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(71) Applicant and

(72) Inventor: **PETTERSSON, Fredrik** [SE/SE]; Klippan 1H,
Läg. 1001, S-414 51 Göteborg (SE).

(74) Agent: **CEGUMARK AB**; P.O. Box 53047, S-400 14
Göteborg (SE).

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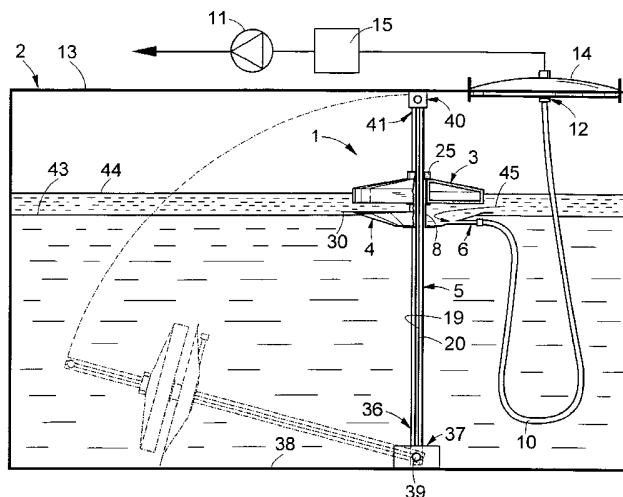
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(54) Title: DEVICE AND METHOD FOR SEPARATING FLOATING SLUDGE OIL FROM WATER IN A STORAGE TANK



(57) Abstract: A device (1) and a method for separation of floating sludge oil from water in a storage tank (2) for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function. The device (1) comprises a flotation body (3) which together with a receiving vessel (4) for the sludge oil mounted adjacent to the flotation body (3) is slidably attached along a guide rod (5) extending in the height direction of the storage tank (2). An evacuation conduit (6) for the sludge oil is positioned adjacent to a bottom portion (7) of the receiving vessel (4). The device (1) is particularly characterized in: that the flotation body (3) and the receiving vessel (4) are attached to a common slide sleeve (8), said slide sleeve being non-rotationally mounted relative to the guide rod (5) by means of rotation locking means (9); and that the evacuation conduit (6) includes a flexible suction hose (10) coupled to a suction pump (11) arranged for sucking up the sludge oil, said suction pump (11) being positioned outside of the storage tank (2).

Device and method for separating floating sludgeoil from water in a storage tank

TECHNICAL FIELD

The present invention relates to a device and a method for separation of floating sludge oil from water in a storage tank, often referred to as a sludge tank, for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function. Such a storage tank or sludge tank contains oil waste products mixed with water. The liquid level in this tank often varies markedly, and hence the device is adapted to follow these marked level changes and simultaneously perform effectively as an oil separator. The invention is adapted for operation at sea with sea motion as a natural environmental factor.

BACKGROUND

An increased environmental awareness has brought forward very restrictive demands on the maximum allowed oil content in so called bilge water, which may be pumped overboard from ships. In order to meet these demands, many ships have been provided with highly effective bilge water separators. Bilge water is volumes of water which is generated during the normal operation of the ship, and originates for example from condensation and washing water. The bilge water separators effectively remove the oil content in the bilge water all the way down to zero ppm. A drawback is, however, that a large amount of oil-containing water is generated in this process, which has to be lead down in a sludge tank prior to being pumped ashore for further processing. It is both costly and time consuming to get rid of this oil-containing water by means of currently available systems.

Sludge oil which enters the sludge tank originates from separation of the fuel used by the ship's motors for propulsion and generation of electricity. When using crude oil as fuel,

between 1 – 2 % of the ship's bunker oil will end up in the sludge tank as a waste product from cleaning the fuel in the centrifugal separators. The sludge oil has a sticky but flowing consistency and may advantageously be burnt onboard in the ship's incinerator or may alternatively be pumped ashore in a more concentrated form. The reason why the sludge oil is not used in the ship's motor, is the content of solid particles and other dirt which will impede an effective injection.

Currently, the separation of sludge oil and water in these sludge tanks aboard a ship, is traditionally performed in the same way as it was 100 years ago. Current oil separation of sludge oil is carried out in such a way that the mix of oil and water is pumped up in a high tank in which it is later settled by gravitation. The water in lower regions of this high tank is drained away whilst the sludge oil is left in the tank to be burnt later in the ship's incinerator or to alternatively be pumped ashore in a more concentrated form. A problem with this method is that the process is very time consuming with long lead times, and that the method may not suitably be performed in heavy seas since this will interrupt the settling process, resulting in an even longer lead time. Current processing methods also result in that pure water, which has not yet been mixed to an oil emulsion as it enters the sludge tank, will be whipped into a hardly soluble emulsion. Emulsions of this kind will be very hard to divide into oil and water by settling in a high tank.

