

(19)



(11)

EP 1 834 900 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

19.09.2007 Bulletin 2007/38

(51) Int Cl.:

B65D 88/36 (2006.01)

A01C 3/02 (2006.01)

E04H 4/06 (2006.01)

(21) Application number: **07075202.7**

(22) Date of filing: **13.03.2007**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE
SI SK TR**

Designated Extension States:

AL BA HR MK YU

(30) Priority: **14.03.2006 NL 1031364**

04.10.2006 NL 1032626

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(54) **An arrangement for covering a liquid surface in a container, as well as a method for manufacturing a floating body**

(57) The present invention relates to an arrangement for covering a liquid surface in a container, wherein a number of individual floating bodies are present in said container, which floating bodies cover the liquid at or near the surface thereof by at least substantially abutting

against each other. The present invention further relates to a method for manufacturing a floating body for use in the aforesaid arrangement.

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Description

[0001] The present invention relates to an arrangement for covering a liquid surface in a container, wherein a number of individual floating bodies are present in said container, which floating bodies cover the liquid at or near the surface thereof by at least substantially abutting against each other. The present invention further relates to a method for manufacturing a floating body, as well as to a floating body for use in the aforesaid arrangement.

[0002] From Dutch patent No. 1002693 an arrangement is known in which mention is made in particular of water basins, such as the basins that are used for irrigation purposes in the market gardening industry. In such water basins, algae develop in the course of time, which algae contaminate the water basin and render it unsuitable for use. Said algal growth can be opposed by the addition of chemical agents, such as chlorine, to the water, in which connection it should be noted, however, that the addition of such agents negatively affects the environment. From the aforesaid Dutch patent it is thus known that algal growth in a water basin used for irrigation purposes is strongly reduced by placing floating bodies in the basin, which floating bodies cover the liquid. The floating bodies used for that purpose are provided with weighting means, so that they can at least partially extend under the liquid surface when placed in the container, which weighting means are formed by liquid-receiving gaps in the outer wall of the floating body, via which gaps the floating body can partially fill with water so that it will take up a stable position. Such floating bodies are unsuitable for use in slurry pits, because the presence of the liquid-receiving gaps will lead to the slurry accumulating therein, as a result of which the emission of harmful gases will increase.

[0003] German Offenlegungsschrift No. 26 57 270 relates to a floating body in the form of a lens, whose immersion depth is adjustable, which floating bodies are claimed to realise a covering degree of the active surface of the liquid layer of about 98%.

[0004] French patent application No. 1,601,744 relates to milk containers, in which use is made of a foamed material provided with a special skin layer.

[0005] US patent No. 3,401,818 relates to a vessel in which more or less spherical floating bodies are present, which floating bodies are claimed to realise a covering degree of the liquid surface of about 90%. The floating bodies mentioned therein are configured to prevent rotation thereof, which is effected by the presence of a circumferential edge provided with a fin.

[0006] French patent application No. 2,250,884 relates to a floating body of substantially hexagonal configuration.

[0007] German Offenlegungsschrift No. 24 20 227 relates to a floating body which must be prevented from rotating, as the moisturized portion will be exposed to the ambient air upon rotation, which leads to evaporation of the liquid.

[0008] German Offenlegungsschrift No. 39 27 616 relates to a disc-shaped floating body provided with a circumferential edge, which edge functions to prevent rotation.

[0009] The present invention is in particular concerned with the emission problem that occurs in intensive stock-rearing stables. In such stables, the cattle are accommodated on a slatted floor, in the cattle's excrements fall through the slatted floor into the slurry pit that is located thereunder. The existing slurry pit has a large liquid-surface area, so that the ammonia contained in the slurry can freely escape into the atmosphere, which leads to high emission levels. It has moreover been found that the ammonia, which has a strong smell, adversely affects the health of the animals in the stable.

[0010] In the past a number of systems have been developed for reducing the emission of ammonia from slurry pits. One such system is the delta system, which is based on a try square of plastic material, which is mounted in the slurry pits with a flexible slab, such that a high sealing percentage is achieved. In practice, however, the system appears to be easily fouled, so that, also in view of the high initial costs and the high maintenance costs, the system was found to be unsuitable. Another system is the cooling system, in which pipes are present in the slurry pit, through which pipes ground water having a temperature of about 11°C is passed. By cooling the slurry in this way, a considerable reduction of the emission of ammonia can be realised. The cooling system has a number of drawbacks, however, such as the major capital outlay and the fact that ground water must be pumped, which leads to high energy costs. It should furthermore be noted in this connection that the cooling of the slurry will also effect a temperature decrease in the stable, which the cattle experience as unpleasant, so that the stable itself will in turn have to be additionally heated, which involves additional energy costs. Another system is the washing system, according to which the air above the slurry is exhausted via a fan, which air is subsequently passed through a scrubber installation for removing the ammonia from the exhausted air. Although this system is being used on a relatively large scale, it is disadvantageous that the liquid ammonia obtained thereby needs to be discharged, that the capital outlay is high and that the costs of running the system are high, inter alia because of the high energy costs.

