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(71) Applicant: **Fairchild Semiconductor Corporation**
South Portland, Maine 04106 (US)

(72) Inventor: **Guertin, Ronald R.**
Scarborough, Maine 04074 (US)

(74) Representative: **McKeown, Yvonne Mary et al**
c/o MacLachlan & Donaldson,
47 Merrion Square
Dublin 2 (IE)

(54) Dual containment isolation valve and corresponding gas/liquid container

(57) A dual-containment isolation valve to minimize leakage through a valve coupled to a fluid storage container. The isolation valve of the invention includes a flange for mating to an upper surface of the container, with a sealing gasket inserted therebetween. As the valve's standard male threads are threaded into the container's standard female threads, the valve's flange is drawn toward the container's upper surface. The coupling of the valve to the container results in a sealing compression of the gasket between the flange and the top surface. The container's top surface is preferably machined to a flat finish to increase gasket-to-surface contact. The valve optionally includes a pressure indicator port for coupling the valve to a pressure indicator.

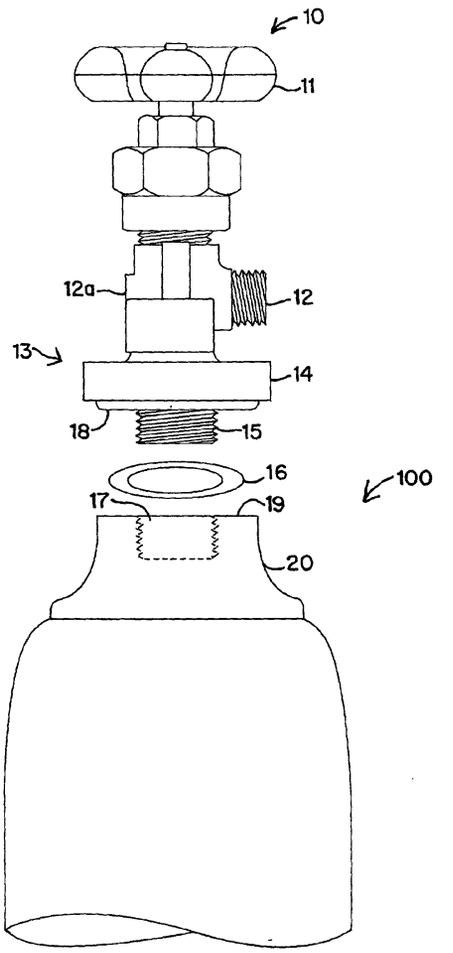

FIG 1

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Description

Background Of The Invention

1. Field of the Invention.

[0001] The present invention relates to gas and liquid storage containers. In particular, the present invention relates to devices for preventing the leakage of gases and liquids from storage containers. More particularly, the present invention relates to the valves used to close storage containers. The present invention includes optional modification of the body of the storage container to accept a dual-containment isolation valve that is the primary focus of the invention.

2. Description of the Prior Art.

[0002] Storage containers are used to hold a variety of gases and liquids for a wide array of purposes. Some of the gases and liquids that they store may be quite hazardous. Additionally, the contained fluids may be expensive, useful only when of a certain purity, and/or useful only when retained at a specified pressure. A storage container that leaks can result in a hazardous environment. It can cause a contamination of the fluid, loss of costly fluid, or a reduction in the expected quality of the fluid. Therefore, in most instances, it is particularly undesirable to have a leaky storage container.

[0003] All fluid storage containers have valves designed to permit the user to regulate the flow of fluid from the container. The primary valve design for storage container isolation is a needle-valve assembly. The assembly includes a rotatable knob used to actuate a needle-shaped valve stem plunger. When the plunger is seated in a plunger seat, the valve is closed. When the plunger is drawn away from the seat, a fluid outlet in the top of the neck of the container is exposed within the confines of the valve's interior chamber. It is then possible to exhaust the fluid through that opening and one or more fluid ports of the valve for delivery to a desired destination.