Other examples of known solutions for separating oil from the sludge tank onboard a ship is to use a centrifugal separator. Also, small separator units are used, which include an elongated cylindrical tank in which the sludge oil/water mix is left to settle, in a similar way as described above in the context of settling in a high tank. The difference between these small separator units and a high tank is that the separator units are placed in the immediate vicinity of the sludge tank, but at a higher level than the sludge tank. In some cases, chemicals are added to speed up the settling process. However, the problem remains also in these cases. The centrifugal separator sucks from the bottom layer of the sludge tank, which results in water being separated out and not sludge oil. The purified water is pumped into a bilge water tank and the separated sludge oil is collected in a barrel

which is then brought ashore as problem waste. This operation involves a lot of onboard manual heavy labour when handling the filled oil barrels.

The current traditional solutions are thus directed towards removing the *water* from the content of the sludge tank. A known device, which instead is directed towards pumping out the *sludge oil* instead of the water, is described in the Swedish patent No. 23620 to A.E. Andersson, which patent was published as early as 1907. However, this solution suffers from several serious practical drawbacks, which resulted in that the solution never reached practical use. One such drawback with the Andersson patent is that the device is directed towards evacuation by means of gravitationally induced oil drainage through a drainage pipe exiting directly in the side of the ship's hull. A sludge tank, however, is normally positioned adjacent to the ship's bottom, which means that it is impossible to drain of the surface oil layer by means of gravitation in such a tank, not to mention the environmentally reprehensible and currently prohibited overboard dumping of oil. Another drawback of the Andersson device is that the flotation body is allowed to rotate freely about a vertical rod, which means that the evacuation conduit is subjected to very large stress at sea. This solution therefore requires frequent maintenance and has an inherent risk of conduit failure and high maintenance costs.

SUMMARY OF THE INVENTION

According to the above-described background, there thus exists a need for pumping out the sludge oil from a sludge tank containing sludge oil and water. In order to fulfil this need, a device is required which always follows the level of the tank content. The sludge oil floats on the water surface and the suction hose must thus be positioned close to the surface of the tank content. The device of this invention is designed to operate within the sludge tank by continuously following the level of the tank content. Hereby, the sludge oil may be pumped out of the sludge tank and up to a high tank in order to be subsequently burnt, without having to also transport large amounts of water.

By means of the invention, it is possible to suck out the sludge oil and leave the water in the sludge tank. The sludge oil is continually burnt onboard in small quantities and hereby, the lead time is shortened from the point where sludge oil has been generated onboard to the point where the sludge oil has been burnt onboard. Thus, the invention enables a shortening of the lead time compared to current the available, traditional solutions.

The content of the sludge tank, which in maritime terminology is simply referred to as "sludge", consists mainly of water, often by 70 % or more. Hence, it is easier to remove the sludge oil from the sludge tank since the quantity is less than the quantity of water in the tank. The continuous onboard burning of the sludge oil will vacate tank capacity which would otherwise have been occupied when using traditional methods.

It is primarily the increased use of highly effective bilge water separators that has created the need for an effective sludge oil separation. Other factors involve the ship's size and the corresponding engine effect which demands enormous quantities of bunker oil consisting of an ever decreasing quality.

Thus, the invention provides a device for separation of floating sludge oil from water in a storage tank for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function. The device comprises a flotation body which – together with a receiving vessel for the sludge oil mounted adjacent to the flotation body – is slidably attached along a guide rod extending in the height direction of the storage tank. An evacuation conduit for the sludge oil is provided, said evacuation conduit being positioned adjacent to a bottom portion of the receiving vessel. The device according to the invention, is particularly characterized in:

- that the flotation body and the receiving vessel are attached to a common slide sleeve, said slide sleeve being non-rotationally mounted relative to the guide rod by means of rotation locking means, and
- that the evacuation conduit includes a flexible suction hose coupled to a suction pump arranged for sucking up the sludge oil, said suction pump being positioned outside of the storage tank.

In a favourable embodiment, said rotation locking means includes a guide projection extending radially inwards, said guide projection being adapting for sliding, rotation-locking engagement with a slot extending along the guide rod.

Furthermore, in an advantageous embodiment of the invention, the guide rod is formed as a hollow pipe, whereby the slot extends along the entire length of the hollow pipe.

In an alternative embodiment of the invention, said rotation locking means includes a guide projection extending radially outwards, said guide projection being adapted for a sliding, rotation-locking engagement with a slot extending along the slide sleeve.

A preferred embodiment, in which the flotation body and the receiving vessel exhibit a substantially circular shape in a horizontal plane, is characterized in that the diameter of the receiving vessel exceeds the diameter of the flotation body.

This embodiment is further characterized in:

- that the flotation body is positioned above the receiving vessel and exhibits a substantially planar lower surface, and
- that the receiving vessel – in a vertical plane – exhibits a substantially conical, bowl-shaped portion, whereby a radially outwardly narrowing gap is defined between the lower surface of the flotation body and the conically bowl-shaped portion of the receiving vessel.

Furthermore, in a favourable embodiment, the receiving vessel exhibits a planar, annular edge portion positioned radially outside of said conically bowl-shaped portion.

In one embodiment, the evacuation conduit is mounted in the receiving vessel, but it may alternatively be mounted in a through-hole in the flotation body.

The suction pump is preferably positioned above the storage tank, whereby the suction hose extends through an opening in the top of the storage tank.

