

C. C. RUPRECHT.  
RECTIFIER.  
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1,059,002.

Patented Apr. 15, 1913.

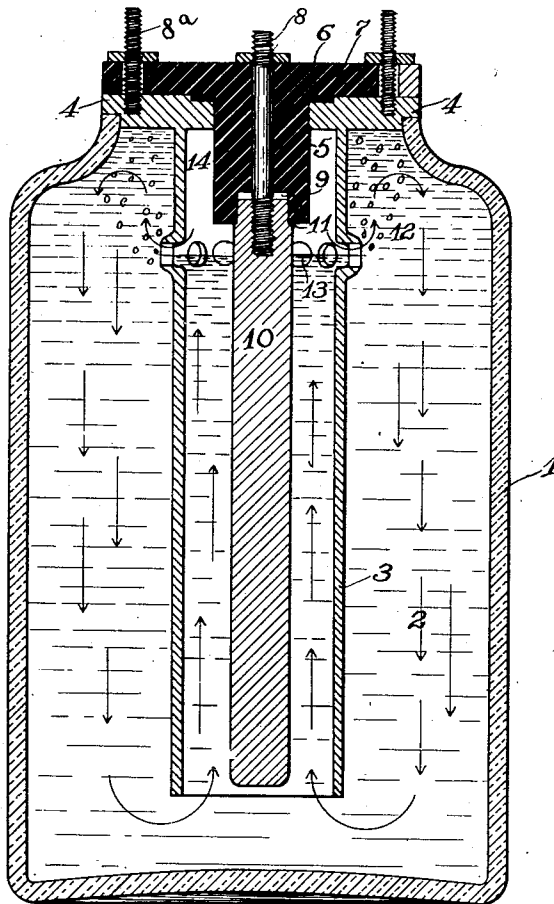


FIG. 1

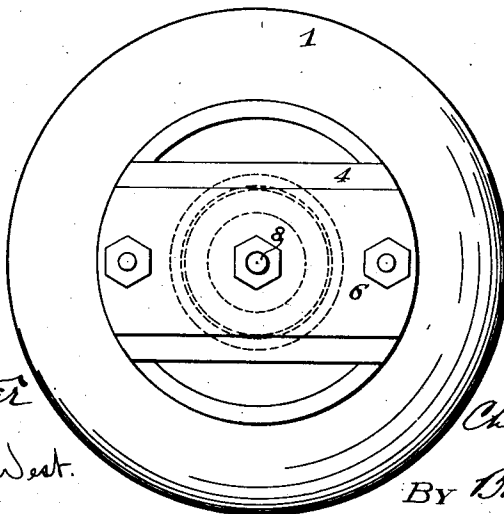


FIG. 2

WITNESSES:

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# UNITED STATES PATENT OFFICE.

CHARLES C. RUPRECHT, OF CLEVELAND, OHIO.

RECTIFIER.

1,059,002.

Specification of Letters Patent.

Patented Apr. 15, 1913.

Application filed November 18, 1907. Serial No. 402,587.

*To all whom it may concern:*

Be it known that I, CHARLES C. RUPRECHT, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Rectifiers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to the rectification of electric currents and has for its object the provision of a method of rectification whereby the undue heating of the apparatus and the polarization of the electrolyte and of the electrodes are prevented; also to the production of an apparatus whereby the method may be cheaply and effectively carried out, the parts being constructed and arranged to keep the apparatus cool during the operation of rectifying as well as to maintain the electrolyte of the same density throughout. Generally speaking, the invention may be defined as consisting of the combinations of steps and elements embodied in the claims hereto annexed, the apparatus for carrying out the method being illustrated in one form thereof in the accompanying drawings, wherein—

Figure 1 represents a central vertical sectional view through a rectifier constructed in accordance with my invention, and Fig. 2 represents a top plan view of the rectifier shown in the preceding figure.

Describing the parts by reference characters, 1 denotes a jar having therein the electrolyte 2.