[0011] The object of the present invention is to provide an arrangement for reducing the emission of ammonia from a slurry pit, wherein the formation of ammonia from the liquid manure is minimised.

[0012] Another object of the present invention is to provide an arrangement for reducing the emission of ammonia from a slurry pit, wherein the energy costs and the maintenance costs are minimised.

[0013] Yet another object of the present invention is to provide an arrangement for reducing the emission of ammonia from a slurry pit, wherein a substantial reduction of the ammonia emission is achieved at minimal cost.

[0014] The present invention as referred to in the introduction is characterised in that the floating bodies are configured to be rotatable in the liquid for discharging manure being deposited thereon to the underlying liquid.

[0015] One or more of the above objects is (are) achieved by using such floating bodies. The present invention is used in stable arrangements, in which stable arrangements the animals are entirely or partially accommodated on a slatted floor, confined by fencing. The animals' excrements fall through the slatted floor into a slurry pit located under said floor. The manure from the animals is collected in said slurry pit and the pit is periodically emptied. Because the floating bodies are according to the invention rotatable about their own axis, the floating body will start to rotate of its own accord when the manure is deposited on the floating body, as a result of which the manure is directly discharged to the underlying liquid layer. The buoyancy will thrust the floating body upwards in the liquid layer, which has a positive effect on the rotation thereof. As a result of the rotation of the floating body, a relatively clean surface of the floating body will be present at the upper part of the liquid layer, as a result of which the emission of ammonia will be reduced. Moreover, as a result of the rotation of the floating bodies about their axis when manure is deposited thereon, the risk of the manure caking on to the floating body is minimised, so that the maintenance costs will be very low. The present floating body will thus constantly clean itself in the liquid as a result of its rotation therein. The term "axis" is to be understood to indicate that the floating body is rotatable about an imaginary axis or centre (of gravity). In the case of a spherical floating body this means that the spherical body can in fact rotate in all directions, in principle about the (imaginary) centre of gravity thereof. In other words, the floating body can turn upside down and subsequently retain that position. The present floating body has a closed outer surface, which means that no liquid can penetrate into the interior of the floating body from outside, except in the case of undesirable leakage, of course. The present floating body therefore does not have any gaps and cavities that would be freely accessible via the outer side of the floating body.

[0016] Spherical floating bodies are suitable floating bodies, which floating bodies preferably have a diameter of 10-40 cm in order to achieve an optimum sealing of the liquid surface. Since the slurry will be pumped from the slurry pit at some point, it is desirable that the floating bodies not be discharged along with the slurry, so that the floating bodies should have a diameter of at least 10 cm. In addition, it has been found that in the case of a diameter of less than 10 cm there is not sufficient buoyancy to cause the floating body to rotate of its own accord. A dimension of more than 40 cm has the disadvantage that the ammonia reduction that is achieved will be insufficient, in particular in the case of small-sized slurry pits, because less floating bodies can be placed in the slurry pit for obtaining a sufficient abutment against each other. At the presently available slurry pits a diameter in

a range from 20 to 30 cm is sufficient. Dimensions of 10-20 cm and 30-40 cm are possible, too. In a specific embodiment of the present invention it is possible that floating bodies having different sizes are present in the container.

[0017] To obtain an optimum sealing of the liquid surface, the specific weight of the floating bodies preferably ranges between 0.4 and 0.6. If a specific weight lower than 0.4 is used, the floating body will float too high on the liquid surface, as a result of which the emission of ammonia will increase. If on the other hand a floating body having a specific weight higher than 0.6 is used, the floating body will lie too low in the liquid surface, so that the free liquid area between two adjacent floating bodies over which the ammonia emission takes place will be too large, resulting in an insufficient reduction of the ammonia emission. Floating bodies having different specific weight values may be used in the present arrangement.

[0018] A suitable material for the present floating body is expanded polystyrene (EPS), which material is available on a large scale and which is of a durable nature. In order to obtain a sufficient chemical resistance of the floating body, the floating body is preferably circumferentially provided with a layer of plastic material, in particular polyurea. An additional advantage of such a layer of plastic material is that a smooth surface is obtained, which will reduce the extent to which manure adheres thereto.

[0019] Another suitable material is plastic, in which connection high-density (HDPE), medium-density (MDPE), low-density and linear-low density (LDPE) polyethylene may be considered, with HDPE being preferred in view of the material properties thereof.

[0020] A suitable arrangement is a stable in which at least one slurry pit is present, in particular a slurry pit in which the animals' excrements are deposited on to the floating bodies, in which slurry pit both liquid and solid excrements are present, therefore. Since the present floating bodies seal the liquid surface and ensure that a relatively clean part of the present floating body projects above the liquid surface at all times, the emission of harmful components from the liquid is minimised.