An embodiment which is advantageous from a maintenance point of view, is characterized in:

- that the guide rod is foldably arranged between a first, erect position of use and a second, folded service position, by means of a mounting foot affixed to the bottom of the storage tank, and
- that the guide rod further exhibits a connection means at its upper end portion for affixing the guide rod to the top of the storage tank in said erect position of use, said connecting means being disconnectably arranged for folding the guide rod to said service position.

Furthermore, the inner dimension of the slide sleeve suitably exceeds the outer dimension of the guide rod in such a way that a gap for water and sludge oil is defined therebetween for lubrication between the slide sleeve and the guide rod.

The flotation body is preferably shaped in such a way as to form a spray hood above the receiving vessel.

The invention also provides a method for separation of floating sludge oil from water in a storage tank for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function. A flotation body which – together with a receiving vessel for the sludge oil mounted adjacent to the flotation body – follows the movements of the water surface in the vertical plane, whilst sliding along a guide rod extending in the height direction of the storage tank. The sludge oil is evacuated via an evacuation conduit which is positioned adjacent to a bottom portion of the receiving vessel. The method is particularly characterized in:

- that the sludge oil is pumped out of the storage tank by means of a suction pump positioned outside of the storage tank, through a flexible hose included in said evacuation conduit, and
- that the evacuation conduit is prevented from being twisted around the guide rod by rotation locking the flotation body and the receiving vessel relative to

the guide rod, by means of rotation-locking means on a common slide sleeve at which the flotation body and the receiving vessel is attached.

Upon servicing, the guide rod is folded down from a first, erect position of use to a second, folded service position by disconnecting a connection means between the upper portion of the guide rod and the top of the storage tank. The guide rod is then folded to its service position about a mounting foot, which mounting foot is hinged to a lower end portion of the guide rod and affixed to the bottom of the storage tank.

Through use of the invention, the sludge oil is removed directly at the water surface in the sludge tank. By continually pumping out the sludge oil from the sludge tank in this way, the level may be effectively maintained in the tank and the effectiveness may be increased by shortening the lead time for the removal of sludge oil. The sludge oil may then be further separated for onboard burning in the ship's incinerators. The onboard effectiveness of the ship may be increased by using up a larger portion of the fuel whilst the quantities of the oil-containing water to be transported ashore, will decrease.

The invention is adapted for use in conditions characterized as dirty, corrosive and hot (temperatures around 70° Celsius). The device is designed to withstand these conditions without the need for more frequent maintenance than is normally required for cleaning and inspection of the tanks.

DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be described in greater detail below, with reference to the accompanying drawings, in which:

Fig. 1 shows a diagrammatic side view of a device for separation of floating sludge oil from water in a storage tank for sludge oil and water, according to a first embodiment of the invention;

- Fig. 2 shows an enlarged, broken, partly cross-sectional side view of the oil-separating device according to the embodiment previously shown in fig. 1, said device including a flotation body;
- Fig. 3 shows an enlarged cross-sectional view along the dash-dotted line III-III in fig. 2, where the rotation-locking means includes a guide projection extending radially inwards, said guide projection being adapted for a sliding, rotation-locking engagement with a slot extending along the guide rod;
- Fig. 4 shows a second embodiment of the invention, in which the evacuation conduit is mounted in a through-hole in the flotation body, and
- Fig. 5 finally shows an alternative embodiment of the rotation-locking means including a guide projection being adapted for a sliding, rotation-locking engagement with a slot extending along the slide sleeve.

DESCRIPTION OF PREFERRED EMBODIMENTS

In fig. 1, reference numeral 1 generally denotes a device for separation of floating sludge oil from water in a storage tank for petrochemical waste products, typically onboard a ship (not shown) or in a land based facility with a similar function. It should be noted that the storage tank 2 is diagrammatically drawn.

The device 1 will not initially be described with reference to the overview fig. 1 and the enlarged, partly cross-sectional view in fig. 2. The device 1 hereby includes a flotation body 3, which – together with a receiving vessel 4 for the sludge oil mounted adjacent to the flotation body 3 – is slideably attached along a guide rod 5 extending in the height direction of the storage tank 2. The device 1 further includes an evacuation conduit 6 for the sludge oil, said evacuation conduit 6 being positioned adjacent to a bottom portion 7 of the receiving vessel 4. The flotation body 3 and the receiving vessel 4 are both attached to a common slide sleeve 8, which is non-rotationally mounted relatively to the guide rod 5 by

means of rotation-locking means 9, as shown in fig. 2. Furthermore, the evacuation conduit 6 includes a flexible suction hose 10 coupled to a suction pump 11 arranged for sucking up the sludge oil. The suction pump 11 is positioned outside of the storage tank 2 and may for example consist of a pneumatically driven diaphragm pump. In the embodiment shown in fig. 1, the suction pump 11 is diagrammatically drawn outside of and above the storage tank 2, whereby the suction hose 10 extends through an opening 12 in the top 13 of the storage tank 2. In the shown example, the opening 12 is more particularly positioned in a hatch 14 placed in the top 13 in the storage tank 2. A suction filter 15 is positioned upstreams of the suction pump 11. The suction hose 10 may be made of reinforced rubber or a rubber-like plastic material.

