

Feb. 9, 1926.

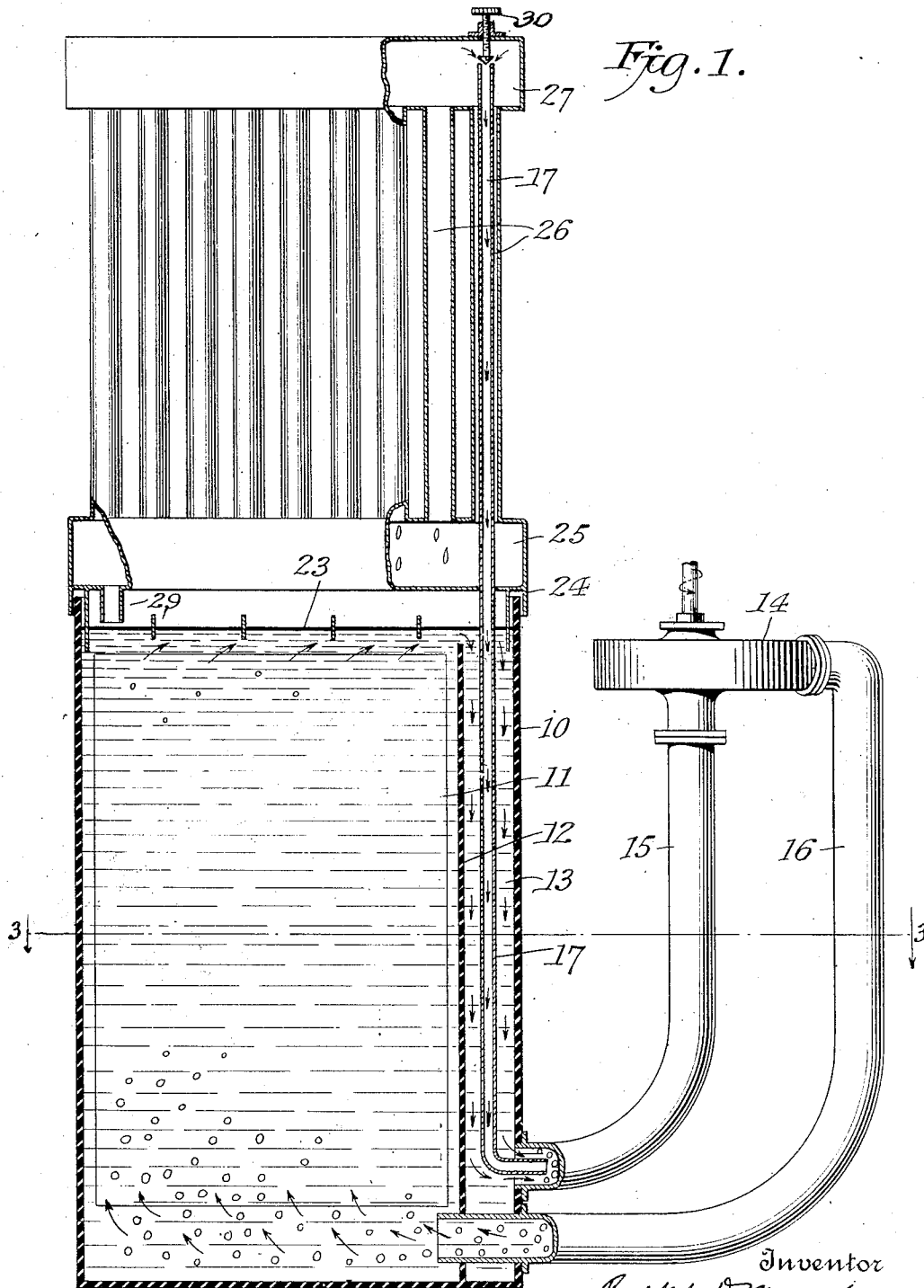
1,572,403

R. D. MERSHON

ELECTROLYTIC APPARATUS AND METHOD OF OPERATING THE SAME

Filed Sept. 18, 1919

2 Sheets-Sheet 1



Inventor
Ralph D. Mershon
By his Attorneys
Kerr, Page, Cropper & Hayward.