[0021] The present invention further relates to a method for manufacturing a floating body for use in the aforesaid arrangement, which method is characterised in that two identical halves, which halves jointly form the floating body, are connected under a liquid surface, enclosing a part of said liquid therein, wherein the two halves interlock via a tongue and groove joint and are durably bonded together through the use of an adhesive.

[0022] Preferably, the circumferential side of the floating body thus formed is provided with a layer of plastic material after the two halves have been durably bonded together, wherein in particular polyurea may be used as the plastic material.

[0023] The above method is preferably carried out in a water-filled space, so that the interior of the floating

body is filled with a predetermined amount of water, which amount is preferably selected so that the final floating body will have a specific weight of 0.4-0.6, as already indicated in the foregoing.

[0024] Another possible method of manufacturing a floating body for use in the above-described arrangement is to supply a liquid to a body that has already been formed into a floating body, via an opening therein, until the desired specific weight value is reached, after which the opening is sealed. If the floating body is made of a plastic material, said sealing may take place by heating or melting.

[0025] In a specific embodiment it is also possible to fill a hollow floating body with another material, for example sand, besides a liquid, preferably water, or with a combination thereof. The filler used in the hollow floating body must not have a negative effect on the capacity of the floating body to rotate about its own axis or its (imaginary) centre of gravity. After all, if the floating body cannot rotate about its own axis or its (imaginary) centre of gravity in the slurry, the slurry will adhere to the floating body, resulting in caking at that location, which will adversely affect the performance of the floating bodies in case of insufficient buoyancy thereof. Using the present invention, the ammonia emission will be lower than the new IPPC "Green Label Standard" of 1.4 kg/ammonia per animal.

Claims

1. An arrangement for covering a liquid surface in a container, comprising a liquid-filled slurry pit and a number of individual floating bodies, which floating bodies cover the liquid surface by at least substantially abutting against each other, wherein the floating bodies are configured to be rotatable in the liquid for discharging manure being deposited thereon to the underlying liquid.
2. An arrangement according to claim 1, **characterised in that** the floating bodies are spherical in shape.
3. An arrangement according to either one or both of the preceding claims, **characterised in that** the diameter of the floating bodies ranges between 10 and 40 cm.
4. An arrangement according to any one or more of the preceding claims, **characterised in that** the specific weight of the floating bodies ranges between 0.4 and 0.6.
5. An arrangement according to any one or more of the preceding claims, **characterised in that** the diameter of the floating bodies ranges between 20 and 30 cm.
6. An arrangement according to any one or more of the preceding claims, **characterised in that** the floating bodies are made of a plastic material selected from the group consisting of HDPE, MDPE and LDPE.
7. An arrangement according to claim 6, **characterised in that** the floating bodies are made of HDPE.
8. An arrangement according to any one or more of the preceding claims, **characterised in that** the floating bodies are present at or near the surface of the liquid in a slurry pit for the purpose of reducing the formation of vapours rising from the manure.
9. An arrangement according to any one or more of the preceding claims, **characterised in that** the floating bodies have a closed outer surface.
10. A method for manufacturing a floating body for use in an arrangement as defined in any one or more of the claims 1-9, **characterised in that** two identical halves, which halves jointly form the floating body, are connected under a liquid surface, enclosing a part of said liquid therein, wherein the two halves interlock via a tongue and groove joint and are durably bonded together through the use of an adhesive.
11. A method for manufacturing a floating body for use in an arrangement as defined in any one or more of the claims 1-9, **characterised in that** a hollow floating body, in which an opening is present, is provided with a filler by supplying the filler via said opening and subsequently sealing the opening.
12. A method according to claim 11, **characterised in that** said filler is a liquid, in particular water.
13. A method according to any one of the claims 10-12, **characterised in that** the floating bodies are made of a plastic material selected from the group consisting of HDPE, MDPE and LDPE.
14. A method according to claim 13, **characterised in that** the floating bodies are made of HDPE.
15. A method according to any one or more of the claims 10-14, **characterised in that** the circumferential side of the floating body is provided with a layer of plastic material.
16. A floating body for use in an arrangement as defined in any one of the claims 1-9.
17. A floating body according to claim 16, **characterised in that** the diameter of the floating body ranges between 10 and 40 cm.

18. A floating body according to either one or both of the claims 16-17, **characterised in that** the specific weight of the floating body ranges between 0.4 and 0.6.

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19. A floating body according to any one or more of the claims 16-18, **characterised in that** the floating body is made of a plastic material selected from the group consisting of HDPE, MDPE and LDPE.

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20. A floating body according to any one or more of the claims 16-19, **characterised in that** the floating body has a closed outer surface.

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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 07 5202

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