(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 316 516 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.06.2003 Bulletin 2003/23

(51) Int Cl.[7]: **B65D 90/50**, B65D 90/00, B08B 9/02

(21) Application number: **02396181.6**

(22) Date of filing: **03.12.2002**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(30) Priority: **03.12.2001 FI 20012368**

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(54) System for cleaning and refilling of the intermediate space of a double shelled container

(57) This invention provides a system to monitor and detect leaks in the intermediate space (4) between the inner and outer shells (2, 3) of a double-shelled container or pipework, and the apparatus and method by which to clean and refill the intermediate space (4) between the inner and outer shells (2, 3) of a double-shelled container or pipework in order to be able to implement the above-mentioned control system.

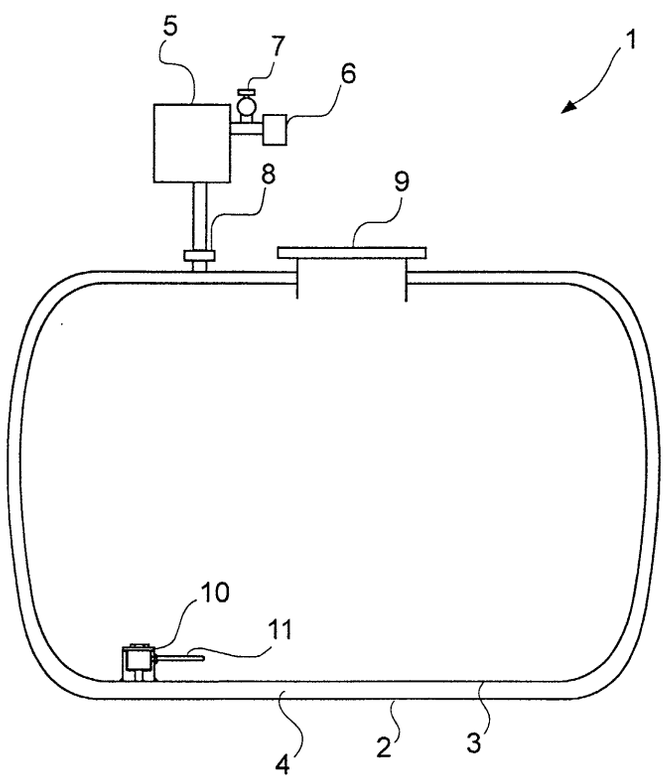

Fig. 1

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Description

[0001] The present invention concerns a system for monitoring the space between the shells of a double shelled container to detect leaks and corrosion in the intermediate space. Further, this invention concerns the method and apparatus with which the intermediate space of a used container can be cleaned and refilled to be able to implement a monitoring system in accordance with this invention. The system, method and apparatus according to this invention can also be applied to double-cased piping and containers in which it is desirable to prevent a product leak or the blending of two separete products.

[0002] Containers having two overlapping shells and an intermediate space in between, are used to store hazardous products to health and environment such as petrol (gasoline), underground or underwater. Double shelled containers can be used also above ground level. The double shells are designed to prevent the release of hazardous or detrimental substances into the environment. Leaks are hard to detect especially with underground containers and can be noticed after a long period of time when detrimental substances to the environment have already been released from the container.

[0003] The intermediate space, the space between the outer and the inner shells, is normally filled with a 50% water-glycol mixture. The intermediate space is typically connected to the open air through piping. The water-glycol mixture, as it ages, causes corrosion to the metal. Therefore the mixture must regularly be replaced. The water-glycol mixture is an environmental toxin and leaks out when the outer shell breaks and spreads out rapidly as it is water-soluble leading to the fact that its removal is difficult. The leaked glycol can cause environmental damage, e.g. the contamination of the aquifer in a groundwater area.

[0004] The breaking down of the inner shell causes the mixture in the intermediate space to blend with the stored product thus usually contaminating the product. For example, there can be 100 cubic metres of product in a fuel container of a petrol station and so the financial loss can be considerable.

[0005] The intermediate space of an aboveground container normally contains only air and is connected to the open air through piping whereupon condensed water builds up in the intermediate space which in time will corrode through the wall of the container.

