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SEEDER ELEMENT AND SOWING MACHINE

Description

Subject of the invention

The present invention relates to a sowing unit for the distribution of at least one granular product, preferably the concomitant distribution of several granular products, which comprises at least one first mobile feed hopper. The invention also relates to a seeder comprising such a sowing element.

Prior art

In the agricultural field, seeders for distributing granular products, of the seed, fertilizer or phytosanitary product type, conventionally comprise a plurality of sowing units borne by a main chassis, the latter generally being equipped with several wheels, enabling movement thereof with respect to the ground, the wheels possibly being mobile, raisable or retractable, such that they are not in contact with the ground, for example during manoeuvres or the transport of the seeder.

The sowing units may be self-propelled, but they are usually towed or drawn by an agricultural vehicle, for example a tractor; they thus comprise means for hitching to an agricultural vehicle or to a main chassis. They conventionally further comprise means for opening a furrow in the ground, means for closing it, one or more hoppers capable of storing, and when in operation containing, a granular product, or different granular products, to be sown or spread, possibly concomitantly.

The sowing units generally comprise one or more assemblies for distributing granular products for distribution thereof on the ground, usually an assembly for distribution by type of granular product, each possibly being able to comprise or cooperate with means for conveying granular products to the ground, the distribution assembly, or each distribution assembly, cooperating or each being connected to a hopper for storing granular products.

For seeders that allow different granular products to be spread concomitantly, it is known to use pivotable and removable hoppers. For example, document EP0140262 describes a seeder comprising a hopper that is able to pivot on itself, with respect to the chassis bearing it, about a single axis, transverse to the chassis, for pivoting towards the rear of the hopper in order to facilitate manipulation thereof by an operator who can then raise it and separate it from the chassis for replacement thereof. Likewise, document EP0729698 describes a hopper with two tanks, which is pivotably mounted at the end of an arm, about a single axis, and moved with the aid of hydraulic cylinders.

Furthermore, document FR2691039 describes a seeder comprising a hopper, which is not mounted on a frame. The hopper is mounted mobile between a high position, a working position, above tools for working the ground, in close proximity to the rear of the tractor to which the seeder is coupled, and a low position, for filling and emptying the hopper or for servicing metering means, a position in which the hopper is at the rear of the seeder. The passage from one position to another is effected by tilting or along an inclined plane, with the aid of two substantially parallel arms, articulated to points of the chassis of the seeder and of the hopper, and with the aid of a hydraulic cylinder connecting one of the arms to the end of the other arm.

Likewise, document DE4417964 describes a seeder comprising a hopper, which is not mounted on a frame. The hopper is mounted mobile between a first high position, which is the working position, a low position, for filling the hopper, and a second high position, for maintenance, in which the hopper and the tools of the seeder are raised, the passage from one position to another being effected with the aid of a series of two parallelograms, each having two arms mounted mobile on an articulated portion of the chassis of the seeder, one of the two parallelograms having a third arm connected to an articulated portion of the chassis with the aid of a hydraulic cylinder, and connected to the hopper by a spring arm, allowing the hopper to be lowered as it is emptied during operation of the seeder.

However, the sowing units have the major drawback of not enabling easy access for the maintenance or the replacement of different elements of which they are composed, such

as the assembly or the assemblies for distributing granular products. Specifically, all the elements of which a sowing unit is composed are disposed very close to one another, generally grouped under the main hopper, so that the sowing unit is as compact as possible and so that a greater number of them can be disposed on a single seeder.

Aims of the invention

The present invention aims to provide a sowing unit and a seeder, comprising such a sowing unit, which do not have the drawbacks of the prior art.

The present invention aims to provide an alternative to the existing solutions in the prior art.

The invention proposes a solution that makes the components of the sowing unit easily accessible, for the purposes of inspecting, maintaining or replacing them, in particular without the use of hydraulic or pneumatic means.

Summary of the invention

The present invention relates to a sowing unit for granular products to be distributed on the ground, comprising a chassis, a first assembly for distributing a first granular product, comprising a main hopper, fastened to a frame which is mobile with respect to the chassis and capable of adopting what is referred to as a “lowered” position, which is the working position of the sowing unit, and what is referred to as a “raised” position, which is the maintenance position of the sowing unit, and of passing from the “lowered” position to the “raised” position and vice versa, the sowing unit further comprising means for tilting the frame, comprising a deformable quadrilateral or a deformable double quadrilateral, connecting the frame to the chassis, the tilting means being disposed substantially perpendicularly to the substantially horizontal plane of extension formed by the chassis extending along the axis X-X', and being held substantially perpendicular to the plane of extension in the “lowered” and “raised” positions and during the passage from one to the other and vice versa.

