No. 667,519. Patented Feb. 5, 1901.

J. HARRIS.

ELECTRIC METER.

(Application filed June 2, 1900.)

(No Model.) 2 Sheets—Sheet 1.

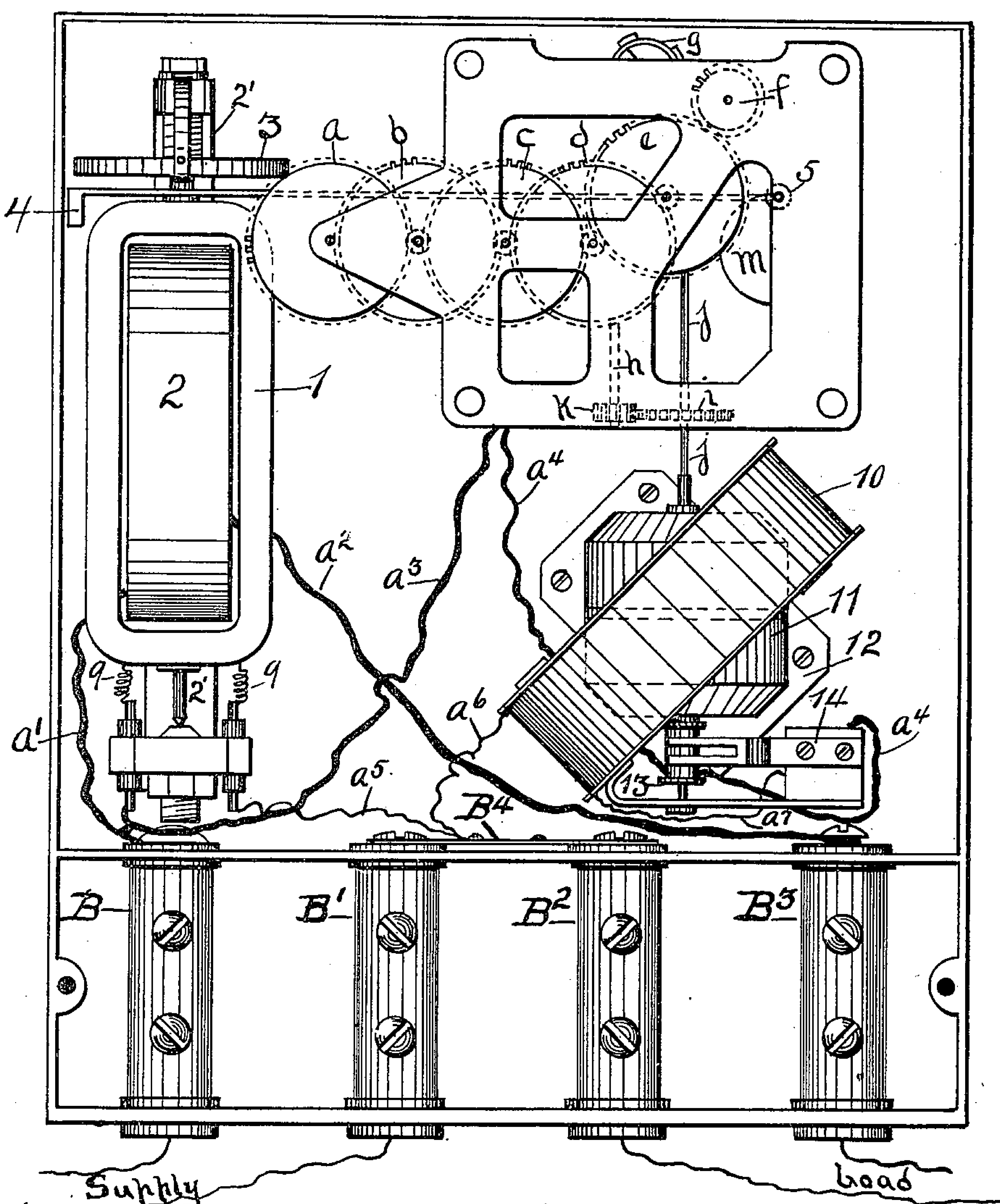

Fig: 1.

Witnesses:
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Inventor:
Jesse Harris:
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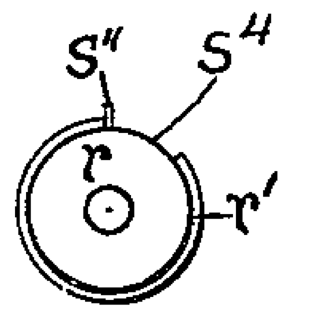

Fig: 4.

