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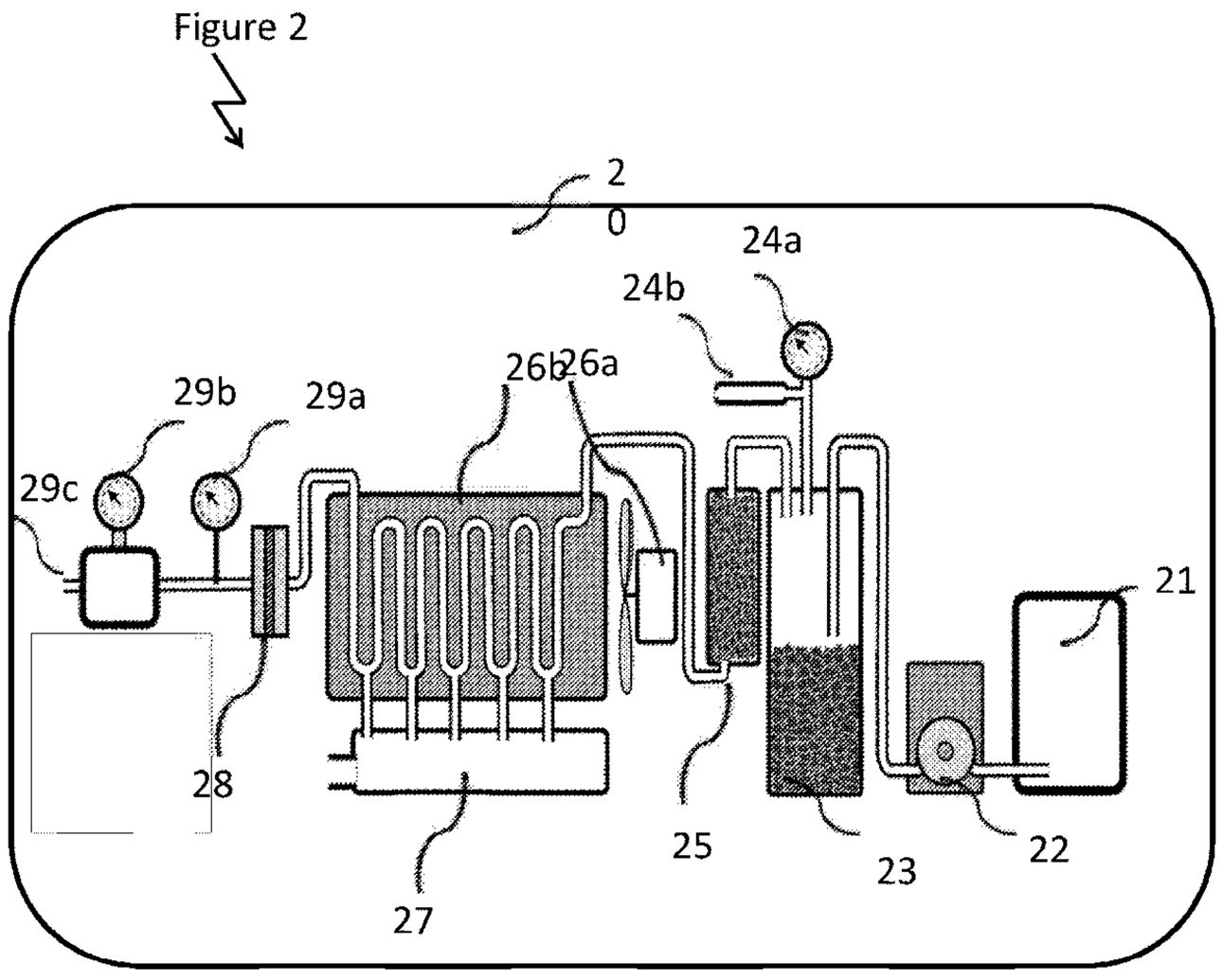
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(54) Title of the Invention: **Portable system for the production of oxygen**
Abstract Title: **A portable chemical oxygen generator using hydrogen peroxide**

(57) A portable device for generating oxygen by decomposition of hydrogen peroxide, comprising at least one hydrogen peroxide solution reservoir 21, a reactor for reacting the solution with a catalyst 23, a feeding system 22 to drive hydrogen peroxide into the reactor from the reservoir, a cooling system 26a,b connected to an outlet of the reactor to cool generated oxygen, a hydrophobic filter membrane 28 to remove water vapour at the oxygen outlet of said cooling system, and a flow regulator 29a-c to control the release of the oxygen from the generator. The cooling system may have a water collection tank 27 and drain. A catalytic filter may be located between the reactor and cooling system to remove hydrogen peroxide vapour. The reservoir may be configured as a removable cartridge. The generator may produce medical grade oxygen and have biofeedback sensors to control the regulator in response to a patient's condition.

