

(19)



(11)

EP 2 773 898 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

06.01.2016 Bulletin 2016/01

(51) Int Cl.:

F17C 13/06 ^(2006.01)

(21) Application number: **12741156.9**

(86) International application number:

PCT/US2012/045914

(22) Date of filing: **09.07.2012**

(87) International publication number:

WO 2013/066430 (10.05.2013 Gazette 2013/19)

(54) **SYSTEM AND METHOD FOR CHARGING AND SEALING PRESSURE VESSELS**

SYSTEM UND VERFAHREN ZUM FÜLLEN UND VERSIEGELN EINES DRUCKBEHÄLTERS

SYSTÈME ET PROCÉDÉ PERMETTANT DE CHARGER ET DE SCELLER DES RÉCIPIENTS SOUS
PRESSION

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

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(30) Priority: **04.11.2011 US 201113289400**

(43) Date of publication of application:

10.09.2014 Bulletin 2014/37

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Description

Field of the Invention

[0001] This invention is directed to a pressure or vacuum container, and more particularly to a high pressure gas container having an improved seal for extended shelf life.

Background

[0002] High pressure gas containers find many uses, including in guided missiles. In a missile, the pressurized gas provides a compact source of energy that can be used, for example, for uncaging gyros, cooling detector elements of infrared seekers, moving control surfaces, etc. These containers can be very small, making them difficult to fill and seal while maintaining a low leak rate.

[0003] One commonly used fill method involves a small diameter tube which breaches the inner volume of the bottle. After the container is filled with gas through the tube, it is resistance welded in several places and then welded shut at its distal end. This general design has been in use for more than 20 years throughout the industry.

[0004] Other preceding pressurized containers for missiles relied principally on a metal-to-metal seal to confine the gas within the container. Some of these seals depended upon a threaded union, while others have used a pressed in plug. Both of these designs require an extremely good surface finish to obtain a seal that will retain the gas in the container. Other seals were formed by molding a soft metal over the opening of the container.

[0005] Prior art document U.S. Patent No. 3487442, corresponding to DE-U-6840730, discloses a flexible thread system for use on screw type closure structures for high pressure vessels and the like wherein a gullet, preferably tapered, is provided below the normal root portion of one, or both, of the mating male and female threads of the screw type closure, the gullet or gullets enabling the thread cross section to deflect as a lever to enable the closure threads to be uniformly stressed and to accommodate the pressurized stress patterns of the vessel system.

Summary of the Invention

[0006] Metal-to-metal seals can be imperfect, allowing the confined gas to slowly leak out of the container, shortening its shelf life. Since guided missiles are often stored for a long time before they are used, the potential of a shortened shelf life increases the risk that the container will not contain sufficient gas when it is needed, which can render the missile useless. Additionally, preceding seals were often not physically robust to mishandling, were not robust to environmental conditions, and/or were not robust to contamination. Despite these shortcomings, they continued to be used because other techniques

were unavailable, did not fit into the available volume, or were more expensive and therefore not suitable for typical qualities of missile subsystems.

[0007] The present invention provides a redundant sealing system that uses both a deformable plug to fill the opening and form an initial seal and a secondary welded seal that can be formed with the addition of a metal cap and an inexpensive orbital welder.

[0008] More particularly, the present invention provides a seal assembly for a pressure container, where the container has a fill port opening and a boss extending from a surface of the container. The boss has a passage aligned with the opening, and the passage has a threaded portion. The seal assembly includes a port plug having a nose portion with a surface shaped to mate with the fill port opening in the container and a set screw portion with external threads for engaging the threaded portion of the passage through the boss to press the nose portion into the fill port opening to form a seal. The seal is an initial or first seal and the seal assembly further includes a weld plug, sized to close the distal end of the passage through the boss. The weld plug is welded to the boss to form a second seal. Naturally, the present invention also provides a pressurized container having such a seal assembly for sealing the opening and the passage.

[0009] The present invention also provides a method of charging a container and then sealing the container to provide an extended shelf life. The method includes the following steps: (a) providing a container having an opening therein and a boss extending from a surface of the container adjacent the opening, the boss having a passage aligned with the opening in the container, the passage being at least partially threaded with internal threads, a port plug that includes a nose portion for closing the fill port opening in the container and a set screw portion with external threads for engaging the threaded portion of the boss; (b) inserting the port plug in the passage with the nose portion closer to the opening than the set screw portion; (c) charging the container via the passage; (d) torquing the threaded port plug to advance the port plug in the passage until the nose portion engages the surface of the container adjacent the opening to create the initial or first seal; (e) installing a weld plug into an outer end of the boss to close the passage through the boss; and (f) welding the weld plug to the boss to create a second seal.

[0010] According to another aspect of the invention, the invention provides a container with a seal assembly, where the container has an opening therein and a boss extending from a surface of the container adjacent the opening. The boss has a passage aligned with the opening in the container, and the passage is at least partially threaded with internal threads. The container and seal assembly further include means for sealing the opening in the container, adjacent the opening at a proximal end of the passage through the boss, and means for sealing the passage through the boss, adjacent a distal end of the passage through the boss.

[0011] In an exemplary embodiment, the opening-sealing means includes a port plug having a nose portion with a surface shaped to mate with the fill port opening in the container and a set screw portion with external threads for engaging the threaded portion of the passage through the boss to press the nose portion into the fill port opening to form a seal. And the passage-sealing means includes a weld plug sized to close the distal end of the passage, the weld plug being welded to the boss to form a second seal.

[0012] The foregoing and other features of the invention are hereinafter fully described and particularly pointed out in the claims, the following description and annexed drawings setting forth in detail certain illustrative embodiments of the invention, these embodiments being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

Brief Description of the Drawings

[0013]

FIG. 1 is an exploded perspective view of a container provided in accordance with the present invention illustrating the sealing components.

FIG. 2 is a cross-sectional view of the completed assembly of the components shown in FIG. 1.

FIG. 3 is a perspective view of the port plug as shown in FIG. 1.

FIG. 4 is a cross-sectional view of the port plug of FIG. 3.

FIG. 5 is a perspective view of a weld plug as shown in FIG. 1.

FIGS. 6-10 are sequential views of the port assembly and sealing mechanisms for the container as shown in FIG. 2 illustrating the assembly and use process.

FIGS. 11-15 illustrate alternative embodiments of a weld plug provided in accordance with the present invention.

FIG. 16 illustrates an alternative port plug provided in accordance with the present invention.

Detailed Description

[0014] As discussed above, prior pressure containers suffered from a number of problems in providing a hermetic seal. For example, some containers were not robust to mishandling, environmental conditions, or contamination, or the sealing method required a high capital cost to implement. In addition, previous sealing methods for pressure containers often leak excessively over time, were not compact and occupied a large volume, or provided no redundancy in the sealing method.

[0015] In contrast, the present invention provides a compact, inexpensive, and redundant sealing method. The pressure container includes an opening for filling with a pressurized gas or liquid. A first element is pressed against an annular surface adjacent the opening and fills

and closes the opening itself. In the process, this first element deforms to mate with the annular surface and provide an initial or a first seal. A second element holds the first element against the container and is removable to release or replace the first element in the event that this initial seal is ineffective or otherwise compromised. A third element is then mounted over the first and second elements and welded in-place to provide a second seal in the event that the initial seal is breached.

[0016] The resulting pressure container is physically small, uses common manufacturing methods, and provides a robust, redundant seal that can be made in the field. Factory conditions are not required to establish either the first seal or the second seal. Moreover, the first seal can be tested before creating the second seal and if the initial first seal fails, the first seal can be reworked before the second seal is applied.

[0017] An exemplary system and method for sealing a container 10 is shown in FIGS. 1 and 2. The container 10, or tank or bottle or other chamber capable of retaining a gas or a liquid, has a fill port opening 14 and a boss 16 extending from a surface of the container 10. The fill port opening 14 preferably is cleaning friendly. The boss 16 has a passage 20 aligned with the opening 14, and the passage 20 and the opening 14 are sealed by the seal assembly 12.

