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(71) Applicant (for all designated States except US): **DESMI**
A/S [DK/DK]; Tagholm 1, DK-9400 Nørresundby (DK).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **ANDERSEN, Bern-**
hard [DK/DK]; Akelejevej 36, DK-9310 Vodskov (DK).

(74) Agent: **PATRADE A/S**; Fredens Torv 3A, DK-8000
Aarhus C (DK).

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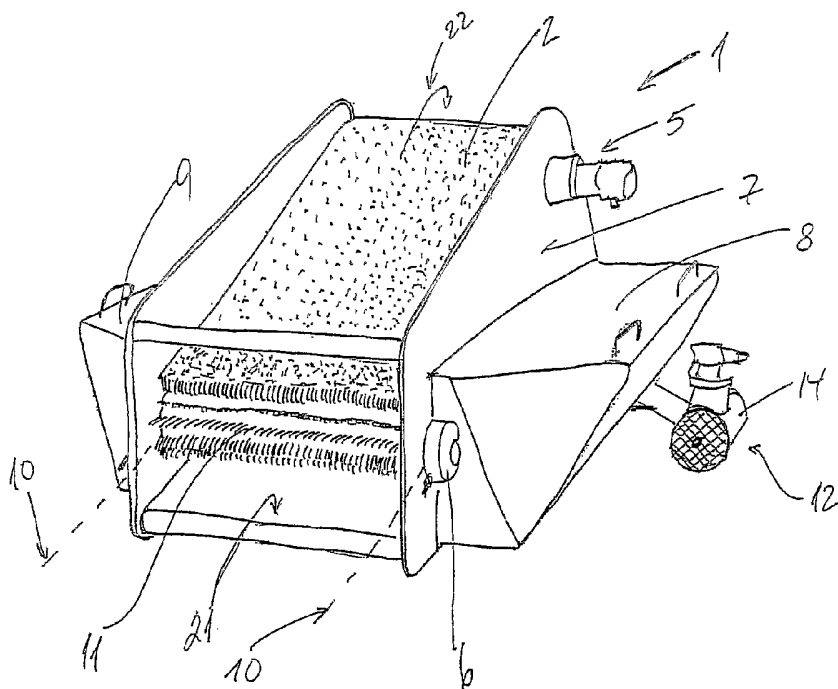
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(54) Title: OIL SKIMMER



(57) Abstract: A skimmer especially suitable for collecting oil floating on a water surface is described. The skimmer uses a brush belt which collects the oil from the surface. The skimmer is fully manoeuvrable due to the provision of pivotable thrusters.

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OIL SKIMMER

The present invention relates to a novel and inventive skimmer which is suitable for collecting liquids or items floating on or just below a liquid surface as well as a
5 method for using such a skimmer.

The requirements to keep the environment as pollution-free as possible are ever increasing. This awareness of the protection and maintenance of a pollution-free environment has, among other things, created a need for cleaning up major as well as minor
10 spills of for example oil, oil derivatives and other potential pollutants from the surface of for example the sea, rivers, lakes, harbours and the like.

For this purpose a number of devices have been developed which for some purposes achieve the results, but which for other purposes have shortcomings.

15 In WO 92 13140 is described an oil skimmer mounted on floats having large booms for collecting and guiding the liquid to be collected into the collection unit. The collection unit is mounted on floats such that it can float on the surface from which the liquid is to be collected. The collector is a brush plate assembly consisting of a number
20 of rigid wheels at the edges of which brush members are arranged. By superposing a number of these wheels on the same axle it is possible to collect the oil from the surface.

Due to the construction of this device it is not particularly manoeuvrable and it will
25 have difficulties collecting liquid/items from the surface having a limited extension as for example rivers, narrow inlets, harbours and the like.

Furthermore, the arrangement with the brush plates is undesirable in that the matter to be collected can become stuck between the plates and, furthermore, the effectiveness
30 of this system is limited in that the brushes are arranged in a longitudinal direction relative to the transport direction of the liquid/items to be collected from the surface such that it will be possible for the material to seep downwards off the plates towards

the surface again between the longitudinally arranged brushes. Although the rotation of the wheels will cause a general forward movement of the liquid to be collected towards the receptacle, the downward flow will decrease the effectiveness of this device. In US 4575426 another device is suggested where two rotating brushes are brought
5 into contact with a surface from where oil is to be collected. The brushes are arranged adjacent suction means such that by creating a huge suction force the oil collected from the surface will be sucked off the brushes and conveyed to collection means. This device is rather large and due to the force of the suction it will suck in a large amount of sea water which will also have to be accommodated in the container means.
10 Furthermore, due to the construction of the floats, the brushes and the associated suction means, this device is also not useful in limited spaces such as for example on rivers, narrow inlets and harbours.

