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(54) **METHOD AND DEVICE FOR SEPARATING SLUDGE-LIKE MATERIAL USING A STREAM OF FINELY DIVIDED AIR BUBBLES**

VERFAHREN UND VORRICHTUNG ZUR TRENNUNG VON SCHLAMMARTIGEN MATERIALEN MITTELS EINER FEINBLASIGEN BELÜFTUNG

PROCEDE ET DISPOSITIF DE SEPARATION DE MATIERE ANALOGUE A LA BOUE

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- **PATENT ABSTRACTS OF JAPAN vol. 006, no. 180 (C-125), 14 September 1982 & JP 57 094388 A (HITACHI LTD), 11 June 1982**

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Description

[0001] The present invention relates to a method for separating sludge-like material and water, said sludge-like material having a specific mass that approaches the specific mass of water, in which method a suspension, comprising water and sludge, is moved through a container.

[0002] A method of this type is generally known in the prior art. The aim is to cause the sludge-like material to float to the top with the aid of flotation techniques and the material that is forced up is skimmed off with the aid of skimming equipment. Separate foaming agents and the like are needed for this purpose. The addition of said agents not only incurs costs, but frequently gives rise to further contamination of the water.

[0003] Other methods for separating sludge-like material and water comprise heating, as a result of which water is removed by evaporation and sludge-like material remains behind. A method of this type is particularly energy-intensive and has been proposed, for example, for concentrating manure-like materials.

[0004] From the Japanese patent application 57094388 a method is known to suppress and prevent the floating and concentrating of sludge. Removal of anaerobic gas is realised by subjecting sludge to flow of air. After aeration sludge is bent to a separate container for further processing.

[0005] The aim of the present invention is to provide a method with which water and sludge-like material are essentially separated from one another without further chemicals or highly energy-intensive steps being required for this purpose.

[0006] This aim is achieved with a method as described above in that a vertically ascending stream of finely divided air bubbles is fed through the sludge suspension in the container and in that a stream containing sludge-enriched fluid is drained from the lower section of the container.

[0007] The insight on which the invention is based is, in contrast to the prior art, not to make use of flotation for the sludge-like material but to lower the apparent specific mass of water by feeding in air, as a result of which settling of sludge takes place because the specific mass of the sludge is then higher. The sludge can then be discharged.

[0008] The method described above can be used, inter alia, for concentrating manure-like materials.

[0009] However, surprisingly it has been found that the method can also be used for cleaning products such as (flower) bulbs. Soil material always adheres to bulbs of this type and for export to certain countries the regulations lay down that there must be absolutely no soil material adhering to such bulbs. For this purpose, in the prior art, the bulbs are subjected to a spray-treatment with water under high pressure. Damage to the bulbs regularly occurs as a result and there is no guarantee that grains of sand and the like have also been completely removed from the bulbs.

[0010] Another method for cleaning bulbs is to introduce them into drums of large diameter, for example having a capacity of 15 m^3. These bulbs, such as lily bulbs, are cleaned using a sort of washing machine treatment. However, the sand present in water damages the bulb by etching into it. Moreover, this method produces large quantities of waste water for which there is no further use. Discharge is becoming increasingly less acceptable under current conditions.

[0011] By now feeding the bulbs, which, including the earth adhering thereto, have a specific mass that approaches the specific mass of water, through a bath in which rising air is moving, any soil material adhering to the bulbs is detached in a very gentle manner and brought into suspension and sludge material of this type precipitates by means of the mechanism described above.

[0012] It is possible to subject the sludge-enriched fluid to a further corresponding treatment, that is to say to pass it again through a bath with an air stream, as a result of which further concentration of the material can take place.

[0013] The invention also relates to a device for separating sludge-like material and water, comprising a container to be filled with water, which container is provided with feed means for said sludge-containing material.

[0014] According to the invention, the base of the container is provided with feed means for air, comprising perforated air feed elements, and a discharge for sludge arranged above these.

[0015] The device will be of different construction depending on the application of the method described above. When cleaning bulbs or other products, such products will be fed with the aid of a conveyor belt into a container which contains water or another suitable fluid. Air is passed through the container and the resulting deposit is discharged. The products are then removed from the container, likewise by mechanical means.

[0016] If, for example, manure has to be concentrated, it is not necessary to remove products from the container. After all, in this case there are, in principle, two waste streams, one containing concentrated sludge and the other containing treated fluid, such as water. However, it is possible to carry out a number of treatment steps and this is important especially in the case of the concentration of sludge-like materials. According to the invention, an assembly comprising a number of devices according to one of Claims 4-7 located downstream of one another in the direction of flow is proposed for this purpose. Such an assembly can comprise a cascade set-up.

