United States Patent

Berman

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[54] MULTILAYER PRESSURE VESSEL

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[52] **U.S. Cl.** **220/3**, 220/83, 220/9, 220/39

[51] **Int. Cl.** **B65d 7/22**, B65d 7/40

[58] **Field of Search** 23/289, 290; 220/3, 83, 9, 220/13, 63, 39

[56] **References Cited**

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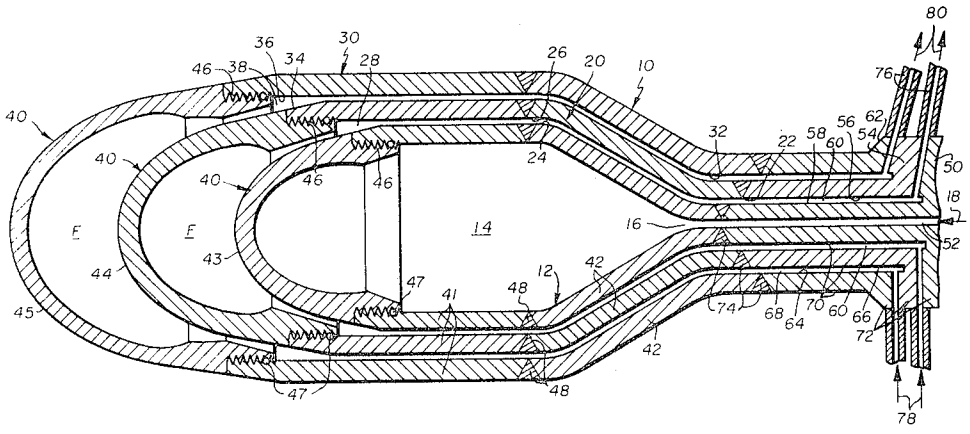
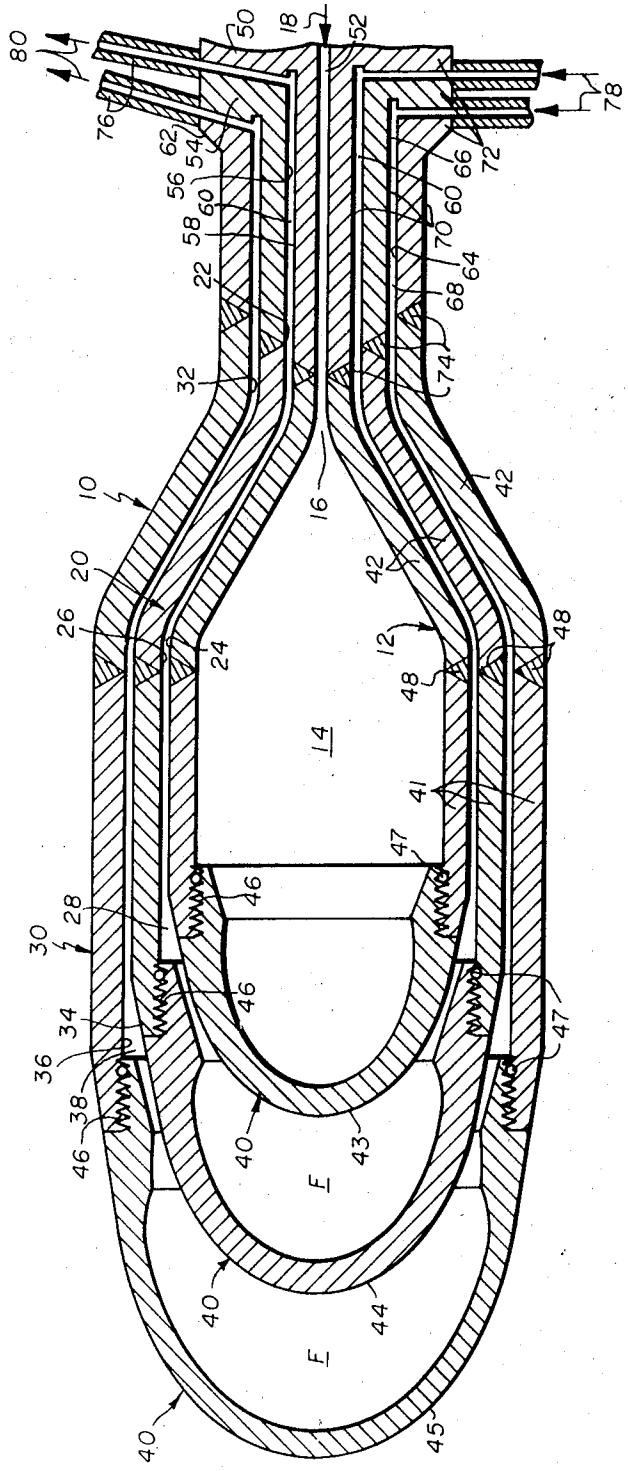
[57] **ABSTRACT**

