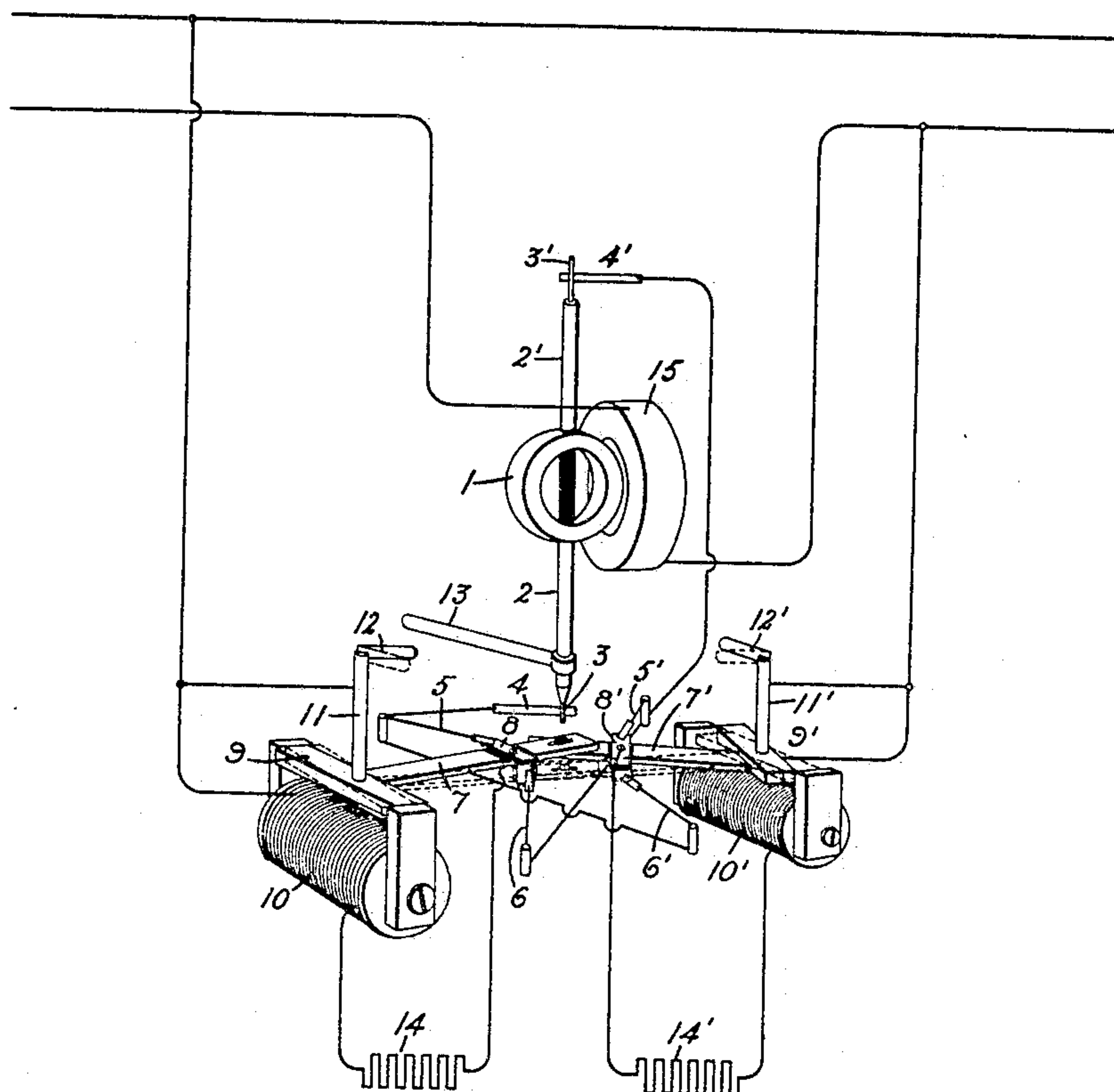


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F. HOLDEN.
ELECTRIC METER.
APPLICATION FILED SEPT. 23, 1903.



