Feb. 28, 1939. H. I. ALLEN 2,149,004

ELECTROLYTIC CELL

Filed Dec. 15, 1936

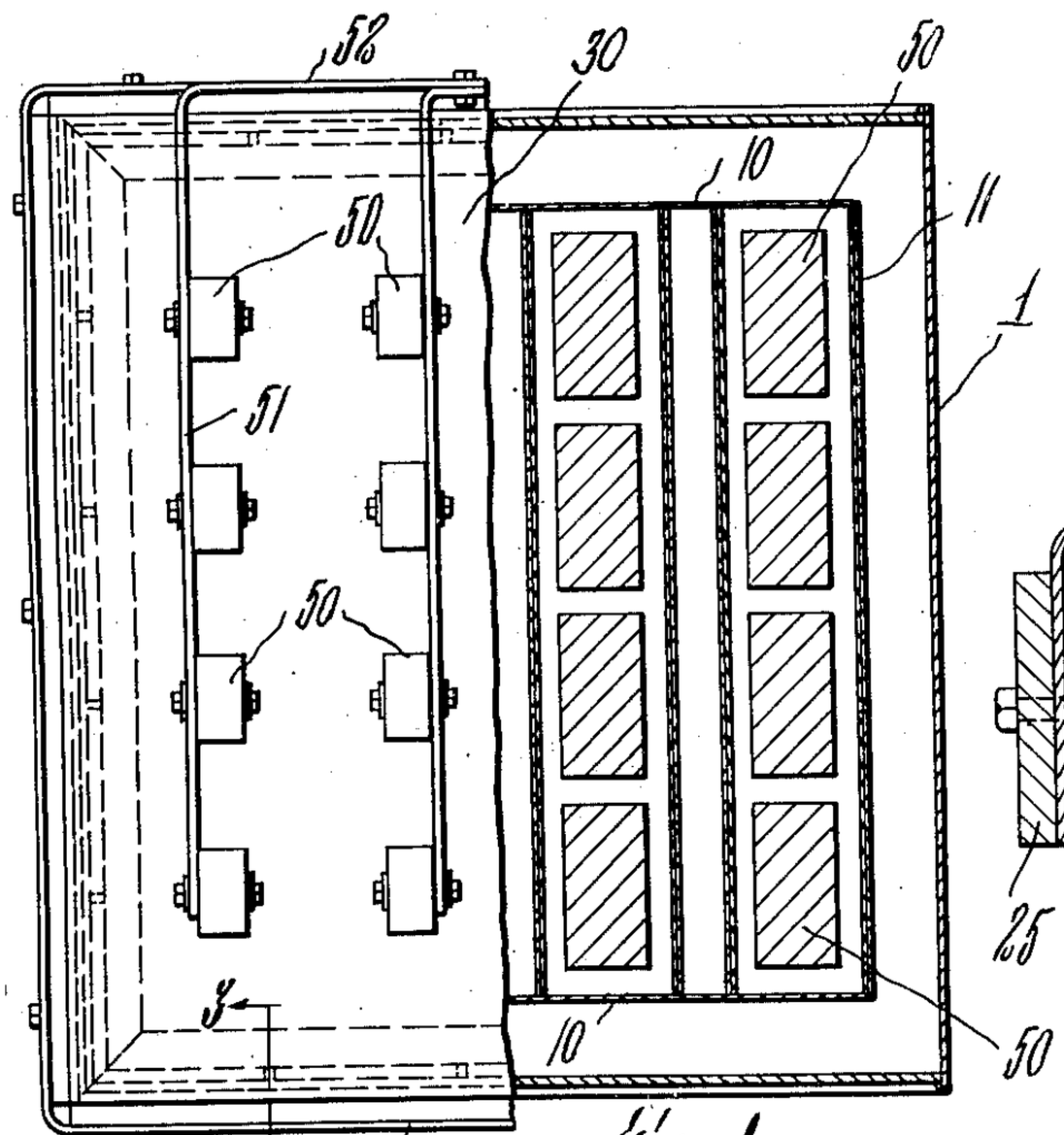

Fig. 1.

