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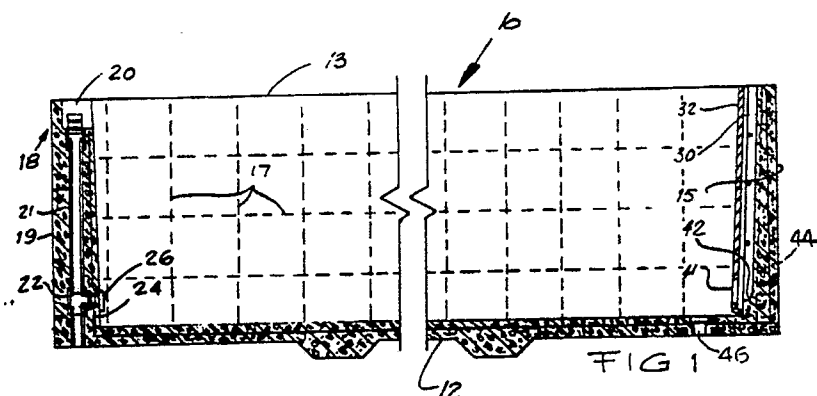
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(54) **Container for corrosive electrolytes.**

(57) A container in which minerals such as copper are purified in an electrolytic process includes bottom (12), end (15, 16) and side walls (13, 14) for containing a corrosive electrolyte, such as, a sulphuric or hydrochloric acid solution. The bottom, end and side walls of the container are composed of a cured mixture of 10-19 percent of a modified, vinylester or polyester thermo-setting resin and the balance consisting of aggregate. The surfaces of the container are coated with a resin layer having a backing layer consisting of about 70%-80% resin

and 20%-30% a reinforcement which may comprise a fiber glass mat of non-continuous strands 1/2"-2" long or a light cloth of fiber glass or other synthetic fiber. An overflow box (20) is integrally formed in a first formation extending vertically along one end wall of the cell and an overflow pipe (21) is molded into the first formation and extends from the overflow box outwardly of the cell. A vertical covered inlet channel (30) or cast-in pipe is provided at the opposite end of the container and extends from its upper to its lower end.



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CONTAINER FOR CORROSIVE MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to containers for highly corrosive solutions and more particularly to containers for use in the electrolytic refinement or electrowinning of metals such as copper.

In one type of process for the refinement of metals such as copper, a substantially pure copper anode is immersed in a suitable electrolyte, such as, a hydrochloric or sulphuric acid solution. The copper is deposited in a pure form on a cathode when an electric current is passed between the electrodes.

One type of prior art container employed for such electrolytic cells consists of an open concrete shell having end and side walls, a bottom and a lead or plastic lining. Spent electrolyte in the cell is replaced by introducing fresh electrolyte at one end of the cell and beneath the electrolyte's surface. At the opposite end of the cell, the spent electrolyte flows into an overflow box from which it is drained by an overflow pipe. Fresh electrolyte is normally fed into the cell at temperatures of about 140-160° F, while the spent electrolyte in the cell will normally be at a lower temperature. It is important to withdraw the colder, spent electrolyte since it tends to solidify at about 120° F.

Prior art cells were not wholly satisfactory because either the method of introducing electrolyte did not insure even distribution of fresh electrolyte along the bottom of the vessel or easily damaged piping was employed. Prior art vessels were also unsatisfactory because the overflow and decanting pipes were susceptible to physical damage, particularly during loading or unloading of cells with anodes and cathodes. Prior art containers were also not wholly satisfactory because the linings often failed resulting in concrete failure before the leaks were detected resulting in the loss of slimes and electrolyte. For this reason, prior art concrete cells required high maintenance, high repair and replacement costs and caused excessive downtime and lost production. In addition, the iron reinforcing bars provide a leakage path for stray electric currents which reduced current efficiency and affected cathode quality. Furthermore, because prior cells tended to absorb highly toxic materials, environmental concerns result in high disposal costs.

One prior art effort to improve such electrolytic cells included a shell fabricated from a mixture of about 20 percent resin and 80 percent various aggregates such as pea size gravel, fine silica sand, silica flour and one-quarter to one-eighth inch chopped fiber glass strands. These prior art cells

had the disadvantage of relatively high fabrication costs, and a susceptibility to short circuiting as a result of the use of reinforcing rods which include ferrous materials. Another disadvantage of prior art cells was that the molding process by which they were formed resulted in cold joints, irregular internal surfaces and required that overflow boxes be separately attached.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a new and improved container for electrolytic materials.

Another object of the invention is to provide containers for electrolytic materials and having improved decanting, overflow, and feed piping.

A further object of the invention is to provide an electrolytic cell feed system which provides more uniform distribution of electrolyte along the lower surface of the cell.

A still further object of the invention is to provide an electrolytic cell wherein the inlet, overflow, and decanting piping is less subject to damage.

It is an object of the invention to provide a new and improved container for electrolytic materials.

Another object of the invention is to provide containers for electrolytic materials which is highly corrosion resistant.

A further object of the invention is to provide a container for electrolytic cells which has a longer life and lower maintenance costs and is easier to maintain and install than prior art cells.

These and other objects and advantages of the present invention will become more apparent from the detailed description thereof taken with the accompanying drawings.