Figure 2



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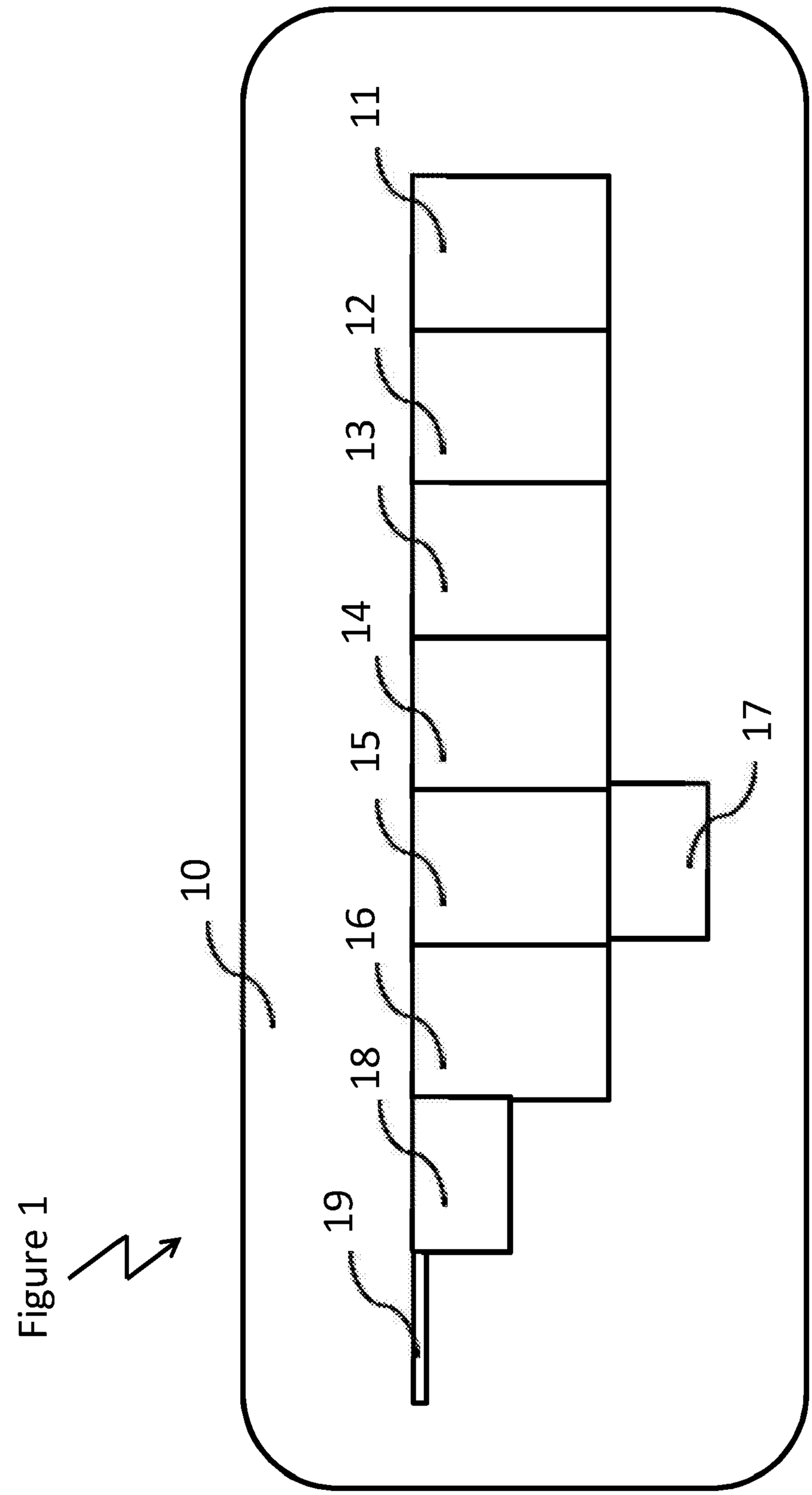


