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(54) **A METHOD AND AN APPARATUS FOR DEPLOYMENT OF A BLADDER INTO AND OUT OF A VESSEL**

VERFAHREN UND VORRICHTUNG FÜR DEN EINSATZ EINER BLASE IN UND AUS EINEM
BEHÄLTER

MÉTHODE ET APPAREIL DE MISE EN UVRE D'UNE VESSIE DANS ET HORS D'UN RÉCEPTACLE

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Description

[0001] The present invention is related to a method and an apparatus for deployment of at least one bellow or bladder into and out of a vessel that might periodically require gas freeing. The vessel may be a transport container for gas on board a gas tanker or other transport facilities like train, lorry etc., or it might be a process tank or pressure vessel where the problem of displacement of dissimilar vapours is a challenge such as bio-gas reactors and other, normally gas filled containers, which sometimes needs gas freeing.

[0002] In the following description a transport case is used for illustration purposes.

[0003] Transport of large bulk volume of gases on board a ship is commonly done with the gas in a liquid phase. When a liquid gas cargo is discharged ashore, the liquid phase of the gas is pumped out of the vessel to the shore terminal. Although the vessel is now empty of its liquid phase of the gas, the vessel is still full of vapours of the discharged cargo, which will be acceptable if the subsequent cargo is of the same type. However, this will very often not be the case.

[0004] Before a new cargo, i.e. another type of gas, is loaded into a transport vessel of the ship, the vessel will have to be cleaned from its remainder of the discharged cargo before the new cargo is allowed to be loaded. Historically, the only method known to the applicant that has been in practical use for such cleaning operation is to purge the vessel with inert gas and vent the mixture of cargo gas and inert gas to the atmosphere until the traces of previous cargo is below a specific level to let the new cargo to be loaded into the vessel. The mixture of remainder cargo gas and inert gas during the purging operation is normally vented directly to the atmosphere since most receiving terminals are not able to handle such a gas mixture. Normally in the case of ship transportation, the ship will have to leave the harbour and move out on sea while doing this polluting operation. This purging operation with ventilation directly to the atmosphere is an environmentally unfriendly operation, it is costly with waste of cargo gas as well as inert gas, and not least it is time consuming, which is also very costly. For a typical gas ship the total time for cleaning and preparation for a new cargo may in some cases last for several days.

[0005] A consequence of this is that the management of most ships, at least those on short and medium distance trade, will choose not to clean the vessels to take on board a new load, but will rather proceed to another harbour where a new cargo of the same as previous grade gas cargo is available. As a consequence of this way of operating a ship, the ship will spend a considerable amount of time without revenue generating cargo in its tanks, which is also environmentally unfriendly as the ship is operated without cargo considerable part of its voyage time.

[0006] Publication JPS59110998 A discloses a meth-

od and a device for replacing gas in a vessel. An inflatable bag is stored outside of the vessel and brought into the vessel when needed for cleaning purpose. The bag is inflated by means of a fluid provided from a fluid source arranged outside of the vessel, thereby replacing a substantially portion of undesired residual gas. Thus, the space to be cleaned is defined by the internal surface of the vessel and an external surface of the inflated bag.

[0007] A method for facilitating the operation of purging a fluid vessel is disclosed in the present applicant's EP 1791772 B1, wherein a bellow arranged within a vessel is filled with an inert gas so as to displace the vapours of the previous cargo and thereafter enable "re-gassing" with a new and different cargo grade without having to do the polluting purging operations first. The method according to the present invention utilizes the same principle of displacing the vapours of the previous cargo prior to purging the tank or vessel.

[0008] The method disclosed in EP 1791772 B1, and also the present invention, ensures that the gas vapour left in the tank from the previous cargo is not lost as will otherwise be the case and thus the emissions are reduced. The method also reduces the time spent on these cleaning operations and preparation for a new cargo, and not least it prepares the ground such that the ship more likely will take on board return cargo or other cargo when such cargo is available and thus increase the utilisation of the transport capacity of the ship, which will also give lower emission per ton transported and considerable lower transport costs. Principally, the same could also be the case for gas transport in tanks on board other transport means like trains, lorries etc. or in other gas tanks where an atmospheric exchange should be necessary.

[0009] In the method disclosed in the EP 1791772 B1 a bellow is arranged inside the tank. Thus, a deflated bellow is stored inside the tank when not in use and re-inflated in the next harbour when a new gas load is to be taken on board.

[0010] In the following the tank will be denoted "vessel".

[0011] A bellow or bladder utilized for the purposes discussed above, is subject to wear and tear due to possible contact with the walls of the vessel and other arrangements that may be in a vessel, and also due to exposure to possible harsh environment within the vessel.

[0012] There is therefore need for an easy replacement of a bladder and also for reducing the exposure time wherein the bladder is in contact with the chemicals inside of the vessel.

[0013] According to a first aspect of the present invention there is provided a method for facilitating purging a vessel by means of an inflatable bladder being connected to a conduit for communicating a fluid into or out of the bladder, the method comprising:

- arranging the bladder in a fluid tight compartment outside the vessel, the compartment being provided with a closable sealing device adapted for selectively

bringing the compartment in fluid communication with the internal of the vessel via an aperture in a portion of the vessel;

- bringing at least a portion of the bladder into the vessel;
- inflating the bladder by means of a fluid provided from a fluid source;
- cleaning the vessel by purging a space which is defined by an internal surface of the vessel and an external surface of the inflated bladder;
- deflating the bladder; and
- bringing the bladder out of the vessel and into the compartment.

[0014] Alternatively, the procedure above may be repeated one or more times dependent upon the degree of cleanliness sought from the purging operation.

[0015] The bladder may be deflated by introducing a new cargo gas on the recently purged space which is defined by an internal surface of the vessel and the external surface of the now deflating bladder. Alternatively, the bladder may be deflated by sucking the fluid out of the bladder.

[0016] Thus, the bladder is stored outside the vessel when not in use. This has the effect that the bladder is not continuously exposed to a possible harsh environment within the vessel.

[0017] In order to avoid a gas, such as for example air, to mix with a vapour within the vessel when the closable sealing device is shifted to an open position in order to allow the bladder to be brought into the vessel, the compartment is purged. The compartment purging fluid may be supplied from the fluid source used to inflate the bladder. Such a fluid may be an inert gas. Alternatively the compartment purging fluid may be fluid communicated from the internal of the vessel. Thus, at the time of opening the sealing device the fluid within the compartment is identical to the fluid within the vessel.

[0018] A closable sealing device may be a valve arranged between the aperture in the vessel and said compartment, the valve being operable for selectively providing communication between the inside of the compartment and said aperture. Preferably the sealing device is gas tight when in the closed position.