As is clearly shown in Fig. 3, said rotation-locking means 9 includes a guide projection 16 extending radially inwards, the guide projection 16 is, in the shown example, welded to a slot 17 formed in the glide sleeve 8, by means of two weld seams 19 positioned on the outside of the glide sleeve. Thereby, the guide projection 16 is adapted for a sliding, rotation-locking engagement with a slot 19 extending along the guide rod 5. From fig. 3, it is further shown that the guide rod 5 is formed as a hollow pipe 20 in the shown example. In fig. 1, it is shown that the slot 19 extends along the entire length of the guide rod 5.

The flotation body 3, the receiving vessel 4 and the glide sleeve 8 will now be described in closer detail with reference to the enlarged, partly cross-sectional view in fig. 2. Thus, the flotation body 3 and the receiving vessel 4 exhibit a substantially circular shape in a horizontal plane (i.e. perpendicular to the plane of the drawing sheet). In fig. 2 it is hereby shown that the diameter of the receiving vessel 4 exceeds the diameter of the flotation body 3. In order to enable a simplified mounting and an improved service availability, the outer diameter of the receiving vessel 4 is adapted in such a way that the device 1 may be inserted into – or removed from – the storage tank 2 through the hatch 14. Further, the flotation body 3 is positioned above the receiving vessel 4 and exhibits a substantially planar lower surface 21. In the shown example the flotation body 3 is hollow and exhibits a cylindrical sleeve surface 22 extending upwardly from said lower surface 21 to a slightly conical top surface 23. The conical top surface 23 on the flotation body 3 facilitates

drainage of sludge oil deposited on top of the flotation body 3, and it also provides a spray hood over the receiving vessel 4, which prevents surface disturbances in heavy sea motion to interrupt the flow into the receiving vessel 4. The flotation body 3 rests with its lower surface 21 on an annular upper shelf 24 which projects from the slide sleeve 8. The flotation body 3 is hereby fixed to the slide sleeve 8 by means of a nut 25 which is in a threaded engagement with an upper threaded portion 26 on the slide sleeve 8. Thus, the flotation body 3 exhibits a central, cylindrical hole 27, through which the slide sleeve 8 extends.

The receiving vessel 4 exhibits, as is clearly shown in fig. 2, a substantially conical, bowl-shaped portion 28 in a vertical plane. Hereby, a radially outwardly narrowing gap 29 is defined between the lower surface 21 of the flotation body 3 and the conically bowl-shaped portion 28 of the receiving vessel 4. Furthermore, the receiving vessel 4 exhibits a planar, annular edge portion 30 positioned radially outside of said conically bowl-shaped portion 28. The fact that the narrowing gap 29 is at its narrowest adjacent to the outer diameter of the flotation body 3 and the transition of the bowl-shaped portion 28 in said edge portion 30, results in a local reduction in pressure for an improved suction effect. The planar, annular edge portion 30 of the receiving vessel 4, hereby prevents water from being sucked into the receiving vessel 4, at the same time as an advantageous laminar flow of sludge oil is obtained.

In the embodiment shown in fig. 1 and 2, the evacuation conduit 6 is mounted on the receiving vessel 4, more particularly in the conically bowl-shaped portion 28, via a fixed pipe section 31. The suction hose 10 is thereby coupled via a quick-attach coupling 32 to the fixed pipe section 31. The bottom portion 7 of the receiving vessel 4 is annular and planar with a central-through-going hole 33 for the slide sleeve 8. Hereby, the receiving vessel 4 rests with its bottom portion 7 against a lower annular shelf 34 on the slide sleeve 8. In the shown example, the receiving vessel 4 is attached to the slide sleeve 8 by means of several screw joints 35 through the bottom portion 7 and the shelf 34 respectively. Alternatively, the receiving vessel 4 may be attached to the slide sleeve 8 in a number of various ways such as for example snap joints (not shown).

In fig.1, it is further shown that the guide rod 5 is foldably arranged between a first, erect position of use (shown with fully drawn lines) and a second, folded service position (shown with dash-dotted lines), to the left in the figure. Hereby, the guide rod 5 is hinged, at a lower end portion 36, via a mounting foot 37 to the bottom 38 of the storage tank 2. The guide rod 5 is hereby intended to be folded about they folding axis 39 being perpendicular to the guide rod 5.

The guide rod 5 further exhibits a connection means 40 at its upper end portion 41 for affixing the guide rode 5 to the top 13 of the storage tank 2 in said erect position of use. The connection means 40 is hereby disconnectably arranged for folding the guide rod 5 to said folded service position.

As is clearly shown in fig. 3, the inner dimension of the slide sleeve 8 exceeds the outer dimension of the guide rod 5 in such a way that a gap 42 for water and sludge oil is defined therebetween for lubrication between the slide sleeve 8 and the guide rod 5. In an alternative, not shown embodiment, glide bearings (not shown) may be positioned between the glide sleeve 8 and the guide rod 5.