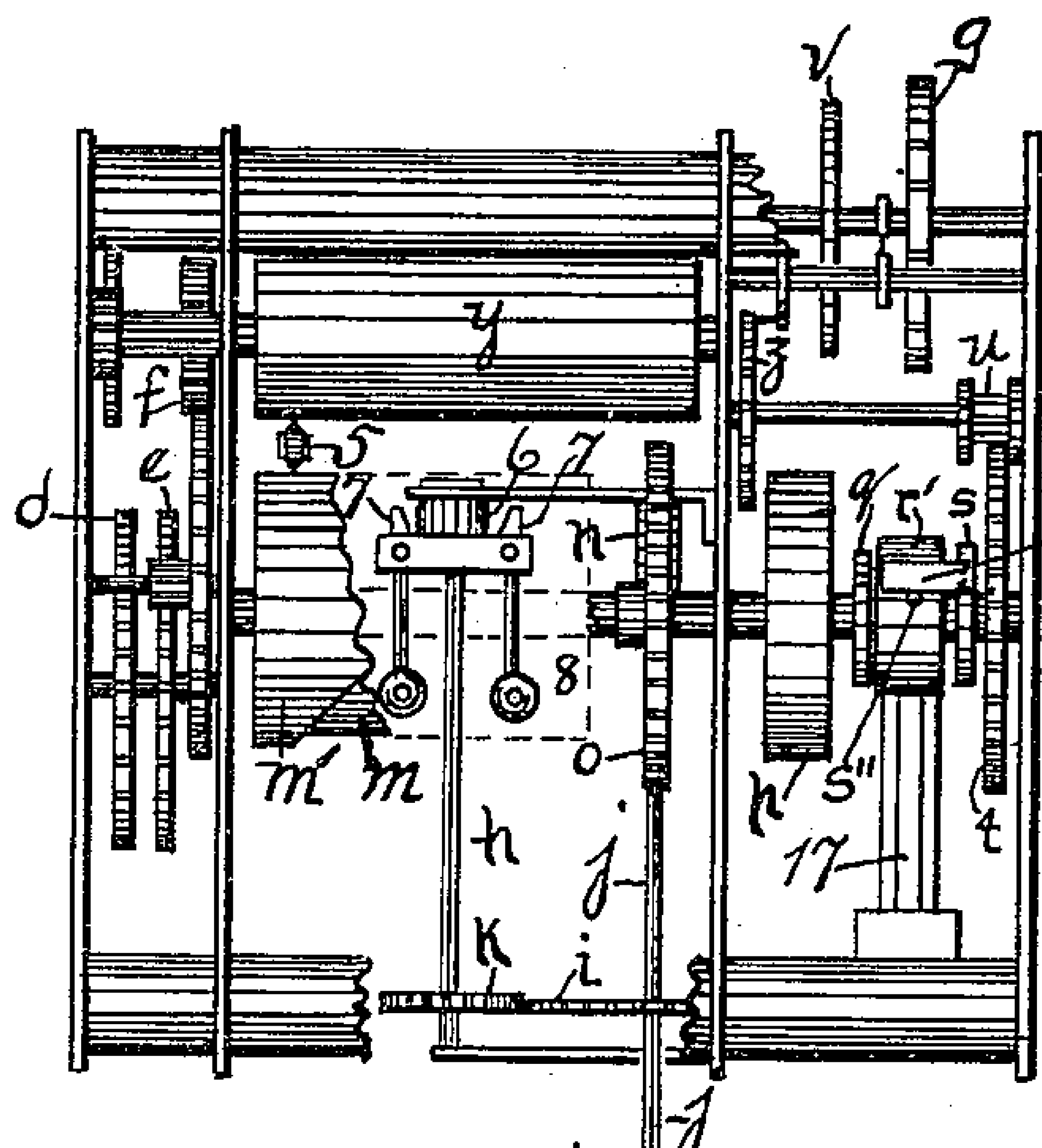

Fig: 2.