According to one of its aspects, the invention comprises a container for corrosive electrolyte used in an electrolytic process and consisting of a cured polymer concrete shell having a pair of side walls, a pair of opposed end walls, and a bottom. An overflow box is formed in one side wall and includes a recess formed below the upper edge of the one end wall and conduit means having one end opening in the recess and the other end opening exteriorly of the vessel. A passage is provided in the second end wall and extending from the upper end of the wall downwardly to a position adjacent its lower end for defining a vertical passage along the inner surface of the other end wall and which is open at its upper end and adjacent the bottom wall of the cell.

According to another of its aspects, the invention comprises a container for corrosive electrolyte

used in an electrolytic process and consisting of a cured polymer concrete shell having side walls, a pair of opposed end walls, and a bottom. Each of the end walls has inner and outer surfaces. A formation is molded on the outer of one end wall and extending from its upper and lower ends and intermediate the sides thereof and a recess is formed in the upper end of the formation and opening toward the inner surface of the end wall and below the upper edge thereof. A discharge passage is formed in the formation and spaced from the outer surface of the formation and the inner surface of the end wall. The discharge passage has a first end opening in the recess and a second end opening at the lower end of the formation. According to another aspect of the invention, a second passage is formed in the formation and extends generally horizontally from the inner surface of the end wall to the discharge passage.

In general terms, a further aspect of the invention comprises a container for an electrolytic process consisting of a cured mixture of 10% to 19% by weight vinylester or polyester thermo-setting resin modified by the addition of a thinning agent, inhibitors, promoters and catalyst and the balance an aggregate, preferably consisting of crystalline silica particles and particles taken from the group consisting of glass beads, chopped fiber glass strands and mica flakes. The surfaces of the cell are coated with a coating consisting of a top layer of pure resin and a reinforcement comprising about 20%-30% fiber glass mat or light cloth and about 70%-80% resin.

According to another aspect, the invention comprises a method of molding a container for an electrolytic process comprising the steps of lining the surfaces of a mold which defines bottom, ends and side walls with a coating consisting of a backing layer of 20%-30% inorganic fiber reinforcement and 70%-80% of pure polyester or vinylester thermosetting resin and a top layer of pure polyester or vinylester resin, mixing 10%-19% by weight of a vinylester or polyester thermo-setting resin modified by the addition of a thinning agent, inhibitors, promoters and catalyst and the balance consisting of an aggregate, continuously pouring the mixture into the mold and allowing said molded mixture and coating to cure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a side elevational view, partly in section, showing a cell according to the present invention;

FIGURE 2 is an enlarged fragmentary cross-sectional view of one end of the cell illustrated in FIGURE 1;

FIGURE 3 is a view taken along lines 3--3 of

FIGURE 2;

FIGURE 4 is an enlarged fragmentary cross-sectional view showing the other end of the cell illustrated in FIGURE 1;

FIGURE 5 is a view taken along lines 5--5 of FIGURE 4;

FIGURE 6 is an enlarged fragmentary view of a portion of the overflow box shown in FIGURES 2 and 3;

FIGURE 7 illustrates an alternate embodiment of the invention;

FIGURE 8 shows an alternate embodiment of the invention;

FIGURE 9 is a view taken along lines 9--9 of FIGURE 8;

FIGURES 10 and 11 show an alternate embodiment of the invention;

FIGURE 12 is a top plan view of the cell shown in FIGURE 1;

FIGURE 13 is a view taken along lines 13--13 of FIGURE 12;

FIGURE 14 is an enlarged fragmentary sectional view; and

FIGURE 15 is a sectional view of a mold in which the cell according to the invention is fabricated.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A cell 10 according to the preferred embodiment of the invention is shown in the drawings to include a bottom 12, side walls 13 and 14, and end walls 15 and 16, only one side wall being seen in FIGURE 1. The cell may be formed of any suitable material such as the polymer concrete disclosed in U.S. patent No. 4,885,072. The inner and outer surfaces of the cell may be coated with a corrosion-resistant lining as will be discussed below. A matrix of reinforcing bars 17 of a nonconductive material, such as FRP fiber glass, is disposed in the bottom 12 and extends up the side and end walls 13, 14, 15 and 16 as reinforcement against damage.

An overflow box 18 is provided in a semi-cylindrical formation 19 integrally molded on the outer surface of end wall 16 and intermediate its ends and extending from its top to its bottom. The overflow box 18 is defined by a recess 20 formed in the inner portion of formation 19 and opening into the interior of the cell 10 and extending downwardly from its upper periphery. At the center of the formation 19 an overflow pipe 21 is cast and extends vertically from the recess 20 downwardly through the lower end of formation 19 and is open at its opposite ends. Spaced upwardly from the lower end of pipe 21, there is a T-joint 22 which opens into an opening 24 extending between the T-

joint 22 and the inner surface 23 of wall 16. As a result, the interior of the cell 10 communicates with the overflow pipe 21 at a point spaced above the lower end of the cell. Normally, when the cell is full, a plug 26 is disposed within opening 24.

