ELECTROLYTIC APPARATUS

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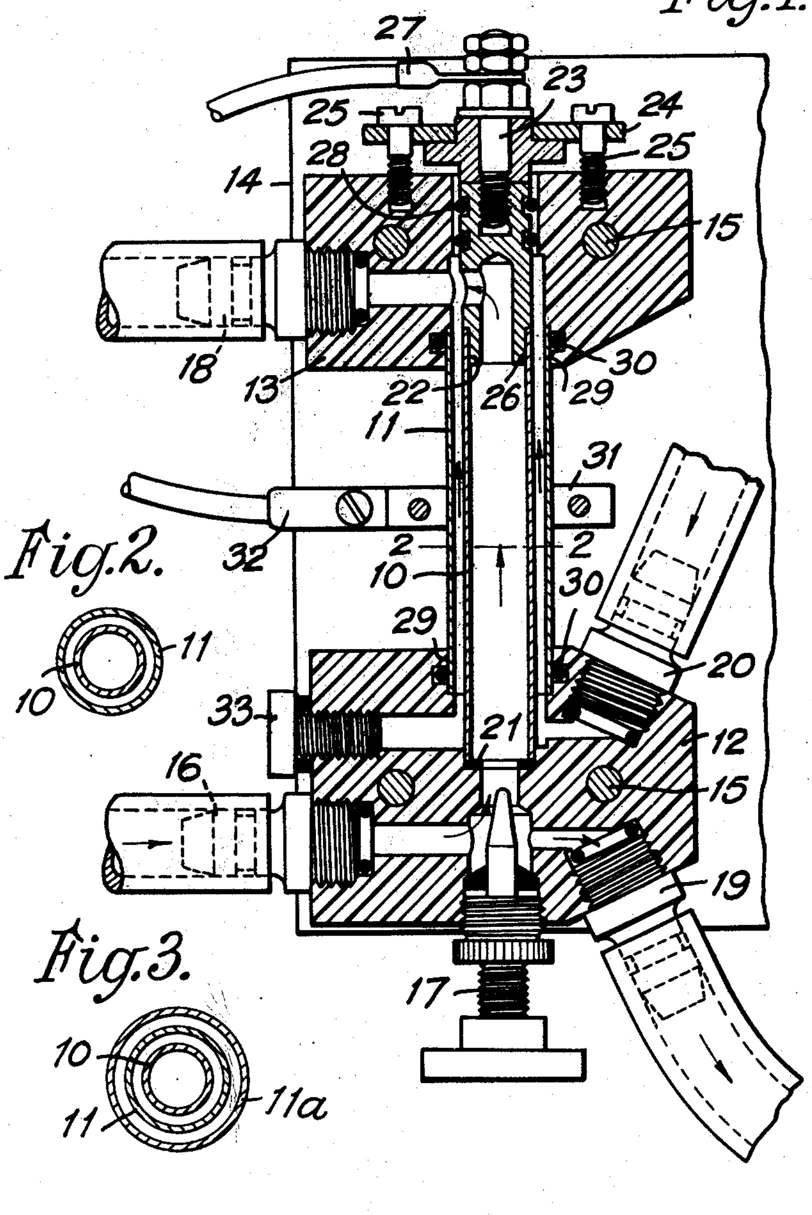

Fig. 1.

Fig. 2.

Fig. 3.

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ELECTROLYTIC APPARATUS

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This invention relates to electrolytic apparatus consisting of cells such as employed for example in the production of sodium hypochlorite from brine.

In such electrolytic cells, the electrodes are usually made of graphite and are liable to erosion in normal use, eventually resulting in irregular action and even destruction of the electrodes.

It is known that platinum is far more resistant to chemical action than graphite, and also that titanium is very resistant to such attack. By coating thin sheets of titanium with platinum, it is therefore possible to produce composite metallic electrodes of substantial thickness, sufficiently rigid for practical purposes, without the high cost of platinum electrodes; by making the electrodes of tubular form, the rigidity will naturally be increased, as compared with flat sheets of the same thickness, so that the thickness and cost of such electrodes will be further reduced.

The main object of the invention is to provide an improved electrolytic cell comprising coaxial tubes of relatively small thickness and diameter, made of titanium and having on at least one of said tubes a very thin coating of platinum in contact with the electrolyte passing between said tubes, so that erosion of the tube surfaces may be reduced to a minimum.

Another object is to provide an improved electrolytic cell of relatively small size, comprising coaxial tubes made of titanium, in which the inner tube forms a passage for cooling fluid so that the cell may be operated at high amperage without undue heating.