[0018] An exemplary container 10 is made of steel, such as stainless steel, and has a wall thickness of approximately 0.07 inches (about 1.8 mm). An exemplary stainless steel for the container is Carpenter Custom 455 stainless steel, from Carpenter Technology Corporation of Wyomissing, Pennsylvania, U.S. Such a container has been found to withstand high internal pressures, up to approximately 25,000 psig (about 172,400 kPa). The boss 16 is in effect a short, permanent tube secured to or formed as an integral part of the container 10. An exemplary boss 16 is cylindrical and has a diameter of approximately 0.25 inches (about 6.4 mm) and a length or height of about 0.30 (about 7.6 mm) in length.

[0019] The passage 20 through the boss 16 to the fill port opening 14 has a threaded portion 22 at a distal end 24 thereof for receiving a port plug 26. The illustrated port plug 26 has a nose portion 30 and a set screw portion 32. In the illustrated embodiment the nose portion 30 and the set screw portion 32 are separate components, but they could be formed as a single part. The nose portion 30 can be made of a malleable material, such as a plastic or a metal, and in the illustrated embodiment the nose-portion 30 has a generally cone-like shape. Other shapes can work as well. An exemplary nose portion 30 is made of brass, such as brass 360. The illustrated nose portion 30 also has a support post or shank 34 extending from a base or distal end of the cone-like shape.

[0020] Referring now to FIGS. 3 and 4 as well, the support post 34 extends into a socket 36 in the set screw portion 32. The support post 34 preferably, but not necessarily, is partially crushed or swaged to permanently capture the nose portion 30 in the set screw portion 32

of the port plug 26. This enables the nose portion 30 to move in the radial direction relative to the set screw portion 32 for self alignment when secured against the annular surface on the container 10. The set screw portion 32 has external threads 40 for engaging the threaded portion 22 on the inner surface of the passage 20 through the boss 16. A proximal end 42 of the set screw portion 32 includes a socket 44 for receiving the support post 34 at the base of the nose portion 30. This hollowed-out set screw portion 32 can facilitate swaging the support post 34 portion of the nose portion 30 (FIG. 15), so that it mushrooms to an increased width and thus is held behind a shoulder 47 in the set screw portion 32. An example of a port plug 26 with a swaged support post 34 is shown in FIG. 16.

[0021] A distal end 46 of the set screw portion 32 includes a driving feature 50 for engaging and driving the set screw portion 32 along the threaded portion 22 of the passage 20 through the boss 16. For example, an exemplary driving feature 50 includes a hexagonal socket formed in a distal end of the set screw portion 32. An exemplary socket 50 is sized to receive a nominal 1/16 inch (approximately 1.6 mm) hexagonal wrench or key. Other types of driving features, such as for receiving a screwdriver, are alternative options. An exemplary set screw portion 32 is made of stainless steel and, more particularly, Nitronic® 60, available from AK Steel Corporation of West Chester, Ohio, United States. Nitronic® 60 is an austenitic stainless steel. The illustrated set screw portion 32 is tubular, and the socket 36 is formed by a hole or passage that extends part or all the way through the set screw portion 32, facilitating the delivery of pressurized gas to the container 10 when the port plug 26 is in the passage 20 in the boss 16. A slot 48 in the side of the set screw portion 26 provides another path for gas to flow past the set screw portion 26 and into the container 10.

[0022] After the container 10 is filled with pressurized gas or evacuated, the port plug 26, inserted in the passage in the boss 16 either before or after charging with or evacuating the gas, is advanced by torquing the set screw portion 32 to press the nose portion 30 against the surface of the container 10 adjacent the fill port opening 14. Since the nose portion 30 is made of a malleable material, continuing to torque the set screw portion 32 deforms the nose portion 30 to mate with that surface adjacent the fill port opening 14, as shown in FIG. 2. This creates an initial seal. This initial seal is reworkable if testing reveals that the seal is leaking. This arrangement also places the threads on the set screw portion 32 of the port plug 26 and the passage 20 in the boss 16 outside the sealed container, on the dirty side of the first seal.

[0023] If testing shows that the first seal has good integrity, then a weld plug 60 is placed over the distal end 24 of the boss 16 and welded in place to provide a second seal, redundant to the first seal. Because the port plug 26 is entirely within the passage 20 through the boss 16, the weld plug 60 and the boss 16 form a hermetically-

sealed chamber over both the port plug 26 and the fill port opening 14. So even if the port plug seal fails, the container 10 will remain sealed by the weld plug 60 and the weld holding it in place. The weld plug 60 typically is made of steel, such as the same steel as the pressure container 10. An exemplary weld plug is approximately 0.060 inches (about 1.5 mm) thick. The weld can be formed with an orbital TIG welder, for example. Such welders are commonly available, generally are small, portable, simple to use, and relatively inexpensive. More importantly, they yield consistent-quality welds with simple operation. Consequently, orbital welders can be used in the field and do not require the precise conditions of a factory environment to form the weld seal. Other types of welding devices can be used to weld the weld plug 60 to the boss 16, however, including laser and electron-beam welders.

[0024] As shown in FIGS. 2 and 5, the weld plug 60 can include a shank or shaft 62 that is received in the port plug 26 and extends through the socket 36 in the set screw portion 32 of the port plug 26. The illustrated port plug 60 has a hexagonal shaft 62 that is received in the hexagonal socket 50 in the distal end of the set screw portion 32. Finally, once the weld plug 60 is welded in place, the engagement of the port plug 26 with the set screw portion 32 prevents the set screw portion 32 from rotating over time as a result of vibration, handling, or any other reason. The shaft 62 also substantially fills the volume contained between the port plug 26 and the weld plug 60, thereby minimizing the volume of gas within the boss 16. This further helps to ensure a good welded, second seal.

[0025] A sequence of operation of a sealing method provided in accordance with the present invention is shown in FIGS. 6-10. FIG. 6 illustrates a pressure container 10 and the boss 16 extending from the pressure container 10 with the passage therethrough to the fill port opening 14. In FIG. 7, the port plug 26 is inserted into the passage 20 in the boss 16. This can be done manually or automatically. As shown in FIG. 8, the pressure container 10 can then be mounted into a fixture or otherwise connected or coupled to a fitting to fill the pressure tank with a pressurized gas or liquid 66 (or alternatively evacuating fluid from the container 10). The fixture or other coupling generally includes a tool or mechanism for torquing the port plug 26 and advancing the set screw portion 32 to deform the nose portion 30 of the port plug 26 against the surface of the pressure container 10 adjacent the fill port opening 14, as shown in FIG. 9. This forms the initial or first seal. This seal can then be tested to determine whether gas leaks through that seal and whether the seal is secure. This can be done through the same coupling used to fill the pressure container 10 or through a separate mechanism or fixture. If the seal leaks, or otherwise fails the testing, the port plug 26 can be removed and replaced or reinstalled.

[0026] As shown in FIG. 10, the pressure container 10 has been removed from the fixture or coupling and a weld

plug 60 is installed at the distal end 24 of the passage 20 through the boss 16. The container 10 and seal assembly 12 can then be installed into an orbital welder and the weld plug 60 is welded to the boss 16 to complete the second, redundant seal for the container 10.

[0027] Although only one type of weld plug 60 has been shown so far, additional designs also are contemplated within the scope of the present invention. FIGS. 11-15 show alternative designs for the weld plug 60 which will be briefly described in the following paragraphs.

[0028] In FIG. 11 a weld plug 70 is received within the passage 20 through the boss 16 and is welded in place from an axial end of the boss 16. In this design, the only thing holding the weld plug 70 in place is the fit of the weld plug 70 within the passage 20, preferably a tight fit, and the weld itself. Alternatively, as shown in FIG. 12, the weld plug 72 may include a threaded portion 74 for engaging the threaded portion 22 in the passage 20 to secure the weld plug 72 in place before it is welded. The weld plug 72 also includes a means for torquing the weld plug 72 into the passage 20, such as by a hexagonal socket 76. A distal end of the weld plug 72 is again provided with an axial weld to secure the weld plug 72 in place. In this design, the weld plug 72 may extend into the passage 20 a sufficient distance to engage the distal end 46 of the set screw portion 32 of the port plug 26 and thus prevent the port plug 26 from loosening due to vibration or handling of the pressure container 10.