At the opposite end of the cell 10, there is a shallow inlet channel 30 formed in the inner surface 31 of the end wall 15 and extending from its upper end to a point spaced above the lower end of cell 10. A channel-shaped duct member 32 is suitably fixed over channel 30 to define a closed, hollow passage 34 therewith. In particular, channel member 32 has a flange 36 affixed to each side and extending along its length. The flanges 36 are fixed to the inner surface 31 of end wall 15 in any suitable manner such as bolts 38 which extend through openings in flanges 36 and are received in a plurality of metallic inserts 39 having internally threaded openings and molded into wall 15 in spaced apart relation along the sides of channel 30. Channel cover 32 extends from the upper to the lower ends of wall 15 and there is an opening 41 at its lower end which corresponds to the arcuate surface 42 at the lower end of channel 30. On the outer surface 44 of end wall 15 in the area of the channel 30, there is a formation 45 so that the channel 30 does not reduce the overall wall thickness.

When fresh electrolyte is being fed into the cell 10, it flows downwardly along channel 30 and between the surface of the channel and cover 32 and outwardly through the opening 41 for distribution at the bottom of the cell 10. This causes the spent, cooler electrolyte in the cell to rise and flow into overflow box 18 and downwardly through discharge pipe 21 where it is suitably collected. To decant the cell 10, the plug 26 is removed to permit the electrolyte to drain through the decant opening 24 which is above the level that sludge would normally collect. Such sludge may then be drained through a normally plugged drain hole 46. The bottom 12 of the cell may be sloped from one side and one end to facilitate the removal of sludge.

The integral overflow box 18, discharge pipe 21, and decanting passage 24 according to the invention along with the inlet channel 30 and cover 32 eliminate exposed piping employed in prior art cells, and thereby substantially minimizes damage and maintenance expense.

As seen in FIGURE 6, the height of the upper end of pipe 20 may be extended by means of a fitting 50 and an extension pipe 51. The fitting 50 is telescoped over the end of pipe 21 and has an integral flange 53 on its inner surface which engages the upper peripheral edge of pipe 21. Extension pipe 51 has a pair of spaced apart peripheral grooves 55 and 56 in its outer surface for receiving a ring 58. Depending upon the added height de-

sired, ring 58 will be disposed in either the lower or upper grooves. After ring 58 has been positioned, it is force fit into fitting 50 so as to fix the extension 51 in position and to seal its outer periphery. It will be appreciated that if a lower height is desired, ring 58 will be positioned in the upper groove 55. In addition, if greater height is desired, the upper portion of pipe 51 can be extended.

FIGURE 7 shows an alternate embodiment of the cover for channel 30. In particular, cover 62 is relatively plainer so that it does not protrude into the interior of the cell.

FIGURES 8 and 9 show an alternate embodiment of the invention wherein the inlet passage is cast into the end wall 15. In particular, the inlet channel is formed of a pipe 70 cast into wall 15 and having manifold pipes 72 and 73 extending laterally from its lower end and in general parallelism with wall 15. Each manifold pipe 72 and 73 has a plurality of laterally spaced apart pipe sections 75 extending in a direction parallel to the bottom 12 and opening into the cell 10. This provides a more even distribution of fresh electrolyte along the bottom 12 of the cell than can be achieved with the embodiment of FIGURES 1-7. While two pipe sections 75 are illustrated, it will be appreciated that any suitable number or size may be employed without deviating from the invention. Preferably, the diameters of the pipes 75 are greater than that of the pipes 73 as shown in FIGURES 8 and 9.

Another embodiment of the overflow pipe extension is shown in FIGURES 10 and 11 to include a cylindrical member 80 which is telescopically received within overflow pipe 21. A flange 82 extends outwardly from member 80 to divide member 80 into a first portion 80a and a second portion 80b. It can be seen in FIGURES 9 and 10 that the flange 82 has a diameter greater than that of the pipe 21 and is closer to one end of the adapter 80 than the other so that the portion 80b is longer than the portion 80a. As a result, if the portion 80b of member 80 is inserted into pipe 21, the upper end of the extension will be at a first height while if portion 80a is disposed within the pipe 21, the upper end of the extension will have a second, higher elevation. In this manner, the upper end of the overflow pipe can be conveniently adjusted.

Electrolytic cells of the type discussed above must be nonporous and possess sufficient mechanical strength and must be chemically inert relative to the electrolyte which comprises a sulfuric or hydrochloric acid solution. One example of a cell with which the present invention may be used comprises a mixture of 10%-19% by weight of a modified vinylester or polyester thermo-setting resin, and the balance consists of a mixture of crystalline silica particles, and particles taken from the group consisting of mica flakes, glass beads and

chopped fiber glass strands. The vinylester or polyester resin is thinned to reduce viscosity and permit higher filler loading. The viscosity of the vinylester or polyester resin should be less than 200 CPS as measured by a Brookfield viscosity meter Model LVT at 77° F with a 13 spindle at 60 RPM. According to one example, the components by weight of the modified vinylester resin are as follows:

80%-90% vinylester resin;
10%-20% styrene monomer (thinner); 1%-5% degassing agent;
.2%-2% methyl ethyl ketone peroxide, or cumene hydroperoxide (catalyst);
.05%-.2% inhibitor;
.2%-.6% cobalt naphthalate (6%) (promoter)
.02%-.5% dimethyl aniline (100%) (promoter);
Any suitable inhibitor, such as 2,4 pentanedione may be employed and any suitable degassing agent such as xylene or acetone may be used.

