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(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0294910 A1****Eichler**(43) **Pub. Date: Dec. 27, 2007**(54) **ROTARY DRUM FOR THE AEROBIC HEATING OF POURABLE SOLIDS**(30) **Foreign Application Priority Data**

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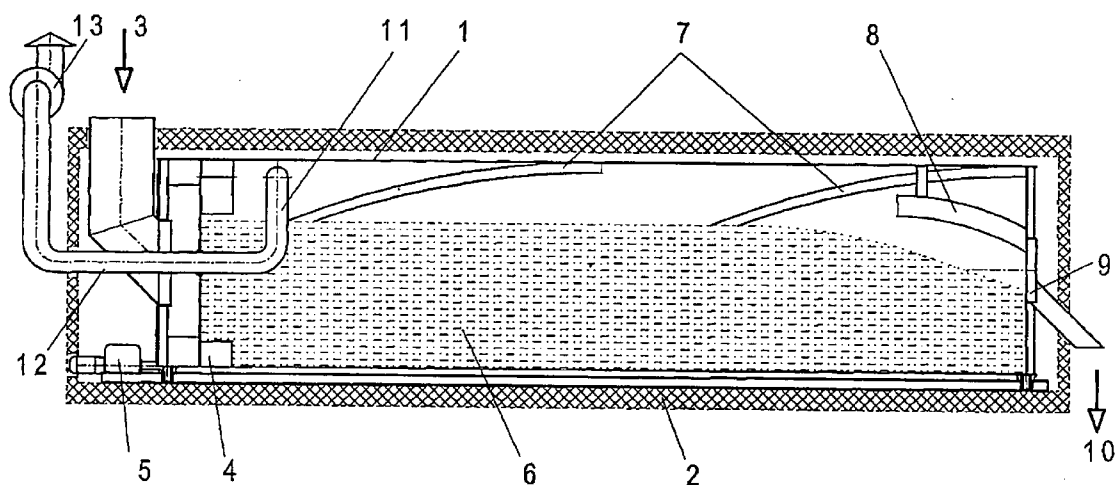
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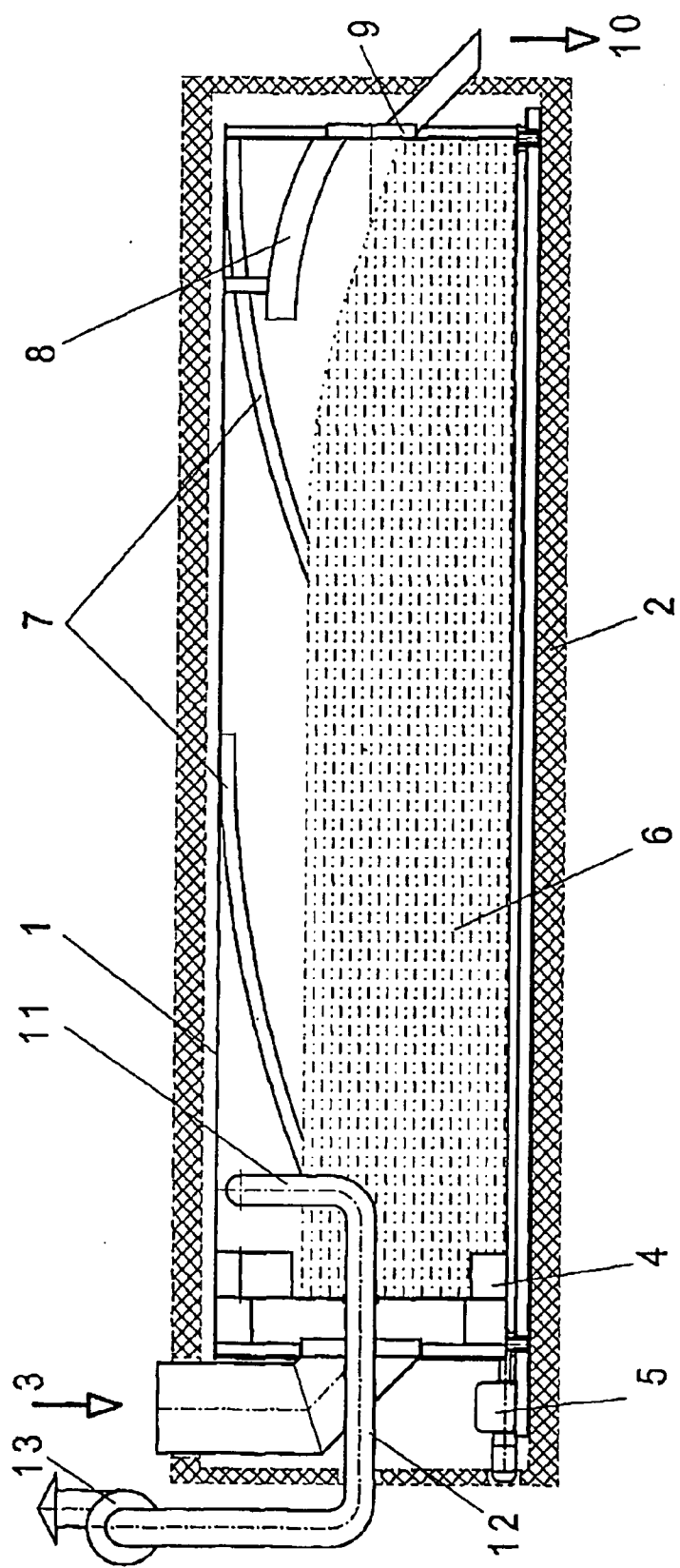
EDWARDS ANGELL PALMER & DODGE LLP**P.O. BOX 55874****BOSTON, MA 02205 (US)**(51) **Int. Cl.**
F26B 11/06 (2006.01)(52) **U.S. Cl.** **34/140**(57) **ABSTRACT**