[0029] Instead of an axial weld, the weld plug may be provided with a radial weld, as was the case with the embodiments previously shown in FIGS. 1 and 10. The embodiment shown in FIG. 13 is similar to that shown in FIG. 10, and like FIG. 11 the weld plug 80 is only held in place by the fit of a proximal portion 82 of the weld plug 80 that extends into the passage 20 through the boss 16. The weld plug 80 in this case is primarily held in place by the weld itself. Another embodiment, comparable to that of FIG. 12, has a threaded portion 84 that extends into the passage 20 to secure the weld plug 86 in place until it is welded. In contrast to FIG. 12, however, in this case the weld plug 86 extends beyond the distal end 24 of the boss 16 and is held in place with a radial weld.

[0030] The weld plug designs shown in FIGS. 12 and 14 included a threaded portion that extended into the passage 20 through the boss 16. Since the passage 20 is already threaded at its distal end 24 to receive the set screw portion 32 of the port plug 26 these designs require no additional machining. An alternative is shown in FIG. 15. In this case, the port plug 90 extends over an outer surface 92 of the boss 16 and is radially welded to the outer surface. This design also includes an exterior thread on the boss 16 that engages an interior threaded portion 96 on the port plug 90, similar to a screw-cap for a bottle. These threaded portions 94 and 96 may be omitted, however, and the weld plug 90 or cap can be welded in place without a threaded connection. Other types of weld plugs for closing the passage through the boss and sealing the port plug in the passage are contemplated

within the scope of the present invention. The weld may be an axial weld, a radial weld, or a combination of the two, in the form of a weld at an angle, such as between parts meeting at a 45 degree angle relative to an axis of the boss 16. Additionally, the welds used to seal the weld plug to the boss can be made using other methods than an orbital TIG welder, such as a laser, electron-beam, or other welding technique.

[0031] Thus the present invention provides a redundant seal for a high pressure gas container 10. First a port plug 26 seats and then deforms a nose 30 portion adjacent a surface surrounding a fill port opening 14 to establish a first seal. The set screw portion 32 both advances the nose portion 30 against the opening 14 and holds the deformed nose 30 in place. A weld plug 60 then caps or covers the port plug 26 and the passage 20 through the boss 16 and is welded in place to provide a second seal for any gas that might escape past the port plug 26.

[0032] In addition, the present invention allows the first sealing elements, the port plug 26 and particularly the nose portion 30, to be reworked or replaced if the first seal is tested and fails the test, before the weld plug 60 is added to form the second seal. An exemplary seal assembly provided by the invention has been found to seal over 40,000 psig (about 276,000 kPa) prior to burst. The resulting seal assembly 12 is robust to mishandling, the first seal is protected from environmental conditions and contamination, and the first and second seals can be formed with inexpensive tools that can be used outside a factory setting, in the field. For example, in an air-conditioning maintenance and repair situation, as well as for supplying gas for a missile. Such an exemplary seal assembly is expected to have an approximately 14 year life, at least, with no more than 200 psig (about 1,400 kPa) leak over that 14 year period.

[0033] In summary, the present invention provides a redundant sealing system includes a seal assembly 12 for a pressurized container 10, where the container 10 has a fill port opening 14 and a boss 16 extending from a surface of the container 10. The boss 16 has a passage 20 aligned with the opening 14, and the passage 20 has a threaded portion 22. The seal assembly 12 includes a port plug 26 having a nose portion 30 with a surface shaped to mate with the fill port opening 14 in the container 10 and a set screw portion 32 with external threads for engaging the threaded portion 22 of the passage 20 through the boss 16 to press the nose portion 30 into the fill port opening 14 to form a first seal. The seal assembly 12 further includes a weld plug 60 sized to close the distal end of the passage 20 through the boss 16, the weld plug 60 is welded to the boss 16 to form a second seal.

Claims

1. A seal assembly (12) for a pressurized container (10), the container (10) having a fill port opening (14)

- and a boss (16) extending from a surface of the container (10), the boss (16) having a passage (20) aligned with the opening (14), the passage (20) having a threaded portion (22), the seal assembly (12) comprising a port plug (26) having a nose portion (30) with a surface shaped to mate with the fill port opening (14) in the container (10) and a set screw portion (32) with external threads (40) for engaging the threaded portion (22) of the passage (20) through the boss (16) to press the nose portion (30) into the fill port opening (14) to form a seal, whereby the nose portion (30) has a cone-like shape with a proximal end that is smaller than the opening (14) and a distal end that is larger than the opening (14).
2. A seal assembly (12) as set forth in claim 1, where the nose portion (30) is a malleable material.
 3. A seal assembly (12) as set forth in claim 2, where the nose portion (30) is brass.
 4. A seal assembly (12) as set forth in any of claims 1 to 3, where the set screw portion (32) has a drive means (50) at a distal end (46) for engaging the set screw portion (32) and advancing or retracting the set screw portion (32) in the passage (20) relative to the boss (16).
 5. A seal assembly (12) as set forth in claim 1, where the seal is a first seal and further comprising a weld plug (60; 70; 72; 80; 86) sized to close the distal end of the passage (20) through the boss (16), the weld plug (60; 70; 72; 80; 86) being welded to the boss (16) to form a second seal.
 6. A seal assembly (12) as set forth in any of claims 1 to 5, where the weld is one of an axial weld and a radial weld or a combination of the two.
 7. A seal assembly (12) as set forth in any of claims 1 to 6, where the boss (16) is generally tubular.
 8. A pressurized container (10), comprising a fill port opening (14) and a boss (16) extending from a surface of the container (10), the boss (16) having a passage (20) aligned with the opening (14), the passage (20) having a threaded portion (22); and a seal assembly (12) as set forth in any of claims 1 to 6 for sealing the opening (14) and the passage (20).
 9. A method of charging a container with gas or liquid and then sealing the container, comprising the following steps:
 - (a) providing a container having an opening therein and a boss extending from a surface of the container adjacent the opening, the boss having a passage aligned with the opening in the container, the passage being at least partially threaded with internal threads, a port plug that includes a nose portion for closing the fill port opening in the container and a set screw portion with external threads for engaging the threaded portion of the boss;
 - (b) inserting the port plug in the passage with the nose portion closer to the opening than the set screw portion;
 - (c) charging the container with a pressurized gas or liquid via the passage;
 - (d) torquing the threaded port plug to advance the port plug in the passage until the nose portion engages the surface of the container adjacent the opening to create a first seal;
 - (e) installing a weld plug into an outer end of the boss to close the passage through the boss; and
 - (f) welding the weld plug to the boss to create a second seal.
 10. A method as set forth in claim 9, where the torquing step includes deforming the nose portion to mate with a surface of the container adjacent the opening.
 11. A method as set forth in any of claims 9 or 10, where the welding step includes forming at least one of a radial weld or an axial weld or a combination of the two.
 12. A method as set forth in any of claims 9 to 11, comprising the step of testing the integrity of the first seal before the step of installing the weld plug.
 13. A gas container (10) with a seal assembly according to claims 1-7, the container (10) having an opening (14) therein and a boss (16) extending from a surface of the container (10) adjacent the opening (14), the boss (16) having a passage (20) aligned with the opening (14) in the container (10), the passage (20) being at least partially threaded with internal threads; means (26, 32) for sealing the opening (14) in the container (10), adjacent the opening (14) at a proximal end of the passage (20) through the boss (16); and means (60; 70; 72; 80; 86) for sealing the passage (20) through the boss (16), adjacent a distal end of the passage (20) through the boss (16).
 14. A container (10) and seal assembly (12) as set forth in claim 13, where the opening-sealing means (26, 32) includes a port plug (26) having a nose portion (30) with a surface shaped to mate with the fill port opening (14) in the container (10) and a set screw portion (32) with external threads (40) for engaging the threaded portion (22) of the passage (20) through the boss (16) to press the nose portion (30) into the fill port opening (14) to form a seal, and the passage-sealing means (60; 70; 72; 80; 86) includes a weld plug (60; 70; 72; 80; 86) sized to close the distal end

of the passage (20), the weld plug (60; 70; 72; 80; 86) being welded to the boss (16) to form a second seal.