Yet another example of an oil skimmer is described in US 4834880 wherein a vessel is
15 equipped with a device for picking up oil from water. The device is constructed by means of a number of chains arranged in parallel with an open space in-between each chain. In some of the chain links, a brush device is arranged comprising bristles which extend radially from the chain covering approximately half a circle. The independent chains are arranged with such an inter-distance that the bristles on adjacent chains will
20 overlap slightly, but still allow water to penetrate and be drained off in the space between the chains. The constructions using chains comprises a number of draw-backs. First and foremost, although oil often is used as a lubricant in its distilled form, when such a device is used for collecting waste oil from a surface, for example the ocean surface, a number of other pollutants as well as other substances will be present in the
25 polluted material. Therefore, there is a tendency for these materials to become stuck in the chain construction, whereby the rotation of the chain around the cylinders may be hampered. Furthermore, this requires additional power in order to overcome the friction and wear resistance due to these obstructing substances which may become lodged in the chain construction. Moreover, the efficiency of such a chain device is
30 rather limited in that for lighter oil products or lighter pollutants, the overlapping brushes will not be strong and/or close enough in order to transport the pollutants from the surface and to the collection receptacle. On the other hand, if the brushes are made sufficiently stiff and closely spaced such that they will be able to transport even lighter

oils or pollutants, due to the nature of these stiffer brushes, these will also have a tendency to be either brittle or bendable, whereby they relatively quickly become useless. Finally, from a maintenance point of view, if a chain should break, it is quite complicated to replace just one chain in that it is intermeshed with the adjacent chains by their bristles and, furthermore, the brush devices are fixed by bolts as illustrated in fig. 4 arranged underneath the brush device which makes the bolts difficult to gain access to, especially considering that the brushes are filled with oil or oil-like materials.

There is, therefore, a need for a device which is effective in removing liquid or items from a liquid surface which is manoeuvrable and has a high efficiency.

The present invention provides a skimmer suitable for collecting liquids or items floating on or just below a liquid surface, where said skimmer comprises buoyancy means as well as at least one endless brush belt and further that the endless belt is arranged for rotation around at least two cylinders and having a plane defined by the length and width of the upper part of the belt between the at least two cylinders and that the brushes are arranged in spaced rows perpendicular to the rotation direction of the endless belt and at an angle to the plane of the belt, and that the brushes are arranged such that when the skimmer is placed on a liquid surface, at least part of the lowermost point of the brush belt is in contact or beneath the liquid surface.

With this arrangement is achieved that the brushes arranged perpendicular to the rotation direction of the endless belt effectively remove the liquid, usually oil or oil derivatives, from the surface such that non-contaminated water will be able to seep back through the brushes without hampering the effectiveness of the device.

The endless belt can have any width desired, but in order to render the device useful in limited spaces such as bay inlets, rivers, harbours and the like, it has been found that a belt width between 400 mm and 3,000 mm is desirable.

The provision of a belt in addition to the brushes also provide the advantage that substances with higher viscosity still will be transported along the transport path due to the continuous belt structure across the entire skimming surface. In the example of the

prior art mentioned above where chains are used, high viscosity materials will have a tendency to be drained off together with the water between the chains and the usefulness of such a device is therefore limited. For the same reasons, it is evident that, although it is undesirable to transport and remove water, the arrangement of the bristles on the belt is such that water will be able to drain off and tests in practise have shown that only minimal amounts of water are transported on the belt, whereas relatively high viscosity oil products or oil derivatives where the viscosity is slightly lower than water will be transported and thereby skimmed off the surface with the present device.

Also, in order to achieve the manoeuvrability and usefulness of the device in narrow spaces, the length of the device as determined by the length of the belt, has been found to be between 500 and 3,000 mm. In this manner the length of the belt will provide for adequate draining of the non-polluted liquid and at the same time maintain an inclination of the endless belt such that the overall length of the device can be kept at a minimum. In this connection it should be noted that the inclination of the belt will be determined by the viscosity of the liquid to be collected in that too steep an angle for the belt will result in the liquid or items to be collected from the liquid surface will slide downwards during the transport operation to a receptacle or, on the other hand, if the belt is not provided with any inclination, the amount of liquid, usually sea water, that will be transferred to the receptacle will be too large and therefore the cleaning process will be less efficient.

The device is especially developed for collecting oil or oil derivatives from a liquid surface, especially the surface of the sea, and therefore the brushes as well as the belt are made from oil resistant materials. In an advantageous embodiment the endless belt is made from polypropylene (PP) and the brushes are made from polyamide (PA6). The brush material needs a certain stiffness to be able to collect the oil from the surface and transport it up the incline towards the receptacle and at the same time it must be flexible enough to be able to release the oil in the vicinity of the receptacle. The wheels or cylinders engaging the brush belt will also come into contact both with the sea water and the pollutant, especially oil or oil derivatives, and should therefore also be made from a material resistant to these substances. In one embodiment of the invention the cylinders or gear wheels are made from nylon (POM). The skimmer itself

is advantageously made from stainless steel or aluminium such that corrosion can be avoided as well as corrosion or destruction from the pollutants from which it is supposed to clean the surface can likewise be avoided. Furthermore, by using a aluminium construction a rather light skimmer can be achieved, whereby the overall requirements to the buoyancy means are lessened.

All the above mentioned materials are very resistant against a number of substances, such as sea water, oil, etc. The invention is not limited to this selection of materials, but any suitable material according to circumstances may be employed.

10 In a further advantageous embodiment the plane of the belt between two cylinders is inclined, and further that cleaning means are provided adjacent the upper end of the endless belt for removing/cleaning at least a substantial part of the collected liquid or items from the brush belt, and that a collection receptacle is provided.