[0004] The valves used to isolate storage containers are joined to the containers by threading the male valve stem threads into the female-threaded necks of the containers. The type of threading varies as a function of the fluid stored. There are primarily four container outlet threads. They are: 1) National Gas Taper Threads; 2) Special Gas Taper Threads; 3) National Gas Straight Threads; and 4) Straight Threads (other than National Gas Straight Threads). The mating of the male and female threading is rarely perfect. In order to minimize the possibility of fluid leakage through threading gaps. It is standard practice to attempt to fill any such gaps. Placing a sealing material around the valve stem threads does this. The sealing material is a pliable sealing compound such as tape dope, SWAK™, etc. Nevertheless, the result is a single-containment valve in that the only sealing site is the threading interface.

[0005] The pliable sealing material and reliance on a reasonably tight fit between the mated threads are the only two features of the present valves that prevent container fluid leakage. Unfortunately, fluid leakage through storage container /valve interfaces is a common occurrence. As a result, toxic, corrosive, and/or flammable gases leak, causing safety hazards. In addition, in production, processing delays are caused by the need to remove the defective container and replace it with a leak-free one and, when necessary, the evacuation of personnel. Finally, there are considerable costs associated with the loss of the use of fluids within such defective container/valve assemblies.

[0006] Therefore, what is needed is a valve assembly that provides greater protection against leakage than that available through present valve assemblies for storage containers. What is also needed is such a valve assembly that operates in substantially the same manner as existing valve configurations. Further, what is needed is such a valve assembly that is essentially compatible with existing container head designs.

Summary Of The Invention

[0007] It is an object of the present invention to provide a valve assembly that provides greater protection against leakage than that available through present valve assemblies for storage containers. It is also an object of the present invention to provide a novel valve assembly that operates in substantially the same manner as existing valve designs. It is a further object of the present invention to provide a valve assembly that is essentially compatible with existing container head designs.

[0008] These and other objects are achieved in the present invention through the development of a dual-containment isolation valve assembly. The dual-containment valve is a modified standard single-containment valve that includes a flange at the base of the valve body. A gasket made of material suitable for use with the particular fluid in the container is positioned between the new flange and an upper surface of the storage container. When the sealed threads of the valve stem are threaded into the female threading of the storage container head, the gasket is compressed into place between the valve flange and the container head. The result is double containment of the fluid therein. First from the sealed threading interface and, more importantly, from the sealing gasket.

[0009] While it is intended to use the modified valve design of the present invention with existing container configurations, it is contemplated that the top surface of the container head may be modified. In particular, that surface may be machined or otherwise shaped to provide a substantially uniform flat surface. That modified surface will increase gasket-to-container contact area when the gasket is compressed, which increased con-

tact area enhances the sealing capability of the dual-containment valve of the present invention.

[0010] The dual-containment valve of the present invention may optionally include a supplemental port. The supplemental port may be used to link the valve's external cavity with a pressure indicator. That is, the valve's cavity that is external to the fluid container. The pressure indicator may be used to determine the pressure in the external cavity in the event of a leak on the valve seat.

[0011] These and other advantages of the present invention will become apparent upon review of the following detailed description, the accompanying drawings, and the appended claims.

Brief Description of the Drawings

[0012] FIG. 1 is a partially-exploded side view of the dual-containment isolation valve of the present invention, shown in relation to a storage container having a machined gasket seal surface.

[0013] FIG. 2 is a simplified side view of a modified version of the dual-containment isolation valve of the present invention showing optional evacuation port and optional indicator port.

Description Of The Preferred Embodiment Of The Invention

[0014] A dual-containment isolation valve **10** of the present invention is shown in FIG. 1 in relation to a storage container that is shown as a storage cylinder **100.** The valve **10** includes an actuation knob **11**, an outlet port **12,** a pressure-relief valve **12a,** and a dual-containment section **13** for coupling the valve **10** to the cylinder **100.** The dual-containment section **13** includes a valve flange **14,** male valve threading **15**, and a sealing gasket **16**. The flange **14** has perimeter dimensions extending beyond the dimensions of said male valve threading **15.** The threading **15** may be of any suitable standard gas/liquid threading compatible with female cylinder threading **17** of cylinder **100.**

[0015] The combination of the coupling of threading **15** and threading **17** links valve **10** and cylinder **100** together in the manner substantially the same as that achieved in the prior art. When those sections of the valve **10** and the cylinder **100** are threaded together, a flange face **18** of the flange **14** and a cylinder face **19** of a cylinder neck **20** of cylinder **100** are drawn together. As that occurs, gasket **16** is captured therebetween and compressed to form a second sealing means that is the key aspect of the present invention. This second sealing means provides sealing contact between the gasket **16** and face **18,** and gasket **16** and face **19.** This second sealing means supplements and enhances the seal between the threading **15,** which is preferably sealed with tape dope or the like, and threading **17**.