Patentansprüche

1. Versiegelungsaufbau (12) für einen Druckbehälter (10), wobei der Behälter (10) eine Fülleinlassöffnung (14) und einen runden Vorsprung (16), der sich von einer Fläche des Behälters (10) erstreckt, aufweist, wobei der runde Vorsprung (16) einen Durchgang (20) aufweist, der auf die Öffnung (14) ausgerichtet ist, wobei der Durchgang (20) einen Gewindeabschnitt (22) aufweist, wobei der Versiegelungsaufbau (12) einen Einlassstopfen (26) mit einem Spitzenabschnitt (30) mit einer Fläche, die so geformt ist, dass sie zur Fülleinlassöffnung (14) im Behälter (10) passt, und mit einem Stellschraubenabschnitt (32) mit einem Außengewinde (40) zum Eingriff in den Gewindeabschnitt (22) des Durchgangs (20) durch den runden Vorsprung (16) aufweist, um den Spitzenabschnitt (30) in die Fülleinlassöffnung (14) zu drücken, um eine Versiegelung zu bilden, wobei der Spitzenabschnitt (30) eine kegelförmige Form mit einem proximalen Ende, das kleiner als die Öffnung (14) ist, und einem distalen Ende, das größer als die Öffnung (14) ist, aufweist.
2. Versiegelungsaufbau (12) nach Anspruch 1, wobei der Spitzenabschnitt (30) ein verformbares Material ist.
3. Versiegelungsaufbau (12) nach Anspruch 2, wobei der Spitzenabschnitt (30) Messing ist.
4. Versiegelungsaufbau (12) nach einem der Ansprüche 1 bis 3, wobei der Stellschraubenabschnitt (32) ein Antriebsmittel (50) an einem distalen Ende (46) zur Ineingriffnahme des Stellschraubenabschnitts (32) und Vorantreiben oder Herausziehen des Stellschraubenabschnitts (32) in den Durchgang (20) relativ zum runden Vorsprung (16) aufweist.
5. Versiegelungsaufbau (12) nach Anspruch 1, wobei die Versiegelung eine erste Versiegelung ist und ferner einen Schweißstopfen (60; 70; 72; 80; 86) aufweist, der so bemessen ist, dass er das distale Ende des Durchgangs (20) durch den runden Vorsprung (16) verschließt, wobei der Schweißstopfen (60; 70; 72; 80; 86) an den runden Vorsprung geschweißt ist, um eine zweite Versiegelung zu bilden.
6. Versiegelungsaufbau (12) nach einem der Ansprüche 1 bis 5, wobei die Schweißung eine axiale Schweißung oder eine radiale Schweißung oder eine Kombination dieser beiden ist.

7. Versiegelungsaufbau (12) nach einem der Ansprüche 1 bis 6, wobei der runde Vorsprung (16) allgemein rohrförmig ist.

8. Druckbehälter (10), umfassend eine Fülleinlassöffnung (14) und einen runden Vorsprung (16), der sich von einer Fläche des Behälters (10) erstreckt, wobei der runde Vorsprung (16) einen Durchgang (20) aufweist, der auf die Öffnung (14) ausgerichtet ist, wobei der Durchgang (20) einen Gewindeabschnitt (22) aufweist; und einen Versiegelungsaufbau (12) nach einem der Ansprüche 1 bis 6 zum Versiegeln der Öffnung (14) und des Durchgangs (20).

9. Verfahren zum Füllen eines Behälters mit Gas oder Flüssigkeit und anschließenden Versiegeln des Behälters, umfassend die folgenden Schritte:

- (a) Bereitstellen eines Behälters mit einer Öffnung in diesem und einem runden Vorsprung, der sich von einer Fläche des Behälters neben der Öffnung erstreckt, wobei der runde Vorsprung einen Durchgang, der auf die Öffnung in dem Behälter ausgerichtet ist, wobei der Durchgang zumindest teilweise mit einem Innengewinde versehen ist, einen Einlassstopfen, der einen Spitzenabschnitt zum Schließen der Fülleinlassöffnung in dem Behälter aufweist, und einen Stellschraubenabschnitt mit einem Außengewinde zum Eingriff mit dem Gewindeabschnitt des runden Vorsprungs aufweist;
- (b) Einfügen des Einlassstopfens in den Durchgang, wobei der Spitzenabschnitt näher an der Öffnung liegt als der Stellschraubenabschnitt;
- (c) Füllen des Behälters mit Druckgas oder Flüssigkeit über den Durchgang;
- (d) Drehen des mit einem Gewinde versehenen Einlassstopfens zum Vortreiben des Einlassstopfens in den Durchgang, bis der Spitzenabschnitt mit der Fläche des Behälters neben der Öffnung in Eingriff kommt, um eine erste Versiegelung zu bilden;
- (e) Anbringen eines Schweißstopfens in ein äußeres Ende des runden Vorsprungs, um den Durchgang durch den runden Vorsprung zu verschließen; und
- (f) Schweißen des Schweißstopfens an den runden Vorsprung, um eine zweite Versiegelung zu bilden.

10. Verfahren nach Anspruch 9, wobei der Schritt des Drehens das Verformen des Spitzenabschnitts umfasst, damit er zu einer Fläche des Behälters neben der Öffnung passt.

11. Verfahren nach einem der Ansprüche 9 oder 10, wobei der Schritt des Schweißens das Bilden einer radialen Schweißnaht und/oder einer axialen

Schweißnaht oder einer Kombination von diesen beiden umfasst.

12. Verfahren nach einem der Ansprüche 9 bis 11, umfassend den Schritt des Testens der Unversehrtheit der ersten Versiegelung vor dem Schritt des Anbringens des Schweißstopfens. 5
13. Gasbehälter (10) mit einem Versiegelungsaufbau nach den Ansprüchen 1 bis 7, wobei der Behälter (10) eine Öffnung (14) in diesem und einen runden Vorsprung (16) aufweist, der sich von einer Fläche des Behälters (10) neben der Öffnung (14) erstreckt, wobei der runde Vorsprung (16) einen Durchgang (20), der auf die Öffnung (14) in dem Behälter (10) ausgerichtet ist, wobei der Durchgang (20) zumindest teilweise mit einem Innengewinde versehen ist; Mittel (26, 32) zum Versiegeln der Öffnung (14) in dem Behälter (10) neben der Öffnung (14) an einem proximalen Ende des Durchgangs (20) durch den runden Vorsprung (16); und Mittel (60; 70; 72; 80; 86) zum Versiegeln des Durchgangs (20) durch den runden Vorsprung (16) neben einem distalen Ende des Durchgangs (20) durch den runden Vorsprung (16) aufweist. 10 20 25
14. Behälter (10) und Versiegelungsaufbau (12) nach Anspruch 13, wobei die Öffnungs-Versiegelungsmittel (26, 32) einen Einlassstopfen (26) mit einem Spitzenabschnitt (30) mit einer Fläche umfassen, die so geformt ist, dass sie zur Fülleinlassöffnung (14) in dem Behälter (10) passt, und mit einem Stellschraubenabschnitt (32) mit einem Außengewinde (40) zur Ineingriffnahme des Gewindeabschnitts (22) des Durchgangs (20) durch den runden Vorsprung (16), um den Spitzenabschnitt (30) in die Fülleinlassöffnung (14) zu drücken, um eine Versiegelung zu bilden, und die Durchgangs-Versiegelungsmittel (60; 70; 72; 80; 86) einen Schweißstopfen (60; 70; 72; 80; 86) umfassen, der so bemessen ist, dass er das distale Ende des Durchgangs (20) verschließt, wobei der Schweißstopfen (60; 70; 72; 80; 86) an den runden Vorsprung (16) geschweißt ist, um eine zweite Versiegelung zu bilden. 30 35 40 45

Revendications

1. Ensemble (12) de scellé pour récipient (10) sous pression, le récipient (10) étant doté d'une ouverture (14) d'orifice de remplissage et d'un bossage (16) s'étendant à partir d'une surface du récipient (10), le bossage (16) présentant un passage (20) aligné avec l'ouverture (14), le passage (20) présentant une partie filetée (22), l'ensemble (12) de scellé comportant un bouchon (26) d'orifice doté d'une partie (30) de nez présentant une surface dont la forme lui permet de s'accoupler à l'ouverture (14) d'orifice de 50 55

remplissage dans le récipient (10) et d'une partie (32) de vis de pression présentant des filets extérieurs (40) destinés à interagir avec la partie filetée (22) du passage (20) traversant le bossage (16) pour enfoncer la partie (30) de nez dans l'ouverture (14) d'orifice de remplissage pour former un scellé, la partie (30) de nez présentant une forme conique dotée d'une extrémité proximale qui est plus petite que l'ouverture (14) et d'une extrémité distale qui est plus grande que l'ouverture (14).