15 Tests with the device have indicated that a substantially larger amount of liquid/items can be removed from the brush belt if a cleaning device, for example in the shape of a comb or the like, is arranged adjacent a collection receptacle, whereby the overall efficiency of the device is greatly increased.

20 In a further advantageous embodiment of the invention the cleaning means is a double comb structure, such that said comb may efficiently remove/clean the brush belt regardless of the direction of rotation of said belt. Tests with the device has indicated a higher efficiency, such that more pollution, for example oil or other debris, may be removed from a liquid surface under certain circumstances, when the belt is rotated
25 such that the substances to be removed from the surface are transported along the underside of the belt. Under circumstances where the material to be removed is rather thick, it may advantageously be conveyed along the underside of the belt. For this purpose, a double-sided comb is provided such that the comb, during normal operation when the material to be removed from the surface is conveyed on the upper side of the
30 belt, will clean the brushes and lead the collected materiel into the collection vessel. The same construction having a double-sided comb is useful when heavier or thicker items are removed from the surface along the underside of the belt structure when the

belt is rotated in the opposite direction such that the brushes may be cleaned by engaging the opposite side of the double comb device.

5 The double comb device may advantageously be constructed as a base structure which is adapted to be fastened on the frame of the machine having a plurality of U-shaped members extending from said base member, where the free ends of the U are fastened to the base member. This configuration provides a very stable and yet simple comb structure which has proven very effective for removing liquid and pollution from the brush belt. The spacing between each separate U may advantageously correspond to
10 the width of the brush such that it is possible for a brush member to pass the comb member relatively easy. Alternatively, the space between two U members may be given for example a wedge shape such that the brushes will be wiped off against the two adjacent U-shaped comb members for more efficient cleaning. This, however, induces a certain degree of wear on the brushes, but on the other hand provides a high
15 degree of cleaning of the brushes.

In a still further advantageous embodiment of the invention below and substantially parallel to the belt and at a distance to said belt a plate member is arranged such that the brushes of the belt may push liquid or items collected from the surface along said
20 plate member to a collection receptacle. Especially in situations where, as mentioned above, the items or liquids to be collected from the surface have certain consistencies, i.e. thick oil or solid items, these may advantageously be collected by rotating the endless belt such that the brushes will sweep up pollution and push the pollution, i.e. the liquid and/or items collected from the surface along the plate member to the collection
25 receptacle. In order to clean the brushes, the double comb structure as described above may advantageously be arranged immediately adjacent the end of the plate member and in the vicinity of the collection receptacle such that material wiped off the brushes by the comb device will fall into the collection receptacle.

30 In a further advantageous embodiment the receptacle is connected via a valve means and a pump means via a preferably flexible hose to a collection vessel. In this manner the device can be kept in a rather small size in that storage means on board the skimmer can be minimized as the collected liquid continuously, or in batches, is pumped to

a collection vessel outside the skimmer. The collection vessel can advantageously be placed on another vessel used to employ the skimmer or collection containers on land or, alternatively, the skimmer can drag along small barges onto which the collected liquid/items can be discharged through the pump and flexible hose means. After a
5 barge is filled the valve will shut off the pumping action long enough to replace the filled barge with an empty one, which thereafter can receive the collected liquid/items. The filled barge can thereafter be transported to a recycling station or other controlled storage station for the collected liquid/items.

10 In a further advantageous embodiment the means for manoeuvring the skimmer are provided on at least two sides of the skimmer, and that said means are arranged such than the thrust from each independent manoeuvring means can be directed in any direction relative to the skimmer.

15 By providing manoeuvring means on the skimmer itself it becomes possible to steer and control the skimmer such that it can gain access to very limited spaces in harbours between jetties, between piles or pillars of the jetties as well as in limited bays, inlets and narrow rivers. Furthermore, as the manoeuvring means are arranged such that they can be directed in any direction relative to the skimmer independently of each other, it
20 is possible to rotate the skimmer on a plate, i.e. around a vertical axis, whereby the versatility and usability of the device is greatly improved.

In a still further advantageous embodiment of the invention the manoeuvring means are hydraulic thrusters, propellers or water jets. These sort of means can all be ar-
25 ranged on a relatively limited space such that the overall construction can be kept a reasonable size whereby the manoeuvrability and the accessibility of the device into narrow spaces can be greatly improved.

In the embodiment where the manoeuvring means consist of hydraulic thrusters or
30 water jets, the water intake for these propulsion means can advantageously be at the rear of the device, i.e. in the liquid behind the skimmer where the liquid has already been cleaned from the pollutant, for example oil or oil derivatives. In this manner it is

avoided that the propulsion means become inoperable by the oil being stuck in the pumps or the like.

5 In a further advantageous embodiment of the invention means are provided for adjusting the height of the lower end of the belt in relation to the buoyancy means, and that these means may comprise electrically, pneumatic or hydraulically operated telescopic means, spindles, actuators, rack and pinions, gear wheels or the like.

