US 20100258449A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2010/0258449 A1**

Fielder (43) **Pub. Date: Oct. 14, 2010**

(54) **SELF-SUFFICIENT HYDROGEN GENERATOR**

(76) Inventor: **William Sheridan Fielder**, Ojai, CA (US)

Correspondence Address:
WILLIAM S. FIELDER
P.O. BOX 1221
OJAI, CA 93024-1221 (US)

(21) Appl. No.: **12/802,957**

(22) Filed: **Jun. 16, 2010**

Related U.S. Application Data

(62) Division of application No. 10/885,876, filed on Jul. 6, 2004.

(60) Provisional application No. 60/485,577, filed on Jul. 7, 2003, provisional application No. 60/487,372, filed on Jul. 15, 2003, provisional application No. 60/489,254, filed on Jul. 22, 2003, provisional application No. 60/494,186, filed on Aug. 11, 2003.

Publication Classification

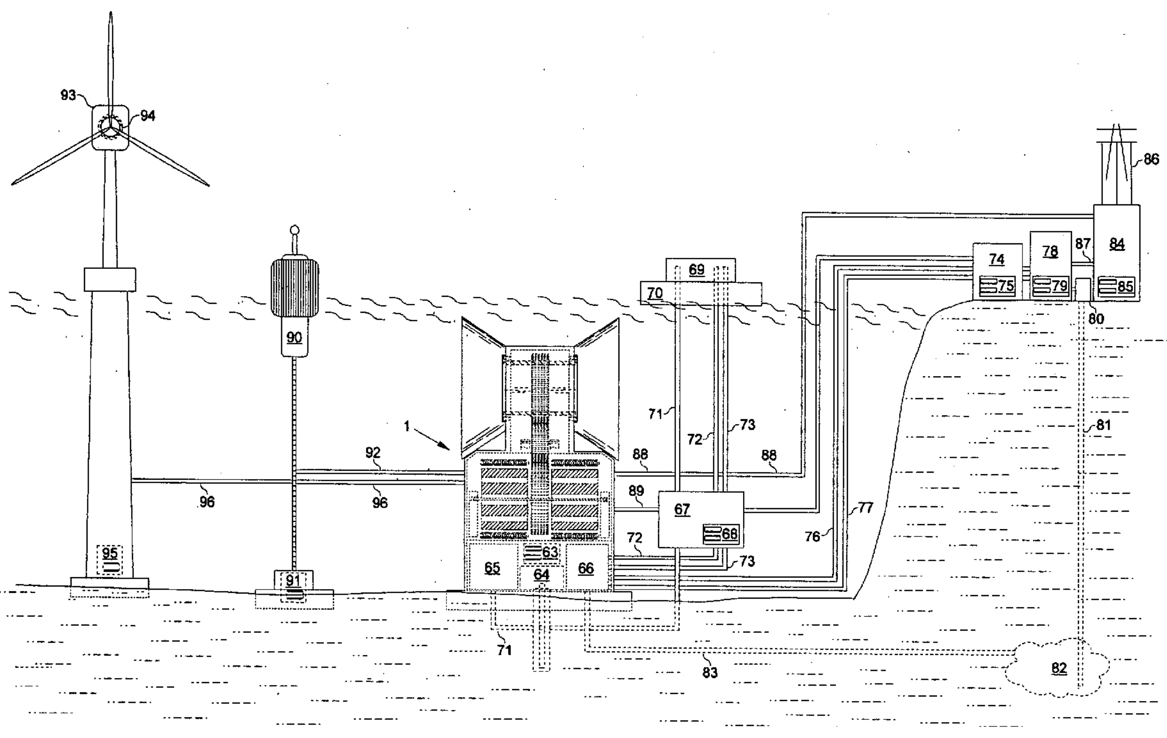
(51) **Int. Cl.**

C25B 1/04	(2006.01)
C25B 9/00	(2006.01)
C25B 15/06	(2006.01)

(52) **U.S. Cl.** **205/628**; 204/278; 204/273; 204/232; 204/241; 204/240; 204/274; 204/275.1; 204/230.4

(57) **ABSTRACT**

A self-sustaining, fully automated, hydrogen generator that utilizes the ocean's currents, tides, and water to produce vast amounts of hydrogen and oxygen. Additional electricity may be supplied by locally generated means including offshore wind, offshore geothermal, as well as wave powered generation. Hydrogen is exported as well as the oxygen not consumed by the life support systems. Residue collected from the ocean water purification process is collected and exported for use elsewhere or dispersed locally around the underwater facility. Systems orchestration is achieved by control systems that operate independently of one another with no single point of failure.



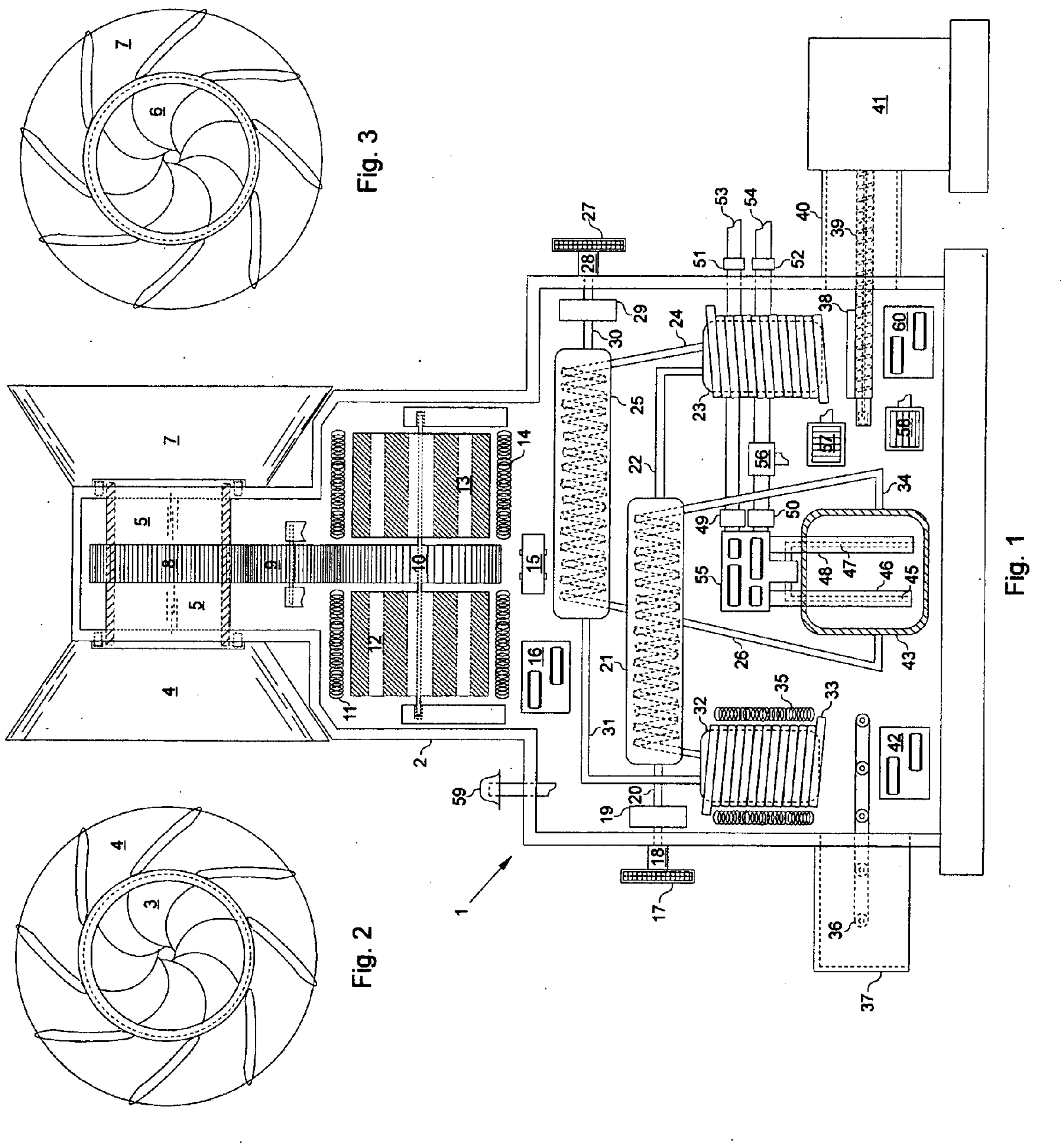


Fig. 1

Fig. 2

Fig. 3

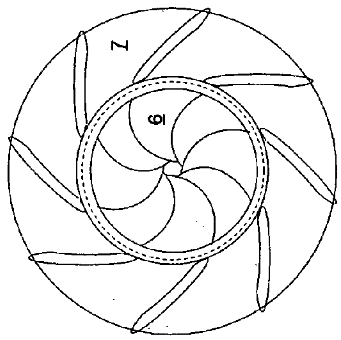


Fig. 6

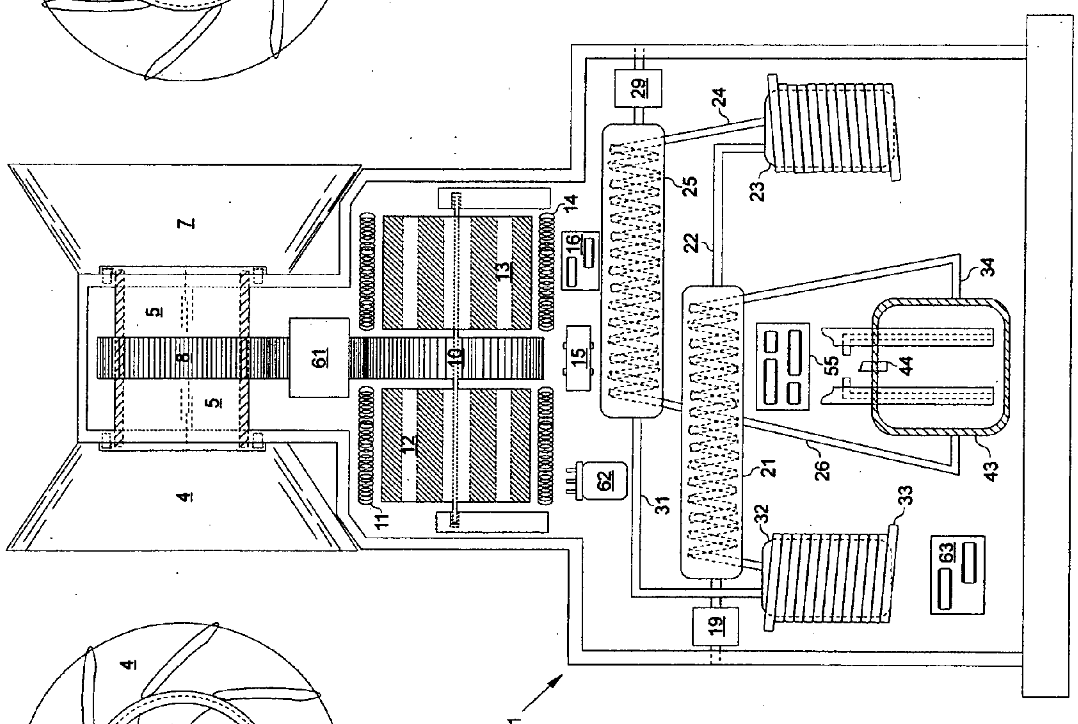


Fig. 4

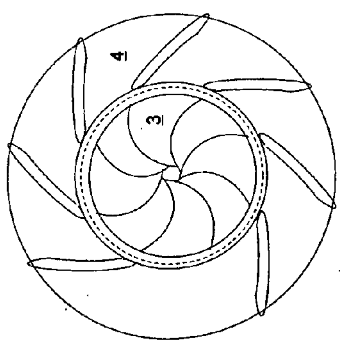


Fig. 5

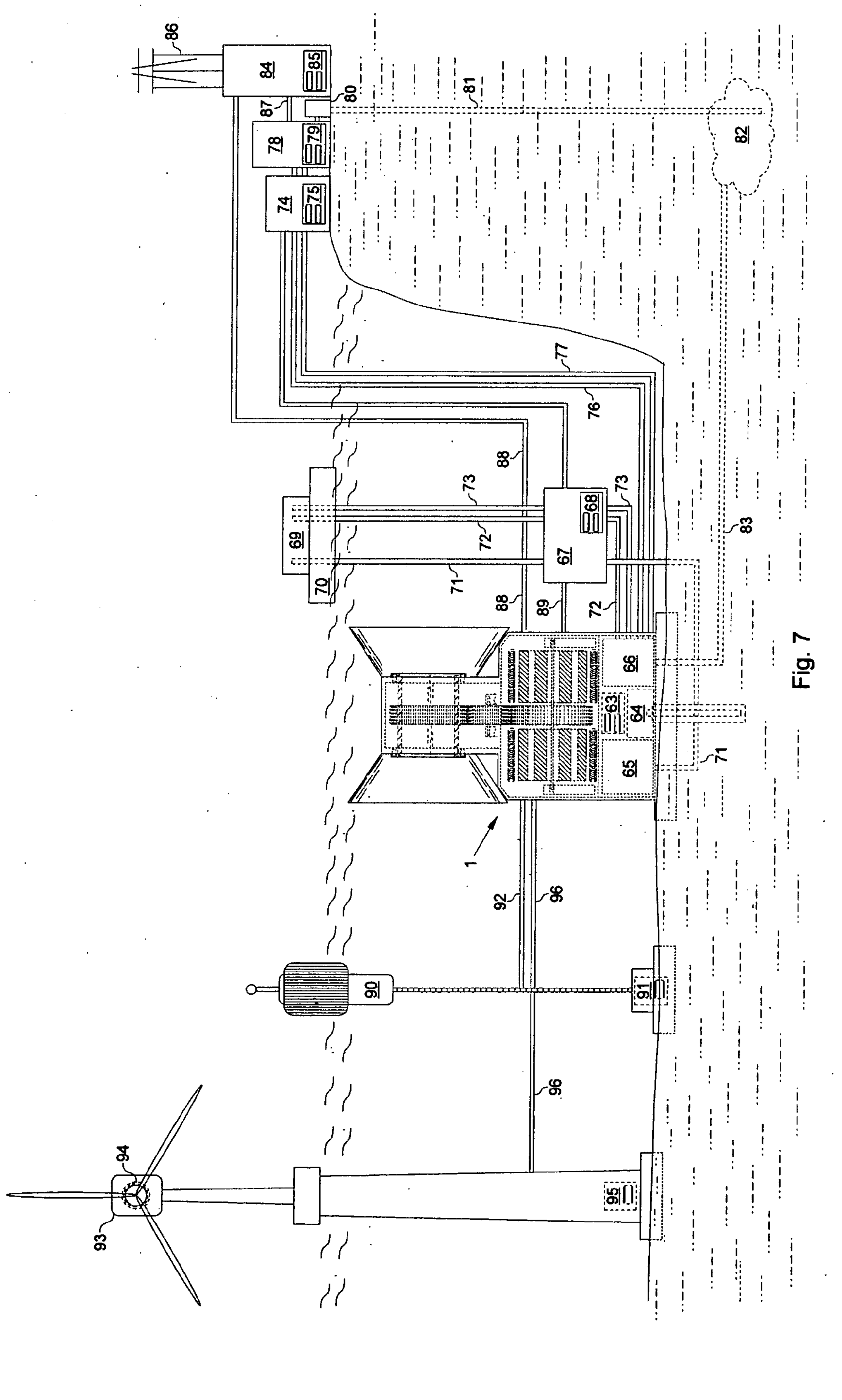

86
84
85
80
81
87
78
79
82
74
75
77
76
88
73
68
69
72
83
67
71
70
88
89
72
66
63
64
65
71
1
92
96
90
91
96
94
93
95

