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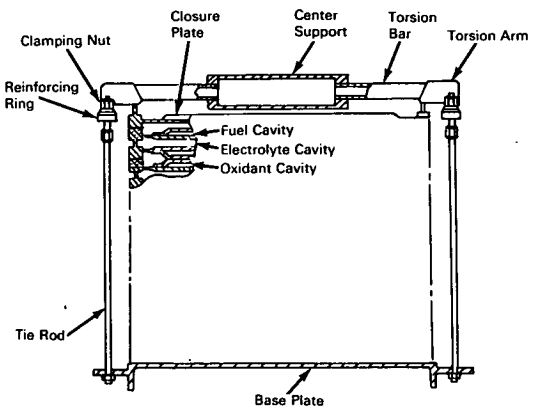
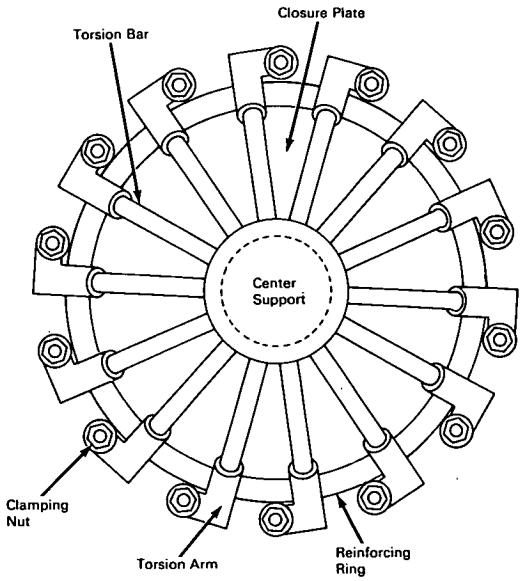
NASA TECH BRIEF

Resilient Clamp Holds Fuel Cell Stack Through Thermal Cycle





The problem:

To obtain useful power output, fuel cells must frequently be assembled in multiple. As these fuel cells cycle between operation and off periods, thermal expansion and contraction occur, causing leakage of seals held by rigid structural members.

The solution:

A clamping device that resiliently holds a stack of fuel cells and maintains seal integrity over a wide stress range by means of a torsion bar action.

How it's done:

Each fuel cell consists of an electrolyte cavity formed by a fuel cavity on one side and oxidant cavity on the other, each formed by a cell electrode. Each electrode is attached to a peripheral disk that mounts a seal ring at its outer extremity. There is a seal between each set of two electrode seal rings that acts to seal off the electrolyte cavity. The assembled stack of fuel cells is held between a base plate at the bottom and a clamping plate (illustrated) at the top. The clamping plate consists of a closure plate with a reinforcing ring around its periphery, and a center support from which a number of torsion bars extend radially to torsion arms resting on the reinforcing ring. Tie bolts extend down through the torsion arms to the base plate where they are suitably anchored with washers and nuts. Each tie bolt is secured above each torsion arm by a washer and locking nut.

As each clamping nut is tightened, its torsion arm will be forced down counterclockwise against the

(continued overleaf)

resistance of its torsion bar. Thus, a clamping pressure is exerted at closely spaced points uniformly located above the reinforcing ring of the closure plate. Torsion bar resilience can be so selected that, with respect to the angle of the torsion arms, there will be only a slight change in tension of the tie bolts within the normal range of axial variation in the fuel cell system. Adjustment of the clamping nuts torques each of the torsion bars to the predetermined moment to provide a low spring rate tension device.

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)), to United Aircraft Corporation, 400 Main Street, Hartford, Connecticut.

Source: Byron H. Shinn of United Aircraft Corporation under contract to Manned Spacecraft Center (MSC-313)