Figure 1

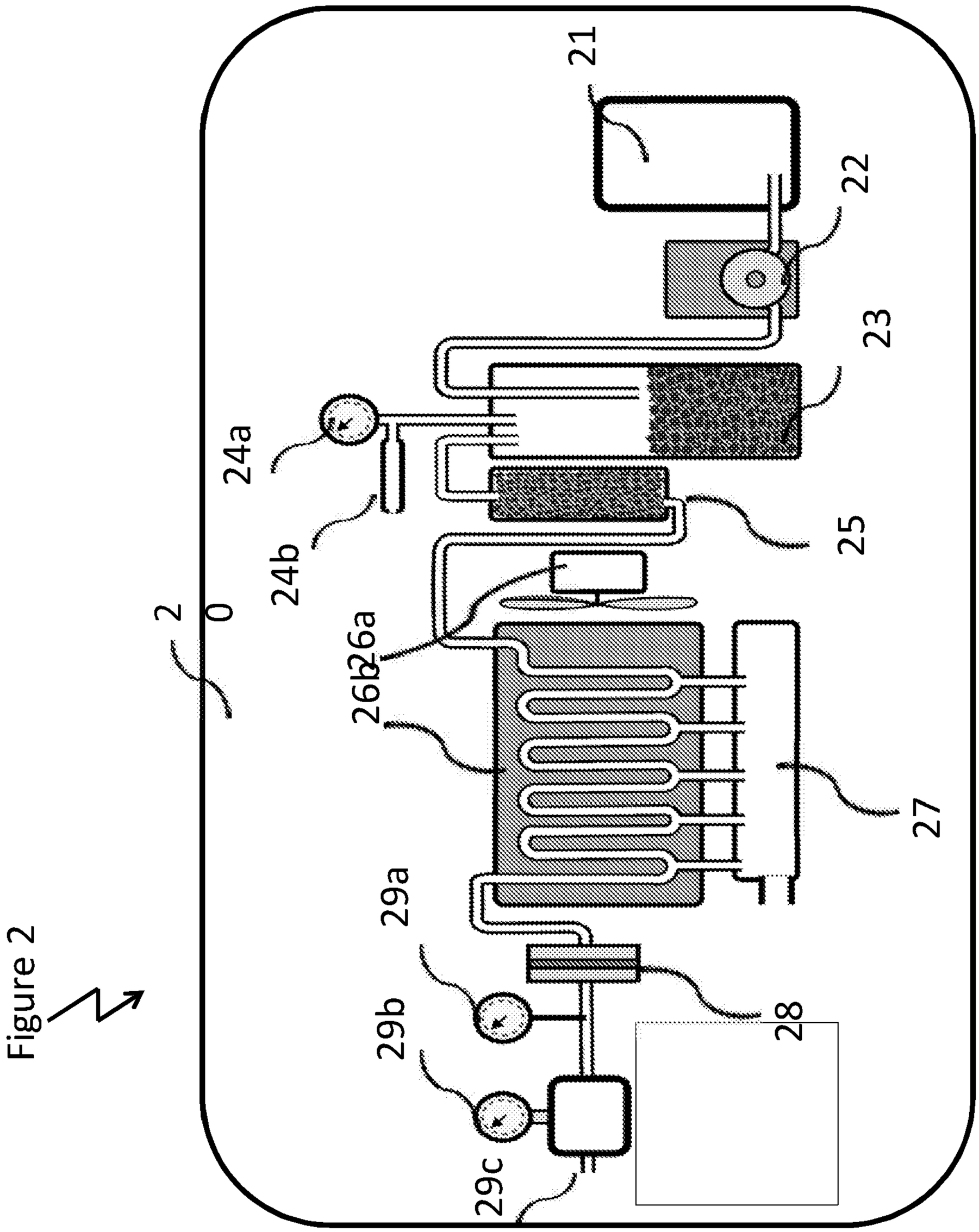


Figure 2

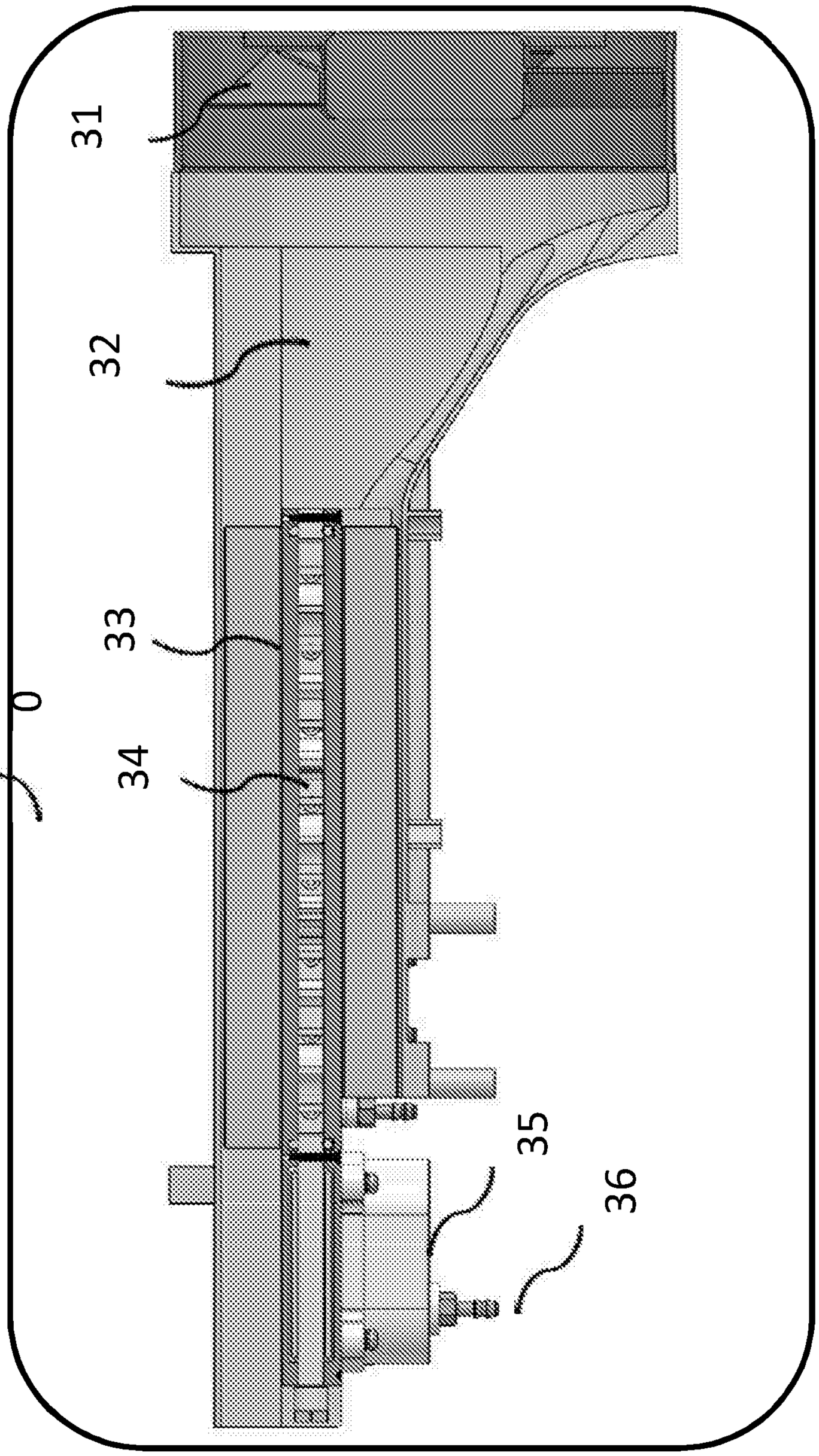


Figure 3

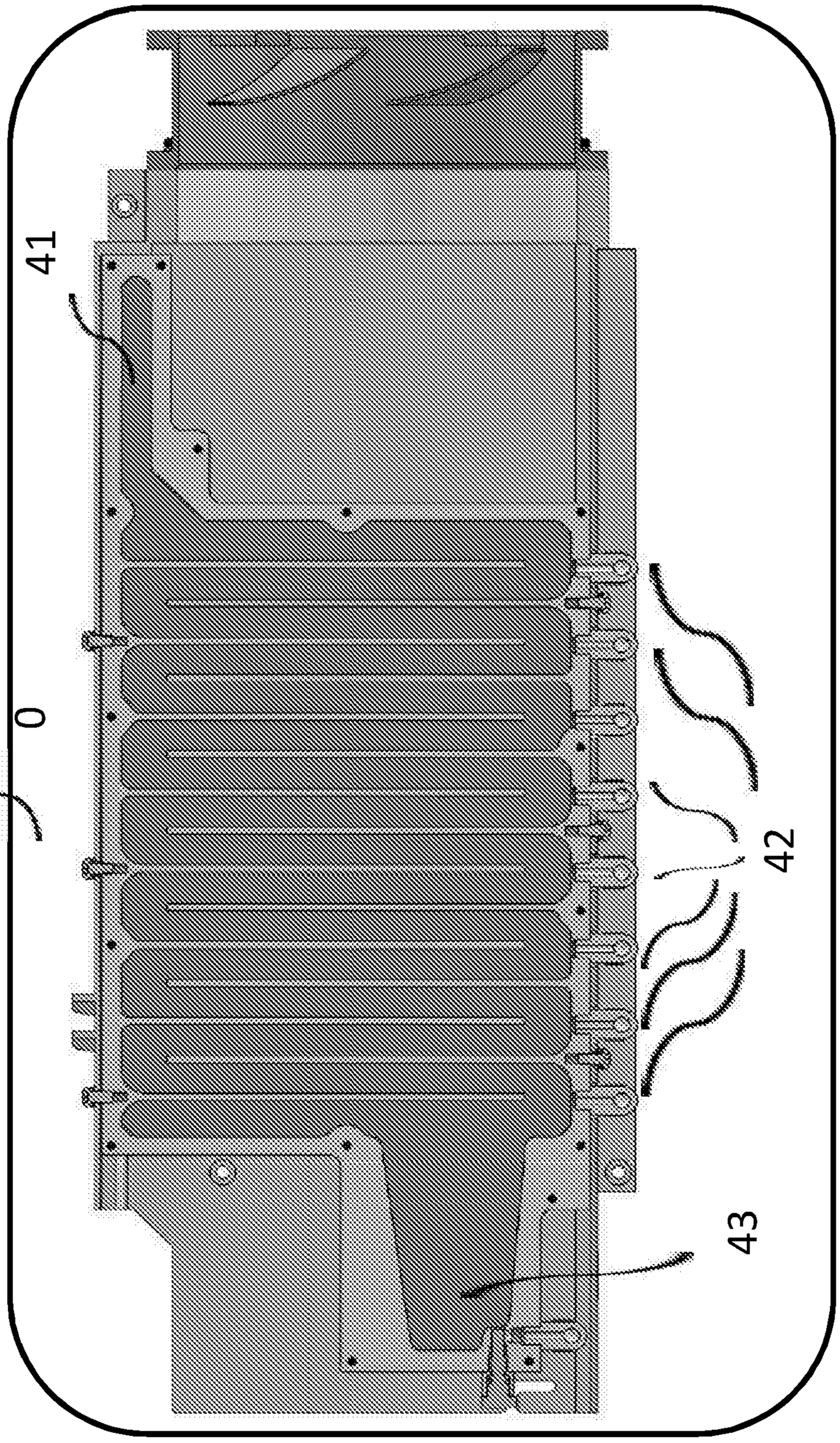


Figure 4

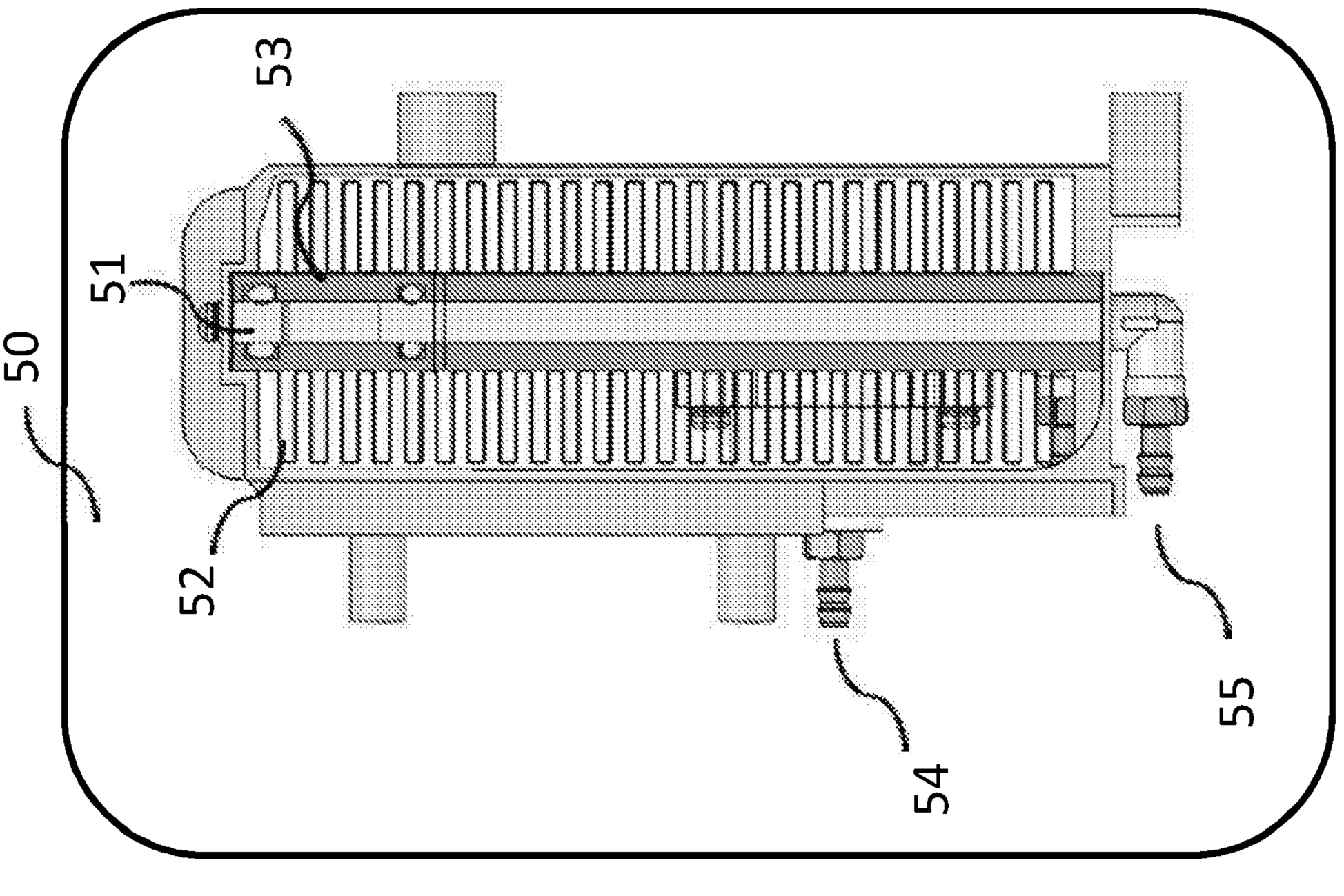


Figure 5

Portable system for the production of oxygen

FIELD OF THE INVENTION

This invention is in the field of oxygen production

BACKGROUND OF THE INVENTION

Oxygen is a critical component of medical treatment. This treatment can be chronic or acute. Supplemental oxygen can be lifesaving in emergency situations, although the burden of providing oxygen during transport and in remote areas is substantial in cost, transport, and materials. Oxygen cylinders are heavy and present a number of potential hazards including combustion, detonation and projectile risks. Liquid oxygen systems provide a large amount of gas with a smaller foot print but are heavy, exhaust gas over time, and present a burn risk if handled improperly. In addition, the output of both of these oxygen systems is finite and requires refilling, which presents logistical issues in far forward military operations.

Portable oxygen concentrators (POCs) and chemical oxygen generators (COGs) have been proposed as a solution. Chemical oxygen generation was first suggested by the work of Joseph Priestly when he discovered oxygen during his work with mercuric oxide. Priestly published his findings in 1775. In 1902, the “Lancet” reported on Kamm’s oxygen generator invention for medical use. The device used chlorate cakes and manganese oxide and when heated by a spirit lamp produced approximately 4 cubic ft of oxygen before needing to be replenished with ingredients.

POCs and COGs have been proposed for use in far forward military operations and in disaster and mass casualty scenarios as alternatives to liquid and pressurized gaseous oxygen systems because of the logistics, weight, and explosive risks. Evaluation of the currently available technologies shows that COGs can operate for only 30 minutes or less, depending on the manufacturer and design and the inability to adjust output, makes the devices unsuitable for continuous clinical care or long term operation (Blackman et al., 2016).

More recently there has been interest in employing this technology in areas where providing oxygen in cylinders or in liquid form is logistically difficult or economically prohibitive such as

during combat casualty care, disaster situations, and in extreme rural environments in undeveloped countries. Simpler, lighter, and longer lasting oxygen delivery systems are needed for military and mass casualty operations.