2. Ensemble (12) de scellé selon la revendication 1, la partie (30) de nez étant en matériau malléable.
3. Ensemble (12) de scellé selon la revendication 2, la partie (30) de nez étant en laiton.
4. Ensemble (12) de scellé selon l'une quelconque des revendications 1 à 3, la partie (32) de vis de pression étant dotée d'un moyen (50) d'entraînement à une extrémité distale (46) pour interagir avec la partie (32) de vis de pression et faire avancer ou rétracter la partie (32) de vis de pression dans le passage (20) par rapport au bossage (16).
5. Ensemble (12) de scellé selon la revendication 1, le scellé étant un premier scellé et comportant en outre un bouchon (60 ; 70 ; 72 ; 80 ; 86) à souder dimensionné pour fermer l'extrémité distale du passage (20) traversant le bossage (16), le bouchon (60 ; 70 ; 72 ; 80 ; 86) à souder étant soudé au bossage (16) pour former un deuxième scellé.
6. Ensemble (12) de scellé selon l'une quelconque des revendications 1 à 5, la soudure étant soit une soudure axiale, soit une soudure radiale, soit une combinaison des deux.
7. Ensemble (12) de scellé selon l'une quelconque des revendications 1 à 6, le bossage (16) étant généralement tubulaire.
8. Récipient (10) sous pression, comportant une ouverture (14) d'orifice de remplissage et un bossage (16) s'étendant à partir d'une surface du récipient (10), le bossage (16) présentant un passage (20) aligné avec l'ouverture (14), le passage (20) présentant une partie filetée (22) ; et un ensemble (12) de scellé selon l'une quelconque des revendications 1 à 6 servant à sceller l'ouverture (14) et le passage (20).
9. Procédé pour charger un récipient avec du gaz ou du liquide puis sceller le récipient, comportant les étapes suivantes :
 - (a) mettre en place un récipient doté d'une ouverture dans celui-ci et d'un bossage s'étendant à partir d'une surface du récipient adjacen-

- te à l'ouverture, le bossage présentant un passage aligné avec l'ouverture dans le récipient, le passage étant au moins partiellement fileté avec des filets intérieurs, un bouchon d'orifice qui comprend une partie de nez servant à fermer l'ouverture d'orifice de remplissage dans le récipient et une partie de vis de pression dotée de filets extérieurs servant à interagir avec la partie filetée du bossage ;
- (b) insérer le bouchon d'orifice dans le passage, la partie de nez étant plus proche de l'ouverture que la partie de vis de pression ;
- (c) charger le récipient avec un gaz ou liquide sous pression via le passage ;
- (d) serrer le bouchon fileté d'orifice pour faire avancer le bouchon d'orifice dans le passage jusqu'à ce que la partie de nez interagisse avec la surface du récipient adjacente à l'ouverture pour créer un premier scellé ;
- (e) installer un bouchon à souder dans une extrémité extérieure du bossage pour fermer le passage à travers le bossage ; et
- (f) souder le bouchon à souder au bossage pour créer un deuxième scellé.
10. Procédé selon la revendication 9, l'étape de serrage comprenant l'action de déformer la partie de nez pour s'accoupler avec une surface du récipient adjacente à l'ouverture.
11. Procédé selon l'une quelconque des revendications 9 et 10, l'étape de soudage comprenant l'action de former au moins une soudure parmi une soudure radiale, une soudure axiale et une combinaison des deux.
12. Procédé selon l'une quelconque des revendications 9 à 11, comportant l'étape consistant à tester l'intégrité du premier scellé avant l'étape consistant à installer le bouchon à souder.
13. Récipient (10) à gaz muni d'un ensemble de scellé selon les revendications 1 à 7, le récipient (10) présentant une ouverture (14) dans celui-ci et un bossage (16) s'étendant à partir d'une surface du récipient (10) adjacent l'ouverture (14), le bossage (16) présentant un passage (20) aligné avec l'ouverture (14) dans le récipient (10), le passage (20) étant au moins partiellement fileté avec des filets intérieurs ; des moyens (26, 32) servant à sceller l'ouverture (14) dans le récipient (10), adjacents à l'ouverture (14) au niveau d'une extrémité proximale du passage (20) traversant le bossage (16) ; et des moyens (60 ; 70 ; 72 ; 80 ; 86) servant à sceller le passage (20) traversant le bossage (16), adjacents à une extrémité distale du passage (20) traversant le bossage (16).
14. Récipient (10) et ensemble (12) de scellé selon la revendication 13, les moyens (26, 32) de scellement de l'ouverture comprenant un bouchon (26) d'orifice doté d'une partie (30) de nez présentant une surface dont la forme lui permet de s'accoupler à l'ouverture (14) d'orifice de remplissage dans le récipient (10) et d'une partie (32) de vis de pression dotée de filets extérieurs (40) servant à interagir avec la partie filetée (22) du passage (20) traversant le bossage (16) pour enfoncer la partie (30) de nez dans l'ouverture (14) d'orifice de remplissage afin de former un scellé, et les moyens (60 ; 70 ; 72 ; 80 ; 86) de scellement de passage comprenant un bouchon (60 ; 70 ; 72 ; 80 ; 86) à souder dimensionné pour fermer l'extrémité distale du passage (20), le bouchon (60 ; 70 ; 72 ; 80 ; 86) à souder étant soudé au bossage (16) pour former un deuxième scellé.

