

A WATER DEBRIS SKIMMING DEVICE

Field of Invention

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This invention relates to water debris skimming devices for cleaning sea water of debris. In particular, this invention relates to floating water debris skimming devices.

Background of the invention

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Many parts of the sea near the coastline are full of floating waste, which can be an eyesore marring the pristine beauty of these areas. Some of the waste such as driftwood comes from natural sources like twigs, leaves, and others are man-made such as plastic objects, fabric and so on. Man-made debris is called marine debris.

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The sea is not the only location with marine debris, the extent of the pollution as far as lakes, rivers or even in the middle of the ocean. Other than contributing an ugly sight, waterborne plastic poses a serious threat to marine life.

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In one particular environment near the south east of U.S., near the coast line of Florida, there are a lot of fallen wood chips and leaves from palm trees or other tropical plants that are popular in the region. These wood chips and leaves wash up to the beach making swimming or enjoying water sports around the beach unpleasant.

It is possible to send seamen out in a boat to trawl in debris before it was washed up to the coastline. However, chasing and collecting debris is difficult, expensive and probably futile.

- 5 Therefore, it is desirable to provide a novel and improved way of collecting marine debris.

Summary of the invention

- 10 In a first aspect, the invention proposes a water debris skimming device comprising: a hollow cylinder having an inlet and an outlet; the cylinder attached with a float; the float positioned adjacent the inlet such that the inlet is bias to be above the outlet when the cylinder is placed into water, and that the inlet is able to capture naturally moving water; a pump to move water in the cylinder out of the cylinder through the
15 outlet; a filter positioned to capture debris in the moving water moving out of the outlet.

- The invention provides the possibility of capturing debris caught when it is carried by natural water movements into a submerged water debris skimming device. The
20 water debris skimming device can be placed in the known flow paths of water to sieve as much water as possible. Accordingly, man power is only needed to position the water debris skimming device. The water debris skimming device does not require constant monitoring while it operates.

Accordingly, the invention provides the possibility of a water cleaning device which can be deployed for long period of time in the sea.

Preferably, the pump is powered by solar power and more preferably, the pump is a floating solar panel for powering the pump. This allows the water debris skimming device to be powered wherever it is located without need for a cable connecting it to a power source. However, embodiments of water debris skimming device cabled to a power supply at the beach or in a boat is envisaged within the scope of this invention.

Optionally, the solar panel is in the form of a lip extending from the edge of the inlet. This allows the solar panel to be an integral part of the water debris skimming device for ease of handling.

Preferably, the water debris skimming device further comprises a one way valve positioned to allow passage of water and debris from the inlet into the cylinder and to prevent debris in the cylinder from leaving through the inlet. The one way valve, particularly one which mainly traps debris, reduces the possibility of debris caught in the water debris skimming device from being thrown out of the inlet when the sea is rough.

Typically, the one way valve comprises at least one panel which is resiliently movable towards a direction to allow passage of water and debris coming in from the inlet, and is unable to move in another direction thereby preventing passage of water and debris towards the inlet.

Typically, the at least one panel is a solid panel movably hinged to the inner wall of the cylinder.

Preferably, the water debris skimming device further comprises an anchor. The
5 anchor helps to station the water debris skimming device.

Preferably, the water debris skimming device further comprises a filter bag
positioned to capture debris in the water moving out of the outlet. Preferably, the
filter bag is disposable type. This allows even easier handling of the water debris
10 skimming device, as the handler need only remove the filter bag by pulling it out of
the water debris skimming device, instead of having to lift the water debris skimming
device out of the sea and turning it upside down to empty the water debris skimming
device.

15 **Brief description of the Figures**

It will be convenient to further describe the present invention with respect to the
accompanying drawings that illustrate possible arrangements of the invention, in
which like integers refer to like parts. Other arrangements of the invention are
20 possible, and consequently the particularity of the accompanying drawings is not to
be understood as superseding the generality of the preceding description of the
invention.

Figure 1 illustrates an embodiment of the invention;

25 Figure 2 illustrates a variation to the embodiment of Figure 1;

Figure 3 illustrates another variation to the embodiment of Figure 1;

Figure 4 illustrates how the embodiment of Figure 1 may be powered;

Figure 4a illustrates a variation to the embodiment of Figure 4;

Figure 5 illustrates another variation to the embodiment of Figure 4;

5 Figure 6 illustrates another variation to the embodiment of Figure 1;

Figure 7 illustrates the embodiment of Figure 6 in a different configuration;

Figure 8 further illustrates the embodiment of Figure 6;

Figure 9 further illustrates the embodiment of Figure 6; and

Figure 10 illustrates another variation to the embodiment of Figure 1.