The FDA dictates that a COG must provide a minimum of **6** L/min of oxygen flow for a minimum of **15** min (21 CFR part 868.5440). However, the US Army demands a higher output, where the system must provide **8** l/min for at least **20** min (Bill Sovitsky MD joint US Army USMMA Facility). This is an increase of 75% in the total O_2 output, a level not attainable by the available COGs. There exists a long felt need for a portable, on-demand oxygen generator.

SUMMARY

It is the object of the present invention to present a portable device for oxygen generation comprising:

a. at least one reservoir for holding a hydrogen peroxide solution;

b. a reactor, for reacting hydrogen solution with a catalyst;

c. a feeding system for supplying hydrogen peroxide to the reactor from the reservoir;

d. a system for cooling, interconnected to outlet of the reactor;

e. a hydrophobic membrane, for removing water at the oxygen outlet of the cooling system; and

f. an oxygen flow regulator, for regulating oxygen flow at the filter outlet;

wherein the cooling system is an open system operatively located between the reactor outlet and the hydrophobic membrane (filter) the cooling system configured to cool oxygen gas flowing between the reactor and the filter.

It is another object of the present invention to present a device as presented in any of the above, wherein the reservoir is configured to hold hydrogen peroxide, a hydrogen peroxide complex or a hydrogen peroxide solution.

It is another object of the present invention to present a device as presented in any of the above, wherein the hydrogen peroxide solution is at least 20% hydrogen peroxide.

It is another object of the present invention to present a device as presented in any of the above, wherein the reservoir is a cartridge.

It is another object of the present invention to present a device as presented in any of the above, wherein the cartridge is attached to the feeding system.

It is another object of the present invention to present the device as presented in any of the above, wherein the cartridge is configured to be instantly replaceable once it gets empty.

It is another object of the present invention to present a device as presented above, wherein the cartridge attachment system enables rapid attaching to the feeding system it.

It is another object of the present invention to present a device as presented in any of the above, wherein the cartridge is collapsible, has a collapsible liner, is hard-sided or soft-sided.

It is another object of the present invention to present a device as presented above, wherein the feeding unit is configured to generate pressure on a soft-sided cartridge.

It is another object of the present invention to present a device as presented in any of the above, wherein the pressure is generated by a spring, a piston or pneumatic pressure.

It is another object of the present invention to present a device as presented in any of the above, wherein the feeding system is a pump, the pump selected from a group consisting of displacement pump, peristaltic pump, syringe pump, piston pump, plunger pump, screw pump and reciprocating pump.

It is another object of the present invention to present a device as presented in any of the above, wherein the reactor is configured to decompose hydrogen peroxide to water and oxygen.

It is another object of the present invention to present the device as presented in any of the above, wherein the reactor contains a catalyst.

It is another object of the present invention to present a device as presented in any of the above, wherein the catalyst comprises an active compound selected from a group consisting of a metal, a metalloid, an alloy of a metal, an alloy of a metalloid, a compound of a metal and a compound of a metalloid.

It is another object of the present invention to present a device as presented in any of the above, wherein the catalyst additionally comprises an electronegative element.

It is another object of the present invention to present a device as presented in any of the above, wherein the device additionally comprises a catalytic filter.

It is another object of the present invention to present a device as presented in any of the above, wherein the catalytic filter comprises at least one catalyst, the catalyst comprises an active compound selected from a group consisting of a metal, a metalloid, an alloy of a metal, an alloy of a metalloid, a compound of a metal and a compound of a metalloid.

It is another object of the present invention to present a device as presented in any of the above, wherein the catalytic filter comprises the same catalysts as the reactor.

It is another object of the present invention to present a device as presented in any of the above, wherein the cooling system is a heat sink.

It is another object of the present invention to present a device as presented in any of the above, wherein the cooling unit additionally comprises at least one fan.

It is another object of the present invention to present a device as presented in any of the above, wherein the fan is electric.

It is another object of the present invention to present a device as presented in any of the above, wherein the cooling system comprises a condenser.

It is another object of the present invention to present a device as presented in any of the above, wherein the cooling system is configured to enable the draining of water, the water condensed by the cooling system.

It is another object of the present invention to present a device as presented in any of the above, wherein the draining system is configured to drain the condensed water from at least one point along cooling system.

It is another object of the present invention to present a device as presented in any of the above, wherein the water is drained immediately and continuously.

It is another object of the present invention to present a device as presented in any of the above, wherein present the cooling system additionally comprises a receptacle for collecting the condensed water.

It is another object of the present invention to present a device as presented in any of the above, wherein the hydrophobic membrane is constructed from a material selected from a group consisting of Polytetrafluoroethylene, Polysulfones and polycarbonate.

It is another object of the present invention to present a device as presented in any of the above, wherein the oxygen flow regulator is a heat/mass oxygen (O_2) flow meter configured for real-time flow measurement.

It is another object of the present invention to present a device as presented in any of the above, wherein the device additionally comprises an electronic control and display unit, comprising

a. Unit sensors;

b. Unit controls;

c. Unit alerts; and

d. Unit feedback circuits

It is another object of the present invention to present a devise as presented in any of the above, wherein the control unit is based on a designated Printed Circuit Board.

It is another object of the present invention to present a devise as presented in any of the above, wherein the unit sensors are configured to measure at least one perimeter selected from a group consisting of user set O_2 flow, exit O_2 flow, exit O_2 temperature, battery capacity, H_2O_2 reservoir level, RC pressure and water tank capacity (weight).

It is another object of the present invention to present a devise as presented in any of the above, wherein the unit control is configured to control at least one perimeter selected from a group consisting of Peristaltic Pump RPM, Cooling Fan speed, Water tank drainage solenoid.

It is another object of the present invention to present a devise as presented in any of the above, wherein the control unit comprises feedback circuits for at least one of the parameters as disclosed in any of the above.

It is another object of the present invention to present a devise as presented in any of the above, wherein the control unit is configured to emit an alert in the case of:

a. low H_2O_2 reservoir;

b. low battery;

c. high water tank level;

d. high device pressure; and

e. device maintenance.

It is another object of the present invention to present the control unit additionally comprises a data logger, the data logger configured to record the status of the device.

It is another object of the present invention to present a devise as presented in any of the above, wherein the control unit is configured to communicate with an external system, the communication selected characterized as:

a. transfer recorded data to an external system;

b. receiving treatment protocol from an external system.

It is another object of the present invention to present the device is powered by a battery unit, the battery is a 12-18V/4-5Ah Rechargeable.