The invention concerns a rotary drum (1), in which the hygienic status of separated, pourable cow manure solids (3) is modified by aerobic heating such that the solids can be re-used as bedding in cowsheds. The aim of the invention is that of achieving a high charge level of the drum (1), which lies horizontally for incorporation in an insulated container (2), with a filling level of 60-70% being achieved. According to the invention, the loaded solid (3) is kept in a chamber (4,8) and is passed to the drum (1) only when there is no solid surrounding the chamber (4,8). An important element is a flap (4,9) of the chamber (4,8), which opens and closes in this area only. If there is solid material on the outside of the flap, then the flap is prevented from opening (4,9).

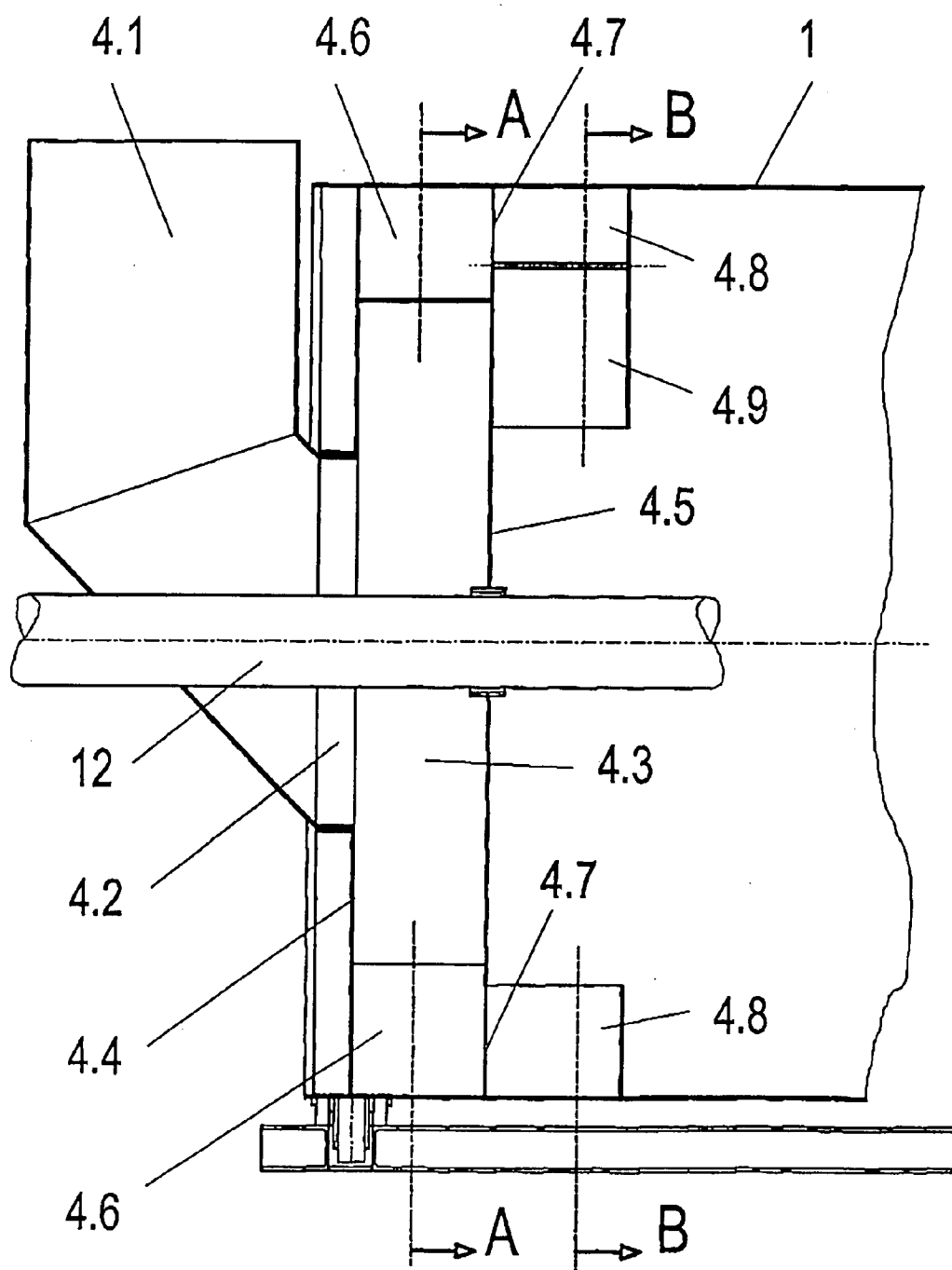
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(2), (4) Date: **May 14, 2007**



