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Title: FULLY WRAPPED COMPOSITE PRESSURE CYLINDERS WITH IMPROVED METALLIC BOSS

Abstract: The present invention relates to metallic boss for fully wrapped composite pressure cylinders with non-metallic inliners intended to use for compressed liquefied and dissolved gases. The fully wrapped composite pressure cylinders with metallic boss are capable of adapting various type of filling/discharge brass valves without modification in the construction. The devised metallic boss wherein joints between metal and plastics are protected by rubber seals and filled in gas does not reach to that area. The fully wrapped composite pressure cylinders can be held by the metallic boss hexagonal head without damaging or deforming the cylinder for fixing or removal of the brass valve. The fully wrapped composite pressure cylinder is provided with some additional sealing parts in the boss center which can be serviced or changed in case of any leakages in extreme temperature cycles. The fully wrapped composite cylinders are provided with built in discharge tubes for horizontal composite pressure cylinder applications and standard brass valves.
FULLY WRAPPED COMPOSITE PRESSURE CYLINDERS
WITH IMPROVED METALLIC BOSS

FIELD OF INVENTION

This invention relates to metal boss for fully wrapped composite pressure cylinders with non-metallic inliners intended to use for compressed liquefied and dissolved gases.

BACKGROUND OF INVENTION

Pressure cylinders for fluids (compressed liquefied and dissolved gases) have been commonly known for many years, based on metal as construction material. Pressure cylinders for fluids have several uses, such as gas cylinders in hospitals and fuel cylinders for motor vehicles, but also in smaller scale such as propane cylinders for gas stoves in cottages, camping caravans and small crafts or boats. In recent years fully wrapped composite pressure cylinders have been put on the market.

A fully wrapped composite pressure cylinder for compressed liquefied and dissolved gases consists of 4 major parts:
(i) metallic inliner, (ii) composite case, (iii) outer shell and (iii) metallic boss for brass valve connection

The composite pressure cylinders with non-metallic inliner are having a thin barrier inliner of plastics polymer which is covered with composite material (composite case) to take the load of pressure of gas filled inside. For accommodating the brass valve for filling and emptying the gas a metal end boss is used which is enclosed in polymer and welded to the inliner by any of the plastics welding processes. The composite case is covered by an outer shell made out of plastics giving the composite pressure cylinder a protective shielding against impact damage.

In conventional fully wrapped composite pressure cylinders the metallic boss is covered by polymer, building the boss assembly, using injection moulding and some joints are formed at the meeting surface of plastics and metal. The conventional metallic boss is of smaller size and for
tightening the brass valve pressure cylinders are to be held on the body to get proper torque. There is no protection on the boss assembly between metal and plastics in case of extreme temperature, with pressure cycle's gap can generate between metal and plastics and gas may escape from there.

In conventional metallic boss arrangement it is not possible to use different kinds of brass valves, only specific design valves are advisable.

**OBJECTS OF THE INVENTION**

The main object of the present invention is to obviate the above drawbacks.

Another object of the present invention is to devise a metallic boss assembly wherein the joints between metal and plastics are sealed by rubber seals or other suitable seals to restrain gas leakage.

Yet another objective of the present invention is to provide fully wrapped composite pressure cylinders wherein the composite pressure cylinder can be held by the metallic boss assembly without damaging or deforming the cylinder during fixing or removal of the brass valve.

Yet another objective of this invention is to provide some additional serviceable sealing parts in the metallic boss which can be replaced in case of any leakages in extreme temperature cycles.

Yet another objective of this invention is to provide fully wrapped composite pressure cylinders with built in discharge tube for horizontal composite pressure cylinder applications and standard brass valves.

Yet another object of the present invention is to provide fully wrapped composite cylinders with metallic boss capable of adapting various type of filling/discharge brass valves without modification in the construction.
BRIEF DESCRIPTION OF DRAWINGS

According to the present invention

Figure 1 shows a fully wrapped composite pressure cylinder.