It is another object of the present invention to present a devise as presented in any of the above, wherein the device additionally comprises a Biofeedback sensor.

It is another object of the present invention to present a devise as presented in any of the above, wherein the biofeedback sensor is configured to detect the peripheral blood O_2 saturation level in the patient.

It is another object of the present invention to present a devise as presented in any of the above, wherein the sensor is configured to communicate with the control unit as disclosed above.

It is another object of the present invention to present the control unit is configured emit an alert in the case of low O_2 patient saturation levels.

It is the object of the present invention to present a method for generating oxygen, comprising steps of obtaining a device and operating the device by:

a. combining a hydrogen peroxide solution with a catalyst;

b. cooling the oxygen and water vapor;

c. draining liquid water, the water condensed from the water vapor;

d. filtering oxygen, removing water; and

e. passing oxygen through a flow regulator.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises a step of generating a flow of the hydrogen peroxide solution into a reactor.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises step of passing oxygen and water vapor through a catalytic filter.

It is another object of the present invention to present a method as presented in any of the above, wherein the step of cooling the oxygen and water vapor, additionally comprises a step of generating a stream of air, the air generated by a fan.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises a step of analyzing the oxygen flow and temperature of oxygen exiting the cooling system.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises a step of alerting the user in the case of low H_2O_2 reservoir, low battery, high system pressure, high water tank level and low patient O_2 saturation levels.

It is the object of the present invention to present a method as presented in any of the above, wherein the method further comprises steps of:

a. providing oxygen to a patient; or

b. storing the oxygen.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises a step of detecting the O_2 saturation levels in a patient.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises at least one step of:

a. logging the data of the device;

b. logging the data of the patient;

c. transferring the data to an external system.

It is another object of the present invention to present a method as presented in any of the above, wherein the method additionally comprises steps of regulating the oxygen flow rate, the regulation controlled by regulating at least one perimeter selected from a group consisting of flow of the hydrogen peroxide solution into a reactor and flow via the flow regulator, the flow regulation determined by at least one perimeter selected from a group consisting of system pressure, reactor pressure, oxygen flow and patient O_2 saturation level.

It is another object of the present invention to present a method as presented in any of the above, wherein the step of regulating the oxygen flow rate comprises a step of measuring the oxygen flow rate.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention wherein:

Figure 1 – is a schematic representation of one embodiment of the present invention

Figure 2 – depicts an embodiment of the present invention

Figure 3 – depicts an embodiment of the cooling system of the present invention

Figure 4 – depicts an embodiment of the heat sink system of the present invention

Figure 5 – depicts an embodiment of the cooling system of the present invention

DETAILED DESCRIPTION OF THE INVENTION

The following description is provided, alongside all chapters of the present invention, so as to enable any person skilled in the art to make use of the invention and sets forth the best modes contemplated by the inventor of carrying out this invention. Various modifications, however, are adapted to remain apparent to those skilled in the art, since the generic principles of the present invention have been defined specifically to provide compositions and methods.

Unless otherwise stated, with reference to numerical quantities, the term "**about**" refers to a tolerance of ±25% of the stated nominal value.

Unless otherwise stated, all numerical ranges are inclusive of the stated limits of the range.

DETAILED DESCRIPTION OF THE EMBODIMENT

Figure 1 schematically shows the basic unit **10**, comprising 9 main units:

11) Reservoir

The reservoir **11** holds the Hydrogen peroxide solution. The holder can be single use or refillable. In some embodiments the reservoir is a cartridge that holds the solution and is feed into the system. In some embodiments the reservoir is part of the system and is refiled from another container. The reservoir can be hard or soft-sided. The reservoir must be constructed from inert, non-reactive, medicinal grade materials such as stainless steel or polymers. In some embodiments the reservoir is constricted like a 'syringe' i.e. is constructed from a barrel and a plunger (or piston).

In some embodiments the reservoir is a canister capable of holding a solution of hydrogen peroxide (H_2O_2) in water. The percentage of H_2O_2 is at least 20% and in some embodiments is 30-60%.

12) Feeding unit

The feeding unit **12** controls the flow of the solution into the reactor. In some embodiments the feeding unit is a pump. The pump could be a displacement pump, peristaltic pump, syringe pump, piston pump, plunger pump, screw pump or reciprocating pump. In some embodiments, the reservoir **12** is collapsible and the feeding unit is configured to put pressure on the reservoir, pushing the hydrogen peroxide solution into the reactor. In some embodiments, the feeding unit acts as a reciprocating pump with the reservoir forming part of the pump.

The feeding unit can be set to control the flow rate according to various parameters: Hydrogen peroxide solution flow rate, Oxygen flow rate (at the exit of the device), and reaction chamber pressure. In some embodiments the feeding unit additionally comprises a pressure sensor.

13) Reactor

The reactor **13** is constructed from an inert, non-reactive material that can withstand temperatures of at least 120°C. In some embodiments, the solution entered the reactor from the feeding unit through at least one aperture or outlet such as a nozzle or a spray nozzle. The reactor contains a catalyst that catalyzes the decomposition of hydrogen peroxide to water and oxygen. In most embodiments the catalyst comprises a metal, a metalloid, an alloy of a metal, an alloy of a metalloid, a compound of a metal and a compound of a metalloid. In a preferred embodiment the catalyst is heterogeneous catalyst comprising a metal, a hydrogen molecule and an electronegative element.

The solution mixes with the solid Catalyst particles, instantly breaking (decomposing) the H_2O_2 to H_2O and O_2. The reaction is thermogenic, reaching temperatures to 90°C. The gas produced by the decomposition of hydrogen peroxide flows out of the reactor and through the catalytic filter **14**.

The reaction chamber can additionally comprise a pressure valve. In some embodiments the pressure valve is configured to regulate the pressure in the reaction chamber by releasing excess gas or by regulating the solution flow rate. Regulation of the flow rate by the pressure valve can be conducted directly or by the control unit.

14) Catalytic filter

The catalytic filter **14** is constructed to decompose any hydrogen peroxide that has been vaporized or distilled by the decomposition reaction. The filter can be constructed of the same catalyst as the reactor or of another catalyst.

15) Cooling unit and water tank

Gas that flows through the filter **14** passes into a cooling unit **15**. The cooling unit is configured to cool the gas, condensing the water vapor into liquid water. The cooling unit enables the liquid to be drained into a tank. In some embodiments, the cooling unit enables draining throughout the

length of the cooling unit. In some embodiments the liquid is drained instantly and continuously. The water tank holds the water and can be drained.