Fig. 7

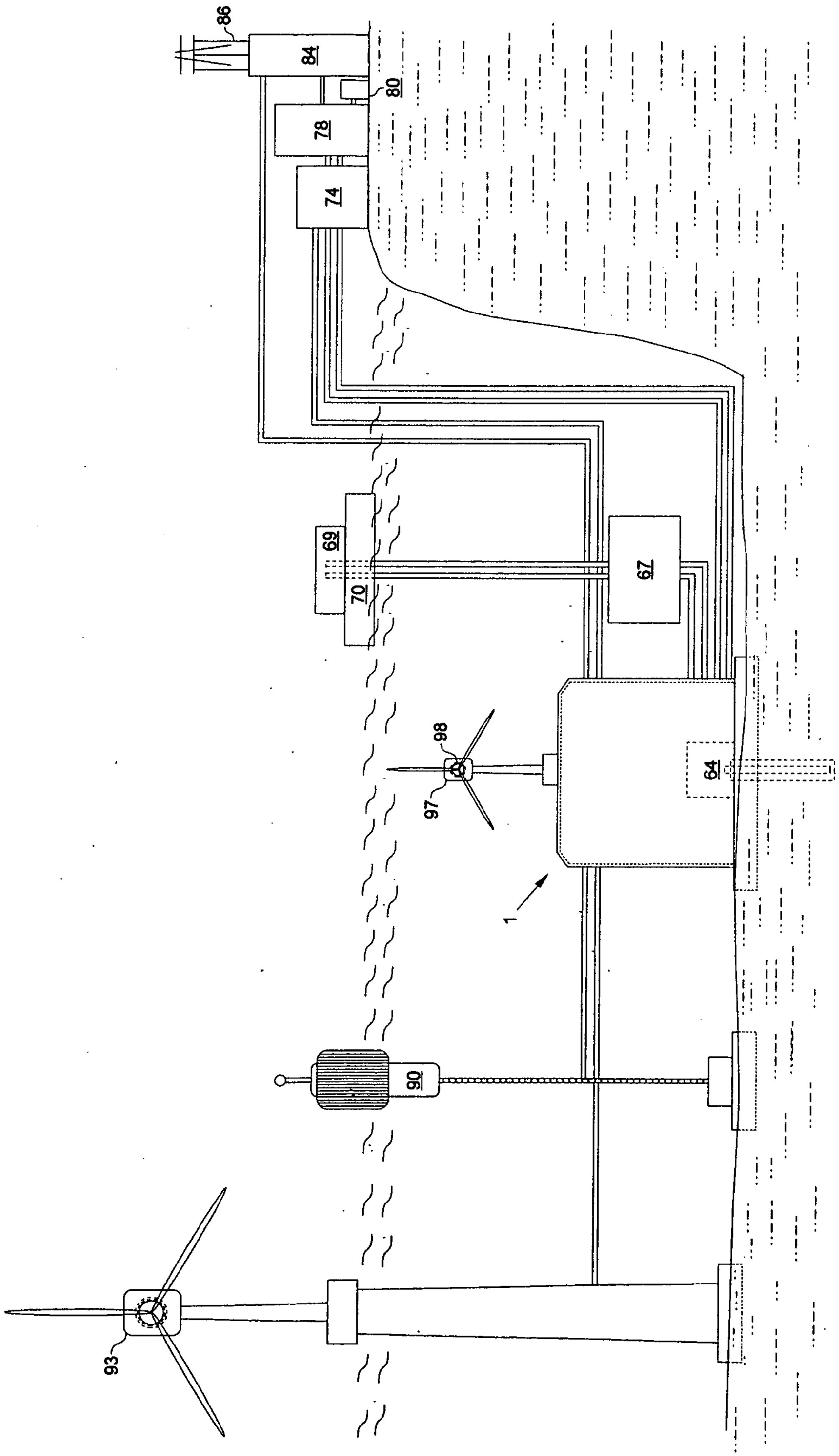


Fig. 8

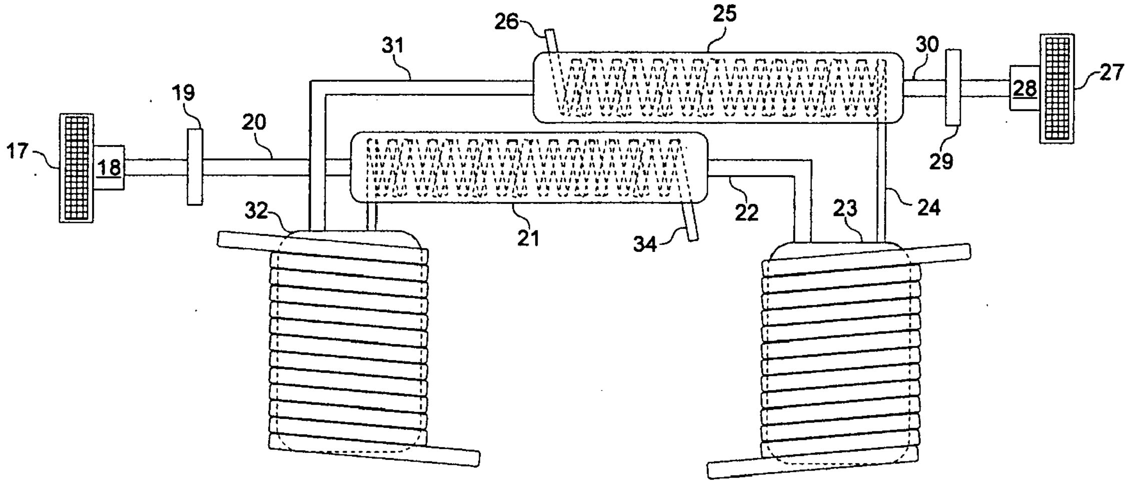


Fig. 9

Fig. 10

Fig. 11

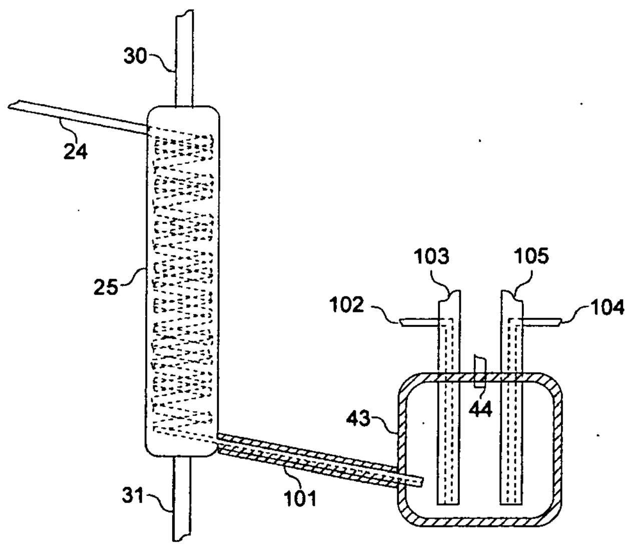


Fig. 12

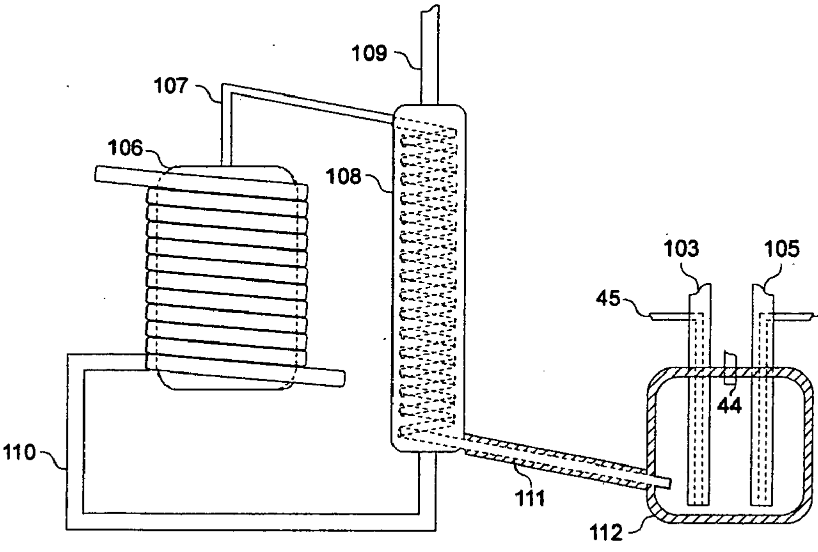


Fig. 13

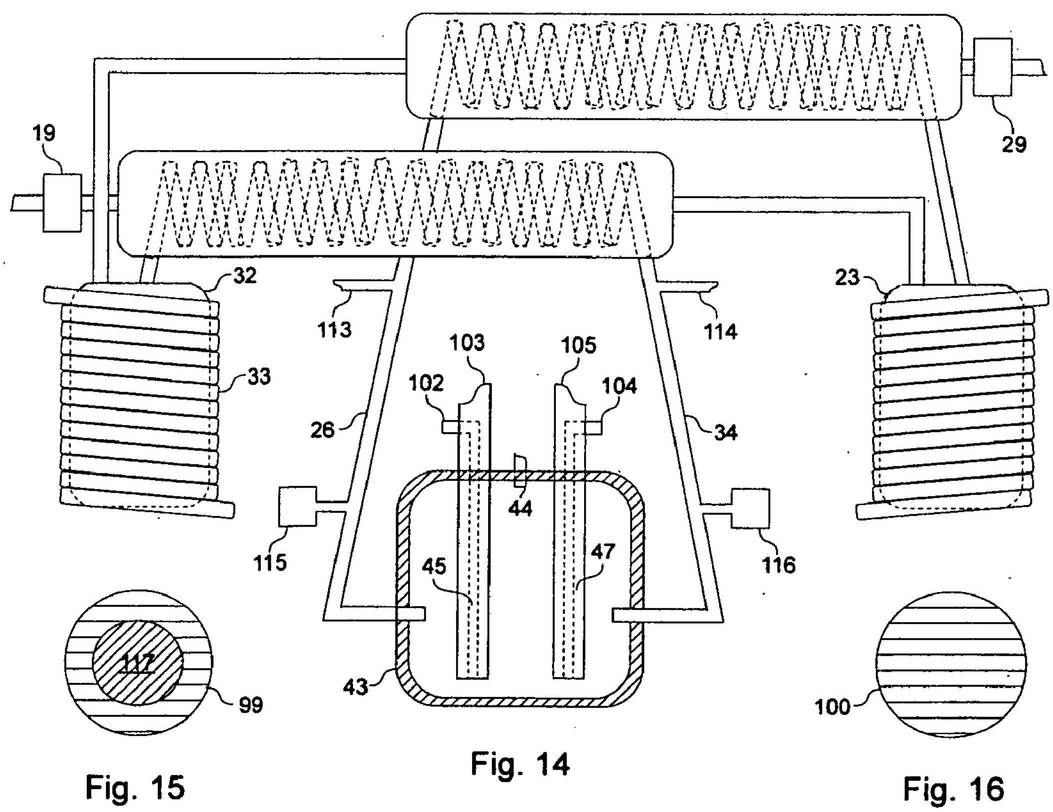


Fig. 15

Fig. 14

Fig. 16

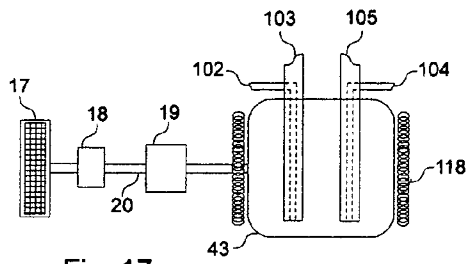


Fig. 17

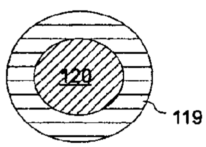


Fig. 18

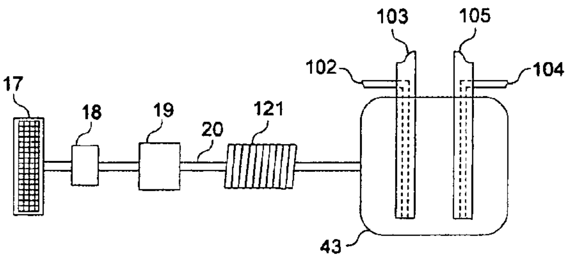


Fig. 19

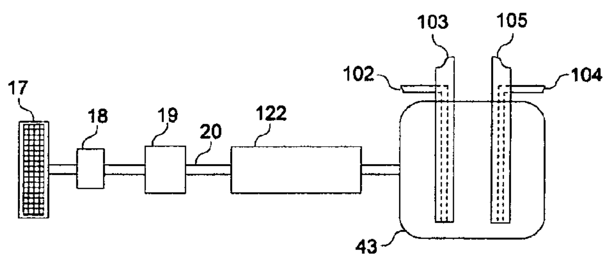


Fig. 20

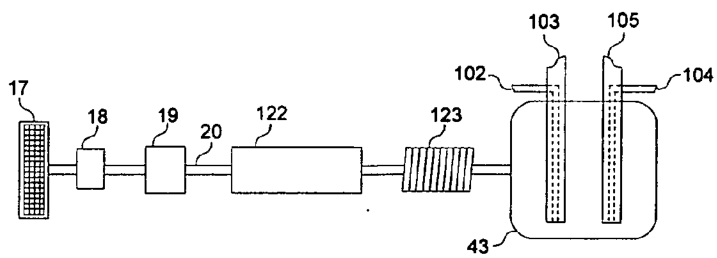


Fig. 21

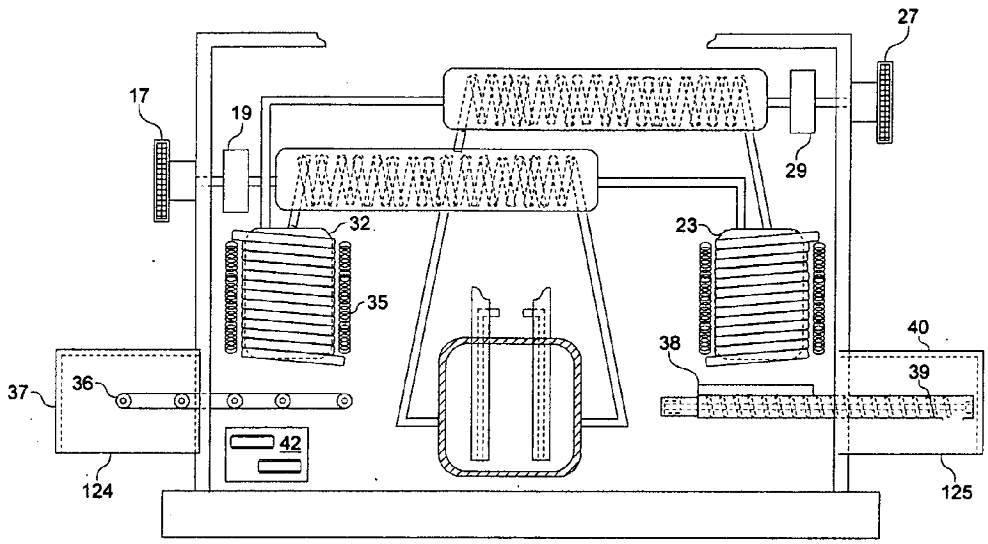

27
17
19
29
32
23
35
40
38
39
37
36
42
124
125

Fig. 22

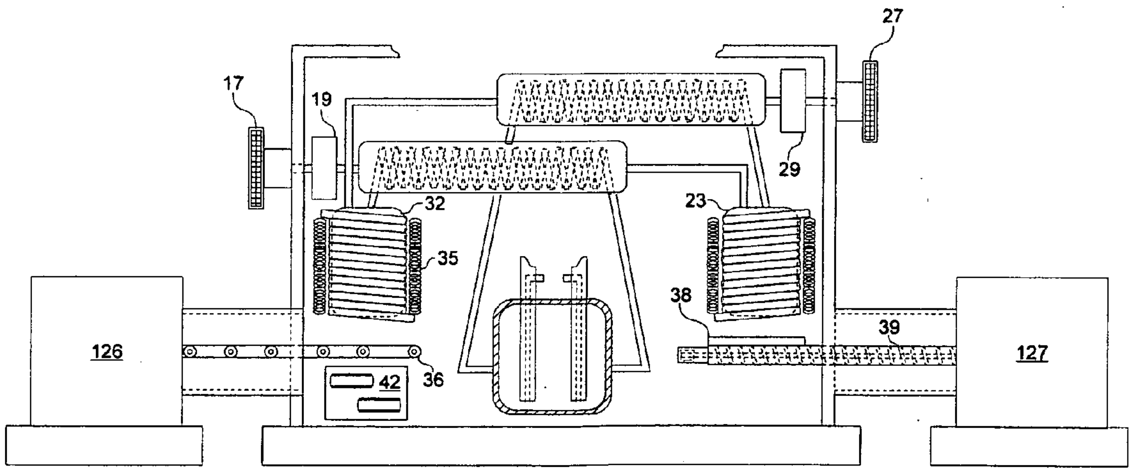

27
17
19
29
32
23
35
38
39
126
127
36
42

Fig. 23

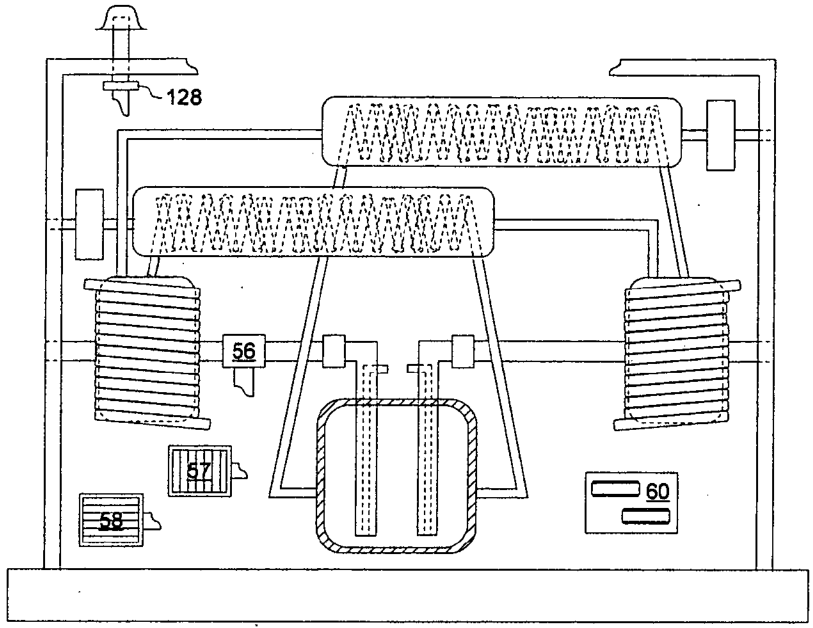


Fig. 24

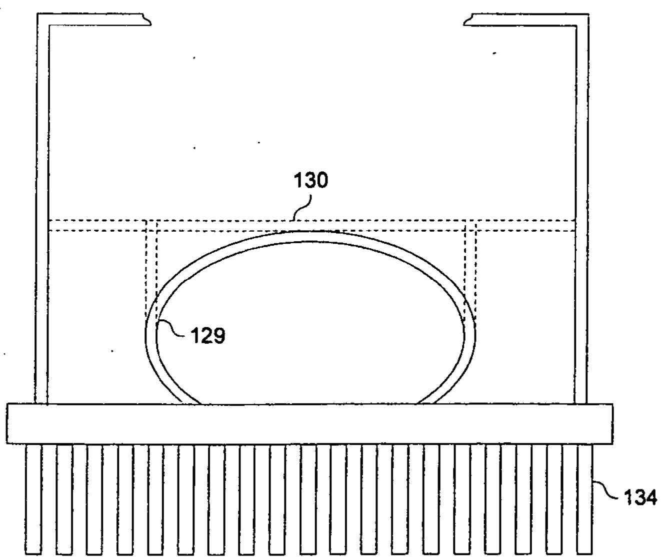


Fig. 25

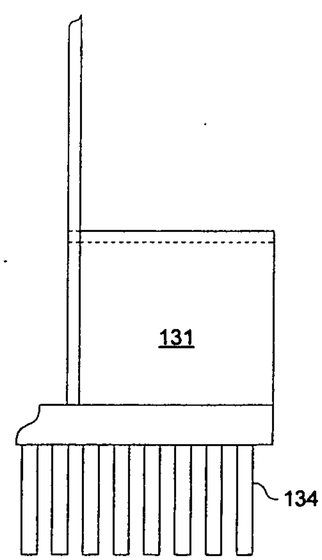


Fig. 26

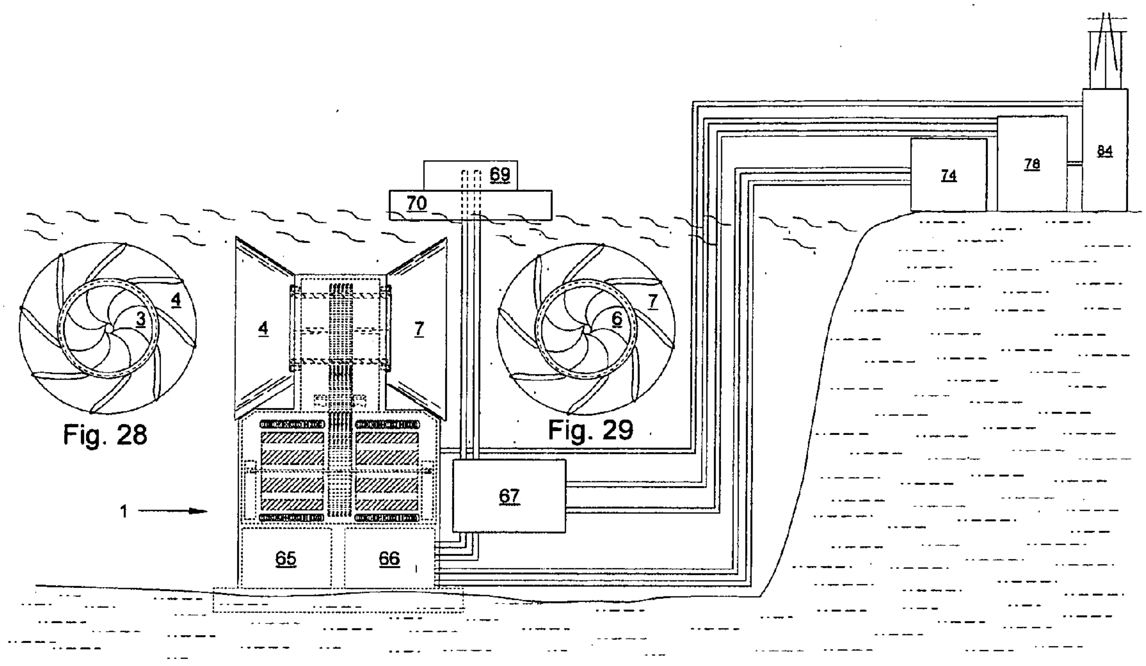

69
70
74
78
84
4
3
4
7
6
7
Fig. 28
Fig. 29
1
67
65
66

Fig. 27

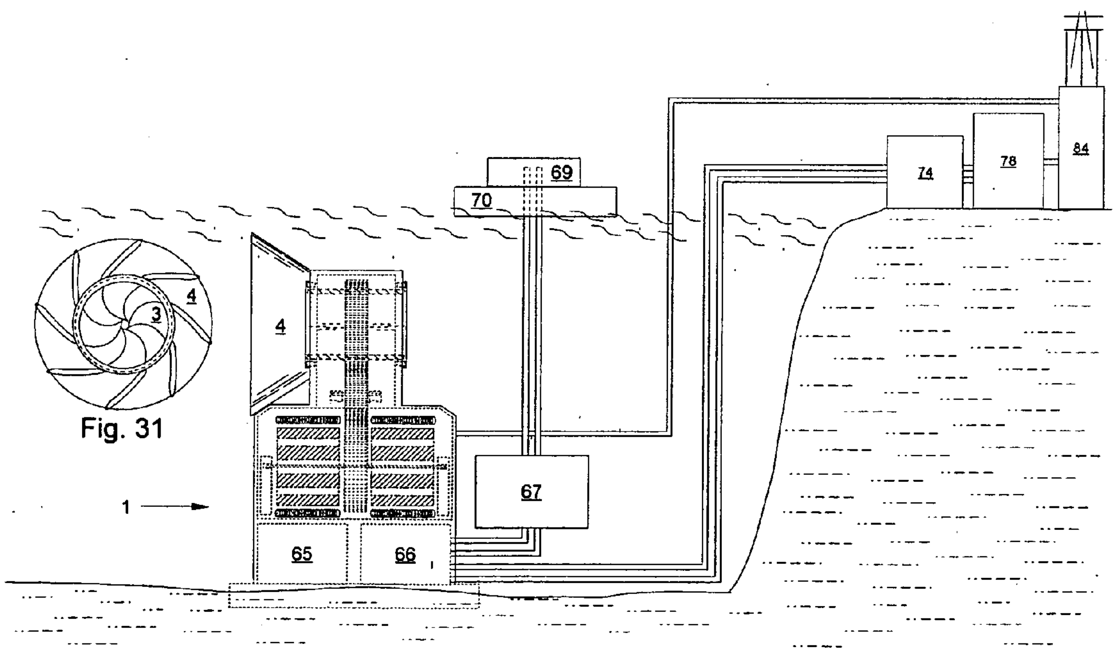

69
70
74
78
84
3
4
4
Fig. 31
1
67
65
66

Fig. 30

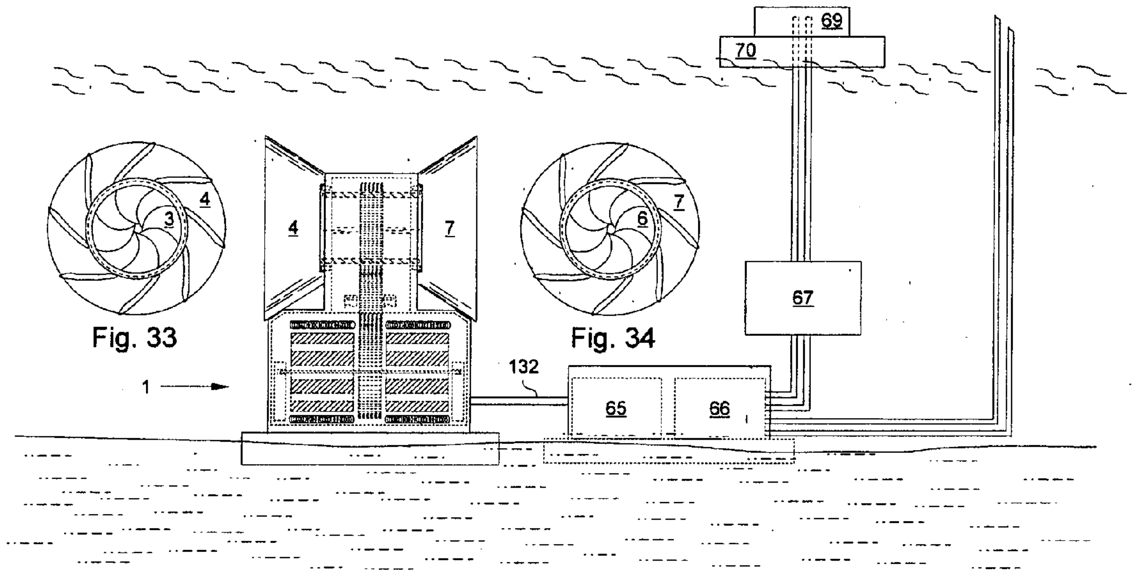

69
70
4
3
4
7
7
6
Fig. 33
Fig. 34
67
132
1
65
66

Fig. 32

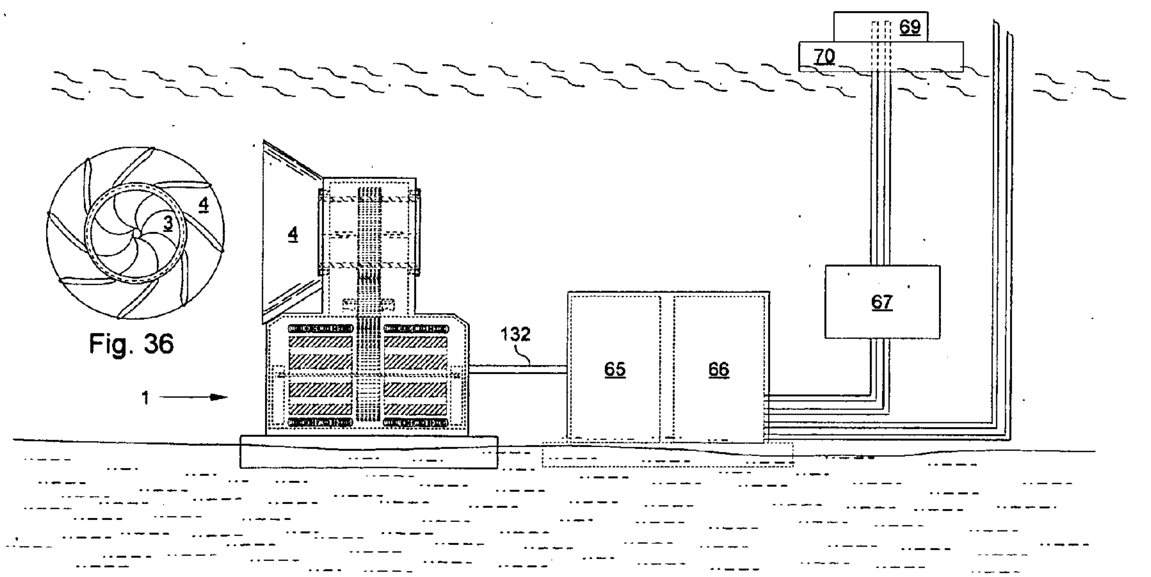

69
70
4
3
4
Fig. 36
67
132
1
65
66

Fig. 35

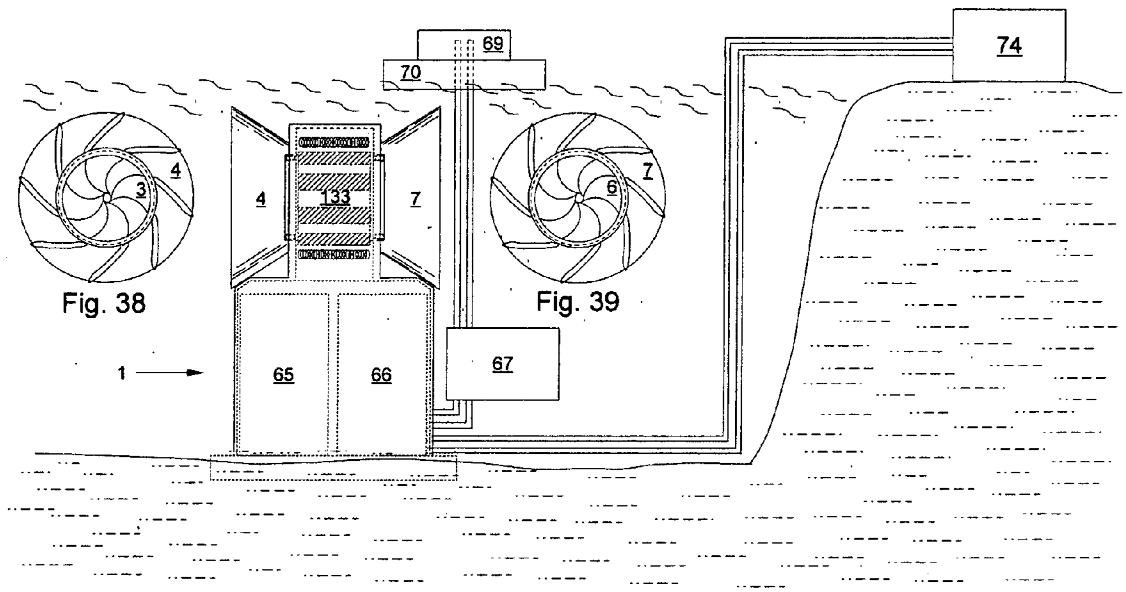


Fig. 38

Fig. 39

Fig. 37

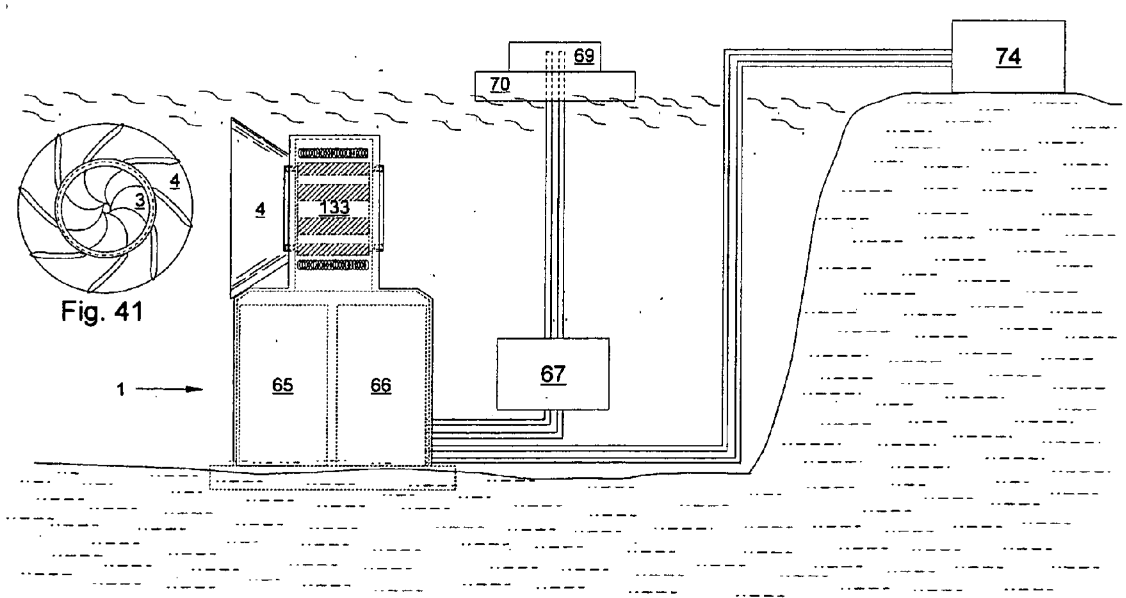


Fig. 41

Fig. 40

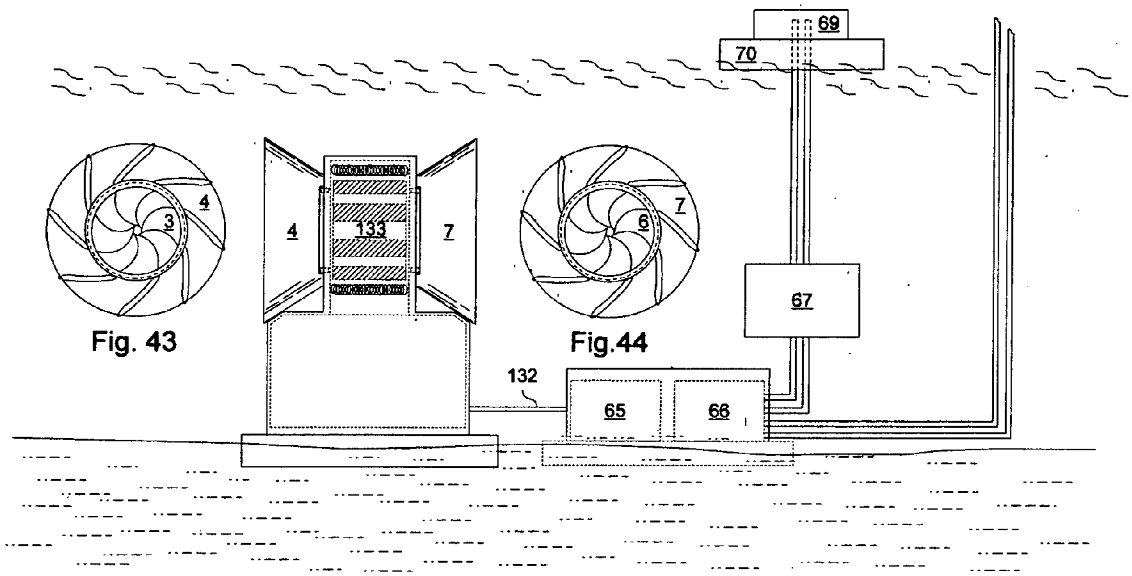

69
70
4
3
4
133
7
7
6
67
Fig. 43
Fig.44
132
65
66

Fig. 42

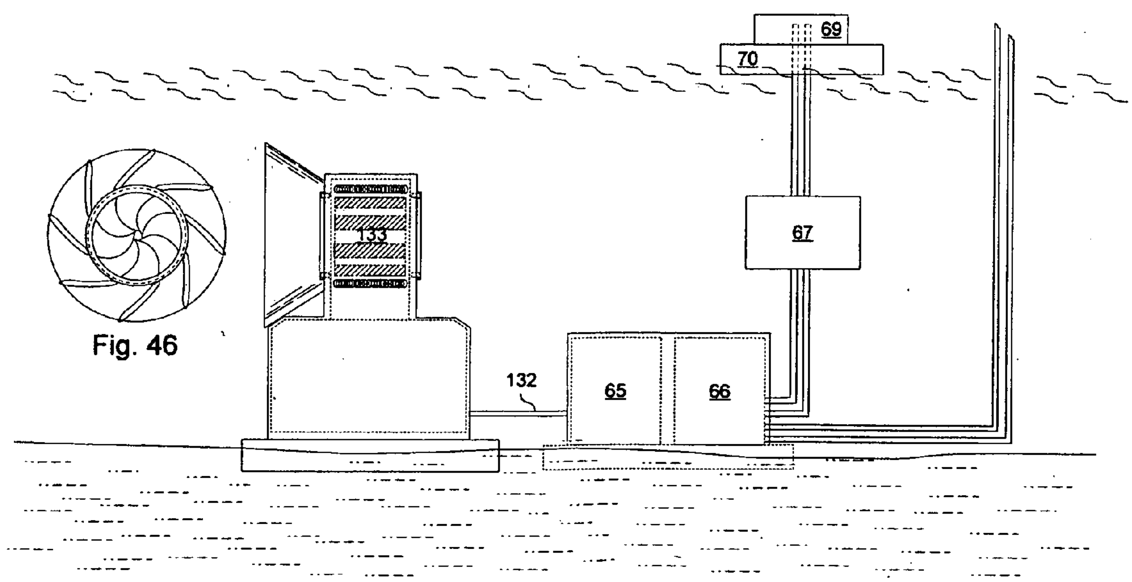

69
70
133
67
Fig. 46
132
65
66

Fig.45

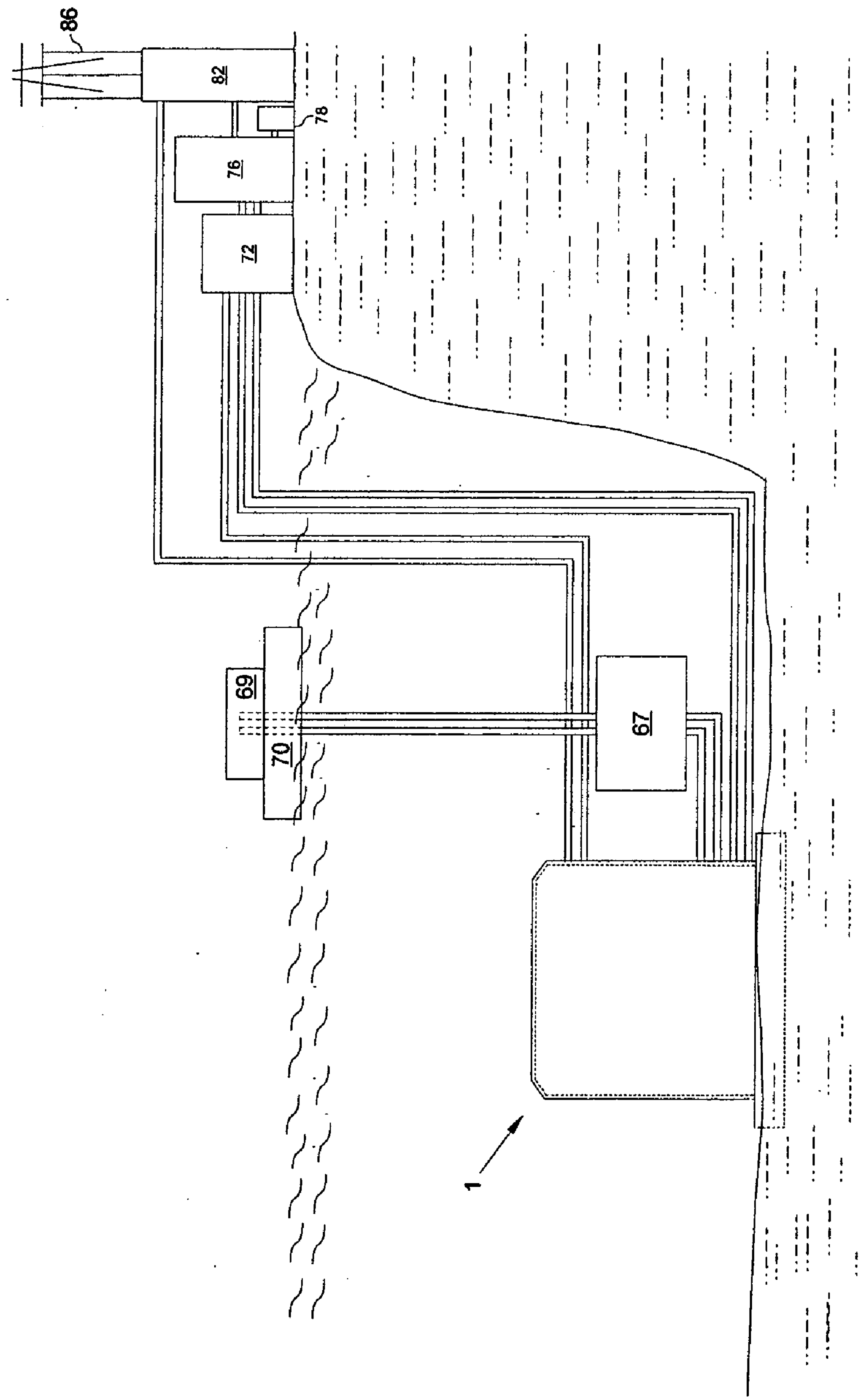


Fig. 47

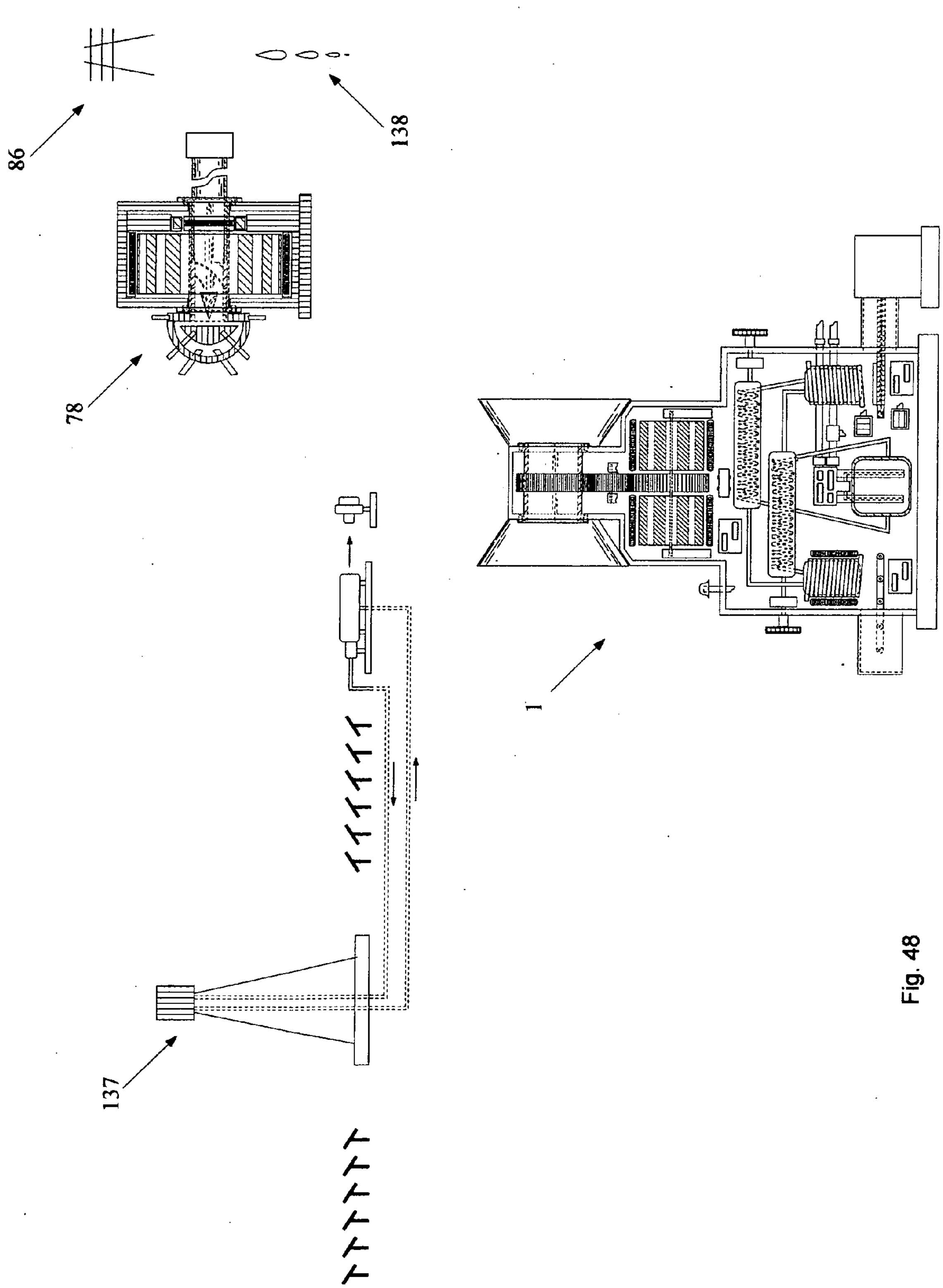


Fig. 48

