separation tank. However, this system is quite cumbersome and difficult to adjust. Also, it is very difficult, if not impossible, to scale down.

There are many kinds of mechanical separating arrangements to separate water and the waste, liquid or solid. These arrangements usually comprise tanks and weirs and such structures that collect waste material. These structures have in common that the water must flow, and that the speed of the flow should be adjusted according to the kind of waste that the water contains and the amount of waste contained in the water. However, this flow is quite hard to control. Many arrangements first gather contaminated water from a large area using, for example, booms or spreading bars on the surface of the water, and this gathered water is cleaned using separating arrangements. Thus the gathered water contains lot of waste, resulting in clogging or obstructions form in the separating arrangement. The obstructions can stop the device and it has to be manually cleaned. Also, the waste in the separating arrangement can stick to the walls of the separating arrangements before the waste is separated from the water, i.e. the contaminated water is moved in the cleaning process.

There is a clear need for a waste-collection device for use in bodies of water such as at sea that collects all kinds of waste material floating on or near the surface, and which device does not easily clog.

BRIEF DESCRIPTION

Embodiments of the invention can significantly reduce the disadvantages and drawbacks of the prior art. In particular, embodiments of the invention provide a separating arrangement for a cleaning device that can separate both solid and liquid waste and do not clog.

According to a first aspect of the present invention, there is provided a separating arrangement for a device for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, and the separating arrangement included a first basin, an opening in the first basin, a separating means, and a collector arrangement for collecting the water and waste and a transfer arrangement for transferring the collected water and waste to the separating arrangement comprising a base pipe, which is configured to extend from the collector arrangement to the opening and a pressure pipe for forcing a jet of water into the base pipe when the device is in use, and the separating means is configured to separate at least a part of the waste from the water from the first basin, and, and the width of the first basin is at least three times the diameter of the opening or more, characterised in that the collector arrangement is a funnel comprising a hole in the bottom of the funnel, and the transfer arrangement comprises a vertical suction pipe connected to the hole of the collector arrangement, and the base pipe is connected to the suction pipe under the funnel, and the pressure pipe is configured to direct the jet of water towards the centre of the base pipe in such a way that the moving water in the base pipe has a speed

gradient and the direction of the jet of water is parallel to the longitudinal axis of the base pipe, and the water coming from the transfer arrangement to the first basin from the opening is directed to the separating means, and the separating means has a first end and a second end, and the first end of the separating means is nearer to the opening than the second end of the separating means.

According to a second aspect of the present invention, there is provided a device for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, the device includes a separating arrangement and the separating arrangement comprises a first basin, an opening in the first basin, a separating means, and a collector arrangement for collecting the water and waste and a transfer arrangement for transferring the collected water and waste to the separating arrangement comprising a base pipe, which is configured to extend from the collector arrangement to the opening and a pressure pipe for forcing a jet of water into the base pipe when the device is in use, and the separating means is configured to separate at least a part of the waste from the water from the first basin, and, and the width of the first basin is at least three times the diameter of the opening or more, characterised in that the collector arrangement is a funnel comprising a hole in the bottom of the funnel, and the transfer arrangement comprises a vertical suction pipe connected to the hole of the collector arrangement, and the base pipe is connected to the suction pipe under the funnel, and the pressure pipe is configured to direct the jet of water towards the centre of the base pipe in such a way that the moving water in the base pipe has a speed gradient and the direction of the jet of water is parallel to the longitudinal axis of the base pipe, and the water coming from the transfer arrangement to the first basin from the opening is directed to the separating means, and the separating means has a first end and a second end, and the first end of the separating means is nearer to the opening than the second end of the separating means.

An embodiment of the invention provides a separating arrangement for a device for collecting waste material floating on or near the surface of water. The separating arrangement comprises a first basin and a separating means. The water containing waste is led to the first basin by a transfer arrangement such as, for example, a pipe. The device is configured in such a way that the water coming from the transfer arrangement has a speed gradient, i.e. the cross section of the transfer arrangement has areas where the speeds of the water flow are different. The fastest speed component of the water has the highest concentration of waste. The first basin and the separating means are configured in such a way that when the water flows into the first basin, most of the waste reaches the separating means and does not clog against the walls of the first basin.

