

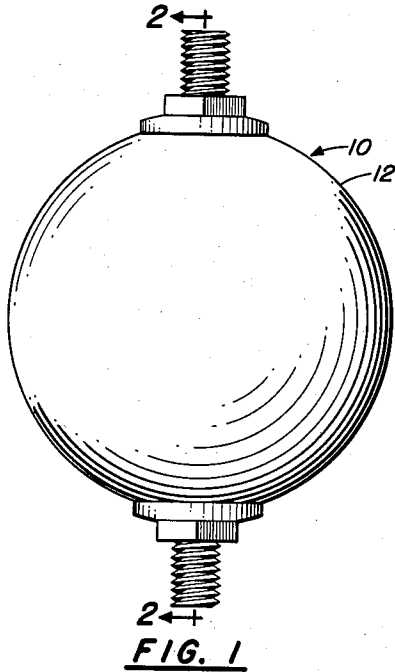
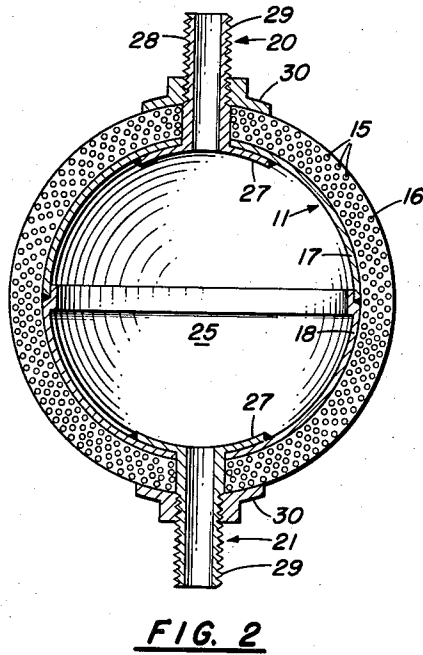
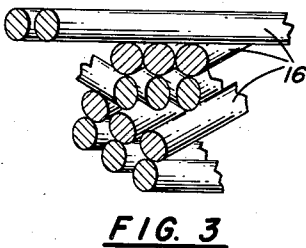
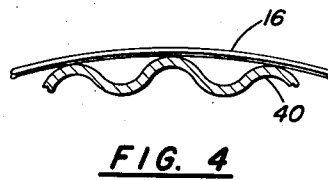
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PROCESS OF MAKING HIGH PRESSURE FLUID CONTAINERS

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PROCESS OF MAKING HIGH PRESSURE FLUID CONTAINERS

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4 Claims. (Cl. 29—423)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to containers for high pressure fluids.

In many fields, a container of high pressure fluids is an important necessity, as, for example, oxygen bottles for aircraft. Heretofore, these containers, both large and small, have usually been formed of wrought steel or aluminum alloy and require, in the large units, heavy sections and welded joints which introduce inherent strength limitations. Moreover, the heavy homogenous walls which form the major strength elements in these containers, when highly stressed, are subject to crack propagation and fragmentation as a result of gunfire or explosion.

Broadly stated, the invention consists in forming a container of a relatively weak sealing liner contained in a mesh of wire of relatively greater strength.

An important object of the invention is to provide a container for high pressure fluids which contains relatively light materials but is strongly resistant to internal pressures. Another object is to provide a container which eliminates use of heavy castings or forgings and welds with their limitations on strength.

Still another object is to provide a high pressure container which is free of crack formation and fragmentation on rupture. Additional objects relate to reduction of critical materials, increased flexibility, reduced complexity in methods of manufacture in relation to high pressure containers, elimination of wear factors in reinforcing mesh wires resulting in breakdown, and use of wire winding procedure insuring uniform stresses on the wire mesh at all radial angles and layer distances from the center of the container.

Other objects and features of the invention will become apparent on consideration of the following description of a preferred form of the invention and of the accompanying drawing, in which:

Fig. 1 is a view in elevation of a typical container of spherical shape;

Fig. 2 is a sectional view of the container taken along lines 2—2 of Fig. 1;

Fig. 3 is a detail view showing the mesh formation; and

Fig. 4 is a detail view showing a section of flexed sealing shell susceptible to elastic take-up when stressed by the expansive contents of the container.

In Fig. 1, a typical container unit 10 is illustrated, the structure of the unit being shown more clearly in Fig. 2 to include the inner sealing liner 14 and the mesh shell 15 enclosing the liner.