10 Depending on the material which is to be collected by the skimmer, i.e. whether it is a heavy fuel oil, conglomerated nuggets of oil, light fuel oils or other items floating on the surface, it can be advantageous to be able to adjust the depth to which the front end of the belt is inserted into the liquid, such that the brushes will only extend so far into the liquid from the surface which is necessary in order to collect the material floating on said surface. When extending the brushes too far into the liquid, too much non-polluted liquid, normally water, will be carried up along the belt and will have to be
15 drained off the belt before the belt discharges into the receptacle. Alternatively, the quality of the pollution collected and pumped to the receiving vessel, i.e. the storage container, will comprise too much non-polluted material which will have to be siphoned off at a later stage. By being able to adjust the depth by which the belt goes
20 into the liquid surface, the entire skimming process can thereby be optimized and the skimmer as such can be even more effective.

As is the case with the power source for the manoeuvring means and the adjustment means for adjusting the height of the lower end of the belt, so is the power source for
25 the valve means, the pump and the manoeuvring means also selectable among a wide variety of sources such a electricity, pneumatic or hydraulic sources. Which ever source is used for driving the belt or giving power to the manoeuvring means should also be used for the rest of the skimmer such that a minimum of power lines from the mother vessel to the skimmer is used.

30

In a further advantageous embodiment the valve means, the pump and the manoeuvring means are electrically, pneumatically or hydraulically powered, and that the power station may either be onboard the skimmer, on an adjacent vessel or on shore.

Also, as discussed above, when selecting the power source it may be beneficiary to use the same power for operating all the means associated with the skimmer such that a minimum of power supply lines are necessary. Also, when the power station is on board the skimmer, it is advantageous that the generated energy shall only be translated to one form of power source, for example via a hydraulic pump or compressor, such that all means associated with the skimmer use this one form of energy. This will greatly simplify the construction of the skimmer and thereby also influence the serviceability of the skimmer.

10 In a further advantageous embodiment a radio signal receiver is arranged in connection with a control unit, where the control unit can control the power station, the pump means, the valve means, and/or the manoeuvring means and any control means or sensors arranged for controlling the receptacle, the power unit by means of a remote portable radio signal emitter coupled to a second control unit thereby allowing for wireless manipulation of the skimmer.

This embodiment is especially advantageous where the skimmer is a self-contained unit, i.e. where a source of power is arranged on the skimmer. Hereby it can be avoided that the skimmer shall drag control lines after the unit, which in some instances, for example between piers of a jetty or under overhanging trees of a lake and the like may impede the manoeuvrability and freedom of operation of the skimmer.

For most applications, however, it is advantageous to have the control of the device transmitted in wires in that such a control system is simpler to verify, simpler to maintain and has a higher degree of reliability.

The invention also relates to a method for removing floating liquid or items floating on a liquid surface, wherein a skimmer according to any of the embodiments described above is used, such that

- 30 - the skimmer is launched, for example by being lowered from the deck of a mother vessel onto the surface to be cleaned;
- the brush belt is rotated by activating drive means, for example a hydraulic motor;

- the level of the lower end of the brush belt may be adjusted by appropriate adjustment means;
- the manoeuvring means are manipulated in order to bring the lower portion of the brush belt into contact with the floating liquid or floating items to be collected and maintain this contact;
- the rotation of the brush belt conveys the material to be collected to the cleaning means arranged on the skimmer;
- the cleaning means causes the collected liquid and/or items to be transferred to the receptacle where a valve means operated in conjunction with a pump means causes the collected liquid to be transferred via a preferably flexible hose member to a collecting vessel, for example a container arranged on the mother vessel.

The skimmer according to the invention can be used and stored in connection with the maintenance and running of harbours. Whenever for example an oil spill is detected in the harbour, the skimmer is launched by attaching a crane to the skimmer and lifting the skimmer onto the surface of the water. Hereafter the skimmer can be manipulated by advancing the manipulating means such that the skimmer will engage the oil pollution in the harbour. The flexible hose provided for transferring the collected oil from the receptacle to a storing vessel on the harbour or on a vessel can advantageously have floating characteristics, whereby the hose will not have any significant impact on the power consumption of the skimmer.

A detailed description of an embodiment of the invention will now be described with reference to the accompanying drawing, wherein

- fig. 1 illustrates an asymmetric view of the skimmer,
- fig. 2 illustrates a vertical lengthwise cross-section,
- fig. 3 illustrates a horizontal view,
- fig. 4 illustrates a vertical cross-section, and
- fig. 5 illustrates a vertical cross-section comprising a double comb device.

Detailed description

The skimmer 1 as illustrated in fig. 1 comprises a brush belt 2 arranged around two cylinders 3,4. In fig. 1 the cylinders are covered by the belt 2, but the drive means 5, in this instance a hydraulic motor, is coupled to the end of the axle around which the cylinder 3 rotates. In the opposite end the cylinder 4 is coupled via a bearing arrangement 6 to the chassis 7 of the device. On either side of the brush belt 2 and connected to the chassis 7 are arranged buoyancy means 8,9. When the skimmer 1 is arranged on a liquid surface, the buoyancy means causes the skimmer to float such that the liquid surface will be approximately at the level of the dashed lines 10. Hereby it is possible for the rows of brushes 11 to engage the liquid or items floating on the liquid surface in such a manner that they will be carried with the brush belt upwards.

For manipulating the skimmer 1, manoeuvring means 12 are provided.

