(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 241 624 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.11.2017 Bulletin 2017/45

(21) Application number: **16168565.6**

(22) Date of filing: **06.05.2016**

(51) Int Cl.:
B08B 9/035 *(2006.01)* ***A47L 7/00*** *(2006.01)*
B08B 9/04 *(2006.01)* ***B08B 9/08*** *(2006.01)*
B65D 88/54 *(2006.01)*

(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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) APPARATUS AND METHOD FOR DEPLETING A TANK

(57) The invention relates to an apparatus (1) for depleting a tank (2), comprising a head (17) having a hose port (24), a first suction opening (27), and an inner chamber (26) connecting said hose port (24) and said first suction opening (27), wherein the head (17) has a pressurizing port (25), a propulsion opening (32), and a duct system (33) connecting said pressurizing port (25) and said propulsion opening (32). The invention further relates to a method of depleting a tank (2) by means of such an apparatus (1).

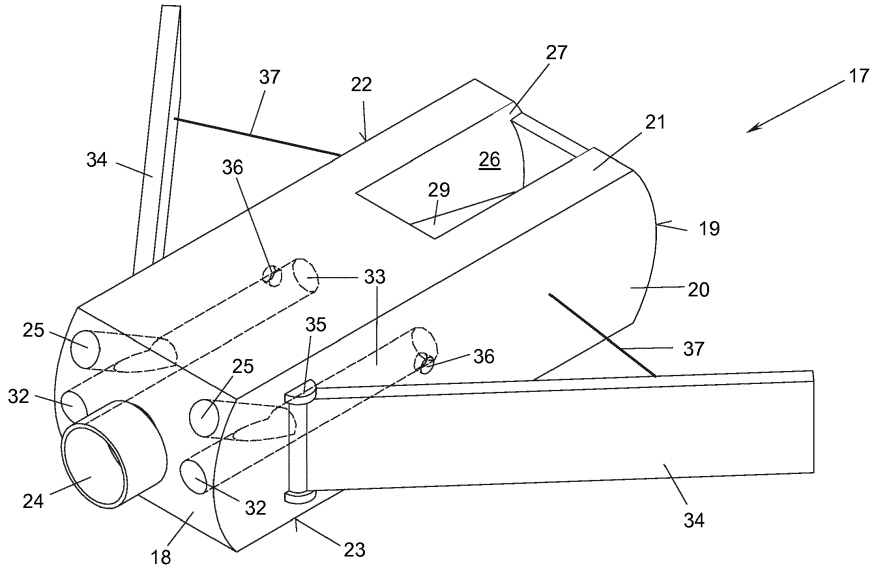

Fig. 2

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Description

[0001] The present invention relates an apparatus and a method for depleting a tank.

[0002] Industrial storage tanks for storing, e.g., mineral oils, fuels, or petrols in gas stations need to be cleaned in regular intervals to avoid aggregation of contaminants, mudding, and the risk of subsequent corrosion of the tank. During cleaning, the tank has to be emptied as much as possible, i.e., thoroughly depleted, usually twice: Firstly before cleaning to discharge the regular storage contents of the tank, and secondly after cleaning, during which fluids have been sprayed onto the interior walls of the tank to loosen deposits and incrustations, in order to remove the cleaning fluids with all such loosened material, which forms a slurry or sludge at the bottom of the tank.

[0003] Cleaning a tank in this way can be done from inside the tank by a workman wearing a heavy duty protective suit with a breathing mask, which is a straining and dangerous job. Therefore it is preferred to use cleaning equipment, such as spraying guns and suction pipes, which can be remotely controlled from outside the tank to avoid entering the tank. However, with currently available cleaning equipment, it is difficult to empty a tank completely without the presence of a workman in the tank, in particular when the bottom of the tank is sloped or uneven, so that patches of fluid, mud, or sludge remain at the deepest spots of the tank.

[0004] It is an object of the invention to provide an apparatus and a method for efficiently depleting a tank from the outside, so that a dangerous, laborious and costly entering of the tank by man can be avoided.

[0005] To this end, in a first aspect the invention provides for an apparatus for depleting a tank, comprising a head having a hose port, a first suction opening, and an inner chamber connecting said hose port and said first suction opening, which apparatus is characterized in that the head has a pressurizing port, a propulsion opening, and an inner duct system connecting said pressurizing port and said propulsion opening.

[0006] In a second aspect the invention provides for a method of depleting a tank by means of such an apparatus, comprising:

inserting the head with attached suction and pressurizing hoses via a tank opening into the tank;
starting the pressurizing pump to move the head further into the tank by propulsion of pressurized fluid exiting the propulsion opening(s) of the head, while letting said hoses pass further through the tank opening into the tank; and
stopping the pressurizing pump and starting the suction pump.