When reference is made in the text to the upper or the lower parts or respective directions such as down or up, a situation is described in which the device according to

embodiments of the invention is in use. Also, when reference is made to the vertical or horizontal directions or surfaces, the device is placed similarly.

One embodiment of the invention is a separating arrangement for a device for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, the device comprises a collector arrangement for collecting the water and waste and a transfer arrangement for transferring the collected water and waste to the separating arrangement, and the separating arrangement comprises a first basin and a separating means. The transfer arrangement is connected to the first basin, and the separating means is configured to separate at least a part of the waste from the water from the first basin. In one advantageous embodiment of the invention, the device is configured in such a way that the moving water in the transfer arrangement has a speed gradient, and the transfer arrangement has an opening in the first basin. The water flowing from the transfer arrangement into the first basin through the opening is directed to the separating means. The width of the first basin is at least three times the diameter of the opening or more so. The separating means has a first end and a second end, and the first end of the separating means is nearer to the opening than the second end of the separating means. The distance between the opening and the first end of the separating means is such that the fastest speed component of the water at the first end of the separating means is 50% or less than the fastest speed component of the water at the opening when the device is in use. The inventor has found out that having a speed gradient in the transfer arrangement concentrate the waste to the faster water flow. When the speed decreases at the first basin, the waste rise on the surface. Because the flow part containing the most of waste is aimed towards the separating means, the amount of the waste clogging to the walls of the first basin is significantly reduced.

In one embodiment of the separating arrangement, the distance between the opening and the first end of the separating means is such that the fastest speed component of the water at the first end of the separating means is 10% to 50% of the fastest speed component of the water at the opening. The inventor has discovered that the speed of the water flow containing waste should not decrease too much.

In a second embodiment of the separating arrangement, the speed gradient of the water at the opening is such that the difference of the fastest speed component of the water and the slowest speed component of the water is 15% or more. The inventor has discovered that if the gradient is smaller, the concentration of waste disintegrates.

In a third embodiment of the separating arrangement, the first basin and the opening are configured in such a way that the upper edge of the opening is below the waterline of the first basin when the device is in use. This feature decreases the possibility of turbulence occurring near the opening.

In a fourth embodiment of the separating arrangement, the first basin and the opening are configured in such a way that the lower edge of the opening is at least half a diameter of the opening or more above the bottom of the first basin near the opening. The

inventor has discovered that in some cases having the bottom nearer to the opening may cause the waste flow to curve down.

In a fifth embodiment of the separating arrangement, the bottom and the side walls of the first basin between the opening and the first end of the separating means are parallel to the direction of the fastest speed component of the water at the opening. This feature allows for smoother flow patterns, and thus improves the flow of waste towards the separating means.

In a sixth embodiment of the separating arrangement, the separating means comprises a conveyor belt arrangement for separating solid waste, and the conveyor belt arrangement is configured to move separated solid waste into one or more containers. In a seventh embodiment of the separating arrangement, the conveyor belt arrangement comprises a first conveyor belt and a second conveyor belt, and the second conveyor belt is inside the first conveyor belt. In an eight embodiment of the separating arrangement, the first conveyor belt and the second conveyor belt have holes, and the first conveyor belt is configured to carry waste particles with a minimum diameter of 1 cm and the second conveyor belt is configured to carry waste particles with a minimum diameter of 500 µm. In a ninth embodiment of the separating arrangement, the conveyor belt arrangement comprises an air blower system, and the air blower system is configured to blow over the second conveyor belt, loosening the waste particles carried by the second conveyor belt. The conveyor belts have been found to be effective in catching solid waste particles. Naturally, they can be used for separating for liquid waste, too.

In a tenth embodiment of the separating arrangement, the separating means comprises an oil separation arrangement, and the oil separation arrangement comprises two or more weir arrangements for lifting oil off the surface of the water, and the weir arrangements are attached to the bottom of the separating arrangement and the weir arrangements are transverse to the direction of the water flow in the separating arrangement, and at least part of the weir arrangements are submerged when the device is in use, and the separating arrangement further comprises a second basin, and the second basin is configured to store the oil that the oil separation arrangement has separated. In an eleventh embodiment of the separating arrangement, the inclinations of the weir arrangements or the distances of the upper edges of the weir arrangements from the surface of the water or both are adjustable according to the properties of the oil.

