No. 702,848. Patented June 17, 1902.

A. WRIGHT.

ELECTRICITY METER.

(Application filed June 26, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. II.

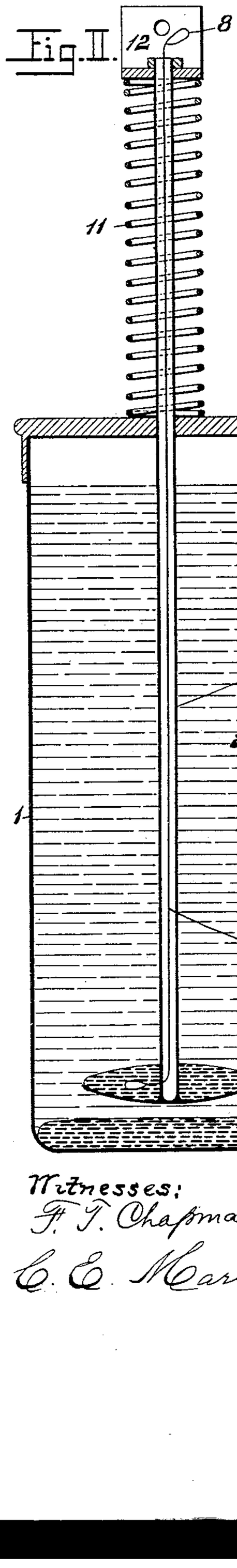


Fig. III.

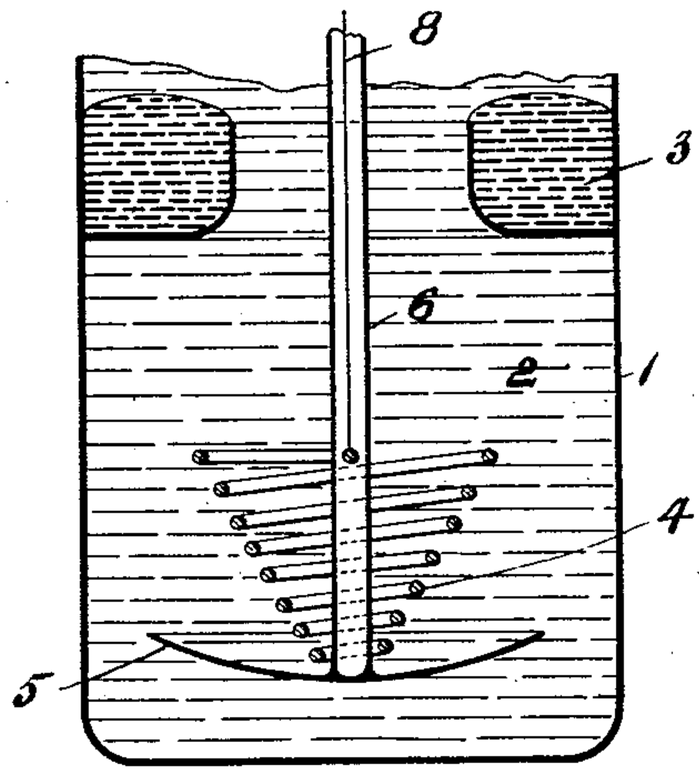


Fig. IV.