[0017] Essentially the same quantity of water can still be used with the method now proposed. The quantity of moisture in the discharged sludge is relatively small. Consequently, small quantities of waste water are produced, which appreciably reduces the problems asso-

ciated with cleaning. Pre-treatment and after-treatment devices can be located upstream and downstream of the device according to the invention. An example of a pretreatment device which may be mentioned is a vacuum chamber with which adhering porous parts are attached, from for example. An after-treatment device can be a separator device in order to enable the used rinsing water to be recycled. An (infra red) drying device for the crop can also be provided.

[0018] The invention will be explained in more detail below with reference to illustrative embodiments shown in the drawing. In the drawing:

Fig. 1 shows, diagrammatically, a side view of a device for cleaning harvested bulbs; and
Fig. 2 shows, diagrammatically, a side view of a device for concentrating manure.

[0019] Fig. 1 shows a device for cleaning bulbs. Said device is indicated in its entirety by 1. A conveyor 2 is fitted, onto which bulbs, indicated diagrammatically by 5, are placed via a feed 3. Conveyor 2 is provided with partitions 4 in order to hold the bulbs as far as possible in place, especially in the descending and ascending section of the conveyor. In the conveyor part 12 of conveyor 2 the bulbs are then introduced into a container 6. The latter is filled with water 7. There is a perforated base 8 in the underside of the container. The perforated base is provided with perforations having a diameter of between 10 and 60 μm and more particularly 20 and 30 μm. The perforated plate can be made of stainless steel or plastic. Beneath the perforated plate there is a chamber through which air is introduced via feed 9. The air rises, as indicated by arrows 11, upwards through the perforated plate 8. Just above the perforated plate there is a discharge 14 for sludge. In a variant it is possible that the first section of the conveyor 2 is also below water level. By this means the fall of the crop onto the conveyor is softened by the water.

[0020] The bulbs, which are on the conveyor part 12, then move out of the container 6 and are deposited in collection bin 10.

[0021] The devicen described above functions as follows:

[0022] On movement of the bulbs, to which earth is adhering, in trough or container 6, said soil particles will be soaked gently away from the bulbs by the rising fine air bubbles. Because the specific mass of the water is relatively low as a result of the presence of air, the soil particles will immediately sediment out and be moved towards discharge 14 by the partitions 4 which are moving in the return part 13 of the conveyor 2. In this way, on the one hand, the bulbs are cleaned and, on the other hand, sludge is removed from the contaminated water.

[0023] Fig. 2 shows a second application of the method according to the invention. The assembly shown in this figure is indicated in its entirety by 21. The assembly consists of a feed conveyor 23 and a number of linked separating chambers 24-27 arranged downstream thereof in cascade form. A screen 28 is fitted in each separating chamber. The screen has approximately the same characteristics as the perforated plate or screen 8. An air feed 29 is fitted below each screen. A splitter plate 30 is located in the lowest section of each separating chamber. The splitter plate 30 can have a fixed position or can be adjustable in height in order to vary the height with respect to the screen 28.

[0024] 31 shows the path of the rising gas bubbles, originating from air feed 29.

[0025] Plate 30 provides for separation between sludge of relatively high specific mass (the underside) and relatively clean water, which is discharged via clean water discharge 32 to drain point 33. Arrow 36 indicates the direction of the discharged sludge.

[0026] There is a discharge conveyor 34, that emerges in container 35, for the relatively heavier sludge.

[0027] The device described above functions as follows:

[0028] A material to be cleaned, such as sludge, manure and the like, that contains a large proportion of water, is placed on feed conveyor 23 and the material is fed into the first chamber 24. The apparent specific mass of water is lowered by the rising gas bubbles, as a result of which the sludge settles out of the suspension with water and moves, in accordance with arrow 36, over the perforated plate 28 beneath plate 30 to chamber 25. The relatively cleaner water is fed directly to the clean water discharge 32. The same operation takes place in chamber 25, further concentration of sludge taking place. The same applies in the case of chambers 26 and 27. In this way concentration of the sludge material can take place without energy-intensive measures and without the supply of chemicals. The air supply can be achieved at relatively low pressure. In practice it has been found that adequate air can be transported through the water using a simple fan of relatively low power.

[0029] For those skilled in the art it will be immediately apparent from the completely different set-ups in the illustrative embodiments described above that numerous variants of the inventive concept are possible without going beyond the scope of the present application. Thus, for example, it is possible in the variant according to Fig. 2 to make the angle between the various chambers adjustable depending on the material to be processed. Furthermore, a wide variety of products can be treated, such as other agricultural products but, for example, also archaeological finds which have to be treated very carefully. It is therefore also intended that variants of this type fall within the inventive concept, as formulated in the appended claims.