[0019] According to a second aspect of the invention there is provided a vessel comprising an apparatus for facilitating purging of the vessel by means of an inflatable bladder, the bladder being connected to a conduit for communicating a fluid between a fluid source into or out of the bladder, the apparatus comprising:

- a fluid tight compartment for housing the bladder;
- a closable sealing means for selectively bringing the compartment in fluid communication with the internal of the vessel via an aperture in a portion of the vessel; and
- means for bringing the bladder into and out of the vessel.

[0020] The bladder may comprise one single bladder. Alternatively, it may comprise one bladder with two or more chambers. In still another alternative, the bladder may comprise two or more separate bladders each having one or more chambers. One of the advantages of having two or more chambers or two or more separate bladders is that the method is less vulnerable to damages of the bladder. That is: If one of, or a portion of the bladder is ruptured, the method will still work although being less effective with regards to reducing the volume to be vented. In the following the term "bladder" may thus cover the above alternatives, if not specifically stated otherwise.

[0021] The vessel may be provided with at least two separate compartments for the bladder. The at least two compartments may be arranged mutually distant, each being connected to a corresponding aperture for communicating the bladder into and out of the compartment arranged outside the vessel.

[0022] The bladder may be replaced by a new one after a predetermined number of venting cycles. A venting cycle is to be understood as bringing the bladder out the compartment, inflating the bladder, purging the vessel, deflating the bladder and bringing it back into the compartment.

[0023] Thus, the bladder may be made from a material allowing reuse one or several times after deployment, inflation, deflation and removal from the vessel and stored in the compartment outside the vessel. The number of reuses of the bladder depends in addition to the bladder material itself, on the cargo type, temperatures and other physical properties to which it has been exposed, and also on the actual design and strength of that particular bladder or system of bladders. This also includes that the actual size of the vessel as well as the shape of the vessel and not least any interior equipment and other disturbances will influence to which degree the bladder may be reused one or several times.

[0024] Alternatively, the bladder may be made from relatively inexpensive material in order to dispose the bladder after each use, and then install new bladder for the next vessel purge on a gas carrier or other atmospheric ventilation purposes. Thus, the bladder may be designed for a single-use only.

[0025] A feature of using such a single-use bladder is the relatively short exposure time to the actual cargo, temperature and other physical properties in its operative environment. This short exposure time enables the use of a lower cost bladder material than what would otherwise be necessary for a bladder which is intended for reuse or otherwise longer exposure times to these conditions. Thus, the bladder may be made from a thin film making the bladder light in weight and easy to handle, even if they are made from a single layer or co-extruded multi-layer film.

[0026] The bladder may be produced from various types of materials, various types of thickness, various numbers of layers with or without reinforcement of the

whole or parts of the bladder to make it strong enough, and possibly also durable enough. Some bladders may be of standard type and size, while other bladders may be tailor made for a specific vessel or a specific part or section of a vessel.

[0027] The bladder may be provided with an electrically conductive material rendering possible grounding the bladder to avoid static electricity building up between the vessel, fluid and bladder. The bladder may thus comprise a layer of carbon or other electrically conductive material.

[0028] The bladder may be folded and packed in a cartridge, canister or other types of container or box having a size and a shape suitable for efficient storage and transport and thereafter easy handling and installation on board for easy use when needed.

[0029] Such a cartridge, canister or container or box may also be directly installed and connected to the vessel ready for introduction into the vessel similar to the cartridge of a gun or a cannon, or it could be other practical devices for connecting the cartridge to the vessel for deployment.

[0030] The bladder may be introduced into the vessel through one or more access areas preferably, but not necessarily, located in a top portion of the vessel. The number of access areas depends for example on: the shape and size of the vessel and thereby on required or practical number of bladders to be used and; the sectioning internally of the vessel; and the types and amount of equipment of various kinds that are installed inside the vessel. One or several bladders may be introduced through each access area depending amongst other things of size and shape of the bladder and access area and also on internal equipment and/or obstacles that may be provided within the vessel or a section of a vessel.

[0031] For a vessel arranged for example on a vehicle, on a train or in a static plant, an access aperture suitable for the deployment of the bladder into the vessel may be located in a position other than in a top portion of the vessel as stated above. The access aperture may for instance but not limited to, be located in an end portion of a typical "horizontal" cylindrical vessel, i.e. a cylindrical vessel having its longitudinal axis substantially in parallel with for example a road, a railway or the ground.

[0032] The bladder may be introduced into the vessel and retrieved in a number of ways. For example:

- deployment into the vessel by means of gravity only and then inflated;
- deployment into the vessel by means of inflation of the bladder; or
- any combination of some or all of these alternatives. It could also be in combination with hanging or suspension devices in order to support the bladder during deployment, during inflation, and during deflation and withdrawal or retrieval from the vessel.

[0033] It will be appreciated that the at least one bladder will be stored outside the vessel. The access aperture will be provided with gas tight closure device. The closure device may for example be a gas tight gate valve or any other type of gas tight valves allowing introduction of bladder into the vessel when the valve has been shifted to an open position.

[0034] The aforementioned bladder cartridge, canister or other type of container or box, may be stored in a gas lock attached to the vessel but separated from the vessel with the said gas tight sealing device.

[0035] From the above it will be appreciated that after deflation and removal of the bladder from the vessel it may be scrapped or repacked for reuse. The bladder may be automatically packed directly into the cartridge or onto other devices for scrap/recycle or ready for re-use at a later stage.

[0036] Hereinafter, an example of a preferred embodiment is described and is depicted in the accompanying drawings, where:

Fig. 1 shows a front elevation of a vessel provided with an external compartment housing a bladder;

Fig. 2 shows in larger scale detail A in fig. 1;

Fig. 3 shows the bladder after a major portion of the bladder has been introduced into the vessel and inflation of the bladder has commenced;

Fig. 4 shows in larger scale detail B in fig. 3;

Fig. 5 shows the bladder in fig. 3 fully inflated; and

Fig. 6 shows a vessel having four vessel compartments, each of which being provided with an external compartment housing a bladder.

[0037] Positional references, such as above, below, right and left, refer to the position shown in the relevant figure.

[0038] Equal or corresponding elements are denoted with the same reference numeral in the various figures.

[0039] In the figures, reference numeral 1 denotes a vessel arranged for receiving an inflatable bladder 3 stored in a housing or compartment 5. The compartment 5 is connected to the vessel 1 by a closable sealing means 7 adapted for selectively opening for communication between the compartment 5 and the internal of the vessel 1. In the figures the means 7 is shown as a gate valve 7.