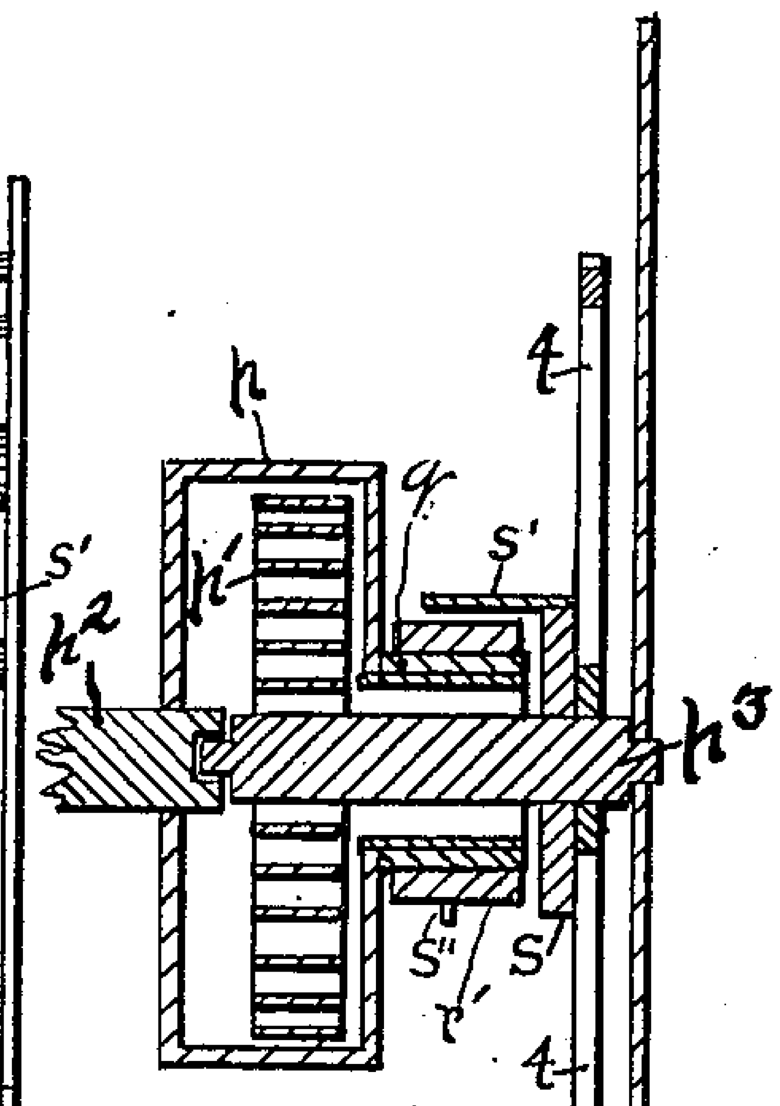

Fig: 3.

