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(54) METHODS AND SYSTEMS FOR ASSEMBLING ELECTROLYZER STACKS

(75) Inventor: **Dana Ray Swalla**, Schenectady, NY (US)

Correspondence Address:
GE TRADING & LICENSING
1 RESEARCH CIRCLE, ATTN: BRANDON, K1 - 2C11
NISKAYUNA, NY 12309 (US)

(73) Assignee: **General Electric Company**, Schenectady, NY (US)

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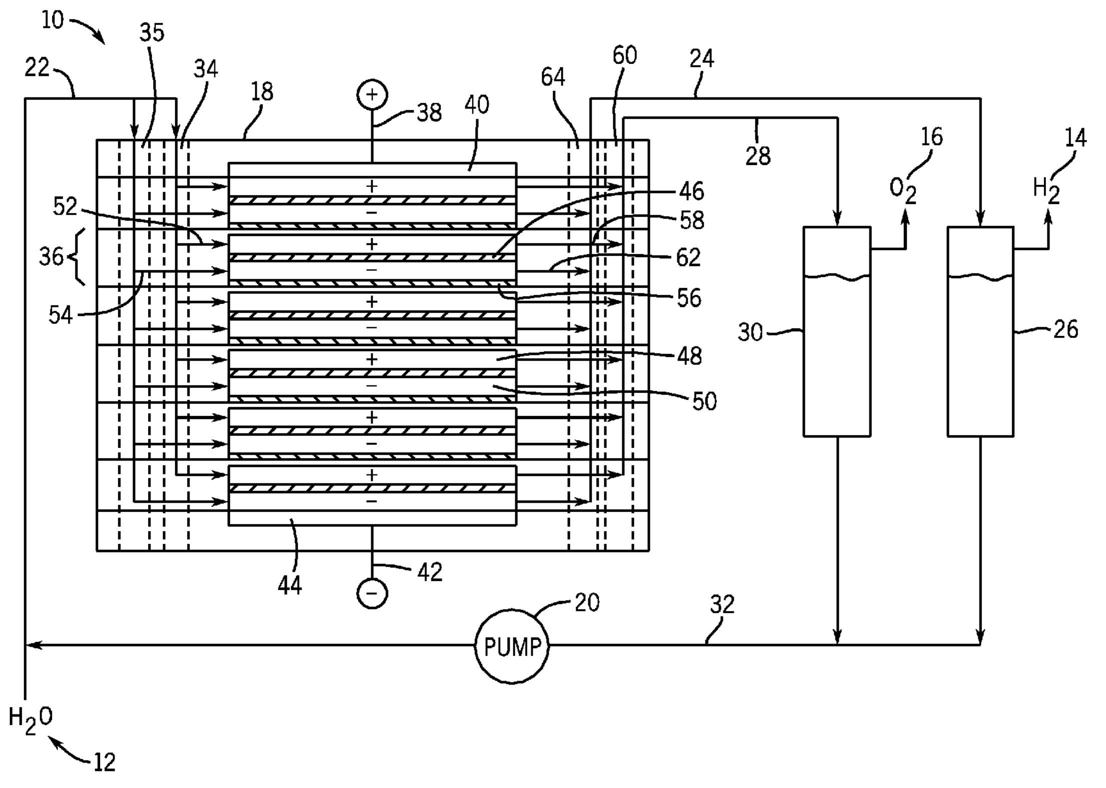
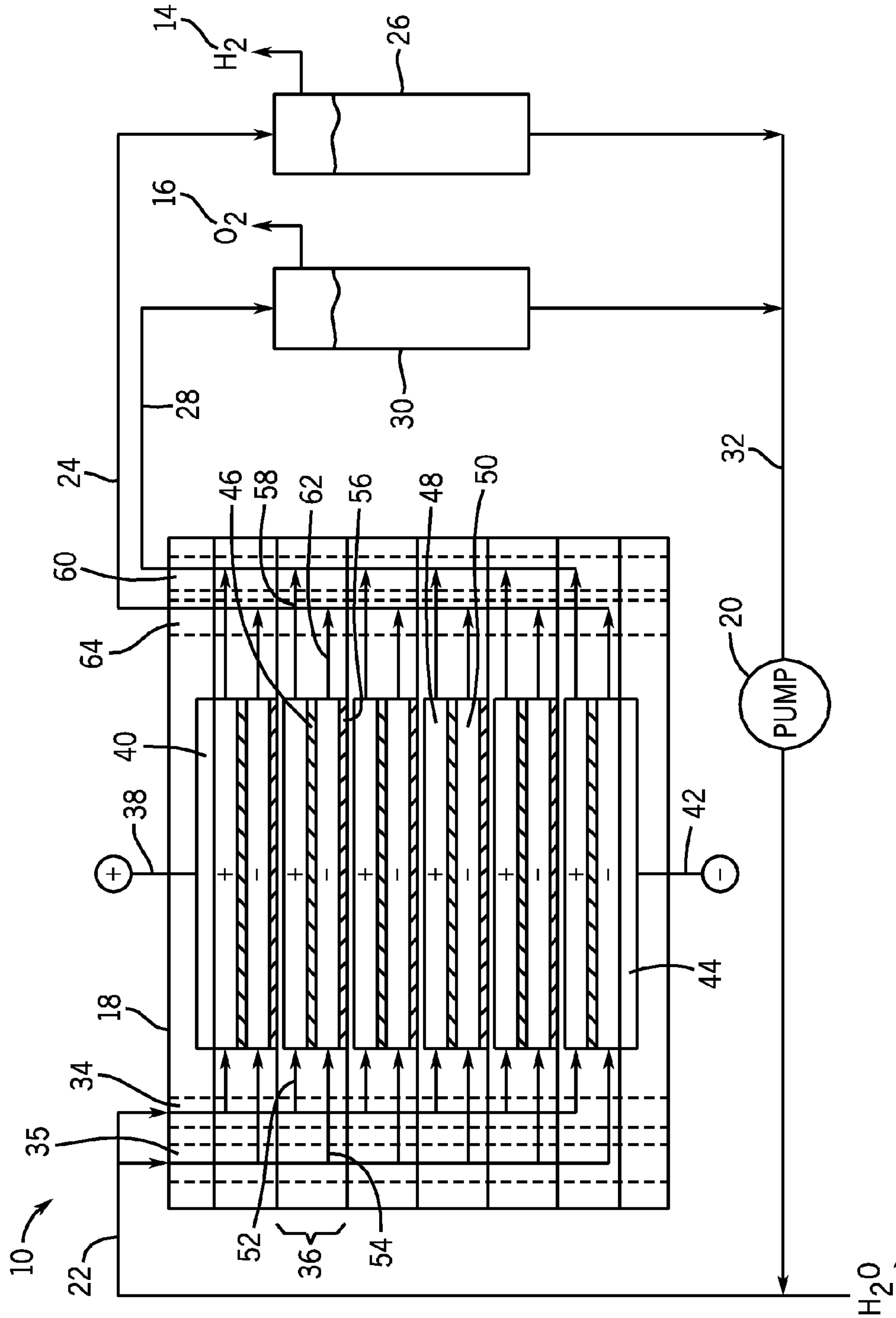
(57) ABSTRACT

The present techniques provide systems and methods for assembling electrolyzers from parts which have internal structures that form fluid flow channels when placed adjacent to one another. In a contemplated embodiment, the assembly technique may use alignment bars, inserted through openings in the individual parts to hold the parts in alignment, while other structures apply pressure to hold the structure together. In another contemplated embodiment, the parts may be aligned by having ridges, or other protrusions, formed on the parts that mate with openings on adjacent parts. The applied pressure seals fluid flow channels formed in the electrolyzer and extending through the joined parts. The use of pressure to hold the structure together allows for the servicing and replacement of individual parts.

