(19) DANMARK

(10) **DK/EP 3884754 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***A 01 C 17/00 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2023-01-30**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2022-11-02**

(86) Europæisk ansøgning nr.: **21165183.1**

(86) Europæisk indleveringsdag: **2021-03-26**

(87) Den europæiske ansøgnings publiceringsdag: **2021-09-29**

(30) Prioritet: **2020-03-26 FR 2002956**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Burel Production, Parc d'activités de la Gaultière , Les Portes de Bretagne, 35220 Chateaubourg, Frankrig**

(72) Opfinder: **ARRIBARD, Gwenvel, 16 Square Léon Bourgeois, 35000 RENNES, Frankrig**
Leveille, Lionel, 33 rue d'Ernée, 35500 Vitré, Frankrig

(74) Fuldmægtig i Danmark: **Larsen & Birkeholm A/S Skandinavisk Patentbureau, Banegårdspladsen 1, 1570 København V, Danmark**

(54) Benævnelse: **Partikelspredningsanordning med roterende skiver, der kompenserer for dosiseffekten ved lav udstrømning**

(56) Fremdragne publikationer:
EP-A1- 0 489 674
EP-A1- 1 504 645
EP-A1- 2 454 928
EP-A2- 1 430 763
US-A- 3 889 883

DEVICE FOR SPREADING OF PARTICLES WITH ROTARY DISCS COMPENSATING THE LOW-RATE DOSE EFFECT

Technical field

[0001] The field of the invention is that of spreading, in the field of agriculture, particles or products in the form of grains, such as fertilisers or seeds. More precisely, the invention relates to centrifugal spreaders which implement one or more rotatably movable discs.

Prior art

[0002] These centrifugal spreaders have been known for a long time. They implement one or more rotating discs, equipped with blades. The product to be spread can especially be stored in a hopper, and fed or discharged above each disc by a channel, which lets the flow of particles freely fall onto the disc, so that it is projected via the blades onto the ground onto which it is to be deposited. One example of this approach is described in patent documents EP 0 170 605 or EP 2 454 928, in the name of the Applicant.

[0003] In other existing spreaders, the material to be spread falls directly from the hopper onto the spreading disc, through one or more ports provided in the bottom of the hopper. The bottom of the hopper is thus rotary, and the spreading width is adjusted by pivoting the feed ports about the axis of rotation of the platens, thus changing position of the deposition point of the product onto the disc.

[0004] In spreaders equipped with channels, such as those designed and marketed by the Applicant, the spreading width is adjusted by pivoting the feed channel about an offset axis. Moving the channel causes moving the fall point of the particles onto the spreading disc, and thus modifying the coverage zone of the spreading coat and of its position with respect to the spreader. Indeed, moving the fall point has an influence especially on the average ejection angle of the particles from each of the spreading discs, with respect to the spreader axis of advance.

[0005] In spreaders with rotating bottoms, as described for example in patent documents EP 1 707 042, EP 1 430 763 or DE 10 2009 026344, the spreading width is adjusted by changing position of the deposition point of the product to be spread onto the disc. For this purpose, the entire bottom rotates about an axis that is concentric with the axis of the platens. The geometry of the opening of the metering member defines the width of the deposition point of the product onto the disc. Especially, patent documents EP 1 707 042 or EP 0 183

292 describe one or more ports, provided in the bottom of the hopper, the degree of closure of which can vary from a closed position to an open position depending on the position of a movable sealing flap, or by pivoting these ports about the axis of rotation of the platens. The shape of these ports is such that in a slightly open position, and therefore at low flow rates, the product to be spread passes through several equivalent openings as it flows from the hopper towards the discs. Thus, in the solution described in patent document EP 1 707 042, the particles to be spread flow, at a low flow rate, through three openings, which generates three points of depositing product onto the disc; in the solution described in patent document EP 0 183 292, it was even already contemplated, at a low flow rate, that the particles to be spread flow through four openings, to generate four points of depositing product onto the disc.

[0006] Regardless of whether these are spreaders with a rotating channel or spreaders with a rotating bottom, as disclosed in patent documents EP 0 489 674, EP 1 504 645 and EP 2 454 928, it is common to observe change in the spreading width when the flow rate of particles changes. This phenomenon, known to manufacturers and users, is called the "flow rate effect", or also, by abuse of language, the "dose effect". Indeed, the geometry of the point of fall or deposition of the product onto the platen, directly influences the semi-circular or crescent shape of the spreading pattern. To better understand this phenomenon, [Fig. 1] illustrates the left rotating disc 10 of a spreader, and the impact zone 11 of the particles to be spread onto the latter, when they fall or are deposited from the metering member; this impact zone is also referred to hereafter as "spot". The arrow referenced 12 illustrates the direction of rotation of the disc, and the arrow referenced 13 illustrates the direction of advance of the spreader.

[0007] Various parameters make it possible to describe geometry of the spot 11, which is expressed hereafter in a polar reference frame having as origin the centre of the platen 10:

- P_{mean} the average radius of product deposition on the disc;

- σP, the standard deviation of the radius of deposition of the product onto the disc;

- $\varnothing_{mean}$, the average angle of deposition of the product onto the disc;

- $\sigma\varnothing$, the standard deviation of the angle of deposition of the product onto the disc.

[0008] These different parameters are set forth in [Fig. 1], to qualify geometry of the spot 11.