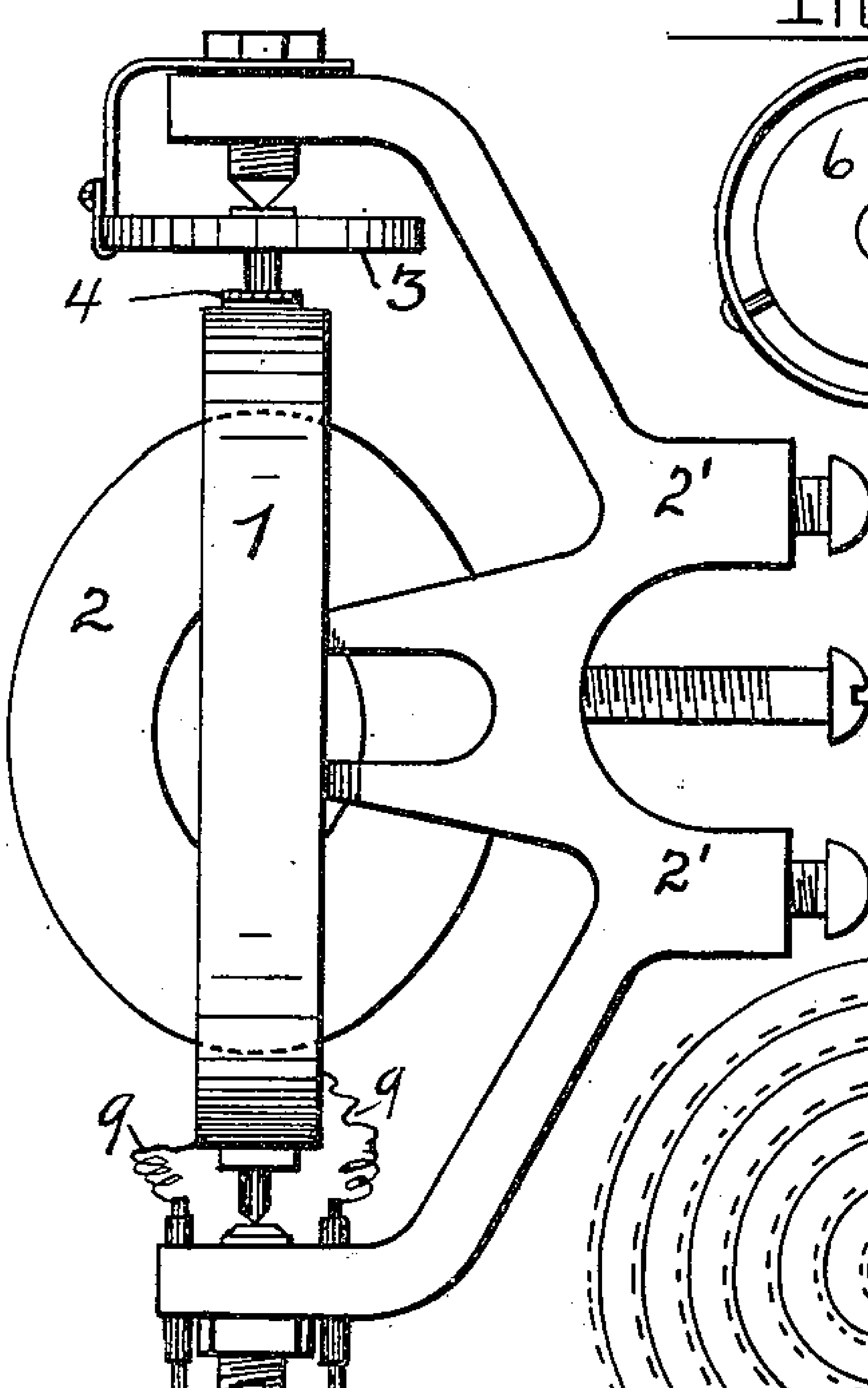

Fig: 7.

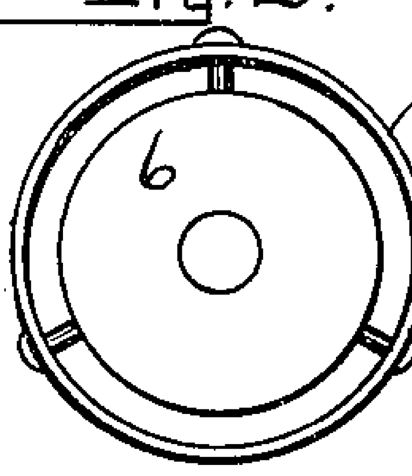

Fig: 5.