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Detailed description of embodiments

Figure 1 shows the cross section of an embodiment 100 for removing debris 102

15 from the sea. The embodiment 100 comprises a hollow cylinder 101 having a top opening 103 and a bottom opening 105. The edge of the cylinder 101 around the top opening 103 is provided with a float 107 which (together with the overall density of the embodiment by selection of materials making up the rest of the embodiment 100) keeps the cylinder 101 just barely submerged beneath the sea surface, and which
20 also ensures that the top opening 103 stays above the bottom opening 105 when the cylinder 101 is placed into the sea.

The float 107 is shown flushed to the edge of the top opening 103, which allows the edge of the top opening 103 to be positioned generally right at the surface of the

25 sea, allowing naturally billowing waves of sea water to spill into the cylinder 101. In

this way, the top opening 103 is an inlet 103 for sea water into the cylinder 101. To prevent the cylinder 101 from filling up with water and so that water flows through the cylinder 101, the bottom opening 105 of the cylinder 101 is provided with an electric pump 109 for pumping sea water out of the cylinder 101. The bottom opening 105 is therefore the outlet 105 of the embodiment 100. The outlet 105 is covered over by an outer mesh 117 which protects the pump from being entangled with submerged debris outside the cylinder in the sea, such as seaweed.

The space inside the cylinder 101 is sub-divided by a filtering mesh 111 into a skimming chamber 113 above and a pump housing 115 below. The pump housing 115 is for installation of the pump 109. The filtering mesh 111 traps large size debris 102 and dirt collected in the skimming chamber 113 from moving past the pump 109 and leaving the cylinder 101 through the outlet 105.

In one preferred embodiment 100, the cylinder has a round cross section in the plan view (not provided) and the diameter of the cylinder 101 is 1.5m. The skimming chamber 113 may be as high as 2m or 3m, depending on where the embodiment 100 is meant to be deployed. The filtering mesh 111 and the outlet mesh 117 are made of an aluminium alloy or other metallic alloy, or reinforced plastic material or other material that resist corrosion by sea water and environment.

In deployment, the embodiment 100 is placed into the sea. Therefore, the choice of material for the cylinder 101 may stainless steel, ceramic, fibre glass, reinforced plastic or any suitable material which is able to cooperate with the float 107 to cause the embodiment 100 to be barely submerged beneath the sea surface. The float 107

may be a collar of rubber or an air filled buoy running around the top opening 103 of the cylinder 101. The density and size of the float is selected to cause the top of the embodiment 100 to be just barely submerged beneath the sea surface. However, it does not matter even if the float 107 causes the top of the embodiment 100 to
5 protrude slightly above the sea surface, as long as the average wave height is high enough to spill over the edge of the cylinder 101 into the top opening 103.

In a preferred variation of the embodiment 100, as shown in Figure 2, a filter bag 201 is placed inside the skimming chamber 113 and stands in the way of water flowing
10 through the cylinder 101. In this position, the filter bag 201 is able to trap debris 102 and dirt carried by the body of water when it flows through the skimming chamber 113. In this case, the filter mesh may be optional. If the filter mesh is still provided in the cylinder 101, it would also serve to prevent the bag from being entangled with the pump 109 should the filter bag 201 comes loosed of fastening holding it to the inside
15 of the cylinder 101. If the fastening of the filter bad is secured enough, however, the filter mesh 111 may not be necessary, as the filter bag 201 already provides the function of a filter in the cylinder 101.

The pump 109 installed in the pump housing 115 is driven by electricity. Therefore,
20 an electric source is provided to the embodiment 100 to provide power to drive the pump 109. In one embodiment 100, the embodiment 100 is installed near the shore such as a beach. The embodiment 100 can be installed up to a mile (or 1.6km) into the sea from the beach. The power supply cable can be extended from power supply on dry land and connected to the embodiment 100 by floating on the water or being
25 laid across the sea bed.

Any suitable type of pumps may be used, such as a diaphragm pump. However, a simple propeller moving water out the outlet as show in Figure 1 may suffice in some situations. Figure 3 shows a cylinder with a tapered outlet to lend greater power to the pump positioned in the smaller diameter conduit. Furthermore a smaller pump is useable at a smaller outlet.

