(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 234 031**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **86117405.0**

(51) Int. Cl.⁴: **E02B 15/04**

(22) Date of filing: **15.12.86**

(30) Priority: **25.02.86 IT 1953586**

(43) Date of publication of application:
02.09.87 Bulletin 87/36

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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(54) Apparatus for depolluting waters of floating substances.

(57) An apparatus for depolluting waters of floating substances comprising a bottomless tank, one or more bladed wheels which transfer liquid together with pollutant substance from the peripheral part to the central part of said tank, and a skimming system for transferring the pollutant substance from said tank to a recovery system.

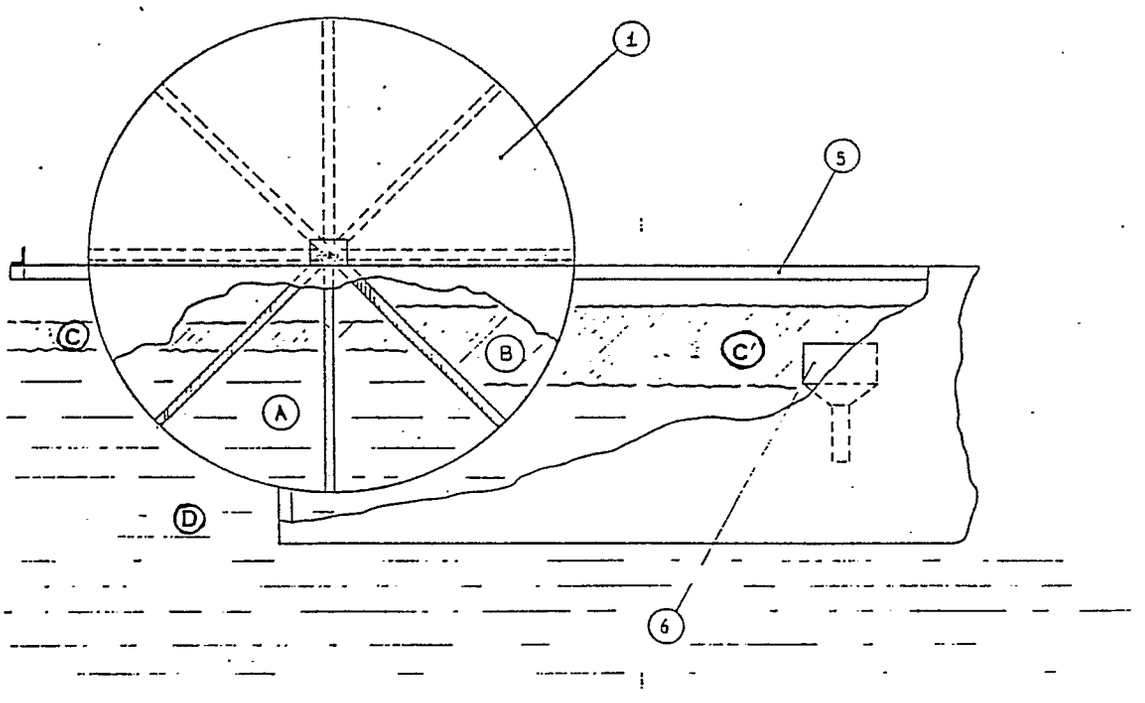


FIG 1

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APPARATUS FOR DEPOLLUTING WATERS OF FLOATING SUBSTANCES

This invention relates to an apparatus for depolluting waters of floating substances.

More particularly, the invention relates to an apparatus for depolluting sea, lake and river waters of oily and solid pollutants, with recovery of the pollutant substances.

The most preoccupying pollution of sea, lake and river waters is known to be oil pollution, which has reached an intolerable level because of the damage being caused in practically all continents.

The main causes of oil pollution are leakages due to oil tanker damage, the washing of tanks in the open sea, occasional industrial discharge, and accidents to coastline storage tanks.

Unfortunately, these are events of daily occurrence which create a serious ecological problem. This problem has been studied in Italy and abroad, and apparatus, which in some cases are rudimentary and in other cases sophisticated, have been constructed for depolluting waters of oily and other substances.

Some of these apparatus operate with recovery of said substances and others operate without recovery, and they can be classified on the basis of the physical principle or chemical medium used, as in the following table:

Apparatus operating with recovery	mechanical treatment	-discs
		-belts
		-suction
		-sponge belt
	gravity treatment	
Apparatus operating without recovery	chemical treatment	-with dispersants
		-with polymerising agents
	treatment with absorbents	-in powder form
		-in bags or pads

Systems with recovery are obviously preferable, both from the economical and ecological viewpoint. In this respect, treatment with chemical substances without recovery only results in the appearance of the problem elsewhere. For example, the use of chemical absorbents spred over the oily surface results in absorption of the oil, which then sinks on to the sea bed with resultant sea bed pollution.