A vessel is provided with a plurality of spaced-apart layers which contain fluid fill and closure means comprising a plurality of layers which are integrally formed with the layers of the pressure vessel. The fluid fill between the layers of the pressure vessel extends into and between closure layers, such that the fluid fill can be maintained under uniform pressure in each layer.

4 Claims, 1 Drawing Figure





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MULTILAYER PRESSURE VESSEL

BACKGROUND OF THE INVENTION

In the construction of pressure vessels for maintaining relatively high pressures in the range of 200,000 lbs. p.s.i. and greater, a large number of failures have been experienced in single-layer vessels. It has been found that the high pressure within a single-layer vessel results in material along the inner surface of the vessel becoming highly stressed. Accordingly, the internal stress pattern within a single-layer pressure vessel causes the material within the vessel to experience excessive yield or fracture. By providing an uninterrupted multilayer pressure vessel and multilayer closure, it is possible to prevent excessive yield and/or fracture to the vessel and closure by maintaining layers of fluid fill under pressure.

In the design of multilayer pressure vessels, it is necessary to have a capability of withstanding extremely high pressures at the closure without causing rupture. Previous multilayer pressure vessels have utilized closures which do not contain multilayers at the closures, which resulted in a sharp change toward zero displacement at the closure, thereby creating a large shearing force. The present invention affords substantially constant displacement at the closure, such that the incidence of rupture is greatly reduced.

A further advantage afforded by the instant invention is the ability to easily remove the material within the vessel after it has been subjected to pressurization. Accordingly, with the present invention, it is possible to remove the outermost closures to obtain access to the pressurized material.

SUMMARY OF THE INVENTION

In accordance with an illustrative embodiment demonstrating features and advantages of the present invention, there is provided a pressure vessel adapted to be surrounded by at least one layer of fluid fill comprising an inner vessel wall defining an inner chamber for maintaining a fluid under pressure. At least one outer vessel wall, spaced apart from the inner vessel wall defines at least one vessel channel which is adapted to contain the fluid fill. Means are provided fro pressurizing the fluid fill in the vessel channel. The inner vessel wall includes an inner closure and inner body section, with the inner closure being removably secured to the inner body section. The outer vessel wall includes an outer closure and an outer body section, with the outer closure being removably secured to the outer body section. Thus, the displacement caused by the fluid under pressure to the inner vessel wall and the outer vessel wall is substantially constant in situ of the inner closure and outer closure.

BRIEF DESCRIPTION OF THE DRAWING

The above brief description, as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of a presently preferred but nonetheless illustrative embodiment in accordance with the present invention, when taken in connection with the accompanying drawing wherein there is shown a sectional view of a combined multilayer pressure vessel and closure of the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawing, there is provided a pressure vessel generally designated 10. An inner wall 12 of a substantially elongated spherically shaped configuration defines an inner chamber 14 having an open end 16 for receiving and maintaining a fluid under a relatively high pressure. The directional arrow 18 schematically shows the means for maintaining the fluid under pressure in the inner vessel chamber 14.

An intermediate wall 20 having an open end 22 is provided for coaxially receiving the inner wall 12, with its outer surface 24 being coextensive with and spaced apart from the inner surface 26 of intermediate wall 20 to define an inner vessel channel 28 for receiving a layer of fluid fill F. It is preferable to utilize fluids which do not freeze under high pressure, such as kerosene, petroleum, ether or mixtures of iso and normal pentanes for the fluid fill F.

An outer wall 30, having an open end 32, is provided for coaxially receiving the intermediate wall 20 with its outer surface 34 being coextensive and spaced apart from the inner surface 36 of outer wall 30 to define an outer vessel channel 38 for receiving a layer of fluid fill F.

The inner wall 12, intermediate wall 20 and outer wall 30 are each comprised of an essentially hemispherical removable closure, generally designated 40, cylindrical sleeve 41 and the necked-down section 42. The hemispherical closures 40 include an inner closure head 43, intermediate closure head 44, and an outer closure head 45 which are joined and sealed to each of the cylindrical sleeves 41 by mans of internal helical threads 46 and annular gaskets 47. Each of the necked-down sections 42 is joined to each of the cylindrical sleeves 41 by means of a fillet weld 48. Thus, it can be appreciated that after the pressurization cycle of the vessel 10 has been completed, it is possible to threadably disengage, first the outer closure head 45, then the intermediate closure head 44, and lastly the inner closure head 43, in order to remove the contents from the inner chamber 14.