[0007] In this way, the suction head can first be moved over the length of the tank bottom, starting from the tank opening and up to the most remote end of the tank, by using the thrust of the fluid exiting the propulsion openings of the head. Then, propulsion of the head is stopped by switching off the pressurising pump and turning on the suction pump. In situations where the remote end of the tank bottom is also the lowest point of the tank, this position of the head is already sufficient to deplete the tank by operating the suction pump at this point. In other situations, where there might be an uneven tank bottom or where the tank bottom is sloped the other way, the head can subsequently be dragged over the tank bottom while operating the suction pump by retracting the hoses slowly out of the tank opening, so that fluid, mud, and sludge patches aggregating in any depressions of the tank bottom will be discharged. To cover the entire length of the tank bottom when dragging the head over the bottom, it is preferred to use a tank opening which lies at one end of the tank.

[0008] As the head has to drag long and heavy hoses when it is propelled by the thrust of the pressurized fluid, preferably the pressure of the pressurising pump is in the range of 50 - 300 bar, most preferably in the range of 100 - 200 bar, to exert sufficient thrust. Such high pressures can be supplied by, e.g., commercial cleaning trucks which carry water compressors in this pressure range, so that existing cleaning equipment can be used to operate the suction head.

[0009] In a preferred embodiment of the apparatus of the invention, the propulsion opening and at least one of the hose port and the pressurizing port lie on the same wall of the head. This yields a symmetric thrust on the head with respect to the hoses dragged and thus a linear movement of the head over the tank bottom.

[0010] For the same reason, it is preferred that the propulsion opening is an annular opening surrounding the hose port and/or the pressurizing port. Alternatively, at least two propulsion openings are arranged around the hose port and/or the pressurizing port, which are connected to said pressurizing port or to at least one further pressurizing port via said duct system.

[0011] In all those embodiments, the pressure hose(s) can be bundled with the suction hose(s), so that the head drags a single bundle of hoses when moving along the tank bottom, or, vice versa, a single bundle of hoses can be pulled to retract the head over the tank bottom when it is in suction mode.

[0012] In a further preferred embodiment, the first suction opening lies on a first side wall of the head, and a second suction opening lies on a second side wall opposite of the first side wall and is connected to the inner chamber, so that the head can discharge in two directions. A baffle can be mounted in the inner chamber pivotably between a first position, in which the inner chamber connects the hose port with only the first suction opening, and a second position, in which the inner chamber connects the hose port with only the second opening. The baffle can, e.g., be driven by an actuator and remote-controlled from outside of the tank in such a way that always the lower one of the two suction openings is in

use, which ensures a complete draining of the tank.

[0013] In a preferred variant of this embodiment, the baffle is pivotable about an axis which lies between the hose port and the suction openings, and the baffle is loaded by weight at the side of the suction openings. Thereby, the baffle is self-operated by gravity so that always the lower one of the suction openings is in operation.

[0014] According to a further preferred feature of this variant, the head carries at least two movable arms, wherein each arm can be moved from a first position close to the head into a second position spread-out from the head in a direction transverse to the opening direction of the first and the second suction openings. By spreading out the arms, a position of the head on the tank bottom in which the suction openings would face to the side can be avoided. The spreading arms force the head to tilt in a position where the suction openings face up and down, respectively.

[0015] Each arm can be spring-loaded towards its spread-out position. When inserting the head through the tank opening, the arms are pressed together against the spring-loading force into their closed position and then automatically unfold into their spread-out positions when having passed the tank opening.

[0016] Instead of a spring-loading mechanism, there could also be a jet opening for each arm on the head directed towards said arm, which jet openings are connected to said duct system. In this way, when starting the pressurizing pump after having inserted the head into the tank, the arms unfold under the jet force of the pressurized fluid exiting the jet openings.

[0017] In a third aspect, the invention provides for an apparatus comprising a suction head as described as well as a suction pump, a suction hose connecting the suction pump and the hose port of the head, a pressurizing pump for pressurizing a fluid, and a pressure hose connecting the pressurizing pump and the pressurizing port of the head.

[0018] The invention will now be described in further detail by means of exemplary embodiments thereof under reference to the enclosed drawings, in which:

Fig. 1 shows an apparatus for depleting a tank and a method of using it according to the invention in a schematic side view, partially broken up;
Fig. 2 shows the head of the apparatus of Fig. 1 in a perspective, partially transparent view; and
Fig. 3 shows the head of Fig. 2 in a longitudinal sectional view.

[0019] Fig. 1 shows an apparatus 1 for cleaning and, in the course of the cleaning, depleting a tank 2. The tank 2 can be any commercial or industrial tank for storing a gas or a liquid, e.g., an underground storage tank in a gas filling station for storing mineral oils, petrols, et cet. In the example shown, the tank 2 is an elongated cylinder, substantially oriented horizontally, forming a tank bottom 3 of, e.g., several meters length, for example up to ten meters. The tank 2 can of course also be mounted overground and/or upright, for example in the form of an upright cylinder of large diameter and low height which stands on the surface.