Feb. 9, 1926

1,572,403

R. D. MERSHON

ELECTROLYTIC APPARATUS AND METHOD OF OPERATING THE SAME

Filed Sept. 18, 1919

2 Sheets-Sheet 2

Fig. 2.

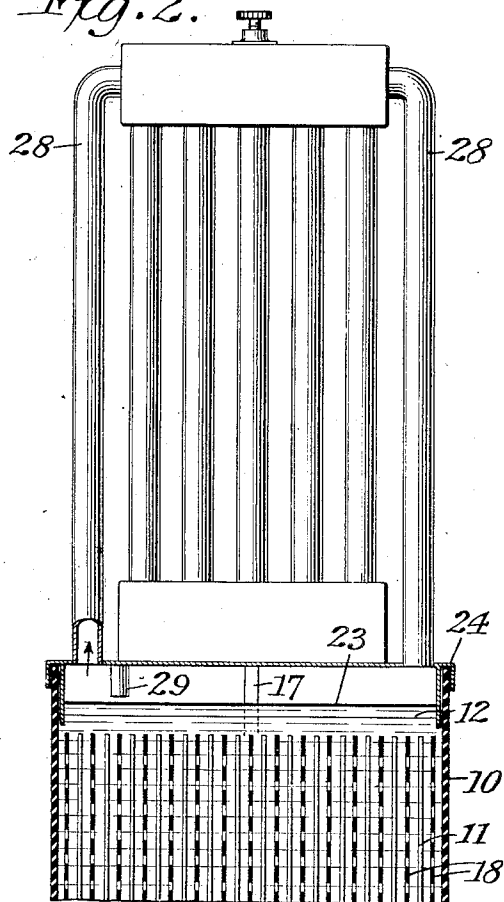


Fig. 4.

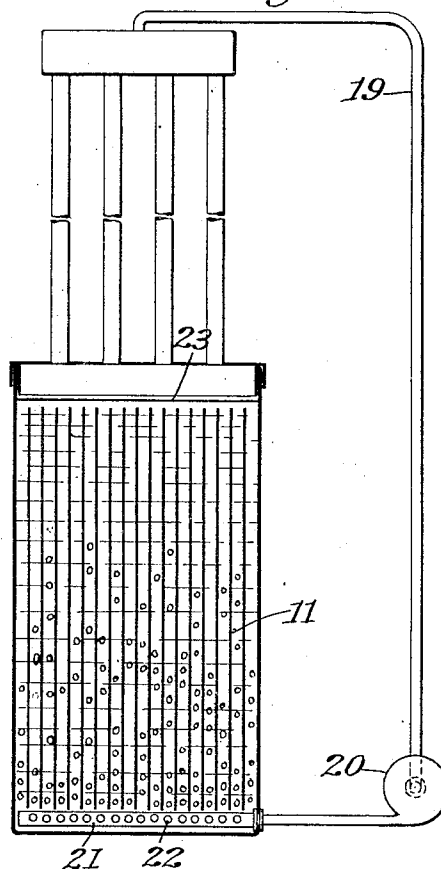
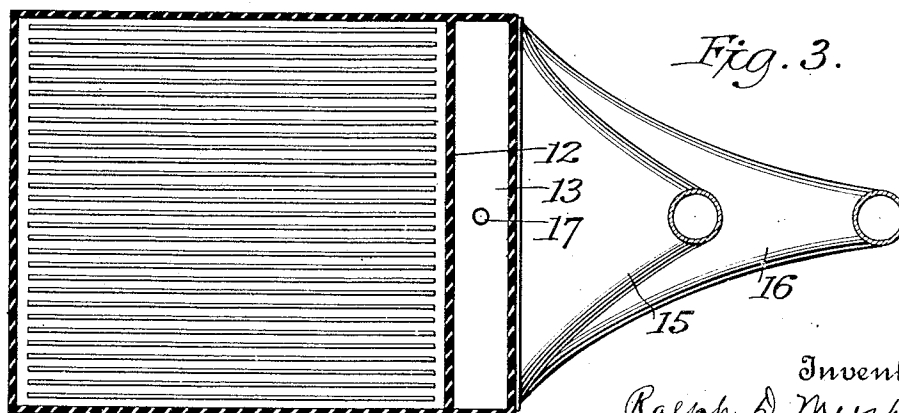


Fig. 3.