[0040] In figures 1 and 2 the bladder 3 is housed in the compartment 5 and fluidly isolated from the internal of the vessel 1 by means of the gate valve 7 being in a closed position. The gate valve 7 is aligned with an aperture 9 in the wall of the vessel 1. Preferably, the gate valve 7 is in the closed position when the bladder 3 is

stored within the compartment 5.

[0041] Fig. 2 shows in a larger scale detail A in fig. 1. The bladder 3 is wound around a hollow drum or axle 51 and connected thereto by means of for example an adhesive or other suitable means to secure an end portion of the bladder 3 to the axle 51.

[0042] A fluid channel 53 runs from an end portion of the axle 51 and to a mid portion of the axle 51 wherein the fluid channel 53 extends through the wall of the axle 51 and connects in a first end portion to a nozzle (not specifically shown) arranged at an end portion of the bladder 3.

[0043] In the second end portion the fluid channel 53 terminates in a slip ring nozzle 55 for connection to a fluid conduit in the form of a tube 57 for communicating a fluid from and to for example an inert gas system of ship, and respectively into or out of the bladder 3. The purpose of the slip ring nozzle 55 is to avoid rotation of the tube 57 while the axle 51 is rotated to bring the bladder 3 from the compartment 5 and into the vessel 1, or from the vessel 1 and back into the compartment 5. In the embodiment shown the rotation of the axle 51 is provided by means of a motor 59 connected to an energy source and control means (not shown).

[0044] The axle 51 is supported to the compartment 5 by means of bearings known *per se*.

[0045] The compartment 5 is fluid tight with the surroundings outside of the vessel 1. This to avoid communication of air into the vessel 1 or fluid out of the vessel 1 when the valve 7 is in an open position as shown in figures 3-5 and also partly in fig. 6.

[0046] Prior to open the gate valve 7, the atmosphere within the compartment 5 is filled with an inert gas or the vapour or gas within the vessel 1, or a mixture of both, prior to commencing the purging operation. This is done via one of the lines 8 shown in figures 2 and 4 only. Each of the lines 8 comprises a valve 8'. The fluid, for example air, to be replaced by said gas, is expelled by opening a valve in a compartment drain 8" arranged in a portion of the compartment 5. The purpose of such a purging of the compartment 5 is to avoid any mixture of for example non-compatible fluids.

[0047] In figures 3 and 4 the valve 7 has been shifted to an open position and the bladder 3 has been introduced into the vessel 1 by unwinding the bladder 3 from the axle 51. A fluid control valve (not shown) has been opened to allow fluid from the fluid source to flow via the tube 57 and the fluid channel 53 into the bladder 3.

[0048] In figure 3 and 4 the bladder 3 is in the process of being filled with fluid and is therefore only partly inflated. In the figures the fluid, preferably a gas, is indicated with dots.

[0049] In order to facilitate the deployment of the bladder 3 into the vessel 1 the lower end portion of the bladder 3 may be provided by weight means (not shown). Such a weight means may also facilitate a tight winding of the bladder 3 around the axle 51 during retrieval of the bladder 3 out of the vessel 1 and into the compartment 5. In

one embodiment the weight means is comprised of one or more weights attached to an outside lower portion of the bladder 3.

[0050] In fig. 5 the bladder 3 is inflated to substantially fill the internal volume of the vessel 1. Thus, the volume in the vessel 1 to be purged is very limited as compared to the total volume of the vessel, and is limited to an annular space defined by the internal wall of the vessel 1 and the external surface of the bladder 3. The advantages of this are thoroughly discussed above.

[0051] The vessel 1 is further provided with a draining nozzle 4. However, a person skilled in the art will understand that a vessel for storing a fluid must be provided with a manhole and further connection points for apparatuses required for operating and purging the vessel 1. For the sake of clarity, those connections points are not shown.

[0052] The gas displaced by the bladder 3 being inflated within the vessel 1 may be communicated out through the draining nozzle 4 and lead via a tube 4' to a plant for further processing or storage. Again, connections necessary for performing the purging operation are not shown.

[0053] Fig. 6 shows a vessel 1 comprising four chambers 11 separated by chamber walls 13. Each chamber 11 is provided with draining nozzle (not shown) corresponding to draining nozzles 4 shown in figures 1, 3 and 5.

[0054] Each chamber 11 is provided with a compartment 5 and a bladder 3 of the same type as disclosed in for example fig. 2. Each compartment 5 is connected to the vessel 1 via a valve 7.

[0055] It should be noted that the chamber walls 13 shown in fig. 6 in an alternative embodiment (not specifically shown) may be provided with one or more apertures so that adjacent chambers are in fluid communication with each other.

[0056] In fig. 6 the bladders 3 are brought into three of the four chambers 11, while the bladder 3 for the fourth chamber 11 (to the left) is still stored in the compartment 5 and the valve 7 being in a closed position isolating the bladder 3 from the compartment 11. Seen from right to left the bladder 3 in the two first chambers 11 are fully inflated, while the third bladder 3 is only partly filled.

[0057] Fig. 6 may show a situation prior to cleaning the vessel 1, where said third bladder 3 is in the process of being filled and prior to introducing the bladder 3 into the left chamber 11. Alternatively fig. 6 may show a situation after the left chamber has been cleaned and the bladder 3 is retrieved out of the chamber 11 and into the compartment 5, and said third bladder 3 is in the process of being deflated prior to retrieval from the chamber 11.

[0058] The embodiment shown in fig. 6 may also be used for a vessel as shown for example in fig. 1, i.e. without the some or all of the chamber walls 13.

[0059] In order to facilitate replacement of the bladder 3 the compartment 5 is disconnected from the valve 7 and the tube 57, and preferably also the motor 59.

