Pressure Dome for High-Pressure Electrolyzer

External gas pressure permits higher pressure and more versatile electrolyzer.

John H. Glenn Research Center, Cleveland, Ohio

A high-strength, low-weight pressure vessel dome was designed specifically to house a high-pressure (2,000 psi (~13.8 MPa)) electrolyzer. In operation, the dome is filled with an inert gas pressurized to roughly 100 psi (~690 kPa) above the high, balanced pressure product oxygen and hydrogen gas streams. The inert gas acts to reduce the clamping load on electrolyzer stack tie bolts since the dome pressure acting axially inward helps offset the outward axial forces from the stack gas pressure. Likewise, radial and circumferential stresses on electrolyzer frames are minimized. Because the dome is operated at a higher pressure than the electrolyzer product gas, any external electrolyzer leak prevents oxygen or hydrogen from venting oxygen or hydrogen from any external electrolyzer leak prior to the electrolyzer product gas, is operated at a higher pressure than the electrolyzer.

Likewise, radial and circumferential forces from the stack gas pressure. The dome pressure acting axially inward helps offset the outward axial forces from the stack gas pressure. The inert gas acts to reduce the clamping load on electrolyzer stack tie bolts since the dome pressure acting axially inward helps offset the outward axial forces from the stack gas pressure. Likewise, radial and circumferential stresses on electrolyzer frames are minimized. Because the dome is operated at a higher pressure than the electrolyzer product gas, any external electrolyzer leak prevents oxygen or hydrogen from venting oxygen or hydrogen from any external electrolyzer leak prior to the electrolyzer product gas, is operated at a higher pressure than the electrolyzer.

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The Pressure Dome consists of two machined segments. An O-ring is placed in a groove in the flange of the bottom segment and is trapped by the flange on the top dome segment when these components are bolted together with high-strength bolts. This work was done by Faranak Davoodi of Caltech and Farhooman Davoudi, Technical Consultant, for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.
Cascading Tesla Oscillating Flow Diode for Stirling Engine Gas Bearings

John H. Glenn Research Center, Cleveland, Ohio

Replacing the mechanical check-valve in a Stirling engine with a micro- machined, non-moving-part flow diode eliminates moving parts and reduces the risk of microparticle clogging.

At very small scales, helium gas has sufficient mass momentum that it can act as a flow controller in a similar way as a transistor can redirect electrical signals with a smaller bias signal. The innovation here forces helium gas to flow in predominantly one direction by offering a clear, straight-path microchannel in one direction of flow, but then through a sophisticated geometry, the reversed flow is forced through a tortuous path. This redirection is achieved by using microfluid channel flow to force the much larger main flow into this tortuous path.

While microdiodes have been developed in the past, this innovation cascades Tesla diodes to create a much higher pressure in the gas bearing supply plenum. In addition, the special shape of the leaves captures loose particles that would otherwise clog the microchannel of the gas bearing pads.

This work was done by Rodger Dyson for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18862-1.

Compact, Low-Force, Low-Noise Linear Actuator

This actuator has potential uses in military and automotive applications.

NASA’s Jet Propulsion Laboratory, Pasadena, California

Actuators are critical to all the robotic and manipulation mechanisms that are used in current and future NASA missions, and are also needed for many other industrial, aeronautical, and space activities. There are many types of actuators that were designed to operate as linear or rotary motors, but there is still a need for low-force, low-noise linear actuators for specialized applications, and the disclosed mechanism addresses this need.

A simpler implementation of a rotary actuator was developed where the end effector controls the motion of a brush for cleaning a thermal sensor. The mechanism uses a SMA (shape-memory alloy) wire for low force, and low noise. The linear implementation of the actuator incorporates a set of springs and mechanical hard-stops for resetting and fault tolerance to mechanical resistance. The actuator can be designed to work in a pull or push mode, or both. Depending on the volume envelope criteria, the actuator can be configured for scaling its volume down to 4\times2\times1 \text{cm}^3. The actuator design...