According to particular embodiments of the invention, the sowing unit according to the invention comprises at least one, or any suitable combination, of the following features:

- the means for tilting the frame comprise a fixed lower arm secured to the chassis, bearing two fixed lower pivot points about which a main link rod and a secondary link rod are respectively articulated, the frame being articulated with respect to the main link rod at a first upper pivot point and the secondary link rod being articulated with respect to an upper connecting arm at a second upper pivot point, the upper connecting arm being connected to the frame or to the main link rod, the first and second upper pivot points being mobile with respect to said chassis,
- the distance between the bottom lower pivot point and the top lower pivot point of the lower arm is greater than the distance between the bottom upper pivot point of the upper connecting arm and the top upper pivot point of the frame,
- the distance between the top lower pivot point of the lower arm and the bottom upper pivot point of the secondary link rod is smaller than the distance between the bottom lower pivot point of the lower arm and the top upper pivot point of the frame,
- the lower arm comprises means for receiving a pivot shaft, the pin of which forms one of the two lower pivot points, and wherein the upper connecting arm comprises means for receiving a pivot shaft, the pin of which forms the second upper pivot point, the secondary link rod comprising means for engaging with the pivot shafts,
- the main link rod comprises means for receiving a lower pivot shaft, the pin of which forms one of the lower pivot points, and means for receiving an upper pivot shaft, the pin of which forms the top upper pivot point,
- the main link rod is secured to the frame, by a fastening tab,
- the sowing unit further comprises hitching means comprise a tool bar, to which the chassis is connected, and further comprising means for adjusting the vertical position of said sowing unit, comprising a deformable parallelogram or a deformable parallelepiped, disposed substantially horizontally, and being articulated with respect to the chassis by at least one pivoting point, which is also a pivot point of the means for tilting the frame,
- the first assembly for distributing the first granular product further comprises first unitary means for distributing the first granular product, which are secured to the frame and are therefore mobile with the frame, the sowing unit further comprising first

means for conveying the first granular product to the ground, which are secured to the chassis and are therefore fixed with respect to the chassis,

- the first unitary means for distributing the first granular product are fastened to an arm fastened to the frame, and extending from the frame towards the chassis, the arm being mobile with respect to the chassis and being capable of engaging with and disengaging from fastening means which are provided on said chassis and are capable of receiving the arm,
- the sowing unit further comprises a second assembly for distributing a second granular product, comprising a first ancillary hopper that is secured to the frame and is therefore mobile with the frame,
- the second assembly for distributing a second granular product comprises second unitary distribution means, secured to the frame, and therefore mobile with respect to the chassis,
- the sowing unit further comprises a third assembly for distributing a third granular product on the ground, comprising a second ancillary hopper that is secured to the frame and is therefore mobile with respect to the chassis, and possibly comprising second means for conveying said second granular product to the ground,
- the third assembly for distributing a third granular product on the ground further comprising third unitary distribution means, which are secured to the frame or to the second ancillary hopper and are therefore mobile with respect to the chassis, the sowing unit further comprising third means for conveying the third granular product to the ground, which are secured to the chassis and are therefore fixed with respect to the chassis.

The present invention also relates to a seeder comprising one or more sowing units according to the invention.

Brief description of the figures

Figure 1 is a schematic representation of a side view of a sowing unit according to the invention, the main hopper of which is in the lowered position.

Figure 2 is the same representation as that in Figure 1.

Figure 3 is a schematic representation of the main hopper of the sowing unit according to the invention.

Figure 4 is a schematic representation of a side view of the sowing unit in Figures 1 and 2, the main hopper of which is in the raised position.

Figure 5 is the same representation as that in Figure 4.

Figure 6 is a schematic representation of the sowing unit according to the invention, the main hopper of which is in the raised position, viewed from the rear.

Figure 7 is a schematic representation of a side view of a cross section of the tilting means according to the invention which are folded.

Figure 8 is a schematic representation of a side view of the tilting means according to the invention during deployment thereof.

Figure 9 is a schematic representation of a side view of the tilting means according to the invention which are deployed.

Figure 10 is a schematic representation of a first perspective view of the tilting means according to the invention which are deployed.

Figure 11 is a schematic representation of a second perspective view of the tilting means according to the invention which are deployed.