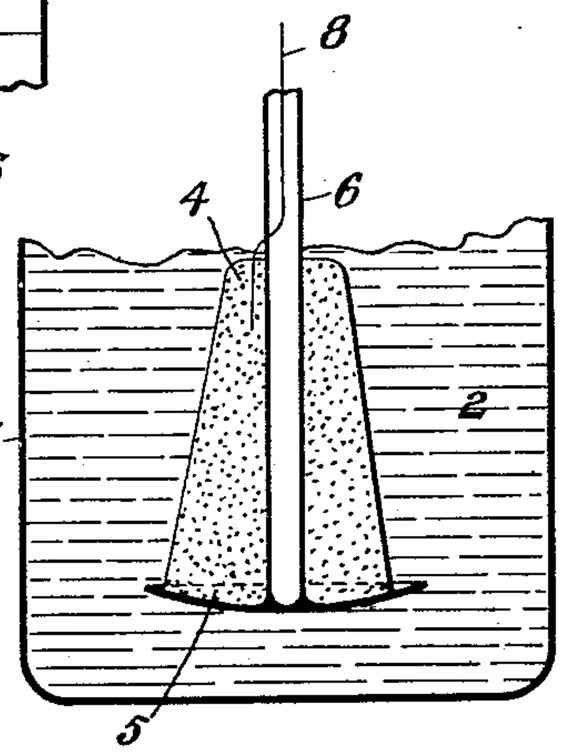
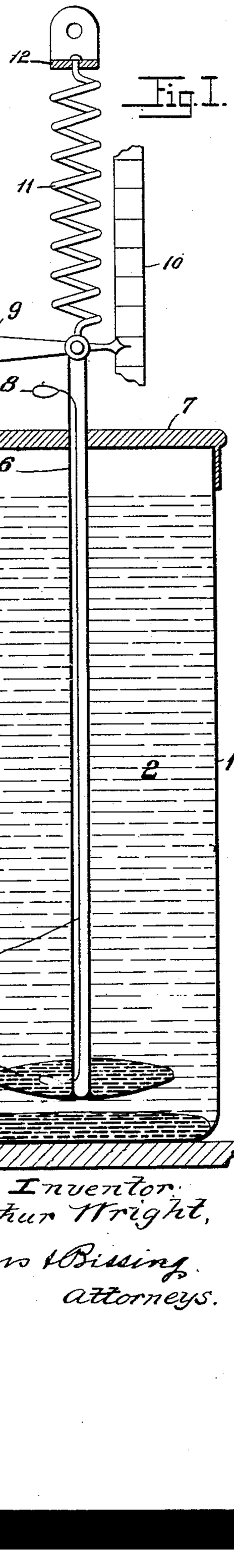


Fig. I.



Witnesses:
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C. E. Marshall

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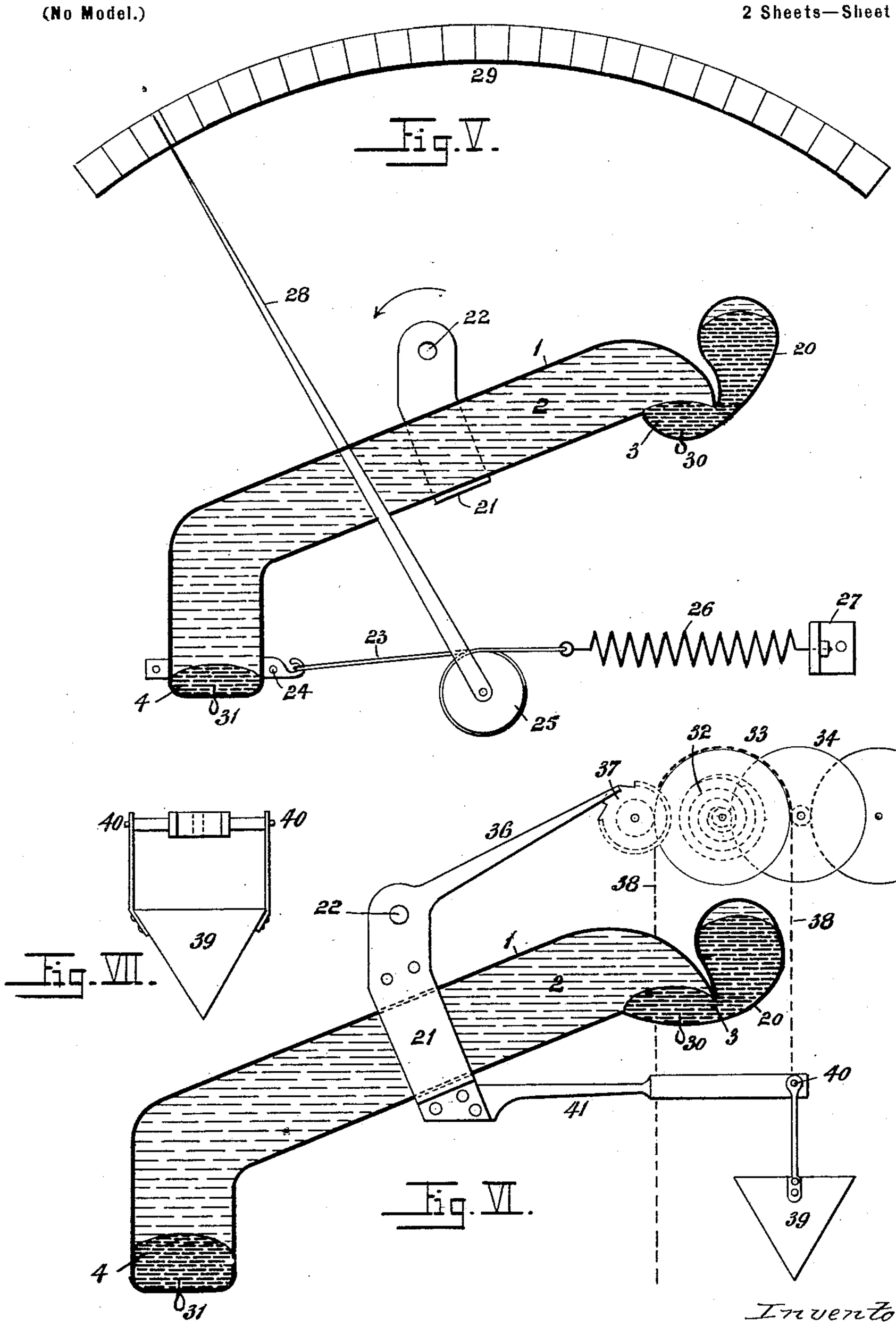