[0009] A refined analysis of the deposition of the product onto the spreading platen and its consequences on spreading made it possible to highlight that this "dose effect" is induced, on the one hand, by modification of the standard deviation of the angle of the spot, and, on the other hand, by modification of the average angle of the spot.

[0010] In current systems, whether they are based on channels or rotating bottoms, the standard deviation $\sigma\varnothing$ on the angle of deposition of the product onto the disc is directly dependent on the flow rate at the outlet of the metering member, and this standard deviation decreases at low flow rates.

[0011] These variations in the angular standard deviation, induced by modification of the geometry of the fall point, lead to variations in the shape of the spreading pattern and are detrimental to the accuracy of spreading control.

[0012] There is therefore a need for a new particle spreading technique, which does not have these various drawbacks of prior art.

[0013] In particular, there is a need for such a technique, which makes it possible to improve accuracy of spreading and adjustment of its width, by minimising deformation of the fall point, especially at low flow rates. More precisely, there is a need for such a technique that allows the standard deviation of the angle of deposition of the product onto the disc to be stabilised, regardless of the feed flow rate at the outlet of the metering member.

[0014] There is also a need for such a technique, which produces interesting effects at low flow rates, which fade at higher spreading flow rates.

[0015] There is also a need for such a technique that makes it possible to create a large standard deviation at low flow rates, without the need for multiple particle outlets from the hopper to the disc.

[0016] Finally, there is a need for such a technique which allows to optimize both the metering of the particles to be spread and their spreading, without the optimisation of one being to the detriment of the other.

[0017] There is also a need for such a technique which is mechanically simple and inexpensive.

Disclosure of the invention

[0018] The invention meets this need by providing a device for spreading particles stored in at least one hopper, comprising a metering member having at least one outlet opening delivering at least one flow of the particles to a rotating spreading disc receiving and projecting the particles. Such a spreading device also comprises a transport channel for the flow of particles from the outlet opening(s) of the metering member to the spreading disc, which has means for breaking up and widening the flow(s) of particles disposed between the outlet opening(s) of the metering member and the spreading disc, said channel comprising means for breaking up and widening said at least one flow of particles disposed between said at least one outlet opening of said metering member and said spreading disc.

[0019] Thus, the invention is based on a quite new and inventive approach to spreading systems. Indeed, the invention advantageously provides, in the trajectory of the flow of particles between the outlet of the metering member and its point of deposition onto the disc, breaking up and widening means, which make it possible to compensate for the decrease in the angular standard deviation of the zone of depositing the particles onto the disc at a low flow rate.

[0020] In this way, the modification of the flow rate at the outlet of the metering member modifies the dose of particles spread, but induces little modification in the geometry of the zone where the particles are deposited onto the disc. The variation in the angle and standard deviation on the spread angle obtained on the ground is thus greatly reduced with respect to solutions of prior art, which allows better control of the spreading accuracy. In contrast to solutions of prior art documents EP 1 707 042 or EP 0 183 292, this control of spreading accuracy is not achieved by providing several openings for the particles to be spread from the hopper to the disc. Thus, spreading is optimised, without this being to the detriment of the metering quality; in other words, the metering function is not impacted by the technique of the invention, which makes it possible, with respect to prior art, to achieve much lower spreading flow rates.

[0021] Indeed, according to physical laws known to the skilled person, a gravity flow is only established in a stable manner when the diameter of the opening is substantially three times the diameter of the particles. In the solution of document EP 1 707 042, the accuracy of the spreading is improved, at a low flow rate, by creating three openings for the particles to be spread from the metering member to the disc. Therefore, with respect to this previous solution, the solution of the invention, in which the means of breaking up and widening the flow are dissociated from the metering member, advantageously makes it possible to achieve flow rates that are three times lower.

[0022] In the case where the metering member has several outlet openings, which therefore deliver several flows of particles to the spreading disc, it is advantageously provided that breaking up and widening means are arranged on the trajectory of each of the flow of particles.

[0023] According to one aspect of the invention, the breaking up and widening means are disposed perpendicularly to the outlet opening(s). Thus, when the flow of particles emerges from the outlet opening of the metering member, its trajectory follows, by gravity, a direction perpendicular to the plane of the horizon, which therefore meets the breaking up and widening means, the latter being disposed perpendicularly to the outlet opening. Such means for breaking up and widening the flow are preferably centred on the small flow rate outlet section of the metering member opening.

[0024] Furthermore, these flow breaking up and widening means are advantageously in the form of a U-shaped or V-shaped profile, disposed along a length of a base wall of the transport channel for the flow of particles from the outlet opening(s) to the spreading disc, a peak of the U or V being arranged perpendicularly to the outlet opening(s). More generally, such a U-shaped or V-shaped profile may take any suitable shape to cause widening in the flow of particles, especially an ovoid shape, a half-sphere shape, etc. For example, it is in the form of a rib running along the base wall of the channel, in the trajectory of the flow of particles. In other words, such a profile is such that it has a base, arranged on the base wall of the channel, which is wider than its peak, and which forms the first zone of contact of the flow of particles with the channel, when it leaves the metering member. The peak edge of this profile is preferably centred below the outlet opening of the metering member, in order to fulfil the function of breaking up the flow of particles into two half-flows, and to create an angular standard deviation $\sigma\varnothing$ of the zone of contact of the flow with the spreading disc. This angular standard deviation at the deposition, which results at low flow rates in the appearance of two dissociated points of deposition, produces a surprising and unexpected effect at the blade outlet, at which the angular standard deviation takes the form of a Gaussian distribution.