In a twelfth embodiment of the separating arrangement, the separating arrangement comprises a lifting arrangement for lifting the conveyor belt arrangement in such a way that the conveyor belt arrangement is above the water when the device is in use. This feature allows the device to be used to collect both liquid waste and solid waste. Also, it makes possible to collect both types of waste simultaneously.

One embodiment of the invention is a device for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, the

device further comprises a collector arrangement for collecting the water and waste, a separating arrangement and a transfer arrangement for transferring the collected water and waste to the separating arrangement. In one advantageous embodiment of the invention, the device has the separating arrangement that was described in the previous embodiments.

In one embodiment of the device, the transfer arrangement comprises a base pipe extending from under the collector arrangement to the opening, and the base pipe is straight and there is a pressure pipe for forcing a jet of water into the base pipe when the device is in use, and the direction of the jet of water is parallel to the longitudinal axis of the base pipe. This feature minimizes turbulence in the transfer arrangement.

It is an advantage of the invention that it provides a separating arrangement in which clogging of the collected waste is significantly reduced. Thus a device employing such a separating arrangement is more efficient than known devices.

Embodiments of the invention also allow for a device that is easy to use and it is suitable for both solid and liquid waste collection and combination of both. Embodiments of the invention also produce a device that has no complex parts, so that it is easier to manufacture and maintain than devices according to known techniques.

One advantage of the invention is that it is quite efficient for collecting liquid waste and prevents mixing of water and liquid waste (emulsification process). The device can also be easily and quickly assembled and disassembled. The device is also suited for collecting both solid and liquid waste. Its construction allows it to be used in shallow water.

It is a further advantage of the invention that it can be easily optimized for different situations. Its scalability is good.

Embodiments of the invention also provide a device that does not easily clog. This means that it can be used in waters with an abundance of algae. Such waters have usually been very problematic to clean.

DESCRIPTIONS OF THE FIGURES

In the following, the invention is described in detail. The description refers to the accompanying drawings, in which

Figure 1A shows an example of a device according to an embodiment,

Figure 1B shows the device presented in Figure 1A as seen from above,

Figure 1C shows the device presented in Figure 1A as seen from the side, and

Figure 2 shows a second example of a device according to an embodiment.

Claims

1. A separating arrangement (105; 205) for a device (100; 200) for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, and the separating arrangement comprises a first basin (111), an opening (112) in the first basin, a separating means (113; 218), and a collector arrangement (103) for collecting the water and waste and a transfer arrangement (104) for transferring the collected water and waste to the separating arrangement comprising a base pipe, which is configured to extend from the collector arrangement to the opening and a pressure pipe (106) for forcing a jet of water into the base pipe when the device is in use, and the separating means is configured to separate at least a part of the waste from the water from the first basin, and, and the width of the first basin is at least three times the diameter of the opening or more, **characterised** in that the collector arrangement is a funnel comprising a hole in the bottom of the funnel, and the transfer arrangement comprises a vertical suction pipe (107) connected to the hole of the collector arrangement, and the base pipe is connected to the suction pipe under the funnel, and the pressure pipe is configured to direct the jet of water towards the centre of the base pipe in such a way that the moving water in the base pipe has a speed gradient and the direction of the jet of water is parallel to the longitudinal axis of the base pipe, and the water coming from the transfer arrangement to the first basin from the opening is directed to the separating means, and the separating means has a first end (115) and a second end (116; 216), and the first end of the separating means is nearer to the opening than the second end of the separating means.

2. The separating arrangement (105; 205) according to claim 1, **characterised** in that the transfer arrangement is configured in such a way that the speed gradient of the water at the opening (112) is such that the difference of the fastest speed component of the water and the slowest speed component of the water is 15% or more.

3. The separating arrangement (105; 205) according to any of claims 1 or 2, **characterised** in that the first basin (111) is configured to be filled with collected water and waste and the opening (112) are configured in such a way that the upper edge of the opening is below the waterline when the device (100; 200) is in use.

