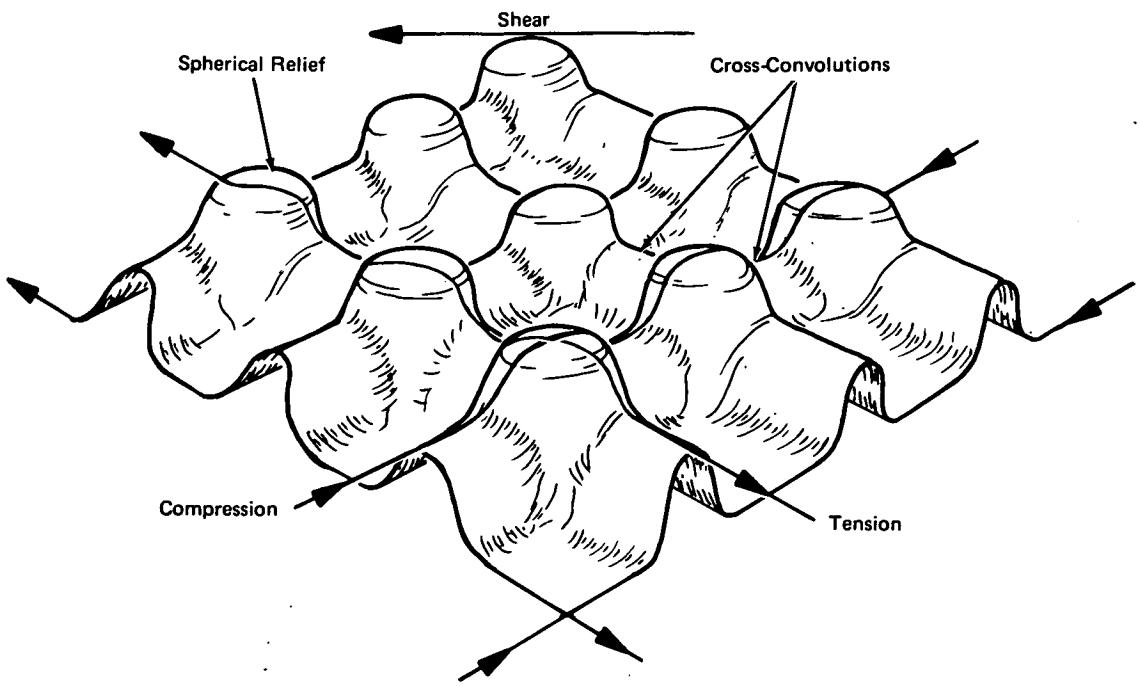
NASA TECH BRIEF

Marshall Space Flight Center

A Flexible All-Temperature Pressure Vessel



Three Dimensional View of Vessel Segment

The problem:

High and/or low temperature studies often require a flexible pressure vessel that can react to shear forces occurring during the thermal expansion or contraction of its contents.

The solution:

By interrupting the lines of stress with convolutions, a structure can be designed to contain pressure, operate at cryogenic and high temperatures, and provide the flexibility necessary for repetitive cycles of parallel-offset shear translation.

How it's done:

The shear flexibility is achieved by interrupting the lines of principal stress with convolutions that change the membrane tension and compression stresses of the structure into bending stresses. This significantly decreases the spring rate in the tension direction and eliminates uncontrolled buckling in the compression direction.

A segment of the structure is shown in the illustration. The cross-convolutions are oriented 45° to the shear vector with spherical reliefs at the convolution junctions. The spherical reliefs are the key to the shear flexibility.

(continued overleaf)

They interrupt the stress lines that act across the ridges (apexes) of the convolutions. The spherical reliefs provide convolutions in both directions in the plane of the cross-convolution ridges.

This structure has several advantages.

a. It can be made of metallic or nonmetallic materials.
b. It is a continuous membrane which can contain pressure.
c. It can carry membrane loads that are oriented 90° to the direction of sheer flexibility.
d. It can operate at any temperature within the limits of the material from which it is made.
e. It can be made to take extensive shear translation, depending on spacing, convolution and spherical relief size, thickness, and material.
f. It can be made to operate below the structural material endurance limit for applications requiring an unlimited life.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention may be made to:

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