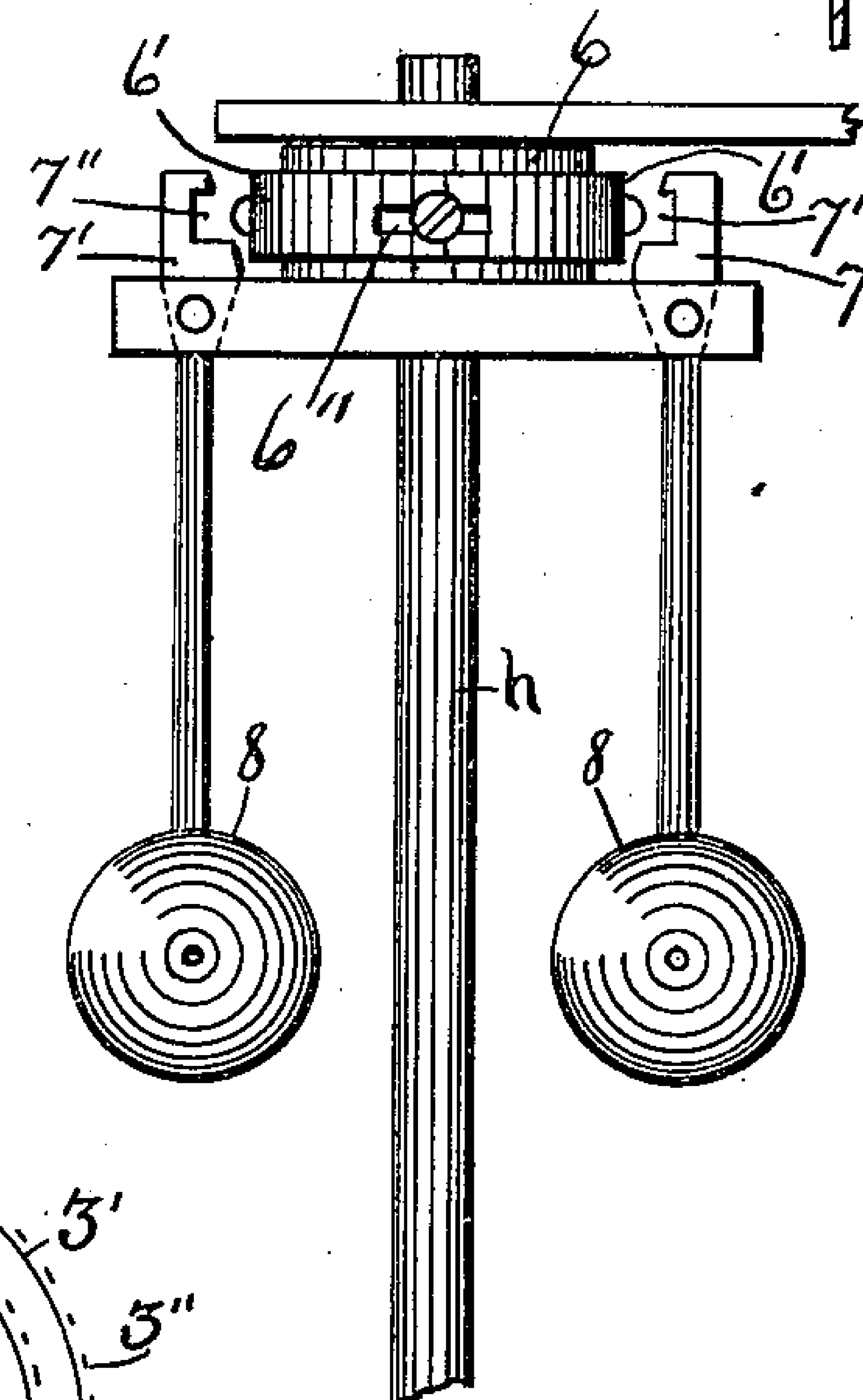

Fig: 6.

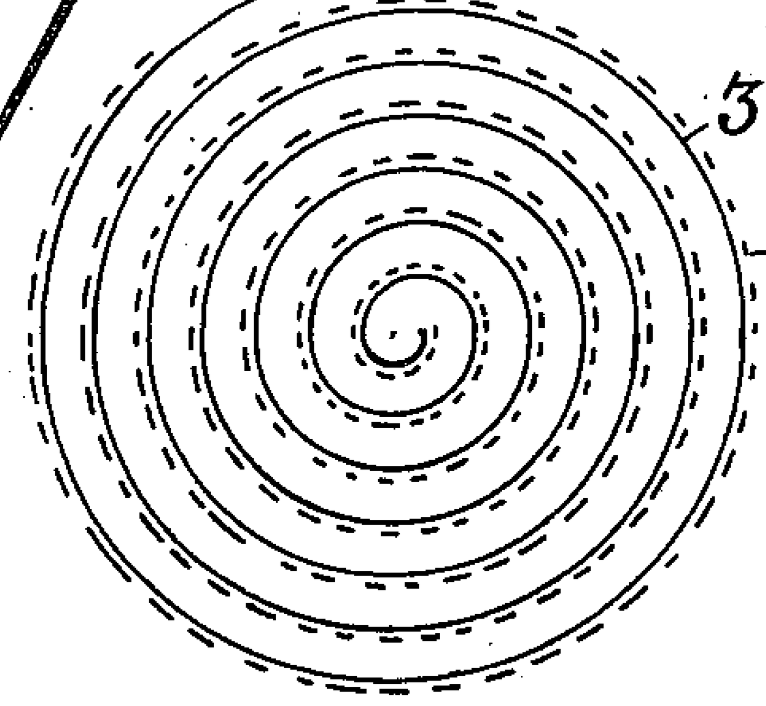

Fig: 8.

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UNITED STATES PATENT OFFICE.

JESSE HARRIS, OF RENSSELAER, NEW YORK.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 667,519, dated February 5, 1901.

Application filed June 2, 1900. Serial No. 18,813. (No model.)