Mounted along the open end 16 of inner chamber 14 is an inner flange section 50 which is formed with a central bore 52 in flow communication with the pressure means 18 and inner chamber 14. An intermediate flange 54 is mounted along the open end 22 of intermediate wall 20, with its inner surface 56 being coextensive with and spaced apart from the outer surface 58 of inner flange section 50, to define an inner channel 60 in flow communication with the inner vessel channel 28.

An outer flange section 62 is mounted along the open end 32 of outer wall 30 with its inner surface 64 being coextensive with and spaced apart from the outer surface 66 of intermediate flange 54 to form an outer closure channel 68.

The flange sections 50, 54 and 62 are each integrally formed with a hollow cylindrical shank 70 and annular shoulder 72. The cylindrical shanks 70 are mounted on the necked-down sections 42 by means of fillet welds 74.

The layers of fluid fill F, which extend from inner vessel channel 28 to inner closure channel 60 and from outer vessel channel 38 to outer closure channel 68, are pressurized through hollow tubing 76 which is secured to the annular shoulders 72. Means for pressurizing the fluid fill F are shown schematically by directional arrows which are designated 78 and means for venting the fluid fill are shown schematically by directional arrows, designated 80.

It should be understood that in accordance with the present invention, the displacement to inner wall 12, intermediate wall 20, and outer wall 30 caused by the fluid fill F under pressure is substantially constant across each of the closures 40 and it is possible to remove the closures 40, to extract the material within inner chamber 14, after the pressurization cycle has been completed.

A latitude of modification, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

I claim:

1. A pressure vessel adapted to be surrounded by at least one layer of fluid fill comprising

an inner vessel wall defining an inner chamber open at one end for maintaining a fluid under pressure,

at least one outer vessel wall, spaced apart from said inner vessel wall, defining at least one vessel channel adapted to contain said fluid fill,

means for pressurizing said fluid fill in said vessel channel,

said inner vessel wall including an inner closure and inner body section, with said inner closure being removably secured to said inner body section,

said outer vessel wall including an outer closure and an outer body section, with said outer closure being removably secured to said outer body section, and

external threads formed on said inner closure and said outer closure, and internal threads formed on said inner body section and said outer body section, such that said inner closure can be threadably engaged with said inner body section and said outer closure can be threadably engaged with said outer body section,

whereby the displacement caused by said fluid fill under pressure to said inner vessel wall and outer vessel wall is substantially constant in situ of said inner closure and outer closure.

2. A pressure vessel according to claim 1 in which an inner gasket is positioned between said inner closure and inner body section, and an outer gasket is positioned between said outer closure and said outer body section.

3. A pressure vessel adapted to be surrounded by at least one layer of fluid fill comprising

an inner vessel wall defining an inner chamber open at one end for maintaining a fluid under pressure,

an intermediate vessel wall, spaced apart from said inner vessel wall, defining an inner vessel channel adapted to contain said fluid fill,

an outer vessel wall, spaced apart from said intermediate vessel wall, defining an outer vessel channel adapted to contain said fluid fill,

means for pressurizing said fluid fill in said inner vessel channel and said outer vessel channel,

said inner vessel wall including an inner closure and inner body section, with said inner closure being removably secured to said inner body section,

said intermediate vessel wall including an intermediate closure and intermediate body section, with said intermediate closure being removably secured to said intermediate body section

said outer vessel wall including an outer closure and an outer body section, with said outer closure being removably secured to said outer body section, and

external threads formed on said inner closure, intermediate closure and said outer closure, and internal threads formed on said inner body section, intermediate body section, and said outer body section, such that said inner closure can be threadably engaged with said inner body section, said intermediate closure can be threadably engaged with said intermediate body section, and said outer closure can be threadably engaged with said outer body section,

whereby the displacement caused by said fluid fill under pressure to said inner vessel wall, intermediate vessel wall, and outer vessel wall is substantially constant in situ of the enclosures.

4. A pressure vessel according to claim 1 in which an inner gasket is positioned between said inner closure and inner body section, an intermediate gasket is positioned between said intermediate closure and intermediate body section, and an outer gasket is positioned between said outer closure and said outer body section.

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