

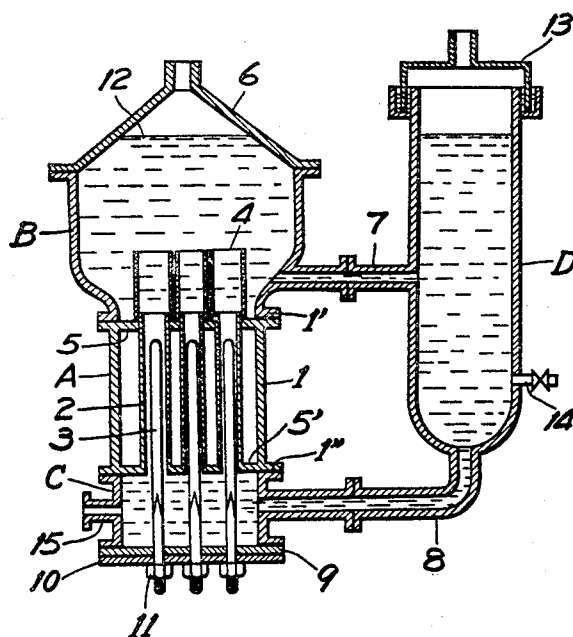
May 28, 1968

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3,385,779

ELECTROLYTIC CELL FOR THE PRODUCTION OF HALOGENOUS OXY-SALTS

Filed Nov. 16, 1965



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**ELECTROLYTIC CELL FOR THE PRODUCTION
OF HALOGENOUS OXY-SALTS**

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Filed Nov. 16, 1965, Ser. No. 508,012

Claims priority, application Japan, Dec. 12, 1964,

39/69,797

9 Claims. (Cl. 204-272)

This invention relates to an electrolytic cell and the electrolytic process performed therein and more particularly to an electrolytic cell for the production of halogenous oxy-salts.

It has been known that an electrolytic cell for the production of halogenous oxy-salts is constructed in such a way that electrolyte both above and below the cathode may be circulated.

This invention is a remarkable improvement on such a conventional type of electrolytic cell for the production of halogenous oxy-salts characterized by lowered voltage and increased current efficiency.

This invention provides an electrolytic cell for the production of halogenous oxy-salts comprising a cell having a cylindrical cathode inside, said cylindrical cathode having an anode inside; an upper tank and a lower tank provided above and below said cell respectively, said upper tank and lower tank being connected with each other inside said cell by means of said cylindrical cathode and outside said cell by means of an electrolyte adjusting tank; an electrolyzed product solution lifting pipe provided above said cylindrical cathode, said electrolyzed product solution lifting pipe being over 300 mm. high, the upper end of said electrolyzed product solution lifting pipe being placed over 20 mm. below the level of said electrolyzed product solution in said upper tank; and a connecting pipe provided near the upper surface of said cylindrical cathode to connect said upper tank with said electrolyte adjusting tank.

In order that the invention may be more clearly understood the cell for the production of halogenous oxy-salts is described, with reference to the accompanying drawing.

In the drawing A is the electrolytic cell, B the upper tank, C the lower tank, D the electrolyte adjusting tank, 1 the electrolytic cell case, 1' the connection between the cell A and the upper tank B, 1'' the connection between the cell A and the lower tank C, 2 the cylindrical cathode, 3 the bar or plate anode, 4 the electrolyzed product solution lifting pipe, 5 the upper compartment plate, 5' the lower compartment plate, 6 the lid for the upper tank B, 7 the connecting pipe between the upper tank B and the electrolyte adjusting tank, 8 the connecting pipe between the lower tank C and the electrolyte adjusting tank D, 9 the bottom plate, 10 the conductor to the anode 3, 11 the nut, 12 the electrolyte level, 13 the liquid-sealed upper lid, 14 the outlet pipe for electrolyzed product solution, and 15 the inlet pipe for electrolyte.

After its pH is adjusted raw brine (a halogenated alkali solution) is fed up to the electrolyte level 12 through the inlet pipe for electrolyte 15; the electrolyte contained in said raw brine being put into the electrolytic cell A from

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below tank C and electrolyzed in said cell, the resultant electrolyzed product solution entering the upper tank B through the electrolyzed product solution lifting pipe 4, entering the electrolyte adjusting tank D through the connecting pipe 7 and then being returned to the lower tank C through the connecting pipe 8, said circulation being caused by the difference of density between the liquid in the upper tank and the liquid in the lower tank as a result of the dispersion inside said lifting pipe 4 of the electrolyzed product gases (i.e. chlorine and hydrogen) and the heat liberated inside said lifting pipe 4 by hypochlorite production.

Of the electrolytic cell for the production of halogenous oxy-salts of this invention, the anode is a titanium clad platinum plated iron bar or plate; the cathode being a round or rectangular steel pipe with chromium-sulfur plating on the inside; the connection 1' between the cell A and the upper tank B and the connection 1'' between the cell A and the lower tank C being provided with rubber packings; and the upper tank B, the lower tank C, the electrolyte adjusting tank D, and the upper tank lid 6 being preferably protected by some appropriate anti-corrosion lining on the inside. Of course the inside surfaces of the connecting pipe 7 and the connecting pipe 8 respectively had better be lined with an anti-corrosive material. The electrolyzed product solution lifting pipe 4 had better be made of an electrically nonconducting material.

In this invention the cathode is chromium-sulfur plated because, if said cathode is only chromium plated, the cathode has the defect that its potential is higher than that of an iron cathode, though the cathode is effective enough to prevent the reduction of hypochlorite, while on the other hand if said cathode is chromium-sulfur plated as in the case of this invention, the cathode is capable of retaining a low potential on account of its increased virtually effective electrolyzing area made by the rough plating surface.

