

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(12)

Oversættelse af europæisk patentskrift

(10) **DK/EP 2436253 T3**

-
- (51) Int.Cl.: **A 01 B 79/00 (2006.01)** **A 01 C 17/00 (2006.01)** **A 01 C 21/00 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2016-08-01**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-04-13**
- (86) Europæisk ansøgning nr.: **11007776.5**
- (86) Europæisk indleveringsdag: **2011-09-23**
- (87) Den europæiske ansøgnings publiceringsdag: **2012-04-04**
- (30) Prioritet: **2010-09-29 DE 102010046832**
- (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: **RAUCH Landmaschinenfabrik GmbH, Landstrasse 14, 76547 Sinzheim, Tyskland**
- (72) Opfinder: **STÖCKLIN, Volker, Grasweg 13, 77975 Ringsheim, Tyskland**
Rauch, Norbert, Bergseestrasse 33, 76547 Sinzheim, Tyskland
- (74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**
- (54) Benævnelse: **Fremgangsmåde til ensartet fordeling af gødning**
- (56) Fremdragne publikationer:
EP-A1- 1 695 606
EP-A2- 0 158 335
WO-A1-83/00978
WO-A1-2009/045114
DE-A1- 19 835 487

Description

The invention relates to a method for the even distribution of fertilizer by means of a two-disc spreader in field regions, the agricultural cultivation of which takes place in cornering travel, for example, in tracks and/or at the outer field boundaries or at tree or plant islands in the interior of the field.

Due to the growing demand for grain, there is a need to also utilize agricultural land that has non-rectilinear tracks and/or non-rectilinear field boundaries and/or forest or plant islands or biotopes - so-called water-filled hollows - in the middle of the field. Power transmission towers and wind power stations are examples of these problematic cases. These agricultural field areas must also be fertilized organically or with minerals.

Two-disc spreaders are used primarily nowadays to distribute mineral fertilizer, which spreaders have so far not been able to solve the aforementioned problematic cases.

Pneumatic spreaders having spreader lines extending transversely to the direction of travel of the tractor are also known, in the case of which the pneumatically conveyed fertilizer is distributed on the ground using equidistantly spaced delivery elements. In the case of curvy field boundaries or in the case of the aforementioned problematic cases, the spreader moves along a curve. Therefore, the sections of the spreader line facing the inner radius move more slowly than the curve-outer sections, with the consequence that, given the same metering quantity, over fertilization occurs in the curve-inner region and under

fertilization occurs in the curve-outer region. DE 10 2004
030 240 A1 discloses that, depending on the curve radius
travelled by the tractor, the metering elements supplying
the delivery elements in the curve-inner region are set to a
5 smaller metering quantity than the metering elements
supplying the curve-outer delivery elements. The pneumatic
spreader also makes it possible to switch off the spreader
lines in partial regions in the event of a profile of the
curvy field boundary that differs from the track or the
10 boundary of the water-filled hollow. Reference is made to
the aforementioned document with respect to further details.

In contrast to a pneumatic spreader, in the case of which
the fertilizer is applied two-dimensionally and, therefore,
15 evenly, in the case of a towed or self-propelling two-disc
spreader, the fertilizer in a semicircular spreading fan is
distributed on the ground at a greater distance from the
spreader, which corresponds to the range of throw of the
spreader. In this case, the maximum of the fertilizer
20 quantity is in the middle, whereas it drops off to the right
and left in the semicircle. During parallel tracking, the
spreading fans are overlapped and an even distribution of
fertilizer is achieved. This applies for distribution in
parallel tracks.

25
Such a method having the features of the preamble of Claim 1
is known from WO 2009/045114.

On agricultural land having non-rectilinear tracks or
30 driving sections, i.e., for example, field boundaries
following a curve, further tracks/driving paths extending
parallel thereto in the interior of the field, and/or tree
and plant islands in the middle of the field, due to

cornering travel, a lower speed of the section of the semicircular spreading fan facing the inner radius of the curve results as compared to the section facing the outer radius of the curve. The result is over metering in the first case and under metering in the second case. In addition, due to the range of throw of the spreading fan, i.e., the distance between the spreading discs and the striking point of the fertilizer on the ground, a spatial offset results in the apothem toward the rear during the movement of the spreader around the curve. Due to the cornering travel, the spreading fan is already moving while it is still following the linear path, i.e., it inadvertently drifts outward.

15 The problem addressed by the invention is that of achieving a preferably even distribution of fertilizer using a two-disc spreader in the aforementioned problematic field and field-boundary regions.

