United States Patent

Zahid

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[54] **PRESSURE VESSEL**

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[52] **U.S. Cl.** **138/30**

[51] **Int. Cl.** **F16l 55/04**

[58] **Field of Search** 138/30

[56] **References Cited**

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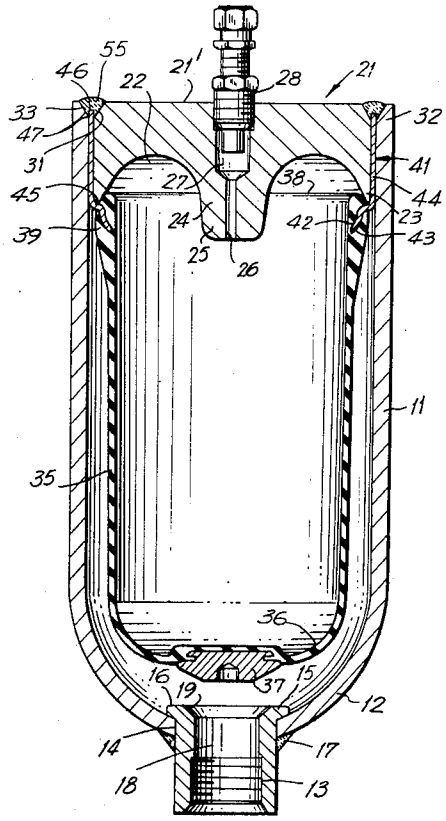
[57] **ABSTRACT**

This invention relates to the art of pressure vessels of the type having a cylindrical container, one end of which is closed and has a port, and the other end of which defines an open mouth. The container has a deformable bladder of resilient material positioned therein, said bladder having a large mouth with an annular supporting member secured thereto and extending outwardly therefrom. The free edge portion of the supporting member which is longitudinally spaced from the region where the bladder is secured thereto, extends into an annular groove defined between the inner surface of the open mouth of the container and the outer periphery of a cover member positioned in the upper portion of the supporting member, the opposed surfaces of the annular groove and the free edge portion of the supporting member being bonded together to seal the container.