Systems using recovery can be of mechanical or gravity type.

Mechanical systems comprise apparatus of disc, belt or suction type.

The discs and belts utilise the adherence of the oil to the respective metal surfaces, which rotate slowly semi-immersed in the liquid.

The disc or belt rotates through the oily layer, and the oil which adheres to the surface is removed by suitable rubber brushes and conveyed into a collection channel.

The suction system uses a principle identical to the vacuum cleaner. In this case, the suction mouth is kept in proximity to the surface by suitable floats so that it draws in only the adjacent liquid layer.

Another system consists of a long endless belt of length 10 or 20 metres formed from sponge fibres and left floating on the surface while kept slowly moving.

At one point the belt passes through a roller system which squeezes the absorbed oil from it and releases it ready to reabsorb further oil, while at the same time driving the belt with slow circular movement. Mechanical systems of the known art are generally complicated and costly. For example the amount of oil collected by a single disc is only small, and therefore many discs in parallel are required.

Other systems are rudimentary, and their performance is limited. For example the sponge belt collects only a small quantity and wears rapidly.

Moreover, in all cases the quantity of water accompanying the collected oil is high, varying from 10% to 40% of the collected oil by weight.

A further drawback is that the collected oil quantity varies with variation in the temperature and viscosity of the dispersed oil.

For very dense oils (heavy crude) or very light oils (petrol or the like), the metal adherence systems are of no practical use because of the small quantity of oil collected.

Furthermore, the maintenance of these systems, involving the replacement of oil collection brushes, removing foreign bodies from the discs, etc., involves heavy investment and operating costs.

The last system which deserves mention for collecting oil dispersed on liquid surfaces is the gravity system.

Water bearing the oil is made to enter a tank, the dimensions of which are calculated so that the liquid moves only at low speed. The oil rises to the surface to create a layer of increasing size whereas the water leaves from the discharge pipe at the base of the tank. A surface skimming channel enables the oil to leave and be collected.

This sytem is used universally today in all civil and industrial water purification plants for the removal of oil and grease.

The system is simple and reliable, and the collected oil contains only traces of water which in any event do not compromise the further use of the collected oil in an industrial cycle.

This system has however the drawback that it cannot be applied to any case in which the oil or grease lies on an extended liquid surface (lake, sea or river).

This is because it would be inconceivable to construct a tank which could treat all the polluted water of a sea, lake or river etc., because of the large water quantity to be cleaned.

The drawbacks of the apparatus of the known art are obviated by the apparatus according to the present invention, which allows the floating pollutant layer, whether in the form of oily, solid or mixed substances, to be gravity-separated from any liquid surface, however large.

The apparatus is suitable for incorporation into large basins or tanks, and if suitably equipped can operate in lakes, ports or on the open sea.

The apparatus for removing floating polluting substances from the surface of water, comprises a bottomless periferically sealed tank and, at the front of the tank one or more wheeles presenting paddle-like spokes suitable for conveying and transferring the liquid containing floating polluting substances from the outer part to the central part on the tank, thus causing a thickening of the layer of polluting matter up to the level of a skimming system which allows to collect the polluting substance from the surface of the water in the periferically tight tank and to transfer it to a recovery system.

These and further characteristics and advantages of the apparatus according to the invention will be more apparent from the detailed description given hereinafter and from the relative figures which illustrate preferred embodiments of the invention by way of non-limiting example.

Figure 1 illustrates the principle of operation of the apparatus according to the invention, and Figure 2 illustrates a floating, self-propelled application of the said apparatus.

Referring to the reference letters and numerals of the figures, the tank 5 is a structure comprising four side walls but no bottom. It can be of fixed type or of floating, mobile self-propelled type.

The wheels 1 and 2 define with their blades various sectors, and in Figure 1 it can be seen that the wheel 1, rotating anticlockwise, withdraws a surface liquid sector A from the outer part of the tank 5 and transfers it to the sector B, in the central part of said tank.

In this manner the layer C' of pollutant substance inside the tank 5 assumes a greater thickness than the layer C of the said pollutant substance outside the tank.

D indicates the underlying body of water.