Preferably, however, power supply is provided by a solar panel 401 floating beside the embodiment 100, as shown in Figure 4. Figure 4 also shows a cable 403

extending from the solar panel 401 to the pump housing 115 where the pump 109 is positioned. The float 107 at the top of the cylinder 101 extends around the entire circumference of the top of the cylinder 101. The float does not prevent debris from entering the cylinder as the slightly submerged embodiment, including the float being beneath water surface, is able to draw in water naturally. Alternatively, even if the float protrudes above the surface of the sea water, the choppiness of sea waves is able to cause the waves to sweep themselves over the float (or the edge of the cylinder) to spill into the cylinder. A variation to the embodiment of Figure 4 is shown in Figure 4a, where the float 107 is provided in pieces and instead of an integral single piece. The bold arrows in Figure 4a show how gaps between the float pieces allow water to flow through, carrying debris into the cylinder. This allows water to flow into the cylinder even if the float pieces generally sit on the water surface and if the waves are not strong enough to wash themselves into the cylinder.

The surface area of the solar panel 401, which is flat, may be as large as 1m^2 or more. A solar panel 401 of this size is usually able to generate about 200 watts of

power, under the right amount and angel of solar radiation. The power to pump 1m^3 of water for 10m (distance) requires about 0.027kW, which is less than power generated by a solar panel of size 1m^2 . Therefore, in one preferred embodiment 100, the surface area of the solar panel 401 may be 2m^2 or otherwise large enough to
 5 generate enough power to drive the pump 109 anyway. Naturally, the performance of the solar panel 401 varies with the weather. In general, however, the pump 109 may be effectively powered by the sun under bright weather conditions.

Figure 4 illustrates that an anchor 405 may be used to secure the location of the
 10 embodiment 100.

Figure 5 shows a variation to the embodiment 100 in which the solar panel 401 is in the shape of a collar placed around the edge of the inlet 103 to the cylinder 101, the top surface area of which is pre-selected to be big enough to supply power required
 15 by the pump 109.

Preferably, the cylinder 101 has at least one internal hinged panel 601 movably affixed to the inner wall of the cylinder 101 by a hinge 603. The internal hinged panel 601 is able to move from a horizontal position in the cylinder downwardly towards the
 20 outlet 105 but unable to move upwardly from the horizontal position towards the inlet 103. Figure 6 shows how a pair of internal hinged panels 601 opens downwardly to allow water to enter the cylinder 101. The skilled man would understand that, if only one such panel 601 is used, the panel 601 preferably has a shape which fits the planar cross-sectional shape of the cylinder 101. If two panels 601 are used, as

shown in Figure 6, the two panels 601 together make up the shape of the planar cross-sectional shape of the cylinder 101.

Accordingly, the pair of internal hinged panels 601 in Figure 6 is shown turning
5 towards the outlet 105 to allow water and debris 102 to enter into the skimming chamber 113 by the inlet 103. The pair of internal hinged panels 601 is biased to return to their horizontal position if no water or debris is weighing on the hinged panels 601. However, none of the internal hinged panels 601 is able to turn in the direction towards the inlet 103 away from the horizontal position, thereby forming a
10 one-way valve which only allows matter to go into the skimming chamber 113 but prevents matter from being washed out of the inlet 103. In particular, when the pump 109 is not operating, the skimming chamber 113 becomes full of water, and the choppy waves of the sea may spill some of the debris in the skimming chamber 113 out of the inlet 103 but for the internal hinged panels 601 being there to prevent this
15 from happening.

The device biasing the internal hinged panels 601 into their horizontal position, as shown in Figure 7, may be a spring or similar mechanical device affixed to the hinge
20 603.

Alternatively, the bias may be provided by the characteristics of the material selected for the internal hinged panels 601, such as plastic which naturally floats on water. If the material is less dense than water, water in a full cylinder 101 floats the internal hinged panels 601 toward the inlet 103 into their closed position, i.e. horizontal
25 position. A physical stop may be provided on the internal wall of the cylinder to

prevent the internal hinged panels 601 from moving further upwardly from this horizontal position. If the pump 109 is in operation, the skimming chamber 113 may be pumped empty of water, and the internal hinged panels 601 will simply drop into the empty skimming chamber 113 naturally, opening the way for water and debris
5 102 to enter into the skimming chamber 113.