To all whom it may concern:

Be it known that I, JESSE HARRIS, a citizen of the United States, residing at Rensselaer, Rensselaer county, New York, have invented certain new and useful Improvements in Electric Meters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

The object of my invention is to provide a new and improved electric meter.

In the drawings, Figure 1 shows a plan view of my device; Fig. 2, an end view of the clockwork and recording mechanism; Fig. 3, a vertical sectional view of the winding apparatus; Fig. 4, a plan view of the spring drum or barrel and its casing; Fig. 5, a plan view of one form of a portion of the frictional controlling device; Fig. 6, a side elevation of one form of a governor; Fig. 7, a side elevation of the current and pressure coil and bracket; and Fig. 8, a coiled spring, the dotted line showing its spread or inclination to change form and position.

The numeral 1 shows a pressure-coil, and 2 the current-coil, of a dynamometer, the pressure-coil being arranged pivotally to move against the resilience of the spring 3 by reason of the torque of the coil caused by the passing current as it flows through elements 1 and 2. To the pressure-coil is affixed the arm 4, having a transmitting-wheel 5 at its end, said wheel being arranged to move longitudinally between rollers *y* and *m* (see Fig. 2) when the torque of the coil swings the arm 4 and to communicate motion to roller *y* whenever the torque of coil 1 swings the arm 4 longitudinally and the raised surface of the roller *m'* comes in contact with the wheel 5, the motion thus given roller *y* being communicated to the counting-train, consisting of wheels *a*, *b*, *c*, *d*, *e*, and *f*, (see Fig. 1,) and to the pointers attached to the pivots of wheels *a*, *b*, *c*, and *d*, the graduated dial over which the pointers move being omitted. The roller *m* has a portion of its surface raised, as seen at *m'*, which may be done in any well-known manner, either by wrapping a strip about the roller or by removing a portion of the surface of the roller. Intermittent motion is given roller *m* as follows: *p* is a drum containing a mainspring *p'*. This spring is attached to the drum and its journal after the manner practiced in securing mainsprings in watches, preferably, and to the journal carrying the drum *p* is carried also an insulator *q* and another drum *r*, (see Fig. 4,) drum *r* being tired over a portion of its periphery by a conducting substance *r'*, preferably of silver, leaving an opening in the tire, as seen at S^4, and having a pin or stud *s''*. On the same journal is carried an insulator S, and attached thereto is a tongue or contact-piece S', preferably of silver, overlapping the tire on drum *r*, and to the same journal is attached the toothed wheel *t*. This journal is composed of two parts p^2 and p^3, one end of p^3 entering and rotating in an opening in the end of p^2, journal p^2 passing through one of the walls of the frame and carrying toothed wheel *o* and roller *m*. Meshing with the teeth on wheel *o* is a worm-gear *n*, set upon the vertical shaft *j*, said shaft being rotatable by means of the motor 11. Said shaft also carries the commutator 13, upon which rests the brushes 14, the motor and its parts being held in position by the base-plate 12. On the shaft *j* is the toothed wheel *i*, meshing with a pinion *k* on the shaft *h*, said shaft *h* having a collet made fast to the bracket and a governor consisting of the balls 8, attached to arms 7, the upper ends of arms 7 being beveled on their sides facing the periphery of the collet 6 in order that when the balls 8 of the governor are spread by centrifugal action these beveled surfaces will hug the periphery of the collet 6 and act as a frictional brake, and thus control the speed of the motor 11, and this is necessary, as when a continuous current is used the motor 11 would acquire too much speed before the brushes 17 arrived at and rested in the open space s^4 of the tire *r'*, and cause studs S'' to impinge on contact-piece *s'* and jamb the clock-movement. As the motor rerevolves by means of the electric current, the shaft *j* revolves the worm *n*, and toothed wheel *o* is also revolved, carrying its shaft p^3 and drum *p* with it. As drum *p* revolves spring *p'* it is wound and brushes 17 come to rest in openings s^4 of tire *r'* and are out of electrical connection. The clockwork being thus wound and the current cut off from the motor 11, the motor comes to quiescence and the clockwork continues to run, rotating wheel t and contact-piece s'. The clock having been only sufficiently wound to run a certain length of time—say one minute—the drum p remains quiescent after being wound until the clockwork has revolved the contact-piece s' until it meets the pin or stud s'', when the brushes 17 and the contact-piece s' are again in electrical connection, when the motor 11 is again started and runs only so long as the brushes 17 and contact-piece s' remain in contact, and thus the drum m is given intermittent rotary motion, and its motion is conveyed to the roller y by the transmission-wheel 5 only when said wheel 5 is in contact with the raised surface m' of the roller m, and that roller revolves by the action of the motor 11, and the motion of roller y is transmitted to the recording-train by the toothed wheels a, b, c, d, e, and f. The balance-wheel g and hair-spring v and the rest of the clock-train are preferably the same as in an ordinary clock. It will be noticed that the arrangement of the brushes 17 and contact-piece s' and drum r is such that when the current is off the clockwork will run until the brushes 17 and contact-piece s will come into contact and be ready when the current is turned on again to make electrical connection and start the motor 11, so that the clockwork will be wound, and when once wound it runs until another contact is made, runs nearly down and another contact is again made, and the winding and running of the clockwork thus proceeds as long as the current flows, and it makes no difference when the current is shut off, for the clockwork will run until contact of piece s' and the brushes and pin s'' are made, when the clockwork comes to final rest.