A specific object of the invention is to provide an improved cell particularly adapted for use in the chlorination of a water supply, water being fed to the cell from the delivery pipe-line of the water to be treated, a portion of this feed being by-passed for the purpose of making up the brine to be electrolysed in the cell, and the remainder of this feed being employed for cooling the cell by passage through the inner tube. For example, about ten gallons per hour could be fed to the cell, of which less than one gallon per hour would be by-passed for conversion into brine and then electrolysed into hypochlorite solution, the remainder of the ten gallons per hour being used for cooling the cell.

Other objects and advantages of the invention will hereinafter appear from the following description given with reference to the accompanying drawing, in which:

FIG. 1 represents in sectional elevation a preferred embodiment for use with a shunt feed from a water supply to be sterilized;

FIG. 2 is a section of the coaxial tubes on the line 2—2 of FIG. 1;

FIG. 3 is a similar section of a modification having three coaxial tubes.

As shown in FIG. 1, the cell comprises two thin tubes 10 and 11, made of titanium and mounted coaxially in a vertical position, with their ends fitted into two blocks 12 and 13, made of transparent plastic material, such as the polymethyl methacrylate resin known under the trademark "Perspex," these blocks being fixed upon a supporting panel 14 by means of bolts 15. The same panel may carry a solution-preparing apparatus (not shown) such as described in the British specification 820,275. The inner tube 10 forms the cathode of the cell, while the outer tube 11, which forms the anode, is coated internally with a very thin layer of porous platinum; the inner tube 10 may also

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be coated with platinum, and if desired both tubes may be coated with platinum, both internally and externally. By way of example, the inner tube 10 may have an external diameter of about ½ inch, being of a thickness of 22 S.W.G. (0.028 inch) and not coated with platinum; the outer tube 11, forming the anode, may have an external diameter of ¾ inch, being of a thickness of 18 S.W.G. (0.048 inch) and coated internally with platinum, this platinum coating being of a thickness of 0.0001 inch.

Water of the shunt feed from the main delivery line enters the lower block 12 through an inlet nipple 16, its flow being controlled by means of a needle valve 17 at the bottom of the block. The greater part of the water passes up the inner tube 10, from the top of which it flows out from the block 13 by way of an outlet nipple 18. A small portion, for example one-tenth or less, of the water entering through the nipple 16 flows past the needle valve 17 to reach an outlet nipple 19, which is connected by a flexible hose to the apparatus for preparing the brine; in this apparatus, the water becomes saturated to the desired extent with salt, and the resulting brine for electrolysis in the cell is led back into the lower block 12 through a flexible hose connected to an inlet nipple 20. From this nipple the brine is admitted to the space around the inner tube 10, and it then flows up the narrow annular space between the two tubes; at the top of this annular space, the electrolysed brine rejoins the cooling water which has flowed up inside the tube 10, the whole leaving through the nipple 18.

The inner tube 10 is seated upon a gasket 21 in the lower block 12, its upper end being jointed to a metal bush 22 secured to a bolt 23 engaged by clamping means 24 connected by screws 25 to the upper block 13. The bolt 23 forms the cathode connection of the cell, being in conductive connection with the inner tube 10 at the joint 26 and having an external connector 27 fixed to its head. The bush 22 is fitted with rubber or like packing rings 28 sealing against the bore of the block 13, while the lower end of the tube 10 is sealed by its gasket 21 upon which it is held firmly by the clamping means 24 at the top. The outer tube 11 has its ends engaged in shouldered recesses 29 in the respective blocks, in which they are sealed by rubber or like rings 30; this tube is fitted externally with a clamp 31, to which an anode connector 32 is attached.

It will thus be seen that with the two blocks 12 and 13 fixed upon the supporting panel 14, which may also carry the solution-preparing apparatus fed by the by-pass between the nipples 19 and 20, the proportion of the feed converted into brine may be controlled by means of the needle valve 17, the rate of this by-pass flow and the strength of the brine obtained being further controlled by the solution-preparing apparatus. In operation, the electrolyte entering through the nipple 20 passes up the annular space between the tubes 10 and 11, which form the cathode and the anode of the cell respectively, being supplied with current from a suitable source of direct current, such as a rectifier; the hypochlorite solution produced finally emerges together with the cooling water through the outlet nipple 18, which will be connected to the point at which the injection into the main delivery is to take place.

Due to the cooling water being passed through the inner tube 10, the cell may be operated with a high amperage relative to its size, resulting in a large electrolytic production.