Figure 2 shows the cross section of a fully wrapped composite pressure cylinder with conventional metallic boss (prior art).

Figure 3 shows the cross section with an installed conventional metallic boss arrangement with inserted brass valve (prior art).

Figure 4 shows a perspective view on a metallic boss assembly according the invention.

Figure 5 shows the cross section of a metallic boss assembly according the invention.

Figure 6 shows the cross section of a composite pressure cylinder with an installed metallic boss arrangement with inserted brass valve according the invention.

Figure 7 shows cross section of fully wrapped composite pressure cylinder with metallic boss and discharge tube according the invention.

Figure 8 shows the cross section of a composite pressure cylinder with an another installed metallic boss arrangement with inserted brass valve according the invention.

BRIEF DESCRIPTION OF INVENTION

The present invention relates to metallic boss for fully wrapped composite pressure cylinders with non-metallic inliners intended to use for compressed liquefied and dissolved gases. The fully wrapped composite pressure cylinders with metallic boss are capable of adapting various type of filling/discharge brass valves without modification in the construction. The devised metallic boss wherein joints between metal and plastics are protected by rubber seals and filled in gas does not reach to that area.

The fully wrapped composite pressure cylinders can be held by the metallic boss hexagonal head without damaging or deforming the cylinder for fixing or removal of the brass valve. The fully wrapped composite pressure cylinder is provided with some additional sealing parts in the boss center which can be serviced or changed in case of any leakages in extreme temperature cycles. The fully wrapped composite cylinders are provided with built in discharge tubes for horizontal composite pressure cylinder applications and standard brass valves.
According to present invention a fully wrapped composite pressure cylinder for compressed liquefied and dissolved gases consists of 4 major parts:
(i) Non-metallic inliner, (ii) composite case, (iii) outer shell and (iii) metallic boss for brass valve connection

The metallic boss is welded to the inliner by its polymer enclosure. This invention is to have some additional sealing of the boss assembly, before the filled in gas reach the conventional metallic boss and polymer enclosure joint sealing. This provision is made by inserting a sealing insert with O-rings. This sealing insert can be threaded in the metallic boss, welded or press-fitted. The sealing insert can be of metal, plastics or any other material.

The height of the metallic part of the boss assembly is also extended up to the top, also covered by the polymer enclosure and profiled in a manner to be hold by using conventional spanners for tightening or unscrewing the brass valve. Provision is also made to accommodate any brass valve with ISO standard thread's available and used conventionally by the extended and reinforced top of the boss assembly. Due to the extended height of the metallic boss part some additional grooves can be provided on his enclosure surface to reduce the risk of leaking or escaping of filled in gas.

**DETAILED DESCRIPTION OF THE INVENTION**

Referring now to the drawings wherein the showing are for the purpose of illustrating the preferred embodiment of the invention only and not for the purpose of limiting the same. According to present application a fully wrapped composite cylinder for gases with metallic boss is having five major parts:
(i) Non-metallic inliner, (ii) composite case, (iii) outer shell and (iii) metallic boss for brass valve connection

**Part designation**
1 composite pressure cylinder
2 inliner of 1
3 composite case of 1
4 outer shell of 1
5 center top end of 4
6 brass valve of 1
7 boss assembly of 1
8 metallic part of 7
9 hexagonal head of 7
10 polymer enclosure of 7
11 enclosure surface of 8
12 sealing insert of 7
13 O-ring of 12
14 joining area of 8, 10 and 12
15 outer sealing grooves of 8
16 discharge tube

**FIG.01** shows a composite pressure cylinder (1) according the invention. The outer shell (4) is covering the composite case (3) and protecting the brass valve (6).

**FIG.02** shows a cut through a composite pressure container (1) according the state of art. The inner part of a composite pressure container (1) is a plastics inliner (2), covered by a composite case (3) and protected by an outer shell (4).

The inliner (2) of a composite pressure cylinder (1) is made out of polymer either by injection moulding, blow moulding or rotational moulding in given shape. The boss assembly (7) is sealing the opening of the inliner (2) and accommodating the brass valve (6).