Witnesses:

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UNITED STATES PATENT OFFICE.

FRANK HOLDEN, OF RUGBY, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 782,030, dated February 7, 1905.

Application filed September 23, 1903. Serial No. 174,317.

To all whom it may concern:

Be it known that I, FRANK HOLDEN, a citizen of the United States, residing at Brownsover, Rugby, in the county of Warwick, England, have invented certain new and useful Improvements in Electric Meters, of which the following is a specification.

This invention relates to direct-current motor-meters; and its object is to avoid the use of a commutator and commutator-brushes on the rotating part of the meter in order to reduce to a minimum the friction on said parts. In pursuance of this object the two ends of the armature-shaft are insulated from each other, and the terminals of the armature-winding are respectively connected with said ends. Light brushes bear gently on the pivots of the shaft and connect the winding with a reversing-switch which is automatically operated at every half-revolution of the armature, preferably by electromagnets acting in opposition to each other and alternately short-circuited by a contact rotating with the armature-shaft.

The accompanying drawing is a diagram of circuits illustrating my invention.

The rotatable armature of the meter consists of a single pressure-coil 1, secured to a shaft divided transversely into two parts 2 2', which are insulated from each other and provided with long slender pivots 3 3'. The two terminals of the coil 1 are connected one to each of the two parts of the shaft. Bearing lightly on each pivot is a brush 4 4', preferably silver-plated to reduce friction. The brushes are connected, respectively, with two light spring-contacts 5 5', which are diagonally connected with two opposite spring-contacts 6 6'. A lever 7 is arranged to vibrate between the contacts 5 6, carrying an insulated segment 8, adapted to close on one contact or the other, according to the position of the lever. A similar lever 7' carries a segment 8', making contact with the contacts 5' 6' alternately. The levers are mechanically connected, so as to move simultaneously, as by a slot-and-pin construction, at their overlapping ends. Each lever is attached to its respective armature 9 9' of an electromagnet 10 10', said armatures

being pivotally mounted on shafts 11 11', on each of which is a contact-finger 12 12'. On one part of the shaft 2 is a light contact-arm 13, adapted to touch the fingers 12 12' in its revolution, said fingers being arranged at equal distances from the shaft and at diametrically opposite points. One side of the line is connected with the contact-finger 12 and also by a branch lead with one terminal of the electromagnet 10, whose other terminal connects, through a resistance 14, with the segment 8. The other side of the line is connected similarly with the finger 12' and the electromagnet 10', which is connected also with the segment 8' through a resistance 14'. The main current-coil 15 is connected, as usual, in series with one side of the line.

The operation of my invention is as follows: With the parts in the position shown the armature is in series with the two electromagnets and the resistances, the circuit being by way of electromagnet 10, resistance 14, segment 8, spring-contact 5, the lower brush 4 and pivot 3, shaft 2, coil 1, shaft 2', upper pivot 3' and brush 4', the spring-contact 5', segment 8', resistance 14', and electromagnet 10'. When the arm 13 touches the finger 12, a low-resistance path will be formed, shunting the brush 4, spring-contact 5, resistance 14, and electromagnet 10, the current passing directly to line through the shaft 11. The short-circuiting of electromagnet 10 allows the electromagnet 10' to attract its armature 9' and turn it into the dotted-line position shown. This carries the segments 8' and 8 into contact with the spring-contacts 6' and 6 and turns the armature 9 out of line with the poles of the electromagnet 10, as indicated by the dotted lines. This turning of the armature 9 oscillates the shaft 11 and throws the finger 12 out of the path of the arm 13, the finger 12' being in turn swung into said path by the armature 9'. All these movements occur simultaneously and quickly, so that the arm 13 barely touches the finger 12, only long enough to close the shunt around the electromagnet 10. The instant that closure takes place the finger is withdrawn, and the arm can proceed without the slightest opposition.

