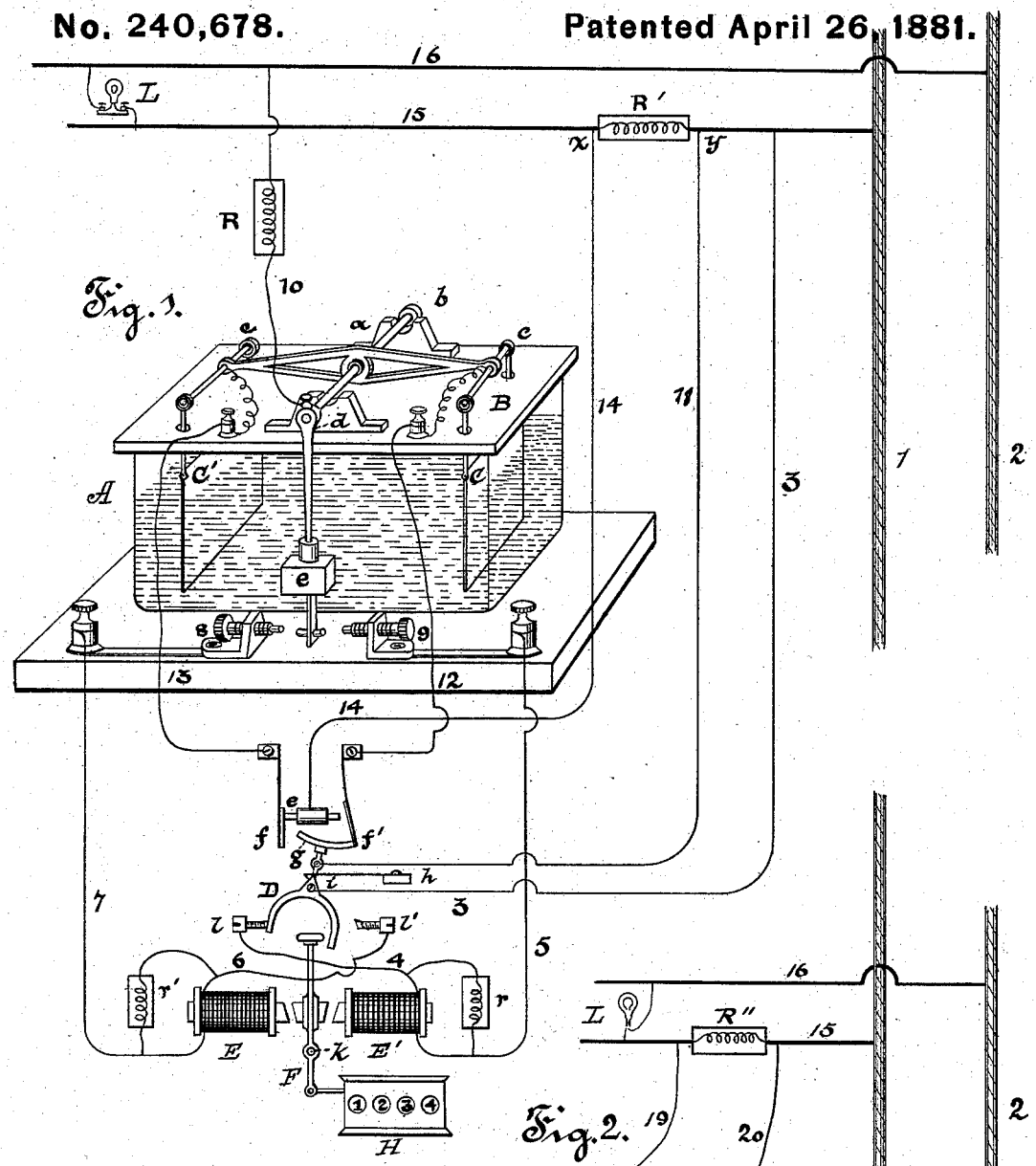
(No Model.)

# T. A. EDISON.

## Webermeter.

No. 240,678. Patented April 26, 1881.

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# UNITED STATES PATENT OFFICE.

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## WEBERMETER.

SPECIFICATION forming part of Letters Patent No. 240,678, dated April 26, 1881.

Application filed October 7, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Webermeter; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In any system of furnishing to consumers electricity for light, power, or other purposes, it is desirable that means be provided which shall accurately measure the current used. It is also desirable that this measure of current should be automatically indicated and registered in a manner analogous to the registration of gas or water flow.

The object of this invention is to provide means for attaining these results; to which end it consists in the particulars more fully hereinafter set forth and claimed.