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H_2
26
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FIG. 1

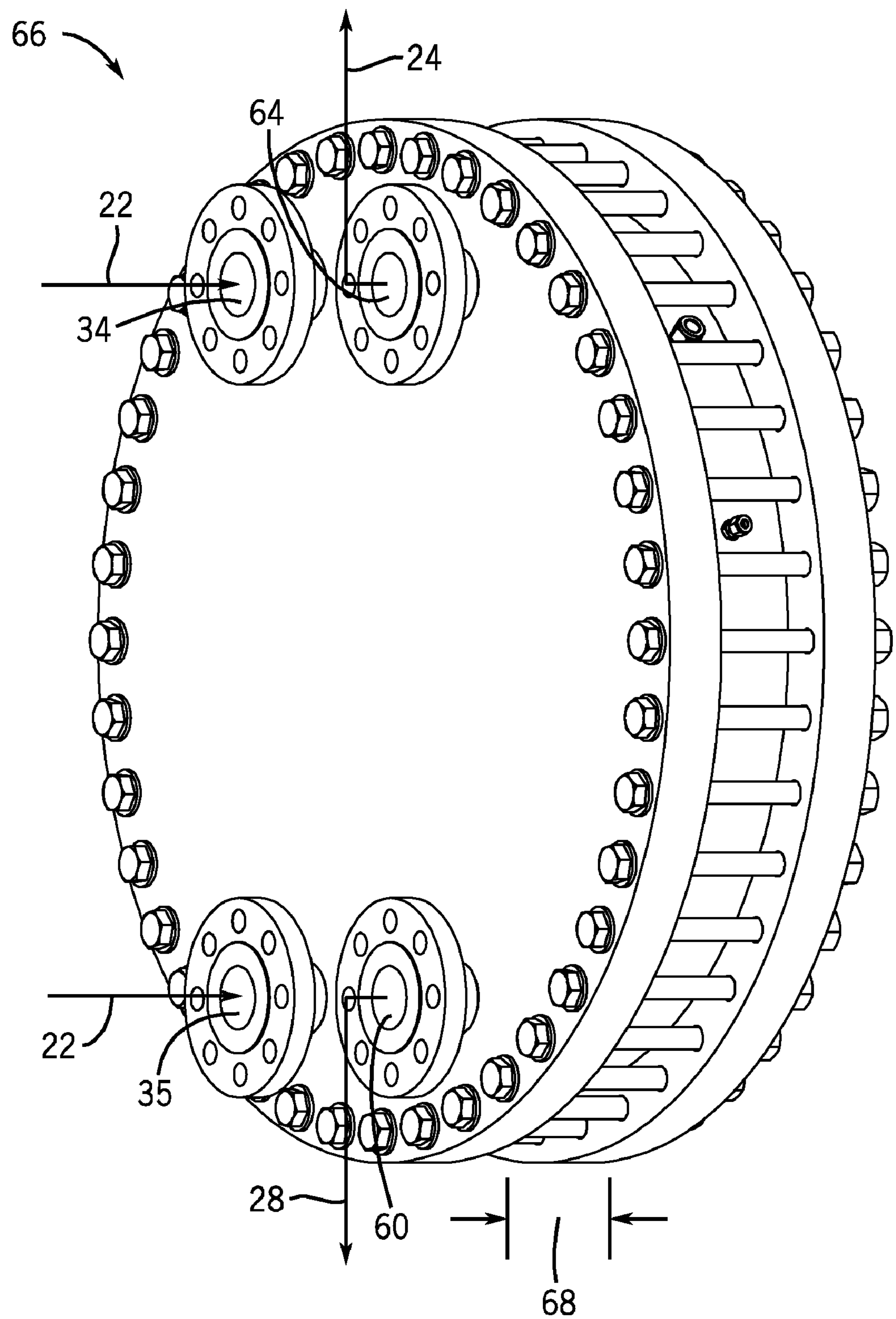

FIG. 2

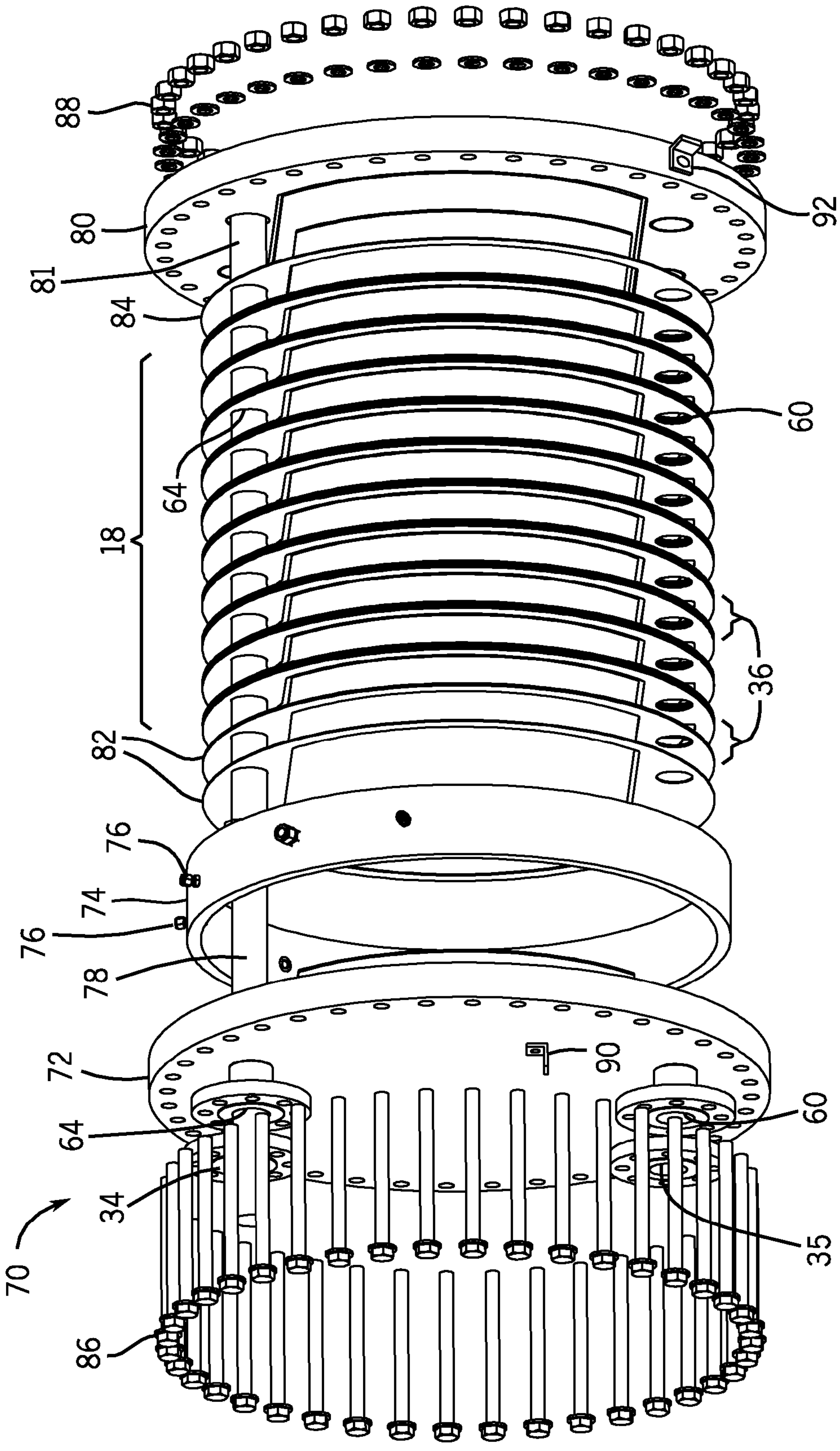

FIG. 3

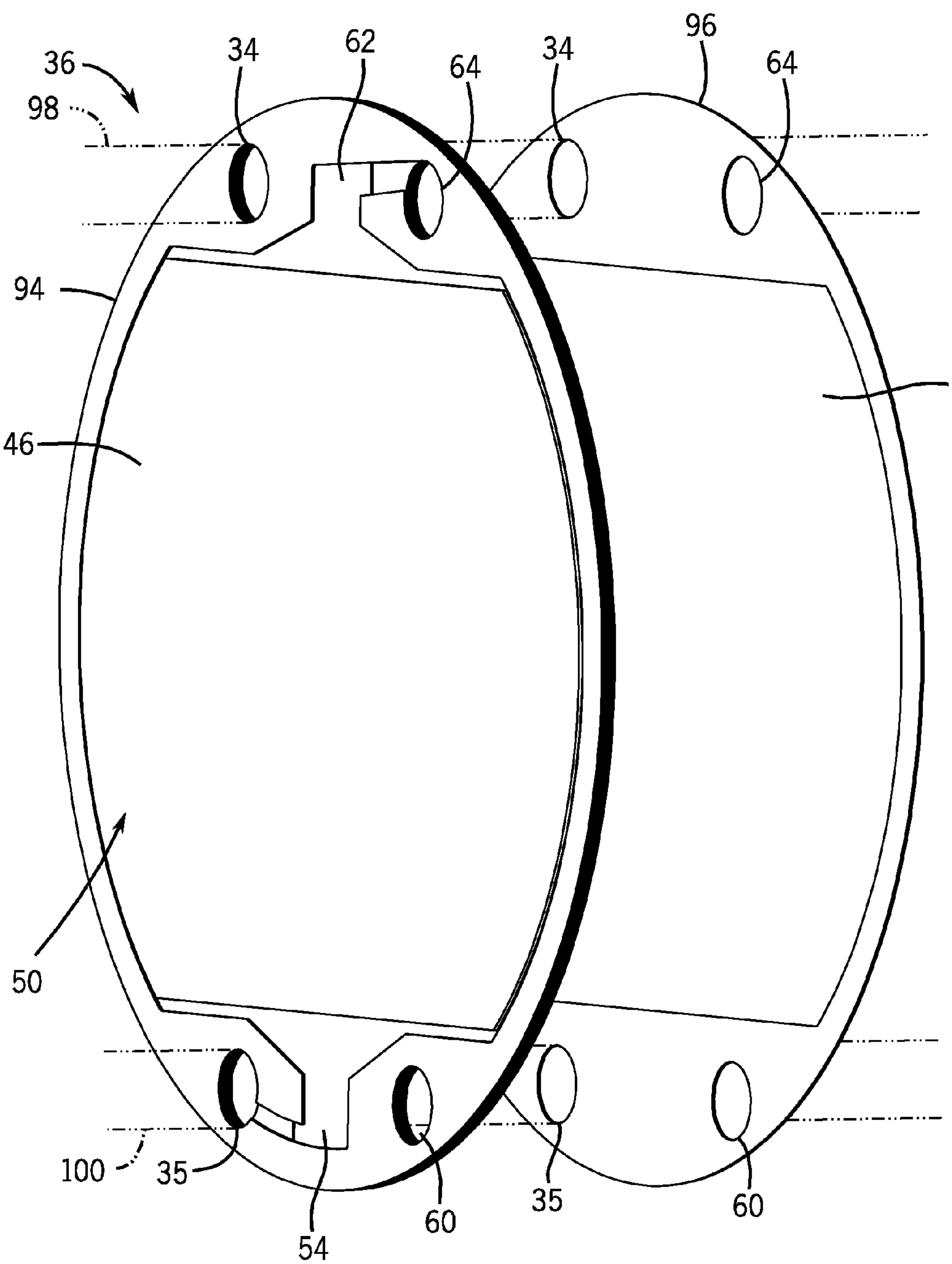

FIG. 4

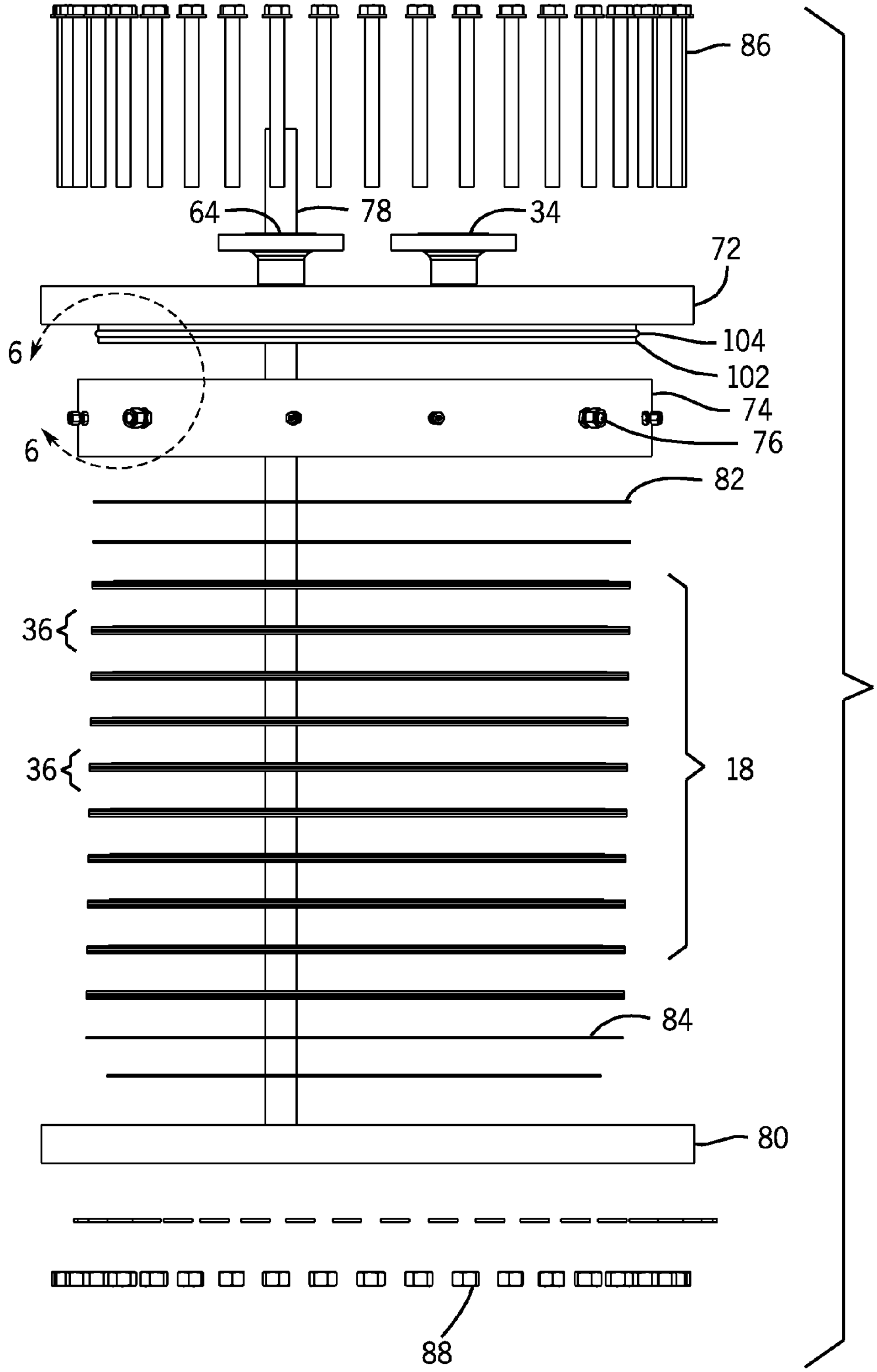