Fig. V.

Fig. VII.

Fig. VI.

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UNITED STATES PATENT OFFICE.

ARTHUR WRIGHT, OF BRIGHTON, ENGLAND, ASSIGNOR TO THE MUTUAL ELECTRIC TRUST, LIMITED, OF BRIGHTON, ENGLAND.

ELECTRICITY-METER.

SPECIFICATION forming part of Letters Patent No. 702,848, dated June 17, 1902.

Application filed June 26, 1900. Serial No. 21,640. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR WRIGHT, a subject of the Queen of Great Britain, and a resident of Brighton, in the county of Sussex, England, have invented certain new and useful Improvements in Electricity-Meters, of which the following is a specification.

My invention relates to electricity-meters of the mercury electrolytic type, by means of which certain advantages are obtained.

In electric meters of this type it is usual to employ an anode of mercury, together with a cathode either of mercury or of some other convenient material—such, for example, as platinum or carbon. When a cathode of mercury is employed, this cathode increases in weight, while the mercury anode decreases in weight, owing to the mercury of the said anode being dissolved by the electrolyte, while at the same time the mercury cathode is being increased by deposition of mercury from the said electrolyte. Similarly, when a cathode of another material than mercury is employed mercury is deposited upon this cathode and in part remains adhering to it and in part drops from it.

My invention is designed to enable the current which has passed to be automatically metered by means of (*a*) the decrease of weight of the mercury anode, (*b*) the increase in weight of the mercury cathode, and (*c*) the increase of weight where a cathode of other material than mercury is employed.

Figure I shows a longitudinal cross-section of one form of apparatus. Fig. II shows a longitudinal cross-section of another form of apparatus. Fig. III shows a longitudinal cross-section of a portion of a third form of apparatus. Fig. IV shows a cross-section of a modified form of electrode. Fig. V shows a section of a tilting indicator. Fig. VI shows a tilting indicator controlling a counter. Fig. VII shows a detail thereof.

A way of carrying my invention into effect when I meter by means of the loss of weight of the mercury anode is to sustain the said mercury anode by a movable device, the amount of whose movement (against, for example, the action of a spring or counterweight or the like) is automatically indicated or registered by the relative change of position of two parts—that is to say, of a fixed and a movable part or attachment or of two movable parts or attachments.

Such a device is shown in Fig. I, in which 1 is the main chamber of the meter, containing the electrolyte 2. 3 is the anode, and 4 the cathode. For convenience I have illustrated both electrodes in this case as consisting of mercury. The mercury constituting the anode 3 is supported in the spoon-like receptacle 5, conveniently made of glass, at the end of the tubular glass rod 6, which passes out through the stopper 7. A platinum wire 8 passes down through the said tubular rod 6, and its lower extremity is sealed through the wall of the said tube and makes contact with the mercury of the anode, as shown. To the upper end of the rod 6 is attached the index 9, arranged to traverse the scale 10. The rod 6, with the anode and index, are suspended from a spiral spring 11, whose upper end is attached to the fixed support 12.