[0025] According to another particular aspect of the invention, a height of the U-shaped or V-shaped profile is substantially between 0.5 cm and 4 cm. It will be noted that this height may be variable along the length of the profile.

[0026] Thus, at a low flow rate, the particles slide along the sides of the U-shaped or V-shaped profile, which makes it possible to space apart the flow of particles and to dissociate the points of deposition of the product onto the disc, creating a bimodal distribution. However, at a high flow rate, the height of the U-shaped or V-shaped profile is such that the means of breaking up and widening the flow no longer have any significant effect on the deposition geometry, and the distribution is thereby of the Gaussian type.

[0027] According to one embodiment of the invention, such a profile has a section, in a plane substantially perpendicular to the base wall, with an increasing width in the direction of an outlet end of said channel. Thus, such a profile widens in the direction of the outlet of the channel: the flow widening function is thus increased, until a dissociation of right and left flow of particles is achieved. This type of profile is particularly advantageous for spreading products with very low standard deviation, such as snail control products for example.

[0028] More specifically, such a profile has, in a plane substantially perpendicular to the base wall, a triangular section perpendicularly to the outlet opening, and a trapezoidal section at an outlet end of the channel. An example of such a profile is illustrated in the figures hereafter.

[0029] According to yet another aspect of the invention, such a profile (for example V-shaped) is formed by removably mounting a polyhedron (for example a triangular prism) on the base wall of the channel. Thus, these means for breaking up and widening the flow of particles can be disassembled and can constitute a retractable accessory of the channel, which can be clipped or screwed onto the base wall of the latter. This is particularly advantageous when the user of the spreading device wants to make spreading at very high flow rate, for example based on pellets. The possibility of disassembling the V-shaped profile prevents clogging and makes cleaning the channel easier.

[0030] According to one advantageous characteristic, the base wall comprises two zones made of flexible material arranged at one side and the other of the (U-shaped or V-shaped) profile. In this way, a "bi-material" channel is made, comprising a rigid part forming the skeleton of the channel, of which the profile forms part (the profile being either U-shaped or V-shaped or a more complex shaped), and a flexible part, to facilitate cleaning in the field without disassembling the channel. The two zones made of flexible material are zones for detaching fertiliser, or more generally the particles, which can deposit during operation and cause the channel to clog. Indeed, the particles when moving generate a cloud of dust which ultimately forms a hard crust on the bottom of the channel, which should be "demoulded".

[0031] Preferably, such a flexible material belongs to the group comprising:

- a silicone material;
- a PVC material (for "Polyvinyl Chloride");
- a polyurethane material.

[0032] Such flexible materials can be easily deformed or pressed to demould the hard crust of particle dust, and thus to clear the channel.

[0033] According to yet another aspect, the channel can be disassembled without tools. This quick and easy disassembly of the channel allows the channel to be easily cleaned, checked, or changed. This is made possible by the utilisation of clamping screws or by clipping.

[0034] According to one particular embodiment of the invention, the breaking up and widening means extend, towards an outlet end of the channel, in the form of guiding means for the particles. More particularly, such guiding means redirect the flow of particles.

[0035] Thus, the breaking up and widening means extend, in the direction of the disc, in the form of a shape redirecting all or part of the flow so as to angularly offset the particle deposition barycentre at low flow rates. Especially, the downstream end of the U-shaped or V-shaped profile, in proximity to the outlet end of the channel, is offset outwardly, inducing a non-linear trajectory of the flow of particles towards the spreading disc. This advantageously allows the flow to be redirected at a low flow rate, so as to attenuate the dose effect, and thus maintain a constant average ejection angle at the disc outlet. Indeed, moving the centroid of the flow of particles causes moving the average feed point, which is angularly offset on the disc: at a low flow rate, this feeding point is delayed, with respect to the direction of rotation of the disc, which delays part of the flow being blade-driven.

Description of the figures

[0036] Further purposes, characteristics and advantages of the invention will become clearer upon reading the following description, given by way of a simple illustrative, and not limitative, example in connection with the figures, among which:

[Fig. 1] sets forth the shape and position of the fall point of the particles onto a spreading disc, as well as the geometrical parameters for characterising the zone of deposition of the particles onto the disc;

[Fig. 2] illustrates a tractor, equipped with a spreading device according to one embodiment of the invention;

[Fig. 3] sets forth a top view of the tractor of [Fig. 2], and the spreading coats obtained on the ground;

[Fig. 4A] illustrates a flow of particles in a distribution channel of a metering member to a spreading disc at a low flow rate;

[Fig. 4B] illustrates a flow of particles in a distribution channel to a spreading disc at a higher flow rate;

[Fig. 5A] sets forth a comparison of the angular mass distribution curves of the spot for a low flow rate, for the solution of the invention and according to prior art;

[Fig. 5B] shows a comparison of the angular distribution curves at the blade outlet for a low flow rate, for the solution of the invention and according to prior art;

[Fig. 6] sets forth as a histogram a comparison of the standard deviations on the particle ejection angle, at low and moderate flow rates, for the solution of the invention and according to prior art;

[Fig. 7] sets forth a perspective view of a portion of a spreading device according to a first embodiment of the invention;

[Fig. 8A] illustrates a first alternative embodiment of the flow breaking up and widening means equipping the channel of [Fig. 7];

[Fig. 8B] illustrates a second alternative embodiment of the flow breaking up and widening means equipping the channel of [Fig. 7];

