

March 19, 1940.

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2,194,443

ANODE FOR ELECTROLYTIC CELLS

Filed Oct. 4, 1937

3 Sheets-Sheet 1

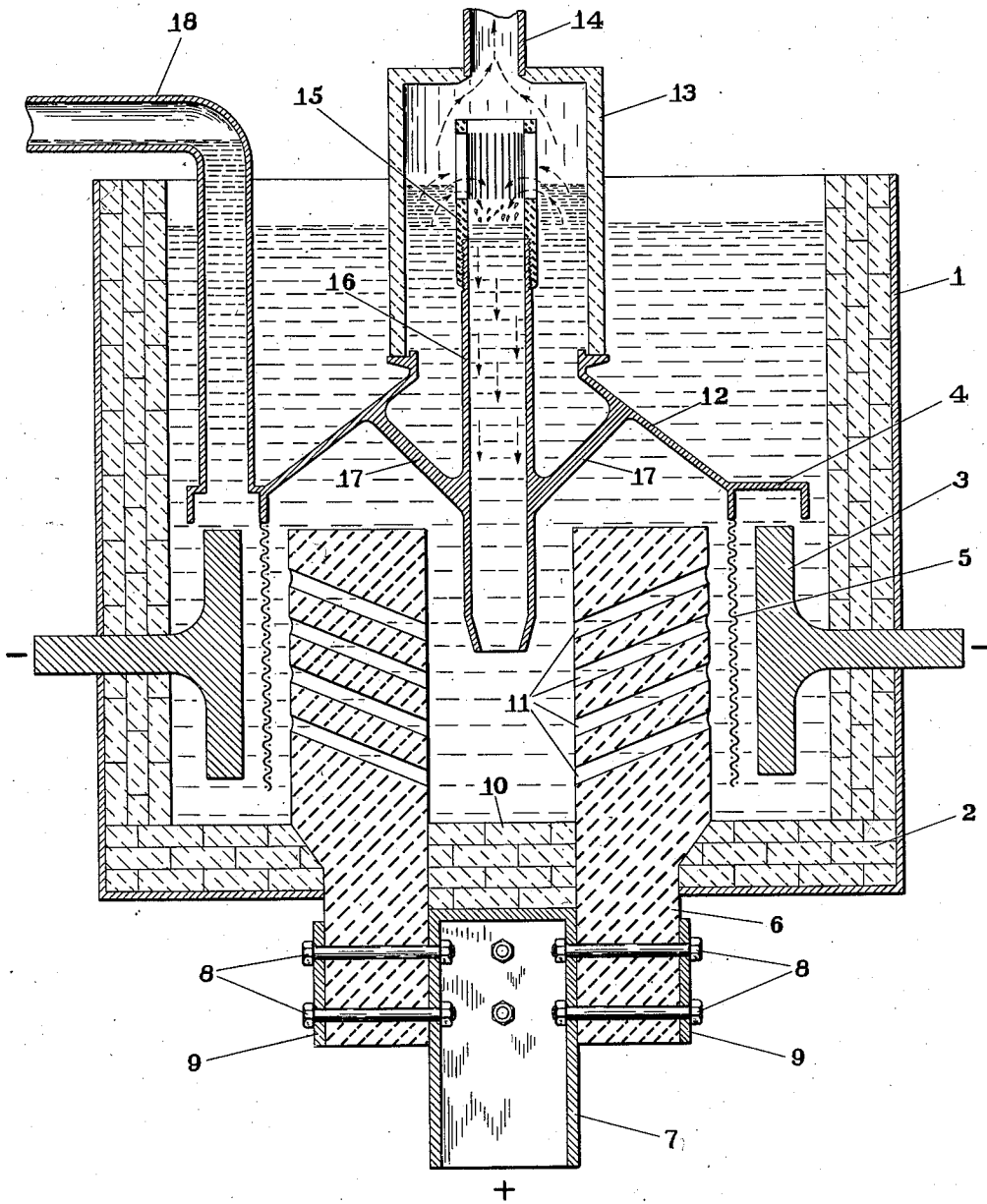


Fig. 1.