4. The separating arrangement (105; 205) according to any of claims 1 to 3, **characterised** in that the first basin (111) and the opening (112) are configured in such a

way that the lower edge of the opening is at least half a diameter of the opening or more above the bottom of the first basin near the opening.

5. The separating arrangement (105; 205) according to any of claims 1 to 4, **characterised** in that the bottom and the side walls of the first basin (111) between the opening (112) and the first end (115) of the separating means are parallel to the direction of the fastest speed component of the water at the opening.

6. The separating arrangement (105; 205) according to any of claims 1 to 5, **characterised** in that the separating means (113; 218) comprises a conveyor belt arrangement (218) for separating solid waste, and the conveyor belt arrangement is configured to move separated solid waste into one or more containers.

7. The separating arrangement (105; 205) according to claim 6, **characterised** in that the conveyor belt arrangement (218) comprises a first conveyor belt and a second conveyor belt, and the second conveyor belt is inside the first conveyor belt.

8. The separating arrangement (105; 205) according to claim 7, **characterised** in that the first conveyor belt and the second conveyor belt have holes, and the first conveyor belt is configured to carry waste particles with a minimum diameter of 1 cm and the second conveyor belt is configured to carry waste particles with a minimum diameter of 500 µm.

9. The separating arrangement (105; 205) according to claim 8, **characterised** in that the conveyor belt arrangement (218) comprises an air blower system, and the air blower system is configured to blow over the second conveyor belt, loosening the waste particles carried by the second conveyor belt.

10. The separating arrangement (105; 205) according to any of claims 1 to 9, **characterised** in that the separating means (113; 218) comprises an oil separation arrangement, and the oil separation arrangement comprises two or more weir arrangements for lifting oil off the surface of the water, and the weir arrangements are attached to the bottom of the separating arrangement and the weir arrangements are transverse to the water flow direction in the separating arrangement, and at least part of the weir

arrangements are under water when the device is in use, and the separating arrangement further comprises a second basin (114; 214), and the second basin is configured to store the oil that the oil separation arrangement has separated.

11. The separating arrangement (105; 205) according to claim 10, **characterised** in that the inclinations of the weir arrangements or the distances of the upper edges of the weir arrangements from the surface of the water or both are adjustable to suit the properties of the oil.

12. The separating arrangement (105; 205) according to any of claims 6 to 11, **characterised** in that the separating arrangement comprises a lifting arrangement for lifting the conveyor belt arrangement (218) in such a way that the conveyor belt arrangement is above the water when the device is in use.

13. The separating arrangement (105; 205) according to any of claims 1 to 12, **characterised** in that the distance between the opening and the first end of the separating means is such that the fastest speed component of the water at the first end of the separating means is 50% or less of the fastest speed component of the water at the opening when the device is in use.

14. A device (100; 200) for collecting oil, plastic or similar waste material floating on or near the surface of the sea or a similar large body of water, the device comprises a separating arrangement (105; 205) and the separating arrangement comprises a first basin (111), an opening (112) in the first basin, a separating means (113; 218), and a collector arrangement (103) for collecting the water and waste and a transfer arrangement (104) for transferring the collected water and waste to the separating arrangement comprising a base pipe, which is configured to extend from the collector arrangement to the opening and a pressure pipe (106) for forcing a jet of water into the base pipe when the device is in use, and the separating means is configured to separate at least a part of the waste from the water from the first basin, and, and the width of the first basin is at least three times the diameter of the opening or more, **characterised** in that the collector arrangement is a funnel comprising a hole in the bottom of the funnel, and the transfer arrangement comprises a vertical suction pipe (107) connected to the hole of the collector arrangement, and the base pipe is connected to the suction pipe under the funnel, and the pressure pipe is configured to direct the jet of water towards the centre of the base pipe in such a way that the moving water in the base

pipe has a speed gradient and the direction of the jet of water is parallel to the longitudinal axis of the base pipe, and the water coming from the transfer arrangement to the first basin from the opening is directed to the separating means, and the separating means has a first end (115) and a second end (116; 216), and the first end of the separating means is nearer to the opening than the second end of the separating means.

15. The device (100; 200) according to claim 14, **characterised** in that the base pipe is straight, and the direction of the jet of water is parallel to the longitudinal axis of the base pipe.