[0020] Via an optional manhole 4 passing through the soil 5, the tank 2 can be entered for cleaning and inspection. However, such entering by man shall be avoided by using the apparatus and methods described herein. Ducts 6, which pass through the soil 5 to the tank 2, can be used to fill and drain the tank 2, respectively. Such filling and draining ducts 6 are usually pipes of a small diameter, e.g., of 5 - 15 cm.

[0021] Some parts of the apparatus 1 to deplete the tank 2 are to be used outside of the tank 2 and other parts inside of the tank 2. The outside parts can be mounted stationary or mobile. In the example shown, most outside parts are mounted on a cleaning truck 8 and comprise a suction pump 9, a waste tank 10 connected to the suction pump 9 for receiving material sucked by the suction pump 9 over a suction hose 11, and a pressurizing pump 12 for delivering pressurized fluid, usually water with or without a detergent, over a pressure hose 13. The pressurizing pump 12 may receive the fluid from a reservoir 14 on the truck 8 or from a water tap stationary on site (not shown).

[0022] The suction pump 9 may, for example, produce a suction pressure (vacuum) in the range of 1 - 10 bar at its suction port 15 for connecting a suction hose 11 of a diameter of 1 - 10 cm, usually 2 - 3 cm (about 1 inch). The pressure pump 12 is a high pressure compressor and can, for example, deliver a pressure of several tens of bar, usually in the range of 50 - 300 bar, preferably in the range of 100 - 200 bar, at its port 16 for connecting a high pressure hose 13 of a diameter of 0,5 - 2 cm, usually 1 cm.

[0023] The pressure hose 13 can be used in a conventional way to connect to a spray gun and to clean the tank 2 by injecting fluid onto its inner walls while moving the spray gun in the tank 2 around (not shown). The suction hose 11 can also be used in a conventional way to drain contents and cleaning fluids from the tank 2 by moving the suction hose 11 in the tank 2 around (not shown). However, to efficiently remove any contents and cleaning fluids from the tank 2 after cleaning, the apparatus 1 is supplemented and used in the following way.

[0024] The suction hose 11 and the pressure hose 13 are both connected to a head 17 to be inserted into the tank 2 for depleting the tank 2, i.e., for completely discharging any contents, cleaning fluids, mud, sludge, and slurry from the tank 2. Figs. 2 and 3 show the construction of the head 17 in detail.

[0025] The head 17 has substantially the shape of a flat box with a rear wall 18, a front wall 19, and four side walls 20 - 23 and can rest with, e.g., the side wall 23 on the bottom 3 of the tank 2, as shown in the example. In general, the head 17 could, however, also have another form, for example the form of a cylinder, ball, or cone of which an underside 23 can rest on the bottom 3.

[0026] The rear wall 18 of the head 17 is provided with a hose port 24 for connecting the suction hose 11 and with one or more pressurizing ports 25 for connecting one or more pressure hoses 13. A single pressure hose 13 could, e.g., be connected to multiple pressurizing ports 25 via a manifold or a Y-adapter, as applicable. In principle, also multiple hose ports 24 could be used in this way.

[0027] As can be seen from Fig. 2, the hose port 24 is usually of a large diameter for connecting a large diameter suction hose 11 of low pressure vacuum, and the pressurizing port(s) 25 is/are usually of a small diameter for connecting a small diameter pressure hose 13 of high pressure.

[0028] The suction port 24 opens into an inner chamber 26 of the head 17 which has one or more suction openings 27, 28 through one or more of the walls 18 - 23, see also Fig. 3. In the embodiment shown, there are two suction openings 27, 28 on opposite side walls 21, 23 of the head 17. Of course, there could also be more than two or only one suction opening.

[0029] In case there are two suction openings 27, 28 lying opposite to each other on the side walls 21, 23 as shown, an optional baffle 29 can be mounted within the inner chamber 26 pivotably about an axis 30. The axis 30 lies between the hose port 24 and the suction openings 27, 28 and is substantially horizontal when the suction openings 27, 28 face up or down. The axis 30 gives the baffle 29 the properties of a lever with two arms. The arm of the baffle 29 that faces the suction openings 27, 28 is loaded by a weight 31 so that it pivots down under the gravity force of the weight 31. This position is shown in Fig. 3 in solid lines. In this position, the baffle 29 divides the inner chamber 26 between the suction openings 27, 28 with respect to the suction port 24 in such a way that it exclusively connects the hose port 24 only with the lower suction opening 28.

[0030] If the head 17 is turned upside down so that the side wall 21 with the suction opening 27 faces the bottom 3 of the tank 2, then the baffle 29 swivels about its axis 30 into its second position (shown in broken lines in Fig. 3), in which the chamber 26 now exclusively connects the hose port 24 with the suction opening 27 that is facing down. In this way, always the lower one of the two suction openings 27, 28 is connected to the hose port 24 for sucking (see arrows in Fig. 3), enabling a maximal depletion of the tank 2.