FIG. 5

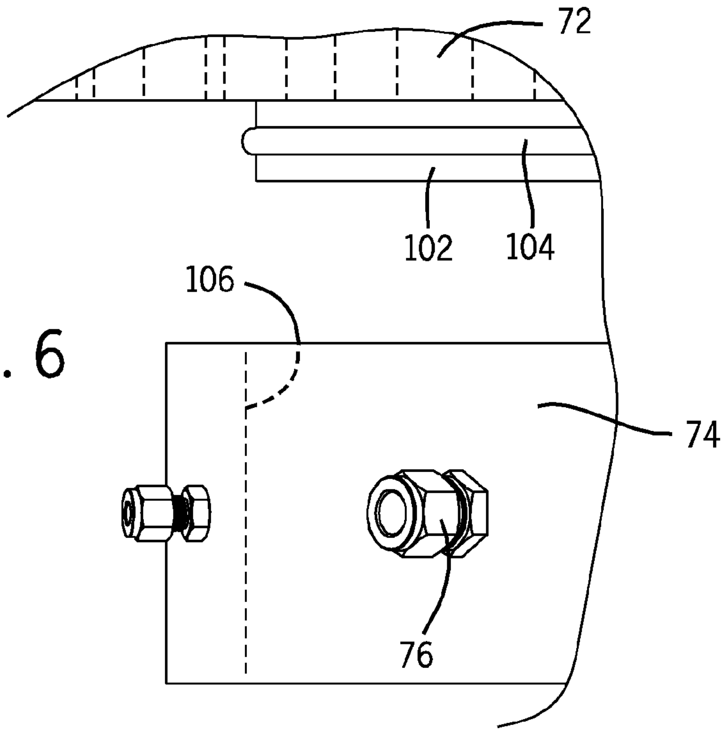
72
102
104
106
74
76

FIG. 6

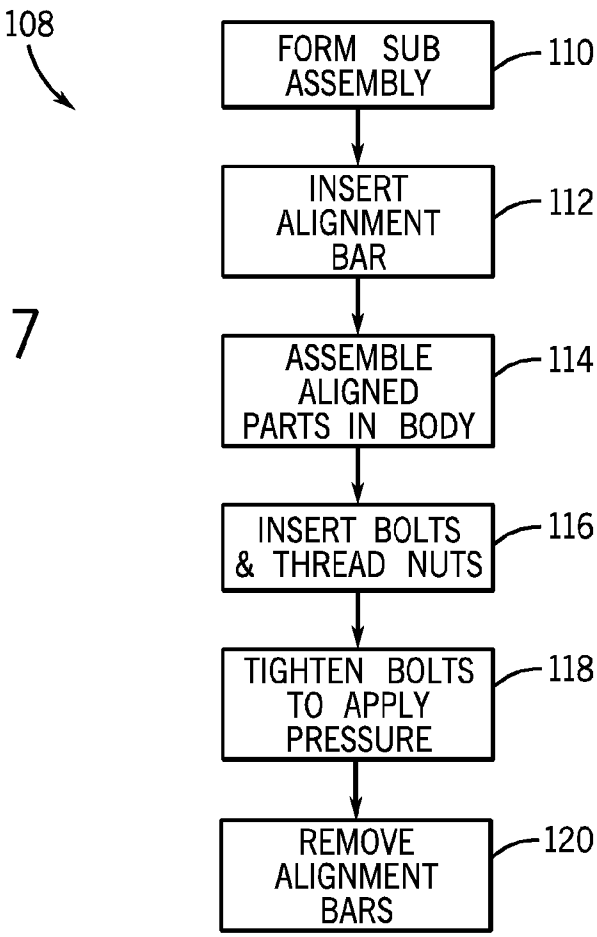
108
FORM SUB ASSEMBLY
110
INSERT ALIGNMENT BAR
112
ASSEMBLE ALIGNED PARTS IN BODY
114
INSERT BOLTS & THREAD NUTS
116
TIGHTEN BOLTS TO APPLY PRESSURE
118
REMOVE ALIGNMENT BARS
120

FIG. 7

METHODS AND SYSTEMS FOR ASSEMBLING ELECTROLYZER STACKS

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH & DEVELOPMENT

[0001] This invention was made with Government support under contract number DE-FC07-06ID14789 awarded by the Department of Energy. The Government has certain rights in the invention.