In figure 1, a water surface 43 is shown along with a sludge oil surface 44 at a level slightly above said water surface 43. The flotation body 3 is dimensioned in such a way that the annular edge portion 30 on the receiving vessel 4 is positioned in or slightly above the water surface. The surface layer of sludge oil which is thus defined between the water surface 43 and the sludge oil surface 44, is normally between 3-5 centimeters in thickness. The vertically slideable unit comprised of the flotation body 3, the slide sleeve 8 and the receiving vessel 4. hereby follows the movements of water surface 43 in the vertical plane, during a sliding movement along the guide rod. By means of the suction pump 11, a suction is created in the evacuation conduits, whereby the sludge oil via the receiving vessel 4 and the evacuation conduits 6, according to the arrow 45 in fig 1. The evacuation conduit 6 includes, as mentioned earlier, a flexible suction hose 10, which is made in such a way that it smoothly follows the vertical movements of the receiving vessel 4 and also

allows a folding of the device 1 to its folded service position. Alternatively, the length of the suction hose 10 may be adapted to only follow the vertical movements of the receiving vessel 4, whereby the suction hose 10 is disconnected from the receiving vessel 4 by means of the quick-release coupling 32 before folding the device 1 to its service position. An essential feature of the invention is that the evacuation conduit 6 – during pumping – is prevented from being twisted about the guide rod 5 by rotation-locking of the flotation body 3 and the receiving vessel 4 relative to the guide rod 5 by means of the rotation-locking means 9, i.e. the guide projection 16.

In fig. 4, an alternative embodiment of the invention is shown, in which the evacuation conduit 6 is mounted in a through-hole 46 in the flotation body 3. The evacuation conduit 6 has a suction entrance 47 positioned adjacent to the bottom portion 7 of the receiving vessel 4. This solution may advantageously be used in storage tanks 2 of lesser dimensions, since the evacuation conduit 6, in these cases, takes up less sideways space. In this embodiment, the flotation body 3 is furthermore homogenously made in a porous cellular foam material, as opposed to the hollow flotation body 3 which is shown in fig. 1 and 2.

In fig. 5 an alternative embodiment of the rotation-locking means 9 is shown, which includes a guide projection 48 extending radially outwards, said guide projection 16 being adapted for a sliding, rotation-locking engagement with a slot 19 extending along the slide sleeve 8. The guide projection 48 is fixedly attached to the guide rod 5 by means of two weld seams 50.

The invention is not limited to the embodiment shown on the drawings and described above, but may freely be varied within the scope of the accompanying claims.

CLAIMS

1. A device (1) for separation of floating sludge oil from water in a storage tank (2) for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function, comprising a flotation body (3) which - together with a receiving vessel (4) for the sludge oil mounted adjacent to the flotation body (3) - is slidably attached along a guide rod (5) extending in the height direction of the storage tank (2), and an evacuation conduit (6) for the sludge oil, said evacuation conduit (6) being positioned adjacent to a bottom portion (7) of the receiving vessel (4),

characterized in:

- that the flotation body (3) and the receiving vessel (4) are attached to a common slide sleeve (8), said slide sleeve being non-rotationally mounted relative to the guide rod (5) by means of rotation locking means (9), and
- that the evacuation conduit (6) includes a flexible suction hose (10) coupled to a suction pump (11) arranged for sucking up the sludge oil, said suction pump (11) being positioned outside of the storage tank (2).

2. A device (1) according to claim 1, **characterized in** that said rotation locking means (9) includes a guide projection (16) extending radially inwards, said guide projection (16) being adapted for a sliding, rotation-locking engagement with a slot (19) extending along the guide rod (5).

3. A device (1) according to claim 2, **characterized in** that the length of the slot (19) substantially corresponds to the length of the guide rod (5).

4. A device (1) according to claim 2 or 3, **characterized in** that the guide rod (5) is formed as a hollow pipe (20), and that said slot (19) extends along the entire length of said hollow pipe (20).
5. A device (1) according to claim 2, **characterized in** that said rotation locking means (9) includes a guide projection (48) extending radially outwards, said guide projection (16) being adapted for a sliding, rotation-locking engagement with a slot (19) extending along the slide sleeve (8).
6. A device (1) according to one or more of the preceeding claims, wherein the flotation body (3) and the receiving vessel (4) exhibit a substantially circular shape in an horizontal plane, **characterized in** that the diameter of the receiving vessel (4) exceeds the diameter of the flotation body (3).
7. A device (1) according to claim 6, **characterized in:**
- that the flotation body (3) is positioned above the receiving vessel (4) and exhibits a substantially planar lower surface (21), and
 - that the receiving vessel (4) - in a vertical plane - exhibits a substantially conical, bowl-shaped portion (28), whereby a radially outwardly narrowing gap (29) is defined between the lower surface (21) of the flotation body (3) and the conically bowl-shaped portion (28) of the receiving vessel (4).
8. A device (1) according to claim 7, **characterized in** that the receiving vessel (4) exhibits a planar, annular edge portion (30) positioned radially outside of said conically bowl-shaped portion (28).
9. A device (1) according to one or more of the preceeding claims, **characterized in** that the evacuation conduit (6) is affixed to the receiving vessel (4).
10. A device (1) according to one or more of claims 1 - 8, **characterized in** that the evacuation conduit (6) is mounted in a through-hole (46) in the flotation body (3).