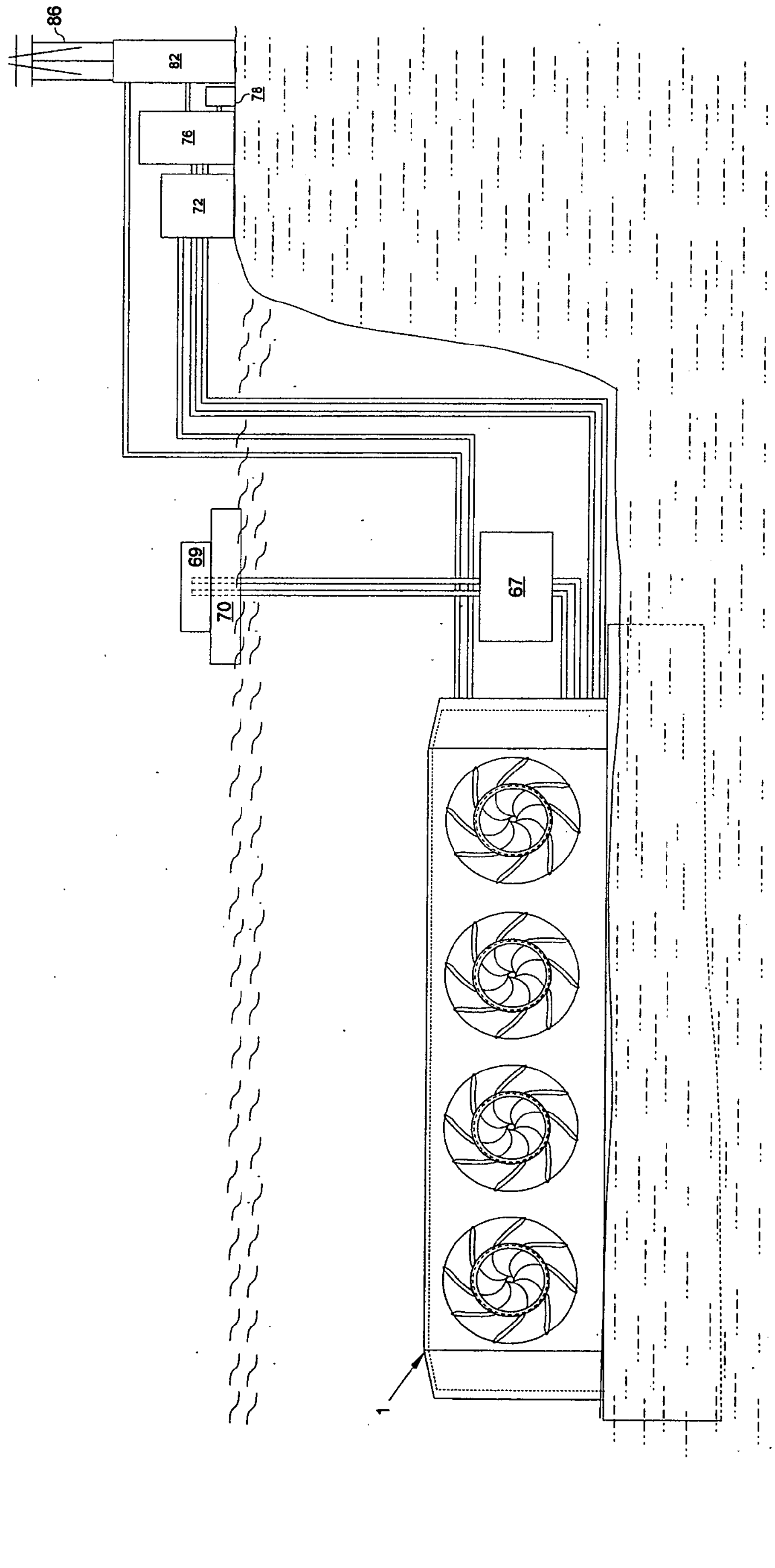


Fig. 49

SELF-SUFFICIENT HYDROGEN GENERATOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a DIV of Ser. No. 10/885,876, filed Jul. 6, 2004, that benefits from Provisional Application Ser. Nos. 60/485,577 filed Jul. 7, 2003; 60/487,372 filed Jul. 15, 2003; 60/489,254 filed Jul. 22, 2003; and 60/494,186 filed Aug. 11, 2003, all by the present inventor, which are all incorporated by reference. Also incorporated by reference is Regular application Ser. No. 11/803,062, filed May 11, 2007, also filed by the present inventor.

FEDERALLY SPONSORED RESEARCH

[0002] Not applicable

SEQUENCE LISTING OR PROGRAM

[0003] Not applicable

BACKGROUND—PRIOR ART

[0004] To date, hydrogen generators of this type are not deployed in any commercial development. Some proposed solutions for commercial development utilize propeller style turbines mounted on the ocean floor, with processing done either underwater or aboard stationary vessels on the surface. Another solution for hydrogen generation involves using a vessel as a wave style electric generator itself, and processing the hydrogen there as well.

[0005] These solutions are expensive and inefficient. Propeller style turbines are subject to breakage and are dangerous to marine life. A fleet of hydrogen production and distribution vessels would consume vast amounts of energy and personnel. These solutions also only allow for a single source of electrical power, thus creating a single point of failure.

[0006] Previously no feasible means of processing the resulting byproducts and debris from ocean water purification has been presented. Underwater life support, as well as a product distribution network, are also missing from these solutions.