The dry mixture comprises:

40%-60% 1/8"-1/4" crystalline silica
10%-25% 1/16"-1/8" crystalline silica
10%-15% 1/32"-1/16" crystalline silica
10%-15% fine silica sand
1% mica flakes
Chopped fiber glass strands 1/4"-1/8" or glass spheres can be substituted for the mica flakes. The proportions of resin and dry ingredients by weight in the final mixture, according to the preferred embodiment of the invention, are as follows:
10%-19% modified vinylester or polyester resin
40%-60% 1/8" x 1/4" crystalline silica
10%-25% 1/16" x 1/8" crystalline silica
10%-15% 1/32" x 1/16" crystalline silica
10%-15% fine silica sand or silica flower
.9%-5% mica flakes, 1/4"-1/8. chopped fiber glass strands, and/or glass spheres

In one specific example a resin mixture was prepared with the following ingredients:

450 pounds vinylester resin;
85 pounds styrene monomer;
13 pounds xylene;
1.5 pounds methyl ethyl ketone peroxide;
15 ounces pentanedione;
22 ounces cobalt naphthalate;
2 ounces dimethyl aniline
Twenty-five pounds of the foregoing modified resin mixture was then mixed with the following quantities of dry ingredients:
100 pounds 1/8"-1/4" crystalline silica
40 pounds 1/16"-1/8" crystalline silica
20 pounds 1/32"-1/16" crystalline silica
20 pounds fine silica sand
2 pounds mica flakes, chopped fiber glass strands 1/4"to 1/8" or glass spheres can be substituted for the mica flakes

The resin acts as a binder for the dry materials and fills the interstices therebetween so that the container is impervious to the electrolyte solution and forms a corrosion-resistant material unaffected by the electrolyte solution. The chopped fiber glass strands, mica and/or glass spheres provide a tighter composite material which also reduces porosity and increases physical strength. The nonconductor reinforcing bars increase physical strength and allow the cells to be supported in only two areas if necessary.

In order to further enhance the corrosion resistance of the cell 10, a corrosion resistant coating 125 is provided. According to the preferred embodiment, coating 125, consists of a backing layer 126 consisting of 20%-30% by weight of an inorganic fiber reinforcement and 70%-80% by weight of pure polyester or vinylester resin. The fiber reinforcement may be a mat of fiber glass strands 1/2"-2" long or a light cloth of fiber glass or other synthetic fiber. One such material is called Nexus veil. In addition, there is a surface coating 127 of vinylester or polyester resin which is 10-20 mils thick. It will be appreciated that the thickness of the layer 126 and the coating 127 are much exaggerated in FIGURE 13 and for purposes of illustration. In actual practice, the walls 113, 114, 115 and 116 are about 2.5"-3.5" thick while the thickness of coating 127 is 10-20 mils.

It was the practice to pour prior art cells in an upright mold. Because the inside bottom, side and end walls of the cell must be smooth to facilitate removal of the sludge, one common practice in molding prior art cells was to pour and trowel the bottom surface before continuing to pour the side and end walls. This sometimes resulted in a cold joint which adversely affected the physical strength of the cell and produced areas of leakage. In the method according to the invention, an inverted mold 130 as shown in FIGURE 5 is used to fabricate the cell 110.

The container according to the preferred embodiment of the invention is formed by applying to the surface of the mold a face layer of polyester or vinylester thermo-setting resin 10-20 mils thick, applying to the coating a backing layer of about 20%-30% by weight of an inorganic fiber reinforcement and about 70%-80% by weight pure polyester or vinylester resin, mixing polyester or vinylester resin and dry ingredients, all identified by the reference numeral 128, and then pouring the same continuously into the inverted mold 130 and onto said backing layer 126. In order to insure that the face coating 127 adheres to the surface of the mold 130, it is applied in the form of a gel coating either by spraying or rolling. One material that has been used successfully is Grey Vinylester, code AG-00003B sold by Co-Plas, Inc. The fiber reinforce-

ment may comprise a fiber glass mat formed of strands 1/2"-2" long or a light cloth of fiber glass or other synthetic material.

The mixture, backing layer 126 and face coating 127 are then allowed to cure at room temperatures. Because an inverted mold is used, the inside bottom, side and end wall surfaces of the face coating are in contact with a smooth mold surface. Accordingly, these surfaces will also be relatively smooth without troweling. This permits continuous casting of the cell to insure that no cold joints are formed. Furthermore, because curing of the resin is air inhibited, the exposed surface layer 127 cures only when the resin and backing layer are allied so that air is excluded. Similarly, the exposed surface of layer 126 will cure only when the resin and and filler 128 are poured. As a result, molecular bonds are formed between the layers 126 and 127 and 126 and 128. These bonds form when air is excluded from the interface of adjacent resin layers and the same cure.

Casting the cell upside down also facilitates the casting of an integral overflow box with the cell. As a result, greater physical strength is achieved over prior art cells where the overflow box was cast separately and then attached to the cell. This prior art method caused leaks and made the overflow box susceptible to mechanical damage.