BACKGROUND

[0002] This invention generally relates to methods of assembling electrolyzer stacks, and in particular to a method of sealing electrolyzer cells together to form fluid channels in electrolyzer stacks.

[0003] Electrochemical devices are useful in chemical reactions in which electrons may participate as reactants or products. For example, an electrolytic cell may use electrical energy to split lower energy reactants into higher energy products, which may then be used as materials, reactants, or in power generation. In another example, voltaic cells and fuel cells may be used to chemically combine higher energy products to form lower energy products, releasing electrons that may be used to power other devices. While in voltaic cells, the electrode may be consumed during the reaction, in a number of other electrochemical devices, such as electrolytic cells and fuel cells, the electrode is not intended to be a reactant, but merely to catalyze the reaction and collect or donate the current from the reaction.

[0004] Electrolytic cells may be useful in a number of processes, such as the splitting of water into oxygen and hydrogen in an electrolyzer. The hydrogen generated may be used in chemical processes, such as hydroformulation or hydrocracking in refineries, or may be stored for later use, such as in the generation of energy in a fuel cell. Electrolyzers may be assembled from a stack of individual plastic components that are joined together to form a contiguous structure, generally by adhesives or welding.

[0005] However, permanently joining the components may be disadvantageous for a number of reasons. For example, the failure of an individual part in an electrolyzer stack my require replacement of the entire electrolyzer stack, particularly if individual modules, sections or parts cannot be serviced or replaced. Accordingly, it would be desirable to have techniques for assembling electrolyzer stacks to form a hermetic seal between the individual parts in ways that permit disassembly, servicing, and replacement.

BRIEF DESCRIPTION OF THE INVENTION

[0006] An embodiment of the present techniques provides an electrolyzer that includes a plurality of electrolyzer cells placed adjacent to one another to form a stack. Each electrolyzer cell includes an electrode assembly and a diaphragm assembly, and the diaphragm assembly of each electrolyzer cell is placed adjacent to an electrode assembly of another electrolyzer cell. An internal fluid channel through the stack is formed by an internal structure of each of the electrolyzer cell, and a mounting configured to maintain a compressive force on the stack seals the internal fluid channel.

[0007] Another embodiment provides a method of assembling an electrolyzer that includes assembling a plurality of cells in an aligned stack. Each cell includes a metal plate and a diaphragm, and has apertures, that when aligned with an adjacent cell, form a fluid channel. The fluid channel is sealed by maintaining a compressive force on the stack.

[0008] Another embodiment provides a method of assembling an electrolyzer, which includes assembling a plurality of electrolyzer cells. Each electrolyzer cell includes a metal plate and a diaphragm, and has a structure configured to form a fluid channel when aligned with other electrolyzer cells. The electrolyzer cells are aligned to form an electrolyzer stack having a first end, a second end, and an internal fluid channel. A body is placed around the electrolyzer stack and an end cap is placed over an end of the body. The end cap has an aperture aligned with the channel in the electrolyzer stack. A base plate over another end of the body to create a compressive force to seal the internal channel in the electrolyzer stack securing the end cap and the base plate to the body.

DESCRIPTION OF THE DRAWINGS

[0009] These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawing.

[0010] FIG. **1** is a diagrammatic representation of an electrolyzer system according to embodiments of the present techniques;

[0011] FIG. **2** is a perspective view of an exemplary assembled electrolyzer;

[0012] FIG. **3** is an exploded view of the electrolyzer of FIG. **2**, showing the individual parts of the assembly;

[0013] FIG. **4** is a perspective view of an exemplary electrolytic cell that may be used in the electrolyzer of FIG. **3**;

[0014] FIG. **5** is an exploded view of the electrolyzer of FIG. **2**, showing the use of a protruding lip on the end cap that may be used to place pressure on the electrolyzer stack;

[0015] FIG. **6** is a magnified view of the protruding lip of FIG. **5**; and

[0016] FIG. **7** is diagram illustrating exemplary steps in a method for assembling an electrolyzer in accordance with embodiments of the present techniques.

DETAILED DESCRIPTION

[0017] As discussed in detail below, the present techniques provide systems and methods for assembling electrolyzers from parts which have internal structures that form fluid flow channels when placed adjacent to one another. In a contemplated embodiment, the assembly technique may use alignment bars, inserted through openings in the individual parts to hold the parts in alignment, while other structures apply pressure to hold the structure together. In another contemplated embodiment, the parts may be aligned by having ridges, or other protrusions, formed on the parts that mate with openings on adjacent parts. The applied pressure seals fluid flow channels formed in the electrolyzer and extending through the joined parts. The use of pressure to hold the structure together allows for the servicing and replacement of individual parts.

[0018] An example of an electrolyzer system **10** that may be assembled by the present techniques is illustrated by the schematic diagram of FIG. **1**. In the electrolyzer system **10**, water **12** is split into hydrogen **14** and oxygen **16** by an electrolyzer stack **18**. In operation, a pump **20** maintains a continuous flow of an electrolyte solution **22** through the electrolyzer stack **18**. Generally, the electrolyte solution **22** is an aqueous solution of about 20 wt % to about 40 wt. %, or about 30 wt %, potassium hydroxide (KOH) or sodium hydroxide (NaOH), although any number of other ionic solutions may be used. For example, the electrolyte solution **22** may contain lithium hydroxide or other metals.

[0019] As a portion of the water **12** is converted to hydrogen **14** and oxygen **16**, additional water **12** is added prior to returning the electrolyte solution **22** to the electrolyzer stack **18**. As discussed in further detail below, the electrolyzer stack **18** produces a hydrogen stream **24** containing bubbles of hydrogen **14** in the electrolyte solution **22**. The hydrogen stream **24** is directed to a hydrogen separator **26**, where the hydrogen **14** separates out and is collected for storage or use. The electrolyzer stack **18** also produces a separate oxygen stream **28** containing bubbles of oxygen **16** in the electrolyte solution **22**, which is directed to an oxygen separator **30**. In the oxygen separator **30**, the oxygen **16** is separated from the electrolyte solution **22**. The hydrogen separator **26** and oxygen separator **30** may generally function as reservoirs for the electrolyte solution **22**. From the separators **26**, **30** a return electrolyte solution **32** may be directed to the pump **20**, where it is circulated to the electrolyzer stack **18**.