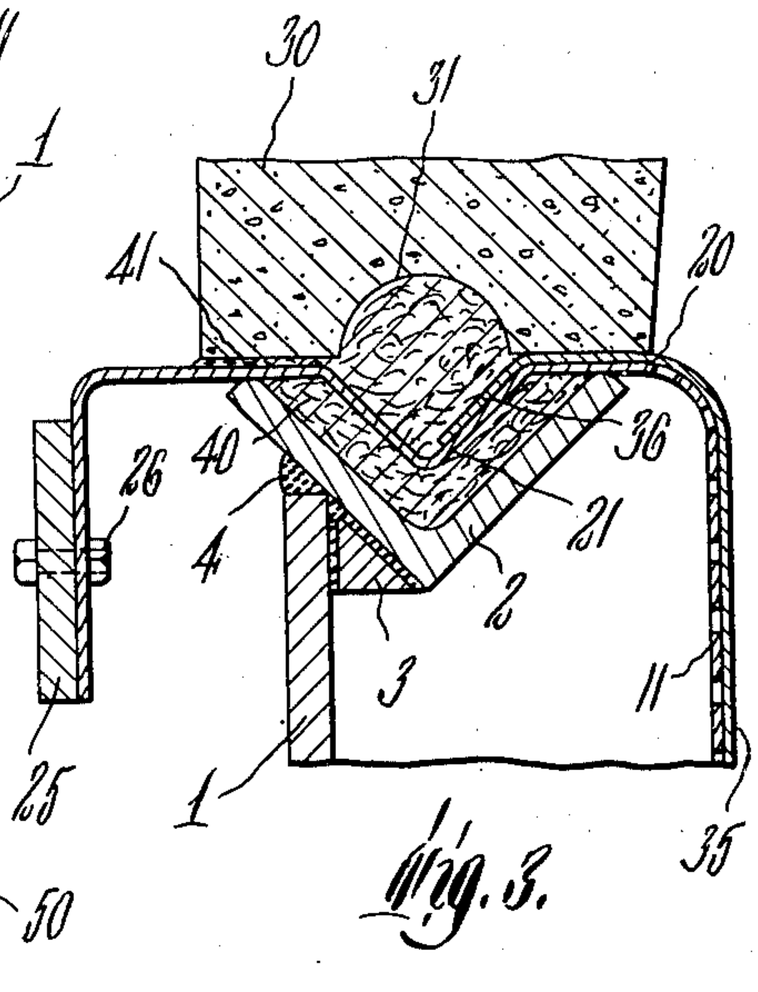

Fig. 3.