The action of this form of my invention is as follows: When the current passes, the anode decreases and the cathode increases in the well-known manner. The weight suspended from the spiral spring 11 decreases, therefore, and the index-arm moves upward over the scale 10, and a reading upon said scale is a measure of the current which has passed through the instrument.

A way of carrying my invention into effect when I meter by means of the addition of weight of the cathode is by similar means, but with this difference, that whereas in the case of the mercury anode the loss of weight will cause the anode to move in one direction, in the present case the gain in weight of the cathode will cause movement in the opposite direction.

This form of my invention is shown in Fig. II, in which the parts 1 to 12 are the same as in Fig. I, except that the rod 6 is attached to the fixed support 12 and the index 9 is attached to the stopper 7, or the index may be conveniently attached to the vessel 1 unless the scale 10 should be marked on said vessel 1, in which case the index 9 is attached to a fixed part. The spiral spring 11 supports the cathode instead of the anode, as in Fig. I. Here it will be seen that the increase in weight of the cathode causes spring 11 to be stretched

and the index 9 to move downward over scale 10.

When the cathode consists of a material other than mercury and the instrument is required to register more than minute currents or currents for more than minute periods, I may attach to the movable cathode or to the movable part with which the cathode is connected a receptacle for such mercury as does not adhere to the actual cathode, so that not only the weight of the adhering mercury, but also that which drops away from it may bear its share in producing the movement automatically indicated or registered.

This form of cathode is illustrated in Fig. III, in which the cathode 4 consists of a platinum wire coiled into the form of an inverted cone around the glass rod 6 and above the glass spoon 5. Here it will be seen that the weight of the whole of the mercury which is deposited at the cathode is taken into account, for that part which does not adhere to the platinum drops from it into the glass spoon.

In the case where the currents are minute or are passed for a minute period only such separate receptacle may be dispensed with, as the deposited mercury may adhere to the actual cathode, which latter may be porous or of such shape as to sustain the small quantity of mercury so deposited.

This form of cathode is shown in Fig. IV, where it will be seen that instead of a receptacle, as in Fig. III, the pores and interstices of the carbon block 4, constituting the cathode, are relied on to retain the small quantity of mercury deposited.

Another way of carrying my invention into effect consists in automatically indicating or registering, as aforesaid, not the movement of the anode or of the cathode merely, but the movement of that part of the instrument which contains, supports, or embraces the two electrodes and the whole or a part of the electrolyte, such movement being conveniently arranged to take place around a center, the said movement being indicated or registered by the relative change of position of the two parts, as before mentioned. One such instrument is shown in Fig. V, in which 1 is the vessel containing the electrolyte 2, the anode 3, and the cathode 4, the said anode having an anode-feeder 20 of the kind described in my pending United States application, No. 18,124, filed A. D. 1900. The vessel 1 is held by a clip 21, pivoted at the point 22. 23 is a cord passing from a clip 24, attached to the lower part of the vessel 1 and passing over pulley 25 to a spiral spring 26, whose other end is attached to the fixed support 27. To pulley 25 is attached an index-finger 28, adapted to traverse the scale 29. 30 31 are platinum terminals connected with the anode and cathode, respectively.

When current is passed through the instrument, some of the mercury of the anode is dissolved in the electrolyte, which also deposits mercury on the cathode. The consequence is that the mercury of the anode decreases and that of the cathode increases in the well-known manner. As this takes place angular movement of the vessel 1 takes place in the direction shown by the arrow. This causes a slackening of cord 23, which is taken up by spring 26, and the index-finger is moved along the scale from left to right. The greater the current which has passed within a given time the greater the transfer of mercury, the greater the angular movement, and the further to the right is the position taken up by the index-finger. The position therefore of said index-finger on the scale gives a reading of the current which has passed.

I have hereinbefore spoken of the indications or registrations being obtained by the relative movement of two parts—that is, to say, of a fixed part and a movable part, or of two movable parts. I may, however, also obtain indication or registration by causing the movement obtained as aforesaid to actuate an indicating or registering mechanism or counter or to actuate a separate motor, which latter may actuate such indicating or registering mechanism or counter. Such motor may, for example, be a wound-up spring or weight or an electric or a pneumatic motor, suitable transmitting mechanism being employed for the actuation of the said motor by the movement obtained by the increase or decrease of weight of the electrodes, as before mentioned.