[0020] In the electrolyzer stack **18**, two inlet channels **34**, **35** direct the electrolyte solution **22** to a number of individual electrolyzer cells **36**. The inlet channels **34**, **35** are formed by adjacently aligned apertures formed in each of the electrolyzer cells **36**. The electrolyzer cells **36** are stacked and electrically connected in series by the electrolyte solution **22**. Generally, the electrolyzer cells **36** are joined, for example, by welding, to form a single structure, in which the inlet channels **34**, **35** form one of two sets of flow paths through the structure. However, embodiments of the present techniques allow for assembling an electrolyzer stack **18** without forming a permanent bond between the electrolyzer cells **36**, by placing the electrolyzer stack **18** under pressure during assembly and use. This holds the electrolyzer cells **36** together with sufficient pressure to form a hermetic seal between the individual electrolyzer cells **36**. Further, these techniques may allow the electrolyzer stack **18** to be serviced by the replacement of or access to individual cells **36**.

[0021] In the illustrated embodiment, the electrolyzer stack **18** contains 10 electrolyzer cells **36**, although any number may be included, such as 50, 75, 100, or more electrolyzer cells **36** depending on the current available and the production rates desired. At one end of the electrolyzer stack **18**, a positive source **38** is connected to a positive current collector **40**. At the other end of the stack, a negative source **42** is connected to a negative current collector **44**. A metal plate **46** disposed within each of the electrolyzer cells **36** functions as a bipolar electrode. As current is passed through the electrolyte solution **22**, a positive charge is induced on the side of the metal plate **46** closest to the positive electrode **38**, forming an anodic surface **48**. Similarly, a negative charge is induced on the side of the metal plate **46** closest to the negative electrode, forming a cathodic surface **50**. The metal plate **46** may have a wire mesh welded to the surfaces **48**, **50** to increase the surface area.

[0022] Generally, during electrolysis, the difference in charge between the anodic surface **48** and cathodic surface **50** may be on the order of about 1.5 volts to about 2.2 volts. Accordingly, as the electrolyzer cells **36** are in series, the voltage supplied to the electrolyzer stack **18** will be increased to accommodate the number of electrolyzer cells **36** in the stack. For example, the voltage supplied to the electrolyzer stack **18** may range from about 15 to about 22 volts, for embodiments with 10 electrolyzer cells **36** and range from about 150 volts to about 220 volts, for embodiments with 100 electrolyzer cells **36**. Other voltages, and indeed, other charge application schemes may also be envisaged.

[0023] During operation of the electrolyzer stack **18**, the electrolyzer solution **22** is passed over the anodic surface **48** of the metal plate **46** through a channel **52** formed in each of the electrolyzer cells **36** and connected to inlet channel **34**. A second channel **54** directs electrolyte solution **22** from inlet channel **35** over the cathodic surface **50** of the metal plate **46**. The water **12** in the electrolyte solution **22** is split into oxygen **16** at the anodic surface **48** and hydrogen **14** at the cathodic surface **50**. The bubbles of hydrogen **14** and oxygen **16** are isolated from each other by a liquid permeable membrane **56**, which allows water and ions from the electrolyte solution **22** to flow conducting current, between the anodic surface **48** and the cathodic surface **50**, but generally prevents the transfer of gas. The liquid permeable membrane **56** may be made from any number of hydrophilic polymers, including, for example, polysulfones, polyacrylamides, and polyacrylic acids, among others.

[0024] The oxygen stream **28** formed at the anodic surface **48** in each of the electrolyzer cells **36** is directed through an oxygen channel **58** to an oxygen outlet channel **60**. From the oxygen outlet channel **60**, the oxygen stream **28** is directed to the oxygen separator **30**. Similarly, the hydrogen stream **24** formed at the cathodic surface **50** of each of the electrolyzer cells **36** is directed through a hydrogen channel **62** to a hydrogen outlet channel **64**. From the hydrogen outlet channel **64**, the hydrogen stream **24** is directed to the hydrogen separator **26**. As for the inlet channels **34**, **35**, the electrolyzer cells **36** have adjacently aligned apertures that form the outlet channels **60**, **64** when electrolyzer cells **36** are joined together to form the final structure. Accordingly, it is desirable that the electrolyzer cells **36** be hermetically sealed to each other to prevent mixing of the hydrogen **14** and oxygen **16** between the outlet channels **60**, **64**, or other parts of the electrolyzer stack **18**.

[0025] The electrolyzer stack **18** is generally mounted in an enclosure as illustrated in FIG. **2**, forming an electrolyzer **66**. The electrolyzer **66** has connections for the inlet channels **34**, **35** to allow the flow of electrolyte solution **22** into the electrolyzer **66**. The electrolyzer **66** also has connections for the oxygen outlet channel **60** to allow the oxygen stream **28** to be removed, and the hydrogen outlet channel **64** to allow the hydrogen stream **24** to be removed. In the illustrated embodiment, the structure forms a pressure vessel, and the connections are flanged connections for interfacing with mating piping. Other physical configurations may, of course, be envisaged. Generally, in a presently contemplated embodiment, the thickness **68** of the electrolyzer **66** may be about 150 cm, but the actual size and dimensions will vary depending upon the number of electrolyzer cells used. The details of the electrolyzer **66** may be seen more clearly in FIG. **3**.

[0026] FIG. **3** illustrates an exploded view **70** showing the individually components of the electrolyzer **66**. As shown in this view, the electrolyzer has an end cap **72**, which has connections to the inlet channels **34**, **35** and outlet channels **60**, **64**. The body **74** of the electrolyzer has a number of connectors **76** mounted along the periphery to allow pressure to be applied during operation. The pressure applied is outside of the electrolyzer stack **18** (within the body **74**) to reduce hoop stress on the electrolyzer stack **18** by generally equalizing or reducing the pressure differential between the interior and exterior regions of the stack.

[0027] The electrolyzer stack **18** is assembled by stacking the electrolyzer cells **36** together to form a single unit, with the apertures in each of the electrolyzer cells **36** aligned to form the inlet channels **34**, **35** and outlet channels **60**, **64**. The alignment of the electrolyzer cells **36** may be performed by inserting an alignment bar **78** through the parts, for example, through the hydrogen outlet channel **64**, as shown. Other alignment bars (not shown) may be inserted through the other channels **34**, **35**, and **60** to further improve the alignment. Further, the electrolyzer cells **36** may be aligned by mating protrusions (not shown) in the surface of the electrolyzer cell **36** with corresponding indentations on adjoining electrolyzer cells **36**.

[0028] A base plate **80** is mounted against the body **74** opposite the end cap **72**. The base plate **80** may have depressions **81** into which the alignment bar **78** may be inserted, aligning the base plate **80** with the rest of the electrolyzer **66**. The end cap **72**, base plate **80**, and body **74** may be constructed from any suitable materials, such as stainless steel, hastalloy, nickel, and so forth. Further, the parts do not have to be made from metal, as a high performance plastic may provide sufficient properties. Suitable high performance plastics may include, for example, polyphenylene sulfide (PPS) or poly(ether-ether-ketone) (PEEK), among others. Moreover the parts may be made of the same material or may be of different materials. For example, the end cap **72** and the base plate **80** may be made from stainless steel, while the body **74** may be made from a high-performance plastic, thereby insulating the end cap **72** from the base plate **80**. The end cap **72** may also be insulated from the base plate **80** by the use of gaskets (not shown) between end cap **72**, the body **74**, and the base plate **80**.