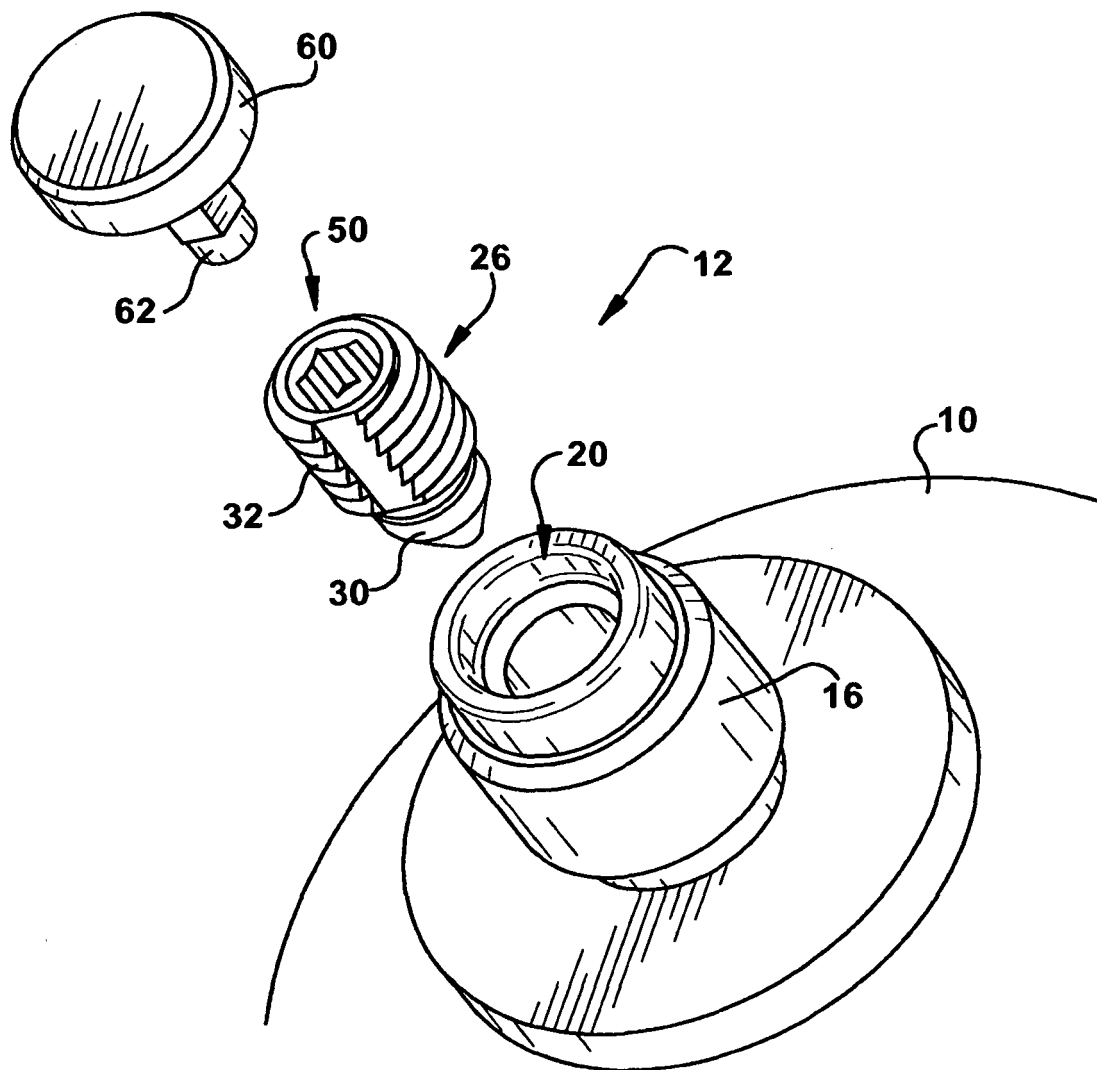


Fig. 1

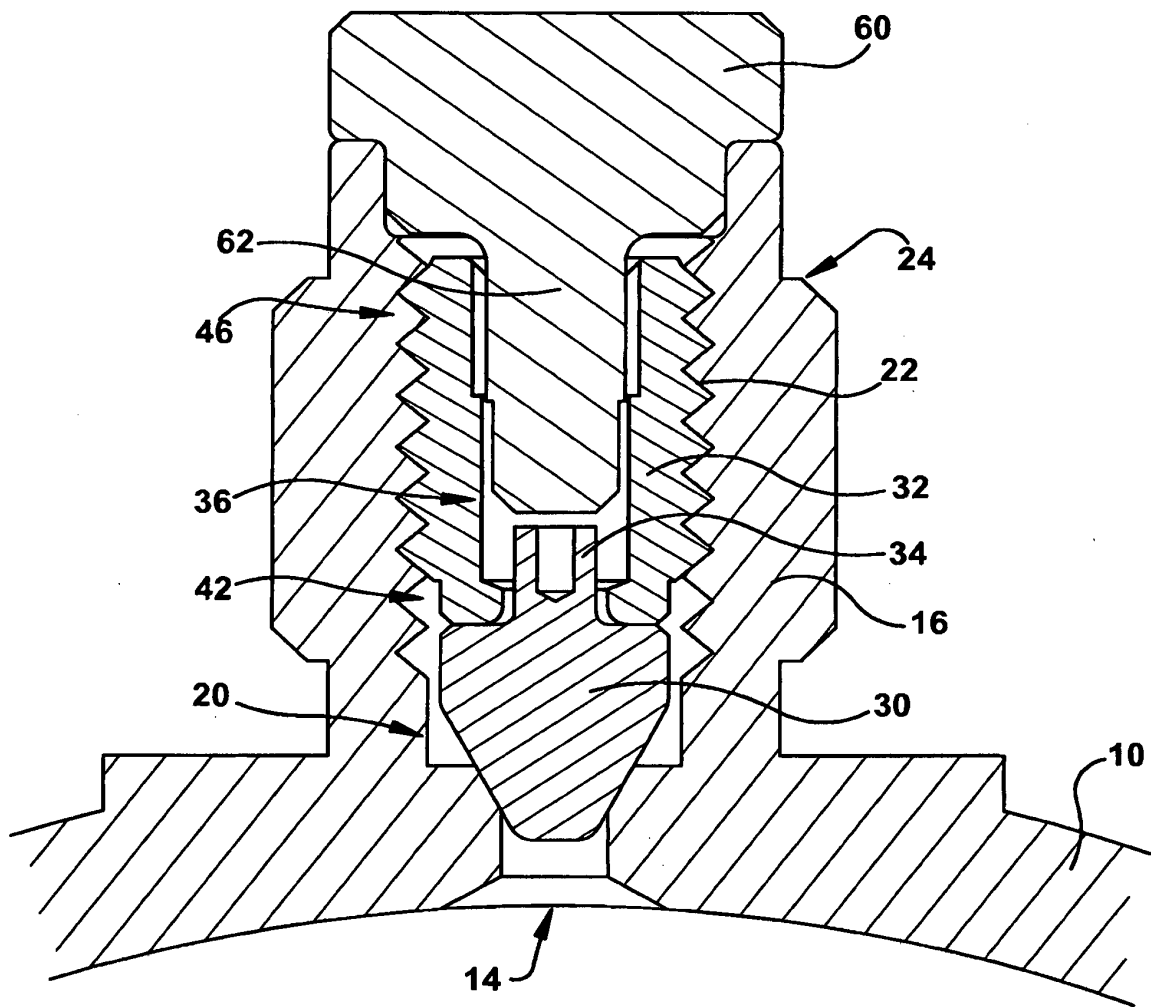


Fig. 2

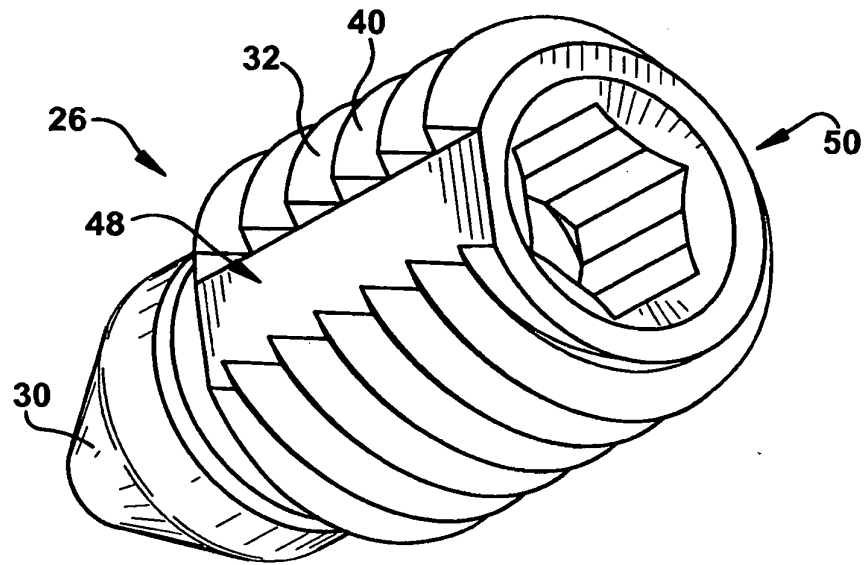


Fig. 3

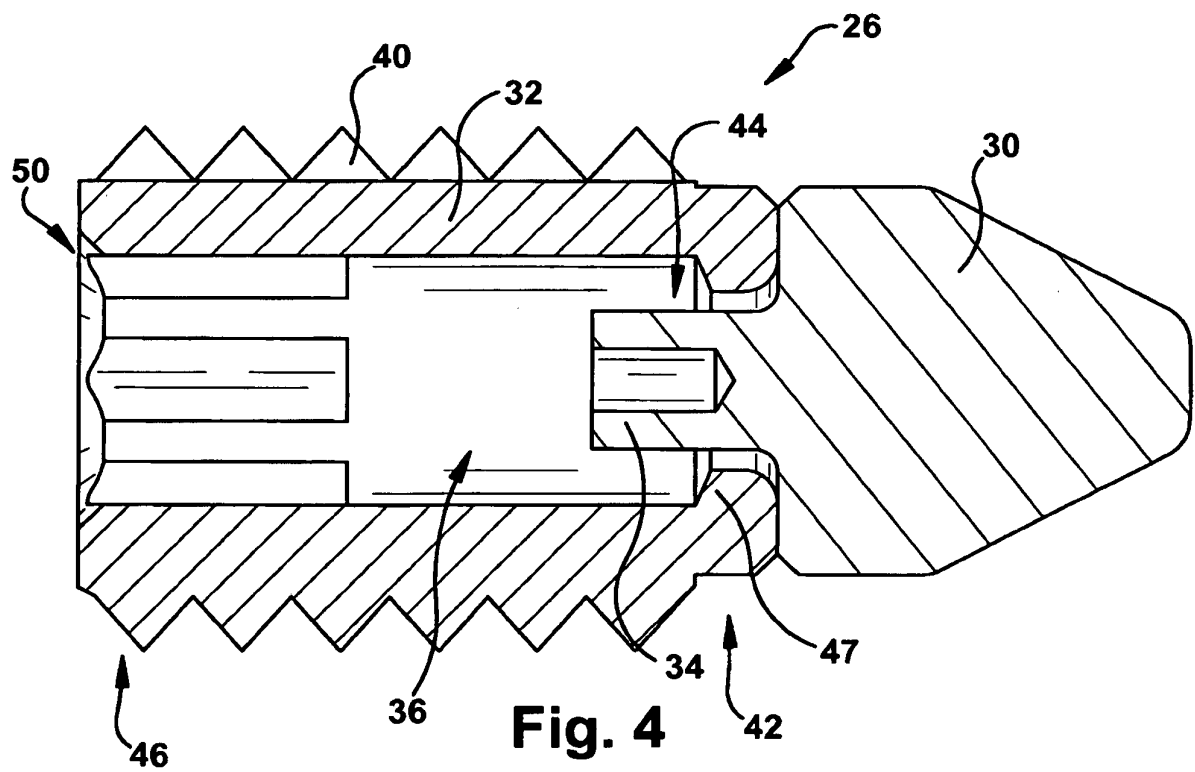


Fig. 4

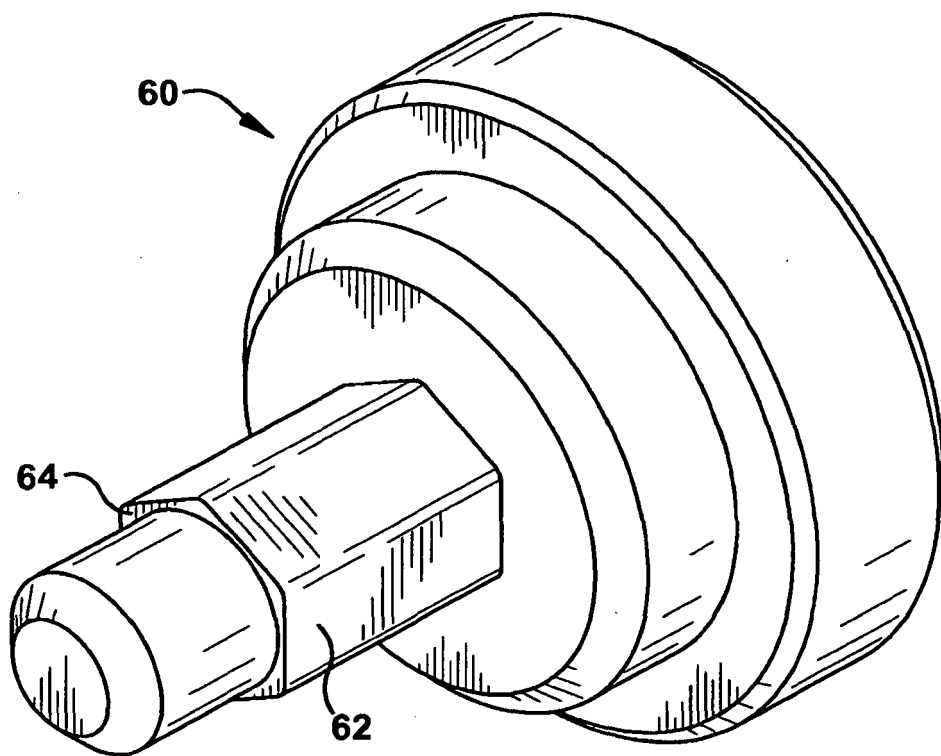
