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(54) Benævnelse: **Apparat til dosering af en additiv-opløsning**

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EP-A1- 2 161 363
WO-A1-2011/073017
US-A- 4 107 274
US-A- 4 473 027

DESCRIPTION

[0001] The present invention relates to a method and a device for dosing a solution of an additive, such as a non-caking agent, over a bulk of particulate material, such as a salt, preferably potassium chloride, and more preferably sodium chloride.

[0002] Sodium chloride tends to form large, agglomerated masses upon exposure to moisture, particularly during long periods of storage. These hardened masses are generally referred to as cakes. A non-caking agent can be added to the salt to prevent caking. Sodium or potassium ferrocyanide is often used as a non-caking additive. Also the Fe3+ salt of meso-tartaric acid (FeMTA) can be used as a non-caking agent, as discussed in WO 2011/073017 and WO 2011/1510698. Such non-caking agents are typically added to sodium chloride as an aqueous solution.

[0003] The non-caking agents, but also other additives for salt, are typically solved into or diluted with water until a desired concentration is obtained. After storage in a buffer tank, the solution is distributed to one or more dosing units. Hitherto, use has been made of dosing units comprising nozzles spraying the solution over an amount of a salt. An example of such a system is disclosed in US 4,107,274. However, such dosing units have the disadvantage that part of the additive solution, which is in the form of a mist, does not end up on the salt. As the additives are relatively expensive, it would be desirable to minimize the loss thereof.

[0004] Furthermore, some types of non-caking agents, particularly FeMTA, tend to crystallize and to clog the nozzles of these conventional dosing units. Finally, it has been found that for acidic additives, such as FeMTA, the used equipment and surroundings are exposed to severe corrosion.

[0005] It is therefore an object of the invention to provide a device for dosing an aqueous solution of an additive into an amount of a particulate material, whereby the loss of additive is minimized. Furthermore, as many additives (especially non-caking agents for salts, e.g. FeMTA for sodium chloride or potassium chloride) are acidic in nature, it is an object of the invention to provide a device which is especially suitable for dosing an aqueous solution of an acidic additive in order for corrosion of the dosing equipment and surrounding equipment to be reduced and/or clogging problems to be minimized or even prevented.

[0006] The objects of the invention are achieved with a device for dosing an aqueous solution of an additive to an amount of a particulate material as set out in claim 1.

[0007] The aqueous solution of the additive is poured under the influence of gravity only, rather than being sprayed on the particulate material. Particularly with acidic additive solutions, it was found that pouring results in substantially less corrosion of the used equipment and surroundings than with spraying. For the sake of clarity, it is noted that the word "pouring" is used to indicate that the solution comes out of the pouring outlet, said pouring outlet preferably comprising a row of evenly distributed pouring spouts, by the use of gravity only instead of via spraying. It is not meant to denote that there is always an uninterrupted stream of liquid. More particularly, the solution can come out by dripping (i.e. in an interrupted stream) or with continuous flows.

[0008] To optimize distribution of the additive over the full width of the flow of particulate material (i.e. the full width of the particulate material located on the conveyor), the pouring outlet is made to have a width corresponding to the width of the conveyor section transporting the particulate material (wherein the wording "conveyor section" denotes the section or part of the conveyor on which the particulate material is located).

[0009] The particulate material according to the present invention is preferably a salt. More preferably, it is potassium chloride and most preferably, it is sodium chloride.

[0010] The additive according to the present invention is preferably a non-caking agent, and most preferably FeMTA or iron ferrocyanide.

[0011] The pouring outlet can for example comprise a row of evenly distributed pouring spouts preferably projecting from a front side of the dispenser to minimize spillage. By "evenly distributed pouring spouts" is meant that the pouring outlet comprises a row of pouring spouts, with said spouts being situated vis-à-vis each other in such a way that there is no more than 50% deviation, preferably 25% deviation, most preferably 10% deviation, in the distances between spouts which are adjacent to each other. By no more than 50% deviation, preferably no more than 25% deviation, and most preferably no more than 10% deviation is meant that if the distance between the two spouts in the pouring outlet which are the closest together is 1 cm, the distance between the other spouts which are adjacent to one another is nowhere larger than 1.5 cm, preferably 1.25 cm, most preferably 1.1 cm. Examples of suitable pouring spouts are gutters, for instance gutters having a V-shaped cross-section. Gutters having a V-

shaped cross-section are particularly preferred. The gutters may for example project from the dispenser in a direction corresponding to the direction of transportation of the conveyor, e.g., with a downward inclination in the direction of the conveyor.