[0029] To place the electrolyzer cells **36** under pressure, one or more spacer plates **82** may be inserted insulate the electrolyzer stack **18** from the end cap **72**. Further, a gasket **84** may be inserted to add additional pressure, and/or to insulate the stack from the base plate **80**. The pressure applied to the electrolyzer stack **18** may be controlled by the number and thickness of the spacer plates **82**. For example, two spacer plates **82** may provide a pressure of about 6.89 bar (100 psi). Other pressures that may be used in embodiments depend on the materials used, as discussed further below. Other ways of imposing pressure on the electrolyzer stack **18** may be used, including an end cap **72** with a protruding lip, as discussed with respect to FIG. **5** below.

[0030] The entire assembly may be held together by bolts **86** inserted through the end cap **72** and base plate **80**, which are threaded into nuts **88** after insertion through the base plate **80**. The bolts **86** will apply the pressure used to seal the electrolyzer cells **36** against each other, forming the inlet channels **34**, **35** and outlet channels **60**, **64**. A power terminal **90** may be welded onto the end cap **72** which may then function as one of the current collectors **40**, **44**. Another power terminal **92** welded onto the base plate **80** may allow the base plate **80** to function as the oppositely charged current collector.

[0031] It should be noted that additional elements may also be placed between the cells to aid in assembly and/or sealing. For example, the cells may be mated through the intermediary of a seal or seal assembly (not shown) that may be placed between adjacent cells or cell elements (i.e., adjacent electrode and diaphragm assemblies). Such seals may be disposed on a surface of one or both of the adjacent elements, or may be recessed in grooves or other structures formed or machined into the elements.

[0032] An individual electrolyzer cell **36** that may be used in the electrolyzer stack **18** is shown in the perspective view of FIG. **4**. The electrolyzer cell **36** generally includes two parts, an electrode assembly **94** mounted to a diaphragm assembly **96**. Both assemblies **94**, **96** have apertures which align with one another, and with other electrolyzer cells to form the inlet channels **34**, **35** and the outlet channels **60**, **64**. The electrode assembly **94** holds the metal plate **46** that forms the bipolar electrode. One side of the electrode assembly **94** has the channel **54** molded in to direct flow of the electrolyte from one of the inlet channels **35** across the cathodic surface **50** of the metal plate **46**. The flow with entrained hydrogen bubbles is then directed to the hydrogen outlet channel **64** via hydrogen channel **62**, which may also be molded into the electrode assembly **94**. An analogous set of channels on the opposite side of the metal plate **46** directs the flow of oxygen **16**.

[0033] The electrode assembly **94** and the diaphragm assembly **96** may be made from any number of materials, and in a presently contemplated embodiment, include a peripheral frame made of a non-conductive, chemically resistant plastic. The plastic material may generally be chemically resistant to an oxidative environment, a reducing environment, an acidic environment, a basic environment, or any combination thereof. For example, the frames of the assemblies **94**, **96**, may be made from polyimides, polyamides, polyetheretherketones, polyethylenes, fluorinated polymers, polypropylenes, polysulfones, polyphenylene oxides, polyphenylene sulfides, polyphenylethers, polystyrenes, polyether imides, epoxies, polycarbonates, impact-modified polyethylene, impact-modified fluorinated polymers, impact-modified polypropylenes, impact-modified polysulfones, impact-modified polyphenylene oxides, impact-modified polyphenylethers, impact-modified polyphenylene sulfides, impact-modified polystyrene, impact-modified polyetherimide, impact-modified epoxies, impact-modified polycarbonates, or any combinations thereof. Other polymers that may be used include high performance blends, such as Noryl, which is a blend of polyphenylether and polystyrene (PS) (available from SABIC Innovative Plastics of Pittsfield, Mass.).

[0034] The materials selected for the electrode assembly **94** and diaphragm assembly **96** will determine the pressure that needs to be applied to the electrolyzer stack **18** to form a hermetic seal between each electrolyzer cell **36**. Specifically, the compliance, or modulus, of the plastic will determine what applied pressure will result in formation of a seal. If the pressure is too low relative to the compliance, the plastic may not adequately seal, allowing the hydrogen **14** and oxygen **16** to mix through leaks between the outlet channels **60**, **64**. If the pressure is too high, the plastic may crack, also allowing leaks to form. In presently contemplated embodiments, the pressure applied to the electrolyzer stack **18** may be about 2 bar, 3 bar, 5 bar, 7 bar, 9 bar, or higher.

[0035] The diaphragm assembly **96** may be permanently joined to the electrode assembly **94** to form the electrolyzer cell **36**. The two assemblies **94**, **96** may be joined by any number of techniques including adhesives, ultrasonic welding, thermal welding, compression, and so forth. The diaphragm assembly **96** holds the liquid permeable membrane **56**, which prevents mixing of oxygen **16** formed on the anodic surface **48** of the metal plate **56** with hydrogen **14** formed on the cathodic surface **50** of an adjoining metal plate. In other contemplated embodiments, the electrode assembly **94** and diaphragm assembly **96** may be left as separate units, and held together by pressure in the final assembled electrolyzer **66**.

[0036] The electrolyzer cell **36** may be slid onto alignment bars **98**, **100** inserted through the channels **34** and **35** to align the electrolyzer cell **36** with adjoining electrolyzer cells **36**, forming the electrolyzer stack **18**. Other alignment bars (not shown) may be inserted through channels **60** and **64**. The alignment bars may generally be cylindrical, but any shape that makes sufficient contact with the sides of the channels **34**, **35**, **60**, and **64** may be used. The alignment bars may be plastic rods or cylinders and may also include plastic tubing and pipe. As previously mentioned, other techniques may be used to align the electrolyzer cells **36**. Protrusions (not shown) may be molded or machined into the electrode assembly **94** or the diaphragm assembly **96**, and designed to interface with matching holes or surface depressions in adjoining parts. The use of mating protrusions may be used in addition to or in place of the alignment bars.

[0037] In addition to the use of spacer plates **82**, described above, another presently contemplated technique that may be used to apply pressure to the electrolyzer stack **18** is shown in the top view of the electrolyzer **66** in FIG. **5**. In this configuration, the end cap **72** has a protruding lip **102** machined into the lower surface. The protruding lip **102** has an o-ring **104** set into a channel machined into the protruding lip **104**. The procedure is generally the same as described for FIG. **3**, with an alignment bar **78** placed through at least one of the channels **64** formed by the aligned apertures in the electrolyzer cells **36**. The spacer plates **82** and gasket **84** may be used to further increase the pressure on the electrolyzer stack **18**. The protruding lip **102** is designed the closely fit within the body **74** of the electrolyzer **66**, with the o-ring **104** forming a seal.