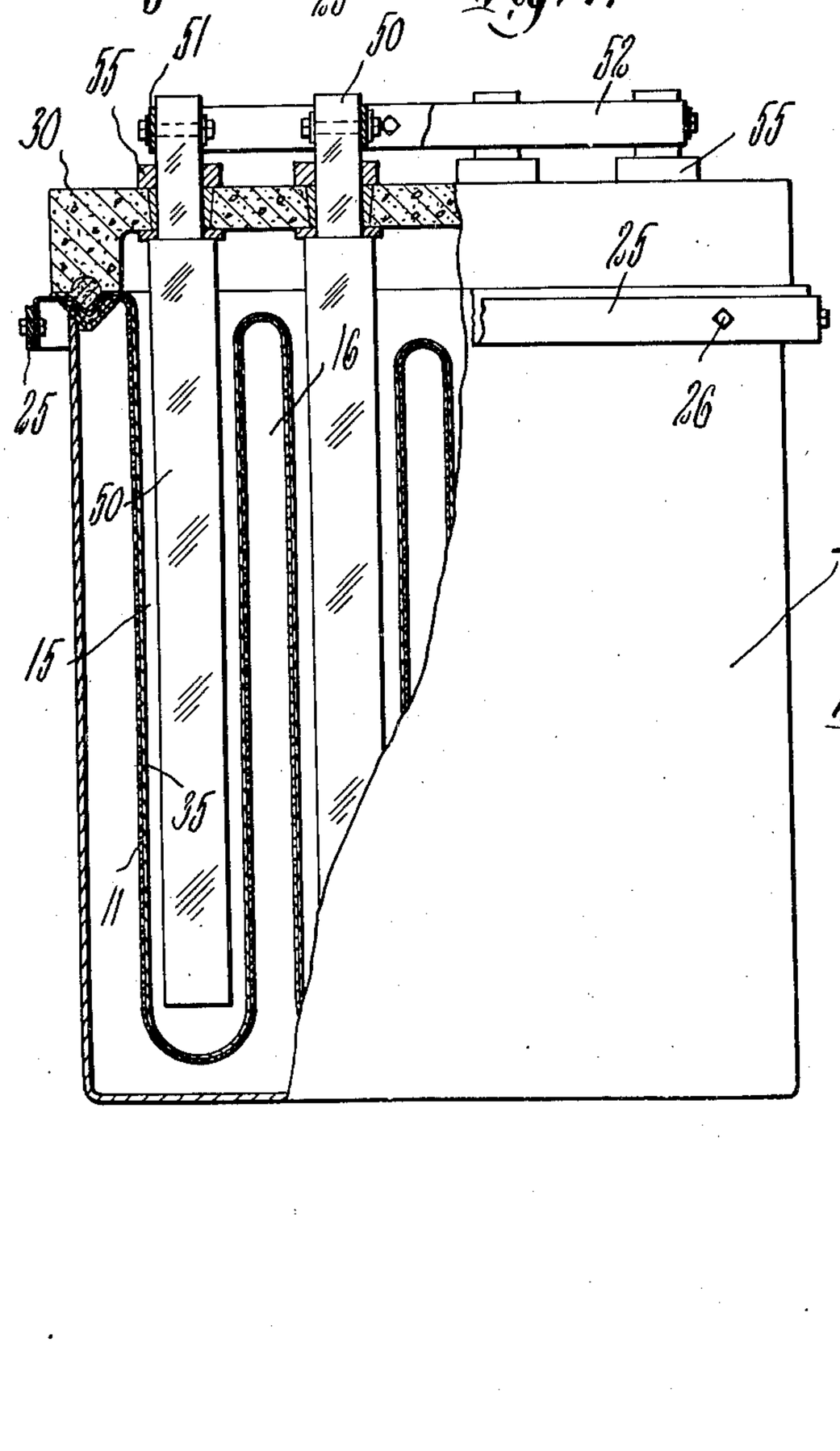

Fig. 2.

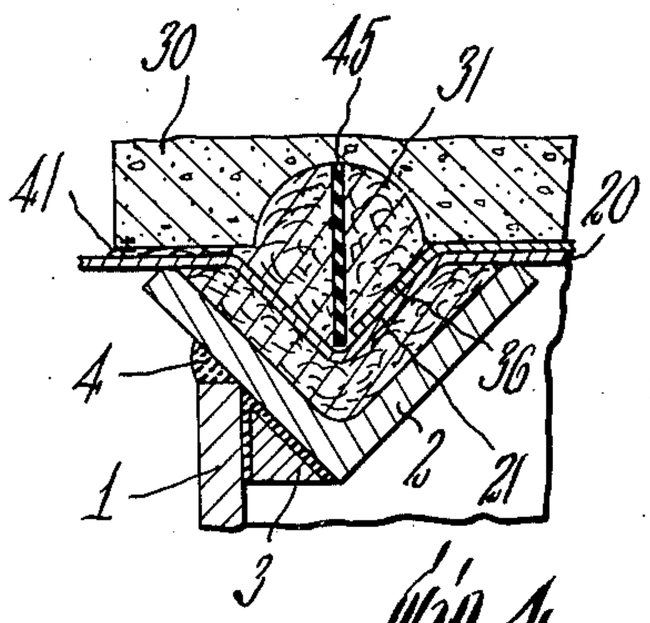

Fig. 4.

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ELECTROLYTIC CELL

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6 Claims. (Cl. 204—58)

This invention relates to electrolytic cells and more particularly to cells especially suitable for the electrolysis of the salts of the alkali metals, such as sodium chloride and potassium chloride.

One of the objects of this invention is to produce a cell of low construction cost, requiring minimum floor area, which will show high efficiency and low maintenance cost, and still be free from the structural defects which have up to this time characterized other cells occupying relatively small floor space.