[0012] The supply of the aqueous solution will preferably open into an inner space of the dispenser. To equalize the flow of solution from the inner space to the spouts, the inner space preferably comprises a weir extending over the width of the inner space and having a lower edge at a distance from the bottom of the inner space. This embodiment has the advantage that the additive solution is evenly distributed over the spouts.

[0013] If the pouring outlet is in the form of gutters having a V-shaped cross-section, it is preferred to have the lower end of said gutters (i.e. the overflow edges of said gutters) at the same horizontal level in order to effectuate an even distribution of the additive solution over the gutters. In other words, for optimum distribution of the additive solution over the gutters, it is preferred to have a straight, horizontal pouring outlet and not a pouring outlet which has a slightly hollow or slightly round shape.

[0014] Preferably, the device according to the present invention has gutters which slant downwardly from a front wall of the device.

[0015] The dispenser can for example be made of a non-corrosive thermoplastic material, such as polyvinyl chloride, polypropylene, polyethylene, and the like.

[0016] The conveyor will typically be a belt conveyor. Other conveyors suitable for transporting bulk material can also be used, if so desired.

[0017] Optionally, a Cardan suspension may be used to suspend the one or more dispensers. In a Cardan suspension a first pivoted support is supported by a second pivoted support with the two pivot axes being orthogonal. This way, the dispensers remain immobile regardless of the motion of the frame and the aqueous solution can be dispensed constantly and equally over the particulate material.

[0018] Using the disclosed device an aqueous solution of an additive can effectively be dosed to a particulate material by pouring the solution with a controlled flow velocity over the width of a conveyor transporting the particulate material. Hence, the present invention also relates to a method for dosing an aqueous solution (2) of an additive into a particulate material (3), wherein the solution is poured with a controlled flow velocity over the width of a conveyor (4) transporting the particulate material. The solution can for instance be poured by dripping or be poured with continuous flows. With a continuous supply of an additive solution via the dispenser and a continuous supply of the particulate material by the conveyor, the additive can be added in a continuous or semi-continuous process. The solution may comprise further additives or other components, if so desired.

[0019] The transport velocity of the, preferably hydrophilic, particulate material and the flow velocity of the solution can be coordinated to obtain a desired mixing ratio. For dosing a non-caking agent to a salt (preferably sodium chloride or potassium chloride) a mixing ratio of about 0.05 to about 5 liters non-caking solution per ton of the salt is particularly useful.

[0020] The method according to the present invention is particularly suitable for metering a non-caking agent into a bulk of salt material, e.g., comprising sodium chloride and/or potassium chloride. As described above, suitable non-caking agents for sodium chloride are for example iron ferrocyanide and iron mesotartrate (FeMTA).

[0021] After dosing the non-caking agent, the salt (preferably potassium chloride, more preferably sodium chloride) can be further transported.

[0022] To obtain good mixing of the metered additive into the particulate material, the particulate material can be deposited onto a next conveyor at a lower level. This step can be repeated a number of times, if so desired.

[0023] The invention will be further explained with reference to the accompanying drawings showing an exemplary embodiment. In the drawings:

Figure 1:
shows schematically an exemplary embodiment of a dosing device according to the present invention;
Figure 2:
shows a dispenser of the equipment of Figure 1 in front view;
Figure 3:
shows the dispenser of Figure 2 in side view.