16) Hydrophobic membrane

Gas that passes through the cooling unit **15** passes through a hydrophobic membrane (or filter) to remove any water vapor that was not condensed throughout the cooling unit. The filter can be a membrane.

17) Oxygen flow regulator

An oxygen flow regulator comprises a flow meter that measures the amount of Oxygen that passes the filter **16**. The flow meter can regulate the feeding unit to ensure that the flow of oxygen is continuous and at the required level. The flow regulator can also measure the temperature of the gas to make sure that the oxygen is not too hot for the patient. In some embodiments the flow regulator additionally comprises a valve for regulating the oxygen flow. The valve can be manual, mechanical or electro-mechanical. In some embodiments the valve is controlled by the user, the control unit or directly by the flow meter.

18) Control and Display unit and power source

A display unit can display all of the critical device parameters: oxygen flow, oxygen temperature, water tank content level, reservoir level, system pressure, battery power level etc.

In some embodiments, the system additionally comprises a biosensor. In some embodiments, the biosensor is an O_2 blood saturation sensor that is connected to a patient. The sensor can be connected to the control unit to track the saturation level of the patient. In some embodiments, the control unit is configured to control the Oxygen flow rate according to the O2 saturation level of the patient. The control unit can control the oxygen rate by regulating the exit valve or the feeding unit.

The control and display unit can also track the overall status of the system, such as usage status, catalyst status, maintenance etc.

19) Exit tube

The final oxygen produced exits the device and can then be delivered to a patient or stored for later use.

Reference is now made to **Fig. 2**. It is within the scope of this patent to disclose a specific embodiment of the invention, an example of a device **20**, comprising:

A hydrogen peroxide (H_2O_2) Cartridge **21**: H_2O_2 [50%-60%] is the substrate of the chemical reaction, producing H_2O and O_2. The cartridge volume is 750-1000ml, sufficient to produce a flow of 10 l/min O_2 for 30-45 min. The cartridge designed to be instantly replaceable once it gets empty, enabling continues flow of O_2.

Peristaltic Pump **22**: The peristaltic pump drives the H_2O_2 from the cartridge to the Reaction Chamber, where the chemical reaction takes place. The pump speed (RPM) is controlled by the Control unit (5)

Reaction Chamber **23** (RC): H_2O_2 flow into the RC, mixing with the solid Catalyst particles, instantly breaking (decomposing) the H_2O_2 to H_2O and O_2. The reaction is thermogenic, reaching to 100°C and creating a constant Power up to 1,500W.

Exiting the RC are O_2, H_2O as steam, and some liquid and gaseous H_2O_2. The flow of the reaction products (O2, H2O) is directly proportional to the pump RPM (the reaction is saturated with Catalyst). A pressure gauge **24a** tracks the pressure in the RC. In cases of excess pressure a pressure valve **24b** can release excess gas.

Catalyst Filter **25**: The mixed steam exiting the RC is directed into a filter, packed with catalytic particles. Traces of H_2O_2 (liquid or gaseous) are chemically decomposed to O_2 and H_2O, preventing any corrosive H_2O_2 reaching the patient.

Heat Sink Air Cooling System **26a** (HS): The mixed steam exiting the Catalyst Filter flows straight into an active air cooling system. While going through the system condensation takes place, water is pouring down through holes at the bottom of each curve within the HS. This arrangement directs efficiently the HS cooling capacity towards low mass steam condensation, rather than cooling high mass water. An Electric Fan **26b** (60W) is used as the active component of the cooling system. Water is collected into a water tank **27** of 1000cc, and drained out timely through a solenoid controlled tap.

Hydrophobic membrane **28**: Humid O_2 exiting the cooling system flows through a hydrophobic membrane, filtering traces of water. Liquid within the O_2 pipe can interfere with accurately measuring the O_2 flow.

O_2 Flow Meter: A Heat **29a** and Mass O_2 flow **29b** meter is used for real-time flow measurement of the gas exiting the device **29c**.

Reference is now made to **Fig. 3**, describing a cooling system **30**. The cooling air is generated by a fan **31** and funneled **32** to an area **33** surrounding the pipe containing the oxygen and water vapor generated by the reactor **34**. The gas stream is then de-humidified by a hydrophobic membrane **35** before exiting the system **36**, to be provided to a patient.

Reference is now made to **Fig. 4** describing a heat sink system **40**. The steam **41** enters the sink at one end of the heat sink. As the gas is cooled, and the water vapor is converted to liquid, it is drained **42** to that the amount of water that exits the system **43** is limited. **Fig. 4** presents the cooling unit of figure 3 at a 90^o rotation on the Y axis.

Reference is now made to **Fig. 5**, another description of the cooling unit **50**, where the pipe containing the oxygen and water vapor generated by the reactor **51** is surrounded by the cooling air **52** and cooling flaps **53**. The dehumidified oxygen exits the system via a connection **54** while the water that is condensed is removed to a holding tank **55**. **Fig. 5** presents the cooling unit of figure 4 at a 90^o rotation on the Z axis.

CLAIMS

1. A portable device for oxygen generation comprising:

a. at least one reservoir for holding a hydrogen peroxide solution;

b. a reactor, for reacting hydrogen solution with a catalyst;

c. a feeding system for supplying said hydrogen peroxide solution to said reactor from said reservoir;

d. a system for cooling, interconnected to an outlet of said reactor;

e. a hydrophobic filter membrane, for removing water at an oxygen outlet of said cooling system; and

f. an oxygen flow regulator, for regulating oxygen flow at said oxygen outlet;

wherein said cooling system is an open system operatively located between said reactor outlet and said hydrophobic filter membrane, said cooling system configured to cool oxygen gas flowing between said reactor and said hydrophobic filter membrane.

2. The device of claim 1, wherein said reservoir is configured:

a. to hold hydrogen peroxide, a hydrogen peroxide complex or a hydrogen peroxide solution; or

b. as a cartridge.

3. The device of claims 1 or 2, wherein said hydrogen peroxide solution is at least 20% hydrogen peroxide.

4. The device of claims 1 or 2, wherein said cartridge is attached to said feeding system.

5. The device of any one of claims 1 to 4, wherein at least one of the following holds true:

a. said cartridge is configured to be instantly replaceable once it gets empty;

b. an attachment system of said cartridge enables rapid attaching said cartridge to said feeding system; and

c. said cartridge is collapsible, has a collapsible liner, is hard-sided or soft-sided.

