For different rates the diameter and number of teeth on the worm-wheels may be changed to suit any requirement without altering the mechanism proper of the registering-train.

What I desire to secure by Letters Patent is—

1. In a multiple-rate system of metering, the combination with the armature of a motor-meter, of a spindle carrying or supporting the said armature, a right-handed worm, a left-handed worm, and a registering mechanism operated by the said worms, as set forth.

2. In a multiple-rate system of metering the combination with the revoluble spindle of a motor-meter, of a right-hand worm, a left-hand worm, both of said worms being secured to and revoluble with the said spindle, a registering mechanism comprising a train of gear-wheels and two worm-wheels and means for connecting or meshing either of the said worms with its respective worm-wheel as and for the purpose herein set forth.

3. In a system of multiple-rate metering the combination of a motor-meter, a source

of current-supply, service-leads carrying said supply, a registering-train operated by the said motor-meter, a single-pole double-throw switch B having one of its contact-points connected with the earth, and means for electromagnetically controlling the operation of the said registering-train with the said switch B, as set forth.

4. In a system of multiple-rate metering the combination with a motor of a registering-train, of an electromagnet 15, an electromagnet 16, a single-pole double-throw switch for energizing the said electromagnets, and a connecting-bar 38 provided with an iron pole at each end and in coöperative relation with the said electromagnets and the said registering-train.

5. In a multiple-rate motor-meter the combination of a motor, two worms driven by said motor, two worm-wheels driven by said two worms, a registering-train, and means whereby the said registering-train may be driven

by either of said worms separately as and for the purpose herein set forth.

6. In a multiple-rate-meter registering mechanism, the combination of a right-hand worm, a right-hand worm-wheel, a left-hand worm, a left-hand worm-wheel, a movable lever carrying the said right and left hand worm-wheels, and means for meshing separately either the said right-hand worm-wheel with the said right-hand worm or the said left-hand worm-wheel with the said left-hand worm, all as herein set forth.

In testimony that the foregoing is my invention I have affixed my signature, in the presence of two subscribing witnesses, at Fort Wayne, Indiana, this 1st day of June, 1898.

THOMAS DUNCAN.

Witnesses:

JOHN E. DALTON,

WILLIAM CUMMINGS.