[0006] Currently it is known to pressurize the water-glycol mixture in the intermediate space e.g. by using an expansion chamber where the alteration of pressure or level of liquid can be detected should the outer or inner shell burst. The apparatus can consist of an alarm system which will indicate the changes in liquid level/ pressure in the intermediate space.

[0007] A double-shelled container is introduced in the FI patent 91625 where the intermediate space is filled with vegetable base oils or equivalent esters that are harmless to the environment and the product in the container. The use of vegetable oils is limited due to their high price.

[0008] The object of the invention presented here is to provide a system with which to monitor the intermediate space and to receive information of possible damages to the shells. The object of this invention is also to provide a method and apparatus with which it is made possible to clean and refill the intermediate space of an existing container so that the monitoring system conformable to this invention can be implemented. These objects have been achieved with the help of the system, method and apparatus according to this invention, the characteristic features of which are described in the accompanying claims.

[0009] According to the invention, an inert oxygen free protective gas, such as nitrogen gas, is brought into the intermediate space under vacuum or overpressure. The gas must be incombustible and completely harmless to the environment and the stored product. Different types of protective gas may be used in the system depending on the stored product. The protective gas inhibits the metal from corrosion because there is no oxygen present in the intermediate space thus diminishing environmental risks as well as the contamination of the stored product. The inspection of the container for determination of corrosion is not necessary. To detect a leak in the inner or outer shell, the intermediate space is interlinked with the apparatus e.g. a pressure gauge, whereupon the alteration in pressure in the intermediate space indicates a breach in one of the shells. The pressure alarm can be attached to a data transmission system, whereby the information will be brought quickly to a desired destiny. The monitoring of the intermediate space may also be achieved by measuring the properties of the gas e.g. the parameters of the oxygen within the protective gas in the intermediate space.

[0010] The monitoring system in accordance with this invention is reliable, inexpensive and does not require heavy maintenance measures. When using a water-glycol mixture or other liquids, the liquid must be replaced regularly to prevent corrosion and the container must be inspected in due order for detection of corrosion. By using a gas that is harmless to the environment and to the stored product a possible leak is easier to control and a fault situation can be taken care of as a normal service call. The safe service life of a container is extended because the breaking of the outer shell creates no environmental damage. The method according to this invention can be utilized in newly structured containers as well as existing double shelled containers. The implementation of this invention on existing containers causes very little structural modifications and is easy to carry out on existing containers.

[0011] The apparatus and method according to this invention can also be applied on existing containers when replacing the water-glycol mixture in the interme-

diate space.

[0012] In the following, the invention is described in greater detail by referring to drawings in which

Figure 1 shows the sectional side view of the system according to this invention for monitoring the intermediate space and apparatus with which the intermediate space of a used container can be cleaned and refilled,

Figure 2 shows in detail the service assembly in figure 1.

[0013] Figure 1 shows a container 1, comprising the outer shell 2 and the inner shell 3, whereupon an intermediate space 4 is formed between the shells. According to the present invention the intermediate space 4 is filled with an oxygen free over- or underpressurized protective inert gas. The intermediate space is connected to the control means 5, with the help of which the properties or pressure of the protective gas in the intermediate space can be measured. The control means 5 can be connected to a transmission device 6 where the signal from the control means is sent. The transmission device 6 can transmit the signal for example into a data system or to another alarm system. A service T-piece with an isolating valve 7 is situated between the control means 5 and the transmission device 6. Similarly, a service coupler 8 is situated between the control means 5 and the intermediate space of the container. Additionally, the container has a manhole 9 through which the internal maintenance of the container can be executed. The container can also comprise product piping not illustrated in the drawing.

[0014] In the lay-out according to this invention a service assembly 10 is brought onto the bottom of the container 1, on which a service pipe 11 can be attached to. The service assembly 10 is described in detail in figure 2a. A service pipe 11 (ref. Fig. 2b and 2c) is included to the service assembly, through which the aged liquid mixture of the intermediate space is removed and through which the new protective gas is introduced into the intermediate space. Additionally, there is a coupling 13 in the service assembly for a drilling assembly and a joint 12 which connects the service pipe 11 to the intermediate space. When applying the arrangement to new containers the service assembly 10 can be fitted already in the construction stage.