The work of closing the shunt-circuit is thus practically negligible and imposes no extra load on the armature. By the shifting of the lever and segments to the dotted-line position the course of the armature-current in passing from segment 8 to segment 8' is reversed. As this is arranged to occur at the instant the coil 1 passes the neutral point, the result is similar to that of a commutator. When the arm 13 touches the finger 12', the magnet 10' is short-circuited and the magnet 10 shifts the levers back to the position shown in full lines, again reversing the current through the pressure-coil.

My invention therefore makes it possible to construct a motor-meter with the rotating parts exceedingly light and with pivots turned down as small as the necessity for mechanical strength will permit, with simple collector-brushes bearing on these delicate pivots, thereby reducing the frictional load to a minimum and with all sparking of contacts removed from the rotating armature-shaft to a stationary reversing-switch. It is therefore possible to use many more turns on the armature than heretofore, thus either diminishing its weight or increasing its torque, or both.

In accordance with the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a motor-meter, the combination with the continuously-rotatable armature, of collector-brushes connected with its terminals, a reversing-switch in circuit with said brushes, and means for automatically operating said switch.

2. In a motor-meter, the combination with a continuously-rotatable armature, of a stationary reversing-switch connected with the terminals of said armature.

3. In a motor-meter, the combination with a continuously-rotatable armature, of a reversing-switch in circuit therewith, and two opposing electromagnets for operating said switch.

4. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, and means for alternately short-circuiting said electromagnets.

5. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, and a contact moving with the armature for closing said shunts alternately.

6. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, a contact moving with the armature for closing said shunts alternately, and means for quickly opening each shunt an instant after it is closed.

7. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, a contact moving with the armature for closing said shunts alternately, and fingers forming parts of said shunts and cooperating with said contact.

8. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, a contact moving with the armature for closing said shunts alternately, fingers forming parts of said shunts and cooperating with said contact, and means for withdrawing said fingers from said contact as soon as the shunts are closed.

9. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, a contact moving with the armature for closing said shunts alternately, fingers forming parts of said shunts and cooperating with said contact, and means whereby the movement of the reversing-switch withdraws said fingers alternately from the path of said contact.

10. In a motor-meter, the combination with a rotatable armature, of a reversing-switch in circuit therewith, two opposing electromagnets for operating said switch, a shunt around each electromagnet, a contact moving with the armature for closing said shunts alternately, fingers forming parts of said shunts and cooperating with said contact, and means whereby the movement of the reversing-switch withdraws from the path of the contact the finger which it has just touched and brings the other finger into said path.

11. In a motor-meter, the combination with a rotatable armature, of a reversing-switch comprising two connected levers, an armature on each lever, an electromagnet for each armature, an insulated contact-segment on each lever, two pairs of contact-springs in circuit with the terminals of said armature, and line connections to said magnets and segments.

12. In a motor-meter, the combination with a rotatable pressure-coil, of a reversing-switch comprising two shafts each carrying a contact-finger, a contact-arm moving with the pressure-coil and cooperating with said fingers, an armature and a lever on each shaft, an electromagnet for actuating each armature, shaft and lever, an insulated contact-segment

on each lever, and two pairs of contact-springs coöperating with said segments.

13. An electric meter comprising a current-coil, a continuously-rotatable pressure-coil, and a reversing-switch connected with the terminals of said pressure-coil.

14. An electric meter comprising a current-coil, a pressure-coil continuously rotatable with respect thereto, and a stationary reversing-switch connected with the terminals of said pressure-coil, and operated by the movement of said pressure-coil.

15. An electric meter comprising a current-coil, an armature continuously rotatable with respect thereto, a reversing-switch in circuit with said armature, and means carried by said armature for automatically operating said switch.

In witness whereof I have hereunto set my hand this 9th day of September, 1903.

FRANK HOLDEN.

Witnesses:

H. D. JAMESON,

F. L. RAND.