Claims

1. A method for facilitating purging a vessel (1) by means of an inflatable bladder (3), the bladder (3) being connected to a conduit (53, 55, 57) for communicating a fluid into or out of the bladder (3), **characterized in that** the method comprising:
 - arranging the bladder (3) in a fluid tight compartment (5) outside the vessel (1), the compartment (5) being provided with a closable sealing means (7) adapted for selectively bringing the compartment (5) in fluid communication with the internal of the vessel (1) via an aperture (9) in a portion of the vessel (1);
 - bringing at least a portion of the bladder (3) into the vessel (1);
 - inflating the bladder (3) by means of a fluid provided from a fluid source;
 - cleaning the vessel (1) by purging a space which is defined by an internal surface of the vessel (1) and an external surface of the inflated bladder (3);
 - deflating the bladder (3); and
 - bringing the bladder (3) out of the vessel (1) and into the compartment (5).
2. The method according to claim 1, further comprising purging the compartment (5) prior to open for communication between the compartment (5) and the internal of the vessel (1).
3. The method according to claim 1 and 2, wherein the means for selectively bringing the compartment (5) in fluid communication with the internal of the vessel (1) is a gate valve (7).
4. The method according to claim 1, further comprising venting the vessel (1) by means of at least two bladders (3).
5. The method according to claim 4, wherein the at least two bladders (3) are arranged in separate compartments (5) each being connected to an aperture (9) in the vessel (1).
6. The method according to any of the preceding claims, wherein the bladder (3) is replaced by a new one after a determined number of venting cycles.
7. The method according to claim 6, wherein the determined number of venting cycles is one.
8. The method according to claim 1, wherein the bladder (3) is provided with an electrically conductive material rendering possible grounding the bladder (3) to avoid static electricity building up between the vessel (1), fluid and bladder (3).

9. The method according to claim 1, wherein the fluid in the bladder (3) is returned to the fluid source during deflation of the bladder (3).

10. A vessel (1) comprising an apparatus for facilitating purging of the vessel (1) by means of an inflatable bladder (3), the bladder (3) being connected to a conduit (53, 55, 57) for communicating a fluid between a fluid source into or out of the bladder (3), **characterized in that** the apparatus comprising:

- a fluid tight compartment (5) for housing the bladder (3);
- a closable sealing means (7) for selectively bringing the compartment (5) in fluid communication with the internal of the vessel (1) via an aperture (9) in a portion of the vessel (1); and
- means (51, 59) for bringing the bladder (3) into and out of the vessel (1).

11. The vessel (1) according to claim 10, wherein the compartment (5) is further provided with means (8, 8', 8'') for purging the compartment (5) when the closable sealing means (7) is in the closed position.

Patentansprüche

1. Verfahren zur Erleichterung der Spülung eines Behälters (1) mittels einer aufblasbaren Blase (3), wobei die Blase (3) mit einer Leitung (53, 55, 57) verbunden ist, um ein Fluid in die Blase (3) hinein oder herauszuführen, **dadurch gekennzeichnet, dass** das Verfahren umfasst:
 - Anordnen der Blase (3) in einem fluiddichten Abteil (5) ausserhalb des Behälters (1), wobei das Abteil (5) mit einem verschliessbaren Dichtmittel (7) versehen ist, welches zum selektiven Bringen des Abteils (5) in Fluidverbindung mit dem Inneren des Behälters (1) über eine Öffnung (9) in einem Teil des Behälters (1) ausgebildet ist;
 - Einbringen von mindestens einem Teil der Blase (3) in den Behälter (1);
 - Aufblasen der Blase (3) mittels eines Fluides, das von einer Fluidquelle bereitgestellt wird;
 - Reinigen des Behälters (1) durch Spülen eines Raumes, welcher durch eine Innenfläche des Behälters (1) und eine Aussenfläche der aufgeblasenen Blase (3) definiert ist;
 - Entleeren der Blase (3); und
 - Bringen der Blase (3) aus dem Behälter (1) heraus und in das Abteil (5) hinein.
2. Verfahren gemäss Anspruch 1, weiter umfassend das Spülen des Abteils (5) vor dem Öffnen zur Verbindung zwischen dem Abteil (5) und dem Inneren

des Behälters (1).

3. Verfahren gemäss Anspruch 1 oder 2, wobei das Mittel zum selektiven Bringen des Abteils (5) in Fluidverbindung mit dem Inneren des Behälters (1) ein Absperrschieber (7) ist. 5
4. Verfahren gemäss Anspruch 1, weiter umfassend das Entlüften des Behälters (1) mittels mindestens zwei Blasen (3). 10
5. Verfahren gemäss Anspruch 4, wobei die mindestens zwei Blasen (3) in getrennten Abteilen (5) angeordnet sind, die jeweils mit einer Öffnung (9) im Behälter (1) verbunden sind. 15
6. Verfahren gemäss einem der vorhergehenden Ansprüche, wobei die Blase (3) nach einer bestimmten Anzahl von Entlüftungszyklen durch eine neue ersetzt wird. 20
7. Verfahren gemäss Anspruch 6, wobei die bestimmte Anzahl von Entlüftungszyklen eins ist.
8. Verfahren gemäss Anspruch 1, wobei die Blase (3) mit einem elektrisch leitfähigen Material versehen ist, das ein Erden der Blase (3) ermöglicht, um die Bildung von statischer Elektrizität zwischen dem Behälter (1), Fluid und Blase (3) zu vermeiden. 25
9. Verfahren gemäss Anspruch 1, wobei das Fluid in der Blase (3) während des Entleerens der Blase (3) an die Fluidquelle zurückgeführt wird. 30
10. Behälter (1) umfassend eine Vorrichtung zur Erleichterung der Spülung des Behälters (1) mittels einer aufblasbaren Blase (3), wobei die Blase (3) mit einer Leitung (53, 55, 57) verbunden ist, um ein Fluid zwischen einer Fluidquelle in die Blase (3) hinein oder herauszuführen, **dadurch gekennzeichnet, dass** die Vorrichtung umfasst: 35
 - ein fluiddichtes Abteil (5) zur Aufnahme der Blase (3);
 - ein verschliessbares Dichtmittel (7) zum selektiven Bringen des Abteils (5) in Fluidverbindung mit dem Inneren des Behälters (1) über eine Öffnung (9) in einem Teil des Behälters (1); und
 - Mittel (51, 59) zum Bringen der Blase (3) in den Behälter (1) hinein und hinaus. 40
11. Behälter (1) gemäss Anspruch 10, wobei das Abteil (5) weiter mit Mittel (8, 8', 8'') zum Spülen des Abteils (5) versehen ist, wenn sich das verschliessbare Dichtmittel (7) in der geschlossenen Position befindet. 45 50 55