Inventor

Ralph D. Mershon

By his Attorneys,

Kerr, Page, Cooke & Hayward

UNITED STATES PATENT OFFICE.

RALPH D. MERSHON, OF NEW YORK, N. Y.

ELECTROLYTIC APPARATUS AND METHOD OF OPERATING THE SAME.

Application filed September 18, 1919. Serial No. 324,518.

To all whom it may concern:

Be it known that I, RALPH D. MERSHON, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electrolytic Apparatus and Methods of Operating the Same, of which the following is a full, clear, and exact description.

In electrolytic apparatus such as condensers, rectifiers, and lightning arresters, the operation of the device depends upon the dielectric film which is formed upon the electrodes (usually composed of aluminum) when current is impressed thereon, and the continuance of high efficiency in the performance of the apparatus depends largely upon the preservation of the film substantially unimpaired. Moreover, unchecked impairment of the film at any point results in more or less rapid corrosion, and ultimate destruction, of the underlying electrode, and it has been found that at the boundaries of areas where the film is not in contact with the electrolyte the film deteriorates, with accompanying loss of efficiency and corrosion of the electrode. Even the presence of a bubble of air or gas adhering to the submerged film is sufficient to permit the film and the electrode to be attacked at the edge of the comparatively small area covered by the bubble. Bubbles thus become an important factor in the operation of the apparatus, in addition to the fact that they increase the internal resistance. High temperature, due to C^2R and hysteretic losses in the apparatus, was formerly the chief cause of injury to the films, but this agency is effectually overcome by the use of heat-resistant films, for example such as are produced by the method described in my prior Patent No. 1,012,889. Films so produced can easily withstand boiling temperature without material injury.

The present invention relates primarily to keeping the electrodes free from adhering bubbles, and to that end it consists essentially in causing a movement, or circulation, more or less continuous, of the electrolyte relative to the electrodes, preferably immediately at the surfaces thereof, so that the adhering bubbles will be swept off by the moving liquid and can rise to the surface.

The desired circulation, movement, or agitation of the electrolyte can be produced in a variety of ways, as by means of a suit-

able pump taking liquid from one part of the vessel and returning it to another part, or by injecting air or other suitable gas into the electrolyte below the electrodes to cause more or less vigorous bubbling of the air through the liquid. These two methods may be combined, the pump which impels the liquid serving also to carry air into the same. Another method is to permit or cause the electrolyte to boil, thus producing rapid convection currents and also producing bubbles of vapor which aid in agitating the liquid. In any case the evaporated electrolyte may be allowed to escape and the losses made up by the addition of water from time to time, but preferably the vapor is condensed and returned to the electrolyte thus making it unnecessary to add water except at relatively long intervals.

Referring now to the accompanying drawings,

Fig. 1 is a diagrammatic side view, partly in vertical section, illustrating a convenient and effective apparatus employing the present invention.

Fig. 2 is an end view of the same, partly in vertical section.

Fig. 3 is a horizontal section, on line 3—3 of Fig. 1.

Fig. 4 is a side view of a modified form of the invention.

In Figs. 1, 2 and 3 the tank or cell 10, containing the electrolyte and the electrodes 11, is provided at one side with a vertical partition 12, providing a vertical well or passage 13. The pump 14, preferably of the centrifugal type as indicated, has its intake 15 connected to the passage, say near the bottom, and its outlet pipe 16 arranged to discharge into the bottom of the main portion of the tank, preferably below the electrodes, the latter being supported at a suitable position above the bottom by any suitable means, not shown. The pump being in operation, the electrolyte is drawn down the well or passage and discharged under the electrodes, thus causing an upward movement of the liquid which sweeps off the bubbles and aids their ascent to the surface. To increase the agitation thus produced air may be admitted to the intake 15, as by means of a pipe 17. The air thus received by the pump is delivered to the electrolyte in bubbles, which are carried along by the upward current and aid in detaching bubbles adhering to the plates.