SUMMARY

[0007] In accordance with one embodiment, a fully automated hydrogen generator comprises a plurality of energy sources, utilizes that energy for the production of hydrogen from the electrolysis of water, and provides oxygen for life support. Housing for the generator is provided, as well as a distribution means for the commercial consumption of the hydrogen, the oxygen, and the byproducts from the processes.

ADVANTAGES

[0008] Advantages of one or more aspects of the Self-Sufficient Hydrogen Generator include, providing a more efficient and comprehensive hydrogen generator that transforms ocean water into hydrogen. The invention described here doesn't harm fish or other marine animals, and has no negative impact on the environment. Other advantages of one or more aspects include providing a more scalable and economically attractive hydrogen generator that doesn't interfere with oceangoing traffic, and is capable of producing vast amounts of hydrogen from renewable resources without relying on diminishing fresh water supplies as other methods of electrolysis normally do. An embodiment located offshore and underwater is easier to secure from intruders, and safe from catastrophic storms, tidal waves, and rising sea levels. These and other advantages of one or more aspects will become apparent from a consideration of the ensuing description and accompanying drawings.

DRAWINGS—FIGURES

[0009] FIG. **1** shows a cross-sectional view of as many of the main features of one embodiment as drawing space will allow.

[0010] FIGS. **2** and **3** show the side views, relative to FIG. **1**, of one aspect of a HOLLOW TURBINE and directional funnels.