Revendications

1. Une méthode permettant de faciliter la purge d'un réceptacle (1) au moyen d'une vessie gonflable (3), la vessie (3) étant raccordée à une conduite (53, 55, 57) permettant d'envoyer un fluide dans ou hors de la vessie (3), **caractérisé en ce que** la méthode comprend :
 - agencer la vessie (3) dans un compartiment (5) étanche aux fluides hors du réceptacle (1), le compartiment (5) étant doté d'un moyen d'étanchéité pouvant être fermé (7) conçu pour mettre en communication fluide sélective le compartiment (5) avec l'intérieur du réceptacle (1) par une ouverture (9) dans une partie du réceptacle (1) ;
 - amener au moins une partie de la vessie (3) dans le réceptacle (1) ;
 - gonfler la vessie (3) au moyen d'un fluide provenant d'une source de fluide ;
 - nettoyer le réceptacle (1) en purgeant un espace qui est défini par une surface intérieure du réceptacle (1) et une surface extérieure de la vessie (3) gonflée ;
 - dégonfler la vessie (3) ; et
 - retirer la vessie (3) hors du réceptacle (1) et la mettre dans le compartiment (5).
2. La méthode selon la revendication 1, comprenant en outre la purge du compartiment (5) avant l'ouverture pour communication entre le compartiment (5) et l'intérieur du réceptacle (1). 30
3. La méthode selon les revendications 1 et 2, dans laquelle le moyen conçu pour mettre en communication fluide le compartiment (5) avec l'intérieur du réceptacle (1) est un robinet-vanne (7). 35
4. La méthode selon la revendication 1, comprenant en outre l'aération du réceptacle (1) au moyen d'au moins deux vessies (3). 40
5. La méthode selon la revendication 4, dans laquelle les au moins deux vessies (3) sont disposées dans des compartiments séparés (5), chacun étant relié à une ouverture (9) du réceptacle (1). 45
6. La méthode selon l'une quelconque des revendications précédentes, dans laquelle la vessie (3) est remplacée par une nouvelle vessie après un nombre déterminé de cycles d'aération. 50
7. La méthode selon la revendication 6, dans laquelle le nombre déterminé de cycles d'aération est de un. 55
8. La méthode selon la revendication 1, dans laquelle la vessie (3) est pourvue d'un matériau électrique-

ment conducteur rendant possible la mise à la terre de la vessie (3) pour éviter une accumulation d'électricité statique entre le réceptacle (1), le fluide et la vessie (3).

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9. La méthode selon la revendication 1, dans laquelle le fluide dans la vessie (3) est renvoyé à la source de fluide pendant le dégonflement de la vessie (3).

10. Un réceptacle comprenant un appareil permettant de faciliter la purge du réceptacle (1) au moyen d'une vessie gonflable (3), la vessie (3) étant raccordée à une conduite (53, 55, 57) permettant d'envoyer un fluide entre une source de fluide dans ou hors de la vessie (3), **caractérisé en ce que** l'appareil comprend :

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- un compartiment (5) étanche aux fluides pour loger la vessie (3) ;
- un moyen d'étanchéité pouvant être fermé (7) conçu pour mettre en communication fluidique sélective le compartiment (5) avec l'intérieur du réceptacle (1) par une ouverture (9) dans une partie du réceptacle (1) ; et
- des moyens (51, 59) pour amener la vessie (3) dans et hors du réceptacle (1).

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11. L'appareil selon la revendication 10, dans lequel le compartiment (5) est en outre pourvu d'un moyen (8, 8', 8'') pour la purge du compartiment (5) lorsque le moyen d'étanchéité pouvant être fermé (7) est dans la position fermée.

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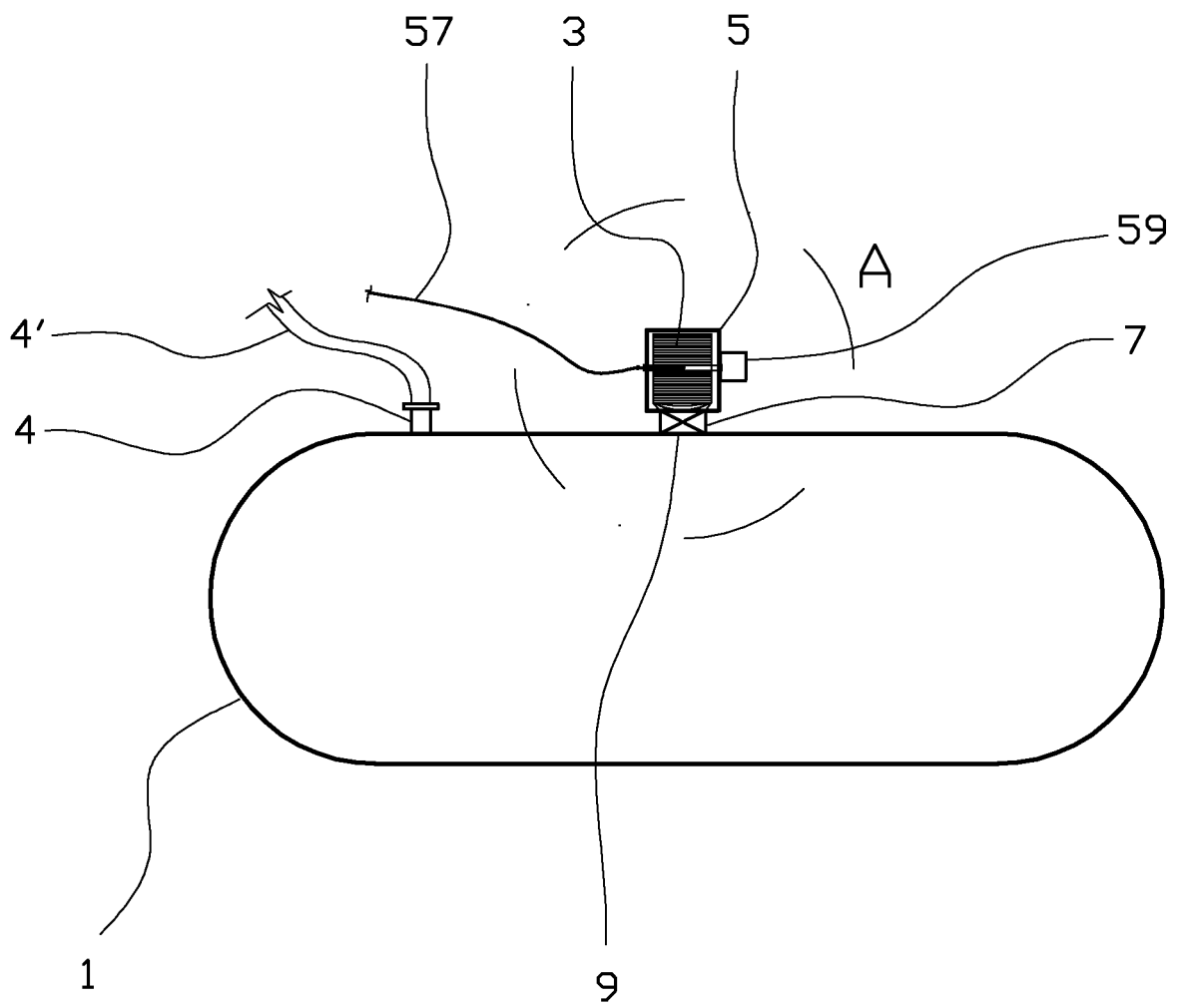