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3 Sheets-Sheet 2

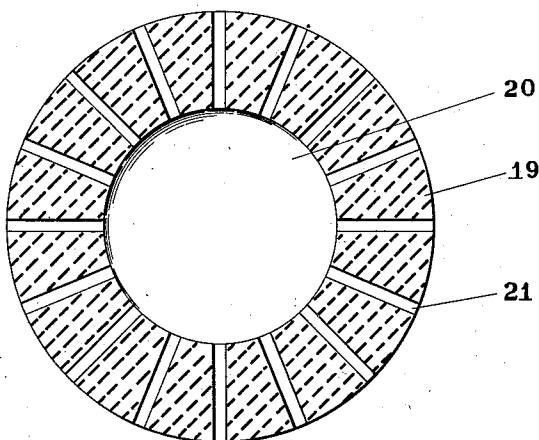


Fig. 2.

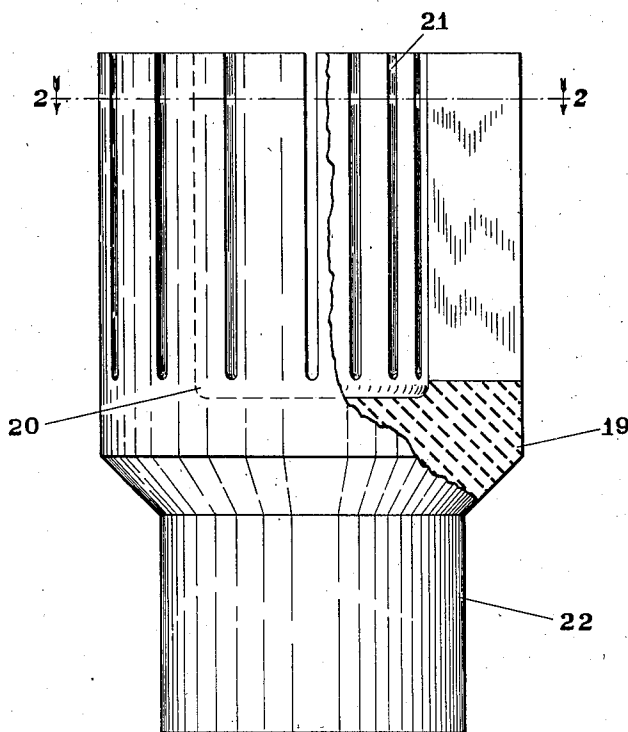


Fig. 3.

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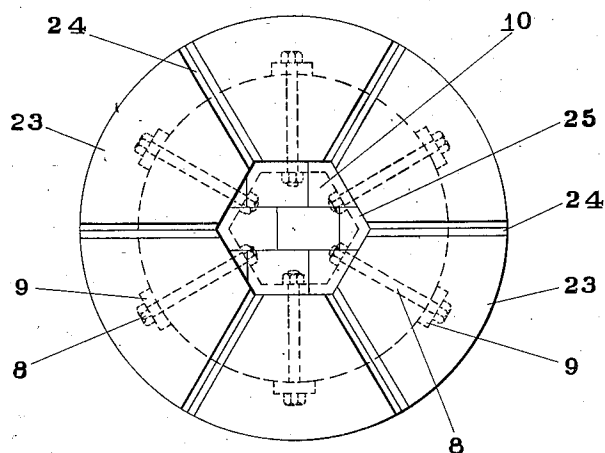


Fig. 4.