All pipes and hoses necessary for driving the different components of the skimmer are not drawn in order not to confuse the overall drawing.

The manoeuvring means in this embodiment is a propeller 13 arranged inside a cylinder 14 such that the resulting water jet can be directed in any direction by manipulating, i.e. rotating the cylinder in relation to the skimmer. Hereby the skimmer can be manoeuvred into any desired position, or turned around a vertical axis without any lateral displacement.

Turning to fig. 2, the same features have the same reference numbers. In order to maintain tension in the brush belt 2, tensioning means 15 are provided in connection with a bearing 6 at the lower end of the brush belt.

Furthermore, cleaning means 16 are provided at the upper end of the brush belt for substantially removing all the liquid/items collected from the liquid surface 10. These means can for example be in the shape of a comb which will allow the brushes to pass with very little deflection, but will scrape off any foreign matter caught in the space between two rows of brushes 11. The liquid/items collected from the liquid surface 10 will be collected in the receptacle provided below the cleaning means 16. The liq-

uid/items collected in the receptacle 17 will, via appropriate valve and pump means be pumped to a collection vessel (not shown) via a preferably flexible hose, which can be connected to the socket 19.

5 When the device is used for collecting more fluid substances, the belt will be rotated in the direction as indicated by the arrow 22. If, however, the liquids or items to be collected from the surface are more dense, the direction of rotation of the belt 2 may be reversed in relation to the indication by the arrow 22. For this purpose, a plate member 21 is arranged below the belt 2 and substantially parallel to said belt 2 as indicated in fig. 2. The brushes 11 will then, by being rotated oppositely to the arrow 22,
10 push the items to be collected up along the plate member 21 and into the collection receptacle 17.

When collecting items where the belt 2 may advantageously be rotated in a direction
15 opposite to the one indicated by the arrow 22, the cleaning device 16 may advantageously be substituted by a cleaning device as indicated in fig. 5. The cleaning device 23 is in the shape of a double comb structure. A plurality of spaced combs 24 is arranged adjacent each other such that the space in-between two adjacent combs substantially corresponds to the width of a brush 11. As the belt 2 is rotated, the brushes
20 will wipe off any foreign material caught in the brushes on the cleaning device 23, such that the collected material will fall into the collection receptacle 17 as indicated in fig. 2. By providing a double comb structure 23 as indicated, the upper part of the comb 25 will carry out the majority of the cleaning of the brushes when the belt 2 is rotated in the direction of the arrow 22. When the belt 2 is rotated in the opposite direction,
25 the lower part of the comb 26 will carry out the main part of the cleaning.

The space provided between two adjacent combs 24 may substantially correspond to width of the brush 11 or, alternatively, have any other shape. An especially preferred shape is wedge-shaped such that the distance between two adjacent combs 24 is wider
30 the further the comb is away from the base plate 27. Hereby is achieved that the brushes when passing the cleaning device 23 will be slightly compressed and the wiping action of the combs 24 will, therefore, be more effective.

In the embodiment shown there is no power unit arranged in the skimmer, which requires that the skimmer be supplied with power from a power source, for example arranged on the mother vessel. When the power is in the shape of a pneumatic pressure line, a hydraulic pressure line or electrical cables, the lines/cables can be let to the
5 skimmer along the flexible hose and be connected to the skimmer via the jack 20.

In figs. 3 and 4 the skimmer 1 according to a preferred embodiment is illustrated from different angles. The same features are provided with the same reference numbers.