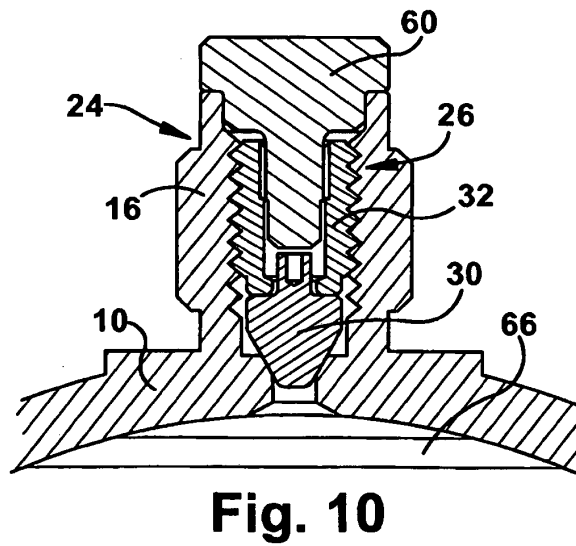
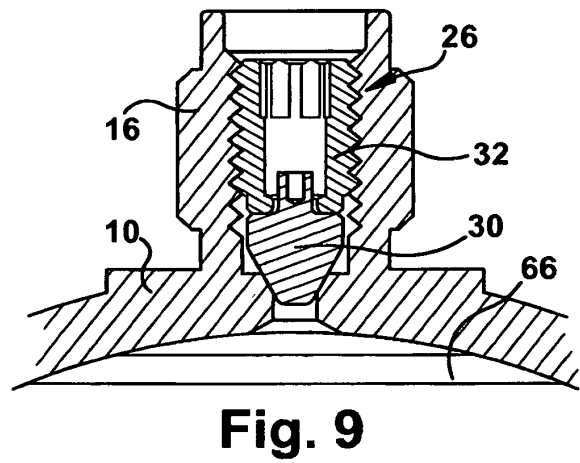
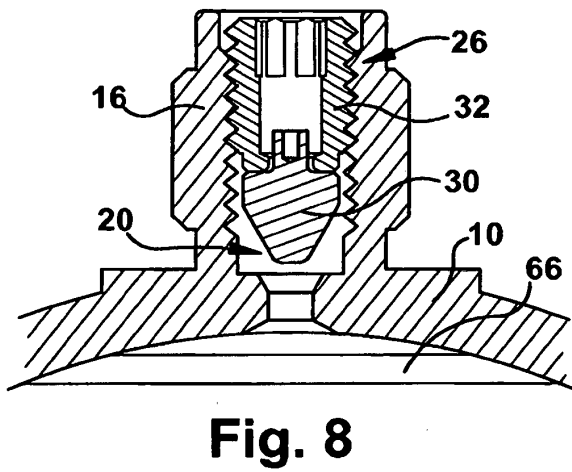
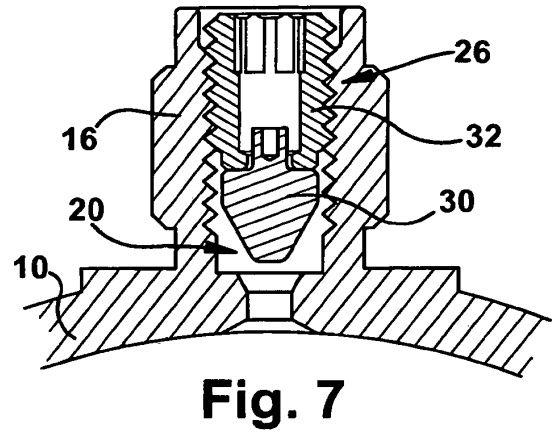
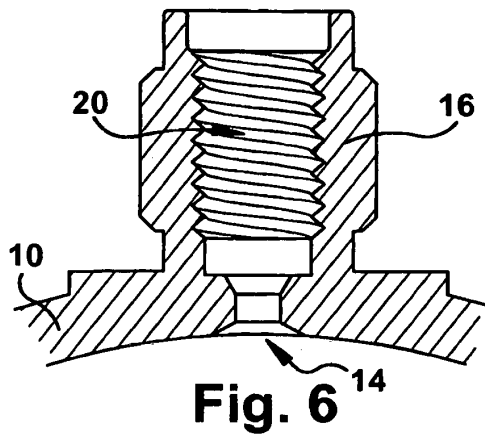