3 denotes a cylindrical electrode of conductive material which is not decomposed by the action of the electrolyte. The material employed for this electrode may be iron, or a composition of lead and antimony, or carbon, or any other conductive material which will withstand the action of the electrolyte. Electrode 3 may be conveniently cast or formed with the head 4 which is adapted to rest upon the top of the jar, but will not completely cover the same, as will appear from Fig. 2. Head 4 is provided with a central aperture through which there projects a core 5 of insulating material, such as porcelain. This core is carried from a head 6 of the same or similar insulating material, which head rests upon the head 4. Head 4 is provided with an annular recess in the upper face thereof immediately surrounding the central bore therethrough, and within said

recess there is inserted a packing 7 of suitable material, whereby a gas-tight joint is formed between 4 and 5.

8 denotes a bolt extending through the core 5 and projecting above the head 6. The lower end of the bolt 8 projects downwardly into a recess 9 formed in the lower end of core 5.

10 denotes the second electrode, which is carried from bolt 8, being threaded onto said bolt and having its upper end projecting into the recess 9. The upper end of electrode 10 is preferably reduced to form an annular shoulder 11 which is adapted to abut against the bottom of core 5 and form therewith a gas-tight joint. Electrode 10 is of considerably smaller diameter than electrode 3, to provide a free annular space therebetween, and is formed of a material which will be oxidized by the electrolyte. While other metals may be employed for this purpose, I have found aluminum to be commercially effective for use in the construction of electrode 10. The electrolyte which will be used will be a liquid which is capable of forming an insoluble oxid with electrode 10, such as a solution of ammonium phosphate, sodium carbonate, or other suitable alkaline salt.

Bolt 8 constitutes one of the terminals to which connection will be made for transmitting currents through the rectifier and 8\* denotes the other. Terminal 8\* is threaded into head 4, with which it is in electrical contact.

An important feature of my invention resides in the construction whereby a closed chamber is provided for the reception of gases liberated by the decomposition of the electrolyte and from which chamber the gases are circulated through the electrolyte, this circulation of the gases causing a continual circulation of the liquid through the cell and between the electrodes, with the result that the cell and the electrolyte are effectively cooled, the electrolyte is depolarized and is maintained at the same density throughout, and the accumulation of bubbles on the electrodes is prevented. The manner in which these results are obtained will be explained more fully hereinafter in connection with the construction for effecting the same.

Below the head 4, at a suitable distance to provide a chamber the lower end whereof is always closed by the surface of the

electrolyte, the electrode 3 is provided with an annular corrugation 12 provided with a plurality of outlet openings 13, constituting a horizontal discharge, below the surface of the electrolyte, for the gases liberated by the decomposition of the water of the electrolyte.

In operation, hydrogen and oxygen liberated by the passage of currents through the electrolyte between electrodes 3 and 10 rise and accumulate within the chamber 14. When the volume and pressure of these gases are sufficiently great, they displace the solution within 3 and escape through openings 13 and ascend to the top of the jar. After the operation has begun, the electrolyte will stand within electrode 3 about half way across the openings 13, and the gases will escape through the upper unsealed portions of these openings. The escape of the gases through these openings causes a circulation of the electrolyte in about the manner indicated by the arrows. That is to say, the escaping gases pass up through the electrolyte outside of 3, cool the upper portion of the cell and the electrolyte therein, produce a suction or aspiration on the electrolyte which is within electrode 3, and finally escape around the side edges of the head 4, as will appear by reference to Fig. 2. The escape of the electrolyte from the inside of the tube 3 by this action of the gases causes the cooler electrolyte from near the bottom of the jar to enter 3, and thus a continuous circulation is produced upwardly through the electrode 3 and downwardly between said electrode and the jar, effectively removing any bubbles that may accumulate on the electrodes and maintaining the temperature and consistency of the electrolyte uniform throughout. The fact that hydrogen is a great heat-absorber renders my device particularly efficient in keeping relatively cool the upper portions of the electrolyte and the electrodes, which are naturally the hottest. This operation begins almost immediately upon sending a current through the rectifier, the time required for the commencement of the operation depending only upon the filling of the chamber 14 with the liberated gases.

