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ANOLYTE LIQUID LEVEL CONTROL FOR CHLOR-ALKALI DIAPHRAGM CELLS

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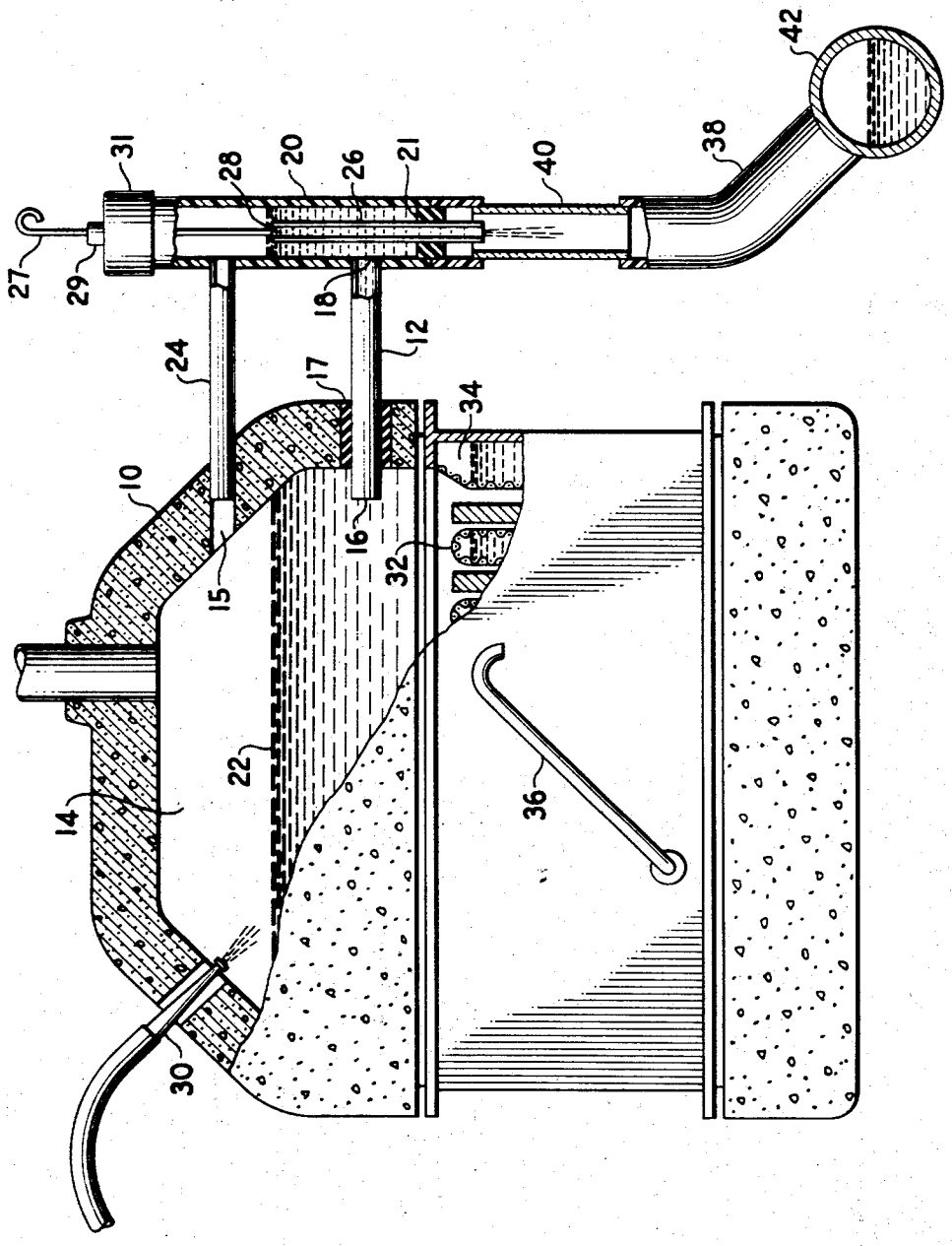

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ANOLYTE LIQUID LEVEL CONTROL FOR CHLOR-ALKALI DIAPHRAGM CELLS

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ABSTRACT OF THE DISCLOSURE

Recirculation of anolyte in a diaphragm type chlor-alkali electrolytic cell is performed in conjunction with control of the anolyte level in the anolyte compartment by anolyte withdrawal means comprising a conduit extending from the interior of the anolyte compartment of the cell to a liquid retaining vessel within which is disposed an overflow pipe which may be adjusted to raise or lower the overflow inlet and thereby raise or lower the level of the anolyte in the electrolytic cell. The liquid level control device may be equipped with means to equalize the pressure within the anolyte compartment and a sight glass for observation of liquid flow.