[Fig. 9] provides a front view of a channel equipped with a V-shaped profile perpendicularly to the outlet port of the metering member;

[Fig. 10] sets forth a side view of the channel illustrating its easy disassembly;

[Fig. 11] illustrates a bi-material channel according to one embodiment of the invention;

[Fig. 12] illustrates one alternative embodiment in which the metering member has two outlet openings;

[Fig. 13A] illustrates one alternative embodiment in which the flow breaking up and widening means extend in the form of guiding means;

[Fig. 13B] illustrates the impact of this alternative embodiment on the angular mass distribution curve at the blade outlet;

[Fig. 14] sets forth one alternative embodiment of the flow breaking up and widening means equipping the channel of [Fig. 7], particularly adapted to the spreading of products with low standard deviation, such as snail control product;

[Fig. 15] summarises in the form of a flow chart the general principle of the device according to the different embodiments of the invention.

Description of the embodiments

[0037] The general principle of the invention is based, in a spreading system, on a solution for depositing the particles to be spread on a rotating platen, thereby reducing the dose effect at low flow rates. To do this, the solution introduces, in the trajectory of the flow of particles, between the outlet opening of the metering member and the spreading disc, means of breaking up and widening the flow, making it possible to stabilise angular standard deviation associated with the zone of deposition of the particles onto the disc, whatever the flow rate at the outlet of the metering member. Such a solution is accurate and tolerant, in that it reduces the user's width adjustment errors. It is furthermore independent of the flow rate and the geometry of the outlet opening of the metering member. It is simple in design, as it consists of a small number of mechanical parts. Finally, it is robust, as it is not very sensitive to clogging and is easy to clean.

[0038] Such a spreading device equips a machine for spreading solid fertiliser or seedlings on a cultivable plot of land, one example of which is schematically illustrated in [Fig. 2]. It takes the form of a tractor 20 equipped with a hopper 21 containing the fertiliser or seeds 22 to be spread.

[0039] The bottom of the hopper 21 comprises, for example, two openings, then two adjustable feed devices, then two devices for adjusting distribution of the fertiliser, for example in the form of channels 23 (only one being illustrated), allowing particles 22 contained in the hopper 21 to pass through, and placed perpendicularly to two distributors each comprising a rotating disc 10 carrying projection blades.

[0040] The discs 10 are most often arranged in a substantially horizontal position and their rotation about a substantially vertical axis 14 ensures projection of the contents 22 of the hopper by centrifugal effect, in the form of a generally crescent-shaped coat extending rearwardly of the spreading machine.

[0041] The two rotating discs rotate in opposite directions to each other, which makes it possible to spread fertiliser and/or seed over a large width, conventionally between 5 and 50 metres.

[0042] Such spreading machines make it possible to treat a cultivable plot of land, or field, most often by following a predefined path to and from it, but also with non-imposed trajectories (for example for spreading on grassland).

[0043] The driver of the machine can adapt some spreading settings, such as, depending on the case, the quantity or the dose of particles distributed, the shape of the spreading pattern, especially its width, ... It can additionally selectively open or close the device for feeding the channel 23, so as to optimise quantities of particles spread, especially at the headland, edge, end or tip of the field.

[0044] [Fig. 3] illustrates a top view of the tractor of [Fig. 2]. In this figure, the tractor 20 transports means 100 for distributing particles, for example granular fertiliser or seedlings. It is equipped with two distributors feeding two discs 10_1 and 10_2, which ensure the projection of the particles respectively onto surfaces 30_1 and 30_2, defining together a coverage surface 30, which is 5 to 30 m away from the distribution means 100, and defining a general crescent shape.

[0045] One embodiment of the invention is now set forth, in connection with figures 4A to 14, in which the spreading device is equipped with a channel for distributing the particles to be spread, from the outlet of the metering member, to the spreading disc.

[0046] According to the embodiment of [Fig. 4A] and [Fig. 4B], such a channel 23 is provided with a V-shaped profile 24, which runs along the base wall of the channel, in the direction of the trajectory of the flow of particles 210, from the outlet 40 of the metering member, towards the lower end of the channel.

[0047] [Fig. 4A] more particularly illustrates the trajectory of the flow of particles 210 along the channel, in the case of a low feed rate of Q = 5 kg/min at the outlet of the metering member. As can be noticed, the V-shaped profile 24 fulfils a breaking up and widening function for the flow 210 at the outlet of the metering member: the flow of particles is split into two flows 210_1 and 210_2, at one side and the other of the V-shaped profile 24. As a result, two fall points appear on the spreading disc 10, at one side and the other of the median line of the channel 23: a bimodal distribution of the particles is thus obtained when deposited onto the disc.

[0048] [Fig. 4B] illustrates the trajectory of the flow of particles 210 for a moderate flow rate of Q = 57 kg/min. The flow 210 then overlaps the V-shaped profile 23, so that the impact of its presence on the spot obtained on the disc is less than at a low flow rate. Thus, at a high flow rate, the product to be spread passes over the V-shaped profile 23 to provide only one fall point onto the disc: the effect of the means for breaking up and widening the flow thus becomes less pronounced at a higher flow rate, and has little impact on the geometry of deposition of the product onto the disc.

