

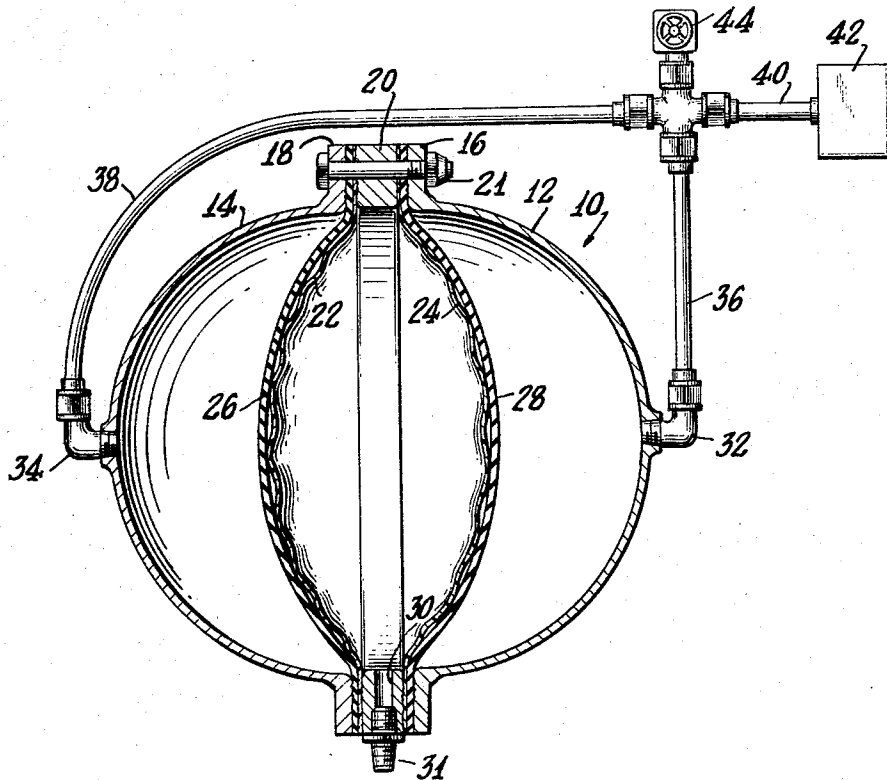
Sept. 27, 1966

T. F. NEE

3,275,418

APPARATUS FOR CONTAINING A NON-RIGID OR FLUID MATERIAL

Filed Oct. 13, 1960



INVENTOR.
THOMAS F. NEE

by *Leonard H. King*

1

3,275,418

APPARATUS FOR CONTAINING A NON-RIGID OR FLUID MATERIAL

Thomas F. Nee, Oakdale, N.Y., assignor to Avien, Inc., Woodside, N.Y.

Filed Oct. 13, 1960, Ser. No. 62,363

2 Claims. (Cl. 23-281)

This invention relates to an apparatus for containing non-rigid materials and has particular reference to a device for containing fluids wherein the position of the center of gravity of the fluid stored is maintained constant at all times with respect to the container independent of the quantity of fluid which is stored therein at any one time.

Storage and delivery of fluids in extraterrestrial environments under conditions of zero gravity present a number of unique problems. One of these problems is to keep the material in one consistent mass having a center of gravity with a predictable location. This problem is of particular importance to propulsion systems which require a consistent supply of propellant. The maintenance of center of gravity at controllable, consistent, and predictable positions is important for vehicle control.

It is an object of the present invention to provide a new and useful container for non-rigid materials such as fluids and the like.

It is a further object of this invention to provide a storage device for non-rigid materials such as fluids which will maintain the center of gravity of the fluid within the storage device at a constant predictable location regardless of the quantity of fluid stored within the storage device.

Another object of this invention is to provide a container for a compact mass which container includes means for maintaining the center of gravity of the mass constant.

Yet another object of this invention is to provide an apparatus for containing non-rigid materials such as fluids having a unique ventage system for the fluid stored.

It is yet another object of this invention to provide an oxygen generator.

A particular object of the invention is to provide means for storing hydrogen peroxide.