With the illustrated procedure, floating pollutant substances of any type, whether of high or low density and of liquid or solid form, are accumulated in the tank 5 provided that their size is compatible with the wheel sectors, whereas the water transferred from sector A to sector B passes into the underlying layer D and returns to the surrounding basin or sea.

This operational procedure demonstrates why the tank 5 must be bottomless.

If the pollutant liquid is oil, its water content is practically nil and this enables the dispersed liquid to be totally recovered and reused.

A suitable skimming system 6 inserted into the tank enables the floating pollutant substances to be collected.

The recovered substances are then transfered by normal means such as pipes, suction pumps and the like.

Thew apparatus shown in the floating, self-propelled application of Figure 2 can vary in dimensions according to requirements.

The following conditions can arise with this application:

-if the wheel 1 and wheel 2 both move anticlockwise, the apparatus moves from right to left;
-if both rotate clockwise, the apparatus moves from left to right;
-if the wheel 1 rotates anticlockwise and the wheel 2 rotates clockwise, the apparatus remains at rest and urges the surface part of the surrounding liquid towards the central part of the tank 5, where the floating substances are collected and conveyed through suitable pipes.

The front and rear walls of the tank 5 are in the form of grids 7 with a mesh size calculated in relation to the maximum dimensions of any solids which may be conveyed within the bladed wheels 1 and 2.

Brushes fixed to the inner surface of the side walls of the tank 5 ensure that the lateral surfaces of the wheels 1 and 2 seal against these walls so as to prevent any dispersal of the layer floating within the tank 5.

The blades of the wheels 1 and 2 are grooved in the part close to the hub to allow any air bubbles to escape, thus ensuring a constant conveyed liquid level.

The rotational speed of the blades 1 and 2 is a critical parameter in ensuring that there is no turbulence and no general movement of the liquids or materials within the tank 5, in order to ensure a degree of rest within the tank which is sufficient to allow separation of the two layers. This rotational speed can for example be between 5 and 20 revolutions per minute.

A further parameter which influences the efficiency of the apparatus is the dimensions of the wheels 1 and 2. The wheel diameter can range from 0.5 to 3 metres, the wheel length can range from 0.5 to 5 metres, and the volume of liquid conveyed by the sectors can range from 10 to some thousands of cubic metres per hour.

The shafts of the wheels 1 and 2 lie above the surface reached by the liquid mass within the tank 5, in order to prevent any part of the pollutant material being picked up and dragged to the outside by the blades.

A system can be constructed in which the height of the wheel shafts can be varied, so enabling both the volume of the conveying sectors to be varied, and the shafts to be raised further above the surface of the materials contained in the tank should said surface rise beyond the predicted limits and faster than the skimming system can cope with.

The dimensions of the tank 5 in terms of length and height of the walls vary according to the conditions of the environment in which the depolluting operation takes place.

The drive system 3 can be of internal combustion, electric or compressed air type, and the transmission is preferably hydraulic to allow simple adjustment both of the direction of rotation and of the speed of rotation.

In all cases the drive unit is disposed in a raised position so as not to interfere with the tank liquid surface.

Finally, the skimming system 6 is chosen individually, according to the pollutant substance to be collected, the collection system used, and the environmental conditions.

Claims

1. An apparatus for removing floating polluting substances from the surface of water, which comprises a bottomless periferically sealed tank a at the front of the tank one or more wheeles presenting paddle-like spokes suitable for conveying and transferrring the liquid containing floating polluting substances from the outer part to the central part of the tank, thus causing a thickening of the layer of polluting matter up to the level of a skimming system which allows to collect the polluting substance from the surface of the water in the periferically tight tank and to transfer it to a recovry system.

2. An apparatus as claimed in claim 1, characterised in that said tank (5) is a structure comprising four lateral walls of which the front and rear wall are in the form of grids (7).

3. An apparatus as claimed in claim 1, characterised in that said tank (5) is of fixed type.

4. An apparatus as claimed in claim 2, characterised in that said tank (5) is of floating, mobile self-propelled type.

5. An apparatus as claimed in claim 1, characterised in that with their blades, said wheels (1) and (2) define various liquid sectors which, by the effect of rotation, are moved from one position to another in said tank (5).

6. An apparatus as claimed in claim 1, characterised in that brushes are fixed on to the inner surface of the lateral walls of the tank (5) to enable the lateral surface of the wheels (1) and (2) to form a seal against said walls.

7. An apparatus as claimed in claim 1, characterised in that said wheels (1) and (2) are grooved at the part close to the hub in order to allow any air bubbles to escape.