11. A device (1) according to one or more of the preceeding claims, **characterized in** that the suction pump (11) is positioned above the storage tank (2), whereby the suction hose (10) extends through an opening (12) in the top (13) of the storage tank (2).

12 . A device (1) according to one or more of the preceeding claims, **characterized in:**

- that the guide rod (5) is foldably arranged between a first, erect position of use and a second, folded service position, by means of a mounting foot (37) affixed to the bottom of the storage tank (2), and
- that the guide rod (5) further exhibits a connection means (40) at its upper end portion (41) for affixing the guide rod (5) to the top (13) of the storage tank (2) in said erect position of use, said connecting means (40) being disconnectably arranged for folding the guide rod (5) to said service position.

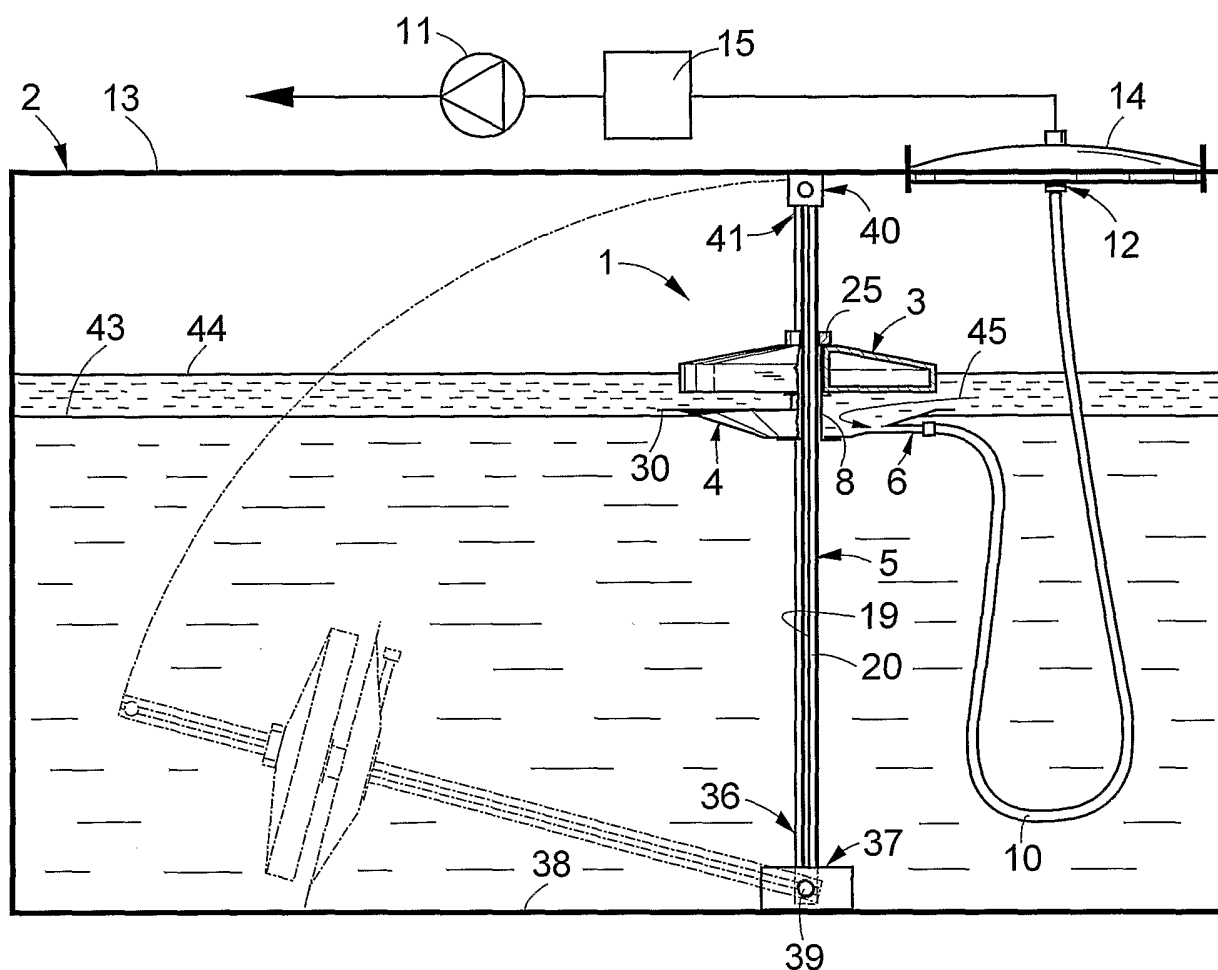
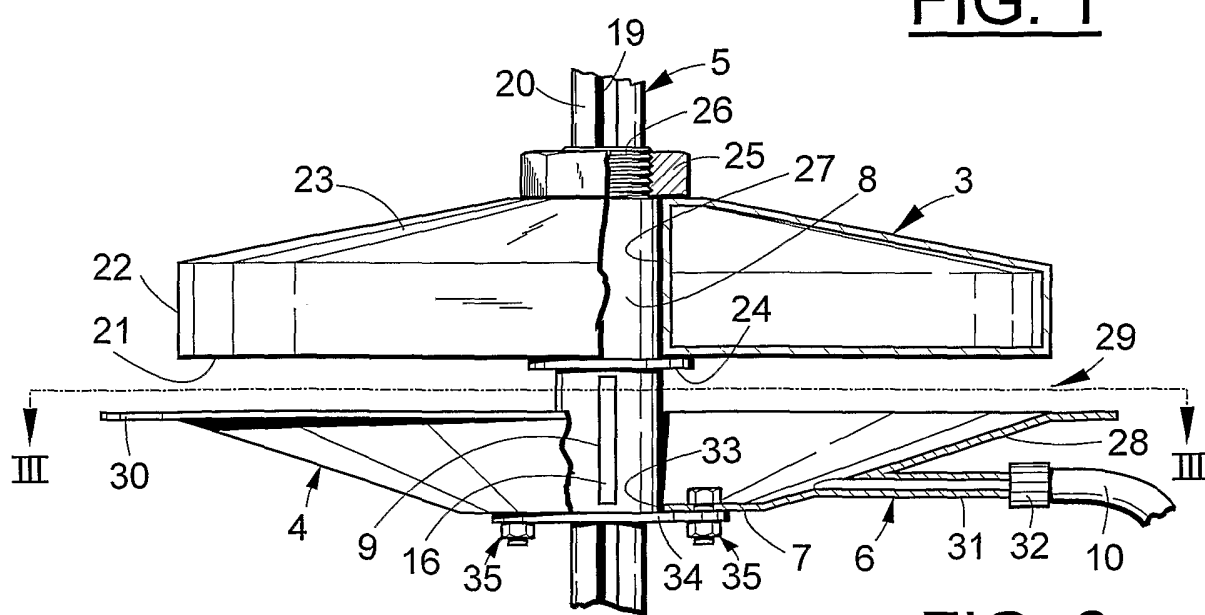
13. A device (1) according to one or more of the preceeding claims, **characterized in** that the inner dimension of the slide sleeve (8) exceeds the outer dimension of the guide rod (5) in such a way that a gap (42) for water and sludge oil is defined therebetween for lubrication between the slide sleeve (8) and the guide rod (5).