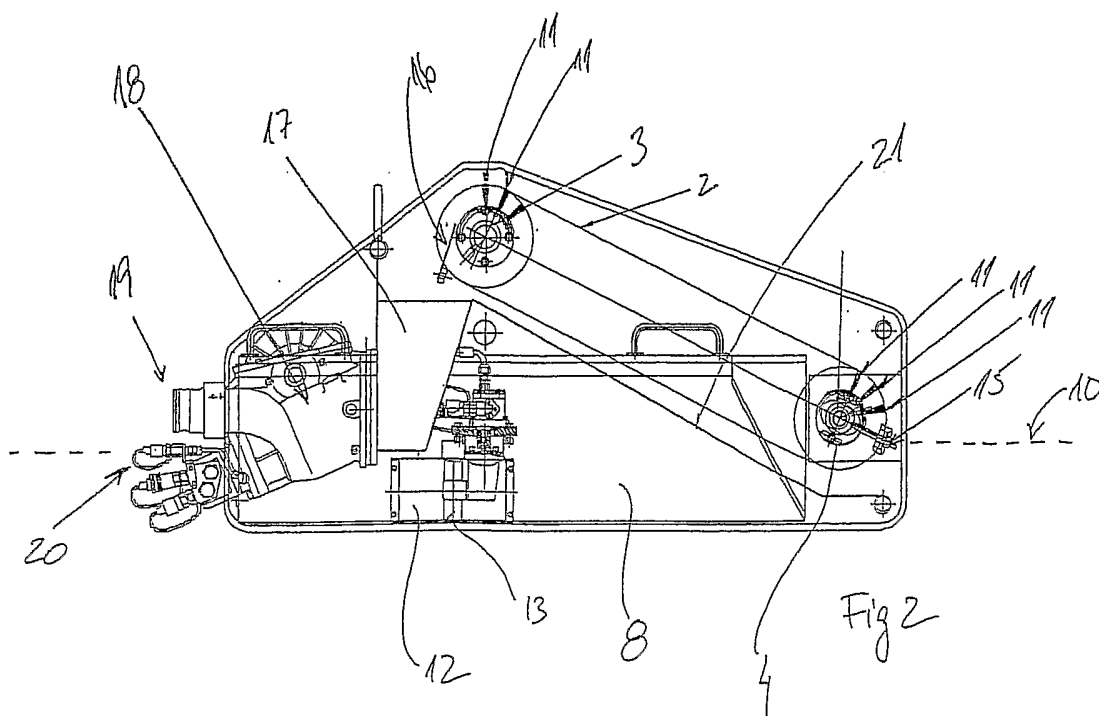
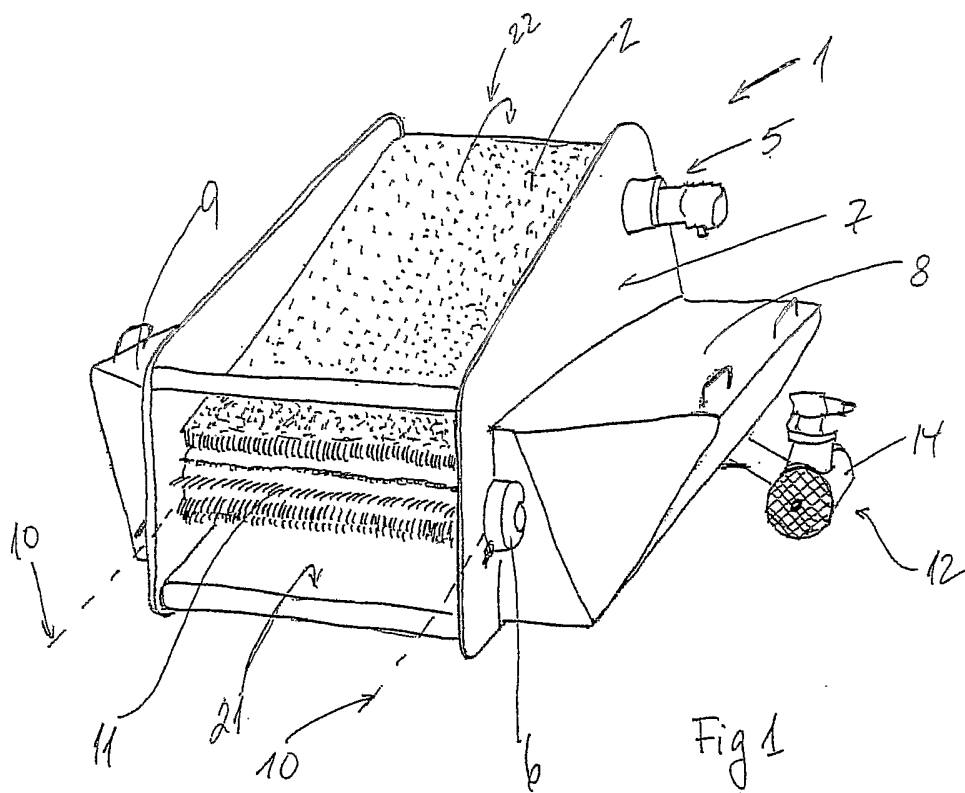
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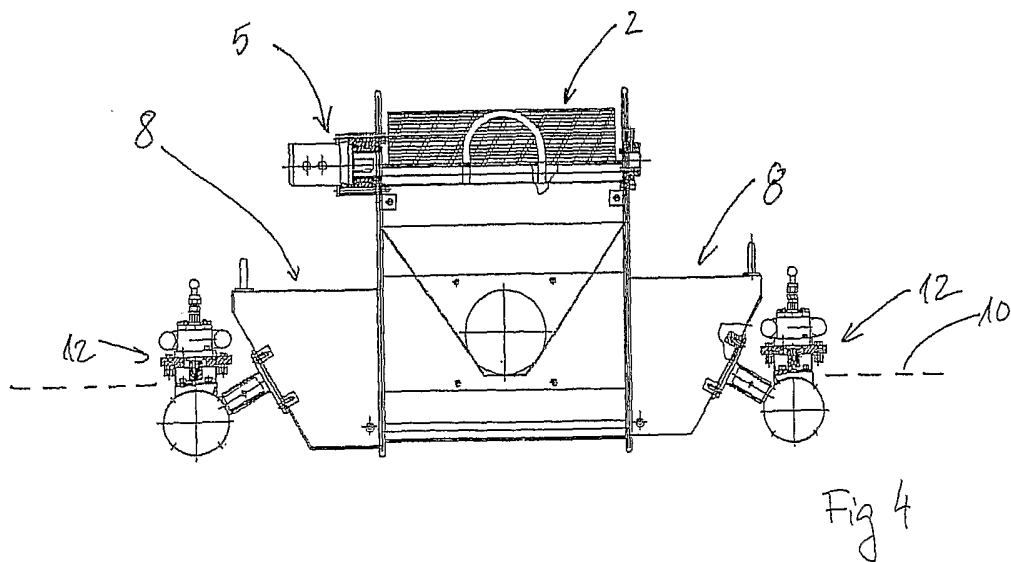
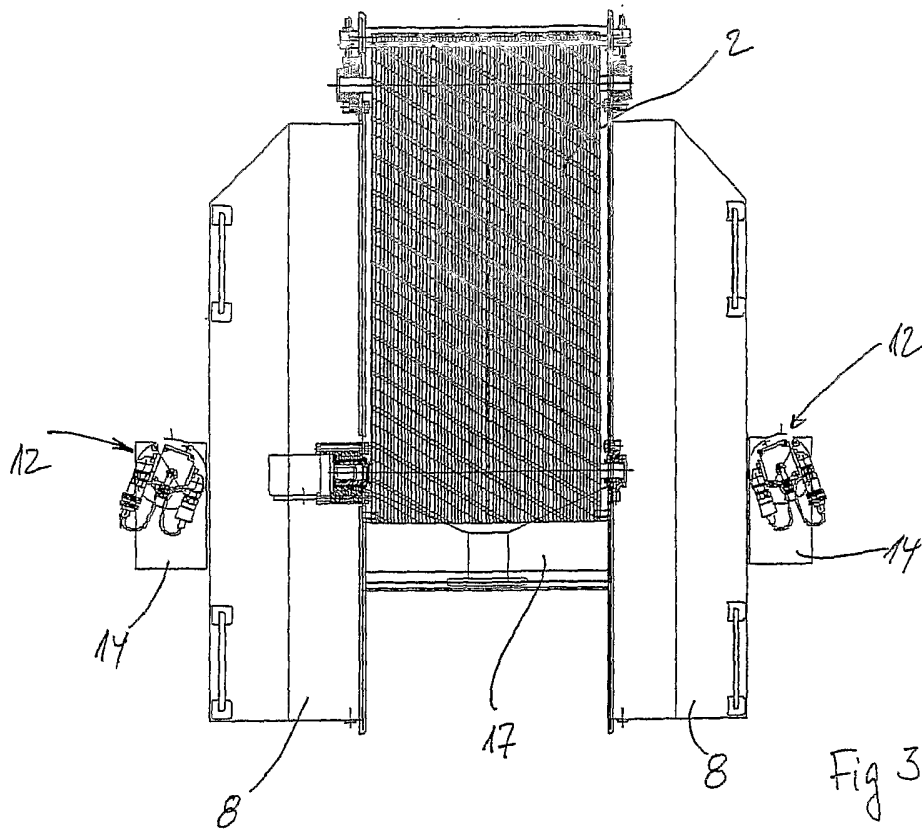
1. Skimmer suitable for collecting liquids or items floating on or just below a liquid surface said skimmer comprises buoyancy means as well as at least one endless brush
5 belt, c h a r a c t e r i s e d in that the endless belt is arranged for rotation around at least two cylinders and having a plane defined by the length and width of the upper part of the belt between the at least two cylinders and that the brushes are arranged in spaced rows perpendicular to the rotation direction of the endless belt and at an angle to the plane of the belt, and that the brushes are arranged such that when the skimmer
10 is placed on a liquid surface, at least part of the lowermost point of the brush belt is in contact or beneath the liquid surface.
2. Skimmer according to claim 1, c h a r a c t e r i s e d in that the plane of the belt between two cylinders is inclined, and further that cleaning means are provided adja-
15 cent the upper end of the endless belt for removing/cleaning at least a substantial part of the collected liquid or items from the brush belt, and that a collection receptacle is provided.
3. Skimmer according to claim 2, c h a r a c t e r i s e d in that the receptacle is con-
20 nected via a valve means and a pump means via a preferably flexible hose to a collection vessel.
4. Skimmer according to any of the claims 1-3, c h a r a c t e r i s e d in that means for manoeuvring the skimmer are provided on at least two sides of the skimmer, and
25 that said means are arranged such than the thrust from each independent manoeuvring means can be directed in any direction relative to the skimmer.
5. Skimmer according to claim 4, c h a r a c t e r i s e d in that the manoeuvring means are hydraulic thrusters, propellers or water jets.
30
6. Skimmer according to any preceding claim, c h a r a c t e r i s e d in that means are provided for adjusting the height of the lower end of the belt in relation to the buoy-