This metor can be used with equal facility with both a continuous and an alternating current. The currents will be traced as follows: Current enters at post B, passing through wire a', to coil 2, to post B^3, to "load," returning to post B^2, across connecting-link B^4, to post B', to supply. Pressure-coil 1 is connected in shunt across the line by means of wires 9 9 and a^5. The motor 11 is also in shunt across the line, the current entering at B, then through a^3 to brush 17, returning by wire a^4, which is connected to brushes 14, thence traversing the armature to opposite brush and by wire a^7 to motor-field coil 10 and wire a^6 to connecting-link B^4.

In this metor I have introduced two novel features never before used in a meter to my knowledge—viz., a frictional governor for the speed of the motor 11 and a resilient device to control the arm 4, having permanent initial resilience. In Fig. 6 I show one form of a frictional governor, 6 showing a stationary collet made fast to the bracket, through which passes shaft h, and $6'$ a spring encircling the collet and held in place by screws, as seen in Fig. 5. The governor-balls 8 are attached to arms $7'$, and these arms have notches $7''$, arranged so that when the balls 8 are spread by centrifugal action the beveled faces of arms $7'$ will hug the spring $6'$, and the heads of the holding-screws will, by entering notches $7''$, not interfere with the motion of the balls and the beveled surface of the arms will have a yielding instead of an unyielding surface to rub against, and the holding-screws being set in slots $6''$ allows of all the motion necessary. While I show these two forms of friction-governors, their equivalent may be used, if desired.

Referring to spring 3, which controls the action of arm 4, I have found empirically that the steel springs as made and now procurable on the market are not desirable for the reason that when coiled, as seen at $3'$, (see Fig. 8,) they do not possess a permanent "set," and after a short period of use such springs spread and weaken and occupy a position illustrated by the dotted lines $3''$ in Fig. 8, and when used in my meter this spreading or yielding throws the arm 4 farther and farther away from the fixed zero-point, and thus disarranges my calibrations, rendering the meter incorrect in its readings, which has to be corrected from time to time by readjusting the spring. This spreading or yielding of the spring is not caused by its becoming magnetized or otherwise affected by the electricity passing the meter, but is inherent in all steel springs on account of the particles or molecules of the steel not receiving a uniform set. After extended labor and great expense I have overcome this difficulty by producing a spring having a permanent and uniform set when first made and which will retain said set under any and all conditions to be met with in my meter, and I have called this spring a "permanent initial resilient device" to distinguish it from those devices heretofore used not possessing this desirable quality. By my new spring I avoid the trouble and expense of resetting the springs, and my meters are always in exact measuring operation without further attention. There are several ways by which this spring may be made to possess this desired quality, one way being as follows: I select, preferably, a metal relatively soft—bronze, brass, or aluminium-bronze may be used—and I cut strips from a sheet of such metal somewhat narrower than the spring will be when finished and cut the strip from the sheet so that the direction of the run of the grain of the metal will be crosswise the strip. I now roll this strip on each edge, forcing the grain along each edge to run lengthwise of the strip, and the rolling is done from right to left on one side of the strip and from left to right on the other edge, or, in other words, from opposite directions on the edges. This leaves the spring with the grain of the metal on one edge running in one direction, the grain on the other edge in the opposite direction, and the grain of the middle of the strip running crosswise the spring. This changing of the run of the grain of the metal produces a spring that has a permanent resilient set and one that will not crawl or spread however long it may be used under conditions similar to those found in my meter. I do not confine myself to this particular manner of making such springs, as I claim equivalents; but I prefer the manner described as being cheap and easily accomplished.