Another object of this invention is to provide a storage means for the propellant to be used in a space vehicle wherein the center of gravity of the propellant stored may be conveniently and simply maintained at a predetermined location and wherein a shift of the center of gravity within the container due to formation of gases is conveniently avoided.

Another feature of the invention is the provision in a storage device of fluid means for controlling the location of the center of gravity of the fluid and the rate of shift of center of gravity as well as providing a means for expelling and drawing the fluid into the storage device.

In accordance with the invention, a variable volume storage device which maintains the center of gravity of fluid material stored therein includes an elastic storage container having a passage port for the fluid material, the container assuming a predetermined collapsed position about a predetermined center of gravity and being symmetrically expandable about the predetermined center of gravity. A symmetrically shaped rigid pressure vessel surrounds the container and includes means for holding the container. A resilient but porous outer backing is supported within the pressure vessel for biasing the elastic container into its predetermined condition. Fluid conducting pressure means are connected to the pressure vessel for varying the external pressure on the elastic container so as to symmetrically expand the container or

2

contract the container and thereby control the passage of the non-rigid material through the port.

As a further feature of the invention, the elastic container includes a pair of symmetrical half-bladders preferably held in a symmetrically shaped vessel. Thus, if the container, i.e., the space between the two bladders, is filled with hydrogen-peroxide, the evolution of oxygen from the hydrogen-peroxide would not shift the center of gravity of the liquid as the oxygen would pass through the permeable Teflon while the resilient and porous backing would compress the bladder against the remaining hydrogen-peroxide. The oxygen may be valved off and used for human consumption.

For a better understanding of the invention, its advantages and other objects, reference should be had to the following descriptive matter and accompanying drawing wherein a preferred embodiment of the invention is described in detail.

The drawing shows, in a vertical cross-section, a liquid container and associated auxiliary means, the latter being shown schematically.

Referring now to the drawing, a rigid pressure vessel, generally designated 10, includes a pair of oppositely facing vessel forming hollow hemispheres 12 and 14, each of which is provided with a peripheral flange 16 and 18 respectively. An annular spacing ring 20 separates the hemispheres which are secured to each other, and to the spacing ring, by means of a plurality of peripherally spaced nut and bolt sets 21 passing through the flanges 16 and 18. An oxygen permeable Teflon membrane 22 is secured at its periphery between one face of the annular ring 20 and the flange 18, while a second oxygen permeable Teflon bladder 24 is secured at its periphery between the other face of the ring 20 and the flange 16. Preferably, the bladders 22 and 24 are between 4-8 mils thick. A perforated resilient silicone rubber backing 26 is secured at its periphery between the membrane 22 and the flange 18 and a second perforated resilient silicone rubber backing 28 is secured at its circular periphery between the edge of the bladder 24 and the flange 16.

The bladders 22 and 24, as well as the backings 26 and 28, are secured at the edges against annular ring 20 to form a liquid tight container. The elastic backing serves to press the Teflon bladders into a collapsed position in the plane of the annular ring. The biasing force exerted by the resilient backing results from the deformation of the backing from its circular disc shape by fluid forced into the container (formed by the bladders 22, 24 and the ring 20) by means of an axially directed fluid conducting port 30 which is connectable to an exterior pipe by means of fluid drain 31 which extends from the port.

The backings 26, 28 are secured at their peripheral surfaces and the flanges 16 and 18 so as to form a gas seal and thereby form a pair of separate chambers with the hemispheres 12 and 14. A pair of mutually connected fluid pipes 36 and 38 are separately connected to the chambers formed by the hemispheres 12 and 14 by means of elbows 32 and 34 secured into the hemispheres. A pressure source 42 is connected to the pipes 36 and 38 by means of a pipe 40. A pressure vent valve 44 is mounted at the common junction of pipes 36 and 38.

The fluid, which may, for example, be the propellant of a space vehicle (i.e., hydrogen peroxide) is initially injected into the container formed by the bladders 22, 24 and the ring 20 through the port 30. The perforated resilient backing sheets 26, 28 which support the bladders 22, 24 are deformed symmetrically into opposite directions so that the container may accommodate the fuel injected. The pressure source 42 is regulated so that the deformation experienced by the backing 26 is

limited to that degree necessary to provide sufficient volume to receive the injected fluid. The limit of deformation is of course determined by the interior surfaces of the hemispheres 12 and 14.

