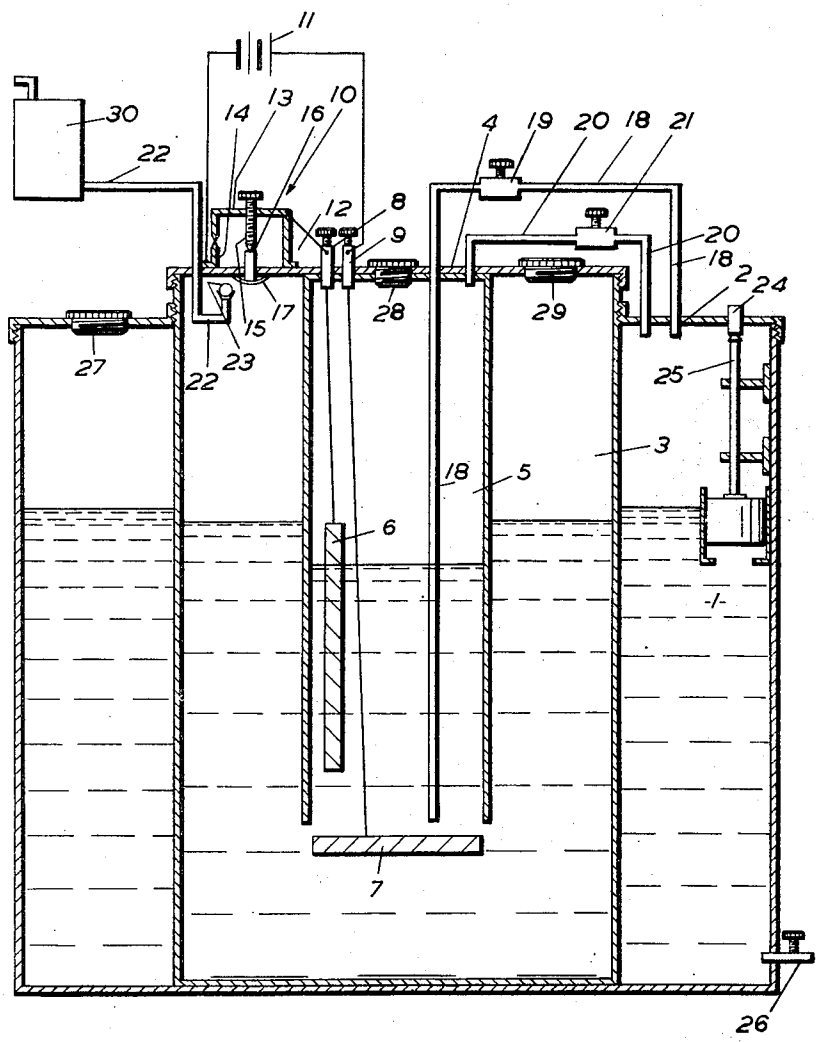
Feb. 8, 1955 V. O. GOUMENT 2,701,790

ELECTROLYTIC HYPOCHLORITE GENERATOR

Filed Dec. 3, 1951



Inventor

By

Attorney

United States Patent Office

2,701,790

Patented Feb. 8, 1955

2,701,790

ELECTROLYTIC HYPOCHLORITE GENERATOR

Vear Oliver Goument, Berwick-on-Tweed, England

Application December 3, 1951, Serial No. 259,678

8 Claims. (Cl. 204—230)

This invention consists in an improved electrolytic generator.

The object of the invention is to provide a process and apparatus for the electrolytic production of a solution which will be entirely automatic in its action according to the amount of solution drawn off.

The more particular object of the invention is to provide an electrolytic generator which will give a copious supply of sodium hypochlorite solution for household and domestic purposes in various sized units to suit private houses, hotels, hospitals, public institutions, ships, dairies and such like; the provision of bleach solution for household and laundry purposes; the provision of sodium hypochlorite for water supply and swimming bath sterilization, and the provision of potassium hypochlorite for similar purposes.