Claims

1. Method for separating sludge-like material and wa-

ter in a container, said sludge-like material having a specific mass that approaches the specific mass of water, in which method a suspension, comprising water and sludge, is moved through said container, **characterised in that** a vertically ascending stream of finely divided air bubbles is fed through the sludge suspension in the container (6; 24-27), and **in that** a stream containing sludge-enriched water depleted fluid is tapped off from the lower section of the container.

2. Method according to Claim 1, wherein the sludge is adhering to products (5) to be cleaned and said products are introduced into the container filled with water and are removed therefrom after the sludge has been detached.

3. Method according to one of the preceding claims, wherein the sludge-enriched fluid is subjected to a further treatment for separating sludge-like material according to Claim 1.

4. Device for separating sludge-like material and water, comprising a container (6; 24-27) for separating sludge-like material and water to be filled with water, which container is provided with feed means (2,23) for said sludge-containing material, **characterised in that** the base of the container is provided with feed means for air, comprising perforated air feed elements (8, 28), and a discharge (14,36) for sludge arranged above these.

5. Device according to Claim 4, wherein the air feed elements comprise a perforated plate.

6. Device according to Claim 4 or 5, wherein said feed means comprise a conveyor.

7. Device according to Claim 6, wherein said conveyor (2) extends over the effective length of the container and from this point on is constructed as a discharge conveyor.

8. Assembly comprising a number of devices (24-27) according to one of Claims 4-7 located downstream of one another in the direction of flow.

9. Assembly according to Claim 8, wherein said devices (24-27) are cascade-like arranged at various levels.

Patentansprüche

1. Verfahren zum Trennen von schlammartigem Material und Wasser in einem Behälter, wobei das schlammartige Material eine Dichte aufweist, die sich der Dichte von Wasser annähert, bei welchem Verfahren eine Wasser und Schlamm umfassende Suspension durch den Behälter bewegt wird, **dadurch gekennzeichnet, dass** ein vertikal aufsteigender Strom von feinverteilten Luftblasen durch die Schlammsuspension im Behälter (6; 24-27) zugeführt wird und dass ein Strom, der schlammangereichertes wasserabgereichertes Fluid enthält, aus dem unteren Teil des Behälters abgezogen wird.

2. Verfahren nach Anspruch 1, bei dem der Schlamm an zu reinigenden Produkten (5) anhaftet und die Produkte in den mit Wasser gefüllten Behälter eingeführt werden und daraus entfernt werden, nachdem der Schlamm losgelöst worden ist.

3. Verfahren nach einem der vorangehenden Ansprüche, bei dem das schlammangereicherte Fluid einer weiteren Behandlung zum Abtrennen von schlammartigem Material gemäß Anspruch 1 unterzogen wird.

4. Vorrichtung zum Trennen von schlammartigem Material und Wasser, umfassend einen mit Wasser zu füllenden Behälter (6; 24-27) zum Trennen von schlammartigem Material und Wasser, welcher Behälter mit Zuführeinrichtungen (2, 23) für das Schlamm enthaltende Material versehen ist, **dadurch gekennzeichnet, dass** die Basis des Behälters mit Zuführeinrichtungen für Luft, umfassend perforierte Luftzufuhrelemente (8, 28), und einem oberhalb von diesen angeordneten Austrag (14, 36) für Schlamm versehen ist.

5. Vorrichtung nach Anspruch 4, bei der die Luftzufuhrelemente eine perforierte Platte umfassen.

6. Vorrichtung nach Anspruch 4 oder 5, bei der die Zuführeinrichtungen eine Fördereinrichtung umfassen.

7. Vorrichtung nach Anspruch 6, bei der sich die Fördereinrichtung (2) über die effektive Länge des Behälters erstreckt und von dieser Stelle an als Austrag-Fördereinrichtung konstruiert ist.

8. Anordnung, umfassend eine Anzahl von Vorrichtungen (24-27) nach einem der Ansprüche 4-7, die in Strömungsrichtung stromabwärts voneinander angeordnet sind.

9. Anordnung nach Anspruch 8, bei der die Vorrichtungen (24-27) an verschiedenen Niveaus kaskadenartig angeordnet sind.

Revendications

1. Procédé de séparation de produit boueux et d'eau dans une cuve, ledit produit boueux ayant une masse spécifique proche de la masse spécifique de l'eau, procédé dans lequel on fait passer une suspension, comprenant de l'eau et de la boue, à travers ladite cuve, **caractérisé en ce qu'**on introduit un courant ascendant verticalement de bulles d'air finement divisées à travers la suspension de boue dans la cuve (6 ; 24 à 27), et **en ce qu'**on soutire un courant contenant de l'eau enrichie de boue de la partie inférieure de la cuve.

2. Procédé selon la revendication 1, dans lequel la boue adhère à des produits (5) à nettoyer et lesdits produits sont introduits dans la cuve remplie d'eau et sont retirés de celle-ci après en avoir détaché la boue.