Figure 7 shows how, when the solar-powered pump 109 is not working at night and the cylinder 101 is full of water, the panels 601 in their closed position prevent debris 102 in the cylinder 101 from being thrown out of the cylinder 101 by the chopiness
10 of waves. Figure 8 shows the cross-section of a more preferable variation of this embodiment 100 in which a column of two internal hinged panels 601 pairs are arranged inside the cylinder 101. Having two or more pairs of internal hinged panels arranged in a column 601 enhances the ability of the cylinder 101 to keep debris 102 within the skimming chamber 113 securely. If the filter bag 201 is used, the mouth of
15 the filter bag 201 has to be attached to the internal wall of the skimming chamber 113 in a way that does not interfere with the performance of the lowest pair of internal hinged panels 601.

Figure 9 illustrates in the perspective view a cylinder 101 having a pair of panels 601
20 hinged to the inner wall of the cylinder 101 acting as one way valve. It can be seen that the pair of internal hinged panels 601 has a combined shape fitting the planar cross-section of the cylinder 101 in order to prevent debris from being thrown out of the cylinder 101 effectively.

Therefore, the embodiment 100 comprises a cylinder 101 which can be submerged just beneath the surface of the sea, having a pump 109 to remove continuously water which has entered through the cylinder 101 mouth. A pump 109 is provided to remove water through an outlet. A filter such as a wire mesh and/or filter bag 201 is
5 placed at the outlet to trap debris 102 which has entered into the cylinder 101, therefore filtering water leaving the cylinder 101. The pump 109 is powered by a floating solar panel 401. The cylinder 101 can be deployed to clean sea water without needing continuous human operation.

10 More specifically, the embodiments include a water debris 102 skimming device is described which comprises a hollow cylinder 101 having an inlet 103 and an outlet, the cylinder 101 attached with a float 107, the float 107 positioned adjacent the inlet 103 such that the inlet 103 is bias to be above the outlet when the cylinder 101 is placed into water, and that the inlet 103 is able to capture naturally moving water, a
15 pump 109 to move water in the cylinder 101 out of the cylinder 101 through the outlet, a filter positioned to capture debris 102 in the moving water moving out of the outlet.

To illustrates that the pump 109 does not have to be provided only at the bottom of
20 the cylinder 101, Figure 10 shows a variation of the embodiment 100 in which the outlet is a pipe that extends out of the water surface and through which the pump 109 removes water from the cylinder 101.

Where 'sea' has been mentioned, the skilled man understands that other bodies of water which can spill into the cylinder can be cleaned by the embodiment, such as rivers, lakes, even swimming pools.

- 5 While there has been described in the foregoing description preferred embodiment 100s of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications in details of design, construction or operation may be made without departing from the scope of the present invention as claimed.

Claims

1. A water debris skimming device comprising:
 - a hollow and free floating cylinder (101) having an inlet (103) and an outlet;
 - 5 the cylinder (101) attached with a float (107);
 - the float 107 positioned adjacent the inlet (103) such that the inlet (103) is bias to be above the outlet when the cylinder (101) is placed into water, and
 - that the inlet (103) is able to capture naturally moving water;
 - a pump (109) to move water in the cylinder (101) out of the cylinder (101)
 - 10 through the outlet;
 - a filter positioned to capture debris (102) in the moving water moving out of the outlet.
2. A water debris skimming device as claimed in claim 1, wherein the pump (109)
- 15 is powered by solar power.
3. A water debris skimming device as claimed in claim 2, further comprising a floating solar panel (401) for powering the pump (109).
- 20 4. A water debris skimming device as claimed in claim 2, wherein the solar panel (401) is in the form of a lip extending from the edge of the inlet (103).
5. A water debris skimming device as claimed in claim 1, further comprising a one way valve positioned to allow passage of water and debris (102) from the

inlet (103) into the cylinder (101) and to prevent debris (102) in the cylinder (101) leaving through the inlet (103).

- 5 6. A water debris skimming device as claimed in claim 5, wherein the one way valve comprises at least one panel (601) which is resiliently movable towards one direction to allow passage of water and debris (102) coming in from the inlet (103), and is unable to move in another direction thereby preventing passage of water and debris (102) towards the inlet (103).
- 10 7. A water debris skimming device as claimed in claim 6, wherein the at least one panel (601) is a solid panel (601).
8. A water debris skimming device as claimed in claim 1, further comprising an anchor (405).
- 15 9. A water debris skimming device as claimed in claim 1, further comprising a filter bag (201) a filter positioned to capture debris (102) in the moving water moving out of the outlet.
- 20 10. A water debris skimming device as claimed in claim 11, wherein the filter bag (201) is disposable type.