20 This problem is solved with a method according to Claim 1. During travel on a rectilinear section, the two-disc spreader is set in the standard or basic setting, depending on the fertilizer type and the working width. In comparison to this standard or basic setting, during cornering travel, non-uniform fertilizer quantities and/or non-uniform application points and/or non-uniform rotational speeds of the spreading discs are set with regard to the profile of the curve on the curve interior and curve exterior. Due to the settability of the aforementioned three parameters individually or collectively, it is possible to react effectively to any problem encountered during cornering travel.

According to one preferred embodiment, it is provided that over metering in the curve-inner region or under metering in the curve-outer region because of the rotational movement of the semicircular spreading fan during the cornering travel is compensated for by a reduction in the metering quantity at the curve-inner spreading disc and by an increase in the metering quantity at the curve-outer spreading disc.

This measure will be selected, in particular, when a continuously curved curve is involved. If cornering travel is followed by such cornering travel in the opposite direction, the setting of the metering quantity is merely changed accordingly from the right spreading disc to the left spreading disc.

In another advantageous embodiment of the invention, it is provided that, in the event of a direction of rotation of the spreading discs in the centre counter to the direction of travel of the spreader, over fertilizing or under fertilizing because of the rotational movement of the semicircular spreading fan is additionally compensated for at the curve-inner spreading disc by means of shifting the application point counter to the direction of rotation and/or outwards in the direction of the circumference of the spreading disc and at the curve-outer spreading disc by means of shifting the application point in the direction of rotation and/or inwards in the direction of the disc centre.

This additional measure of shifting the application point determines the angle of rotation at which the fertilizer particles leave the spreading disc. The further outward the application point is located, the sooner the fertilizer particles leave the spreading disc, and the further inward

it is located, the later the fertilizer particles leave the spreading disc. Therefore, the position of the spreading fan is influenced.

5 In another embodiment of the invention, it is provided that over metering or under metering because of the rotational movement of the semicircular spreading fan is additionally compensated for by a reduction in the rotational speed of the curve-inner spreading disc and/or by an increase in the
10 rotational speed of the curve-outer spreading disc.

This measure, which is primarily additionally provided, is easily implemented in modern two-disc spreaders having a hydraulic or electric drive of the spreading discs.

15

The direction of movement and/or the curve radius of the two-disc spreader can be determined by means of a GPS signal, and the movement of the semicircular spreading fan can be calculated.

20

Information regarding lane courses to be expected can also be transmitted by the GPS signal and included in the calculation.

25 Instead thereof, the movement of the semicircular spreading fan can also be calculated by means of the steering angle of the front wheels of the tractor or self-propelling vehicle. In the case of a towed or self-propelling two-disc spreader, the movement of the semicircular spreading fan can be
30 determined by means of the different speed of the wheels.

As an additional measure, it is recommended that, in the event of the cornering travel at field boundaries, at the

spreading disc in the vicinity of the boundary, boundary spreading devices are additionally engaged or boundary spreading settings (rotational speed, application point, metering quantity) implemented. Such devices and settings
5 are known in the prior art.

Advantageously, it is provided that shiftings of the application point on the right/left during cornering travel are added to or calculated with the basic settings of the
10 two-disc spreader on a rectilinear driving section on the level and additionally are added to or calculated with possible setting changes during travel on a slope transversely to and in the direction of travel depending on the respectively measured slope angles. With respect to
15 spreading using a two-disc spreader on a slope, reference is made to the non-published patent application DE 10 2010 034 215 belonging to the applicant.

Furthermore, it is advantageous if the spatial offset
20 between the outer striking point of the spreading fan on the ground and the spreading disc is taken into consideration during the shifting of the spreading fan and the striking points on the right/left are controlled.

25 In addition, it can be advantageous if the application points are controlled in such a manner that the centre of the spreading fan is always located on the centre of the driving section travelled.

30 Finally, it is provided that all of the measures - metering quantities, application points, rotational speeds - of the basic setting in the field are calculated together with the measures of the rotational movement of the spreading fan, of

the spatial offset of the spreading fan and the orientation thereof always with respect to the centre of the driving section, and with the boundary spreading settings.