Detailed description of the invention

In the remainder of the description and the claims, the terms “top”, “bottom”, “above”, “below”, “upper”, “lower”, “vertical” and “horizontal”, “front” and “rear” refer to the normal position of the sowing unit 1 according to the invention, and of the elements of which it is composed, during normal use thereof, and, in particular, they refer to the positions thereof as shown in Figures 1 to 11.

The sowing unit 1 according to the invention is mounted on a chassis 2, self-propelled, or else borne or towed by an agricultural vehicle, for example a tractor. The chassis 2 extends substantially horizontally, in the plane X-X', and comprises a front part 3 which is defined according to the movement direction D of the sowing unit 1 during normal use thereof, as shown in Figure 1. For a towed sowing unit 1, it is the part situated in proximity to the rear of the agricultural vehicle, and bearing hitching means 4 allowing

it to be reversibly connected to the agricultural vehicle, and a rear part 5, which is opposite said front part 3.

Preferably, the hitching means 4 comprise a tool bar 41, to which the chassis 2 is connected by means for adjusting the vertical position, along the axis Y'-Y, of the sowing unit 1 with respect to the tool bar 41. These adjusting means comprise a deformable parallelogram 44 comprising at least two series of upper arms 42, preferably also two series of lower arms 43 substantially parallel to the upper arms 42, the deformable parallelogram 44 being articulated with respect to the chassis 2 at at least one pivot point on the chassis 2, preferably two pivot points, advantageously two series of two pivot points, thus allowing the upper arms 42 and the lower arms 43 to be articulated with respect to the chassis 2.

The sowing unit 1 further comprises means 6 for opening a furrow in the ground, preferably of controlled depth, which are, or comprise, opening discs, and preferably also comprising one or more gauge wheels 7 making it possible to adjust, depending on their position, the depth of the furrow, and possibly also means for fashioning the form of the bottom of the furrow.

The sowing unit 1 may comprise means 8 for packing one or more granular products deposited at the bottom of the open furrow. Preferably, these means 8 are, or comprise, at least one press wheel.

The sowing unit 1 further comprises means 10 for closing the furrow, which are, or comprise, one or more closure discs or wheels, extending behind the means 6 for opening the furrow, and at the rear of the packing means 8 if they are present. Preferably, these means 10 are disposed at the rear of the sowing unit 1.

The sowing unit 1 may further comprise debris removal means 9 for removing crop residues, clumps of earth or stones which are, or comprise, at least one rotary wheel, disposed at the front of the sowing unit 1.

The sowing unit 1 comprises at least a first assembly for distributing a first granular product, which is preferably a grain or seed, said first assembly being capable of depositing the first granular product between the means 6 for opening the furrow.

This first assembly comprises a hopper 11, referred to as "main" hopper, capable of containing, and when in operation containing, the grains to be sown, which is preferably disposed in the upper part of the chassis 2, above, in line with or at the rear of the means 6 for opening a furrow, at the front of the means 10 for closing the furrow.

The main hopper 11 can adopt all the possible or suitable dimensions and forms, defining an internal volume. Preferably, it has a substantially parallelepipedal form and comprises a front wall 12, a rear wall 13, opposite the front wall 12, a first side wall 14, a second side wall 15, opposite the first side wall 14, a lower wall 16 and an upper wall 17, opposite the lower wall 16 (Figure 3), the upper wall 17 being, preferably, open or partially open in order to allow it to be filled with at least the first granular product, and closable, and when in operation closed, by a mobile cover.

The first distribution assembly further comprises first distribution means 18 for the unitary and dissociated distribution of the first granular product, grains to be sown, which are, in operation, connected with the main hopper 11, for example by an opening, preferably closable, formed in the lower wall 16 of the main hopper 11. These first unitary distribution means 18 preferably use a pneumatic principle, the grains being loaded, by the unit, by suction or depression, on a cellular distribution disc, disposed substantially vertically, and which is rotating, the grains being then released, or extracted, one by one, by blowing or by stopping the depression or with the aid of mechanical extraction. To these ends, the first distribution assembly may comprise or cooperate with suction and/or blowing means.

The first distribution means 18 are disposed, preferably, under the main hopper 11, above, and at the rear, of the means 6 for opening a furrow, for example for a deposition of the grains by gravity. These first distribution means 18 are capable of depositing the first granular products between the means 6 for opening the furrow, for a deposition of the first granular products in the furrow formed. Preferably, the first distribution means 18

cooperate and are connected, in operation, with first conveying means 19 making it possible to direct the grains as they drop and avoid having them fall outside of the furrow, first conveying means 19 advantageously also cooperating with means for transferring grains from the distribution disc of the first distribution means to the first means 19 for conveying grains to the ground.