[0049] [Fig. 5A] sets forth, in solid lines, the angular mass distribution curve of the spot obtained on the spreading disc 10, in the case of a low flow rate of Q = 5 kg/min of [Fig. 4A]. By way of comparison, the dashed curve in [Fig. 5A] corresponds to the same angular mass distribution curve of the spot obtained with a channel according to prior art, free of means for breaking up and widening the flow 210 of particles. As can be noticed in [Fig. 5A], the presence of means for breaking up and widening the flow 210 of particles makes it possible to obtain a bimodal distribution of particles on the disc 10, with two zones of particle concentration around 0 = 30° and 0 = -30°. As illustrated in [Fig. 5B], the spreading system then makes it possible to smooth this distribution towards a uniform profile (presence of a central plateau). In [Fig. 5B], the solid line curve illustrates the angular distribution at the blade outlet for a low flow rate Q=5kg/min, with a channel 23 equipped with a V-shaped profile 24, and the dotted line curve illustrates the same angular distribution, obtained with a channel of prior art. This dashed curve has a sharper peak centred at about 110°, whereas the solid curve, according to one embodiment of the invention, has a broad central plateau substantially between -150° and -75°. Thus, surprisingly, by acting on the angular standard deviation upon deposition by generating two dissociated fall points at a low flow rate (illustrated by the two peaks in solid lines in Fig. 5A), smoothing of the angular standard deviation at the outlet of the blades is achieved, which is reflected by the flattened Gaussian in solid lines in [Fig. 5B]. While the skilled artisan would naturally have thought of making the angular standard deviation uniform upon deposition (Fig. 5A) in order to achieve uniformity of the angular standard deviation at the blade outlet (Fig. 5B), the inventors go against these preconceptions by breaking up the flow in order to generate two dissociated deposition points, so as to produce this surprising effect of uniformity of the Gaussian distribution at the blade outlet. Looking at [Fig. 6], if the angular distributions at the blade outlet are compared, between the channel of prior art (hatch patterns), and the channel according to the embodiment of the invention (dot patterns), it is noticed, for all flow rates at the outlet of the metering member (histograms 1, on the left, corresponding to a low flow rate and histograms 2, on the right, corresponding to a higher flow rate), an increase and a stabilisation of the standard deviation $\sigma\varnothing$ of the ejection angle of the particles, at the blade outlet.

[0050] Thus, by breaking up the flow 210 of particles, it is possible to stabilise the standard deviation on the ejection angle, whatever the feed rate to the channel 23.

[0051] [Fig. 7] sets forth a perspective view of a portion of the spreading device according to this first embodiment of the invention. The metering member 42 has an outlet opening 40, which can be sealed by a rotary slide valve 41. The particles 21 stored in the hopper 22 flow out of the metering member through the outlet opening 40 and fall onto the channel 23. The base wall of channel 23 is equipped with a V-shaped profile 24, which runs along the channel in the flow direction of the flow of particles towards the disc 10. The V-shaped profile 24 is arranged perpendicularly to the outlet opening 40. Thus, the upper edge of the V is substantially centred with respect to the outlet opening 40, so that when the flow of particles falls, substantially perpendicularly to the horizon line, from the metering member, it encounters the upper edge of the V-shaped profile 24, which breaks up and widens the flow at one side and the other of the profile 24. As seen hereinbefore, the deposition spot of the particles onto the disc 10 is then widened, and at low flow rates may have a bimodal distribution. The particles are then ejected from the disc 10 by the blades 70.

[0052] [Fig. 8A] sets forth one exemplary embodiment of the channel 23, in which the means for breaking up and widening the flow comprises a central rib, in the form of a V-shaped profile 24. [Fig. 8B] sets forth another exemplary embodiment of the channel 23, wherein the means for breaking up and widening the flow comprises a U-shaped profile 25.

[0053] [Fig. 9] provides a front view of a channel 23 equipped with a V-shaped profile 24 perpendicularly to the outlet port 40 of the metering member. As will be noted, the upper edge 241 of the V-shaped profile 24 is preferably centred with respect to the outlet opening 40.

[0054] To ensure the performance of the system over time, it is contemplated, in one particular embodiment, to facilitate cleaning of the channel 23. To this end, as illustrated in [Fig. 10], the channel 23 can be disassembled without tools, by virtue of the use of clamping screws, through the ports 26. Alternatively, the channel 23 can be mounted by clipping. This makes it easy to clean, check or change the channel 23. Furthermore, in one particular embodiment illustrated in [Fig. 11], the channel 23 is comprised of a rigid skeleton-forming part for maintaining the functional dimensions. Especially, the V-shaped profile 24 provides a stiffener to the channel allowing plastic processing methods without impacting the maintenance of functional dimensions over time. At one side and the other of the V-shaped profile 24, a flexible material, for example silicone or PVC, is added to the bottom of the channel skeleton to facilitate cleaning in the field without disassembling. Thus, the two zones 271 and 272 at one side and the other of the flow breaking up and widening means are for example covered with flexible silicone allowing manual demoulding of the crust of dust which forms during use. In addition, it may also be contemplated that the V-shaped profile 24 may itself be disassembled, to further facilitate cleaning in the event of clogging.

[0055] [Fig. 12] sets forth an alternative embodiment in which the metering member has two outlet openings 40_1 and 40_2. In this case, two V-shaped profiles 24_1 and 24_2 are arranged in the bottom of the channel 23, each perpendicularly to one of the outlet openings 40_1 and 40_2 of the metering member. These two V-shaped (or U-shaped) profiles extend along the base wall of the channel 23 along the direction of travel of the flow of particles from the outlet opening 40_1, 40_2 towards the lower end of the channel 23, where this flow falls onto the spreading disc 10.