Preferably the plates or electrodes are spaced closely together so that the movement of the electrolyte at their surfaces will be as vigorous as possible. If the close spacing is for any reason impracticable or undesirable apertured plates 18, Fig. 2, of glass or other suitable insulating material can be provided between the electrodes to keep the currents close to the latter. These plates may also serve to keep the electrodes apart, and may be in the form of perforated or slotted plates or may be sheets of woven fabric, as for example spun glass.

Instead of pumping the electrolyte through the tank the circulation may be produced on the "thermo-siphon" principle, taking the warm or hot liquid from the top, delivering it to a suitable radiator or cooler, and returning it to the bottom of the tank.

In some instances the movement or circulation of the electrolyte by a pump or by the thermo-siphon method may be dispensed with and reliance placed upon mere bubbling of air, vapor or other gas through the liquid. The air is preferably taken from the top of the vessel, as in Fig. 4, through a pipe 19 to a blower or compressor 20 and delivered by the latter to a manifold 21 extending across the bottom of the vessel and connected to a series of perforated pipes 22 preferably below the spaces between the electrodes 11. The air thus discharged bubbles through the electrolyte and thus keeps the latter in motion. It is to be understood that this method may be used in conjunction with a positive circulation of the electrolyte by the pump or thermo-siphon method outlined above.

Still another method, which can be used alone or in conjunction with any or all of the above methods, is by boiling the electrolyte, the necessary heat being produced partly if not entirely from C²R and hysteretic losses in the apparatus. For this purpose the vessel containing the electrolyte may be jacketed if necessary to prevent loss of heat by radiation, and on the surface of the electrolyte a film or layer of oil 23, may be spread, preferably a non-volatile paraffin. The layer of oil has a highly advantageous function, in that it prevents or greatly decreases quiet evaporation at the surface of the electrolyte and hence compels the evaporation to take place in the body of the liquid, thus insuring or aiding ebullition. The bubbles of vapor, rising to the surface, readily break through the oil film. The boiling may take place at substantially atmospheric pressure, or, if the tank is sealed, at a pressure above or below atmospheric. If below, the desired ebullition will occur at a lower temperature and in general will be more vigorous. If necessary or desirable a suitable exhaustor or other means may be provided to restore

the desired low pressure in case of leakage of air into the tank.

In the thermo-siphon method it is advantageous to use the bubbling method also, either by boiling the electrolyte or by introducing air into the same, in the ascending leg of the siphon. The bubbles rising in this leg tend to carry the liquid along, and also, by decreasing the density of the liquid relative to that in the descending leg, the difference of head between the two legs is increased thereby increasing the rapidity of the circulation.

The boiling method of producing the desired movement or circulation of the electrolyte is particularly useful in cases where it is necessary or desirable to keep down the size or bulk of the apparatus or to avoid the use of moving parts. Furthermore, in producing the boiling by heat resulting from losses in the apparatus the heat is generated chiefly at the surfaces of the electrodes, thus causing the circulation to be most vigorous at such surfaces, as is desirable.

In any of the above methods it is desirable to conserve the liquid by condensing the vapor and returning the resulting liquid to the electrolyte. For this purpose the vapor may be delivered to a suitable condenser, preferably mounted on the vessel or tank. For this purpose the tank cover 24 may be provided with a lower chamber 25 connected by vertical tubes 26 to an upper chamber 27. The electrolyte vapor, rising through the inlet 29, passes into the tubes and is condensed therein, the resulting liquid falling into the chamber 25 and passing thence through the tube 29 back to the tank 10. The air pipe 17, for supplying atmosphere from above the electrolyte to the pump 14, extends up to chamber 27 and has its inlet orifice controlled by a suitable valve 30 so that the amount of air taken can be regulated or cut off entirely, as desired. The suction through pipe 17 also increases the circulation through the radiator and tends to produce a more uniform distribution of the vapor among the radiator tubes.

The movement or circulation of the electrolyte is preferably continuous during the time current is impressed on the apparatus, but in some cases it may be intermittent or periodic, especially where the load on the apparatus is not heavy.