Fig. 5



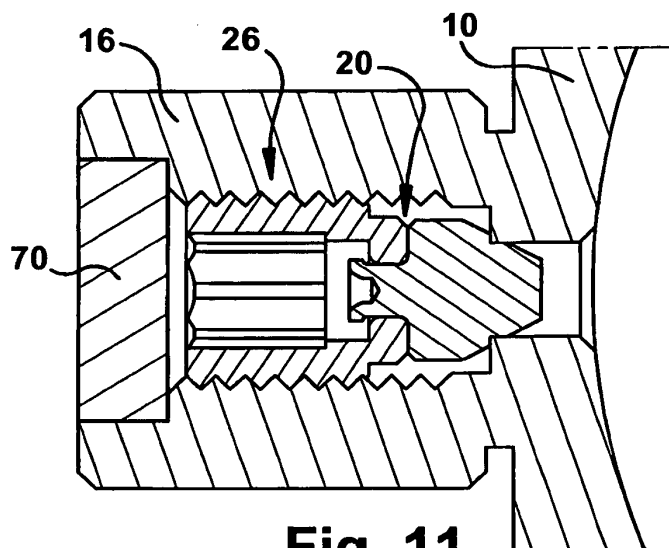


Fig. 11

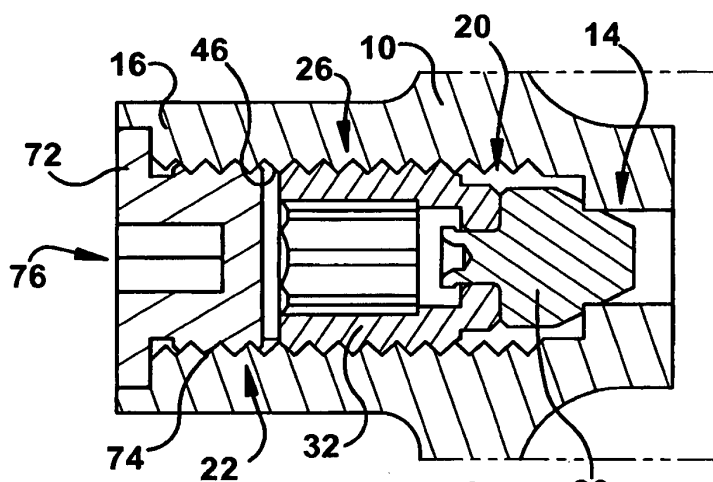


Fig. 12

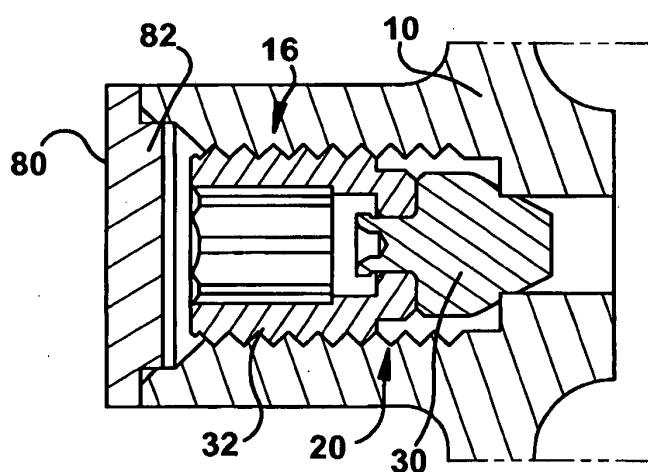


Fig. 13

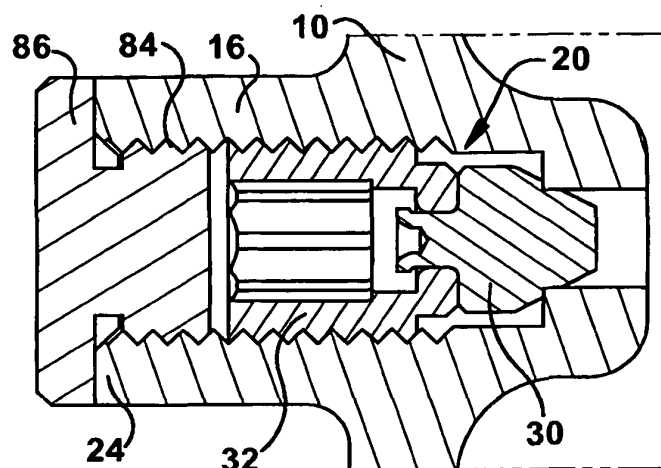


Fig. 14

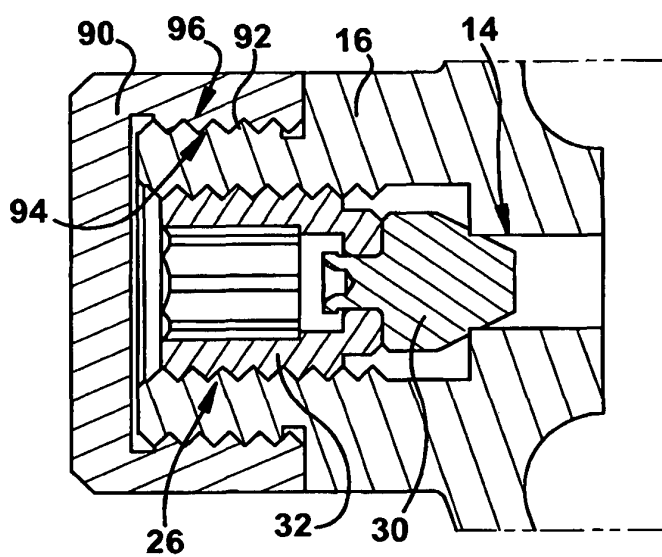


Fig. 15

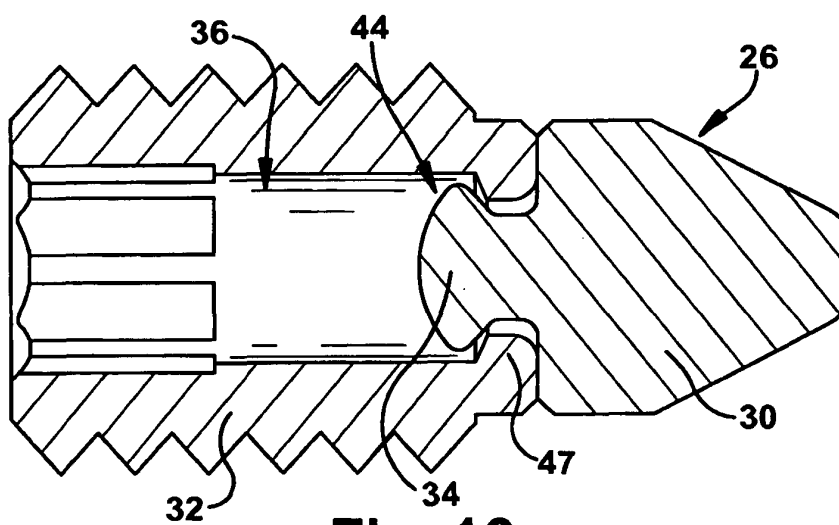


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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