[0056] In one alternative embodiment, illustrated by [Fig. 13A] and [Fig. 13B], the flow breaking up and widening means extend in the form of guiding means for the flow of particles. These guiding means advantageously allow the product to be spread at a low rate, and further attenuate the dose effect. Especially, they make it possible to maintain a constant average ejection angle at the blade outlet, whatever the feed flow rate to the channel 23.

[0057] As illustrated in [Fig. 13B], the V-shaped profile 24 is not rectilinear, but follows a curved trajectory at the lower end of the channel 23, in order to displace the barycentre of the section of the flow of particles 210. Thus, the central edge 241 of the V-shaped profile 24 follows a curve, for deviating the product deposition spot onto the disc 10 at a low flow rate. The mark 130 in [Fig. 13B] illustrates this flow redirection at a low flow rate. Moving the centroid of the section of the product flow causes moving the average feed point, which is angularly offset on the disc, so as to delay its blade driving.

[0058] [Fig. 13A] illustrates, in superposition, the curves of the angular mass distributions at the blade outlet, obtained for different mass flow rates at the outlet of the metering member. The dotted curve represents the course of the mass distribution as a function of the blade outlet angle for a large flow rate; the solid curve represents the course of the mass distribution as a function of the blade outlet angle for a small flow rate.

[0059] As illustrated by the two lines referenced 131 and 132, there is therefore an offset $\Delta\varnothing_{m\ blade}$ of the average ejection angle at the blade outlet, at a low flow rate, with a strictly rectilinear V-shaped profile 24, that is sought to be compensated for by virtue of the introduction of these guiding means.

[0060] [Fig. 14] sets forth another alternative embodiment of the channel 23, in which the profile has a more complex shape, the section of which, in the plane perpendicular to the base wall of the channel, widens towards the outlet end of the latter. Such an elaborate shape makes it possible to separate the functions of breaking up and widening the flow, which is particularly advantageous for products with low standard deviation, such as snail control product. Thus, perpendicularly to the outlet opening of the metering member (zone referenced 26), the profile has, for example, a triangular section, which allows the flow of particles to be broken up. This section progressively widens towards the outlet of the channel, to assume a trapezoidal shape 251 at the outlet end of the channel 23 (referenced zone 25): widening of the flow is thus increased until a dissociation of the right and left flow of particles is achieved, at one side and the other of the profile. This alternative can be advantageously combined with the alternative of [Fig. 13B], so as to jointly increase widening of the flow and move the barycentre of the section of the flow of particles.

[0061] The flow chart in [Fig. 15] summarizes the general principle of the device according to the different embodiments of the invention. As illustrated in schematic form in this figure, it aims to obtain a constant product feed profile at the platen inlet 10 (block referenced 166), regardless of the product feed profile at the outlet of the metering member (block referenced 164).

[0062] Indeed, the flow of product to be spread at the outlet of the metering member (block 164) depends on multiple parameters, such as the characteristics 161 of the product to be spread (granularity, density, etc.), the metering member opening position 162 (i.e. position of the sealing flap of this opening), or the geometry 163 of this opening (i.e. the shape of the opening itself or of a flow rate selector that can be interfaced with this opening, to adapt the range of feed flow rates to the characteristics of the product to be spread). By varying these different parameters, it is possible to obtain different feed profiles for the product to be spread at the outlet of the metering member, in order to optimise the metering function of the centrifugal spreader.

[0063] However, it is important that the spreading function is optimal, regardless of the feed profile at the outlet of the metering member.

[0064] This spreading function is optimised, according to the different embodiments of the invention, by means of the flow breaking up and widening means (block 165), which have a strong effect at a low flow rate, which fades at a higher flow rate, and which make it possible (block 166) to obtain a constant feed profile for the spreading discs, whatever the feed profile at the outlet of the metering member.

[0065] Thus, in its different embodiments, the invention allows dissociation of the metering and spreading functions, unlike techniques of prior art.

P A T E N T K R A V

1. Spredningsanordning til partikler (21), som opbevares i mindst én tilførselstragt (22; 100), der omfatter en doseringsindretning med mindst én udløbsåbning (40), som tilfører mindst én strøm (210) af partiklerne til en roterende spredeskive (10), der modtager og udskyder partiklerne, og som omfatter en sliske (23) til at transportere strømmen af partikler fra doseringsindretningens mindst ene udløbsåbning til spredeskiven,
kendetegnet ved, at slisken omfatter midler (24; 25; 141) til findeling og udvidelse af den mindst ene strøm af partikler, der er anbragt mellem doseringsindretningens mindst ene udløbsåbning og spredeskiven.

2. Spredningsanordning ifølge krav 1, kendetegnet ved, at midlerne til findeling og udvidelse er anbragt lodret over den mindst ene udløbsåbning.

3. Spredningsanordning ifølge et hvilket som helst af kravene 1 og 2, kendetegnet ved, at slisken over en længde af en bundvæg har mindst én U- eller V-formet profil, som danner midler til findeling og udvidelse af strømmen, idet et toppunkt af U'et eller V'et er anbragt lodret over den mindst ene udløbsåbning.

4. Spredningsanordning ifølge krav 3, kendetegnet ved, at en højde af den U- eller V-formede profil i det væsentlige ligger mellem 0,5 cm og 4 cm.

5. Spredningsanordning ifølge et hvilket som helst af kravene 3 og 4, kendetegnet ved, at profilen i et plan, der

i det væsentlige er vinkelret på bundvæggen, har en del med stigende bredde i retning af en udløbsende af slisken.

