

E. WEINTRAUB.
ELECTROLYTIC METER.

APPLICATION FILED FEB. 14, 1910.

1,006,612.

Patented Oct. 24, 1911.

Fig. 1.

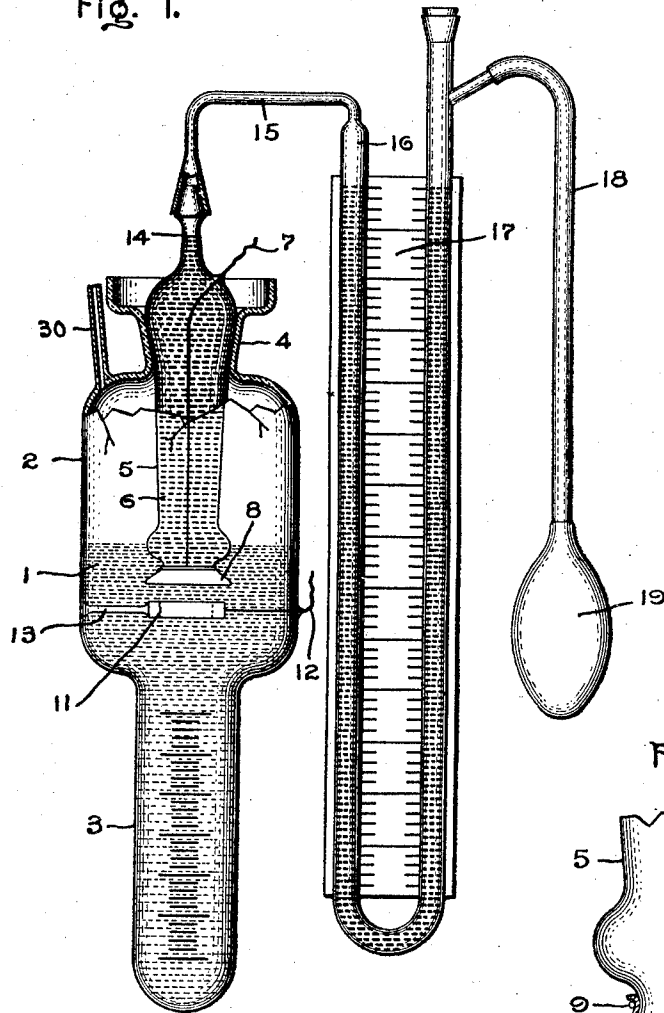


Fig. 2.

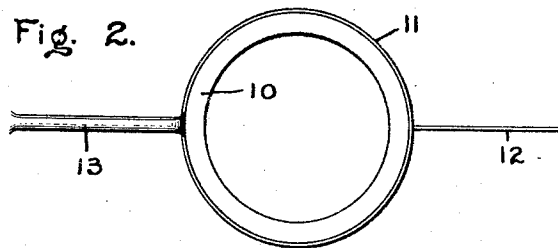
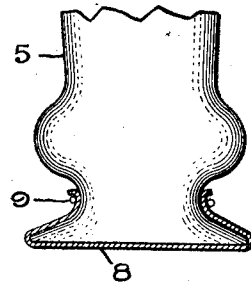


Fig. 3.



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ELECTROLYTIC METER.

1,006,612.

Specification of Letters Patent.

Patented Oct. 24, 1911.

Application filed February 14, 1910. Serial No. 543,754.

To all whom it may concern:

Be it known that I, EZECHIEL WEINTRAUB, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Electrolytic Meters, of which the following is a specification.

My invention relates to meters for measuring the consumption of electric current in a circuit, that depend for their action upon the decomposition of an electrolyte by the current. Meters of this class have been heretofore proposed in which the anode is a body of mercury, but it has been found difficult to maintain them in proper working order owing to imperfect circulation in the electrolyte that tends to permit the establishment of a counter-electromotive force in the meter, and to incomplete agglomeration of the mercury deposited from the solution, etc.

My invention aims to eliminate these objections and to produce a simple, reliable and stable instrument.