Preferably, the main hopper 11 is fastened to a rigid frame 20, by any suitable means. Preferably, the frame 20 is fastened to the outer surface of the front wall 12 of the main hopper 11, and possibly also to the outer surface of the lower wall 16, and follows the contour of this or these walls 12, 16 if this or these walls are not straight (Figure 3).

The first distribution means 18 of the first distribution assembly may be secured to the chassis 2; however, preferably, they are also fastened to the frame 20, and are thus secured to the main hopper 11. In embodiments in which the first distribution means 18 comprise means for transferring granular products to the first conveying means 19, these transfer means are also secured to the main hopper 11. They are fastened to the frame 20, either directly or by way of the distribution means 18.

Preferably, the first distribution means 18 are fastened to an arm 21, which is fixed with respect to the frame 20, protruding and extending from the latter towards the chassis 2, substantially vertically, from top to bottom, possibly obliquely (Figure 4). The free end 22 thereof, namely the end opposite the one fastened to the frame 20, reversibly engages with the chassis 2, possibly by non-positive engagement, by way of the fastening means 23 provided on the chassis, this having the advantage of constituting a point for locking the frame 20 on the chassis 2.

For example, the free end 22 of the arm 21 may be provided with one or more hooks, preferably pivotable, coming into engagement with a transverse pin, along the axis Z-Z', provided on the chassis 2 and fixed with respect to the latter, or a toggle latch on the arm 21 engaging with centring pins on the chassis 2. It is also possible to provide for the free end 22 of the arm 21 to be able to be provided with an open-ended orifice, and for the fastening means 23 of the chassis 2 to comprise a fastening tab that is itself provided

with an open-ended orifice, the orifices being intended to receive a removable transverse pin, or a spindle.

The frame 20 is movably connected to the chassis 2 of the sowing unit 1, for tilting of the frame 20, and therefore of all the elements connected to the latter, such as the main hopper 11, with respect to the chassis 2, not by a simple pivoting movement with respect to a single pivot point, or pivot pin, of the chassis 2, but by a rotational movement towards the front of the sowing unit 1, coupled with a substantially horizontal translational movement.

The frame 20 can adopt, with respect to the chassis 2, what is referred to as a "lowered" position and what is referred to as a "raised" position, and can pass from one position to the other.

The lowered position is the one in which the frame 20, and therefore at least the main hopper 11, is (are) substantially disposed horizontally, substantially in the plane X-X', and in proximity to the chassis 2, as shown in Figures 1 and 2. It is the working position of the main hopper 11, during normal use thereof on the seeder 1, and the normal working position of the seeder 1 during normal operation thereof.

The raised position is the one in which the frame 20, and therefore at least the main hopper 11, is substantially disposed vertically, substantially in the plane Y-Y', or substantially obliquely, substantially distant from the chassis 2, as shown in Figures 4 to 6. It is the maintenance position of the seeder 1.

The passage of the frame 20, and therefore of the main hopper 11, from the lowered position, the working position, to the raised position, the maintenance position, and vice versa, is effected by tilting means which are mechanical and not pneumatic or hydraulic.

Preferably, the tilting means act as a deformable parallelogram, without thereby being strictly limited to a parallelogram in the geometrical sense of the term. The tilting means comprise an articulated quadrilateral 24, which is preferably not a parallelogram 24, but this is in no way ruled out. The quadrilateral 24 has a form substantially perpendicular

to the plane formed by the chassis 2, therefore it is disposed substantially in the plane Y-Y', whether the frame 20 is in the lowered or raised position, and remains substantially in this perpendicular position when the frame 20 passes from the lowered position to the raised position and vice versa.

The articulated quadrilateral has the advantage not only of not requiring the use of hydraulic or pneumatic means for the passage from one position to the other, but also of offering the frame 20 a stable raised position which is not achievable through the use of a simple pivoting about a single pivoting point or a single pivot pin. These tilting means also have the advantage of allowing a large travel of the frame 20 allowing easy access to the constituent elements of the sowing unit 1 according to the invention.

Preferably, the deformable quadrilateral 24 comprises a lower arm 29 fixed with respect to the chassis 2, a main link rod 30, a secondary link rod 31 and an upper connecting arm 32, and comprising four pivot points 25, 26, 27, 28, with respect to which the lower and upper arms 29, 32 and the link rods 30, 31 are articulated. The lower arm 29 bears two lower pivot points 25, 26, fixed with respect to the chassis 2, about which the main link rod 30 and the secondary link rod 31 are respectively articulated, the main link rod 30 also being articulated with respect to the frame 20 about a first upper pivot point 28 and the secondary link rod 31 being articulated with respect to the frame 20, and in particular with respect to the upper connecting arm 32, about a second upper pivot point 27, the first and second upper pivot points 27 and 28 being mobile with respect to the chassis 2 when the frame 20 passes from its lowered position to its raised position, and vice versa.