According to the invention the evolution of gas caused by the electrolysis is caused to build up a pressure which is used to lower the electrolyte level against an electrode in the electrolyte in accordance with the degree of such pressure so that the degree of electrolysis is accordingly varied.

For producing a continuous supply of sodium hypochlorite from an aqueous solution of sodium chloride for example, the electrolysis takes place in a chamber whose upper end communicates with the upper end of a storage chamber and has a pipe extending from its lower portion for conveying liquid under pressure to the latter, this storage chamber having means near its base for drawing off liquid, and at its upper end a float controlled vent adapted to be closed when the liquid in the chamber is at a predetermined level, while the lower end of the electrolysis chamber communicates with a cushioning chamber to which at its upper portion water is fed through a non-return pressure controlled valve.

Preferably pressure operated means are provided in the upper portion of one of the chambers for interrupting the electrolytic circuit on a predetermined pressure being attained in the said chamber.

The invention will now be described by way of example with reference to the accompanying semi-diagrammatic drawing which shows a sectional elevation of a unit arrangement of the three chambers.

Referring more particularly to the drawing, 1 is an outer cylindrical storage compartment which is screw threaded at its upper end to receive an annular cover 2 having a threaded downwardly directed flange which screws over the threaded portion. The cover plate 2 has an upwardly directed flange formed at its inner periphery which is internally threaded to receive the correspondingly threaded upper end of an intermediate cushion chamber 3 which extends to the bottom of the chamber 1, and projects beyond its upper end, the projecting portion being threaded to receive a correspondingly threaded flange of a circular cover 4.

Co-axial with and rigidly secured to the under face of the cover 4 is an inverted bell-like generating chamber 5 in which are arranged a vertical cathode 6 and a horizontal anode 7 at the lower end of the chamber, the said electrodes being respectively connected to terminals 8, 9 insulatedly mounted on the cover 4 and projecting through the upper end of the chamber 5. The terminal 8, is connected through a diaphragm controlled switch 10 to the negative side of a current source 11—for example a standard type of battery trickle charger; while the terminal 9 is connected to the positive side of the current source. The switch 10 comprises a bracket 12

which is insulatedly mounted on the cover 4, and to the upper end of which is hinged a switch contact arm 13 which is adapted to contact with an insulated contact 14 connected to the negative side of the current source 11. Mounted in the middle of the arm 13 is an adjusting screw 15 whose inner end contacts with a plunger 16 to the lower end of which is secured a sealed diaphragm 17 whose underface is subjected to the gaseous pressure inside the cushion chamber 3.

A pipe 18 extends from the lower end of the generating chamber 5, and passes through the upper end of the said chamber and the cover 4, whence it leads through a control valve 19 to the upper portion of the storage chamber 1. A second pipe 20 extends from the upper end of the chamber 5 through a control valve 21 to the upper end of the chamber 1.

Leading into the upper end of the cushion chamber 3 is a water supply pipe 22 terminating in a non-return valve 23 which is subject to the gaseous pressure in the chamber 3.

A vent pipe 24 is led into the upper portion of the chamber 1 the lower end of which pipe has a valve seating against which is adapted to seat a float controlled valve 25. Preferably the vent pipe 24 is carried to the open air to ensure the escape of the hydrogen given off as a result of the electrolysis.

A cock 26 is provided in the lower portion of the chamber 1 for drawing off hypochlorite solution as required.

27, 28, 29 are stoppers for the chambers 1, 5, 3 respectively.

A closed tank 30 may be arranged in the water pipe line 22 as a common salt reservoir. A saturated solution of salt is then delivered through the valve 23 as required.

In operation, if the apparatus is not given an initial filling of sodium hypochlorite solution, a preliminary charging is required. This is done by passing a current through the apparatus after a quantity of salt has been placed in it and sufficient water added to cover the electrode 6. While this is being done stopper 29 is kept closed, and the stopper 28 is left open during the charging period and until a strong odour of chlorine is given off. The stopper 28 is then screwed in, and the water supply is turned on.