[0011] FIG. **4** shows another cross-sectional view including some of the main features of one embodiment that would not fit in FIG. **1**.

[0012] FIGS. **5** and **6** show the side views of one aspect of a HOLLOW TURBINE and directional funnels.

[0013] FIG. **7** shows one embodiment implemented in one of many configurations.

[0014] FIG. **8** shows another embodiment implemented in one of many configurations.

[0015] FIG. **9** shows one means of distillation.

[0016] FIGS. **10** and **11** depict two slatted boiler bottoms that open to allow the debris from boiling water to fall freely from the bottom of the boiler.

[0017] FIG. **12** shows a condenser connected to an insulated pipe that connects to an insulated electrolyzer.

[0018] FIG. **13** shows one embodiment that incorporates just one boiler.

[0019] FIG. **14** shows parts that could not be illustrated on previous figures.

[0020] FIG. **15** depicts a nonstick coating within the boiler bottom.

[0021] FIG. **16** shows a boiler bottom.

[0022] FIGS. **17** and **19** to **21** show various aspects related to water filtration and electrolysis.

[0023] FIGS. **18**, **22** and **23** show three aspects related to debris removal and processing.

[0024] FIG. **24** shows one representation of the apparatus associated with a life support system.

[0025] FIG. **25** shows one means of entering and exiting the facility, as well as one foundation means.

[0026] FIG. **26** is a side view of FIG. **25**.

[0027] FIGS. **27** to **47** show several embodiments in various configurations.

[0028] FIG. **48** shows an embodiment that utilizes sunlight and ocean water to produce potable water and electric power.

[0029] FIG. **49** shows a large scale embodiment with multiple turbines.