6. Spredningsanordning ifølge krav 3, kendetegnet ved, at profilen i et plan, der i det væsentlige er vinkelret på bundvæggen, har en trekantet del (26) lodret over den mindst ene udløbsåbning og en trapezformet del (25) ved en udløbsende af slisken.

7. Spredningsanordning ifølge et hvilket som helst af kravene 3 til 6, kendetegnet ved, at profilen dannes ved aftagelig montering af et polyeder på bundvæggen af slisken.

8. Spredningsanordning ifølge et hvilket som helst af kravene 3 til 6, kendetegnet ved, at bundvæggen omfatter to områder (271, 272) af et fleksibelt materiale, der er anbragt på hver side af profilen.

9. Spredningsanordning ifølge krav 8, kendetegnet ved, at det fleksible materiale tilhører gruppen omfattende:
- et siliconemateriale
- et PVC-materiale (for "Polyvinylchlorid")
- et polyurethanmateriale.

10. Spredningsanordning ifølge et hvilket som helst af kravene 1 til 9, kendetegnet ved, at slisken kan aftages uden værktøj.

11. Spredningsanordning ifølge et hvilket som helst af kravene 1 til 10, kendetegnet ved, at midlerne til findeling og udvidelse strækker sig i retning af en

udløbsende af slisken i form af midler til føring af partiklerne.