The only outlets from the chambers 3 and 5 are the pipes 18 and 20 which immediately start discharging sodium hypochlorite solution and a mixture of air and hydrogen already collecting in the generating chamber 5. The rate of emission, small at first, increases to a maximum as the pressure in the chambers 3 and 5, owing to the incoming water at the valve 23 on one hand and the evolution of hydrogen in the chamber 5 on the other, equates itself. The setting of the valve 21 ensures a gradual rise or subsidence in the level of electrolyte in the chamber 5 to a stabilized condition where two-thirds of the electrode 6 is submerged while the control valve 19 has been set to emit a hypochlorite solution of satisfactory strength. This is hereinafter referred to as "normal operational pressure." The apparatus is now in a condition to function automatically in replacing sodium hypochlorite solution as it is drawn off from the storage compartment 1.

Assuming the apparatus is now in the condition as above described, and the electrolysis is proceeding, under normal operational pressure, the chamber 5 continues to discharge sodium hypochlorite solution and hydrogen into the storage compartment 1, the hydrogen escaping to atmosphere through the open vent 24. Water dribbles in through the valve 23 to balance the quantity of sodium hypochlorite solution discharged from the chamber 5 to the storage chamber 1.

If the replacement of water through the valve 23 is not taking place, the continual discharge of sodium hypochlorite solution to the storage chamber 1 has a continual depressing influence on the internal pressure in both the chambers 3 and 5, which is accentuated by a gradual drop in the level of the electrolyte at the electrode 6. This factor ensures the continuous entry of water of replacement until the set level on the electrode 6 is reached. If, on the other hand, the liquid level on

the electrode 6 rises too high, a greater than normal evolution of hydrogen takes place and as the control valve 21 cannot cope with it, the resulting rise in pressure closes the valve 23 to shut off further entry of water, and depresses the level of liquid on the electrode 6 back to normal. Thus the state of balance at normal operational pressure is established.

In this way regular production proceeds until the level of liquid in the storage chamber 1 raises the float of the valve 25 to close the vent pipe 24. The escape of hydrogen is now cut off, and after a short period in which the pressure in the storage chamber 1 balances that in the chambers 3 and 5, the pressure in the whole apparatus starts building up owing to the further evolution of hydrogen. The chamber 5 is the focus from which pressure is increasing, and to establish an equilibrium between this chamber and the chamber 3, the electrolyte in the chamber 5 is displaced into the chamber 3. As the level in the chamber 5 sinks, the resistance to the passage of current increases until after a lapse of time the electrode 6 is, to all intents and purposes, out of contact with the electrolyte, electrolysis ceases, and a condition of static stability is realized.

The general pressure in the apparatus is now well above the normal operational pressure (which is the pressure of the water supply). As a matter of design, in order to keep the pressure increase within reasonable limits, the volume of liquid displaced from the chamber 5 is small compared to the volume of compressed air or gas above the liquid in the chamber 3 at normal operational pressure.

If part or the whole of the sodium hypochlorite solution in the storage chamber 1 is now drawn off, the valve 25 opens the vent 24 as the sinking level of liquid in the storage chamber 1 allows the valve float to drop. Hydrogen again escapes to atmosphere from the chamber 5, and as the pressure in this chamber subsides the electrolyte begins to submerge the electrode 6, until gradually two-thirds of it is submerged and normal operational pressure is established. Automatic operation then proceeds as above described.

The switch 10 acts as a safety device which cuts off the current if the pressure in the apparatus exceeds a safe maximum. When the apparatus is in a state of static stability as above described, the plunger 16 on the diaphragm 17 rises to a certain level as a result of the pressure below it. If the screw 15 is now screwed down so that it just touches the top of the plunger 16, but has not commenced to open the points of the contacts 13, 14, any further rise in pressure causes the plunger 16 to rise and so open the contacts. The current is thus cut off until some release of pressure from the apparatus takes place. This device is not intended to operate during normal working. It is purely an emergency device.