A depositing-cell is used in which the plates are suspended but insulated from a balanced arm, to which is attached a lever-arm, on which is a weight adjustable on a lever-arm, so that the amount of excess of weight upon one plate over the other required to cause a tilting of the balanced arm may be determined and regulated. The cell so arranged is placed in a branch circuit—that is, a circuit derived from one member of the circuit supplying the translating devices—resistances being so arranged that a definite fraction of the current used shall traverse the branch circuit and depositing-cell. It is evident, then, that as the weight of one plate is increased by the deposition of, say, copper from the solution, it will tip the balanced arm when the weight of the increase becomes sufficient to overbalance the weight alluded to as on the lever-arm. The lever-arm, moving, causes a movement of a registering apparatus, registering each tip, and at the same time causes a reversal of the current through the cell, the effect of which is that the copper is torn off from the now heavier plate and deposited upon the lighter until it, in turn, becomes the heavier, causing another tipping, another registration, and another reversal. As the amount of current needed to cause the deposition of metal enough to cause the tipping is known, and as it is a definite percentage of the entire current, the registration may indicate the total amount of current; or, as the ratio existing between current and feet of gas for illuminating effect has been determined, the registration may indicate the equivalency in light of feet of gas. As stated, the tipping of the balanced arm and attached lever-arm causes a movement of a registering apparatus and a reversal of the current through the depositing-cell. It may cause this directly by having either the balanced or the lower arm connected directly to a register and to a reverser, or indicated by setting into operation intermediate mechanism. In the latter case the following is a convenient arrangement: Two magnets are used with their poles placed oppositely, between which plays an armature-lever, one end of which is attached to the prime motor of the register, the other end playing in the open part of a fork or Y, whose upper end operates a reverser. The play of the Y is limited by two set-screws, one on either side, with a circuit-connection from each to one of the magnets, the connection from the left-hand screw being to the right-hand magnet and from the right-hand screw to the left-hand magnet. The play of the weighted lever-arm, before referred to, is determined by two set-screws, each screw being connected with the magnet upon its side.

From one member of the circuit containing translation devices is a circuit-connection to the Y, while the lever-arm is connected to the other member. In this circuit is interposed a very large resistance, so that but a small percentage of the current passes therethrough, simply enough to operate an ordinary electro-magnet. A circuit then may be formed through either magnet, in which are two breaks, one closed by the weighted lever at the end of its movement, the other by the Y at the end of its movement, the circuit being shifted from one magnet to the other as the lever-arm is tipped by the plate receiving its determined load by deposition. Around each magnet is a short circuit of large resistance, which affords a path for the extra or induced current, avoiding spark therefrom at the contact-points. The same principle—namely, the effecting of a registration by the overweighting of a plate by deposition—may also be carried into effect

by mounting upon a shaft a series of plates which radiate therefrom. This shaft is journaled in a suitable case, which is filled with the proper depositing-solution nearly up to the shaft. Upon the shaft are a series of commutator-blocks, one for each plate. Commutator-springs are so arranged as to bear simultaneously upon the blocks of the plates remote from each other in the fluid, a branch circuit from one member of the consumption-circuit being connected to the springs. As deposition proceeds one plate becomes so loaded as to cause a partial rotation of the shaft, which causes the circuit to be formed through another plate, which, becoming loaded, causes further rotation, bringing another plate into the circuit, whereupon the first plate is again in circuit, but in such relation as to be the plate which is reduced to afford material for deposition upon the other plate in circuit, each plate being thus successively loaded and stripped, the movement from one pole to the other, caused by loading the deposition, being registered by the rotation of the shaft.

The invention may be carried into effect in many other ways; but the ones here described are sufficient to illustrate its principle.

Instead of a balanced arm from which the plates are suspended, a spring-balance may be used, the plate, as it becomes loaded, acting on a spring to make the necessary circuit-connections at the predetermined point.

In the drawings, Figure 1 is a view, partly perspective, showing the form first described, while Fig. 2 is a second plan or modification.

In Fig. 1, A is any suitable containing-cell, provided with a cover, B, upon which is a balanced arm, *a*, attached to a shaft, *b*, pivoted in suitable bearings or supports attached to the cover. From the ends of the arm *a* are suspended the plates C C′, forming the anode and cathode of the cell. Upon the end of *b* is a lever-arm, *d*, upon which slides the weight *e*, provided with means for securing it in any desired position. At its lower or free end *d* is provided with contact-points, which take against the set-screws 8 9, which limit its motion.

E E′ are two electro-magnets, whose poles face each other, acting upon armatures upon a lever, F, pivoted at *k*, playing between the two magnets, and so connected at its lower end with a register, H, as to operate it upon each vibration of the armature-lever. At its upper end F takes between the limbs of the fork D, pivoted at *i*, to whose upper end is attached an arm, *g*, taking between contact springs or levers *f f′*, which, in connection with *e*, form a reverser.

*h* is a small spring, having a projection at its end taking over a small projection upon D with sufficient force to hold it against accidental displacement.