[0015] Before starting to clean up the intermediate space, the used container 1 must be emptied of the stored product and cleaned. The service assembly 10 is welded on the bottom of the container. In an alternative solution the service assembly 10 is fitted outside the container as near the bottom as possible. In that case also the cleaning and refilling of the intermediate space is possible without emptying the container.

[0016] The drilling assembly 14, 15, 16 is installed onto the assembly 10 inside the container with which the drilling depth is adjusted to the equivalent thickness of shell 2 thus preventing damage to the outer shell during the drilling operation (Fig. 2b). A hole will be drilled onto the inner shell and the drilling assembly will be removed. Should the service assembly 10 be installed outside the container, the hole will be drilled onto the outer shell 3. The liquid in the intermediate space 4 is pumped out through the service pipe 11. The pump is removed when the intermediate space is empty. The successful evacuation of the intermediate space is confirmed and at the same time the intermediate space is ventilated by pumping air through the service coupler 8.

[0017] To feed in the protective gas, the coupling 13 for the drilling assembly must be plugged with a sealing plug 17, so, that the tip of the service pipe 11 is still left open (Fig. 2c). A container of gas, with which to fill the intermediate space 4, is connected to the service pipe 11. The service T-piece with an isolating valve 7, between the control means 5 and the transmission device 6, is opened. An oxygen gauge is connected to the other outlet of the sevice T-piece 7 and the other is left open, thus enabling the air in the intermediate space 4 to exit through it. The protective gas is cautiously released into the intermediate space until the oxygen gauge indicates that there no longer is oxygen in the system. The service pipe 11 and the service T-piece 7 are closed off. After a settling period of about a half an hour it should be confirmed using this process that the intermediate space is free of oxygen. The service assembly 10 is sealed with the sealing plug 17, so, that the service pipe 11 and the joint 12 are shut off to the intermediate space (Fig. 2d). The service pipe 11 is removed.

[0018] Should it be desired to monitor the space between the inner and outer shells to detect leaks through change in pressure, a manometer and a vacuum pump is installed onto the service T-piece 7 with which a vacuum of not more than 0.5 bar is applied. The product is returned into the container. If necessary, the vacuum cycle will be repeated until a stable underpressure has been achieved. Following this, the control means 5 is installed and the system is ready for operation.

[0019] Embodiments of this invention have been described above. This invention is not restricted to the examples presented, but the principle of the present invention can be varied within the scope of protection of the claims.

Claims

1. An apparatus to clean and to refill the intermediate space (4) between the inner and outer shells (2, 3) of a double-shelled container (1) or pipework, **characterized in that** it consists of
   on the bottom of the container (1) installed service assembly (10) which comprises couplers for the drilling assembly (14, 15, 16), couplers for the service pipe (11) and fittings to access the intermediate

space (4), onto the service assembly (10) connected service pipe (11), through which the potential aged liquid in the intermediate space is removed and the new liquid mixture or gas is introduced, in the service assembly (10) a joint (12), which interconnects the service pipe (11) with the intermediate space (4), in the service assembly (10) onto the coupler (13) fitted drilling assembly (14, 15, 16), with which the drilling depth on the inner shell (2) is adjusted respectively and with which a hole is drilled on the inner shell (2).

2. An apparatus according to claim 1, **characterized in that** the apparatus further comprises a pump to remove the liquid in the intermediate space (4) through the service pipe (11).

3. An apparatus according to claim 1, **characterized in that** the apparatus further comprises leak detecting control means (5) onto which a service T-piece with an isolating valve (7) is connected.

4. An apparatus according to claim 1, **characterized in that** the service assembly (10) is fitted outside the container (1) near the bottom, wherein with a drilling assembly (14, 15, 16), fitted onto the coupler (13) of the service assembly (10) the drilling depth on the outer shell (3) is adjusted respectively and the hole is drilled on the outer shell (3).

5. A method to clean and refill the intermediate space (4) between the outer and innershell (2, 3) of a double-shelled container (1) or pipework, **characterized in that** it comprises steps:

   fitting a service assembly (10) onto the bottom of the container which comprises couplers for the drilling assembly (14, 15, 16), couplers for the service pipe (11) and couplers to access the intermediate space (4),
   connecting a service pipe (11)onto the service assembly (10),
   fitting a drilling assembly (14, 15, 16) of the service assembly (10) onto the coupler (13), with which the drilling depth on the inner shell (2) is adjusted respectively and with which a hole is drilled on the inner shell (2) through joint (12),
   removing the aged liquid mixture and introducing a new liquid mixture or protective gas through the service pipe (11) and joint (12) into the intermediate space (4).