1 Claim, 3 Drawing Figures



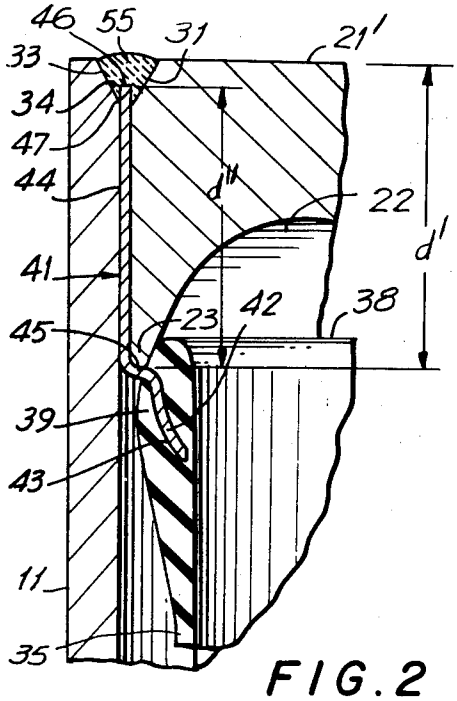


FIG. 2

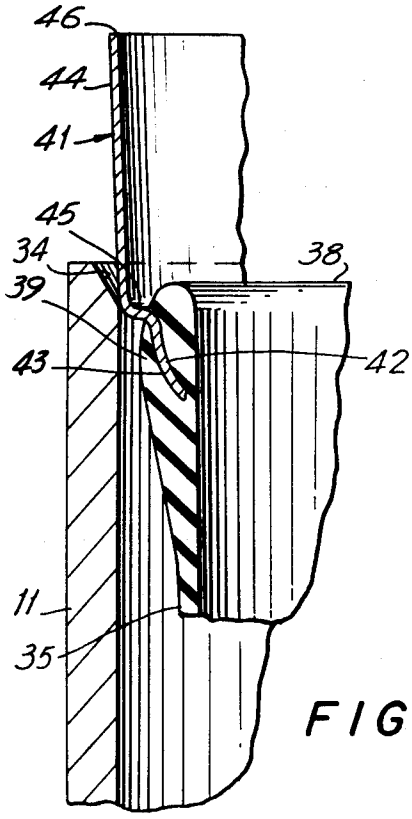
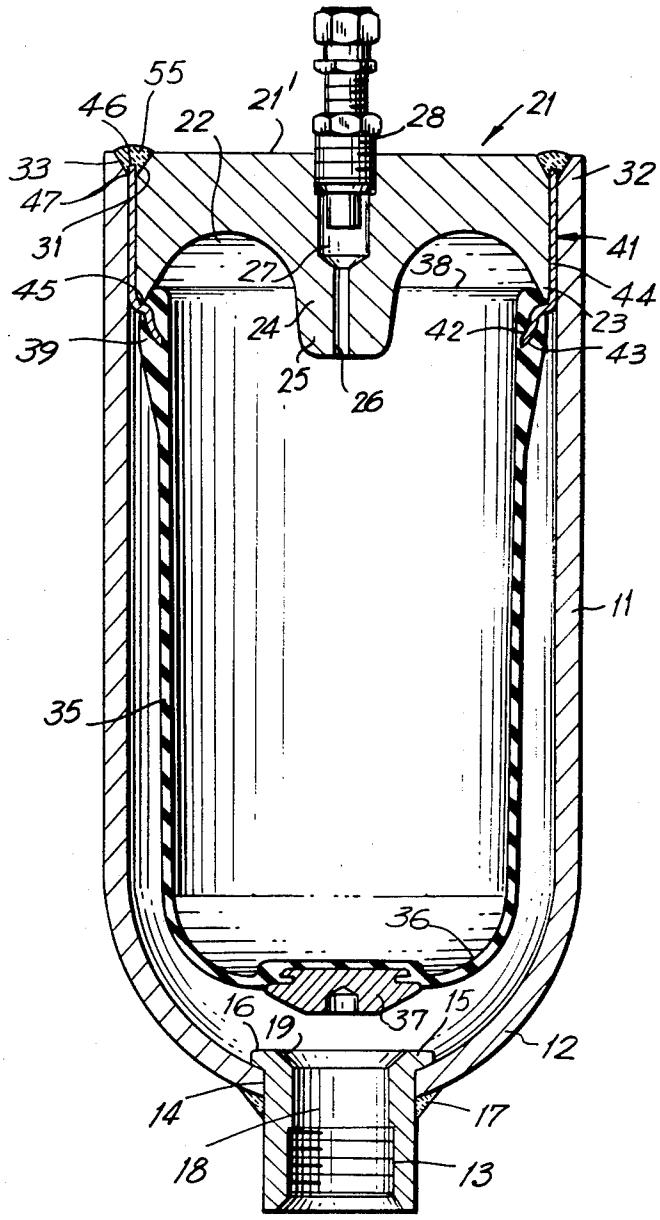


FIG. 3

FIG. 1



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PRESSURE VESSEL

As conducive to an understanding of the invention, it is noted that where a pressure vessel is of the type comprising a rigid container with a deformable bladder therein intervening between two ports, through one of which a large amount of fluid may flow into and out of the chamber defined between the exterior of the bladder and the rigid container, and through the other of which the bladder is charged with gas under pressure, if the bladder which is in communication with said last named port is not dependably secured in place or if the chamber into which the fluid flows is not dependably sealed, leakage may occur with resultant malfunctioning of the pressure vessel.

It is accordingly among the objects of the invention to provide a pressure vessel of the above type which may readily be manufactured at relatively low cost and which will provide for dependable retention of the bladder in the container with assurance that a dependable leak-proof seal will be provided to prevent leakage of gas and oil from the container.

According to the invention, these objects are accomplished by the arrangement and combination of elements hereinafter described and more particularly recited in the claims.

In the accompanying drawings in which is shown one of various possible embodiments of the several features of the invention,

FIG. 1 is a longitudinal cross sectional view of a pressure vessel made in accordance with the invention herein,

FIG. 2 is an enlarged detailed view showing the connection of the supporting member to the container, and

FIG. 3 is a fragmentary detail view illustrating a step in the assembly of the pressure vessel.

Referring now to the drawings, the pressure vessel illustratively comprises a substantially cylindrical container 11, of rigid material such as steel or aluminum, capable of withstanding the pressure to which it is to be subjected in use.

