

CLAIMS

What is claimed is:

1. A gas-reservoir electrochemical pressure generator comprising:
an electrical power source;
an electrochemical pressure generator selectably connected to the electrical power source,
wherein the electrical power source is configured to power the electrochemical pressure generator in high-pressure mode operation to convert a solid state of hydrogen or oxygen within the electrochemical pressure generator into a high-pressure gas with a first pressure when connected thereto;
one or more gas reservoirs in fluid communication with the electrochemical pressure generator and each comprising a first chamber and a second chamber arranged in series,
wherein the first chamber of each of the one or more gas reservoirs is in fluid communication with the electrochemical pressure generator and includes a first surface of a non-rigid dividing element having a first area, and
wherein the second chamber of each of the one or more gas reservoirs includes a second surface of the non-rigid dividing element having a second area, the second surface mechanically connected to the first surface by the non-rigid dividing element to generate a second pressure; and
a hydraulic means coupled to the second chamber for transmitting the second pressure to a load.

2. The gas-reservoir electrochemical pressure generator in accordance with Claim 1 further comprising an energy storage device coupled to the electrochemical pressure generator, wherein the electrochemical pressure generator is configured to charge the energy storage device when converting the high-pressure gas into the solid state.
3. The gas-reservoir electrochemical pressure generator in accordance with Claim 2 wherein the power source comprises the energy storage device.
4. The gas-reservoir electrochemical pressure generator in accordance with any of the preceding claims wherein the first chamber of each of the one or more gas reservoirs comprises a first expandable chamber.
5. The gas-reservoir electrochemical pressure generator in accordance with Claim 4 wherein the first expandable chamber of each of the one or more gas reservoirs comprises bellows.
6. The gas-reservoir electrochemical pressure generator in accordance with Claim 4 wherein the first expandable chamber of each of the one or more gas reservoirs comprises pistons.
7. The gas-reservoir electrochemical pressure generator in accordance with any of the preceding claims wherein the second chamber of each of the one or more gas reservoirs comprises a second expandable chamber.

8. The gas-reservoir electrochemical pressure generator in accordance with Claim 7 wherein the second expandable chamber of each of the one or more gas reservoirs comprises bellows.
9. The gas-reservoir electrochemical pressure generator in accordance with Claim 7 wherein the first expandable chamber of each of the one or more gas reservoirs comprises pistons.
10. The gas-reservoir electrochemical pressure generator in accordance with any of the preceding claims wherein the second chamber of each of the one or more gas reservoirs is filled with a non-compressible fluid.
11. The gas-reservoir electrochemical pressure generator in accordance with Claim 10 wherein the non-compressible fluid comprises a fluid selected from silicone oil, mineral oil and water.
12. The gas-reservoir electrochemical pressure generator in accordance with any of the preceding claims wherein the one or more gas reservoirs comprise a single gas reservoir in fluid communication with the electrochemical pressure generator to receive the high-pressure gas, and wherein the first area of the first surface is larger than the second area of the second surface and the second pressure is greater than the first pressure.
13. The gas-reservoir electrochemical pressure generator in accordance with any of Claims 1 to 11, wherein the electrochemical pressure generator is further configured

to operate in a low-pressure mode to convert the high-pressure gas back into the solid state, and

wherein the one or more gas reservoirs comprise a first gas reservoir and a second gas reservoir, both the first and second gas reservoirs in fluid communication with the electrochemical pressure generator, and

wherein the first area of the first surface of the first chamber of the first gas reservoir is larger than the second area of the second surface of the second chamber of the first gas reservoir and the second pressure within the second chamber of the first gas reservoir is greater than the first pressure within the first chamber of the first gas reservoir, and wherein the first area of the first surface of the first chamber of the second gas reservoir is smaller than the second area of the second surface of the second chamber of the second gas reservoir and the second pressure within the second chamber of the second gas reservoir is smaller than the first pressure within the first chamber of the first gas reservoir,

the gas-reservoir electrochemical pressure generator further comprising a plurality of valves configured to control pressure transmitted to the load by the hydraulic means, wherein a first portion of the plurality of valves is located between the electrochemical pressure generator and each of the first gas reservoir and the second gas reservoir and a second portion of the plurality of valves is located between each of the first gas reservoir and the second gas reservoir and the hydraulic means; and

the gas-reservoir electrochemical pressure generator further comprising a control means coupled to each of the plurality of valves and configured to alternate gas flow between the first gas reservoir and the second gas reservoir and to the hydraulic means as operation of the electrochemical pressure generator alternates between the high-pressure mode and the low-pressure mode.

14. A dual-gas-reservoir electrochemical pressure generator comprising:
- an electrical power source;
 - an electrochemical pressure generator selectably connected to the electrical power source,
- wherein the electrical power source is configured to power the electrochemical pressure generator to produce a high-pressure gas with first pressure $P1$ from a solid state of hydrogen or oxygen within the electrochemical pressure generator, and
- wherein the electrochemical pressure generator is configured to convert the high-pressure gas into a solid state of the hydrogen and the oxygen, resulting in a second pressure $P2$;
- a first gas reservoir in fluid communication with the electrochemical pressure generator and comprising a first and second chamber arranged in series,
- wherein the first chamber is in fluid communication with the high-pressure gas having the first pressure and includes a first surface on a first non-rigid dividing element separating the first chamber from the second chamber, the first surface having an area $S1$, and
- wherein the second chamber is filled with a non-compressible fluid and includes a second surface of the first non-rigid dividing element having an area $S1'$ to generate a pressure $P1'$, and
- wherein $S1 > S1'$ and $P1 < P1'$;
- a second gas reservoir in fluid communication with the electrochemical pressure generator and comprising a third and fourth chamber arranged in series,
- wherein the third chamber is in fluid communication with gas having the second pressure $P2$ and includes a third surface of a second non-rigid dividing element

separating the third chamber from the fourth chamber, the third surface having an area S_2 , and

wherein the fourth chamber is filled with a non-compressible fluid and includes a fourth surface having an area S_2' in contact with the third surface to output a pressure P_2' , and

wherein $S_2 < S_1'$ and $P_2 > P_2'$;

a hydraulic means is selectably coupled to the second chamber and the fourth chamber for transmitting the pressure P_1' and the pressure P_2' to a load;

a plurality of valves for controlling flow of gas from the electrochemical pressure generator to the first and third chambers and for controlling the flow of pressure from the second and fourth chambers to the hydraulic means; and

a control means coupled to the plurality of valves and configured for controlling transmission of the pressure P_1' and the pressure P_2' to the load.

15. The dual-gas-reservoir electrochemical pressure generator in accordance with Claim 14 further comprising an energy storage device, wherein the electrochemical pressure generator is configured to charge the energy storage device when converting the high-pressure gas into a solid state.