Figur 1



Figur 2

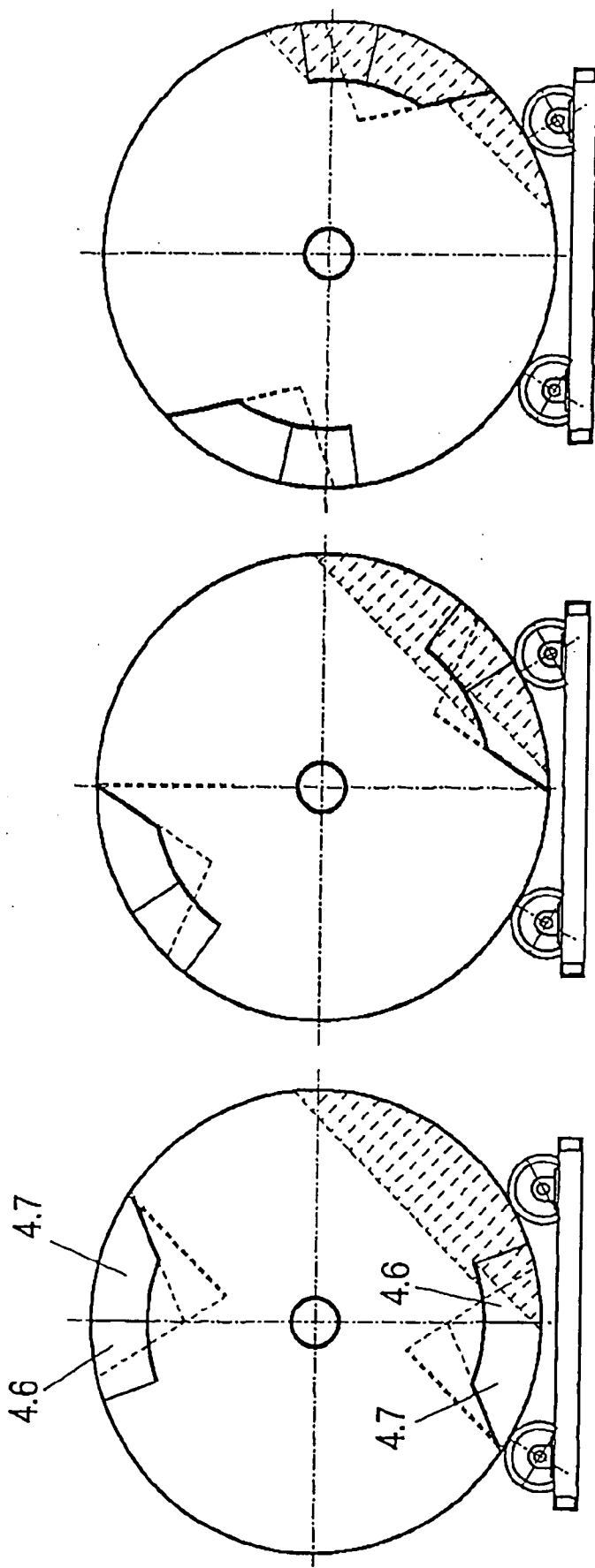
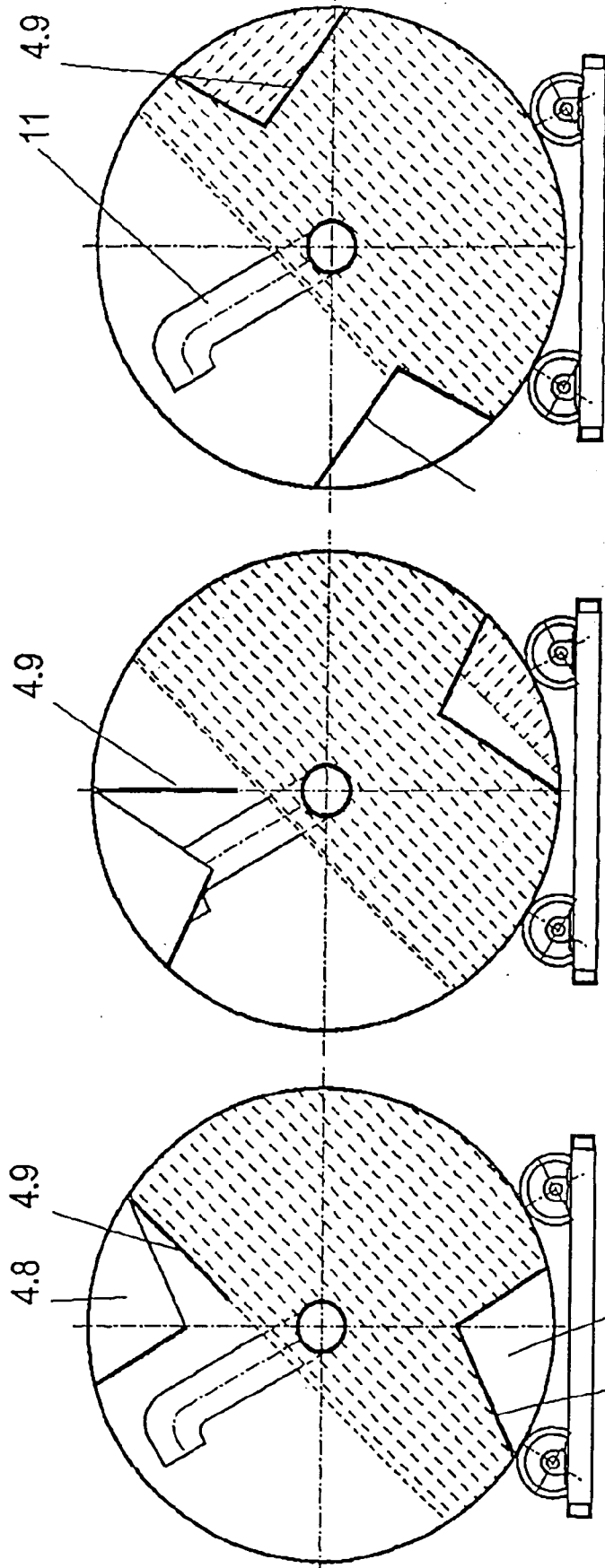


Figure 3 Figure 4 Figure 5



Section B-B

Figur 6

Figur 7

Figur 8

ROTARY DRUM FOR THE AEROBIC HEATING OF POURABLE SOLIDS

[0001] The invention relates to a rotary drum in which the hygienic status of pourable solids separated from liquid cattle manure is modified by aerobic heating in such a manner that said solids can be reused as bedding in cattle sheds.

[0002] The object of the invention is to obtain a high loading factor amounting to 60-70% filling of the drum which is located horizontally for installation in an insulated container.

[0003] In accordance with the invention, the loaded solid is kept in a chamber and is only transferred to the drum when there is no solid surrounding the chamber.

[0004] The crucial element is a flap of the chamber which only opens and closes in this area. If there is any solid resting on the outside of the flap then opening of the flap is prevented.

[0005] In order to enable ventilation to be effected despite the filling process taking place along the axis, supply air is sucked in through the ring-shaped weir required for the discharge of the solid in a direction opposed to that in which the solid is being advanced and is then sucked out through a fixed pipeline at the inlet end.