The meter which I have invented may take various forms, and the one which I shall illustrate is a form which I have found to be satisfactory in practice. In general my meter consists of a suitable vessel to contain the electrolyte, with a fall tube at the bottom to collect the deposited mercury, and a container for the mercury anode suspended in the upper part of said vessel with a hermetically tight joint between them; the lower end of said container being closed by a diaphragm of a suitable substance possessing osmotic properties and having sufficient strength to sustain the weight of the mercury and also capable of resisting the action of the electrolyte. I prefer to use for this purpose a piece of gold beater's skin. I also provide means for measuring the loss of mercury from the anode by supplying fixed quantities of mercury to make up said loss; the supply of fresh mercury being stored in a reservoir consisting of a U-shaped tube connected to the upper end of the anode container and having a compressible bulb or equivalent means for causing a definite portion of such stored mercury to pass over into said container; the U-shaped tube being graduated to enable such portion to be easily read. I also provide a special form of cathode. The theory of these mercury meters is well known, and it is not necessary to go

into this at any length, but merely to say that the action of the meter depends upon the deposition of mercury from an electrolyte containing a mercury salt in solution; the decrease in mercury being made up constantly by solution from the anode. In my meter this solution takes place through the membrane or diaphragm.

For a further understanding of my invention reference may be had to the accompanying drawings, where—

Figure 1 is a side elevation partly in section of my meter; Fig. 2 is a top view of a special form of cathode on a larger scale; and Fig. 3 shows a part of the lower end of the anode container with the diaphragm in section.

Referring first to Fig. 1, the electrolyte 1 is held in a glass vessel 2, from whose lower end depends the fall tube 3, smaller in diameter than the vessel and graduated, as shown, to enable the deposited mercury to be readily measured. The upper end of the vessel 2 has a throat 4, preferably somewhat conical, to receive a tapering glass container 5 in which the mercury anode 6 is inclosed. The top of the vessel 2 is provided with a thick walled capillary tube 30, through which liquid cannot pass, but which is sufficient to relieve the pressure which occurs as the mercury dissolves from the anode and collects in the vessel 2. This pressure would otherwise cause the electrolyte to filter through the osmotic diaphragm and get into the container 5, a condition which should be avoided, and is avoided by the use of this tube. The joint between the vessel 2 and the container 5 is made air-tight, preferably by forming a ground joint where the two come in contact. A leading-in wire 7 passes through the upper part of the container and extends down into the mercury. The lower end of the container is open and has a flaring or flanged construction, affording a convenient means for securing the membrane of diaphragm 8, which is preferably composed of gold beater's skin and is drawn tightly over said flange and suitably secured in place, as by a tie-wire 9 of platinum. At a little distance below the membrane is the cathode, consisting of a supporting non-conducting member, such as a glass ring 10, whose outside vertical face is covered with a thin sheet or foil 11 of a conducting substance, to

which the leading-in wire 12 is connected. I prefer to make this foil of some metal of the platinum group, such as platinum. The ring is conveniently supported by an arm 13 projecting from the wall of the vessel 2 lying in a horizontal plane and having its axis vertically in line with that of the container 5. The advantages of this special form of cathode are that the cathode is rigid: it has a large surface, and the surface is formed of a metallic foil which is very smooth, and hence the small globules of mercury formed upon the cathode will fall off while small.

The upper end of the container has a contracted neck 14 which is connected hermetically by a ground joint with a capillary glass tube 15 leading to the upper end of one leg of a U-shaped storage tube or reservoir 16. Suitable means are provided for determining definite quantities of the contents of said reservoir, such as a graduated scale 17 placed adjacent to said tube. The upper end of the other leg of the reservoir is closed and is connected by a link of rubber tubing 18 with a compressible bulb 19.

On the contracted neck 14 of the container is a mark to which it is originally filled with mercury. In the continued operation of the meter, the mercury drops away from this mark, and when it is desired to ascertain how much mercury has been dissolved from the anode, the bulb 19 is compressed, exerting pneumatic pressure upon the mercury in one leg of the reservoir and driving enough mercury from the other leg of the reservoir to fill the container again to said mark. It will be seen that as the mercury in the anode chamber goes down a slight vacuum will be created in this chamber, the communicating tube 15 and the upper portion of reservoir 16. When bulb 19 is pressed, exerting air pressure upon the right leg of reservoir 16, the mercury in the reservoir will be pressed over through tube 15 into the anode chamber, thus partially compensating for the vacuum. When the mercury reaches the end of the capillary tube 15, it will go into the anode chamber in the form of fine drops, one by one until the chamber is filled up to the mark. When the chamber has been filled up to the mark, the original set of conditions holding when the meter was first operated exists, as the anode chamber has merely been refilled with mercury to its original position, and hence no straining or bursting of the diaphragm can occur. When the rubber bulb 19 is released, the mercury snaps back leaving the capillary tube 15 perfectly clean. After the operation of filling up the anode chamber from the reservoir, a slight vacuum will exist in the anode chamber, tube 15 and the lefthand leg of the reservoir owing to the decrease in the amount of mercury in the reservoir. When,