3. Procédé selon l'une quelconque des revendications précédentes, dans lequel le fluide enrichi en boue est soumis à un traitement supplémentaire pour séparer le produit boueux selon la revendication 1.

4. Dispositif de séparation de produit boueux et d'eau, comprenant une cuve (6 ; 24 à 27) pour séparer le produit boueux et l'eau et à remplir d'eau, ladite cuve étant dotée de moyens d'alimentation (2, 23) pour ledit produit contenant de la boue, **caractérisé en ce que** la base de la cuve est dotée de moyens d'alimentation en air, comprenant des éléments d'alimentation en air perforés (8, 28) et une décharge (14, 36) pour la boue disposée au-dessus de ceux-ci.

5. Dispositif selon la revendication 4, dans lequel les éléments d'alimentation en air comprennent une plaque perforée.

6. Dispositif selon la revendication 4 ou 5, dans lequel lesdits moyens d'alimentation comprennent une bande transporteuse.

7. Dispositif selon la revendication 6, dans lequel ledit transporteur (2) s'étend au-delà de la longueur effective de la cuve et à partir de ce point est construit comme un transporteur de décharge.

8. Ensemble comprenant un certain nombre de dispositifs (24 à 27) selon l'une des revendications 4 à 7, disposés en aval les uns par rapport aux autres dans la direction d'écoulement.

9. Ensemble selon la revendication 8, dans lequel lesdits dispositifs (24 à 27) sont disposés en cascade à différents niveaux.

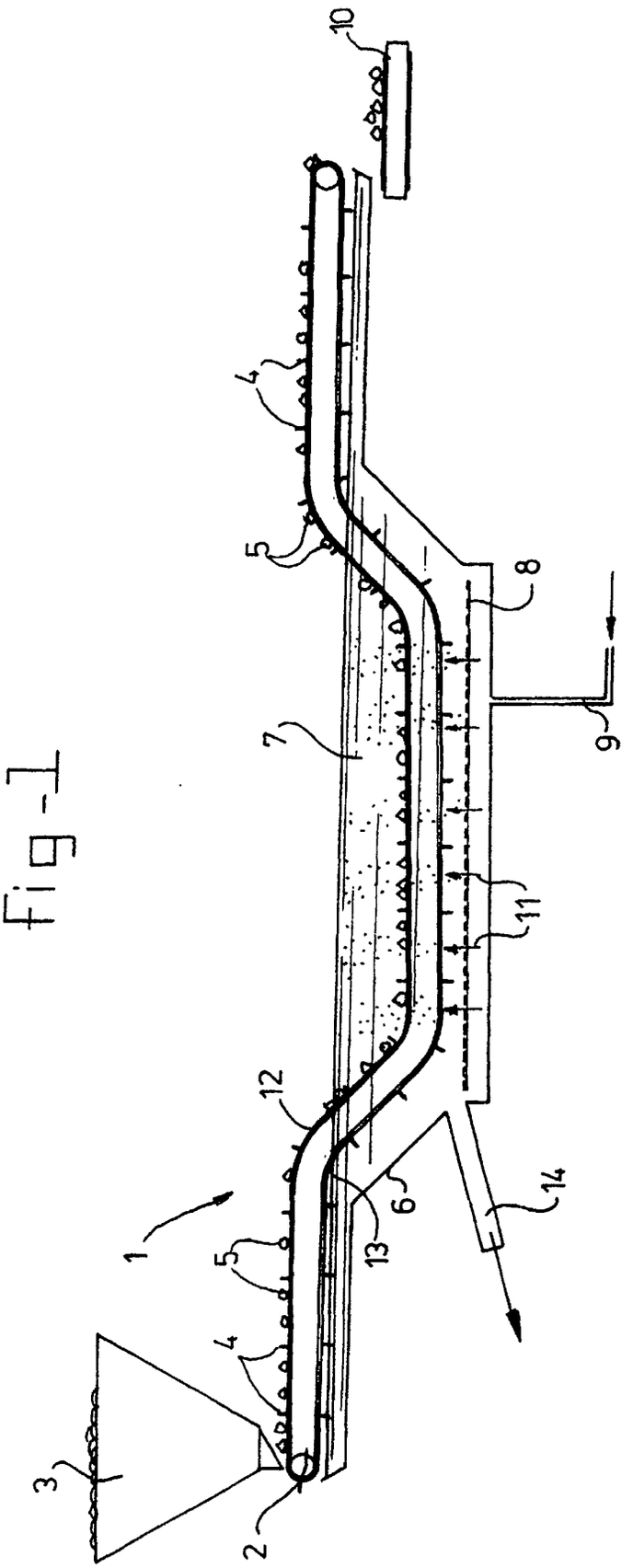

Fig-1

Fig-2