**FIG.03** illustrates that the boss assembly (7) according the state of art consists of two parts; metallic boss part (8) and polymer boss enclosure (10).

The metallic boss part (8) is made of either brass alloy or any suitable material. The metallic boss part (8) is covered by a polymer boss enclosure (10) for adoption with the inliner (2). The polymer boss enclosure (10) is welded to the inliner (2) by hot plate welding or any other welding process. The inliner (2) with the boss assembly (7) is wrapped by composite material to a composite case (3) to accommodate the inliner (2) and increase his bursting strength. This
complete assembly is then covered by an outer shell (4) to keep composite pressure cylinder (1) in upright position, allow his handling and to give him a proper appearance. The metallic boss part (8) is fixed to the inliner (2) by a polymer boss enclosure (10). The boss assembly (7) consists of two different materials, metal and plastics and there is no bonding between metal and plastics. During thermal cycle gap generates between metal and plastics along the enclosure surface (11) of the metallic boss part (8) of the boss assembly (7) and the filled in gas might escape. The fixing of the brass valve (6) is difficult because the hexagonal head (9) of the boss assembly (7) is located underneath the center top end (5) of the outer shell (4) and can’t be used easily.

**FIG. 04** shows a perspective view on a boss assembly (7) without brass valve according the invention. The extended metallic part (8) including the reinforced hexagonal head (9) is completely covered by the polymer enclosure (10).

**FIG.05** shows a cut through a boss assembly (7) according the invention without the brass valve with these additional features:
- Sealing insert (12) with O-rings (13),
- Outer sealing grooves (15) of metallic part (8) of boss assembly (7),
- Extended boss assembly (7) height insuring that the reinforced hexagonal head (9) of the boss assembly (7) is above the center top end (5) of the outer shell (4).

The embodiments of the invention will be explained according **FIG.06**. One sealing insert (12) with O-rings (13) is fixed inside the center of the metallic boss part (8) to isolate the internal joining area (14) of the metallic boss part (8) and polymer boss enclosure (10) so that filled in gas of the composite cylinder (1) inliner (2) will not reach the internal joining area (14) of both boss parts and shall not escape via the enclosure surface (11) even if the metallic and polymer parts are separated. The sealing insert (12) can be either plastics or metal or any other suitable material. The sealing insert (12) can be fixed in the metallic boss part (8) center by threading, press-fitting, welding or any other suitable means. The O-rings (13) can be of compatible rubber, plastics, metal or any other suitable material.

For inserting or changing the brass valve (6) the boss assembly (7) can be held by the polymer enclosed metallic boss hexagonal head (9). The metallic boss hexagonal head (9) increases the
stiffness of the upper part of the metallic boss part (8) and a longer boss assembly (7) increases also the length of the metallic boss enclosure surface (11). With an enlarged length of the metallic boss enclosure surface (11) the risk of leaking or escaping of filled in gas is reduced and the longer cylindrical part of the metallic boss part (8) allows the formation of outer sealing grooves (15).

For discharge of filled in gas of the composite pressure cylinder (1) any conventional brass valve (6) available can be used due to the increased stiffness of the upper part of the boss assembly (7) and there is no need to have special fitting arrangements.

For horizontal applications of the composite cylinder (1) it is necessary to put a discharge tube (14) into the boss assembly (6) as shown in FIG.07. In this invention the discharge tube (14) is fixed to the sealing insert (12) by threading and welding to prevent rotation. The composite pressure cylinder (1) shall be marked for upright position during production to ascertain proper vertical position of discharge tube (14). With this provision for special applications where composite pressure cylinders (1) are mounted horizontally conventional brass valves (6) can be used and no special brass valves (6) are required.

FIG.08 shows a cut through an installed boss assembly (7) according the invention with the brass valve with these additional features:

- Modified sealing insert (12), for safer composite cylinder filling, with O-rings (13),
- Outer sealing grooves (15) of metallic part (8) of boss assembly (7),
- Extended boss assembly (7) height insuring that the reinforced hexagonal head (9) of the boss assembly (7) is above the center top end (5) of the outer shell (4).