[0016] Face **18** and face **19** are preferably fabricated with machined surfaces in order to increase the contact at the respective interfaces to the gasket **16**. However, it is to be understood that such machining may not be necessary, dependent upon the material selected to create the gasket **16**. In particular, a soft, pliable material, such as rubber, will more easily conform to surface variations in faces **18** and **19**, as the gasket **16** is compressed. Nevertheless, the gasket **16** may be formed of any material suitable for potential contact with the fluid stored in the cylinder **100,** including, but not limited to, metals such as Nickel-plated steel, and a wide array of plastics, such as Teflon™ or Viton™. Its selection must, however, account sufficiently for surface variations in faces **18** and **19** so that the fluid within the cylinder **100** cannot escape through pathways associated with such variations.

[0017] An alternative dual-containment isolation valve **10'** of the present invention is shown in FIG. 2. In the figure like components are given the same designations as those provided in FIG. 1. The valve **10'** includes a pressure indicator port **21** for linking the backside of a valve stem **10a** to a fluid pressure indicator **22.** The indicator **22** may be used to determine whether gas has leaked by the valve seat and has pressurized a valve stem cavity **10b.** That cavity **10b** consists of the valve stem **10a,** the outlet port **12,** and the indicator port **21.** If the pressure indicator **22** indicates a positive pressure, a safety cap used to cover the outlet port **12** of the valve **10'** should be left in place and the cylinder **100** handled in a suitable manner.

[0018] While the invention has been described with reference to particular example embodiments, it is intended to cover all modifications and equivalents within the scope of the following claims.

Claims

1. A dual-containment isolation valve for coupling to a fluid storage container having a top surface and internal threading within the top surface thereof, the isolation valve comprising:

   a. a male threaded section for coupling to the internal threading of the storage container;
   b. a flange having a flange face, wherein when said male threaded section is coupled to the internal threading, said flange face is drawn toward the top surface of the storage container; and
   c. a gasket positionable between said flange face and the top surface of the storage container.

2. The isolation valve as claimed in **Claim 1** wherein said gasket is formed of a plastic material.

3. The isolation valve as claimed in **Claim 1** further comprising a pressure indicator port for coupling

said valve to a pressure indicator.

4. A combination of a dual-containment isolation valve and a fluid storage container comprising:

a. a storage container having a top machined surface and an interior threaded section;
b. an isolation valve for coupling to said storage container, said isolation valve comprising:

i. a male threaded section for coupling to said internal threading of said storage container; and
ii. a flange having a flange face, wherein when said male threaded section is coupled to said internal threading, said flange face is drawn toward said top machined surface of said storage container; and

c. a gasket positionable between said flange face and said top surface of said storage container.

5. The combination as claimed in **Claim 4** wherein said gasket is formed of a plastic material.

6. The combination as claimed in **Claim 4** further comprising a pressure indicator port for coupling said valve to a pressure indicator.