FIELD OF APPLICATION

[0006] The subject matter of the invention is a rotary drum in which germs can be reduced and water removed by means of an aerobic heating process. The field of application is mainly in the treatment of pourable solids separated from liquid cattle manure. Hereby, the object is to modify the hygienic status of the solid in such a way that it can be reused as bedding in cattle sheds.

TYPICAL CHARACTERISTICS OF KNOWN TECHNICAL SOLUTIONS

[0007] Rotary drums for the treatment of materials in different ways have been known for a long time. The pourable solids are introduced through funnels as is disclosed in specifications DE 26 34 220 C2 and U.S. Pat. No. 4,168,915. Consequently, without special adapters in the loading area thereof, it is only possible to fill a horizontal drum to a capacity of approximately 35% taken with respect to the diameter of the drum.

[0008] In order to get quantities above this into the drum, it is necessary to have blades, baffle plates and guide plates or screw conveyers of various designs installed in the drum. A plurality of similar built-in features are provided for this purpose in patent specification DE 270 86 98.

[0009] In order to enable the drum to be ventilated by means of a suction draught from the supply to the discharge side, a spiral channel using the solid being discharged as a closure member is arranged at the discharge side in DE-PA 199 28 883,6. This solution requires precise dosage of the quantities being fed-in and discharged. The drum would otherwise be either overfilled or emptied. In this publication, the drum is accommodated in a container. This arrangement has the advantage that the heat from the biological process and the heated air from a drive motor can be distributed uniformly over the outer casing of the drum.

THE OBJECT OF THE INVENTION

[0010] An object of the invention is to obtain a filling degree of 60-70% for a horizontal drum that is to be installed in a container utilising a simple device. Furthermore, just as much solid as is being supplied to the filling side should always be automatically leaving the drum.

[0011] The supply of air necessary for the micro-biological process should be designed in such a way that, by using the counter-flow principle, the treated material comes into contact with cold fresh air whereas the material in the vicinity of the supply side comes into contact with used warm air.

FEATURES OF THE INVENTION

[0012] According to the invention, the pourable solid that is to be fed-in is kept in a chamber and is only delivered in that area thereof in which no solid is present. The crucial element is a flap provided in the chamber which opens only within the area and closes. If any solid is resting on the outside thereof, the flap cannot open.

[0013] For the purposes of carrying out this operation, the pourable solid at the inlet side of the rotary drum passes through a funnel and a central opening into an antechamber bounded by an outer side wall of the drum and an inner side wall located behind and spaced from the outer side wall. An inlet channel provided on the wall of the drum and located between these walls picks up the solid in the direction of rotation. An opening in the inner side wall leads to a release chamber located in the interior of the drum.

[0014] The release chamber is covered by a flap which opens into the interior of the drum but which does not open until, due to the rotation of the drum, the release chamber is in an area where there is no solid present. In the course of further rotation, the flap closes again before it re-enters the solid.

[0015] Depending on the quantity of solid that is to be introduced, several such devices for inserting the pourable solid can be located around the periphery of the drum.

[0016] Supply air is sucked in through a ring-shaped weir required for the discharge of the solid in a direction opposed to that in which the solid is being advanced. Sucking off the air is effected through a fixed axially located pipeline which is extended radially into the solid-free portion of the drum in the vicinity of the filling side for the solid. A downwardly arranged elbow portion is attached here for preventing solids from falling into the pipe. The suction pipe is fixed to the funnel. A fan produces a negative pressure required for the movement of the air.

EXEMPLARY EMBODIMENT

[0017] FIG. 1 shows a longitudinal section through a rotary drum (1) which is installed in an insulated container (2). Goods to be treated (3) are introduced into the interior of the rotary drum (1) through a filling device (4). The rotary drum (1) is set into rotation by a drive (5). The pourable solid (6) is constantly moved toward the discharge side by blades (7) attached to the surface of the drum. Guide plates (8) effective in opposite direction are located in the vicinity of the discharge side and are fixed at a distance of approximately half a radius from the surface of the drum. They dam

up the solid in front of the ring-shaped discharge weir (9). In consequence, a large portion of the drum volume remains filled with 65-75% solid. Only that much solid as is supplied by way of the filling device (4) is discharged from the drum through the discharge weir (9).

[0018] The air flowing through the discharge weir (9) in a direction counter to that of the flow of the solid, over the filling volume (6), is sucked out of the system by means of a fan (13) through a fixed ventilation pipe (11) and the following axial pipe (12). If necessary, a filter system corresponding to the state of the art can be connected here at the outlet side thereof.