The air-bubbling method of producing or aiding the desired movement or agitation of the electrolyte is especially advantageous in cases where the temperature of the apparatus should be kept down as the relatively cool bubbles of air cool the electrolyte by absorbing heat therefrom and also by facilitating evaporation. Moreover any bubbles ascending through the electrolyte,

whether of air or other gas or vapor, which come in contact with bubbles clinging to the electrodes tend to coalesce therewith and drag them off or by increasing their size cause them to float off.

In order to avoid unnecessary confusion of the drawings I do not show the terminals or leads for connecting the electrodes to the external circuit, but it will be understood that alternate electrodes are connected to one side of the circuit and the intermediate electrodes are connected to the other side.

Close spacing of the electrodes, or the use of fillers such as indicated at 13, Fig. 2, is particularly desirable when the electrodes are of the crimped type described in my co-pending application Ser. No. 159,146, filed April 2, 1917, now Patent No. 1,326,134, issued December 23, 1919, so as to insure rapid movement of the electrolyte in the folds, where the adhering bubbles are difficult to dislodge.

It is to be understood that the invention is not limited to the apparatus and procedure herein specifically described but can be practiced in other ways without departure from its spirit. It is also to be understood that the invention is applicable with advantage to electrolytic apparatus other than condensers, and particularly to electrolytic rectifiers, but not to storage batteries, electrodeposition cells, and the like.

I claim:

1. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising heating the electrolyte and thereby causing the same to boil.

2. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising permitting heat liberated by internal electrical losses to accumulate and thereby cause boiling of the electrolyte whereby active movement of the latter is produced.

3. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising heating the electrolyte and causing ebullition thereof whereby active movement of the electrolyte is produced and bubbles on the electrodes are swept off, and condensing and returning to the electrolyte the vapor liberated in the ebullition.

4. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising permitting heat liberated by internal current losses to accumulate and cause ebullition of the electrolyte whereby active movement of the electrolyte is produced and bubbles on the electrodes are swept off, and condensing and returning to the electrolyte the vapor liberated in the ebullition.

5. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising permitting heat liberated by internal electrical losses to accumulate and thereby cause the electrolyte to boil, while preventing evaporation at the surface of the electrolyte, whereby active movement of the latter is produced.

6. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising removing adhering bubbles from the surface of the electrodes by active circulation of the electrolyte produced by boiling thereof.

7. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising causing the electrolyte to boil by heat liberated therein whereby circulation of the electrolyte is produced and bubbles on the surface of the electrodes are detached therefrom.

8. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising heating the electrolyte and causing ebullition thereof, and discharging bubbles of atmosphere into the electrolyte to aid the ebullition, whereby active movement of the electrolyte is produced and bubbles on the electrodes are swept off.

9. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising heating the electrolyte and causing ebullition thereof, while preventing evaporation at the surface of the electrolyte, and discharging bubbles of atmosphere into the electrolyte to aid the ebullition, whereby active movement of the electrolyte is produced and bubbles on the electrodes are swept off.

10. The method of operating electrolytic apparatus of the kind described, having an electrolyte and electrodes immersed therein, comprising heating the electrolyte and causing ebullition thereof, condensing the liberated vapor and returning the resulting liquid to the electrolyte, and discharging bubbles of atmosphere into the electrolyte to aid the ebullition, while preventing evaporation at the surface of the electrolyte.

11. In electrolytic apparatus of the kind described, a vessel containing an electrolyte, a plurality of electrodes in the electrolyte, a vapor-condenser connected with the vessel, and means for taking atmosphere from the vapor-condenser and discharging it into the electrolyte.

12. In electrolytic apparatus of the kind described, a vessel containing an electrolyte, a plurality of electrodes in the electrolyte, a pump connected with the vessel to produce

a movement of the electrolyte over the surface of the electrodes, and means for delivering atmosphere to the pump for discharge thereby into the electrolyte.

- 5 13. In electrolytic apparatus of the kind described, a closed vessel containing an electrolyte, a plurality of electrodes therein, and

means for taking atmosphere from the vessel above the electrolyte and discharging it into the electrolyte.

In testimony whereof I hereunto add my signature.

RALPH D. MERSHON