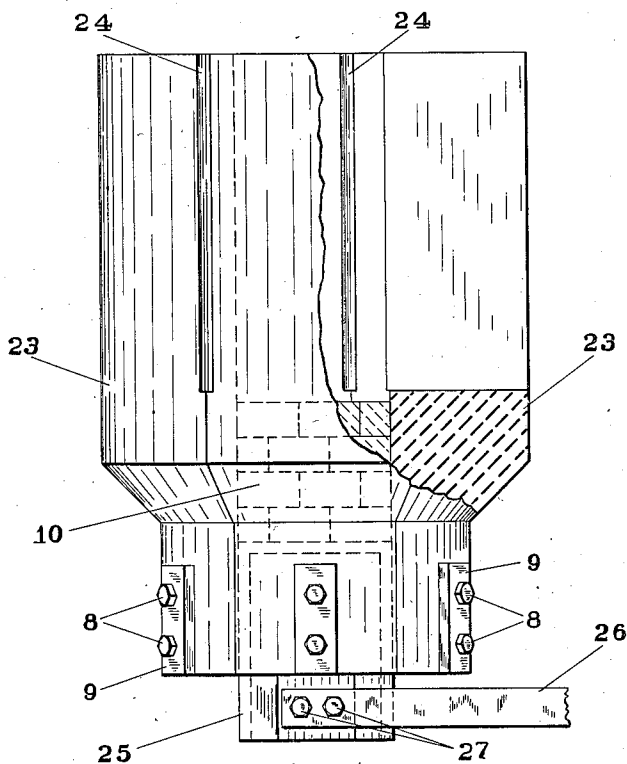


Fig. 5.

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UNITED STATES PATENT OFFICE

2,194,443

ANODE FOR ELECTROLYTIC CELLS

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Application October 4, 1937, Serial No. 167,196

6 Claims. (Cl. 204—19)

This invention relates to electrolytic cells for the electrolysis of fused salts, for example, in the production of alkali metals or similar metals, and has for an object the improvement of the efficiency of such electrolytic cells. A further object is to provide an improved means for circulating the electrolyte within such electrolytic cells. Other objects of the invention will be apparent from the following description.

The appended drawings illustrate several specific forms of the present invention. Fig. 1 is a vertical sectional view of an electrolytic cell constructed in accordance with the present invention. Fig. 2 is a horizontal cross-section of an anode for an electrolytic cell and Fig. 3 shows the anode of Fig. 2 partly in elevation and partly in vertical cross-section. Figs. 4 and 5 illustrate another anode for electrolytic cell which is made up of a plurality of parts. Fig. 4 shows a top view of the anode while Fig. 5 shows the same anode partly in elevation and partly in vertical cross-section.

Fig. 1 illustrates one form of the present invention. The side walls and bottom of the electrolytic cell are formed by a steel shell 1 which is lined with refractory brick 2. A centrally located anode is constructed of a plurality of graphite segments 6 which are bolted to a steel center block 7 by means of bolts 8 and backing plates 9, the assembly of the graphite segments forming a hollow substantially cylindrical structure. Each graphite segment is provided with a plurality of holes 11 which slope upwardly from the hollow space in the center of the anode to the outside surface. A layer of fire brick 10 is laid over the top of the center block 7 to prevent contact of the electrolyte in the cell therewith. The anode is surrounded by an annular shaped cathode 3. Above the cathode is an annular inverted collecting trough 4 which, together with pipe 18, serves to collect and lead from the cell the cathodic product. From one edge of the collecting trough 4 a cylindrical diaphragm 5 of conventional type is suspended between the anode and cathode. Suspended above the anode by conventional means not shown is a conical gas collector 12 which in turn is surmounted by the gas collecting dome 13. Pipe 14 connected to the top of dome 13 serves to carry out gaseous anodic products. In the center and upper portion of gas collecting dome 13 is located a device for separating gas from liquid electrolyte 15. Preferably, the gas separation device 15 is that described and claimed in co-

pending patent application by Hulse, Hansley and Laughlin, S. N. 152,246, filed July 6, 1937. As described in that application, such device consists of the graphite tube 15, the upper portion of which is provided with a series of slots leading into the interior of the tube. The separating device 15 is fastened to the top of a down-flow pipe 16, which in turn is supported to gas collector 12 by means of arms 17. The down-flow pipe 16 terminates within the hollow space in the center of the anode.

When the electrolytic cell illustrated by Fig. 1 is operated, for example, to electrolyze a fused alkali metal halide to produce alkali metal and halogen gas, the halogen gas formed at the surface of the anode rises through collector 12 and into the dome 13. The relatively constricted area through which the gas passes in dome 13 causes a gas-lift action in dome 13 which causes the liquid level therein to rise above the electrolyte level elsewhere in the cell. The electrolyte passes through the slots in separator 15 and thence travels downwardly in down-flow pipe 16, the gas which is disengaged from the electrolyte flowing out through pipe 14. The electrolyte flowing down through pipe 16 enters the depression or hollow space of anode 6 and thence flows through the openings 11 into the annular space between anode and cathode. In this manner, by means of the depression or hollow space in the anode, together with the openings 11, a fresh supply of electrolyte is constantly fed to the space between the anode and cathode, thus ensuring efficient operation of the cell. The present invention is not restricted to the particular type of electrolytic cell which is illustrated by Fig. 1 but may be adapted to various types of cells by using the same or a similar anode. Also, the down-flow pipe 16 and the separator associated therewith may be omitted although it is generally preferable to utilize a down-flow pipe or equivalent means to circulate electrolyte into the depression or hollow space in the anode.