Thus the fluid, in operation, is contained within the bladders and the bladders are supported by the resilient tension backing which controls the position and shape of the bladders. Although the bladder backing 26, 28 is shown as a flat sheet, in its preferred embodiment this flat sheet is perforated. However, the backing may assume any configuration or material such as, for example, springs. Such configurations are considered within the scope of the invention. Loading of the cell, or container formed by the bladders, with fluid extends the bladder placing the backing under tension. This tension exerts pressure on the stored fluid keeping it in a single mass at a desired location. The gases evolved permeate through the bladders and into the pressure chambers formed by the hemispheres.

In addition to the pressures exerted by the backings 26, 28, expulsion pressures are provided by the pressure source 42 to the pressure vessel 10. It will of course be understood that the pressures within the vessel 10 and exerted by the pressure source are equal on each side of the backings 26, 28 so as to produce symmetrical expansion of the container in which the fluid is retained.

While Teflon is the currently preferred bladder material for the storage of H_2O_2 , other materials may be employed for the storage of still other liquids. The material chosen should be chemically resistant to the stored liquid and if the liquid evolves gases, it should be porous to the evolved gas.

The apparatus of this invention may also be employed as a source of oxygen as, for example, for human consumption under adverse conditions either under water, under ground or in space, by filling the container with an oxygen-liberating liquid such as concentrated H_2O_2 . Decomposition of the liquid releases oxygen which diffuses through the Teflon bladder 24 to the outer chamber from which it may be released as needed through valve 44.

Self-decomposition of H_2O_2 will take place at a slow rate. If a faster rate is desired, a suitable catalyst may be introduced into the container, or the H_2O_2 may be passed through a catalyst coated screen before introduction into the container. Suitable catalysts are well known to the art.

While preferred embodiments of the invention have been described in detail it will be understood that many modifications will become obvious to those skilled in the art.

What is claimed is:

1. A variable volume storage device for storage of chemically unstable fluid material in the minimal volume

condition at a preselected pressure, said device comprising:

a relatively narrow spacing ring provided with a port; a pair of gas-porous flexible bladder members fastened at their peripheries to each side of said spacing ring in confronting relationship and adapted to retain fluid in a storage area defined by said bladders and said spacing ring;

a pair of gas-porous resilient backing members, each of said backing members rigidly retained proximate to said ring at their peripheries in close abutting relationship to one of said bladder members, respectively, on the outward face thereof, and biasing said bladder members towards said minimal volume condition, said backing members having the same cross sectional thickness for all volumetric conditions of the storage area defined by said bladders and said spacing ring;

a pair of symmetrically shaped rigid vessels, each of said vessels rigidly retained proximate to the periphery of one of said backing members in sealing relationship thereto;

a pressure source provided with an outlet line;

a pair of fuel lines operatively connected to said outlet line;

each of said fuel lines operatively connected to one of said rigid vessels respectively, and adapted to provide equal pressures to each of said rigid vessels; and

a discharge outlet disposed proximate to the juncture of said fluid pressure lines and said outlet line, whereby said gaseous decomposition products are adapted to pass through said bladder members and said backing members and to be withdrawn through said discharge outlet.

2. A device as in claim 1 wherein said bladder members are formed of Teflon, and said backing members are formed of perforated resilient silicone rubber.

References Cited by the Examiner

UNITED STATES PATENTS

1,337,975	4/1920	Frary	23—252
2,597,907	5/1952	Steiner et al.	
2,627,454	2/1953	Tschinkel	23—221 X
2,757,067	7/1956	Cornell et al.	23—1
2,768,405	10/1956	Mineah.	
2,894,732	7/1959	Taber et al.	
2,913,317	11/1959	Bovard	23—281
3,061,413	10/1962	Akerlof	23—221
3,075,576	1/1963	Herbert	220—85

MORRIS O. WOLK, *Primary Examiner.*

MAURICE A. BRINDISI, *Examiner.*

J. H. TAYMAN, E. STERN, *Assistant Examiners.*