ancy means, and that these means may comprise electrically, pneumatic or hydraulically operated telescopic means, spindles, actuators, rack and pinions, gear wheels and the like.

- 5 7. Skimmer according to any of the claims 3-6, c h a r a c t e r i s e d in that the valve means, the pump and the manoeuvring means are electrically, pneumatically or hydraulically powered, and that the power station may either be onboard the skimmer, on an adjacent vessel or on shore.
- 10 8. Skimmer according to any preceding claim, c h a r a c t e r i s e d in that a radio signal receiver is arranged in connection with a control unit, where the control unit can control the power station, the pump means, the valve means, and/or the manoeuvring means and any control means or sensors arranged for controlling the receptacle, the power unit by means of a remote portable radio signal emitter coupled to a second control unit thereby allowing for wireless manipulation of the skimmer.
- 15 9. Skimmer according to any preceding claim, c h a r a c t e r i s e d in that below and parallel to the belt and at a distance to said belt a plate member is arranged such that the brushes of the belt may push liquid or items collected from the surface along said plate member to a collection receptacle.
- 20 10. Skimmer according to claim 2, c h a r a c t e r i s e d in that the cleaning means is a double comb structure such that said comb may efficiently remove/clean the brush belt regardless of the direction of rotation of said belt.
- 25 11. Method for removing a floating liquid or items floating on a liquid surface wherein a buoyant skimmer according to any of claims 1 – 8 is used, such that
- the skimmer is launched, for example by being lowered from the deck of a mother vessel onto the surface to be cleaned;
 - 30 - the brush belt is rotated by activating drive means, for example a hydraulic motor;
 - the level of the lower end of the brush belt may be adjusted by appropriate adjustment means;

- the manoeuvring means are manipulated in order to bring the lower portion of the brush belt into contact with the floating liquid or floating items to be collected and maintain this contact;
- 5 - the rotation of the brush belt conveys the material to be collected to the cleaning means arranged on the skimmer;
- the cleaning means causes the collected liquid and/or items to be transferred to the receptacle where a valve means operated in conjunction with a pump means causes the collected liquid to be transferred via a preferably flexible hose member to a collecting vessel, for example a container arranged on the
10 mother vessel.





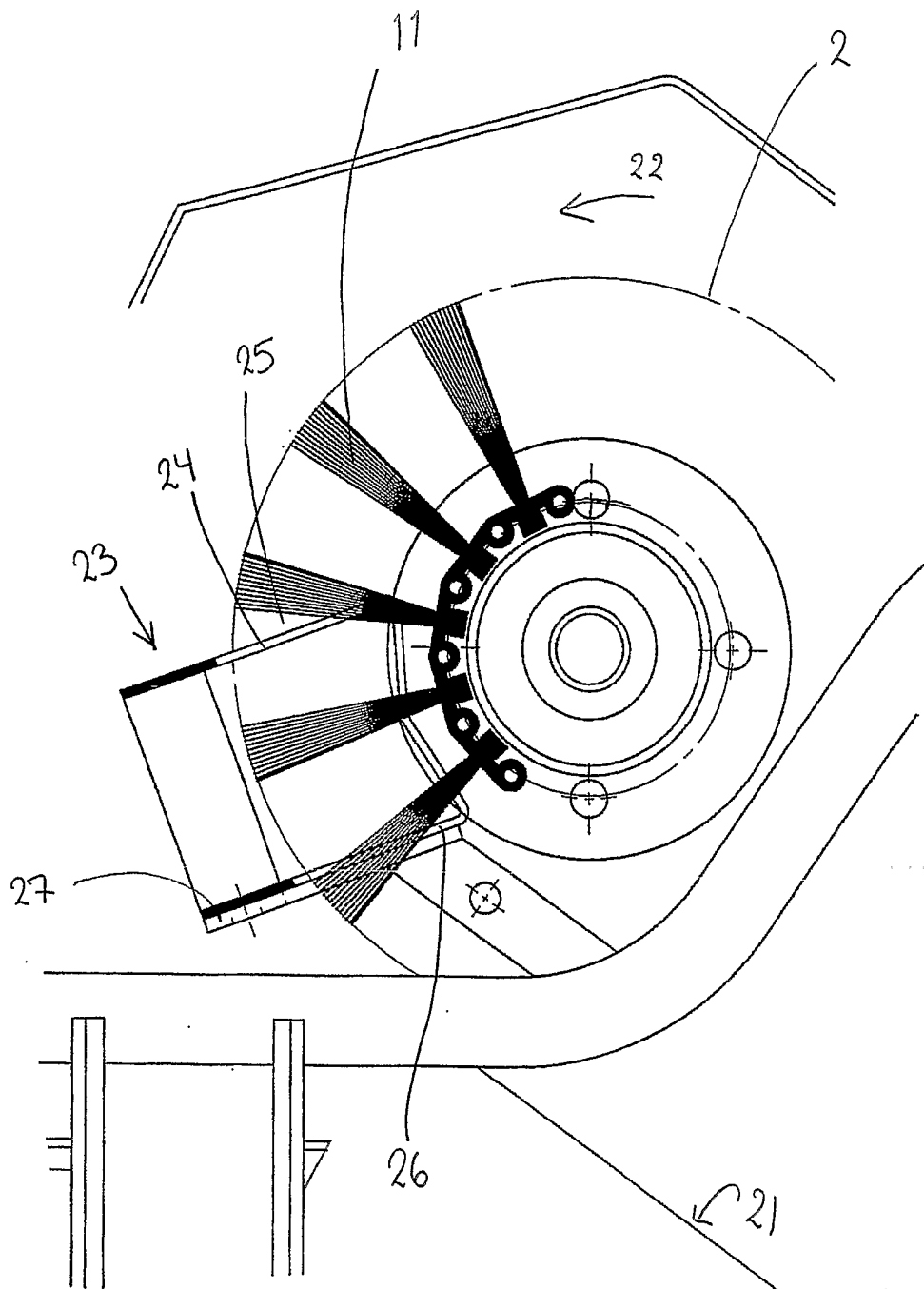


Fig 5