This invention relates to an anolyte liquid level control device for chlor-alkali cells, and more particularly, to an apparatus for the withdrawal of anolyte solution from a chlor-alkali diaphragm cell while maintaining a predetermined liquid level within the anolyte compartment.

It has recently been found to be desirable to operate a chlor-alkali diaphragm cell utilizing an anolyte recirculation method wherein brine feed solution is fed to the anolyte compartment of a chlor-alkali cell at a rate greater than that at which the feed solution flows through the diaphragm into the catholyte compartment. In the operation of the anolyte recirculation method, it is also desirable to maintain a certain liquid level within the anolyte compartment which level provides a hydrostatic head which brings pressure to bear upon the diaphragm thereby forcing liquid through the diaphragm. It is further desirable to be able to change the hydrostatic head within the anolyte compartment to provide for changes in operating procedures, thereby regulating the flow rate of anolyte liquor through the diaphragm into the catholyte compartment.

It is an object of the present invention to provide an apparatus for the withdrawal of excess brine feed solution from an anolyte compartment of a chlor-alkali cell diaphragm cell. Another object of the present invention is to provide an apparatus for the control of the liquid level within the anolyte compartment of such cells. These and other objects will become apparent to those skilled in the art from the description of the invention which follows.

In accordance with the invention, there is provided an anolyte liquor withdrawal means for a chlor-alkali diaphragm cell comprising a passageway for liquids, such as a tube, said passageway having an inlet means and an outlet means for liquids, said inlet means being in communication with the anolyte compartment of said cell and said outlet means being positioned external to the anolyte compartment of said cell, said outlet means having liquid level control means in communication therewith, thereby providing for the controlled removal of anolyte liquor from said anolyte compartment. In a preferred embodiment of the present invention, the described passageway is a tube, pipe or drain positioned below the surface of the anolyte liquid in the anolyte compartment, through which anolyte liquor flows to a level control means, said level control means having

pressure equalizing means in communication with the anolyte compartment, such as a gas vent, wherein the level of the anolyte liquor within the cell is controlled by the position of an overflow device within said level control means.

The present anolyte liquid level control has particular advantages in withdrawing anolyte liquor from below the liquid surface in the anolyte compartment in that it provides more thorough mixing of the feed brine within the anolyte compartment due to the greater distance between the brine feed means and the withdrawal point and in eliminating the withdrawal of the particles which float on the surface of the anolyte liquor, such as pieces of asbestos, thus reducing the likelihood of clogging the withdrawal means.

The invention will be readily understood by reference to the drawing which is a partial vertical sectional view of a chlor-alkali diaphragm cell showing the apparatus of the present invention located on the upper sidewall of the cell.

The apparatus of the present invention is preferably mounted on the upper cell wall of a chlor-alkali cell in a position such that passageway **12** extends through packing **17** into the anolyte compartment **14** of said chlor-alkali cell. Passage **12** has liquid inlet means **16** and outlet means **18** in communication with level control means **20**. Level control means **20** is a liquid retainer having pressure equalizing means **24** to vent gases to anolyte compartment **14** through opening **15** above anolyte liquid level **22**. Since chlor-alkali cells normally are run under slightly reduced pressure, pressure equalizing means are preferably provided to result in a smooth withdrawal of liquid from the cell. Rather than equalizing the gaseous pressure directly with the anolyte compartment, pressure equalizing means can be attached to the chlorine withdrawal means of the cell.

Liquid overflow **26** regulates the anolyte liquid level **22** within anolyte compartment **14** by withdrawing liquid through passageway **12** into level control means **20** from which it is subsequently removed through overflow **26** into stand pipe **38**. Overflow **26** can be adjusted by raising or lowering the liquid intake **28**, by means of handle **27** which protrudes through bushing **29** in cap **31**, thereby controlling the anolyte level **22** within the cell.

In the operation of the cell, brine is fed through brine feed means **30** into anolyte compartment **14**, from whence it passes into the catholyte compartment **34** by passing through diaphragm **32**. Cell liquor (brine containing sodium hydroxide) is withdrawn from the catholyte compartment by means of withdrawal pipe **36**. In using the anolyte recirculation method, the brine feed rate is greater than the rate at which the brine passes from the anolyte compartment **14** through the diaphragm **32** into the catholyte compartment **34**. This excess brine may be withdrawn from the anolyte compartment **14** by means of passageway **12**.