14. A device (1) according to one or more of the preceeding claims, **characterized in** that the flotation body (3) is shaped in such a way as to form a spray hood above the receiving vessel (4).

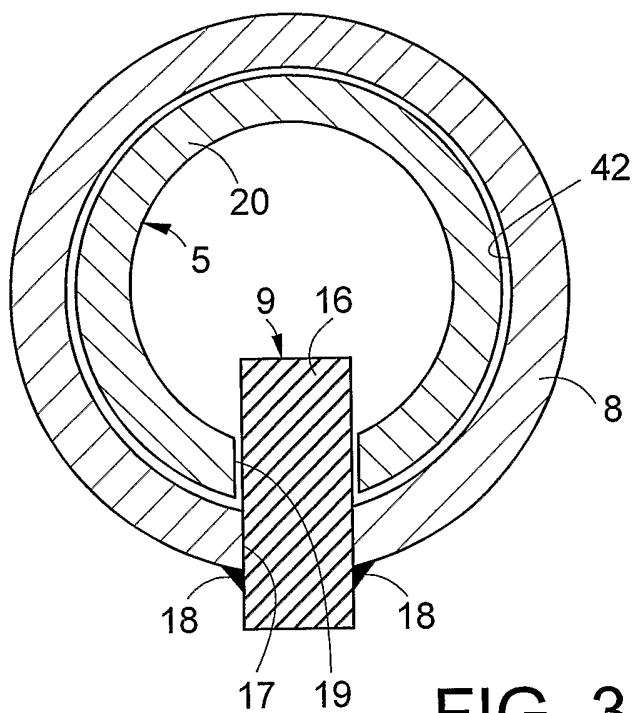
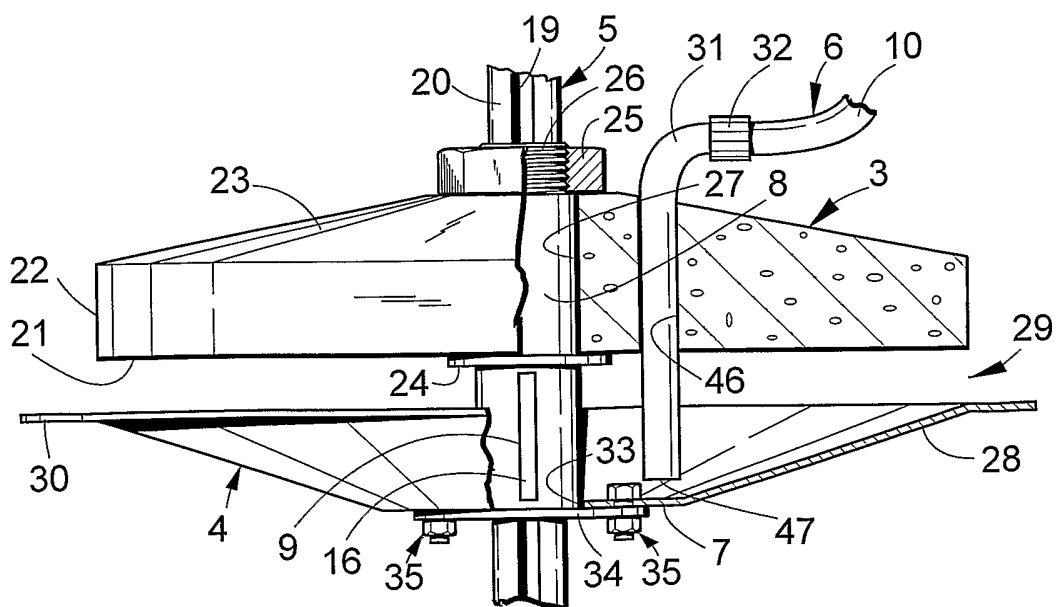
15. A method for separation of floating sludge oil from water in a storage tank (2) for petrochemical waste products, typically onboard a ship or in a land based facility with a similar function, wherein a flotation body (3) which - together with a receiving vessel (4) for the sludge oil mounted adjacent to the flotation body (3) - follows the movements of the water surface (43) in the vertical plane, whilst sliding along a guide rod (5) extending in the height direction of the storage tank (2), whereby the sludge oil is evacuated via an evacuation conduit (6) which is positioned adjacent to a bottom portion (7) of the receiving vessel (4), **characterized in:**