Further, the invention is not restricted to the particular anode construction shown in Fig. 1, since equivalent results may be obtained in accordance with the present invention by other forms of anode which have a central depression or well and openings leading from the well to the exterior of the anode. One example of such other form is illustrated by Figs. 2 and 3 of the drawings. The anode illustrated by Figs. 2 and 3 may be formed by machining a solid cylinder of graphite. The anode is essentially cup-shaped, having a centrally located depression 20 and a plurality of slotted openings 21 which lead from

the depression to the exterior of the anode. The lower portion of the anode is tapered to form stem 22 adapted to protrude from the cell and which may be provided with suitable electrical contacts.

Figs. 4 and 5 of the drawings illustrate another form of anode in accordance with the present invention. This is a composite anode made of six segmentary pieces of graphite which are bolted to a hexagonal center block. Each segmentary portion of graphite 23 is bolted to a side of center block 25 by means of bolts 8 and backing plates 9. The center block may be connected to an electrical conductor, as bus bar 26, by means of bolts 27. The face of the center block 25 is covered with a plurality of courses of fire brick 10 to prevent contact of electrolyte with the center block. Each segmentary piece of graphite 23 is provided with cut-a-way portions so that when the 6 pieces are assembled, the 6 slots 24 will be formed between the respective pieces. The slots 24 open into the hexagonal depression or well in the interior of the assembled anode and extend to the exterior of the anode surface.

It will be apparent that various other modifications of the invention illustrated above may be made without departing from the spirit and scope thereof. In its broader aspect our invention consists in an anode for an electrolytic cell which has a centrally located depression or well and is provided with openings leading from the said depression toward the outside of the anode. Preferably the openings are in the form of radial slots.

We claim:

1. An anode assembly for a fused salt electrolysis cell comprising a plurality of longitudinal segmentary graphite members, each member being provided with cut-a-way portions and a stem portion, said members being assembled together with the stem portions bolted to a common center block so as to form a substantially cylindrical structure having a hollow interior space open at the end opposite to said center block and said cut-a-way portions forming substantially vertical slots passing through the vertical portions of said cylindrical structure and leading into said hollow space.

2. In a fused salt electrolysis cell, a centrally

located, substantially vertical, graphite anode surrounded by cathode means, said anode having a centrally located depression open at the top and extending to a point lower than the bottom of said cathode means and provided with a plurality of openings leading outwardly from said depression to the annular space between the anode and cathode.

3. In a fused salt electrolysis cell, a centrally located, substantially vertical, graphite anode surrounded by cathode means, said anode having a centrally located depression open at the top and extending to a point lower than the bottom of said cathode and provided with a plurality of substantially vertical slots leading outwardly from said depression to the annular space between the anode and cathode.

4. A fused salt electrolysis cell having a centrally located, cylindrical, graphite anode surrounded by an annular cathode, said anode being provided with a centrally located, open depression which extends downwardly to a point lower than the bottom of said cathode, means for introducing a stream of electrolyte into said depression and a plurality of openings adapted to permit the flow of electrolyte from said depression into the annular space between the anode and cathode.

5. A fused salt electrolysis cell comprising a centrally located, vertical, substantially cylindrical, graphite anode having a central depression, an annular cathode surrounding said anode, a gas collecting dome surmounting said anode, separating means for separating gas from electrolyte in the upper portion of said dome, a down-flow pipe leading from said separating means to the interior of the depression in said anode and a plurality of openings leading from said depression into the annular space between the anode and cathode.

6. In a fused salt electrolytic cell, a substantially vertical anode surrounded by cathode means, said anode having a substantially centrally located depression open at the top and closed at the bottom and a plurality of openings leading from said depression outwardly directly into the space between said anode and said cathode means.

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