The diameters and lengths of the tubes 10 and 11 may be as desired; apparatus of different amperage may be constructed by assembling tubes of greater or less length, while using standard diameters and fittings, the blocks 12 and 13 being spaced apart to suit the selected length of the tubes. If desired, more than two coaxial tubes made of titanium may be provided, as shown in FIG. 3, the innermost tube **10** still affording a continuous passage for the cooling fluid, while the outer tubes **11** and **11***a*, which are coated internally with platinum, provide annular spaces for electrolyte to flow in parallel streams around the innermost tube, forming a multipolar assembly between the outermost tube or anode and the innermost tube or cathode.

The current flowing through the electrolyte may be reversed periodically by any conventional means, such as a time-controlled reversal mechanism operating for about one minute in every hour and then restoring the normal polarity; this change of polarity will cause the detachment of any adhesions of hydrates forming on the cathode, most of the detached hydrate being carried off in the flowing stream of electrolyte but any precipitated material collecting in the bottom space around the cathode tube, from which it can be removed from time to time by way of a drain aperture normally closed by a screw plug **33** or the like.

It will be understood that the invention is not limited to the particular embodiment described and illustrated; the cell may be arranged for operation with a direct feed of brine to the annular space between the tubes **10** and **11**, by way of the lower block **12**, through an inlet nipple such as shown at **20**, and with a separate supply of cooling water or other medium to the inner tube **10**, also by way of the lower block, through an inlet nipple such as shown at **16**, the outlets from the top of the two tubes being maintained separate or combined, according to requirements.

The simplicity of the cell constructions, coupled with the use of transparent plastic material for the blocks **12** and **13**, will permit visual inspection to be carried out at all times; diminution of the electrode area covered with porous platinum may be noticed visually after prolonged use, or it may be revealed by a rise in the voltage necessary to maintain output. The cell can then readily be dismantled and fitted with replacement electrodes, the original titanium tubes being replated with platinum for further use.

What I claim is:

1. A closed electrolytic cell comprising two tubes of titanium mounted vertically between an upper and a lower insulating mounting block and arranged co-axially one within the other, the outer surface of the inner tube and the inner surface of the outer tube defining a narrow annular passage, a surface coating of platinum on that surface of at lease one of said tubes which defines said narrow passage, a first inlet defined by said lower mounting block and connected to the bottom of said narrow passage, a second inlet defined by said lower mounting block and connected to the bottom of said inner tube, an inlet port defined by said lower mounting block and connected both to said second inlet and to a conduit, which conduit is connected to an electrolyte forming device, which electrolyte forming device is connected to said first inlet, said inlet port including an adjustable valve so located as to be capable of regulating the flow of a liquid from said inlet port to said second inlet relative to the flow of liquid from said inlet port to said conduit, an outlet defined by said upper mounting block connected to the top of said inner tube and to the top of said narrow passage, and means for applying an electrical potential difference between said two tubes.

2. A closed electrolytic cell according to claim 1 wherein said upper and lower mounting blocks are made of polymethyl methacrylate.

3. A closed electrolytic cell according to claim 1 wherein said adjustable valve is a needle valve positioned with its needle entering an annular collar at the bottom of said inner tube.

4. A closed electrolytic cell comprising three tubes of titanium mounted vertically between an upper and a lower insulating mounting block and arranged co-axially one within another, the outer surface of the inner tube the inner surface of the outer tube, and the outer and inner surfaces of the intermediate tube defining two narrow annular passages, a surface coating of platinum on that surface of at least one of the tubes which defines one of the narrow passages, a first inlet defined by said lower mounting block and connected to the bottom of said two narrow passages, a second inlet defined by said lower mounting block and connected to the bottom of the inner tube, an inlet port defined by said lower mounting block and connected both to said second inlet and to a conduit, which conduit is connected to an electrolyte forming device, which electrolyte forming device is connected to said first inlet, said inlet port including an adjustable valve so located as to be capable of regulating the flow of a liquid from said inlet port to said second inlet relative to the flow of liquid from said inlet port to said conduit, an outlet defined by said upper mounting block connected to the top of said inner tube and to the tops of said two narrow passages, and means for applying an electrical potential difference between the inner and outer tubes.

5. A closed electrolytic cell according to claim 4, wherein said upper and lower mounting blocks are made of polymethyl methacrylate.

6. A closed electrolytic cell according to claim 4, wherein said adjustable valve is a needle valve positioned with its needle entering an annular collar at the bottom of said inner tube.

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