By the construction described herein, it will be apparent that I am enabled to prevent the polarization of the electrodes and of the electrolyte, by causing a circulation of the electrolyte in contact therewith through the gases liberated by the decomposition of the electrolyte, and that this circulation of gases results in the production of a rectifier of high capacity and efficiency due to the fact that the parts thereof are maintained relatively cool, both by the circulation of the electrolyte and by the high heat-absorbing qualities of the hydrogen liberated by the decomposition of the elec-

trolyte. A further advantage of my construction is that the provision of a gas chamber in the top of the electrode 3 prevents the electrolyte from creeping up between the electrodes and producing short-circuits. Moreover, the maintenance of a uniform temperature and density of solution or electrolyte and the relatively low degree of temperature maintained reduce leakage to a minimum. Should the electrolyte be denser at one portion than at another, the leakage will be correspondingly increased in such denser portion, with a corresponding loss of efficiency. The construction whereby the improved results herein set forth have been accomplished is exceedingly simple and economical of production.

Having described my invention what I claim is:

1. In a rectifier, the combination of a cell having an electrolyte therein and comprising a pair of electrodes, one of said electrodes extending around the other and being provided with a closed chamber at the upper end thereof provided with a discharge outlet located below the surface of the electrolyte, and connections for transmitting current from one electrode to the other through said electrolyte, substantially as specified.

2. In a rectifier, the combination of a cell having therein an electrolyte and a pair of electrodes, and connections for sending electric current through the electrolyte between said electrodes, one of the aforesaid parts having a chamber provided with an outlet below the surface of the electrolyte, whereby the gases of decomposition are caused to produce a circulation of the electrolyte about the electrodes, substantially as specified.

3. In a rectifier, the combination of a cell having therein a pair of electrodes and an electrolyte, and connections for passing an electric current through said electrolyte and between said electrodes, said rectifier being provided with a chamber wherein the gases liberated by the decomposition of the electrolyte may be collected, said chamber being provided with a discharge outlet located below the surface of the electrolyte and through which the gases may be discharged radially in all directions, substantially as specified.

4. In a rectifier for electric currents, the combination of a cell having therein an electrolyte and a pair of electrodes, one of said electrodes extending around the other and having at the upper end thereof a closed chamber for the reception of gases liberated by the decomposition of the electrolyte, said inclosing electrode being provided with a lateral outlet at the bottom of said chamber, through which said gases may be discharged

into the electrolyte, substantially as specified.

5. In a rectifier, the combination of a cell having therein an electrolyte and a pair of electrodes, one of said electrodes extending around the other, and connections whereby an electric current may be circulated through said electrolyte and between said electrodes, the inclosing electrode being provided with a closed chamber at the upper end thereof and with a series of ports located below the surface of the electrolyte, substantially as specified.

6. In a rectifier, the combination of a cell having therein an electrolyte and a pair of electrodes, one of said electrodes extending around the other, and connections whereby an electric current may be circulated through said electrolyte and between said electrodes, the inclosing electrode being provided with a closed chamber at the upper end thereof and with a series of ports located at the same distance below the surface of the electrolyte, substantially as specified.

7. In a rectifier, the combination of a cell having therein an electrolyte and a pair of electrodes, one of said electrodes extending around the other and having a closed chamber in the top thereof and being provided below the top of the electrolyte with an outwardly projecting bend or corrugation having outlets therein and connections for passing electric currents through said rectifier, substantially as specified.

8. In a rectifier, the combination of a cell having therein an electrolyte and a pair of electrodes, one of said electrodes extending around the other and having a closed chamber in the top thereof and being provided below the top of the electrolyte with an outwardly projecting bend or corrugation hav-

ing therein a plurality of outlet ports, and connections for passing electric currents through said rectifier, substantially as specified.

9. In a rectifier, the combination of a jar or cell having therein an electrolyte, a head adapted to be supported by the said jar and having a tubular electrode depending therefrom, said head being provided with a central aperture, a second head supported on the former head and provided with a depending portion or core of insulating material passing through said aperture, an electrode secured to said core and forming a gas-tight joint therewith, means for forming a gas-tight joint between said core and the first-mentioned head, said first-mentioned electrode being provided with a horizontal discharge outlet located below the surface of the electrolyte, and connections whereby current may be transmitted through said rectifier, substantially as specified.

10. In a rectifier, the combination of a jar having an electrolyte therein, a pair of electrodes in said jar, connections for transmitting current through the electrolyte between said electrodes, a hollow receiving compartment communicating with the space between said electrodes for collecting the gases liberated by the decomposition of said electrolyte, and having one or more discharge outlets submerged in the electrolyte, substantially as specified.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

CHARLES C. RUPRECHT.

Witnesses:

H. MILLER,  
J. B. HULL.