P a t e n t k r a v

- 5 1. Fremgangsmåde til ensartet fordeling af gødning ved hjælp af en gødningsspreder med to skiver i områder af en mark, hvor den landbrugsmæssige bearbejdning sker i kurvekørsel, f.eks. i spor og/eller ved de ydre markgrænser eller ved træ- eller planterøer inde på marken, **kendetegnet ved, at** der med hensyn til den gødningstypeafhængige og arbejdsbreddeafhængige indstilling ved kørsel på en lige kørestrækning i forhold til kurvens forløb på indersiden af kurven og ydersiden af kurven indstilles uens afgivelsespunkter, hvor der tages hensyn til den rumlige forskydning mellem spredeviftens ydre træfpunkt på jorden og spredeskiven ved forskydning af spredeviften, og afgivelsespunkterne til højre/venstre reguleres på en sådan måde, at midten af spredeviften altid befinder sig på midten af den kørte kørestrækning.
- 10 2. Fremgangsmåde ifølge krav 1, **kendetegnet ved, at** der kompenseres for en overdosering i området på indersiden af kurven eller en underdosering i området på ydersiden af kurven ved en drejebevægelse af den halvcirkelformede spredevifte ved kurvekørsel ved en reduktion af doseringsmængden ved spredeskiven på indersiden af kurven og ved en forøgelse af doseringsmængden ved spredeskiven på ydersiden af kurven.
- 15 3. Fremgangsmåde ifølge krav 1 eller 2, **kendetegnet ved, at** der ved en drejeretning af spredeskiverne i midten mod gødningssprederens kørselsretning yderligere kompenseres for en over- eller undergødskning ved en drejebevægelse af den halvcirkelformede spredevifte ved spredeskiven på indersiden af kurven ved hjælp af en forskydning af afgivelsespunktet mod drejeretningen og/eller udad i retning af spredeskivens omfang og ved spredeskiven på ydersiden af kurven ved hjælp af en forskydning af afgivelsespunktet i drejeretningen og/eller indad i retning af skivens midte.
- 25 4. Fremgangsmåde ifølge et af kravene 1 til 3, **kendetegnet ved, at** der yderligere kompenseres for en over- eller underdosering ved en drejebevægelse af den halvcirkelformede spredevifte ved en reduktion af omdrejningstallet på spredeskiven på indersiden af kurven og/eller ved en forøgelse af omdrejningstallet på spredeskiven på ydersiden af kurven.
- 30 35

5. Fremgangsmåde ifølge et af kravene 1 til 4, **kendetegnet ved, at** bevægelsesretningen og/eller kurveradiussen af gødningssprederen med to skiver fastslås ved hjælp af et GPS-signal, og den halvcirkelformede spredeviftes bevægelse udregnes.
- 5
6. Fremgangsmåde ifølge krav 5, **kendetegnet ved, at** information om de forventelige sporforløb overføres fra GPS-signalet og indgår i beregningen.
7. Fremgangsmåde ifølge et af kravene 1 til 4, **kendetegnet ved, at** den halvcirkelformede spredeviftes bevægelse udregnes ved hjælp af styrevinklen af traktorens eller den selvkørende maskines forhjul.
- 10
8. Fremgangsmåde ifølge et af kravene 1 til 4, **kendetegnet ved, at** den halvcirkelformede spredeviftes bevægelse ved en trukket eller selvkørende gødningsspreder med to skiver fastslås ved hjælp af hjulenes forskellige hastighed.
- 15
9. Fremgangsmåde ifølge et af kravene 1 til 7, **kendetegnet ved, at** der ved spredeskiven tæt på grænsen i forbindelse med kurvekørsel ved markgrænser endvidere tilkobles grænsespredningsindretninger eller der foretages grænsespredningsindstillinger (omdrejningstal, afgivelsespunkt, doseringsmængde).
- 20
10. Fremgangsmåde ifølge et af kravene 1 til 8, **kendetegnet ved, at** forskydninger af afgivelsespunktet til højre/venstre ved kurvekørsel lægges til eller beregnes med grundindstillingerne af gødningssprederen med to skiver på en lige kørestrækning i det plan og endvidere lægges til eller beregnes med eventuelle indstillingsændringer ved kørsel på en skråning på tværs af og i kørselsretningen afhængigt af de i hvert tilfælde målte skråningsvinkler.
- 25
- 30
11. Fremgangsmåde ifølge et af kravene 1 til 10, **kendetegnet ved, at** alle foranstaltninger - doseringsmængder, afgivelsespunkter, omdrejningstal - af grundindstillingen i marken beregnes med foranstaltningerne ved spredeviftens drejebevægelse, spredeviftens rumlige forskydning og dens orientering
- 35
- altid på midten af kørestrækningen og med grænsespredningsindstillingerne.