[0024] Figure 1 shows a dosing device 1 for dosing an aqueous solution 2 of an additive, preferably a non-caking agent, into an amount of a particulate material, e.g. a salt 3 (which is preferably potassium chloride, more preferably sodium chloride). The dosing device 1 comprises a belt conveyor 4 for transporting the particulate material, e.g. a salt 3, and a dispenser 5 arranged above the belt conveyor 4. The dispenser 5 is operatively connected to a supply (not shown) for the aqueous solution of the additive, preferably the non-caking agent. The dispenser 5 comprises a container 7 of a plastic material (for sake of clarity, dispenser 5 denotes the entire dispensing unit, i.e. it comprises the parts 6 to 15). The container 7 has a front wall 8 with a top edge provided with a recess 9. The recess 9 is provided with a pouring outlet 10 formed by row of V-shaped pouring spouts or gutters 6. The gutters 6 project downwardly from the front wall 8 at an angle with the horizontal. The dispenser 5 also comprises a back wall 11 provided with two suspension bars 13 for suspending the dispenser 5 to a frame (not shown). The front wall 8 inclines at an angle of about 10 - about 70 degrees with the vertical in the direction of transportation of the belt conveyor 4, indicated with arrow A in the drawing.

[0025] The dispenser 5 comprises an inner space 14, which is divided by a weir 15 extending over the full width of the inner space 14. The weir 15 has a lower edge 16 at a distance from the bottom 17 of the inner space 14 (see Figure 3). The weir 15 helps to equalize the flow of solution to the row of gutters 6.

[0026] When the aqueous solution 2 of the additive, preferably a non-caking agent, is supplied via a supply line, the solution 2 flows into the container 7 of the dispenser 5. The solution 2 flows via the gutters 6 and drips or flows straight down under gravity onto the particulate material, e.g. a salt 3 (which is preferably potassium chloride, more preferably sodium chloride) on the belt conveyor 4. If the particulate material is a salt and the additive is a non-caking agent, the transport velocity of the salt and the flow velocity of the non-caking agent solution are preferably coordinated to obtain a mixing ratio of about 0.05 - about 5 liters per ton of the salt.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO2011073017A [0002]
- WO20111510698A [0002]
- US4107274A [0003]

Patentkrav

1. Apparat (1) til dosering af en vandig opløsning (2) af et additiv i en mængde partikelformet materiale, hvilket apparat omfatter en transportør (4) til transport af det partikelformede materiale og et eller flere dispenseringsorganer (5), som er anbragt oven over transportøren, hvilke dispenseringsorganer er forbundet med et forråd af den vandige opløsning af additivet, **kendetegnet ved, at** dispenseringsorganet omfatter mindst en udhældningsåbning (10), som strækker sig over bredden af en transportør-sektion, som transporterer det partikelformede materiale.

2. Apparat ifølge krav 1, hvor udhældningsåbningen (10) omfatter en række jævnt fordelte hældetude (6).

3. Apparat ifølge krav 2, hvor i det mindste en del af hældetudene (6) foreligger i form af render.

4. Apparat ifølge krav 3, hvor renderne (6) har et V-formet tværsnit.

5. Apparat ifølge krav 3, hvor renderne (6) hælder nedad fra en forvæg (8) i apparatet.

6. Apparat ifølge krav 3 eller 4 eller 5, hvor renderne (6) udrager fra forvæggen (8) i dispenseringsorganet (5), og hvor forvæggen hælder mod båndtransportøren (4).

7. Apparat ifølge ethvert af de foregående krav, hvor dispenseringsorganet (5) er af termoplastisk materiale.

8. Apparat ifølge ethvert af kravene 1-5 og 7, hvor transportøren er en båndtransportør (4).

9. Apparat ifølge ethvert af de foregående krav, hvor de et eller flere dispenseringsorganer er båret ved hjælp af en Kardan-ophængning.

10. Apparat ifølge ethvert af de foregående krav, hvor forrådet af vandig opløsning er åbent ind i et indre rum (14) i dispenseringsorganet (5), og hvor det indre rum har en slusedel (15), som strækker sig over det indre rums bredde og har en nedre kant (16) i afstand fra en bund (17) i det indre rum.

11. Fremgangsmåde til dosering af en vandig opløsning (2) af et additiv i et partikelformet materiale (3), **kendetegnet ved, at** opløsningen – under indflydelse fra tyngden – med en styret strømningshastighed hældes over bredden af en transportør (4), som transporterer det partikelformede materiale.

12. Fremgangsmåde ifølge krav 11, hvor opløsningen dryppes over det partikelformede materiale.

13. Fremgangsmåde ifølge krav 11 eller 12, hvor opløsningen hældes fra et dispenseringsorgan (5), som har en række udgangsåbninger (11), der hælder mod båndtransportøren (4).