DRAWINGS—REFERENCE NUMERALS

[0030] **1**. SELF-SUFFICIENT HYDROGEN GENERATOR

[0031] **2**. submersible structure

[0032] **3**. HOLLOW TURBINE

[0033] **4**. directional funnel

[0034] **5**. turbine cylinder, outer surface

[0035] **6**. HOLLOW TURBINE

[0036] **7**. directional funnel

[0037] **8**. rotational energy connecting element

[0038] **9**. rotational energy connecting element

[0039] **10**. rotational energy connecting element
[0040] **11**. stator
[0041] **12**. rotor
[0042] **13**. rotor
[0043] **14**. stator
[0044] **15**. rectifier
[0045] **16**. control system, electricity generation and importation
[0046] **17**. intake filter
[0047] **18**. check valve
[0048] **19**. intake pump
[0049] **20**. intake pipe
[0050] **21**. steam condenser
[0051] **22**. boiler water intake pipe
[0052] **23**. boiler
[0053] **24**. boiler steam output pipe
[0054] **25**. steam condenser
[0055] **26**. electrolyzer water intake pipe
[0056] **27**. intake filter
[0057] **28**. check valve
[0058] **29**. intake pump
[0059] **30**. intake pipe
[0060] **31**. boiler water intake pipe
[0061] **32**. boiler
[0062] **33**. boiler heating element
[0063] **34**. electrolyzer water intake pipe
[0064] **35**. electromagnet for vibrating boiler
[0065] **36**. conveyor belt for boiler debris
[0066] **37**. boiler debris exhaust port
[0067] **38**. boiler debris collector
[0068] **39**. auger style boiler debris removal system
[0069] **40**. boiler debris exhaust port
[0070] **41**. boiler debris processing plant
[0071] **42**. control system, boiler debris removal
[0072] **43**. electrolyzer
[0073] **44**. electrolyzer ventilation
[0074] **45**. positive electrode
[0075] **46**. gas accumulator pipe
[0076] **47**. negative electrode
[0077] **48**. gas accumulator pipe
[0078] **49**. exhaust pump
[0079] **50**. exhaust pump
[0080] **51**. check valve
[0081] **52**. check valve
[0082] **53**. hydrogen output pipeline
[0083] **54**. oxygen output pipeline
[0084] **55**. control system, providing orchestration for electrolysis
[0085] **56**. oxygen injection means to ventilation system
[0086] **57**. nitrogen injection means to ventilation system
[0087] **58**. carbon dioxide (CO_2) scrubber
[0088] **59**. air exhaust vent
[0089] **60**. control system, providing orchestration for life support systems
[0090] **61**. SELF-WINDING GENERATOR
[0091] **62**. transformer
[0092] **63**. control system, network communication, information processing, and transaction processing
[0093] **64**. geothermal power source
[0094] **65**. seawater purification means
[0095] **66**. electrolysis means
[0096] **67**. submerged gas storage and distribution facilities
[0097] **68**. control system, network communication and information processing
[0098] **69**. gas pipeline and debris export means
[0099] **70**. barge
[0100] **71**. seawater debris removal pipeline
[0101] **72**. hydrogen export pipeline
[0102] **73**. oxygen export pipeline
[0103] **74**. onshore gas storage and distribution facilities
[0104] **75**. control system, network communication and information processing
[0105] **76**. hydrogen export pipeline
[0106] **77**. oxygen export pipeline
[0107] **78**. HYDROGEN-FIRED HOLLOW GENERATOR
[0108] **79**. control system, network communication and information processing
[0109] **80**. water processing plant
[0110] **81**. water pipeline
[0111] **82**. water storage cavern
[0112] **83**. water pipeline
[0113] **84**. electric substation
[0114] **85**. control system, network communication and information processing
[0115] **86**. electric power grid
[0116] **87**. conduit, electric transmission power lines.
[0117] **88**. conduit, electric transmission power lines
[0118] **89**. nitrogen supply pipeline
[0119] **90**. wave powered electric generator
[0120] **91**. control system, network communication and information processing
[0121] **92**. conduit, electric transmission power lines
[0122] **93**. wind turbine
[0123] **94**. SELF-WINDING GENERATOR
[0124] **95**. control system, network communication and information processing
[0125] **96**. conduit, electric transmission power lines
[0126] **97**. propeller style submerged turbine
[0127] **98**. SELF-WINDING GENERATOR
[0128] **99**. boiler bottom with hinged slats
[0129] **100**. boiler bottom with hinged slats
[0130] **101**. insulated electrolyzer water input
[0131] **102**. positive electrode
[0132] **103**. gas accumulator pipe
[0133] **104**. negative electrode
[0134] **105**. gas accumulator pipe
[0135] **106**. boiler
[0136] **107**. boiler steam output pipe
[0137] **108**. steam condenser
[0138] **109**. boiler water intake pipe to condenser
[0139] **110**. boiler water intake pipe
[0140] **111**. insulated electrolyzer water input
[0141] **112**. insulated electrolyzer
[0142] **113**. vacuum/gas inlet
[0143] **114**. vacuum/gas inlet
[0144] **115**. electrolyte injector
[0145] **116**. electrolyte injector
[0146] **117**. boiler nonstick coating
[0147] **118**. electromagnet for vibrating an electrolyzer
[0148] **119**. electrolyzer bottom with hinged slats
[0149] **120**. electrolyzer's interior nonstick coating
[0150] **121**. in-line water heating element
[0151] **122**. reverse osmosis means
[0152] **123**. in-line water heating element
[0153] **124**. boiler debris exhaust port opening
[0154] **125**. boiler debris exhaust port opening
[0155] **126**. boiler debris processing plant

[0156] 127. boiler debris processing plant
[0157] 128. air exhaust check valve
[0158] 129. portal entrance to a submerged structure
[0159] 130. floor
[0160] 131. side view entrance to the submerged structure
[0161] 132. conduit, electric transmission power lines
[0162] 133. HOLLOW GENERATOR
[0163] 134. vertical columns/foundation anchors
[0164] 135. ocean water intake pipe.
[0165] 136. residue discharge pipeline.
[0166] 137. solar thermal power plant
[0167] 138. water distribution means

DETAILED DESCRIPTION

First Embodiment—FIGS. 1 to 7 and FIGS. 10, 11, 14, 15 and 23

[0168] One embodiment of the hydrogen generator **1** is illustrated in FIGS. **1**, **2** and **3**. The present embodiment utilizes electricity derived from a HOLLOW TURBINE **3**, as seen from the left side in FIG. **2**, and as seen from the right side as reference number **6** in FIG. **3**, and is mounted to a submersible structure **2**.

[0169] I contemplate the submersible structure **2** be constructed from reinforced, possibly marine grade, concrete, or other suitable materials, and sufficient in size to accommodate all of the apparatus that comprise the hydrogen generator **1**. The submersible structure **2** may be fabricated onshore and towed into place by tug boats, and lowered to its ideal position. The apparatus to be included with the structure, such as turbines, electric generators, and electrolyzers may be assembled and installed onshore as well. As seen in FIGS. **25** and **26** the submersible structure **2** also includes an underwater entrance **129** and **131** that provides access to the structure while protecting it from accidental contact with submersibles.

[0170] Vertical columns **134**, attached to the bottom of the foundation, act as anchors to prevent movement due to use and/or earthquakes, and are depicted in FIGS. **25** and **26**. The generator's housing may not be fastened directly to the foundation and held in place instead by its own weight, if sufficient so as to allow for movement without breakage. If the structure's weight is insufficient to hold itself in place, then mounts incorporating rubber struts and springs, similar to those used to support skyscrapers, may be implemented. These struts and springs help structures survive earthquakes.

[0171] I contemplate using submersibles, including diving bells, to transport people and materials to and from the facilities. An enclosed road, inside a tube, similar to San Francisco's Bay Area Transit system, would enable personnel and materials to be driven directly into and out of the facility.

[0172] Referring again to FIG. **1**, directional funnels **4** and **7** connect to the submersible structure at the opening of the turbine. The HOLLOW TURBINE **3** connects to the rotors **12** and **13** via rotational energy connecting elements **8**, **9**, and **10**, and are mounted in close proximity to stators **11** and **14**. The stators **11** and **14** connect to the rectifier **15** by cables that are not shown. A transformer **62**, as seen in FIG. **4**, is used to induce different voltages from the generated current. Orchestration of the various processes required to generate, import, and distribute electricity is performed by a control system **16**, and illustrated in FIGS. **1** and **4**. Referring now to FIG. **4**, an optional SELF-WINDING GENERATOR **61** is connected between the turbine and the rotors **12** and **13** and provides continuous rotational energy at a constant rate.

[0173] Referring to FIG. **1**, filters **17** and **27** connect to check valves **18** and **28**, and intake pumps **19** and **29**, via intake pipes **20** and **30**. Intake pipes **20** and **30** connect to the steam condensers **21** and **25** and provide the cold water necessary to condense the steam generated by boilers **32** and **23**.

[0174] Steam condensers **21** and **25** connect to the electrolyzer **43** via the water intake pipes **26** and **34**. Attached to the electrolyzer's intake pipes **26** and **34** are vacuum/gas inlets **113** and **114**, and electrolyte injectors **115** and **116**, respectively, as seen in FIG. **14**. Also attached to the electrolyzer **43** is an electrolyzer ventilation means **44**. Referring again to FIG. **1**, electrodes **45** and **47** are attached and centered within the gas accumulator pipes **46** and **48**, and are mounted through the top of the electrolyzer **43**. Electric cables for connecting the electrodes **45** and **47** to the electricity generation means are not shown. The hydrogen accumulator pipe **46** connects to a pump **49**, check valve **51**, and output pipe **53**. The oxygen accumulator pipe **48** connects to a pump **50**, oxygen injection means **56**, check valve **52**, and output pipe **54**.

[0175] Referring now to FIG. **23**, electromagnets **35** are mounted in close proximity to the boiler **32**. A conveyor belt **36** is located directly below the boiler **32** and extends to the debris exhaust plant **126**. Electromagnets are also mounted in close proximity to the boiler **23**. A boiler debris collector **38** connects to an auger style boiler debris removal system **39** located directly below the boiler **23**, and extends to boiler debris processing plant **127**. The choice of which debris removal system to incorporate is dependent on the space limitations of the facility. FIGS. **10** and **11** show the hinged boiler bottoms **99** and **100** of the boilers **32** and **23**. A nonstick coating **117**, as depicted in FIG. **15**, coats the inner surfaces of the boilers **32** and **23**. Teflon is an example of one such coating. Rubber supports and springs, not shown, may be utilized to allow the boilers to vibrate without causing damage.

[0176] Also connected to the submersible structure **2**, and shown in FIG. **1**, is an air exhaust vent **59**. The structure's ventilation system includes an oxygen injection means **56**, a nitrogen injection means **57**, and a carbon dioxide scrubber **58**. Blowers, not shown, circulate the manufactured air.

[0177] Referring to FIGS. **1** and **7**, the hydrogen gas accumulator pipe **46** connects to the exhaust pump **49** and the check valve **51** via the output pipeline **53** that connects to the hydrogen export pipelines **72** and **76**. The oxygen gas accumulator pipe **48** connects to the exhaust pump **50** and the check valve **52**, and the oxygen injection means **56**, via the pipeline **54** that connects to the oxygen export pipelines **73** and **77**. The export pipelines **72** and **73** connect to the submerged gas storage and distribution facilities **67**, then to a barge **70**, and ultimately to a gas pipeline and debris export means **69**. Another set of export pipelines, hydrogen **76** and oxygen **77**, connect to the onshore gas storage and distribution facilities **74**.

[0178] Control systems are provided for the entire production process including: electricity generation **16**, boiler debris removal **42**, electrolysis **55**, and also for life support systems **60**, specifically ventilation. A separate communication and information processing control system **63** is also incorporated, and shown in FIG. **7**.

Operation

First Embodiment—FIGS. 1 to 7 and FIGS. 14 and 23

[0179] Water entering directional funnels **4** and **7** is channeled so as to impact the HOLLOW TURBINE's blades at an optimal angle. The turning HOLLOW TURBINE transfers rotational energy, via rotational energy connecting elements **8**, **9**, and **10**, to rotors **12** and **13** that induce current by rotating their alternating magnetic fields in close proximity to the stators **11** and **14**. Referring now to FIG. **4**, an optional SELF-WINDING GENERATOR **61** is incorporated to provide constant rotational energy from inconstant sources of kinetic energy.

[0180] Referring to FIG. **1**, the resulting alternating current is transformed into direct current by means of a rectifier **15**. A transformer **62**, as seen in FIG. **4**, is used to induce different voltages from the generated current. Interconnecting electric cables are not shown. Orchestration of the various processes required to generate and distribute electricity is performed by a control system **16**, and illustrated in FIGS. **1** and **4**.

[0181] Ocean water enters through the filters **17** and **27**, and later passes through check valves **18** and **28**, and intake pumps **19** and **29**, via intake pipes **20** and **30**. Intake pipes **20** and **30** connect to steam condensers **21** and **25** and provide a means of cooling the steam from the boilers **23** and **32**, while simultaneously preheating the incoming water.

[0182] Referring to FIG. **14**, the superheated water, necessary for the high temperature electrolysis that results from the distillation of ocean water in the boilers **23** and **32**, enters the electrolyzer **43** via the water intake pipes **26** and **34**. Electrolytes are injected into the superheated water by the electrolyte injectors **115** and **116**. Possible choices of electrolytes for electrolysis include: a strong acid, such as sulfuric acid (H_2SO_4), or a strong base such as potash (KOH), or sodium hydroxide (NaOH). Any pressure imbalances are compensated for by vacuum/gas inlets **113** and **114**, via water intake pipes **26** and **34**.

[0183] Electrons exiting the electrolyzer **43** through an electrode **45**, attract hydrogen atoms, while electrons entering the electrolyzer through an electrode **47** attract oxygen atoms. A pump **49**, as seen in FIG. **1**, compresses the hydrogen gas while a pump **50** compresses the oxygen. Pressurized hydrogen exits the generator passing through a check valve **51** and an output pipe **53**. Pressurized oxygen exits the generator, passing through the oxygen ventilation injection means **56**, the check valve **52**, and the output pipe **54**. The electrolysis process is orchestrated by a control system **55**.

[0184] Referring now to FIG. **22**, an alternating magnetic field vibrates the boilers **23** and **32** and loosens the debris stuck to the nonstick coated boiler interiors. Falling debris from the boiler **32** is removed by a conveyor belt **36** and transported to the boiler debris exhaust port **124**, where it falls back into the ocean. Falling debris from the boiler **23** is captured by a debris collector **38** and removed by an auger style debris removal system **39** to the boiler debris processing plant **127**, as seen in FIG. **23**. Referring to FIG. **7**, debris may also be exported by barge **70** via the sea water debris removal pipeline **71**. The entire process is directed by the control system **42**, and shown in FIGS. **22** and **23**.