Another object is to produce a cell in which the life of the anodes and the life of the diaphragms will be approximately the same. Various processes plus features of design have successfully prolonged the life of graphite anodes for periods of from two to seven years, while recently acquired knowledge of the treatment and care of diaphragms has prolonged the life of this item of cell construction to equal periods. The design of this cell permits taking advantage of such knowledge. In many chemical plants it is a definite advantage in labor saving to have a cell which will operate efficiently for relatively long periods without the necessity of changing diaphragms or anodes, or of cleaning the cell interior. The breakage of anodes which would have a considerable useful life if left alone, and the cost of unnecessary diaphragm changing, due to unequal wearing out of anodes through faulty current distribution, constitute formidable items of maintenance cost with most cells.

A further object of this invention is to provide a cell in which multiple compartments may be used advantageously and without excessive expense.

A still further object is to produce a cell requiring a relatively small floor space.

Still another object is to produce a cell wherein a very uniform current distribution can be produced at low cost.

Another object is to produce a cell which in a small floor area will provide sufficient anode and cathode area to effect a low current density (and hence a low power cost per unit of product). This by means such as to require less than the usual amount of graphite per 1000 amperes of load.

A further object is to improve the joint between the cathode, diaphragm, tank, and cover or gas chamber.

For a more complete understanding of this invention, reference may be had to the accompanying drawing in which—

Figure 1 is a top plan view partly broken away and in section of a cell constructed in accordance with this invention.

Figure 2 is a side elevation partly broken away of the same.

Figure 3 is a detail section to a larger scale on line 3—3 of Figure 1.

Figure 4 is a view similar to Figure 3, but showing a modification.

Referring to the drawing, at 1 is shown a tank substantially square in plan. About the top margin of this tank is positioned a trough member shown as formed by an angle 2. This may be supported at suitable intervals along the side walls of the tank, as by angle bracket pieces 3, and it may be welded to the top of the tank, as by the weld strip 4. This trough, as shown, extends continuously around all four sides of the tank.

The cathode as shown is also substantially square in plan and comprises end walls 10, rectangular in shape, and a plaited wall member 11 secured at its ends to the inner faces of the end walls 10. The plaiting of this member 11 forms a plurality of anode compartments 15 open at their upper ends and which are spaced by compartments 16 open at their lower ends, so that there are thus formed a plurality of elongated anode compartments extending between the walls 10 and separated from each other by the relatively narrow compartments 16.

The wall member 11 may be formed foraminous as is usual with cells of this type, and the walls 10 are also foraminous so that the anode compartments are active throughout their entire sides, ends, and bottoms. The wall member 11 is provided with laterally extending flanges 20 at its ends and the wall members 10 are likewise provided with similar flanges which overlie the angle members 2 and preferably, as shown, are depressed into the channel formed thereby as at 21. The flanges 20 preferably extend substantially entirely around the upper edge of the cell and the parts may be so cut as to be entirely continuous, if desired. The extremities of these flanges which extend outwardly beyond the wall of the tank 1 may be turned into a substantially vertical plane, as shown, these ends being turned downwardly, and a bus bar 25 which extends substantially wholly around the cell is secured to this flange. As shown bolts and nuts as 26 may be employed for this purpose, and if desired the bus bar may be sweated or otherwise secured substantially throughout its length to the flange. This provides for an even distribution of current to the cathode and permits the connections to other cells to be taken off at any desired points therearound.

The cell is shown as provided with a cover 30 which may form a gas chamber above the tank, and the lower edge of its margin is shown as provided with a recess 31 extending therearound, and which, when the cover is in position, comes above the marginal trough formed by the angle members 2 so as to form a pair of confronting mar-

ginal channels. The inner face of the cathode is overlaid by the diaphragm **35**, the outer margin of which may project down into the depressed portion of the cathode as at **36**. A sealing compound, such as **40**, may fill the space defined by the trough **2** and the cathode and the recess **31** in the cover member, and fill the joint between these parts through which joint the flange **20** extends and make it gas and liquid tight. This joint is exposed at its outer edge so that any leaks may be detected and repaired. A separate filler strip such as **41** may be employed between the outer portion of the cover and the flange **20**, this being of the same thickness as the diaphragm so that the lower face of the cover member may be flat across and yet not leave an undesired space between the lower face of the cover member and the flange **20** adjacent to the outer edge of the cover member.