One means of adjusting the anolyte liquid level **22** is by raising or lowering overflow **26** within liquid level control means **20** by sliding overflow **26** through gasket means **21**. Alternatively, adjustments can be made in the position of liquid intake **28** on overflow **26** by manual movements of overflow **26**, by placing or removing tubular extensions on the top of overflow **26**, by changing the level at which liquid flows into overflow **26** as by opening or closing a series of openings along the length of said overflow device as well as other methods which will be readily apparent to those skilled in the art from the disclosure herein. Thus, the anolyte liquid level **22** can be raised to within about half-inch or so of the top of the anolyte compartment of the chlor-alkali cell and lowered to the level of passageway **12**. Such a change in anolyte liquid level **22** changes the hydrostatic pressure

within the cell and affects the flow of liquid through diaphragm **32**. By these means, the flow of anolyte liquor through the diaphragm **32** can be regulated by changing anolyte liquid level **22**. A higher liquid level **22** increases the hydrostatic pressure and, as such, increases the flow rate through the diaphragm.

Passageway **12** and overflow **26** are of a diameter sufficient to withdraw anolyte liquor at a rate approaching that at which brine is fed to the anolyte compartment. Since the brine is often fed to the anolyte compartment under pressure, and whereas the flow through the liquid withdrawal means is primarily by means of gravity, the diameter of passageway **12** and overflow **26** are preferably about equal to or larger than brine feed means **30**. Normally, passageway **12** and overflow **26** have an inside cross-sectional area equal to about 1 to 5 times the inside cross-sectional area of brine feed means **30**. The anolyte liquor withdrawn from the cell by means of level control **20** is passed to manifold **42** for subsequent mixing with additional anolyte liquor from other cells prior to resaturation with salt and returning to the anolyte compartment of a cell for further reaction.

Passageway **12**, level control means **20** and overflow **26** may be constructed of any material substantially inert to the conditions existing within the cell. Such conditions include operating temperatures within the range of about 90 to 110 degrees centigrade while in contact with a concentrated salt (NaCl) solution saturated with chlorine. In addition, such material of construction is preferably capable of withstanding chlorine attack at a pH in the range of about 1 to 7. The material selected is preferably, but not necessarily, electrically nonconductive to avoid loss of electrical current. It has been found, that various synthetic polymers, such as polyvinylidene chloride, after-chlorinated polyvinyl chloride, chlorinated polyesters, chlorinated rubbers, and the like materials can be used. Glass and ceramic and various metals, such as tantalum, titanium, and the like, can also be used as the anolyte level control apparatus.

Stand pipe **38** into which overflow **26** passes anolyte liquor, has sight glass **40** through which observations of the liquor being withdrawn from the anolyte compartment **14** and the flow rate thereof can be made.

The present invention provides a means for controlling the caustic soda concentration of the cell liquor produced in the catholyte compartment of the cell by regulating the caustic concentration, so that a more desirable salt to caustic ratio can be obtained. By changing the anolyte liquid level within the cell by means of the present invention, the hydrostatic pressure is changed, thus changing the residence time of the brine within the catholyte compartment due to a slower flow through the diaphragm. Thus, in addition to withdrawing anolyte liquor from the cell, the present apparatus coacts with the cell to produce a more desirable cell liquor.

As will be readily recognized by those skilled in the art, various modifications of the present apparatus can be made without departing from the spirit thereof. The particular shape and design of the liquid level control can be changed to meet the particular cell requirements and to provide for various other methods of changing the liquid level within the cell.

While there have been described various embodiments of the present invention, the apparatus described is not

intended to be understood as limiting the scope of the invention, as it is realized that changes therein are possible. It is further intended that each element recited in any of the following claims is to be understood as referring to all equivalent elements for accomplishing substantially the same results in substantially the same or equivalent manner. It is intended to cover the invention broadly in whatever form its principles may be utilized.

What is claimed is:

1. In a chlor-alkali diaphragm cell comprising an anolyte compartment separated from a catholyte compartment by a porous diaphragm, said anolyte compartment comprising an anode, brine feed means and chlorine gas withdrawal means, the improvement which is anolyte liquor withdrawal means comprising a passageway having an inlet in communication with the anolyte compartment of said cell and an outlet external to the anolyte compartment, said outlet having liquid level control means in communication therewith which provides for controlled removal of anolyte from said anolyte compartment.

2. The apparatus of claim **1** wherein said liquid level control means has gaseous pressure equalizing means between upper portions of said control and said anolyte compartment.

3. The apparatus of claim **2** wherein said liquid level control means comprises a liquid retainer having positioned therein liquid overflow means.

4. The apparatus of claim **3** wherein the liquid level within said anolyte compartment is regulated by changing the level at which said overflow means withdraws liquids in said level control means.

5. The apparatus of claim **1** wherein sight means is provided in communication with said liquid level control means for the observation of liquid flow.

6. The apparatus of claim **4** wherein the liquid intake means of said overflow means in said liquid level control is vertically movable to change the liquid level in said anolyte compartment.

7. The apparatus of claim **1** wherein said liquid level control means is a liquid retainer having an adjustable liquid overflow therein and gaseous pressure equalizing means in communication with the anolyte compartment above the liquid level thereof.

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U.S. Cl. X.R.

204—266; 137—577, 247.51