The container has one end closed as at 12 and a sleeve 13 is positioned in an axial opening 14 in such closed end. As is clearly shown, the inner end 15 of the sleeve has an outwardly extending annular flange 16 which rests on the periphery of opening 14, and the sleeve is secured in fixed position as by welding as at 17.

The bore 18 of the sleeve 13, which defines a port through which fluid may flow, has its inner end beveled as at 19 to define a valve seat.

Positioned in the mouth of the container 11 remote from the closed end 12 thereof is a closure head or cover member 21 which illustratively has an annular groove 22 in its undersurface defining a relatively narrow peripheral rim 23 on its undersurface and an axial hub 24 the inner end 25 of which extends beyond the plane of peripheral rim 23.

The closure head 21 has an axial bore extending therethrough, the portion 26 of said bore extending through the axial hub 24 being of smaller diameter than the outer portion 27 of said bore, a conventional gas charging valve 28 being removably secured in said outer bore portion 27.

The periphery of said closure head at its outer surface is beveled as at 31 and the inner surface of the outer end or mouth 32 of said container 11 has a corresponding bevel 33. The two beveled surfaces 31 and 33 when the closure head is positioned in the mouth 32 of the container thus form a V groove 34 shown in FIG. 2.

Positioned in the container 11 is a deformable partition, illustratively in the form of an elongated bladder 35 of rubber or similar material having like characteristics. The bladder 35 is closed at one end as at 36 and such closed end 36 has secured thereon hereon and preferably molded integral therewith a rigid button or valve member 37 which is axially aligned with the bladder and designed to move against the valve seat 19 when the bladder is expanded to close the port 18.

The mouth 38 of the bladder 35 has a thickened rim 39 to which an annular supporting member 41 is affixed by being bonded thereto hereto or molded therein as illustratively shown. The supporting member or ring 41 is of relatively thin resilient sheet metal such as sheet steel and has a curved lower or mounting portion 42 convex on its outer surface as at 43 and an upper or retaining portion 44.

The lower portion 42 is molded integrally into the thickened rim 39 of the bladder 35 with the upper portion 44 being transversely spaced outwardly from the lower portion 42 to define an annular seating shoulder 45.

Inasmuch as it is costly to hold diametrical tolerances on deep drawn low cost shells as well as on metallic rings, the upper portion 44 of the supporting member 41 initially tapers outwardly slightly as shown in FIG. 3 so that the outer diameter of its free edge 46 is just slightly greater than the inner diameter of the container 11 adjacent the mouth thereof and below the beveled surface 33. Thus, when such upper portion is forced into the mouth 32 of the container it will readily fit therein with a snug fit.

The supporting ring is forced into the container mouth to an extent such that the upper or outer edge portion 46 of the supporting member will protrude outwardly slightly beyond the lower end 47 of the beveled surface 33 as is shown in FIG. 2. Due to the slight outward taper of the upper portion 44 of the supporting member, its outer surface will press snugly against the inner surface of the container just slightly below the lower end 47 of beveled surface 33, without any discontinuities or gaps.

As shown in FIG. 1, the closure member 21 is positioned in the substantially cylindrical upper portion 44 of the supporting member with the peripheral rim 23 of the closure member resting against locating shoulder 45 of the supporting member. In such position, the top surface 21' of the closure member is substantially flush with the mouth 32 of the container and the beveled surface 31 of the closure member is aligned with the beveled surface 33 of the container to define such V groove 34. The upper edge 46 of the supporting member will thus protrude upwardly into the groove 34 beyond the apex thereof.

Preferably the closure member 21 fits relatively loosely in the supporting ring to insure that the peripheral rim 23 of the closure member will rest on the locating shoulder 45 in order that the upper portion 46 of the supporting ring will protrude freely into V groove 34.

It is to be noted that the distance *d'* between the outer edge of peripheral rim **23** and the outer surface **21'** of the closure member must be greater than the distance *d''* between the locating shoulder **45** to the outer edge **46** of supporting ring **41** to insure that the outer edge portion protrudes into V groove **34**.

In order to provide a dependable gas and liquid seal, a weld **55** is formed in the V groove **34** which will securely join the opposed beveled surfaces **31**, **33** as well as the protruding portion **46** of the supporting ring **41** together.