The sealing liner is formed preferably in two sections 17 and 18 fitted and welded or otherwise attached together to form a closed spherical cavity with the adjoining edges engaging in overlying relationship. The liner is of flexible material such as brass, copper or aluminum alloys. At the pole points of each half section, fittings 20 and 21

are inserted in apertures formed at these points, fitting 20 serving, for example, as an inlet to the interior chamber 25 and fitting 21 as an outlet. Permanent connection between liner and fitting is made by brazing or welding.

As shown, each fitting includes an arced root member 27 attachable to the liner, a short tube 28 having attachment means such as the screw thread 29 at the outer end thereof for connection to inlet or outlet pipe lines, and a clamp element 30 attached to the tube and having an extended flange for overlying the mesh layer and resisting side impact on the tube end.

The wire mesh 15 is constructed of a metal wire 16 having a relatively high tensile strength, such as piano or music wire. In forming the mesh the shell is first filled with solid material in particle form, e. g., sand, in order to give solid support to the yieldable shell wall during the wire winding step, this material being removed after the mesh is completed. The wire is carried around the great circumference of the liner, with the angular relationship of liner surface and wire progressively varying after each loop by approximately equal increments so that consecutive wire layers are formed with a strand section at any point being angularly disposed relative to adjacent strand sections, as indicated in Fig. 3.

When the mesh winding is completed the wire ends are secured in any suitable manner and the mesh impregnated with a filler, such as the phenolic or other resins, e. g., acrylic resin. The purpose of this plastic embedment is not only to insure immobilization of the wire strand structure but also aid in the prevention of corrosion and injury from impact. On the completion of the wire impregnation the clamp elements 30 are forced closely on the mesh.

Where due to large size of the shell or high pressures in use the shell is susceptible to marked deformation, or merely to permit use of thinner gauge metal, it may be advantageous to form the liner with furrows or depressions as indicated by 40, in Fig. 4, the wire 41 lying tangent to the shell ridges. On application of internal pressure the flexible liner tends to flatten as the mesh layer yields. Thus, the likelihood of liner fracture is diminished and lighter shell metal may be used.

In the winding operation it is usually desirable to increase the wire tension in successive layers so that in use all the wire layers are under the same radial stress. This arises from the fact that the inner shells of a spherical layer of substantial thickness are subject to higher pressures, and hence, with progressively increased layer tensions, moving radially outwardly, the possibility of shell fracture is reduced.

Metal wires for the mesh are indicated as desirable for the reason that with wires of reduced strength either the wire must be so large as to be bulky, or a coating of substantial thickness must be provided, as in glass fiber, to compensate for the weakness or brittleness of the filament. Where a coating is used, there is a marked tendency to wear the coating between contacting filaments which is particularly likely at the inner mesh layers. Eventually, these inner layers lose the support of the layer material and break progressively outwardly until the sealing shell is disrupted.

While in the preferred form of the disclosure the casing 10 is spherical in shape, it is apparent that cylindrical or other shapes are feasible depending on the requirements of use. Also, while a solid granular material, such as sand, is indicated to provide pressure resistance in the wire wrapping step, any pressure resistant removable material may be used.

Obviously, modifications other than these described may be made and hence it is understood that the invention

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may be practiced otherwise than as specifically mentioned, within the scope of the appended claims.

This application is a division of my copending application, Serial No. 441,957, filed July 7, 1954.

What is claimed is:

1. The process of making a high pressure fluid container comprising forming a sealed inner liner of flexible material having at least one transport duct connected thereto and communicating with the liner interior, filling said liner only with removable pressure resistant material through said transport duct to give support to said liner during subsequent wire winding of said liner, wrapping the liner exterior with reinforcing wire under tension to form a pressure resistant layer external to said liner, and removing said pressure resistant material from the interior of said liner.

2. The process of making a high pressure resistant container as defined in claim 1 including additionally the step

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of impregnating the wire layer with a protective and immobilizing coating.

3. The process of making a high pressure resistant container as defined in claim 1 with said wrapping continued to form a wall of several wire layers, and applying progressively increased tension to the wire as each layer is applied to the liner exterior.

4. The process of making a high pressure resistant container as defined in claim 3 and impregnating the wire layers with a protective and immobilizing coating.

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