[0185] Stale air is exhausted through an air exhaust vent **59**, as seen in FIG. **1**. Fresh breathable air is produced on site by combining the necessary amounts of: oxygen generated from electrolysis **56**, nitrogen from nitrogen injection means **57**, and obtained from external sources. Carbon dioxide is eliminated by scrubbers **58** that remove the toxic gas from the environment. The control system **60** orchestrates these processes.

[0186] Referring to FIGS. **1** and **7**, the hydrogen generated at the electrode **45** by the electrolyzer **43** is exported first through a gas accumulator pipe **46** and pressurized by an exhaust pump **49** before being transferred to a submerged storage and distribution facilities **67**, and/or onshore storage and distribution facilities **74** where terrestrial pipelines will attach. The oxygen generated at the electrode **47** by the electrolyzer **43** is exported first through a gas accumulator pipe **48** and pressurized by an exhaust pump **50** before being transferred to the same storage facilities **67** and **74**. The export procedure for the oxygen produced on site is the same as is for hydrogen.

[0187] A communications control system **63**, shown in FIG. **7**, is incorporated to transmit supply data to interested consumers of the resources produced, including a HYDROGEN-FIRED HOLLOW GENERATOR **78**. These interested consumers, include debris processing plants **126** and **127**, FIG. **23**, hydrogen storage control systems **68** and **75**, and any other hydrogen generators. These consumers will also incorporate these same systems to transmit the demanded product quantities, delivery time and dates, and also to negotiate price with the suppliers control system **63**. The communications control system **63** will calculate responses to these demands based on the total market demand at that time, and transmit those responses back to the consumers' control systems. All the operators of these consuming systems must do is enter the already mentioned data, as well as a priority of vendors, into their control systems. The control systems themselves orchestrate the entire process of production and distribution. Thus, aggregate demand for the various commodities produced on site will dictate the production schedule for the production facilities.

Alternative Embodiment—FIG. **7**

[0188] FIG. **7** illustrates the hydrogen generator's operating environment including the alternative sources of electric power and the consumers of the products produced.

[0189] Alternative electric power sources include: a wind turbine **93** with a control system **95** and an optional attached SELF-WINDING GENERATOR **94**, a wave powered electric generator **90** and control system **91**, geothermal power **64**, and an electric substation **84** and control system **85** that integrates grid power **86** and electricity generated by an optional HYDROGEN-FIRED HOLLOW GENERATOR **78** and control system **79**.

Operation

[0190] Operation of the hydrogen generator **1** is unaffected by the choice for a source of electricity.

Alternative Embodiment—FIG. **8**

[0191] Referring to FIG. **8**, the hydrogen generator **1** is not limited to the HOLLOW TURBINE that is described in the previous embodiment and shown in FIGS. **1** to **7**. A traditional propeller style turbine **97** with an optional SELF-WINDING GENERATOR **98** is fastened to the top of the submersible structure **2**.

Operation

[0192] Operation of the hydrogen generator **1** is unaffected by the choice for a source of electricity.

Alternative Embodiment—FIG. **47**

[0193] FIG. **47** depicts a hydrogen generator **1** that operates exclusively on electricity obtained from the national electric power grid **86**. This embodiment is appropriate where no renewable energy resources are available.

Operation

[0194] Operation of the hydrogen generator **1** is unaffected by the choice for a source of electricity.

Alternative Embodiment—FIG. **13**

[0195] Referring to FIG. **13**, this embodiment features a single boiler **106** desalination system, including a water intake pipe **109** connected to a steam condenser **108** that connects to the boiler water intake pipe **110**. The boiler steam output pipe **107** is attached to the steam input of the condenser **108** that connects to an insulated electrolyzer water input **111** that is attached to an insulated electrolyzer **112**.

Operation

[0196] Cold water enters the steam condenser **108** through a boiler water intake pipe **109** and is preheated by the cooling steam within the same steam condenser **108**. The preheated water enters the boiler **106** through a boiler water intake pipe **110**. The resulting steam is channeled by the boiler steam output pipe **107** through the same steam condenser **108** that preheated the incoming water. The resulting superheated purified water enters the insulated electrolyzer **112** through an insulated electrolyzer water input **111**. The remainder of the operation is the same as previously disclosed.

Alternative Embodiment—FIGS. **17** to **21**

[0197] FIGS. **17** to **21** depict various electrolyzer embodiments that electrolyze ocean water without first being desalinated.

[0198] FIGS. **17** and **18** show one embodiment that provides for the recovery of the debris that will remain after electrolyzing ocean water. As seen in FIG. **17**, an intake filter **17** is connected by an intake pipe **20** to a check valve **18** as well as an intake pump **19** and an electrolyzer **43**. Also depicted are electromagnets **118** that are positioned in close proximity to an electrolyzer **43**. FIG. **18** illustrates the hinged interior bottom **119** of the electrolyzer **43** with a nonstick coating **120**.

Operation

[0199] Large debris is removed from the entering ocean water by an intake filter **17** before passing through a check valve **18** on the way to an intake pump **19** before arriving at an electrolyzer **43**. After a predetermined amount of debris has collected within the electrolyzer **43**, the hinged bottom **119** opens to allow the debris to safely fall away from the electrolyzer **43**. An alternating magnetic field is generated by an electromagnet **118** and vibrates the electrolyzer to help dislodge any debris stuck within the electrolyzer's inner nonstick coated surface **120**.

[0200] FIG. **19** illustrates a high temperature electrolyzer. As before, the intake filter **17** is connected by the intake pipe **20** to the check valve **18** and the intake pipe **20** as well as the intake pump **19** and the electrolyzer **43**, except that this embodiment includes the heating element **121** positioned on the intake pipe **20** before attaching to the electrolyzer **43**.

Operation

[0201] This embodiment operates the same as above with the exception of energizing the heating element **121** to produce a predetermined temperature.

[0202] FIG. **20** depicts a standard electrolyzer as demonstrated in FIG. **17**, but with additional filtering. This is accomplished by adding a reverse osmosis filtration system **122** in line with the other previously introduced components on the intake pipe **20**.

Operation

[0203] As previously mentioned, ocean waters enters the system through intake filter **17** and passes through check valve **18**, intake pump **19** and a reverse osmosis filtration means **122** before entering electrolyzer **43** through intake pipe **20**.

[0204] FIG. **21** illustrates a high temperature electrolyzer. As before, an intake filter **17** is connected by intake pipe **20** to the check valve **18**, as well as the intake pump **19**, a reverse osmosis filtration means **122**, and an electrolyzer **43**, except this embodiment includes a heating element **121** positioned on intake pipe **20** before attaching to the electrolyzer **43**.

Operation

[0205] This embodiment operates the same as above with the exception of energizing the heating element **121** to produce a predetermined temperature.

Alternative Embodiment—FIGS. **1** and **22**

[0206] FIGS. **1** and **22** depict alternative means of removing the debris associated with water purification, than was previously described.

[0207] FIG. **22** illustrates a debris removal system that incorporates local discharge. A boiler debris exhaust port **37** is attached to a submersible structure **2** at the point at which the conveyor belt **36** exits the submersible structure **2**.

Operation

[0208] Debris from the boiler **32** falls onto the conveyor belt **36** and travels out of the submersible structure **2** through an exhaust port **37**, where the conveyor belt **36** ends, the debris falls down and back into the surrounding ocean water.

[0209] FIG. **1** depicts an alternate debris removal embodiment comprising a combination of local dumping and debris removal. A boiler debris exhaust port **37** is attached to submersible structure **2** at the point at which the conveyor belt **36** exits the submersible structure **2**. The conveyor belt **36** is positioned under a boiler **32** and extends out into a boiler debris exhaust port **37**. Attached to another point of the submersible structure **2** is a boiler exhaust port **40** and to it a boiler debris processing plant **41**. A boiler debris collector **38** is positioned under the boiler **23** and connects to an auger style boiler debris removal system **39** that extends through the boiler exhaust port **40** and into the boiler debris processing plant **41**.

Operation

[0210] Debris falling from the boiler **32** lands on the conveyor belt **36** and is transported into the boiler debris exhaust port **37** where it falls off the conveyor belt **36** and into the ocean. Debris falls from the boiler **23** into the boiler debris collector **38** that feeds the auger style boiler debris removal system **39** that transports the debris through boiler exhaust port **40** and into the boiler debris processing plant **41**, where it is processed for export.

Alternative Embodiment—FIGS. **27** to **46**

[0211] FIGS. **27** to **46** illustrate alternative operating environments and connections.

[0212] FIGS. **27** to **29** show a hydrogen generator **1**, suitable for tidal flow applications, with a connected submerged gas storage and distribution facility **67** that also connects to an optional barge **70** and a gas pipeline and debris export means **69**. The hydrogen generator **1** also connects to an optional onshore gas storage and distribution facility **74** and an optional HYDROGEN-FIRED HOLLOW GENERATOR **78**. An optional electric substation **84** connects to both the hydrogen generator **1** and HYDROGEN-FIRED HOLLOW GENERATOR **78**, as well as to the national electric power grid **86**.

[0213] FIGS. **30** and **31** are identical to the embodiment above except that there is only one directional funnel **4**, suitable for ocean current installations.

[0214] FIGS. **32** to **34** are identical to the embodiment for FIGS. **27** to **29** above, with the seawater purification means **65** and electrolysis means **66** housed in a second submersible structure.

[0215] FIGS. **35** and **36** are identical to the embodiment above except that there is only one directional funnel **4**, suitable for ocean current installations.

[0216] FIGS. **37** to **39** are the same as the embodiment for FIGS. **27** to **29**; however, instead of a HOLLOW TURBINE **3** with rotors and stators, this embodiment features a HOLLOW GENERATOR **133**.

[0217] FIGS. **40** and **41** are identical to the embodiment above except that there is only one directional funnel **4**, suitable for ocean current installations.

[0218] FIGS. **42** to **44** are identical to the embodiment for FIGS. **37** to **39** above, with the seawater purification means **65** and electrolysis means **66** housed in a second submersible structure.

[0219] FIGS. **45** and **46** are identical to the embodiment above, except that it has only one directional funnel **4**, suitable for ocean current installations

Operation

[0220] Operation of the hydrogen generator **1** in all of these configurations is unaffected by the choice of operating environments.

Alternative Embodiment

[0221] One embodiment may omit life support systems, including breathable air, thus reducing size and complexity.

Operation

[0222] The processing necessary for hydrogen generation remains the same.

Alternative Embodiment

[0223] One embodiment may omit life support systems and on site electric generation greatly reducing size and complexity. The reduced size and complexity may even allow the generator to be easily lowered into place for operation and raised for servicing and replacement.

Operation

[0224] The processing necessary for hydrogen generation remains the same.

Alternative Embodiment—FIG. **48**

[0225] This embodiment depicts an onshore version of the present invention **1** that includes at least one electrolyzer, not shown, and optional water purification means, also not shown, and connects to the seawater intake pipe **135** and to the residue discharge pipe **136**.

Operation

[0226] Seawater for the facility is pumped in through the seawater intake pipe **135**. The residue resulting from operations is discharged through the residue discharge pipe **136**. Otherwise the facility's operation is the same as described above.

Alternative Embodiment—FIG. **49**

[0227] FIG. **49** shows a embodiment of the present invention that utilizes multiple HOLLOW TURBINES.

Operation

[0228] Operation of this embodiment is the same as in previous embodiments, except with the addition of a means of synchronizing the HOLLOW TURBINES, not shown.

ADVANTAGES

[0229] From the description above, a number of advantages of some embodiments of the self-sufficient hydrogen generator become evident:

[0230] (a) Large scale hydrogen production is possible, economical, and highly scalable.

[0231] (b) Leveraging the kinetic energy of ocean currents and tides, together with the use of ocean water for electrolysis, provides a very effective and efficient hydrogen generator and water purification means, with both methodologies utilizing renewable resources that do not deplete scarce fresh water sources.

[0232] (c) Located just offshore and underwater, the hydrogen generator does not obstruct views, require expensive oceanfront property, does not interfere with oceangoing traffic, and will not harm fish or other marine animals, or otherwise harm the local environment in which it is deployed. As such, it is easier to secure from intruders, impervious to extreme storms, tidal waves and rising sea levels. The detached foundation will allow the facility to survive earthquakes, while remaining in place, thanks to its vertical columns acting as foundation anchors.

[0233] (d) The debris resulting from the purification or the electrolysis of ocean water is captured, and may be exported, and possibly used to offset the desalination effect of melting glaciers, in locations such as off the coast of Greenland.

CONCLUSION, RAMIFICATIONS, AND SCOPE

[0234] Thus the reader will see that at least one embodiment of the hydrogen generator provides for an efficient and environmentally friendly hydrogen generation system that can generate vast amounts of hydrogen. Located just offshore and underwater, the hydrogen generator preserves scenic ocean views, avoids expensive oceanfront property, and provides a secure operational environment.

[0235] While the above description contains many specificities, these should not be construed as limitations on the scope, but rather as an exemplification of several preferred embodiments thereof. Many other variations are possible and have been broken down into three categories: process related, structure related, and life support related.

Process Related

[0236] The electrolyzers may be immersed in heated solutions in order to raise and maintain the water's temperature within the electrolyzer. That heated solution may be oil.

[0237] The electric power generated on site is best utilized by incorporating three phase electric power. Two and one phase power will also work.

[0238] Electromagnets and other devices may be cooled by circulating helium around them, or by circulating any other cooler substance, most likely in liquid form.

[0239] Electrodes used in electrolysis may be composed of platinum.

[0240] The boilers may further include a scraping means to further aid in debris removal.

[0241] In addition to boilers, evaporating plants/evaporators may be used to purify ocean water.

[0242] Additional means of exporting the ocean water debris include diving bells and/or an auger style device that lifts the debris to the surface.

[0243] The control systems may incorporate other business rules/business logic, and are usually expressed as algorithms. These algorithms may be written in Java, Scala, C, or another appropriate programming language, and embedded within microcontrollers, single board computers, or other information processing appliances. A robotic operating system (R.O.S.) may also be incorporated.

[0244] Producers may access weather information, and possibly other external data, and incorporate it into the production forecast models. These models form the basis for expert and decision support systems (DSS) that may be utilized by both producers and clients to produce dynamic contracts that form another module in an enterprise resource planning system (ERP).

[0245] Sun's Java Real-Time System (Java RTS) is a mature technology that is well suited for control systems.