Fig. 1

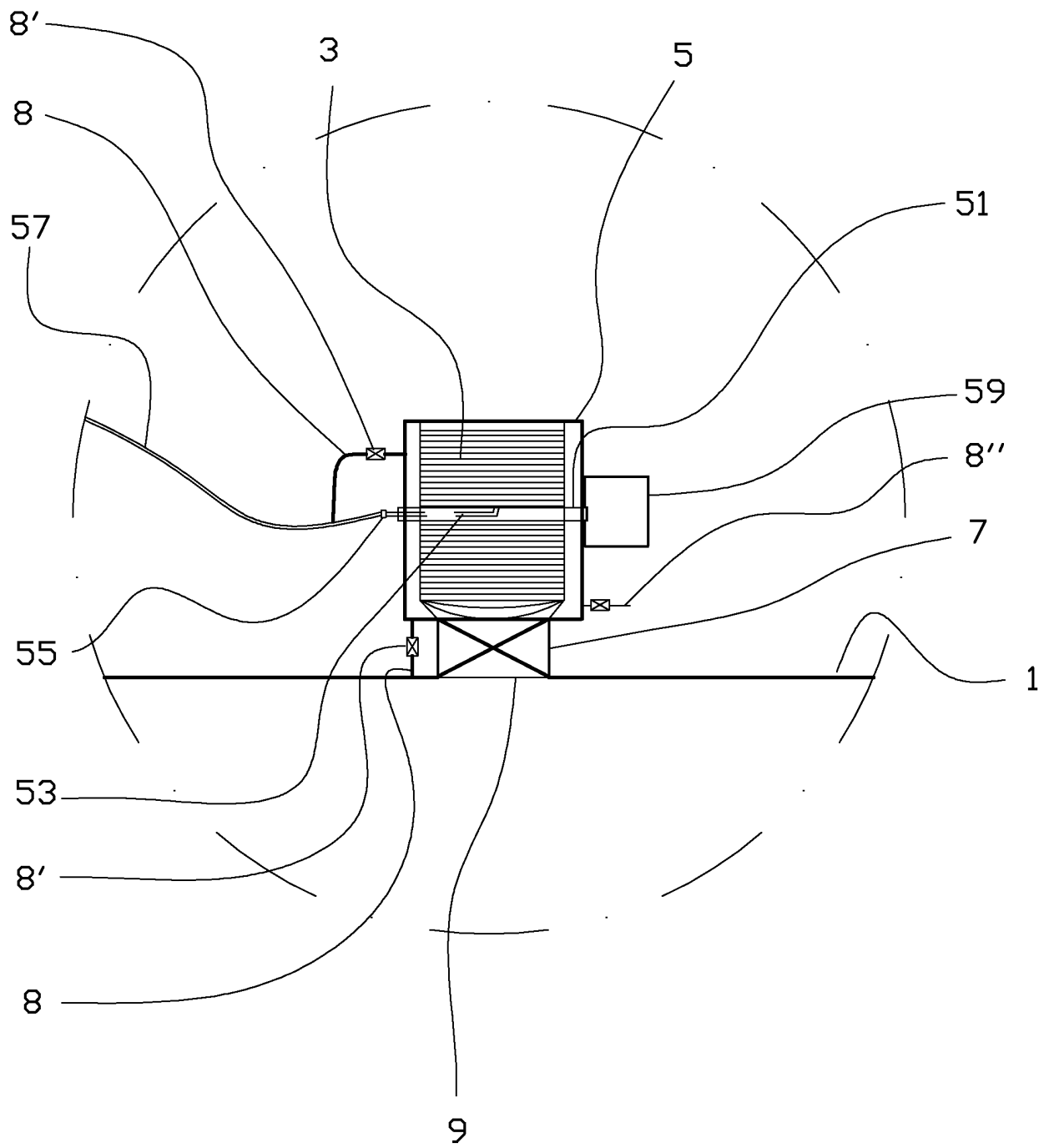


Fig. 2

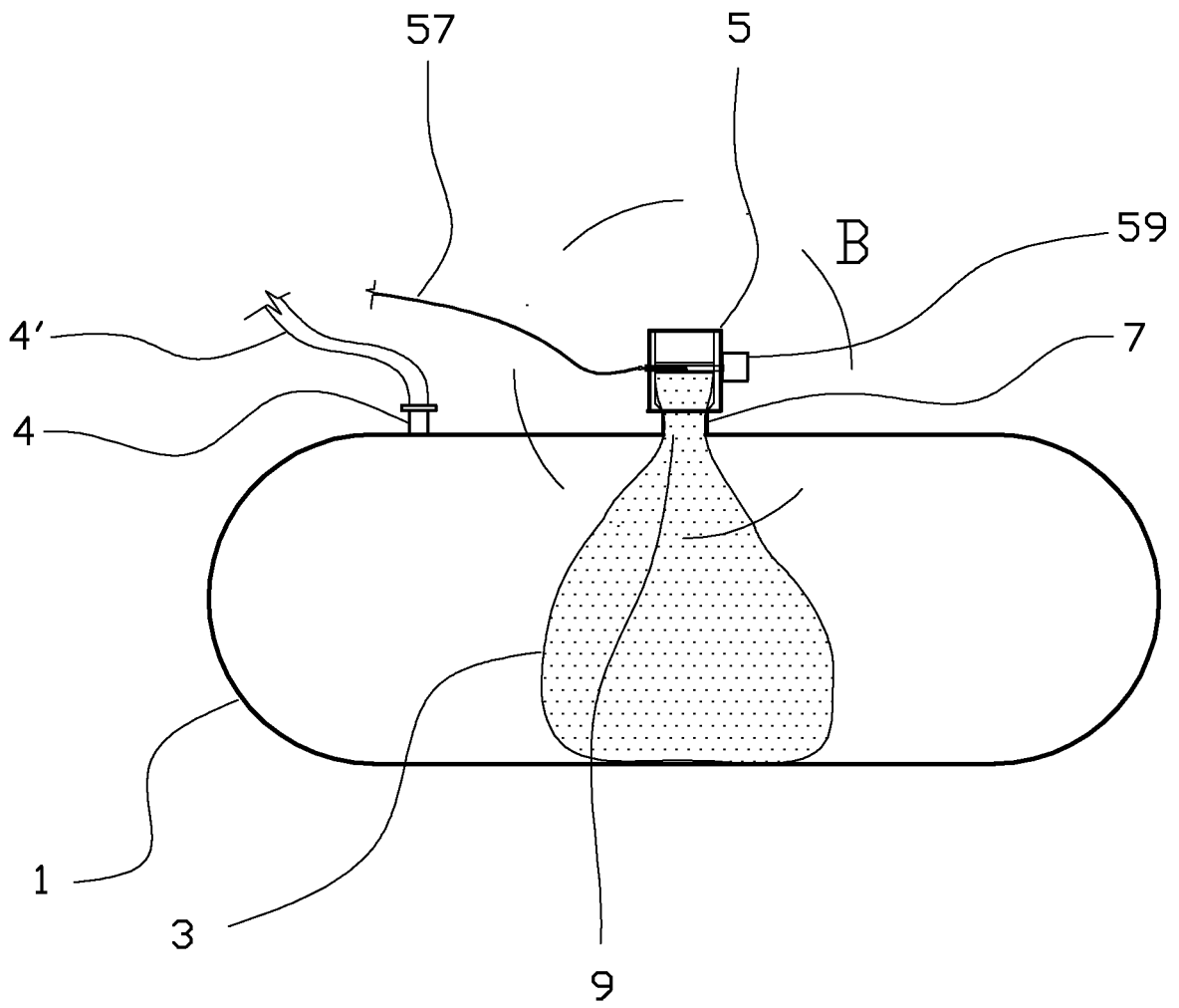


Fig. 3