Because of the strength of the cell made in accordance with the mixture and reinforcing bars discussed above, a cell wall thickness of about two and one half inches at the top and three and one half inches at the bottom is satisfactory for a conventional cell which is about sixteen feet in length, four and one half feet in height and four and one half feet in width. Conventional concrete cells have a wall thickness of about five to six inches. As a result, cells made in accordance with the present invention provides cells with a greater internal capacity for the same outside dimensions. Since the one factor in determining the electrorefining capacity of a refining facility is by the number of cells and their capacity, the use of cells having thinner walls significantly increases total plant capacity. A typical electrolytic refinery has capacity of approximately 120,000 tons per year. This capacity could increase, for example, by approximately 7,000,000 Pounds Per year with the additional internal cell capacity.

While the life expectancy of cells according to the present invention has not as yet been determined, it is estimated that as a result of their physical strength, impermeability and non-conductiveness, their useful life will be much longer than conventional concrete cells. In addition, any physical damage to cells according to the invention can be more readily repaired than prior art concrete cells, thereby reducing maintenance costs and pro-

duction downtime.

The operating temperature of some prior art cells was limited to about 160° F because the plastic linings employed tended to lose shape and reduce useful life at higher temperatures. With the cell according to the present invention, coupled with the use of nonconducting reinforcing rods, higher current densities and temperatures can be employed, thereby increasing production rates, quality and capacity.

Bars of elongate and preformed nonconductive material, such as, for example, precured fiber glass are preferably inserted into the bottom and side walls and corners of bottom-side and bottom-end wall corners of the container as the same is being poured thereby substantially increasing the physical strength properties and minimizing the possibility of electrical short-circuiting due to the use of metallic reinforcing bars in prior art containers. Such reinforcing lap boards which support the bars permit the electrodes to be mounted directly on the cell wall, thereby eliminating the necessity for an insulating board as in prior art devices.

While only a single embodiment of the invention is described herein, it is not intended to be limited thereby but only by the scope of the appended claims.

Claims

1. A container for a corrosive electrolyte used in an electrolytic process, said container consisting of a cured polymer concrete shell and having side walls, a pair of opposed end walls, and a bottom, each of said end walls having inner and outer surfaces, characterized in that a formation is molded on the outer surface of one end wall and extends from its upper and lower ends and intermediate the sides thereof, a recess is formed in the upper end of the formation and opening toward the inner surface of said end wall and below the upper edge thereof, a discharge passage is formed in said formation and spaced from the outer surface of the formation and the inner surface of the end wall, the discharge passage having a first end opening in the formation and a second end opening at the lower end of the formation.
2. The container set forth in Claim 1 further characterized in that there is a second passage formed in said formation and extending generally horizontally from the inner surface of the end wall to the discharge passage.
3. The container set forth in Claim 2 further characterized in that the discharge passage is defined by a first pipe embedded in said formation, and said second passage is formed by a T-connection in said pipe and extending to the inner surface of the end wall.

4. The container set forth in Claim 1 further characterized in that there is a second passage formed in the second end wall and in the inner surface thereof, said second passage extending from the upper end of said wall downwardly to a position adjacent its lower end.

5. The container set forth in Claim 4 further characterized in that the second passage comprises a channel formed in the second end wall and on the inner surface thereof, and a cover is disposed over the channel and has an opening adjacent its upper and lower ends, the cover and the channel defining a vertical passage along the inner surface of the outer wall and which is open at its upper end and adjacent the bottom of the cell.

6. The container set forth in Claim 4 further characterized in that the second passage is defined by a pipe molded into said second end wall and beneath the surface thereof, the pipe defining a vertical passage within the second end wall and which is open at its upper end and adjacent the bottom of the cell.

7. The container set forth in Claim 6 wherein means defining multiple openings are provided at the lower end of the pipe for defining a plurality of openings therein spaced apart adjacent the bottom of the cell for defining a plurality of outlets for the lower end of said passage, whereby fresh electrolyte may be disperse along the bottom of the cell.

8. The container set forth in Claim 7 further characterized in that the multiple opening means are defined by a pair of manifold pipe means disposed in said second end wall and adjacent the lower end thereof, each of the manifold pipe means having a plurality of spaced apart openings communicating with said container.

9. The container set forth in Claim 5 further characterized in that wherein the other end wall has a formation on its outer surface corresponding to the channel and extending from its upper to its lower end so that the channel does not diminish the relative thickness of the end wall at said channel.

10. The container set forth in Claim 9 further characterized in that the channel has an arcuate surface at its lower end facing inwardly, the opening adjacent the lower end of said cover being opposed to said arcuate surface, whereby electrolyte delivered to said passage will flow downwardly along said channel and be redirected by said arcuate surface outwardly of said opening for distribution of the electrolyte along the bottom of the container.

11. The container set forth in Claim 10 further characterized in that there is a third passage formed in the formation and extending generally horizontally from the inner surface of the end wall to the discharge passage.

12. The container set forth in Claim 11 further

characterized in that the discharge passage is defined by a first pipe embedded in said formation, and said second passage is formed by a connection in said pipe and extending to the inner surface of the end wall.

13. The container set forth in Claim 1 and including extension means adjustably coupled to the upper end of the discharge passage means for extending said passage means above the level of the recess.