[0031] Reverting to Fig. 2, the rear wall 18, which carries the suction hose 11 and the pressure hose 13, is provided with one or more propulsion openings 32. In the example shown, two propulsion openings 32 are disposed symmetrically around the hose port 24. There could also be more than two propulsion openings 32 distributed around the suction port(s) 24 and/or the pressurizing port(s) 25. Alternatively, an annular propulsion opening 32 (slit) surrounding the hose port(s) 24 and/or the pressurizing port(s) 25 could be used.

[0032] The propulsion opening(s) 32 is/are connected to the pressurizing port(s) 25 via an inner duct system 33 of the head 17 so that pressurized fluid supplied from the pressure pump 12 over the pressure hose 13 to the pressurizing ports 25 exits the propulsion opening(s) 32. The fluid exiting the propulsion openings 32 generates thrust, which propels the head 17 in the direction F (Fig. 1) along the bottom 3 of the tank 2, dragging the hoses 11, 13 behind. The hoses 11, 13 (more specifically: the hose port(s) 24 and the pressurizing port(s) 25) should therefore preferably be at the same wall 18 where the propulsion openings 32 are to achieve a substantially linear movement of the head 17 over the bottom 3. For the same reason, the propulsion openings 32 should preferably be symmetrical to at least one of the hose and pressurizing ports 24, 25. Exerting a slight force of resistance (withholding) from the outside on that hose(s) 11, 13 that is/are symmetrically surrounded by propulsion openings 32 can additionally straighten the movement of the head 17 along the bottom 3.

[0033] The duct system 33 can be formed by bores or inner channels within the walls 18 - 23 of the head 17, as shown in Fig. 2, or can be built-up from pipings mounted on the head 17 or in the chamber 26. The duct system 33 can be split into separate parts, in particular in case of multiple pressurizing ports 25 and multiple propulsion openings 32, or form a manifold, as needed.

[0034] To ensure that the head 17 comes to rest on one of its side walls 21, 23 that is provided with a suction opening 27, 28 when the head 17 is lowered to the bottom 3 of the tank 2, the head 17 can optionally be provided with one or more moveable arms 34. The arms 34 can be spread-out to tilt the head 17, should it inadvertently land on one of the other side walls 20, 22 when touching the bottom 3.

[0035] The arms 34 can be hingedly attached to the walls 18 - 23 by means of hinges 35 or can be mounted linearly extendable and retractable on or in the walls 18 - 23. In either case, the arms 34 can move from a position close to the head 17, in which the head 17 can pass through a small diameter duct 6, into a spread-out (pivoted-out or linearly extended) position, in which they are spread-out from the head 17 in a direction transverse to the opening direction of the suction openings 27, 28.

[0036] The arms 34 can, e.g., be spring-loaded towards their spread-out position so that they immediately spread when having passed the duct 6; such spring-load can, inter alia, be achieved by making the arms 34 out of an elastic material such as rubber. Alternatively, the arms 34 could be remotely controlled from the outside, e.g., by electric or hydraulic actuators provided in the head 17. Preferably and as shown in Fig. 2, the propulsion system of the head 17 can be used to spread the arms 34. To this end, for each arm 34 a jet opening 36 of small diameter can be provided on the head 17, directed towards the arm 34 and connected to the duct system 33. Upon pressurizing the duct system 33 via the pressure hose 13 and the pressurizing port(s) 25, pressurized fluid exits the jet openings 36 and impinges on

the arms 34 to spread them out. Flexible threads 37 extending between the walls 20, 22 and the arms 34 can be used to limit the outward movement of the arms 34.

[0037] As shown in Fig. 3, optionally a ring, hook etc. 38 for attaching a rope 39 can be mounted on or integrated into one of the sidewalls 21, 23. For easily passing the head 17 through the duct 6, the ring, hook etc. 38 can optionally be made out of an elastic material such as rubber. By pulling the rope 39 when inserting the head 17 into the tank 2, a position of the head 17 can be attained in which the suction opening opposite of the ring 38, here the suction opening 28 on the sidewall 23, faces down. This embodiment is particularly useful when there is only one suction opening 27 or 28, in which case no baffle 29 is needed.

[0038] By means of the apparatus 1, the tank 2 can be depleted as follows.

[0039] First, the head 17 with attached suction and pressurizing hose(s) 11, 13 is inserted into the tank 2 via any tank opening available, such as the manhole 4 or one of the ducts 6, and is lowered down to the bottom 3. Optionally the head 17 can be held and guided by pulling or withholding the rope 39 when lowering the head 17 down to the bottom 3.