12. Spredningsanordning ifølge krav 11, kendetegnet ved, at midlerne til føring afbøjer strømmen af partikler.

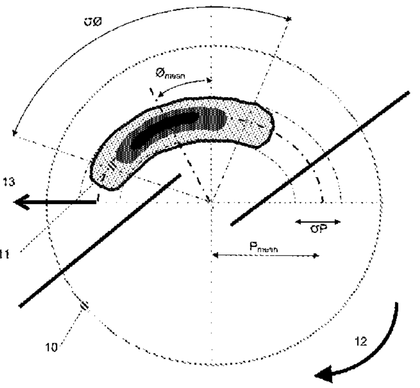

Fig. 1

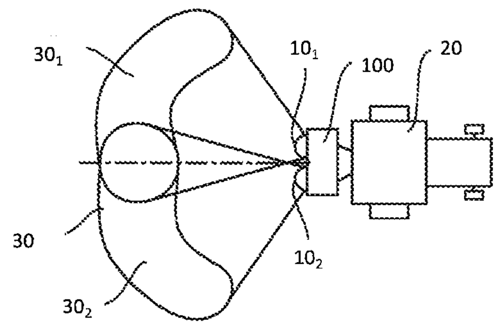

Fig. 3

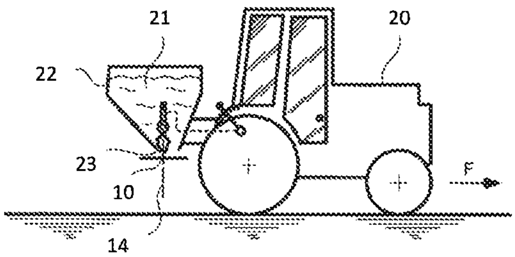

Fig. 2

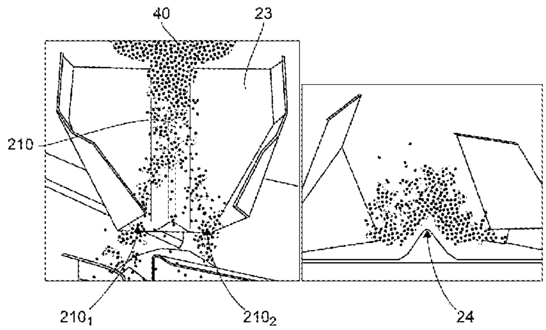

Fig. 4A

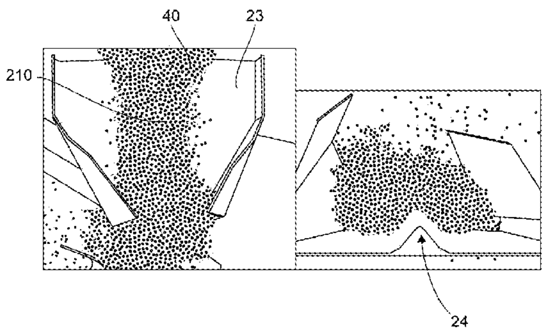

Fig. 4B

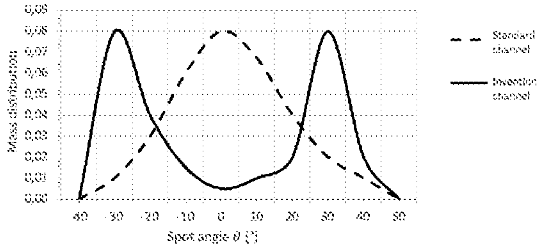

Fig. 5A

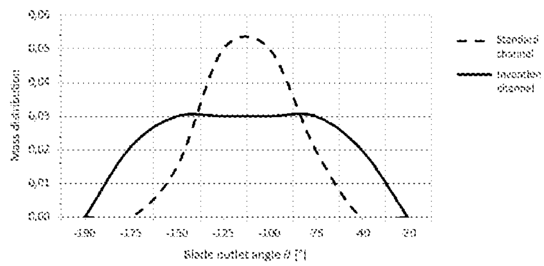

Fig. 5B

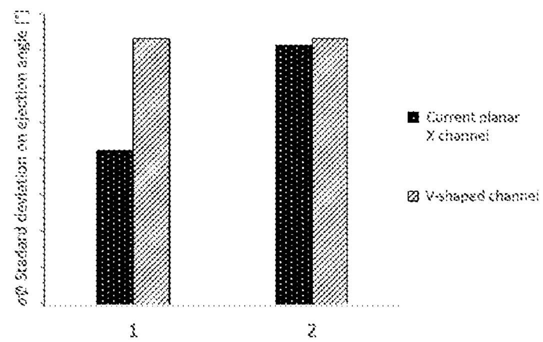

Fig. 6

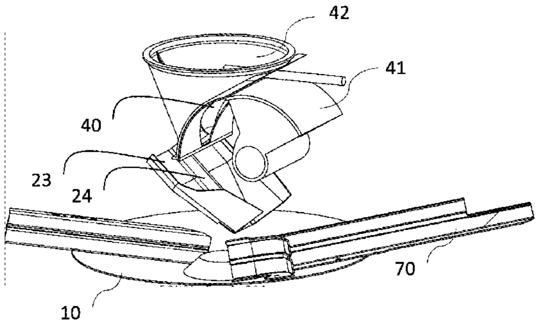

Fig. 7

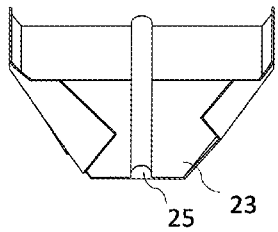

Fig. 8B

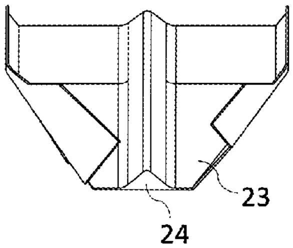

Fig. 8A

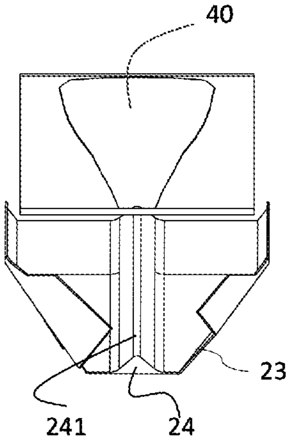

Fig. 9

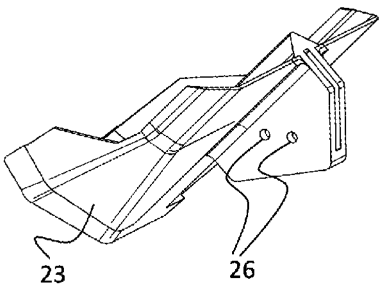

Fig. 10

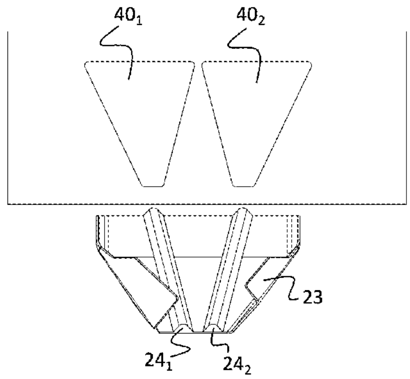

Fig. 12

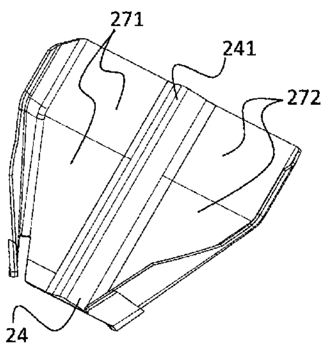

Fig. 11

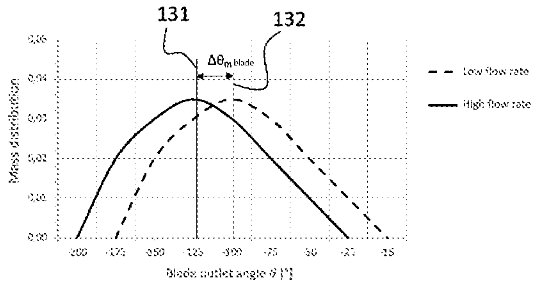

Fig. 13A

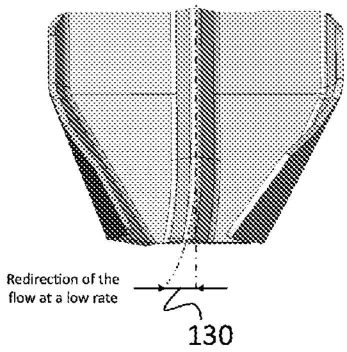

Fig. 13B

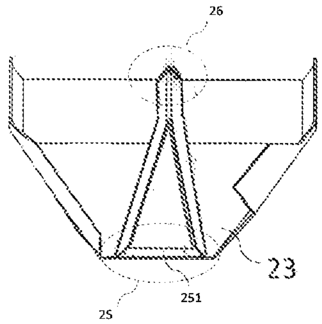

Fig. 14

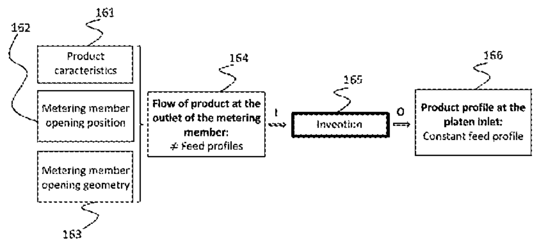

Fig. 15