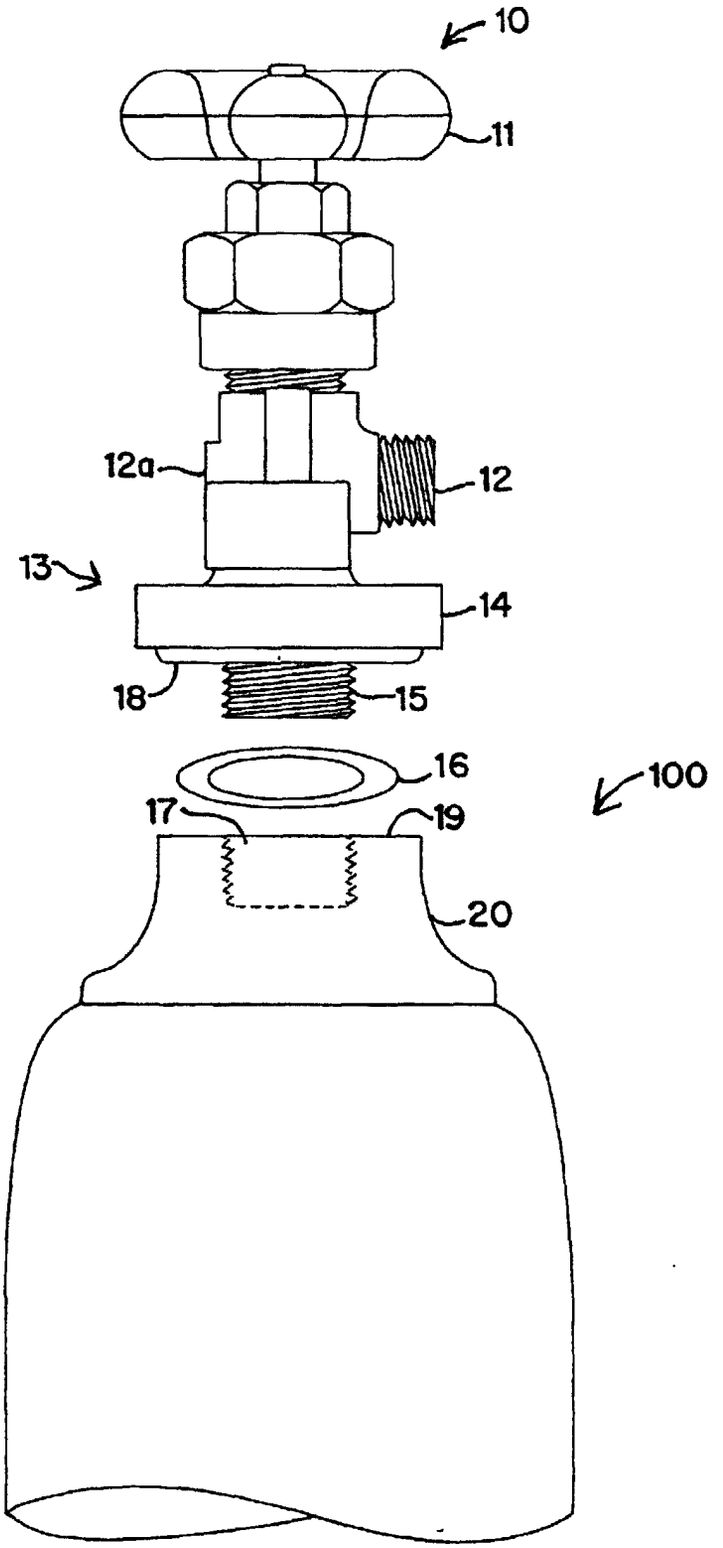

FIG 1

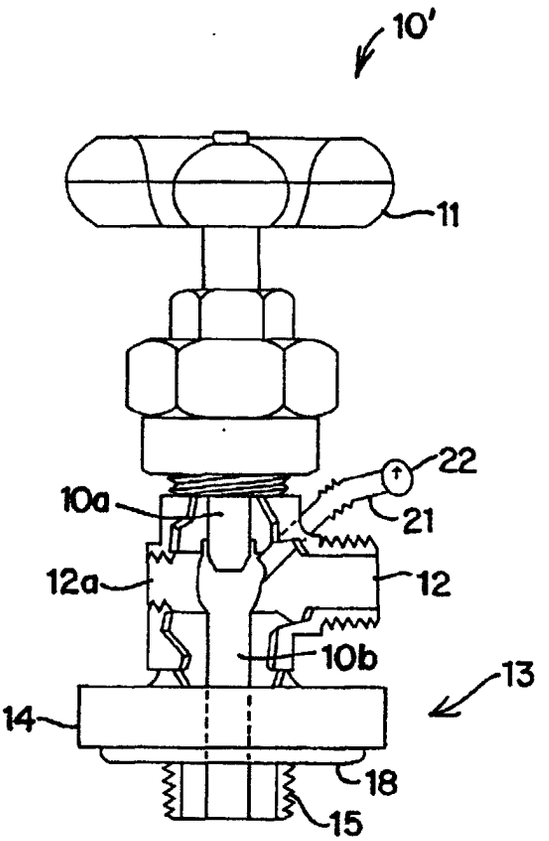

FIG 2