- that the sludge oil is pumped out of the storage tank (2) by means of a suction pump (11) positioned outside of the storage tank (4), through a flexible hose (10) included in said evacuation conduit (6), and
- that the evacuation conduit (6) is prevented from being twisted around the guide rod (5) by rotation locking the flotation body (3) and the receiving vessel (4) relative to the guide rod (5), by means of rotation locking means (9) on a common slide sleeve (8) at which the flotation body (3) and the receiving vessel is attached.

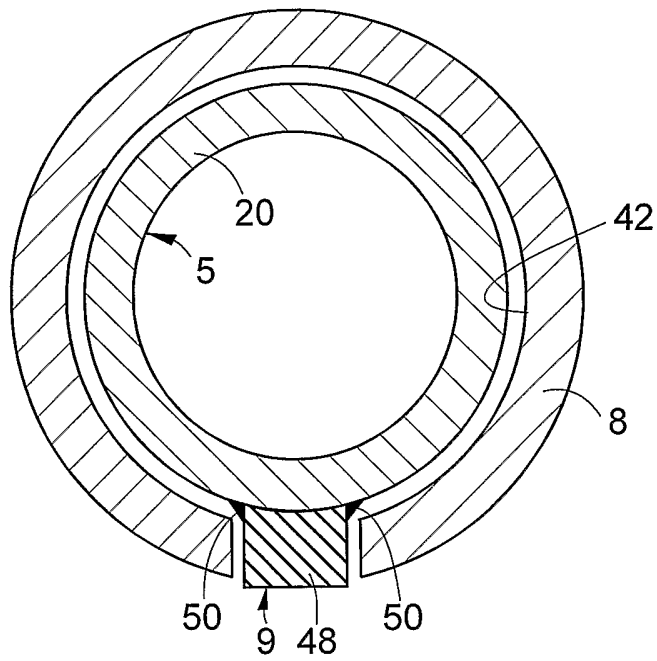
16. A method according to claim 15, **characterized in** that the guide rod (5) - upon servicing - is folded down from a first, erect position of use to a second, folded service position by disconnecting a connection means (40) between the upper portion (41) of the guide rod (5) and the top (13) of the storage tank (2), whereafter the guide rod (5) is folded to its service position about a mounting foot (37), which mounting foot (37) is hinged to a lower end portion (36) of the guide rod (5) and affixed to the bottom (38) of the storage tank (2).

FIG. 1FIG. 2

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FIG. 3FIG. 4

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FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/01482

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C02F 1/40, B01D 17/032

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C02F, B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI DATA, EPO-INTERNAL, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 23620 C (A.E. ANDERSSON), 13 March 1906 (13.03.06), see the whole document --	1-16
A	GB 983060 A (SIMMERING-GRAZ-PAUKER AKTIENGESELLSCHAFT FÜR MASCHINEN-KESSEL-UND WAGGONBAU), 10 February 1965 (10.02.65), see the whole document --	1-16
P,A	US 6358409 A (WILLIAM L. JACOBY, JR. ET AL), 19 March 2002 (19.03.02), column 4, line 19 - column 6, line 10, figures 1,2,5 -- -----	1-16

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

21 November 2002

25-11-2002

Name and mailing address of the ISA/

Authorized officer

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Jens Waltin/ELY

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE 02/01482

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
SE	23620	C	13/03/06	NONE		

GB	983060	A	10/02/65	AT	231300 B	27/01/64
				CH	415331 A	15/06/66

US	6358409	A	19/03/02	NONE		