14. The container set forth in Claim 13 wherein the discharge passage means comprises pipe means embedded in said formation and extending from its upper to its lower end, the extension means comprising a short pipe section, and ring means surrounding the pipe section for engaging the upper end of said pipe means for supporting the pipe section and sealing the outer periphery thereof, the pipe section extending the length of the pipe means above the recess.

15. The container for a corrosive electrolyte as set forth in Claim 2 and further characterized in that a corrosion resistant layer is provided and comprises a face layer of a material taken from the group consisting of vinylester resin and polyester resin and a backing layer consisting of an inorganic fiber impregnated with a material taken from the group consisting of vinylester resin and polyester resin.

16. The container set forth in Claim 15 further characterized in that the backing layer is about 20%-30% by weight fiber and about 70%-80% by weight resin.

17. The container set forth in Claim 16 further characterized in that the inorganic fiber is fiber glass in the form of a mat.

18. The container set forth in Claim 16 further characterized in that the mat is formed of strands 1/2"-2" long.

20. The container set forth in Claim 17 or 18 and further characterized in that the face layer is about 10-20 mils thick.

21. The container set forth in Claim 17 further characterized in that the polymer concrete consists of 10% to 19% by weight of a resin taken from the group consisting of vinylester and polyester thermo-setting resin.

22. The container set forth in Claim 18 further characterized in that the modified resin comprises 80%-90% of a resin taken from the group consisting of vinylester and polyester resin and the balance a thinning agent, inhibitors, promoters and a catalyst.

23. The container set forth in Claim 19 further characterized in that the crystalline silica comprises 40%-60% by weight particles 1/4"-1/8" in size, 10%-25% by weight particles 1/8"-1/16" in size and 10%-15% by weight particles 1/16"-1/32" in size, 10%-15% fine silica sand or silica flour and including .9%-5% by weight particles taken from

the group consisting of mica flakes about 1/64" in size and 1/4"-1/8" chopped fiber glass strands.

24. A method of manufacturing the container set forth in Claim 1 characterized in that said method comprises the steps of applying to the surface of a mold, a face layer consisting of a material taken from the group consisting of vinylester resin and polyester resin, applying to said face layer a backing layer consisting of an inorganic fiber mat impregnated with material taken from the group consisting of polyester resin and vinylester resin, mixing a thermo-setting resin taken from the group consisting of vinylester and polyester resin and an aggregate, and continuously pouring the mixture into an inverted mold having said face layer and backing which defines bottom, ends and side walls and allowing said molded mixture to cure whereby the surfaces of the container will contact the mold surfaces so that smooth inner surfaces will be molded.

25. The method set forth in Claim 24 wherein said inorganic fiber is fiber glass in the form of a mat.

26. The method set forth in Claim 24 wherein said mat is formed of strands 1/2"-2" long.

27. The method set forth in Claim 14 wherein said face layer is above 10-20 mils thick.

28. The method set forth in Claim 27 further characterized in that the backing layer is about 20%-30% by weight fiber and about 70%-80% by weight resin.

29. The method set forth in Claim 28 further characterized in that the aggregate comprises a mixture of 80%-90% by weight of particles which are 1/4"-1/32" in size, 10%-15% by weight particles taken from the group consisting of fine silica sand silica flour and .9%-5% by weight of particles taken from the group consisting of mica flakes about 1/64" in size and chopped fiber glass strands 1/4"-1/8. in size.

30. The method of set forth in Claim 28 further characterized in that the modified resin comprises 80%-90% of a resin taken from the group consisting of vinylester and polyester resin and the balance a thinning agent, inhibitors, promoters and catalyst.