6. The device of any one of claims 1 to 5, wherein said feeding unit is characterized by at least one of the following:

a. said feeding unit is configured to generate pressure on a said cartridge.

b. said feeding system is a pump, said pump selected from a group consisting of displacement pump, peristaltic pump, syringe pump, piston pump, plunger pump, screw pump and reciprocating pump.

7. The device of any one of claims 1 to 6, wherein said pressure is generated by a spring, a piston or pneumatic pressure.

8. The device of claim 1, wherein said reactor is characterized by at least one of the following:

a. said reactor is configured to decompose hydrogen peroxide to water and oxygen;

b. said reactor contains a catalyst.

9. The device of any one of claims 1 to 8, wherein said catalyst comprises:

a. an active compound selected from a group consisting of a metal, a metalloid, an alloy of a metal, an alloy of a metalloid, a compound of a metal and a compound of a metalloid; or

b. an electronegative element.

10. The device of claim 1, wherein said device additionally comprises a catalytic filter.

11. The device of any one of claims 1 to 10, wherein said catalytic filter comprises at least one catalyst, wherein:

a. said catalyst comprises an active compound selected from a group consisting of a metal, a metalloid, an alloy of a metal, an alloy of a metalloid, a compound of a metal and a compound of a metalloid;

b. said catalytic filter comprises the same catalysts as said reactor.

12. The device of claim 1, wherein said cooling system is characterized by at least one of the following:

a. comprising at least one heat sink;

b. comprising at least one fan, said fan is electric;

c. comprising at least one condenser;

d. comprising at least one drain, configured to drain water condensed by said cooling system.

13. The device of any one of claims 1 to 12, wherein said water drain is characterized by at least one of the following:

a. configured to drain said condensed water from at least one point along said cooling system;

b. said draining of said water is done immediately upon condensation and continuously;

c. comprising a receptacle for collecting said condensed water.

14. The device of claim 1, wherein said device is characterized by at least one of the following:

a. a hydrophobic membrane constructed from a material selected from a group consisting of Polytetrafluoroethylene, Polysulfones and polycarbonate;

b. an oxygen flow regulator that is a heat/mass oxygen (O_2) flow meter configured for real-time flow measurement.

c. additionally comprising an electronic control and display unit, comprising at least one of the following:

i. Unit sensors;

ii. Unit controls;

iii. Unit alerts;

iv. Biofeedback sensors and

v. Unit feedback circuits

15. The device of any one of claims 1 to 14, wherein said control unit is characterized by at least one of the following:

a. comprising a designated Printed Circuit Board;

b. comprising unit sensors configured to measure at least one perimeter selected from a group consisting of user set O_2 flow, exit O_2 flow, exit O_2 Temperature, Battery capacity, H_2O_2 reservoir level, RC pressure and water tank capacity (weight);

c. is configured to control at least one perimeter selected from a group consisting of Peristaltic Pump RPM, Cooling Fan speed, and Water tank drainage solenoid;

d. comprising feedback circuits for at least one of the device parameters, selected from a group consisting of user set O_2 flow, exit O_2 flow, exit O_2 Temperature, Battery capacity, H_2O_2 reservoir level, RC pressure and water tank capacity (weight) Peristaltic Pump RPM, Cooling Fan speed, Water tank drainage solenoid;

e. is configured to emit an alert in the case of any of:

i. low H_2O_2 reservoir;

ii. low Battery;

iii. high water tank level;

iv. high device pressure; and

v. device maintenance.

f. additionally comprising a data logger, said data logger configured to record the status of said device.

g. is configured to communicate with an external system, said communication comprising:

i. transferring recorded data to an external system;

ii. receiving treatment protocol from an external system.

16. The device of claim 1, wherein said device is powered by a unit battery, said battery is a 12-18V/4-5Ah Rechargeable.

17. The device of any one of claims 1 to 14, wherein said biofeedback sensor is configured to:

a. detect the peripheral blood O_2 saturation level in said patient; and

b. communicate with said control unit.

18. The device of any one of claims 1 to 17, wherein said control unit is configured to emit an alert in the case of low O_2 patient saturation levels.

19. A method for generating oxygen, comprising steps of obtaining a device of claim 1 and operating said device by:

a. combining a hydrogen peroxide solution with a catalyst;

b. cooling oxygen and water vapor;

c. draining liquid water, said water condensed from said water vapor;

d. filtering oxygen, removing said water vapor; and

e. passing oxygen through a flow regulator.

20. The method of claim 19, wherein said method additionally comprises at least one of the following steps:

a. generating a flow of said hydrogen peroxide solution into a reactor;

b. passing oxygen and water vapor through a catalytic filter;

c. generating a stream of air, said air generated by a fan;

d. analyzing the oxygen flow and temperature of oxygen exiting said cooling system;

e. alerting the user in the case of Low H_2O_2 reservoir, Low Battery, High system pressure, High water tank level and/or low patient O_2 saturation levels;

f. providing oxygen to a patient;

g. storing said oxygen;

h. detecting the O_2 saturation levels in a patient;

i. logging the data of said device;

j. logging the data of said patient;

k. transferring said data to an external system;

l. regulating the oxygen flow rate, said regulation controlled by regulating at least one parameter selected from a group consisting of flow of said hydrogen peroxide solution into a reactor and flow via said flow regulator, said flow regulation determined by at least one parameter selected from a group consisting of system pressure, reactor pressure, oxygen flow and/or patient O_2 saturation level.

Intellectual Property Office

Application No:	GB1907885.6	**Examiner:**	Michael Knight
Claims searched:	1-20	**Date of search:**	12 July 2019

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-2, 6-9, 12 & 19-20	KR 101027904 B (KIM) See figures 1 & 2, paragraphs [0043]-[0044] & [0082].
X	1-5, 8-9, 12-13 & 19-20	WO 97/23413 A1 (GENO2X) See figures 1, 8 & 9, page 5 line 7, page 8 lines 18-21. See also JP S5326445 Y incorporated by reference.
X	1-3, 6, 8-9, 12-16 & 19-20.	US 4861560 A (NAKAJIMA) ee figures 2 & 3, column 6 lines 23-33, column 7 line 22. See also US 4792435 A incorporated by reference.
X	1 at least	JP S62297201 A (DAIWA GIKEN) See figures.
X	1 at least	DE 752731 C1 (DRAEGERWERK) See figure.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

A61M; A62B; A62D; C01B

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI, Patent Fulltext

Intellectual Property Office

International Classification:

Subclass	Subgroup	Valid From
A62B	0021/00	01/01/2006
A61M	0016/10	01/01/2006
A61M	0016/14	01/01/2006
A62B	0007/08	01/01/2006
C01B	0013/02	01/01/2006