[0038] A closer view of the protruding lip **102** may be seen in the magnified view of FIG. **6**, taken along cut line **6-6** in FIG. **5**. In FIG. **6**, it can be seen that the protruding lip **102** may be only slightly within the inside edge **106** of the body **74**. This tight fit may enable the o-ring **104** to securely engage the inside edge **106** of the body **74** forming the seal. As the nuts **88** are tightened onto the bolts **86**, the protruding lip **102** may function as a piston, applying pressure to the electrolyzer stack **18**, and sealing the channels **34**, **35**, **60**, and **64**.

[0039] A method **108** for assembling an electrolyzer **66** is illustrated in the flow chart in FIG. **7**. The method **108** begins with the formation of the sub-assemblies (block **110**). The sub-assemblies include the electrolyzer cells **36** which are made by joining an electrode assembly **94** to a diaphragm assembly **96**, as described above. Once the sub-assemblies are made, they are placed onto an alignment bar **78** (block **112**), to form an electrolyzer stack **18**. Any other parts desired are then placed onto the alignment bars, such as the spacer plates **82** and gasket **84**. In other contemplated embodiments, protrusions on each of the electrolyzer cells **36** may be matched to indentations on adjoining electrolyzer cells **36** to align the fluid channels **34**, **35**, **60**, **64**. In this contemplated embodiment, matching protrusions and indentations may also be formed into the spacer plates **82**, gasket **84**. In this embodiment, matching indentations or protrusions may also be machined into the end cap **72** and the base plate **74**.

[0040] The aligned electrolyzer stack **18** is then assembled into the body **74** (block **114**). The alignment bars are placed through the end cap **72** to align the channels **34**, **35**, **60**, and **64** with the end cap **72**. The opposite end of the alignment bars may be placed into depressions in the base plate **80** to align the base plate **80** with the rest of the parts. After all parts are assembled, the bolts **86** are placed through the end cap **72** and base plate **80**, and the nuts **88** are ed onto the bolts **86** (block **116**).

[0041] Once the bolts **86** are attached to the nuts **88**, they are tightened to apply pressure to the electrolyzer stack **18** (block **118**). The pressure seals the electrolyzer cells **36** to each other, forming the inlet channels **34**, **35** and outlet channels **60**, **64**. Once the assembly is complete, the alignment bars are removed by pulling them from the channels **34**, **35**, **60**, and **64** in the end cap **72** (block **120**), leaving a fully assembled electrolyzer unit.

[0042] While only certain features of the invention have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

1. An electrolyzer, comprising:
- a plurality of electrolyzer cells placed adjacent to one another to form a stack, wherein each electrolyzer cell comprises an electrode assembly and a diaphragm assembly, and wherein the diaphragm assembly of each electrolyzer cell is placed adjacent to an electrode assembly of another electrolyzer cell;
- an internal fluid channel through the stack formed by an internal structure of each of the electrolyzer cells;
- a mounting configured to maintain a compressive force on the stack sufficient to seal the internal fluid channel.

2. The electrolyzer of claim **1**, wherein the compressive force creates a pressure between cells of between about 3 bar and a pressure less than the maximum allowable compressive load of the cell material.

3. The electrolyzer of claim **1**, wherein the mounting is configured to be opened to permit access to any one of the plurality of electrolyzer cells.

4. The electrolyzer of claim **1**, wherein either the electrode assembly, the diaphragm assembly, or both, comprises a plastic material that is chemically resistant to an oxidative environment, a reducing environment, an acidic environment, a basic environment, or any combination thereof.

5. The electrolyzer of claim **1**, wherein either the electrode assembly, the diaphragm assembly, or both, comprises polyimides, polyamides, polyether ether ketones, polyethylenes, fluorinated polymers, polypropylenes, polysulfones, polyphenylene oxides, polyphenylene sulfides, polyphenylene ethers, polystyrenes, polyether imides, epoxies, polycarbonates, impact-modified polyethylene, impact-modified fluorinated polymers, impact-modified polypropylenes, impact-modified polysulfones, impact-modified polyphenylene oxides, impact-modified polyphenylene sulfides, impact-modified polystyrene, impact-modified polyetherimide, impact-modified epoxies, impact-modified polycarbonates, or any combination thereof.

6. The electrolyzer of claim **1**, wherein the mounting comprises a body around the stack, an end cap comprising a manifold configured to be in fluid contact with the internal fluid channel, and a base plate, wherein the end cap and the base plate are configured to maintain the compressive force.

7. The electrolyzer of claim **6**, wherein the end cap comprises a lip configured to extend into the body and maintain the compressive force.

8. The electrolyzer of claim **6**, comprising a spacer between the stack and the end cap, wherein the spacer plate maintains the compressive force.

9. The electrolyzer of claim **1**, wherein the electrode assembly and the diaphragm assembly of each electrolyzer cell form a single unit.

10. The electrolyzer of claim **1**, wherein the electrode assembly and the diaphragm assembly of each electrolyzer cell are held together by the compressive force.

11. The electrolyzer of claim **1**, comprising an inlet channel for introducing an electrolyte solution into the electrolyzer, a hydrogen outlet channel, an oxygen outlet channel, or any combination thereof.

12. A method of assembling an electrolyzer, comprising:

assembling a plurality of cells in an aligned stack, each cell comprising a metal plate and a diaphragm, and each cell having aligned apertures forming a fluid channel when aligned with an adjacent cell; and

maintaining a compressive force on the stack to seal the fluid channel.

13. The method of claim **12**, comprising placing an alignment bar through the cells to align the plurality of cells.

14. The method of claim **12**, comprising mating a protrusion on each cells with a depression on each adjacent cell to align the plurality of cells.

15. The method of claim **12**, wherein the compressive force creates a pressure between cells of between about 3 bar and about 9 bar.

16. The method of claim **12**, wherein the compressive force is maintained by a spacer.

17. The method of claim **12**, wherein the compressive force is maintained on the device by a lip on an end cap disposed adjacent to the stack.

18. The method of claim **12**, comprising releasing the pressure to access one of the plurality of cells.

19. A method of assembling an electrolyzer, comprising:

assembling a plurality of electrolyzer cells, wherein each electrolyzer cell comprises a metal plate and a diaphragm, and wherein each electrolyzer cell has a structure configured to form a fluid channel when aligned with other electrolyzer cells;

aligning the plurality of electrolyzer cells to form an electrolyzer stack having a first end, a second end, and an internal fluid channel;

placing a body around the electrolyzer stack;

placing an end cap over an end of the body, the end cap having an aperture aligned with the channel in the electrolyzer stack;

placing a base plate over another end of the body to create a compressive force to seal the internal channel in the electrolyzer stack securing the end cap and the base plate to the body.

20. The method of claim **19**, comprising disposing at least one spacing element in contact with the electrolyzer stack to create the compressive force.

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