14. Fremgangsmåde ifølge krav 11, 12 eller 13, og hvor det partikelformede materiale er et salt, fortrinsvis natriumchlorid eller kaliumchlorid, og at additivet er et "ikke-kagedannende" middel, og hvor transporthastigheden af saltet og strømningshastigheden af opløsningen er således koordineret, at der opnås et blandingsforhold på 0,05 – 5 liter pr. ton salt.

15. Fremgangsmåde ifølge krav 14, og hvor det ikke-kagedannende middel omfatter mindst en forbindelse, som er valgt fra gruppen, der omfatter jern-ferrocyanid og jern-mesotartrat.

DRAWINGS

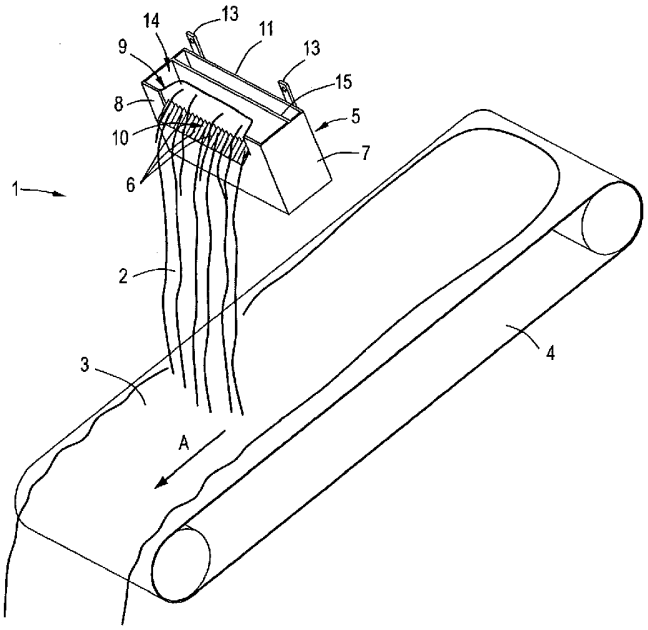


Figure 1

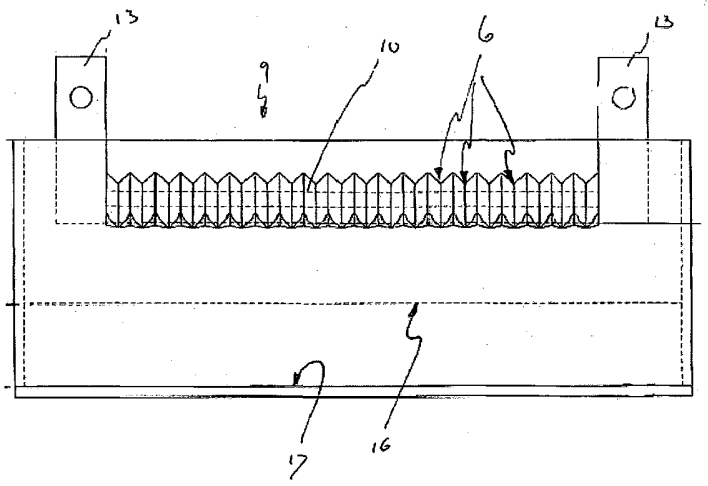


Figure 2

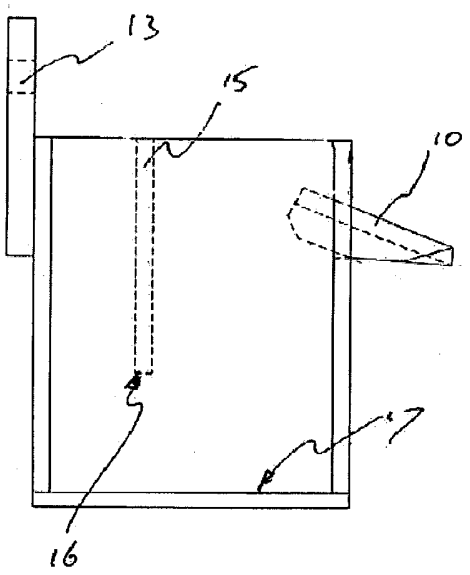


Figure 3