1 2 are the main conductors of a system from which lead conductors 15 16 to and through the place of consumption. From 15 a circuit is formed through the depositing-cell by 11 *g* *f′* 12 C C′ 13 *f e* 14, the direction of the current in the cell being determined by the contacts of *f*, *f′*, and *e* in the reverser. Between 11 and 14 in 15 a resistance, R′, is placed, adjusted to cause a definite and determined fraction of the entire current traversing 15 to pass through the cell.

A circuit for the magnets E E′ is formed as a derived or multiple-arc circuit to 15 16 by 3 D, and then in one position of D, by *l* 4 E′ 5 9 *d* 10, to 16, or in another position of D, by 3 D *l′* 6 7 8 *d* 10, to 16.

In 10 a resistance, R, is placed, adjusted to the resistance of the main circuit, so that only a small amount of current, simply enough to make E or E′ effective, shall traverse the circuit through them.

Short circuits around E E′ are formed, containing resistance *r r′*, for the purpose of absorbing the extra or induced current, lessening or avoiding spark at the contact-points.

The operation is as follows: Suppose the parts to be in the position shown in Fig. 1, and the current flowing through the cell, so that C is the anode and C′ the cathode. As metal is deposited upon C′ it gradually overbalances C, swinging *d* out of the perpendicular, until finally it takes against screw 9, whereupon the circuit through E′ is closed *via* 10 *d* 9 5 4 *l* D 3. E′ attracts F, causing it to operate the register H. F, in moving toward E′, strikes D, causing it to break circuit at *l* and carrying it over against *l′*. At the same time the arm *g* is carried in the reverse direction, leaving *f′* and allowing it to contact with *e*, and at the same time contacting with *f*, and causing it break contact with *e*, causing the current to pass through the cell in the reverse direction. C′ now becomes the anode, and the metal deposited thereon is dissolved therefrom and carried to C, which, finally becoming the heavier, causes a repetition of the operations described.

It is evident that the reverser and register might be actuated directly by *d*; but the devices shown are more accurate and delicate, and destructive sparks at the contacts are greatly lessened, if not entirely obviated.

In Fig. 2, K is any suitable case, in which rotates a shaft from which project radial plates *n o p*, &c., dipping into the fluid O. The plates are insulated from each other and each is attached to a commutator-block. *m m′* are commutator brushes or springs, arranged to bear upon the blocks of the plates remote from each other in the fluid. To *m m′* lead conductors 19 20, completing a branch circuit from the house or consumption circuit. Suppose the current to flow in such direction that *n* is the anode and *p* is the cathode, as *p* becomes loaded it sinks in the fluid, causing N to rotate, which movement is registered upon a register attached thereto. This movement has brought *o* in contact with *m*, making it the anode, and *r* in contact with *m′*, making it the cathode. When *r* becomes loaded it causes a rotation, when *p* becomes the anode and *s*

the cathode, whereupon the metal formerly deposited thereon is dissolved off. In both forms each plate is alternately an anode and a cathode, receiving a deposit only to have it stripped off, the very act of deposition setting in operation agencies which cause the change from anode to cathode and agencies which register the change.

The register H may be made so as to indicate webers or current-units, or, as the relation between current and gas for light-production is known, it may indicate the number of feet of gas, which would be equivalent in light-production to the amount of current registered.

While these devices are shown in a branch circuit, so that only a portion of the current passes therethrough, it is evident that they may be placed directly in the circuit.

While the circuits controlling the mechanical devices are here shown as branch or multiple-arc circuits, it is evident that they may be battery local circuits.

It is also evident that all the mechanical devices may be actuated by clock-work which is controlled by the balanced arm or lever.

As this arrangement registers the exact number of webers or current-units passing therethrough, I have applied to it the term "webermeter."

What I claim is—

1. In an electro-depositing cell, the combination, with the plates therein, of means for changing the anode and cathode relation of the plates, substantially as set forth.

2. The combination of a decomposing-cell, balanced polar plates therein, and a registering apparatus controlled by the overloading of either plate, substantially as set forth.

3. The combination of a decomposing-cell, balanced polar plates therein, and a reverser reversing the direction of the current through the cell, and controlled by the overloading of either plate, substantially as set forth.

4. The combination of a decomposing-cell, balanced polar plates therein, and registering apparatus, and means for reversing the direction of the current through the cell, the register and reverser being controlled by the overloading of either plate, substantially as set forth.

5. The combination, with a main circuit, of a shunt or branch circuit through which passes a definite portion of the current, a depositing-cell containing balanced plates, a register, and a reversing apparatus, substantially as set forth.

This specification signed and witnessed this 22d day of September, 1880.

THOS. A. EDISON.

Witnesses:

W. CARMAN,

S. MOTT.