6. A method according to the claim 5, **characterized in that** the liquid in the intermediate space (4) is removed by pumping it through the service pipe (11).

7. A method according to the claim 5, **characterized in that** for the introduction of the protective gas, the coupling (13) of the service assembly (10) for the drilling assembly, is plugged with a sealing plug (17), so, that the tip of the service pipe (11) is left open.

8. A method according to the claim 7, **characterized in that** a container of gas, with which to fill the intermediate space (4), is connected to the service pipe (11), the service T-piece with an isolating valve (7), following the leak detecting control means (5), is opened, an oxygen gauge is connected to the other outlet of the service T-piece (7) and the other is left open, thus enabling the air in the intermediate space (4) to exit through it, the protective gas is released into the intermediate space until the oxygen gauge indicates that there no longer is oxygen in the system, the service pipe (11) and the service T-piece (7) are closed off, the service assembly (10) is sealed with a plug.

9. A method according to the claim 5, **characterized in that** the service assembly (10) is fitted outside the container (1) near the bottom, and a drilling assembly (14, 15, 16), with which the drilling depth on the outer shell (3) is adjusted respectively and with which the hole is drilled on the outer shell (3) is fitted onto the coupler (13) in the service assembly (10).

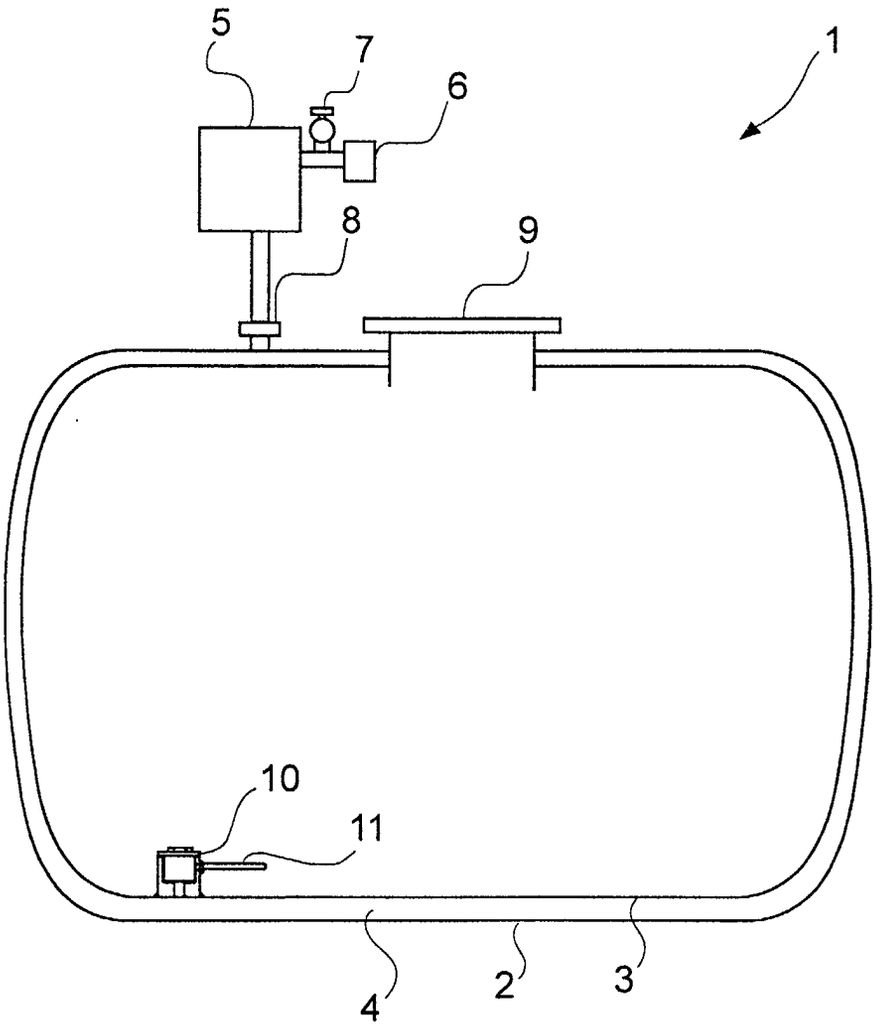

Fig. 1

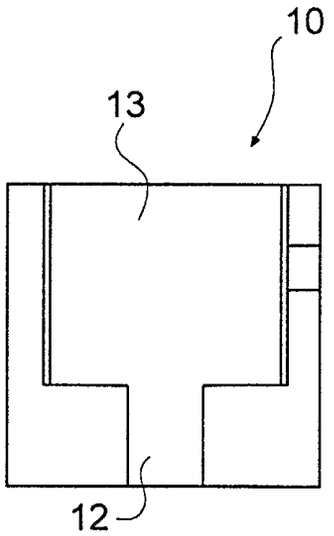

Fig. 2a

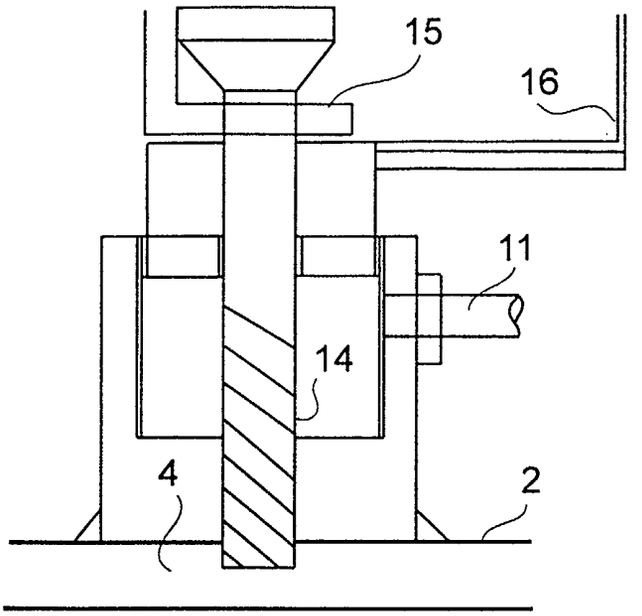

Fig. 2b

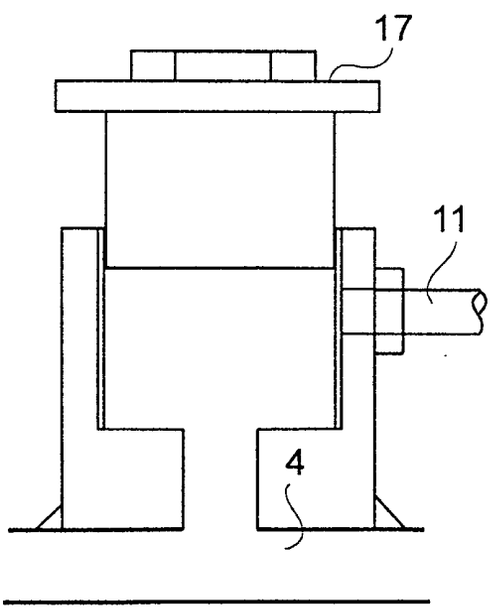

Fig. 2c

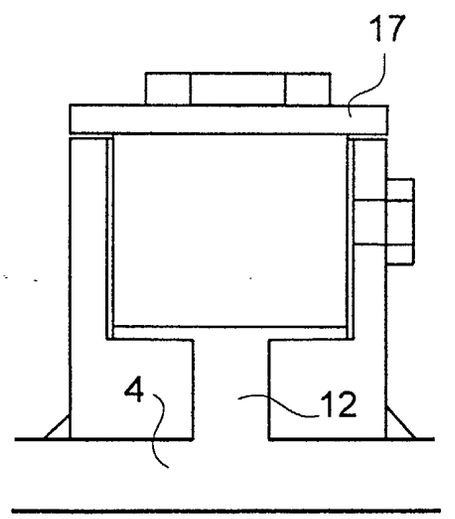

Fig. 2d

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 39 6181

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65D
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 March 2003	Zanghi, A

CATEGORY OF CITED DOCUMENTS

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