In this invention, the electrolyzed product solution lifting pipe is made over 300 mm. high because, if said pipe is lower than 300 mm., a smooth circulation of the liquid as intended by this invention becomes impossible; also the upper end of the electrolyzed product solution lifting pipe is placed over 20 mm. below the level of said electrolyzed product solution in the upper tank because, if said upper end of said pipe is less than 20 mm. below said level of said solution, not merely is the smooth circulation of the liquid impossible but also the liquid agitation in said upper tank becomes weak.

The following table indicates the conditions and performances of a typical operation of the electrolytic cell of this invention in comparison with those of conventional types of cells having no upper and lower tanks. In this example, the electrolyte is a saturated common salt solution (pH 5.0-6.0), the anode being made of platinum plated titanium, the cathode being a chromium-sulfur plated iron pipe, the distance between said anode and said cathode being 13 mm., the electrolyzed product solution lifting pipe being 300 mm. high, the upper end of said electrolyzed product solution lifting pipe being placed 50 mm. below the level of said electrolyzed product solution in the upper tank, and the electrolyzing temperature being 75° C.

TABLE.—COMPARISON OF ELECTROLYZING CONDITIONS AND PERFORMANCES

	Cell of this In- vention	Conventional Types of Cells	
Conditions:			
Current Density (amp./l.)	6	5.88	5.88
Anodic Current Density (amp./dm. ²)	20	10.24	10.24
Cathodic Current Density (amp./dm. ²)	15.7	6.84	6.84
Temperature (° C.)	75-80	35	60
pH	5.8	5.9-6.5	5.9-6.5
Performances:			
Voltage	3.45	3.5	3.15
Power Consumption (kw.h.)	569.8		
NaClO ₃ Content in liquid (g./l.)	350		
NaClO ₃ Production (kg.)	105		
Product	96.18	85-88	80-84
Current efficiency (percent), Gas analysis	97.8		
Power consumption per ton of product (kw.h./t.)	5,427	6,238	5,965
Anode consumption Pt. (g.) per ton of product	1-2		
Graphite (kg.)		4	20

NOTE.—Comparison is made between those at similar current density.

While a preferred example of embodying the present invention has been shown and described, it should be understood that various changes and modifications may be made therein without departing from the principles of the invention, the scope of which is to be determined by the appended claims.

What we claim is:

1. An electrolytic cell for the production of halogenous oxy-salts comprising, in combination, an upper tank; a lower tank downwardly spaced from said upper tank; upright tubular cathode means extending between and communicating at upper and lower ends thereof with said upper and said lower tanks, respectively; anode means extending with clearance at least partly through said tubular cathode means; passage means arranged laterally of the tubular cathode means and communicating at one end thereof with a bottom portion of said upper tank and with a lower end thereof with said lower tank; inlet means communicating with said lower tank for feeding electrolyte into said lower tank so that the electrolyte will pass through the clearance between said tubular cathode means and said anode means to be electrolyzed and to pass as electrolyzed product into said upper tank; lifting pipe means communicating with said upper end of said tubular cathode means and projecting upwardly therefrom into said upper tank to such a length so that its upper end is adapted to be located below the level of an electrolyzed product solution therein so as to produce an increased circulation of electrolyte product solution from said upper tank through said passage means to said lower tank; and solution outlet means communicating with said passage means for controlled discharge of electrolyzed product solution therefrom.

2. An electrolytic cell as defined in claim 1, wherein said passage means include an upright electrolyte adjusting tank.

3. An electrolytic cell as defined in claim 1, wherein said passage means include an elongated upright electrolyte adjusting tank located laterally of said cathode means, a first connecting pipe communicating with opposite ends thereof, respectively, with a bottom region of said upper tank and with a region of said adjusting tank intermediate the ends of the latter, and a second connecting pipe communicating at opposite ends thereof, respectively, with a bottom portion of said adjusting tank and with said lower tank, said solution outlet means communicating with a bottom portion of said adjusting tank.

4. An electrolytic cell as defined in claim 3, and including a casing between said upper and said lower tank, said casing having a top and a bottom wall respectively closing the bottom of said upper tank and the top of said lower tank, said cathode means comprising a plurality of tubular cathodes extending between said top and bottom walls of said casing, said anode means comprising a plurality of anodes respectively located in said tubular cathodes, and said lifting pipe means comprising a plurality of pipes respectively coaxially arranged and communicating with the upper ends of said tubular cathodes, each of said lifting pipes having a length of at least 300 mm. and the upper ends thereof are adapted to end at least 20 mm. below the level of an electrolyzed product solution in said upper tank.

5. An electrolytic cell as defined in claim 4, and including insulating means between said bottom wall of said casing and the top of said lower tank and between said top wall of said casing and the bottom of said upper tank.

6. An electrolytic cell as defined in claim 5, wherein each of the anodes is formed from titanium clad platinum and wherein each of said tubular cathodes is formed from a steel pipe with an inner chromium-sulfur plating.

7. An electrolytic cell as defined in claim 6, wherein said lifting pipes are formed from electrically non-conductive material.

8. An electrolytic cell as defined in claim 1, wherein said lifting pipe means has a length of at least 300 mm.

9. An electrolytic cell as defined in claim 8, wherein the upper end of said lifting pipe means is adapted to be located at least 20 mm. below the level of an electrolyzed product solution in said upper tank.

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