[0040] Next, the pressurizing pump 12 is started to let pressurized fluid exit the propulsion openings 32. The head 17 is thus propelled in the direction F opposite to the opening direction of the propulsion openings 32 along the bottom 3 until the most remote end 40 of the tank 2 is reached.

[0041] Then, the pressurizing pump 12 is stopped. The arms 34, being spread-out after insertion of the head 17 into the tank 2 as described above, ensure a correct position of the head 17 with suction opening 27 or 28 facing down. The suction pump 9 is started and now discharges fluid, mud, sludge, or slurry from the bottom of tank 3 via the lower suction opening 27, 28 and the suction hose 11 into the waste container 10. During operation of the suction pump 12, the head 17 is retracted all the way back over the bottom 3 by slowly and carefully pulling the suction and/or pressure hoses 11, 13 from outside of the tank 2. In this way, any patches of fluid, mud, sludge, or slurry aggregating in depressions of the bottom 3 can be drained and the tank 2 can be thoroughly depleted.

[0042] Lastly, the head 17 is withdrawn through the insertion opening, here the duct 6. When passing through the duct 6, the arms 34 return to their position close to the head 17.

[0043] Optionally, the depletion of the tank 2 can be finished by spraying a binding or encapsulating agent into the tank 2 to bind or encapsulate any residual chemicals in the tank. The agent can, e.g., be sprayed by the head 17 via one or more of its openings 27, 28, 32, 36 by using the suction and/or pressure hoses 11, 13 to feed the agent to head 17. Alternatively, a separate spray gun or nozzle (not shown) can be inserted into the tank 2 via one of the tank openings 4, 6 to spray the agent into the tank 2. Such a spray gun or nozzle can, e.g., be manoeuvred around in the tank 2 in order to spray the agent onto the interior walls of the tank in order to bind or encapsulate any chemical residues on the interior tank walls and/or any chemicals dispersed as aerosols in the tank to concurrently devaporize the tank 2.

[0044] The invention is not limited to the specific embodiments disclosed herein but encompasses all variants, modifications, and combinations thereof which fall into the scope of the appended claims.

Claims

1. An apparatus (1) for depleting a tank (2), comprising a head (17) having a hose port (24), a first suction opening (27), and an inner chamber (26) connecting said hose port (24) and said first suction opening (27), **characterized in that** the head (17) has a pressurizing port (25), a propulsion opening (32), and a duct system (33) connecting said pressurizing port (25) and said propulsion opening (32).

2. The apparatus according to claim 1, **characterized in that** the propulsion opening (32) and at least one of the hose port (24) and the pressurizing port (25) lie on the same wall (18) of the head (17).

3. The apparatus according to claim 1 or 2, **characterized in that** the propulsion opening (32) is an annular opening surrounding the hose port (24) and/or pressurizing port (25).

4. The apparatus according to claim 1 or 2, **characterized by** at least two propulsion openings (32) arranged around the hose port (24) and/or the pressurizing port (25), which are connected to said pressurizing port (25) or to at least one further pressurizing port (25) via said duct system (33).

5. The apparatus according to any one of the claims 1 to 4, **characterized in that** the first suction opening (27) lies on a first side wall (21) of the head (17), and **in that** a second suction opening (28) lies on a second side wall (23) opposite of the first side wall (21) and is connected to the inner chamber (26).

6. The apparatus according to claim 5, **characterized in that** a baffle (29) is mounted in the inner chamber (26) pivotably between a first position, in which the inner chamber (26) connects the hose port (24) with only the first suction opening (27), and a second position, in which the inner chamber (26) connects the hose port (24) with only the second suction opening (28).

7. The apparatus according to claim 6, **characterized in that** the baffle (29) is pivotable about an axis (30)

which lies between the hose port (24) and the suction openings (27, 28), wherein the baffle (29) is loaded by a weight (31) at the side of the suction openings (27, 28).

8. The apparatus according to any one of the claims 5 to 7, **characterized in that** the head (17) carries at least two movable arms (34), wherein each arm (34) can be moved from a first position close to the head (17) into a second position spread-out from the head (17) in a direction transverse to the opening direction of the first and second suction openings (27, 28).

9. The apparatus according to claim 8, **characterized in that** each arm (34) is spring-loaded towards its second position.

10. The apparatus according to claim 8, **characterized in that** for each arm (34) there is a jet opening (36) on the head (17) directed towards said arm (34), which jet openings (36) are connected to said duct system (33).

11. The apparatus according to any one of the claims 1 to 10, further comprising a suction pump (9), a suction hose (11) connecting the suction pump (9) and the hose port (24), a pressurizing pump (12) for pressurizing a fluid, and at least one pressure hose (13) connecting the pressurizing pump (12) and the at least one pressurizing port (25).