however, mercury is refilled in the reservoir to its zero mark so that the reservoir contains the original amount of mercury, it will readily be seen that this vacuum can no longer exist, the volume relations of the mercury in the reservoir and the anode chamber and of the air in the same and the capillary tube being the original ones, and thus the pressure will be reestablished to the atmospheric one. By means of the graduated scale 17, the quantity thus transferred from the reservoir can be easily determined and this is an accurate measure of the previous loss from the anode, and consequently of the current consumption. By reading the amount of mercury deposited in the fall tube I am able to check up the amount of mercury supplied from the reservoir and thus I obtain a double method of reading, the one for a large quantity of mercury or for the measure of current consumed during a long interval of time, and the other for the current consumed during shorter intervals of time, this latter being read from the mercury taken from the reservoir.

My osmotic membrane solves several of the problems which have heretofore been troublesome in this class of meters, and makes the reduction of the volume in the anode immaterial and also permits placing the anode directly above the cathode and thus reduces the distance between them to a very small value, so that the difference in concentration of the solution due to the electrolytic action is very slight. It secures a good circulation of the solution. I have also found that in order to get the best results, the electrolyte should be free from both acid or alkaline substances, or substances that are liable to give in the course of operation slightly acid or alkaline reactions.

Some of the advantages of this form of meter are: first, the deposited mercury is constantly recorded in the large fall tube, so that after a long interval of time the amount of mercury deposited can be read; second, a perfect agglomeration of the deposited mercury in the fall tube is not as much of a necessity as in other types of meter; third, the sticking of the mercury to the cathode does not introduce any error in the readings which are ordinarily taken from the scale adjacent to the U-shaped reservoir; and, fourth, the length of the meter is reduced.

While I have described my invention as applying to a particular form of meter with an osmotic membrane and a particular solution of an electrolyte, I do not claim these inventions in this application, but do claim them in my co-pending application, Serial No. 543,755, filed February 14, 1910.

While I have illustrated one embodiment of my invention, I do not limit myself to this particular embodiment, but seek in the appended claims to cover all such embodi-

ments as would be obvious to those skilled in the art and will not depart from the spirit of my invention.

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

1. An electrolytic meter comprising a vessel for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, a reservoir for mercury connected to the container, and means for driving mercury from the reservoir into the container.

2. An electrolytic meter comprising a vessel for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, a reservoir for mercury connected to said container, and pneumatic means for driving mercury from the reservoir into the container.

3. An electrolytic meter comprising a vessel for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, a tube for holding mercury connected at one end to said container, and a compressible bulb connected to the other end of the tube.

4. An electrolytic meter comprising a vessel from whose lower end depends a graduated tube for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, having an open lower end covered by an osmotic membrane, a reservoir for mercury connected to the container, and means for driving mercury from the reservoir into the container.

5. An electrolytic meter comprising a vessel for the electrolyte, a container for the mercury anode depending from the upper

part of said vessel, a graduated reservoir for mercury connected to the container, and means for driving mercury from the reservoir into the container.

6. An electrolytic meter comprising a vessel for the electrolyte, a container for the mercury anode depending from the upper part of said vessel, a graduated tube for holding mercury connected to one end of said container, and pneumatic means for driving mercury from the reservoir into the container.

7. An electrolytic meter comprising a vessel from whose lower end depends a graduated tube for the electrolyte, a container for the mercury anode depending from the upper part of said tube, a graduated U-shaped tube for holding mercury connected at one end to the container, and a compressible bulb connected to the other end of the tube.

8. An electrolytic meter comprising a vessel for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, and means for relieving the pressure in said vessel as mercury dissolves from the anode.

9. An electrolytic meter comprising a vessel for the electrolyte, a container for a mercury anode depending from the upper part of said vessel, and a capillary tube connected to said vessel.

In witness whereof, I have hereunto set my hand this eleventh day of February, 1910.

EZECHIEL WEINTRAUB.

Witnesses:

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CHARLES A. BARNARD.