The drawing shows the liquid levels in the three compartments after the apparatus has been in operation following an evacuation, the storage chamber has refilled and the valve 24, 25 is about to close.

I claim:

1. Apparatus for the continuous supply of a solution from an electrolyte solution comprising an electrolysis chamber, a storage chamber, a cushioning chamber, an electrode in said electrolysis chamber disposed above the bottom of the electrolysis chamber so that the electrolyte can be forced out of contact therewith, said electrode being arranged at an angle to the horizontal, the upper end of said electrolysis chamber communicating through a pipe with the upper end of said storage chamber, means for regulating the flow through said pipe, a second pipe in said electrolysis chamber extending from a point below the electrode in said electrolysis chamber to the upper portion of said storage chamber, means at the lower portion of said storage chamber for drawing off liquid, a vent at the upper end of said storage chamber, a float controlled valve operative to close said vent when the liquid in said chamber is at a predetermined level, the lower end of said electrolysis chamber communicating with the lower end of said cushioning chamber, water inlet means in the upper end of said cushioning chamber, and a pressure controlled valve operative to control the rate of flow of water through said inlet means.

2. In apparatus according to claim 1 said first means comprising valve means for controlling the flow of gases through said first pipe, and valve means for controlling the communication through the second pipe between the lower portions of the electrolysis chamber and the storage chamber.

3. Apparatus according to claim 1, in which the pressure controlled valve is disposed on the inner end of said inlet, said valve being subjected in its opening action to the pressure of the water and in its closing action to that of the gas pressure whereby the gas pressure is controlled by the water pressure.

4. Apparatus according to claim 1, including a pressure operated switch means in one of the chambers, said switch being disposed in an electrolytic circuit including a source of electric current and said electrodes, said switch being adapted to interrupt the electrolytic circuit on a predetermined pressure being attained in the said chamber.

5. Apparatus according to claim 1 including a tank for containing the solution to be submitted to electrolysis, said tank having an inlet for connection with a water supply, and said tank being connected to the water inlet means.

6. Apparatus for the automatic electrolytic production of a solution of a salt of a metal from an electrolyte solution, comprising an electrolytic cell, a cushioning chamber, the lower end of the said electrolytic cell communicating with the said cushioning chamber, a storage chamber, the upper end of the said electrolytic cell communicating by pipe with the upper end of the said storage chamber, a control valve on the said communicating pipe to control the rate of emission of gas, a pipe in the said electrolytic cell extending from the lower portion of the cell to the upper portion of the said storage chamber, a control valve on the said pipe to control the rate of emission of the resulting electrolysed solution, an electrode, roughly vertical in the said electrolytic cell, the inlet end of the pipe being disposed below the vertical electrode, an electrode of opposing polarity to the aforementioned electrode, roughly horizontal, at the lower end of the cell, means at the lower end of the said storage chamber for drawing off liquid, a vent at the upper end of the said storage chamber, a float controlled valve operative to close the said vent when the liquid in the said storage chamber is at a predetermined level, water supply means including a pressure controlled non-return valve for admitting water into the said cushioning chamber.

7. Apparatus according to claim 6, comprising a closed tank, situated on the said water supply line, which is adapted for charging with salt for the solution to be submitted to electrolysis.

8. Apparatus according to claim 6, comprising an electric circuit including said electrodes, and pressure operated switch means in the electric circuit of the electrodes disposed in one of the chambers adapted to break the electrolytic circuit on a predetermined pressure being attained in the said chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,380,183	Boisen	May 31, 1921
2,098,629	Knowlton	Nov. 9, 1937

OTHER REFERENCES

Serial No. 254,376, Salles (A. P. C.), published May 18, 1943.