If desired, also, a sealing strip of material such as rubber, or the like, which is a non-conductor and which is resistant to the electrolyte and to the products of the electrolysis, such as chlorine, may be positioned as shown in Figure 4 at **45** to extend into the recess **31** of the cover member and into the depressed portion of the flange **20**, being embedded in the sealing compound, thus to further act as a baffle and seal to prevent leakage of electrolyte or gas from between the cover member and the tank.

The cathode is preferably of a length and breadth at least six and one-half times its height and better, eight times its height, this being found in practice to be the most efficient proportions. By plaiting the cathode the effective cathode length, neglecting the cathode ends and bottom, is the sum of the lengths of the side walls of the individual anode compartments. As shown there are four of these compartments so that the effective cathode length is substantially eight times the length of each compartment. By the use of a tank square in plan, the tank may be built of thinner gage metal than if it is made elongated as in the previously known rectangular cells and still be of sufficient strength to support the load of cover and anodes. This considerably cheapens the cell for the same capacity and by reason of the plaited cathode the desired area of active cathode surface may be produced with the square proportions, which otherwise would require a cell considerably longer than its width. The cell thus has the proportional advantages found with a round cell but in a form considerably cheaper to produce, since it is a difficult and expensive matter to shape the cathode of a round cell with plaits and with an outwardly extending marginal flange. Moreover, the square construction minimizes the floor area required and makes possible a greater production of electrolysis products per square foot of cell room area.

As shown there are a series of anodes **50** arranged in each of the anode compartments between the side and end walls of the cathode and these may be secured in rows to bus bars **51** which may be joined to connecting bus bars **52** which may, if desired, also surround the margin of the cell above the cathode bus bars **25**. This makes possible short and nearly uniform connections from the bus bars to the anodes further tending to equalize current distribution through the cell. The anodes may pass up through the gas chamber and be supported and sealed in the cover **30** in any suitable manner, as by bushings **55**. From the foregoing description of an embodiment of this invention, it should be evident to those skilled in the art that various changes and modifications may be made without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. An electrolytic cell comprising a tank, a trough extending around said tank and secured thereto, a cathode having a marginal flange extending downwardly into said trough, a cover overlying said trough and having a marginal recess in its lower face above said trough, a diaphragm overlying said cathode and having its margin lying in said trough, and a sealing compound between said trough and cover and sealing the joint between said tank, cathode, diaphragm and cover.

2. An electrolytic cell comprising a tank, an angle member secured to the top of said tank in position to form a marginal trough therearound, a cathode having a marginal top flange overlying said angle and having a portion depressed into said trough, a diaphragm overlying said cathode and having its margin lying in said depressed portion, a gas chamber supported on said diaphragm and having a marginal channel facing said trough, and a sealing compound substantially filling said trough and channel and into which said depressed portion extends and sealing said joint between said chamber and tank.

3. An electrolytic cell comprising a tank, a marginal trough about the top of said tank, a cathode having an outwardly turned flange at its top overlying said trough, a diaphragm overlying said cathode, a gas chamber supported on said diaphragm and having a channel facing said trough, and a sealing compound substantially filling said trough and channel and through which said cathode extends.

4. An electrolytic cell comprising a tank, a cathode having an outwardly turned flange overlying said tank, a gas chamber overlying said flange, said tank and gas chamber having confronting channels, a sealing strip extending into both channels, and a sealing compound in said chamber and in which said strip is embedded.

5. An electrolytic cell comprising a tank, a cathode having an outwardly turned flange overlying said tank, a gas chamber overlying said flange, said tank and gas chamber having confronting channels, a sealing strip extending into both channels, and a sealing compound in said chamber and in which said strip is embedded, said strip being a non-conductor and resistant to the electrolyte and to products of the electrolysis.

6. An electrolytic cell comprising a tank, a marginal trough about the top of said tank, a cathode having an outwardly turned flange at its top overlying said trough, a diaphragm overlying said cathode, a gas chamber supported on said diaphragm and having a channel facing said trough, and a sealing compound substantially filling said trough and channel and through which said cathode extends, said cathode having a depressed portion extending into said channel, and an insulating strip projecting into said depressed portion and said channel.

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