12. A method of depleting a tank by means of an apparatus according to claim 11, comprising:

inserting the head (17) with attached suction and pressurizing hoses (11, 13) via a tank opening (4, 6) into the tank (2) ;
starting the pressurizing pump (12) to move the head (17) further into the tank (2) by propulsion of pressurized fluid exiting the propulsion opening(s) (32) of the head (17), while letting said hoses (11, 13) pass further through the tank opening (4, 6) into the tank (2); and
stopping the pressurizing pump (12) and starting the suction pump (9).

13. The method of claim 12, comprising the subsequent step of pulling said hoses (11, 13) through the tank opening (4, 6) out of the tank (2) while operating the suction pump (9).

14. The method of claim 12 or 13, **characterized in that** an opening of the tank (2) lying at one end of the tank (2) is used as said tank opening (6).

15. The method of any one of the claims 12 to 14, **characterized in that** the pressure of the pressurizing pump (12) is in the range of 50 - 300 bar, preferably in the range of 100 - 200 bar.

16. The method of any one of the claims 12 to 15, **characterized by** the subsequent step of spraying a binding or encapsulating agent into the depleted tank, preferably onto the interior walls of the depleted tank.

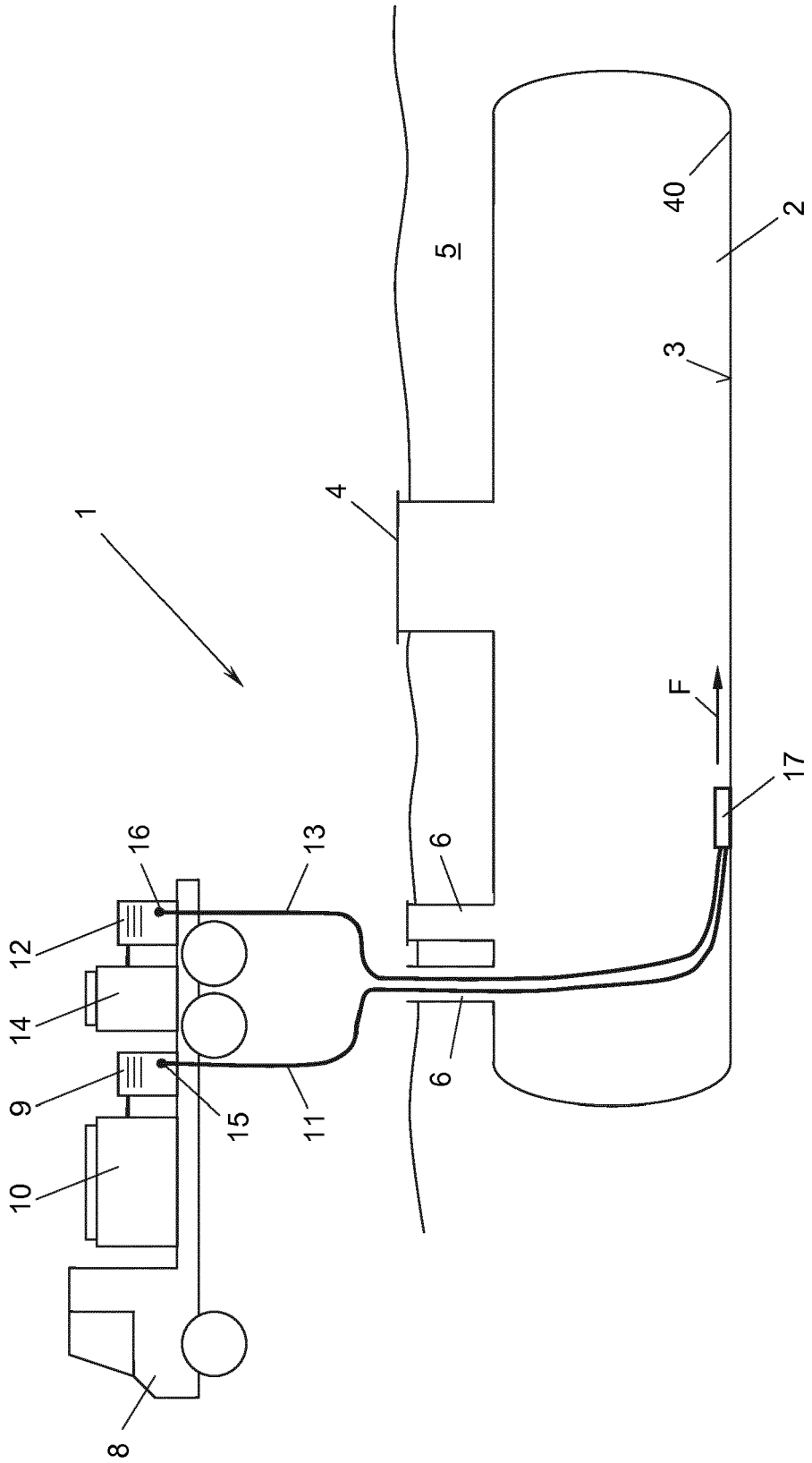

Fig. 1

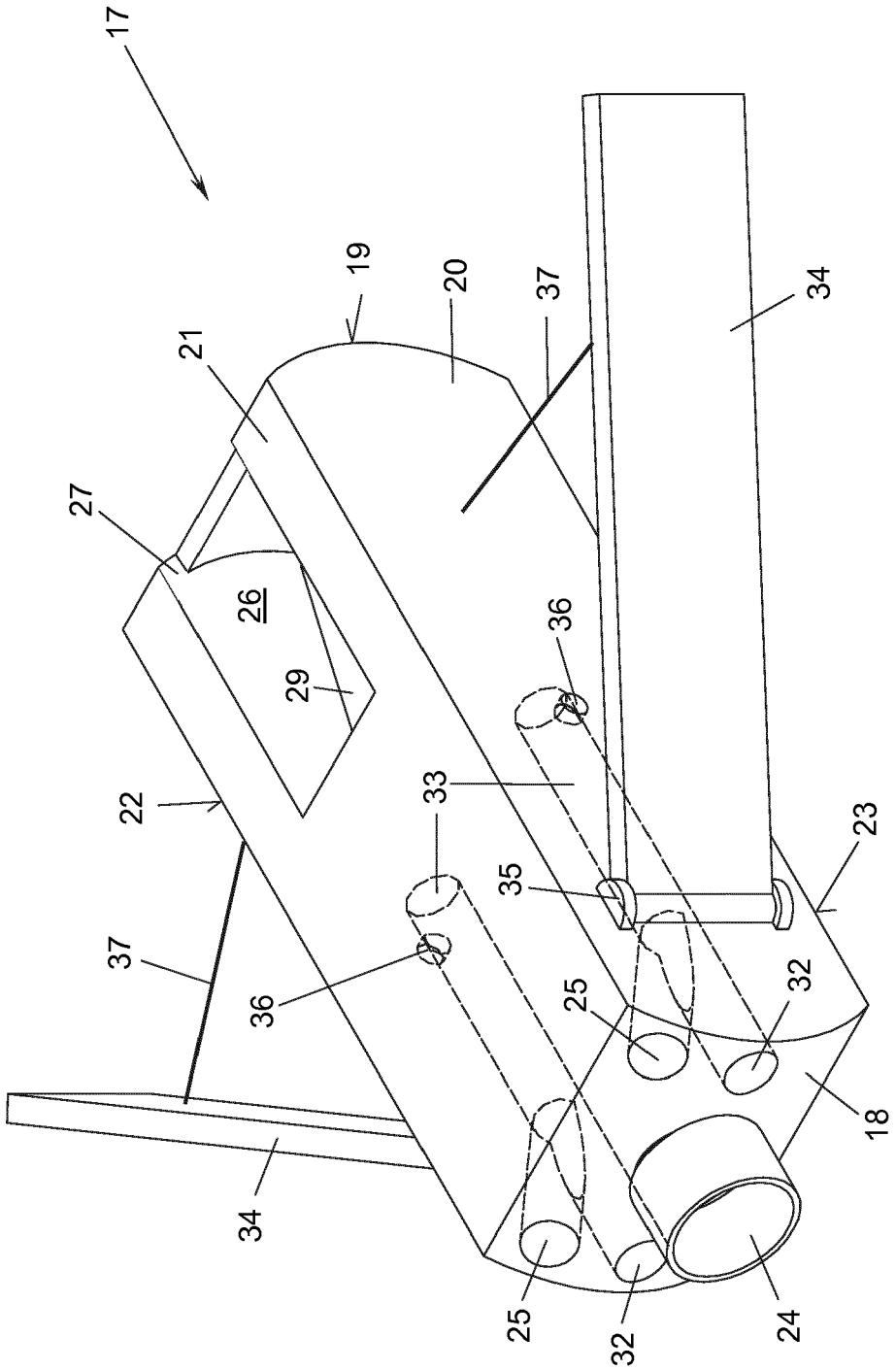

Fig. 2

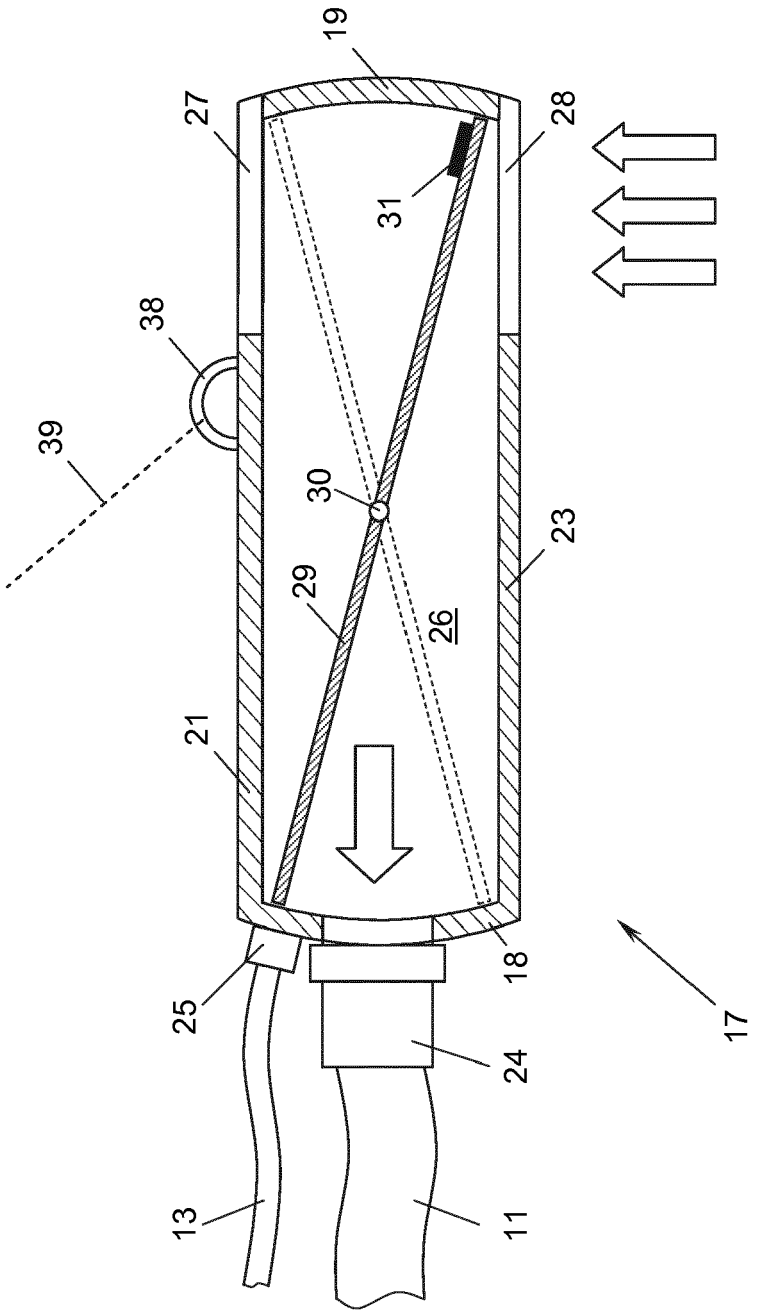

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 8565

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	Claq Wasserfilteranlagen: "CLAQ Wasserfilteranlagen", , 13 February 2006 (2006-02-13), XP055353423, Retrieved from the Internet: URL:http://www.claq.at/schlammsauger.html [retrieved on 2017-03-09]	1,2,5,11	INV. B08B9/035 A47L7/00 B08B9/04 B08B9/08 B65D88/54
Y	* the whole document *	4	
Y	US 5 985 156 A (HENKIN MELVYN L [US] ET AL) 16 November 1999 (1999-11-16) * column 1, lines 18,19,47 - column 2, line 54 * * column 3, line 6 - column 7, line 10 * * column 8, line 32 - column 10, line 37; figures 1-8 * * column 15, line 28 - column 17, line 45 *	4	
A	DE 101 31 419 A1 (LOBBE TANKSCHUTZ GMBH [DE]) 16 January 2003 (2003-01-16) * paragraphs [0001] - [0116]; claims 1-37; figures 1-30 *	1-16	TECHNICAL FIELDS SEARCHED (IPC) B08B A47L B65D
A	US 2008/236628 A1 (HORVATH TIBOR [US] ET AL) 2 October 2008 (2008-10-02) * paragraphs [0053] - [0121]; claims 1-31; figures 1-35 *	1,6,7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 March 2017	Psoch, Christian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 16 8565

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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16-03-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5985156 A	16-11-1999	AT 324194 T	15-05-2006
		AU 715666 B2	10-02-2000
		CA 2258746 A1	31-12-1997
		CA 2258842 A1	31-12-1997
		EP 0907814 A1	14-04-1999
		EP 1695770 A1	30-08-2006
		NZ 333404 A	23-06-2000
		NZ 333405 A	28-01-2000
		US 5985156 A	16-11-1999
		WO 9749882 A1	31-12-1997
DE 10131419 A1	16-01-2003	DE 10131419 A1	16-01-2003
		WO 03002275 A1	09-01-2003
US 2008236628 A1	02-10-2008	AU 2009260864 A1	23-12-2009
		CN 102037198 A	27-04-2011
		EP 2279313 A1	02-02-2011
		IL 208293 A	28-05-2014
		US 2008236628 A1	02-10-2008
		WO 2009154662 A1	23-12-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82