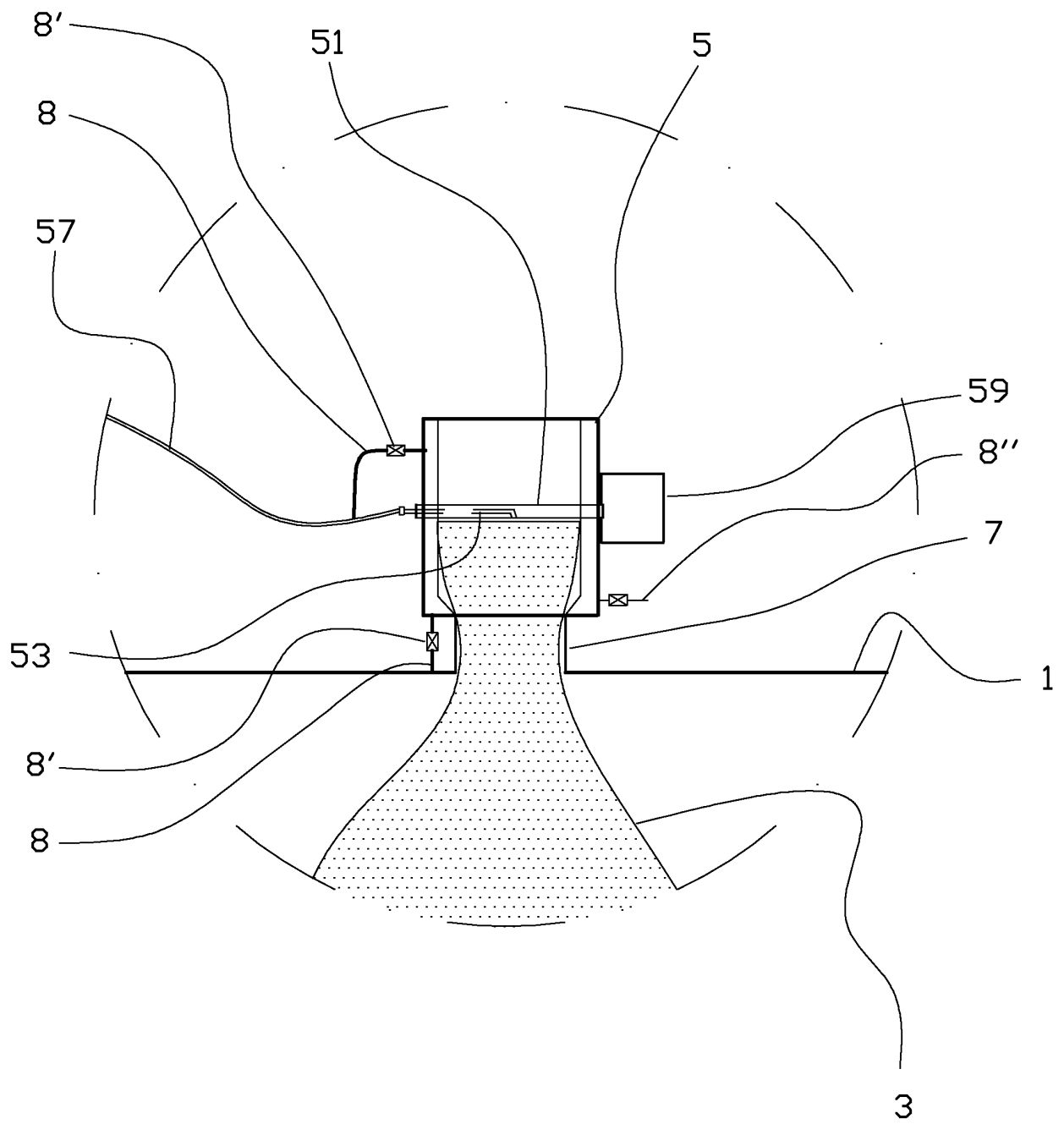


Fig. 4

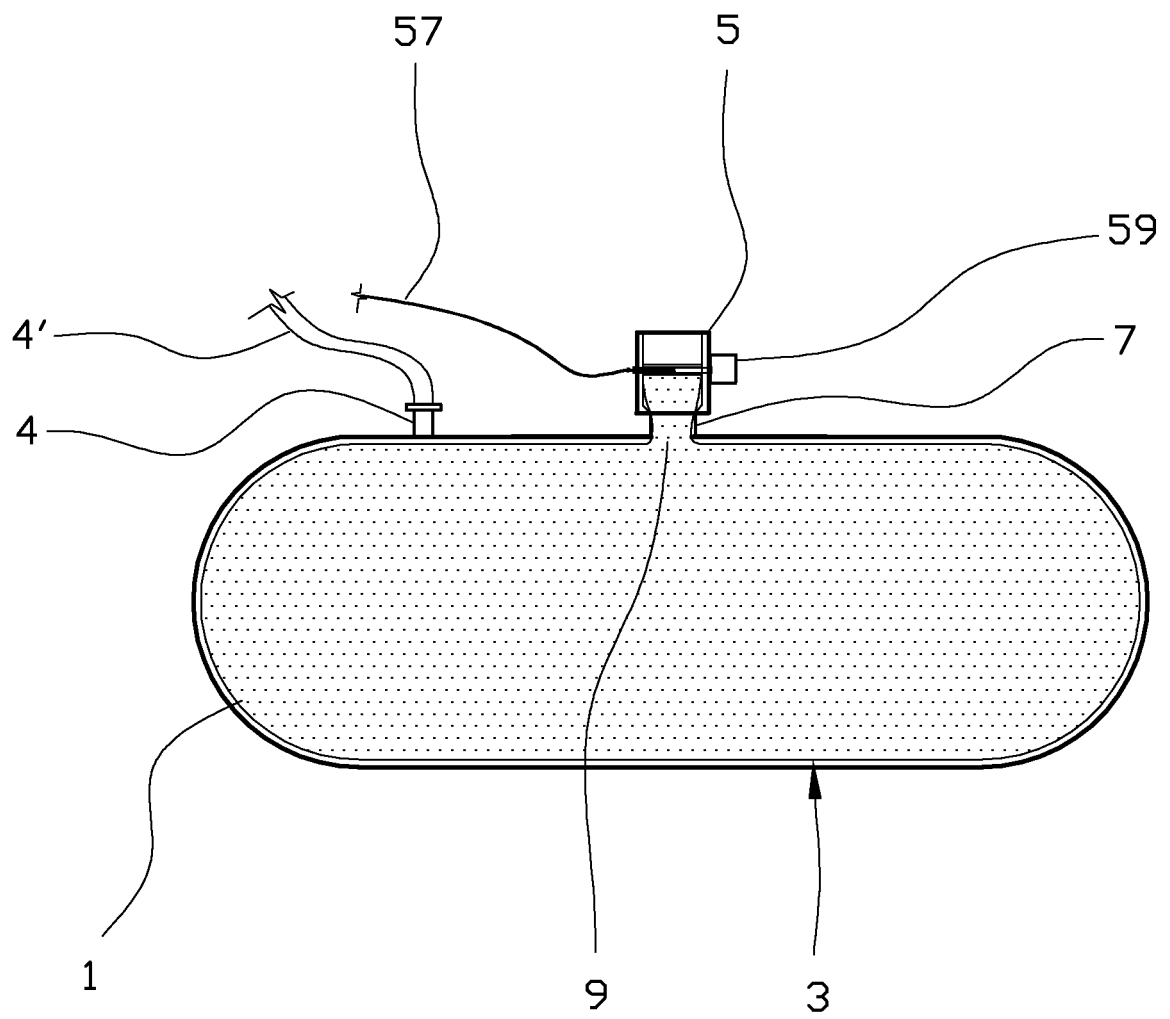


Fig. 5