[0246] Scala is a hybrid functional and object-oriented programming language that can leverage its higher level of abstraction to take full advantage of the parallelism in modern, multicore systems. It's designed for concurrency, expressiveness, and scalability. Other functional programming languages, such as Erlang, may also be utilized.

[0247] Multiple technologies for application integration have included: remote procedure call (RPC), Common Object Request Broker Architecture (CORBA), Distributed Component Object Model (DCOM), .NET remoting, Enterprise Java Beans (EJBs), Java EE Connector Architecture (JCA), Java Web Start, and Java Remote Method Invocation (RMI). A newer technology for application integration is Java Business Integration (JBI).

[0248] One possible means of enterprise application integration incorporates a service oriented architecture (SOA). Application integration enables disparate systems to communicate, and in one embodiment it orchestrates the business processes between producers and clients. SOA may also be leveraged for communication between the control systems within the hydrogen generator itself. An enterprise service bus (ESB), including web services, is one means of incorporating a SOA. These technologies are part of an enterprise information system (EIS).

[0249] Technologies, at the time of this patent application, of a SOA platform may include, but are not limited to: business process management (BPM), enterprise decision management (EDM), enterprise service bus (ESB), event stream processing (ESP), message-oriented middleware (MOM), a registry/repository, service components and compositions, and web service mediation (WSM).

[0250] The control systems may utilize web services without conforming to the restrictions of a SOA.

[0251] There are three ways to implement a service: as a component, as a Web Service, and as a REST service.

[0252] There are four integration architectures: Point-to-Point, Hub-and-Spoke, Enterprise Message Bus, and Enterprise Service Bus.

[0253] Services, including message oriented middleware (MOM), may be hosted independently on application servers and enable business-to-business integration. Web servers may be utilized to provide an interface to these applications. Database management systems (DBMSs) will act as data repositories for plant operations and transactions management.

[0254] Networking topologies may include, but are not limited to, local area networks, wide area networks, metropolitan area networks, the Internet, and intranets. These networks, internal and distributed, may be wired or wireless.

[0255] These technologies, and possibly others, are integrated to provide "intelligent auctions" that feature open, automated-bidding between producers and consumers.

[0256] Producers will be able to signal consumers when it is time to begin and time to end extracting resources from the pipelines, while ensuring that producers don't produce more products than can be consumed.

[0257] Data, as well as network access, backup means, local and remote, are also incorporated.

[0258] Data encryption is used to secure data locally and remotely. The encryption system may include, but is not limited to: Symmetric-key ciphers, and/or Asymmetric-key algorithms, and/or Shared-Secret algorithms (all may have wide keys), and a combination of asymmetric and symmetric key encryption.

[0259] Distillation may be performed by either batch or continuous processing.

[0260] Both state and federal regulators may utilize these technologies to monitor ongoing processes.

Structure Related

[0261] The invention is also a candidate for incorporating the principle of a BUOYANT GENERATOR. As described in the U.S. Pat. No. 7,348,686 B2, a BUOYANT GENERATOR incorporates flotation devices that reduce the vertical loads on bearings, allowing for greater efficiency, stability, and product life cycles.

[0262] DC motors, servomechanisms, including servomotors, stepper motors, actuators, including linear and rotary, hydraulics, including hydraulic cylinders, sensors, robotic arms, and other mechanisms control the moving elements of the generator and its facilities. AC motors, especially three-phase AC motors, may be utilized for any heavy lifting.

Microcontrollers may be used for real-time processes and processing and may incorporate object-oriented architectures, as well as a robotic operating system (R.O.S.).

[0263] A single master controller may orchestrate the entire process, possibly in a one-to-many architecture resulting in a fully automated hydrogen generator.

[0264] Single board computers (SBCs) may be incorporated.

[0265] A communications buoy may also be necessary.

[0266] The previously referenced HOLLOW TURBINE may further include intake and exhaust pipes within the turbine's cylinder that prevent entering and exiting flows from adding weight and drag to the turbine. An optional directional cone and its helical supports may channel incoming water in a direction perpendicular to the outermost and efficient portion of the turbine's blades and may be fastened within the intake pipe directly before the turbine's blades.

[0267] A turbine steering means may be employed to maximize the turbine's efficiency.

[0268] Hydraulics may be used where appropriate and remotely operated vehicles, autonomous underwater vehicles, and hybrid remotely operated vehicles may be useful for outside maintenance. Operators may be stationed within the submerged plant, or remotely from onshore, or aboard a vessel.

[0269] Built in cameras, microphones, and speakers may be necessary for efficient operations.

[0270] The invention's boilers, transfer pipes, condensation tubes, and electrolyzers all may benefit from being covered in insulation.

[0271] The foundation may be extended laterally to compensate for structural shifts due to seismic events.

[0272] The structures and attached components may include a copper/nickel veneer (70/30 respectively is one common ratio) to resist corrosion from saltwater, and to protect from barnacles and other marine life. Paint with copper added may also be used.

[0273] Attaching an electrified grate or screen (regularly energized for short periods of time) to openings and/or wire cloth to structures, will help prevent jelly fish and other marine animals, including barnacles, from clogging inlets and attaching to other parts of the structure. A structural coating may also be utilized to repel ocean life.

[0274] Sliding panels, or other constricting means, functioning like an aperture in a camera, may be incorporated to seal or regulate the turbine's water intake and discharge openings.

[0275] Localized dredging will increase the energy of the waves and flows around the installation that will increase the efficiency of the facility's turbine.

[0276] Tunnels bored into the earth's crust, or tubes, sufficient in size and extending from the shoreline, may also provide access to the underwater facilities.

[0277] Incoming ocean water may be circulated through pipes embedded within the structure's walls and/or floors, in order to cool the facility where needed.

[0278] Likewise, heated water from distillation or by other means may also be circulated through pipes embedded within the structure's walls and/or floors, in order to heat the facility where appropriate.

[0279] Additional electric power may also be obtained by solar thermal and solar cell installations mounted on a buoy. The same buoy may also be utilized for importing atmospheric air for life support. This is how the NOAA submersible lab acquires its air and electrical power.

[0280] A smaller, possibly portable, version of the present invention, without life support and/or desalination apparatus, may be used for other applications. For in stream versions, the unit may be constructed from titanium covered carbon fiber composites.

[0281] Installations of the present invention off the Southern California coast, and/or the Gulf of California, may provide enough hydrogen to supply the water and electricity needs of present and yet to be built cities in the southwestern states. Electricity for the offshore generators described here may be secured from the grid or from solar power projects in the same deserts that will benefit most from these hydrogen generators. The same corridors of land that would provide the necessary space for electric transmission lines could also be utilized to provide the space necessary for the returning hydrogen pipelines. Providing a new source of fresh water to Southern California will allow more of the High Sierra runoff to remain in the San Joaquin Valley where it can be used for agricultural products.

[0282] A means of oil and water separation may be necessary in some cases. At least one storage tank may be incorporated to allow oil to rise to the upper regions of said tank where it may be removed, in a process known as sedimentation. Evaporation, perhaps by distillation, is another means of removal. Introducing certain bacteria to a tank of oil laced ocean water, under the right conditions, will enable the microbes to eat the oil. Dispersants may help the microbes in the process by reducing the oil to droplets. Centrifugation and membrane separation are other means for removing oil from water. Two other technologies are Vertical Tube Coalescers, from the U.S. Army, and Vessel Internal Electrostatic Coalescers, from offshore-technology.com.

[0283] Offshore solar power, photo voltaic or solar thermal, located on an old oil platform or floating barge, may completely supply electric power, or supplement other means.

Human Life Support Related

[0284] Life support systems may or may not be present in all embodiments.

[0285] Purified ocean water may also be used for human consumption.

[0286] Waste management facilities may be incorporated into the facilities.

[0287] Employee facilities, including locker rooms, showers, kitchen facilities, and lounges may be added, perhaps in a secondary structure. Such facilities may form the basis for an underwater city.

[0288] Nitrogen may be imported via pipelines directly within the structure or stored, perhaps as a liquid, elsewhere within the facility.

[0289] Nitrous oxide may also be mixed into the circulated air, if necessary, for life support.

[0290] Breathable air, circulated by a blower, maybe imported directly from the ocean's surface or from onshore.

[0291] Temperature for the facility may be provided by circulating water, hot or cold, perhaps harvested from the system's processes, through pipes embedded within the structure's walls, ceilings, and/or floors.

[0292] The invention may form the basis for an underwater complex.

I claim:

1. A hydrogen generator comprising:

at least one means to house said hydrogen generator, wherein said at least one means to house said hydrogen generator is at least one submersible structure;

at least one means to acquire electricity;

a means to acquire water;

at least one means to electrolyze said water with said at least one means to acquire electricity;

at least one means to distribute the hydrogen generated by the electrolyzed water;

at least one means to distribute the oxygen generated by the electrolyzed water;

whereby creating an environmentally friendly way to generate vast amounts of hydrogen without using hydrocarbons or precious domestic water supplies;

whereby scenic land and seascapes are preserved and utilizes space that would have otherwise gone unused;

whereby providing an environment secure from intruders and capable of withstanding violent storms, tidal waves, and rising sea levels.

2. The hydrogen generator as claimed in claim 1, further including at least one ventilation system; whereby simultaneously generating hydrogen and providing life supporting oxygen, from electrolysis, to said at least one submersible structure.

3. The hydrogen generator as claimed in claim 1, further including at least one turbine;

whereby enabling on-site energy capture and transfer.

4. The hydrogen generator as claimed in claim 3, wherein said turbine further includes at least one energy storage spring as described in the SELF-WINDING GENERATOR, U.S. Pat. No. 7,127,886 B2; whereby providing continuous rotational energy at a constant rate.

5. The hydrogen generator as claimed in claim 3, wherein said at least one turbine is a HOLLOW TURBINE comprising:

a cylindrical shell having an inner and an outer surface, and a hole at each of the opposing ends of said cylindrical shell;

at least one plurality of blades attached to said inner surface of said cylindrical shell;

a supporting structure;

at least one means to allow said cylindrical shell to rotate freely in said supporting structure;

whereby providing a light weight, efficient, long lasting turbine with few points of failure and potentially large blades for greater energy capture;

whereby entering fish and debris safely exit through an opening formed by the distal edges of said plurality of blades and over the blades themselves.

6. The hydrogen generator as claimed in claim 5, wherein said HOLLOW TURBINE further includes at least one rotational energy connecting element.

7. The hydrogen generator as claimed in claim 5, further including at least one electric generator comprising: at least one rotor and at least one stator;

whereby providing electric power to the facility.

8. The hydrogen generator as claimed in claim 5, wherein said HOLLOW TURBINE further includes at least one array of magnets mounted on said outer surface of said HOLLOW TURBINE's cylinder and at least one stator comprising: at least one stationary coil of an electric conductor located in close proximity to said at least one array of magnets; whereby kinetic energy is captured and transformed into electricity efficiently in a compact fashion.

9. The hydrogen generator as claimed in claim 3, wherein said at least one turbine is of the wind turbine type, specifically designed for underwater operation, comprising: at least one propeller blade attached to a center axle that ultimately connects to at least one electric generator; whereby providing electric power to the facility.

10. The hydrogen generator as claimed in claim 3, wherein said at least one turbine is of the wind turbine type comprising:

at least one propeller blade attached to a center axle that ultimately connects to at least one electric generator;

a means of supporting said wind turbine above the ocean surface;

whereby providing electric power to the facility.

11. The hydrogen generator as claimed in claim 1, wherein said at least one means to acquire electricity further includes electric power from the national power grid; whereby providing electric power to the facility.

12. The hydrogen generator as claimed in claim 1, further including at least one means to purify ocean water;

13. The hydrogen generator as claimed in claim 12, wherein said at least one means to purify said ocean water is distillation.

14. The hydrogen generator as claimed in claim 12, wherein said at least one means to purify said ocean water is filtration.

15. The hydrogen generator as claimed in claim 12, wherein said at least one means to purify said ocean water is, in combination, filtration and distillation.

16. The hydrogen generator as claimed in claim 12, wherein said at least one means to purify said ocean water further includes at least one means to capture the residue resulting from the ocean water purification.

17. The hydrogen generator as claimed in claim 1, wherein said at least one means to electrolyze said water is high-temperature electrolysis; whereby increasing efficiency.

18. The hydrogen generator as claimed in claim 17, wherein said high-temperature electrolysis is achieved by electrolyzing the purified water while still hot from distillation; whereby fully leveraging the resulting resources of the hydrogen generator.

19. The hydrogen generator as claimed in claim 1, wherein said at least one means to electrolyze said water further includes a means to add an electrolyte to the water; whereby increasing efficiency.

20. The hydrogen generator as claimed in claim 1, further including at least one control system means; whereby providing the system's orchestration necessary for the hydrogen generator to function properly.

21. The hydrogen generator as claimed in claim 1, further including:

at least one control system means used to distribute, outside said structure, the resulting electricity, water, gases, byproducts and any other products produced by said hydrogen generator;

wherein said at least one control system means communicates with the connected consumers of the resulting gases, by-products and any other products produced;

whereby providing a framework for negotiating, coordinating and distributing the gases and byproducts produced, whereby providing an open, automated-bidding system between producers and consumers;

whereby said hydrogen generator and said connected users don't have to rely on any external network controller, whereby eliminating a single point of failure.

22. A method of generating hydrogen comprising:

providing at least one means of housing a hydrogen generator, wherein said at least one means to house said hydrogen generator is at least one submersible structure;

providing at least one means of acquiring electricity;

providing a means of acquiring water;

providing a means of electrolyzing said water;

providing at least one means of distributing the hydrogen generated by the electrolyzed water;

providing at least one means of distributing the oxygen generated by the electrolyzed water;

whereby providing hydrogen and oxygen in an environmentally safe and secure manner.

23. Method and apparatus to convert sunlight and water into electricity and potable water comprising:

at least one means of capturing sunlight and converting it into electricity;

at least one submersible hydrogen generation means;

at least one means of utilizing said electricity to power said hydrogen generation means;

at least one hydrogen powered hydrogen generator capable of combining the hydrogen generated in said submersible hydrogen generation means with oxygen;

at least one means of capturing and distributing the resulting electricity from said hydrogen powered hydrogen generator;

at least one means of capturing and distributing the resulting water from said hydrogen powered hydrogen generator;

whereby providing water and electric power in an environmentally safe manner.

* * * * *