8. An apparatus as claimed in claim 1, characterised in that the shafts of said wheels (1) and (2) are raised above the surface of the liquid mass within the tank (5).

9. An apparatus as claimed in claim 1, characterised in that the height of the shafts of said wheels (1) and (2) above the surface of the liquid mass within the tank (5) can be varied.

10. An apparatus as claimed in claim 1, characterised in that said wheels (1) and (2) have a diameter varying from 0.5 to 3 metres and a length varying from 0.5 to 5 metres.

FIG 1

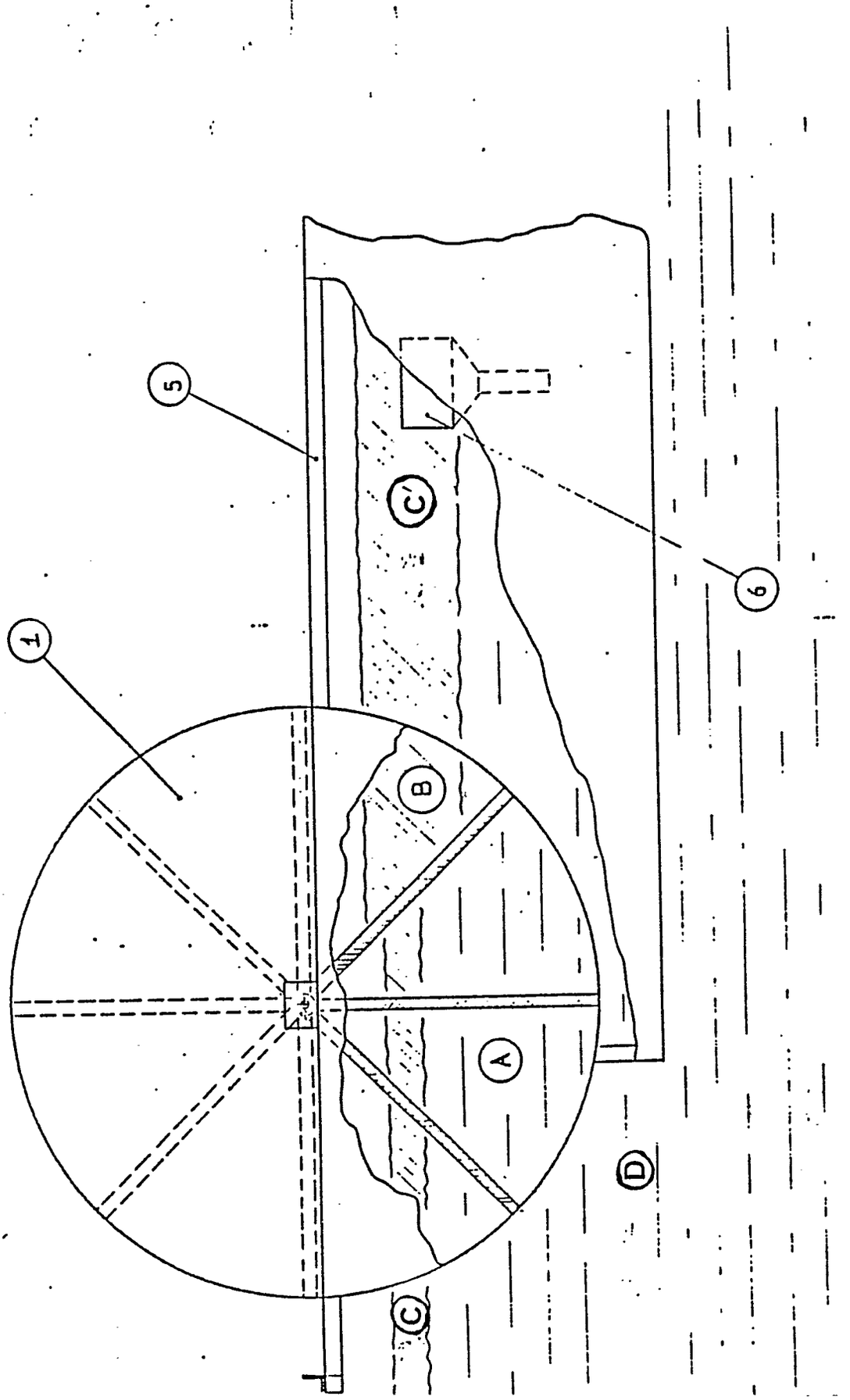


FIG 2