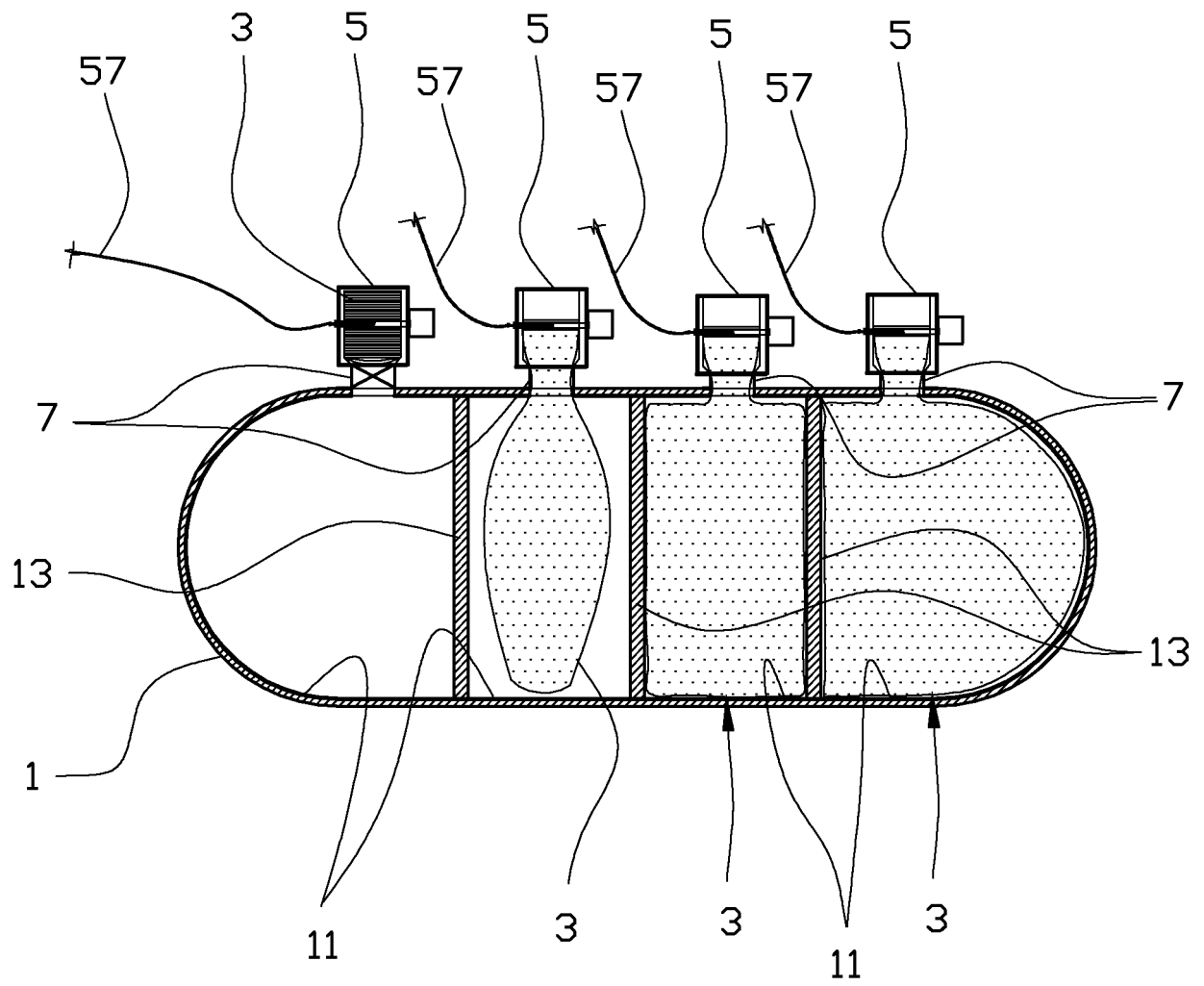


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1791772 B1 [0007] [0008] [0009]