The operation of my meter is as follows: The current being turned on a torque is produced in coil 1, which swings the coil and the arm 4 laterally and causes transmission-wheel 5 to move lengthwise of the rollers y and m. The current also starts motor 11, which operates worm n and wheel o, and this winds the spring p' in drum p, such winding taking, as I have arranged my meter, about eleven seconds of time. The clockwork continues to run for the space of about one minute, revolving wheel t and contact-piece s', said contact-piece passing over the periphery of the drum r and its tire r', the brushes 17 at such time resting in opening s^4 out of electrical connection. As the contact-piece continues its travel over and above the periphery of drum r it comes into contact with the brushes 17 on their under sides and raises them and continues to travel until pin s'' is reached. This establishes electrical connection with the motor, and it is again set in motion and again winds the clockwork, the motor's motion continuing only so long as contact exists between the brushes and piece s'. When the motor is in motion, it rotates roller m, which rotates transmission-wheel 5 only, however, when that wheel is in contact with the raised surface m' of roller m, and this motion given wheel 5 is communicated to roller y and its motion to the train and to the pointers over the graduated dial. As the motor is set running its speed would become too rapid, and to govern it the governor, with its balls 8, spreading by centrifugal action, causes friction between the upper ends of the arms and the surface of the collet 6, and thus retards the accelerating motion of the motor and controls it. Spring 3 having permanent initial resilience never changes its predetermined control over the arm 4, and all resetting of such spring and all varying of records of measurements is avoided.

Having described my invention, what I claim is—

1. In an electric meter a frictional governor consisting of weights attached to arms and arranged to spread by centrifugal motion, the upper ends of the arms being beveled, and having a stationary collet, the beveled faces of the arms being arranged to impinge upon the collet when the weights and arms are spread in order that the speed of the meter may be controlled and governed automatically substantially as described.

2. In an electric meter a frictional governor consisting of weights attached to arms and connected to a revolving spindle the ends of the arms being arranged to impinge upon a stationary part of the meter and create friction in order that the speed of the motor may be governed automatically substantially as described.

3. In an electric meter a frictional governor for automatically governing the speed of the moving parts consisting of weights attached to arms and arranged to spread by centrifugal action, and having a yielding surface in proximity to the ends of the arms arranged so that when the arms spread the arms will impinge upon the yielding surface and cause friction and thus govern the speed of the moving parts of the meter substantially as described.

4. In an electric meter a frictional governor consisting of arms and weights attached thereto and arranged to spread by centrifugal action, and a stationary collet, said collet having a resilient device attached thereto, in proximity to the said arms and arranged so that when the arms spread they will impinge upon the resilient device and produce friction and thus govern the speed of the moving parts of the meter substantially as described.

5. In an electric meter a resilient device arranged to have permanent initial resilience, said device being attached to and controlling the movements of some of the moving parts of the meter substantially as described.

6. In an electric meter a resilient device arranged to have permanent initial resilience and having an arm moved by the torque of the coil carrying a transmission device, the movements of said arm being controlled by said resilient device, said transmission device being arranged to induce movement in a recording-train and thus move indicating-pointers over the face of a graduated dial substantially as described.

7. An electric meter having a source of power consisting of a motor and a clockwork; the motor being arranged to receive initial power intermittently and to intermittently wind the clockwork, the clockwork being arranged to complete an electric circuit whereby the motor is given motion, the meter also having a registering-train, an indicating device and a transmitting device, the registering-train being arranged to intermittently receive motion from the transmitting device and the transmitting device arranged to receive motion from the motor and communicate said motion to the registering-train and indicating device, the transmitting device having a resilient device in connection therewith whereby its movements are controlled said resilient device having permanent initial resilience substantially as described.

8. In an electric meter an indicating-train and a transmitting device in operative construction, the transmitting device having a resilient controlling device connected therewith, said resilient controlling device having

permanent initial resilience, and having a motor and a clockwork, the transmitting device consisting of a wheel and a plurality of rollers arranged to operate by surface contact, one roller being operatively connected with the motor, the clockwork being arranged to complete an electric circuit intermittently and to intermittently set the motor in operation, the motor being arranged to intermittently wind the clockwork and having a friction-governor arranged to control the movements of the meter substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JESSE HARRIS.

Witnesses:
W. M. BROWN,
A. M. TURNER.