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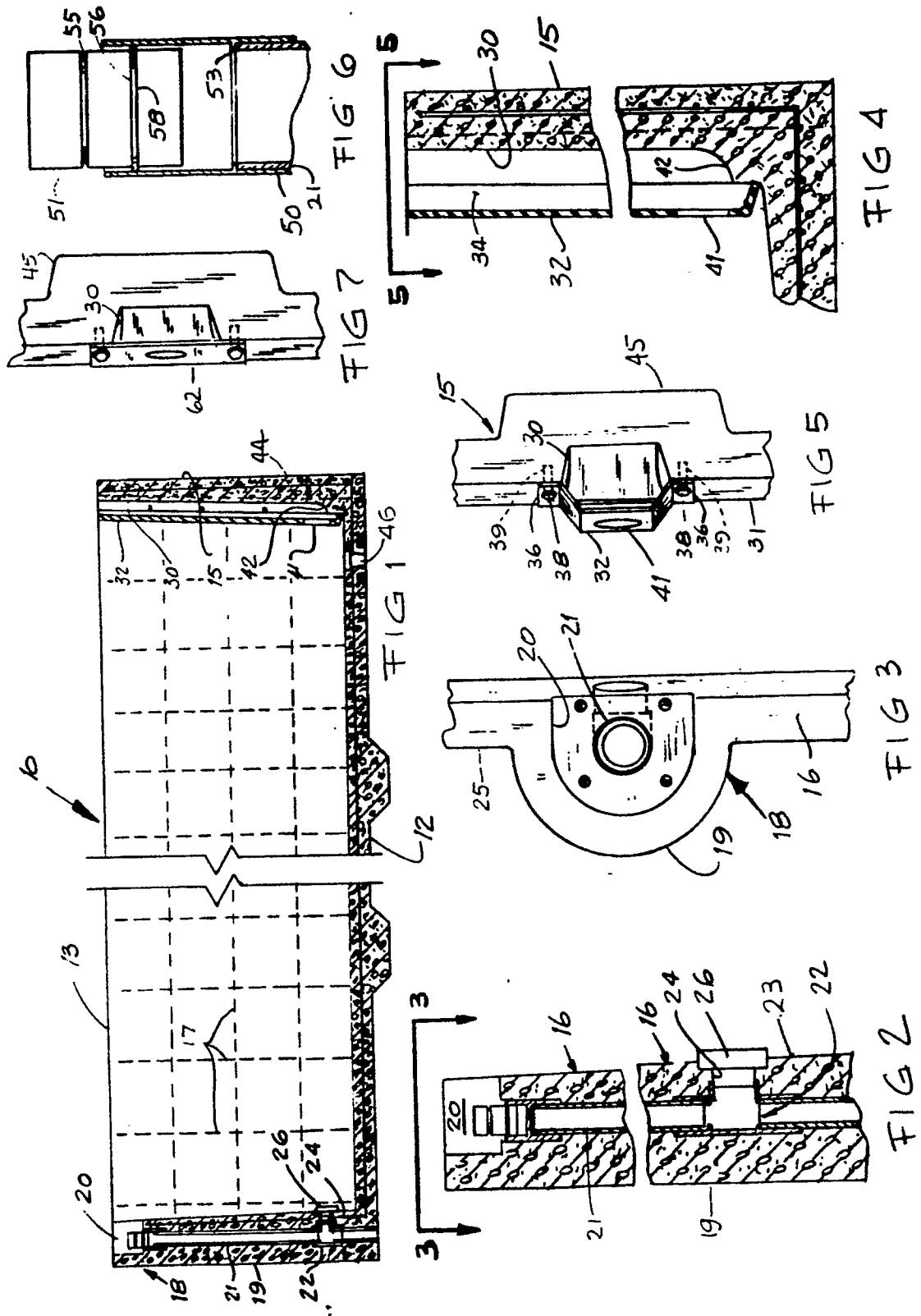
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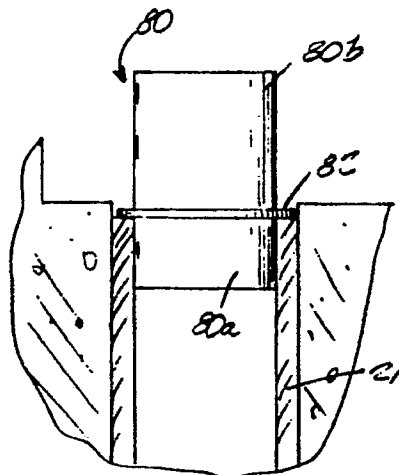
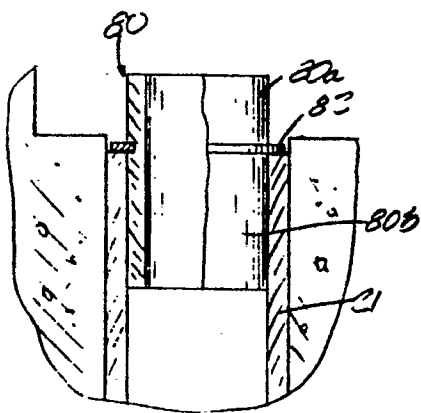
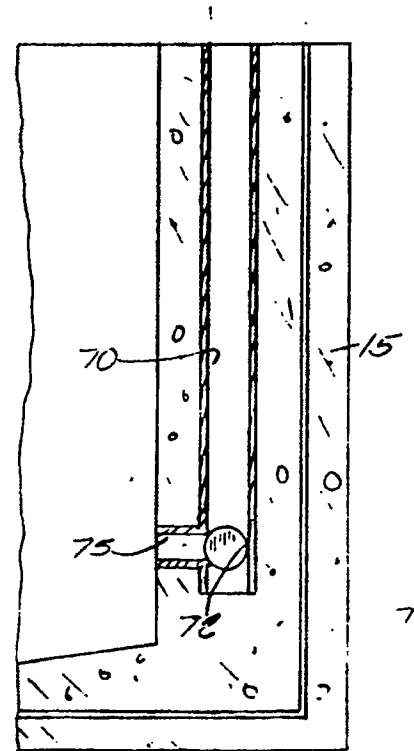
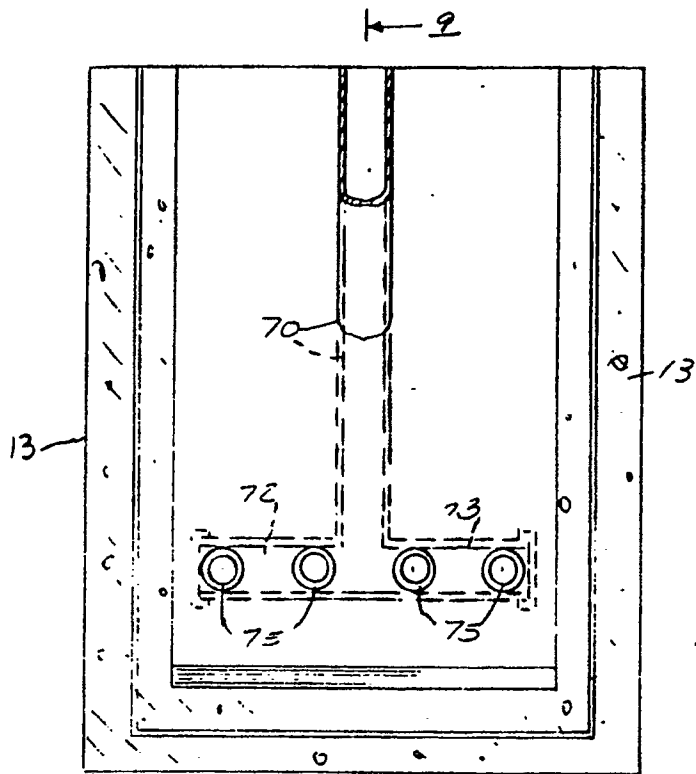
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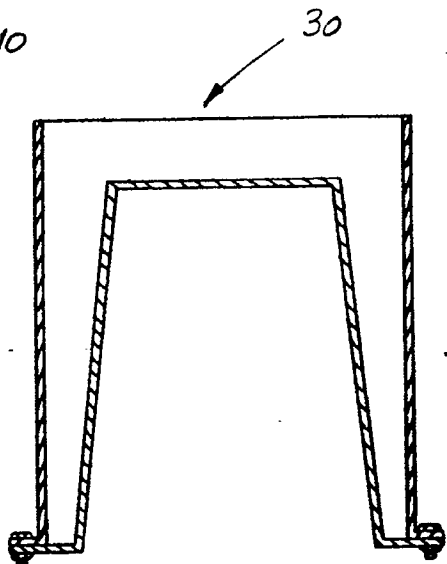
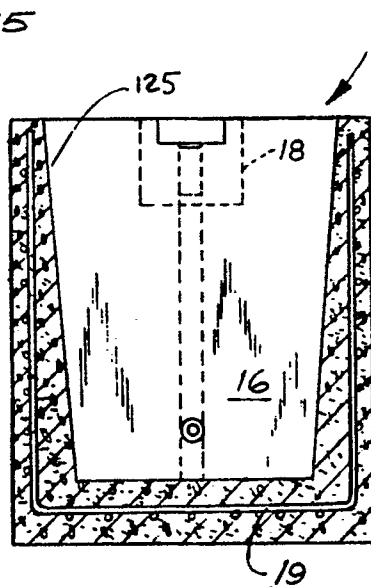
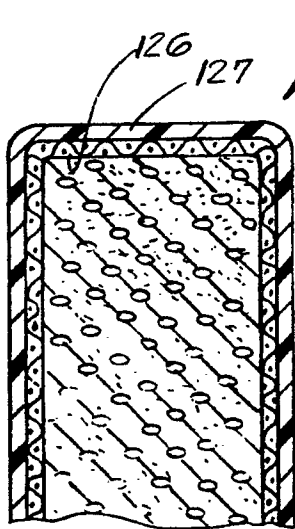
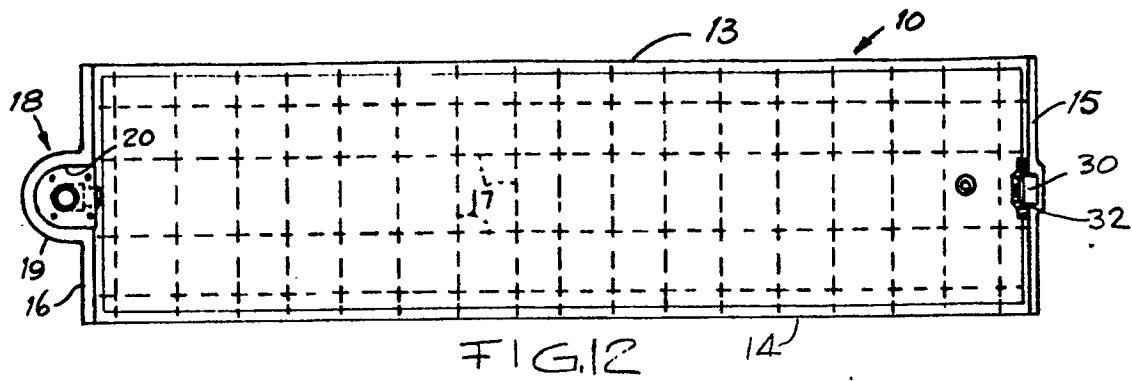
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EUROPEAN SEARCH REPORT

Application Number

EP 90 12 0914

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 170 740 (NONCOR LININGS N.V.) * Pages 14-17; claims * - - -	1,24	C 25 C 7/00 C 25 B 9/00
A	US-A-3 682 809 (K.F. MARQUARDSON) * Column 3, lines 29-50; figures 1,2 * - - -	1,13	
A	FR-A-1 177 974 (SOLVAY) * Page 2, abstract * - - -	1,17	
P,A	US-A-4 885 072 (J.O. HARRY) * Whole document * - - - - -	22-30	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			C 25 C 7 C 25 B 9
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 29 January 91	Examiner GROSEILLER PH.A.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ----- &: member of the same patent family, corresponding document			