An instrument of this kind is shown in Figs. VI and VII, in which 1 is the main chamber of the instrument, containing the electrolyte 2, the anode 3, and the cathode 4. 20 is an anode-feeding device, as hereinbefore mentioned, and 30 31 are the conductor-terminals. The vessel 1 is supported by the clip 21 and is capable of angular movement around the pivot 22. The motor in this case consists of the wound-up spring 32, shown in broken lines driving or tending to drive the train of indicating wheels or disks 33 34 35. A click 36, engaging with a ratchet-wheel 37, prevents the indicating-wheels being moved when the parts are in their normal position. Movement produced by change of weight of the electrodes causes click 36 to be removed from ratchet-wheel 37 when the indicating-wheels are at once driven.

A chain 38, also driven by the spring-motor, as shown, is transferred while the motor is in action into a receptacle 39. This receptacle or bucket 39 is articulated at the points 40 40 to the forked arm 41, extending from clip 21, so that the leverage remains constant at different positions. As soon as an amount of chain has been wound into the bucket corresponding with the change of weight of the electrodes movement in the opposite direction to the previous one takes place and again brings the click into engagement with the ratchet-wheel and stops the clock-motor and with it the indicating-wheels. Continued

passage of the current again brings about the same cycle of operations, and so on. A true method of "zero-indication," as it is termed, is thus obtained.

It is to be understood that although in Figs. V and VI, I have shown the cathode as of mercury a cathode of other material—such, for example, as platinum—may be employed.

It will be noticed that the anode in the several structures shown in the drawings is placed above the cathode. This prevents the formation of crystals at the anode, due to the electrolyte at that point becoming very rich in mercury. The surface of the anode being convex, the portion of the anode above the cathode allows of the flow of the electrolyte from this point. This feature is also set forth and claimed in my companion application, No. 18,124, of May 26, 1900.

I use the term "indicator" in my claims in its generic sense to designate any means for giving an indication, whether such indication be merely transitory or whether it be registered or permanently recorded.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An electrolytic mercury-meter comprising a movable electrode, the weight of the mercury on which varies during the passage of the current, and an indicator operated by its change of weight, substantially as described.

2. An electrolytic mercury-meter having its anode above the cathode, and having one or both electrodes movable, the weight of the mercury of the movable electrode varying during the passage of the current, and an indicator operated by its change in weight, substantially as described.

3. An electrolytic mercury-meter comprising a tilting electrode-chamber, the change in weight of the mercury on the cathode during the passage of the current causing a tilting of the chamber, and an indicator controlled by the tilting chamber, substantially as described.

4. An electrolytic mercury-meter, comprising a tilting electrode-chamber, the change in weight of the mercury on the electrodes causing a tilting of the chamber, and an indicator controlled by the tilting chamber, substantially as described.

5. An electrolytic mercury-meter comprising a tilting electrode-chamber, the increased weight of the mercury on the cathode and the diminished weight of the mercury-anode each causing a tilting of the chamber, and an indicator controlled by the tilting chamber, substantially as described.

6. An electrolytic mercury-meter comprising a tilting chamber, having the anode situated above the cathode, the change in weight of the mercury on the electrodes causing a tilting of the chamber, and an indicator controlled by the tilting chamber, substantially as described.

7. An electrolytic mercury-meter comprising a tilting electrode-chamber, the change in weight on the electrodes causing a tilting of the chamber, and an indicator comprising a driven register checked or restrained by the tilting chamber and permitted to be operated by the tilt of the chamber, substantially as described.

8. An electrolytic mercury-meter comprising a tilting electrode-chamber, the change in weight on the electrodes causing a tilting of the chamber, an indicator comprising a driven register checked or restrained by the tilting chamber and permitted to be operated by the tilt of the chamber, and a restoring mechanism for the tilting chamber operated by the register, substantially as described.

9. An electrolytic mercury-meter comprising a tilting electrode-chamber, the change in weight on the electrodes causing a tilting of the chamber, an indicator comprising a driven register checked or restrained by the tilting chamber and permitted to be operated by the tilt of the chamber, and a restoring mechanism comprising a bucket and chain for restoring the tilting chamber to engagement with the register, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

ARTHUR WRIGHT.

Witnesses:
JOHN REID DICK,
JAMES G. LORRAIN.