It is apparent that when rubber is bonded to steel member such as the rim **39** of the bladder to the lower portion **42** of the supporting member **41**, the introduction of heat resulting from welding, brazing or fusing can readily be transferred through the heat conductible steel supporting member **41** to the area where the rubber is bonded to the lower portion **42** of the supporting member **41**, and such heat if excessive, would destroy the bond.

By reason of the construction which is the subject of this invention, the transmission of heat to the bond of the rim of the bladder to the lower portion **42** of the supporting member **41** is minimized.

Thus, in the first instance the region where the bond is formed (i.e. in the annular groove **34**) is remote from the bonded region of the rim **39** to the lower portion **42**.

Furthermore, a relatively large mass of metal is provided between the bonding region defined by the groove **34**, and the rim **39** of the bladder. More particularly, this mass of material is provided by the cover member **21** and the wall of the container **11**, these members functioning as a heat sink to disperse the heat engendered by the welding action in the annular groove **34**.

In addition, it is to be noted that the peripheral rim **23** of the cover member rests on the annular supporting surface **45** of the supporting member so there either is no contact or only a minimum contact between the peripheral rim of the cover member and the rim **39** of the bladder to minimize the transfer of heat.

Moreover, it is to be noted that due to the fact that the lower mounting portion **42** of the supporting member is inwardly displaced, the rim **39** of the bladder as well as the wall portion thereof will be spaced from the container wall again to minimize heat transfer.

Due to the fact that the free edge **46** of the supporting member protrudes into the annular groove, the weld performed in such annular groove will dependably connect such free edge with the sides of the annular groove defined by the beveled surfaces **31** and **33** to insure that an absolute gas and liquid tight seal will be formed.

If the free edge **46** should be below the apex of the groove, the weld joint might not positively engage such free edge so that an absolute seal might not be formed.

By reason of the configuration provided whereby the peripheral rim will seat on the annular supporting surface, the parts are properly located to insure that a dependable seal will be formed.

In addition to the foregoing, since the weld is performed at the top of the pressure vessel, a more dependable weld will be achieved than would be accomplished if the weld was at the side of the pressure vessel. This is due to the fact that the metal will flow downwardly and more uniformly into crevices that exist. As a result of this feature, the welding action may be performed with the pressure vessel in upright position without need to rotate the pressure vessel in a jig but it is merely necessary for the welder to move his welding torch around the top of the pressure vessel.

Furthermore, by reason of the construction above described, there is no possibility of burn-through or melting of the supporting member which might cause portions of the latter to fall into the bladder and burn the same, and furthermore, metal particles falling into the pressure vessel could cause serious damage to pumps, gauges and the like, used in the hydraulic system in which the pressure vessel is incorportated.

By reason of the fact that the weld is preformed in a V-groove which is substantially closed at its apex, the possibility of dislodgement of particles into the pressure vessel is substantially precluded.

In addition, the mechanical seal formed by the engagement of the two edges of the beveled surfaces of the container and the cover member against the protruding free edge of the supporting member prevents any cracks or crevices being formed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A pressure vessel comprising an elongated container of rigid material, having one end open and the other end closed, said closed end having an axial port therethrough, a deformable bladder of resilient material in said container, said bladder having a mouth at one end, and being closed at its other end, an annular supporting member of relatively thin material bonded to the mouth of said bladder and having a retaining portion extending outwardly therefrom, a cylindrical cover member positioned in the annular retaining portion, said cover member and its encompassing supporting member being positioned in the mouth of said container, the opposed surfaces of said cover member and the mouth of said container adjacent the outer ends thereof being beveled to define an annular groove therebetween that is substantially V-shaped in cross section having its apex directed downwardly, with the free edge of said retaining portion protruding slightly through said apex into said annular groove, and weld means bonding the opposed beveled surfaces of said groove in said cover member and said container and opposed surfaces of the protruding portion of said supporting member, to form a dependable gas and liquid seal said bladder having a thickened rim portion at its mouth, said annular supporting member having a mounting portion bonded in the thickened rim portion, said retaining portion being transversely spaced radially outwardly from said mounting portion to define an annular seating shoulder, said cover member having a relatively narrow peripheral rim on its inner surface resting on said seating shoulder between the thickened rim portion of said bladder and the retaining portion of said supporting member, the lower ends of the beveled surface of said container mouth and said cover member being aligned when the peripheral rim of said cover member is seated on said annular sealing shoulder.

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