[0019] FIG. 2 is an axial section of the drum (1) showing the filling device (4) at the intake side and the positions of the sections A-A and B-B shown in the following figures. The damp solid that is to be composted passes through the funnel (4.1) and the central opening (4.2) and enters the antechamber (4.3) which is formed by the face wall (4.4) and the inner side wall (4.5).

[0020] In this embodiment, two oppositely located identical filler systems are provided for feeding purposes.

[0021] During rotation of the drum, the pourable solid is picked up by the inlet channel (4.6) that is open in the direction of rotation, and is carried into the rear portion of this channel during further rotation of the drum. Here, there is an opening (4.7) in the inner side wall (4.5) through which the solid enters the release chamber (4.8) in the course of further rotation.

[0022] At the appropriate side thereof, this chamber has a flap (4.9) which will only open when the chamber reaches that portion of the drum in which no solid is present so that the flap can only open here. A further condition for the position of the flap (4.9) is that it closes before it re-enters the solid and remains closed whilst in the solid.

[0023] For the purposes of a better overview, the reference symbols are only provided at a few locations of the following figures.

[0024] FIGS. 3, 4 and 5 show the section A-A through the antechamber (4) illustrated in FIG. 1. The drum is rotated through approximately 33° in FIG. 4 and through a further 45° in FIG. 5. In FIG. 3, the solid begins to flow into the inlet channel (4.6) in the lower filler device. In the upper filler device, the process of emptying the channel through the opening (4.7) is already completed. In FIG. 4, the process of filling the inlet channel (4.6) is almost completed and the solid is already entering the release chamber (4.8) represented by dashed lines through the opening (4.7) in the inner side wall (4.5). In FIG. 5, just so much solid as the release chamber (4.8) can accommodate now slides through the opening (4.7) from the inlet channel (4.6).

[0025] FIGS. 6, 7 and 8 show the section B-B represented in FIG. 2. Hereby, the drum is likewise rotated through

approximately 33° in FIG. 7 and through a further 45° in FIG. 8. In FIG. 6, the flap (4.9) of the release chamber (4.8) of the now upwardly located filler device has just opened and the solid has slid down into the drum. The flap of the filler device in the lower position is held in a closed position by the solid abutting the flap.

[0026] In FIG. 7, the flap (4.9) of the filler device now located in the upper position has reached its largest opening angle and then begins to close again under its own dead weight. In FIG. 8, the outpouring solid begins to cover the already closed flap (4.9). In the oppositely located filler device, the associated flap would open under its own dead weight if there were no solid in the drum. However, it cannot open up because the still immovable solid is preventing this action. In consequence, its contents are carried into the area in which the flap can reopen due to the flow-off of the solid thereby enabling 60-70% filling of the drum.

[0027] In this figure furthermore, the fixed ventilation pipe (11) is shown together with its elbow portion which leads away from the solid-free part of the drum.

1. A rotary drum for aerobic heating of a pourable solid by constantly revolving a still damp solid and supplying fresh air, wherein the solid at the inlet side of the rotary drum enters an antechamber through a funnel and a central opening, said antechamber being bounded by an outer side wall and an inner side wall located behind and spaced from the outer side wall, wherein an inlet channel is provided between these side walls on the wall of the rotary drum, which picks up the solid in the direction of rotation, wherein, in the inner side wall, there is an opening which leads to a chamber located in the interior of the drum, said opening is covered by a flap which opens into the interior of the drum and only opens when the chamber is in a portion of the rotary drum wherein no pourable solid is present and closes again before it re-enters the solid, and wherein the fresh air is sucked in through a ring-shaped discharge weir for the pourable solids and is sucked out through a ventilating means located in the vicinity of the filling device and an axially arranged pipe.

2. The rotary drum according to claim 1, wherein several filler devices for charging the pourable solid incorporating correspondingly effective flaps are provided around the periphery of the drum.

3. The rotary drum according to claim 1, wherein blades directly attached to the casing of the drum advance the pourable solid towards the discharge side whereat guide plates effective in opposite direction are fixed at a distance of half a radius from the casing.

4. The rotary drum according to claim 1, wherein there is a fixed ventilation pipe located in the vicinity of the inlet side for the solid comprising a radial pipe portion leading into the solid-free portion of the drum, a downwardly directed elbow portion and a succeeding axial pipe portion.

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