The central hole of the modified sealing insert (12) is closed at his lower end, the compressed liquefied and dissolved gases have to pass some radial holes, this will divide gas stream, change the direction of flow, reduce the velocity of the gas entering into composite cylinder and also reduce the build-up of electric and/or electrostatic charges which may produce sparks igniting the gas, in particular during filling of the cylinder.
The height of the metallic part of the boss assembly is also extended up to the top, also covered by the polymer enclosure and profiled in a manner to be hold by using conventional spanners for tightening or unscrewing the brass valve.

The foregoing description is specific embodiment of the present invention. It should be appreciated that this embodiment is described for purpose of illustration only, and that numerous alterations and modifications may be practiced by those skilled in the art without departing from the spirit and scope of the invention. It is intended that all such modifications and alterations be included insofar as they come within the scope of the invention as claimed or the equivalents thereof.
We claim

1. A composite pressure cylinder (1) with non-metallic inliner intended to use for compressed liquefied and dissolved gases comprising a thin barrier polymer inliner (2), covered by a composite case (3), closed by a boss assembly (7) consisting of a metallic boss part (8) and a molded on polymer enclosure part (10) welded to the inliner (2) and accommodating a brass valve (6), covered by an outer shell (4), wherein the enclosure surface (11) of the metallic boss part (8) is sealed to the liquefied and dissolved gases contained in the inliner (2) by a sealing insert (12).

2. The composite pressure cylinder as claimed in claim 1 wherein said sealing insert (12) removably fixed to the metallic boss part (8) is adapted to isolate entry of liquefied and dissolved gases filled in said composite cylinder into internal joining area (14) formed between assembled said metallic boss (8) and polymer boss enclosure (10) and/or through boss enclosure surface (11) on separation of said metallic boss (8) and polymer boss enclosure (10).

3. The composite pressure cylinder as claimed in claim 1 wherein said the sealing insert (12) consist of plastics, metal or other suitable material.

4. The composite pressure cylinder as claimed in claim 1 wherein said the sealing of the sealing insert (12) is done by O-rings made out of compatible rubber, metal or other suitable material.

5. The composite pressure cylinder as claimed in claim 1 wherein said the sealing of the enclosure surface (11) of the metallic boss part (8) is improved by outer sealing grooves (15) of the metallic boss part (8).

6. The composite pressure cylinder as claimed in claim 1 wherein said the boss assembly (7) is extended so that the metallic boss hexagonal head (9) is above the center top end of the outer shell (4).

7. The composite pressure cylinder as claimed in claim 1 wherein said the sealing insert (12) is extended by a fixed discharge tube (16).
8. The composite pressure cylinder as claimed in claim 1 wherein said the fixed discharge tube (16) is allowing the horizontal operation of the composite pressure cylinder (1) in a marked position.

9. The composite pressure cylinder as claimed in claim 1 wherein said sealing insert (12) is provided with a central hole closed at the bottom end configured to pass the liquefied and dissolved gases through radial holes of the sealing insert (12) for reaching the inliner (2) during filling, reducing velocity and electric and/or electrostatic charge.

10. The composite pressure cylinder as claimed in claim 1 wherein increased stiffness of upper part of said metallic boss (8) by hexagonal head (9) is configured to facilitate mounting of any of the conventional brass valve (6).

11. The composite pressure cylinder as claimed in claim 1 wherein longer boss assembly (7) is adapted to increase the length of metallic boss enclosure surface (11) for providing the outer sealing grooves (15) facilitating sealing against gas leakage.

12. The composite pressure cylinder as claimed in claim 1 wherein the height of the metallic part of the boss assembly covered by the polymer enclosure is configured to be extended up to the top and profiled in a predetermined manner to facilitate holding by using conventional spanners for tightening or unscrewing the brass valve.