Spool Valve for Switching Air Flows Between Two Beds

U.S. Patent 6,142,151 describes a dual-bed ventilation system for a space suit, with emphasis on a multiport spool valve that switches air flows between two chemical beds that adsorb carbon dioxide and water vapor. The valve is used to alternately make the air flow through one bed while exposing the other bed to the outer-space environment to regenerate that bed through vacuum desorption of CO₂ and H₂O. Oxygen flowing from a supply tank is routed through a pair of periodically switched solenoid valves to drive the spool valve in a reciprocating motion. The spool valve equalizes the pressures of air in the beds and the volumes of air flowing into and out of the beds during the alternations between the adsorption and desorption phases, in such a manner that the volume of air that must be vented to outer space is half of what it would be in the absence of pressure equalization. Oxygen that has been used to actuate the spool valve in its reciprocating motion is released into the ventilation loop to replenish air lost to vacuum during the previous desorption phase of the operating cycle.

This work was done by W. Clark Dean of United Technologies Corp. for Johnson Space Center.

Title to this invention, covered by U.S. Patent No. 6,142,151 has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (j)). Inquiries concerning licenses for its commercial development should be addressed to:

Hamilton Sundstrand
Space Systems International, Inc.
One Hamilton Road
Windsor Locks, CT 06096-1010
Phone No.: (860) 654-6000
Refer to MSC-23667, volume and number of this NASA Tech Briefs issue, and the page number.

Reusable Hybrid Propellant Modules for Outer-Space Transport

A report summarizes the concept of reusable hybrid propellant modules (HPMs), which would be used in outer space for long-term cryogenic storage of liquefied spacecraft-propellant gases, including for example, oxygen and hydrogen for combustion-based chemical rocket engines and xenon for electric thrusters. The HPM concept would provide the fundamental building block for an efficient, reusable in-space transportation system for both crewed and uncrewed missions. Each HPM would be equipped to implement an advanced zero-boil-off method of managing cryogenic fluids, and would include a fluid-transfer interface comprising standardized fittings that would be compatible with fittings on all supply facilities and on spacecraft to be supplied. The HPM, combined with a chemical or electric orbital transfer spacecraft, would provide an integrated propulsion system. HPMs would supply chemical propellant for time-critical transfers such as crewed missions, and utilize the more efficient electric-propulsion transfer vehicles to trans-