The deformable 24 quadrilateral 24 is substantially folded on itself, or partially open, when the frame 20 is in the lowered position (Figure 7), it unfolds when it passes from one position to the other (Figure 8) and is unfolded, or open, when the frame 20 is in the raised position (Figure 9), while still maintaining an orientation substantially perpendicular to the plane X-X'.

The lower arm 29 of the deformable quadrilateral 24 is fixed with respect to the chassis 2 and extends from the latter, obliquely, towards the top and the rear of the chassis 2. It

comprises the lower pivot points 25, 26, which may be disposed in the same plane X-X', for example the plane formed along the axis X-X'; however, they are preferably not disposed in the same horizontal plane, but in an oblique plane with respect to the plane X-X'. There is then a bottom lower pivot point 25 and a top lower pivot point 26. Preferably, the lower arm 29 comprises an upper part which is bent towards the top and the rear of the chassis 2, and the upper end of which comprises the top lower pivot point 26.

Preferably, the bottom lower pivot point 25 is also a pivot point of the horizontal deformable parallelogram 44 allowing vertical adjustment of the sowing unit 1. Advantageously, it is the pivot point between the chassis 2 and the upper arm 42 of the deformable parallelogram 44.

Preferably, the bottom lower pivot point 25 of the lower arm 29 fastened to the chassis 2 is disposed at a distance from the top lower pivot point 26 which is greater than the distance between the bottom upper pivot point 27 and the top upper pivot point 28 of the upper connecting arm 32.

The main link rod 30 of the deformable quadrilateral 24 is articulated and mobile, and connects the chassis 2 to the frame 20. It is articulated with respect to the chassis 2, and in particular to the lower arm 29, at the bottom lower pivot point 25, and mobile with respect to the frame 20 at the top upper pivot point 28.

The secondary link rod 31 is also articulated and mobile, and connects the chassis 2 to an upper arm 32, which is itself articulated and mobile, connecting the secondary link rod 31 to the frame 20 or connecting the secondary link rod 31 to the main link rod 30. The secondary link rod 31 is articulated with respect to the chassis 2, and in particular to the lower arm 29, at the top lower pivot point 26, and with respect to the upper connecting arm 32 at the bottom upper pivot point 27. The upper connecting arm 32 may be fixed with respect to the frame 20 or mobile at the top upper pivot point 28.

Preferably, the secondary link rod 31 is shorter than the main link rod 30 such that the distance between the top lower pivot point 26 and the bottom upper pivot point 27 is

smaller than the distance between the bottom lower pivot point 25 and the top upper pivot point 28.

Preferably, the main link rod 30 has a length at least equal to or greater than the sum of the lengths of the secondary 31 and upper 32 link rods such that the distance between the bottom lower 25 and top upper 28 pivot points is at least equal to or greater than the sum of the distances between the bottom lower 26, bottom upper 27 and top upper 28 pivot points.

In addition to the lowered position and the raised position, the quadrilateral 24 makes it possible to adopt at least one intermediate position in which the main link rod 30 is in a position allowing the alignment of the pivot points 26, 27 and 28.

When the frame 20 is in the lowered position, the bottom upper pivot point 27 and the top upper pivot point 28 are substantially aligned with one another substantially vertically, in the plane Y-Y'. These pivot points 27 and 28 are located substantially on the same projected vertical line P1, P2, on the ground, or in a plane X-X'. The projected points P1 and P2, respectively of the upper pivot points 28 and 27, are at a relative position situated between the projected point P3 of the top lower pivot point 26 and the projected point P4 of the bottom lower pivot point 25 (Figure 7).

When the frame 20 and therefore the main hopper 11 are raised, the main link rod 30 pivots with respect to the bottom lower pivoting point 25, such that the top upper pivot point 28 moves towards the front of the chassis 2, in a substantially horizontal translational movement, in the plane X-X'. The projection P1 of the top upper pivot point 28 moves towards the front and moves beyond the projection P4 of the bottom lower pivot point 25. Concomitantly, the secondary link rod 31 pivots with respect to the top lower pivoting point 26 and is deployed obliquely towards the top of the chassis 2, then horizontally towards the rear, allowing the bottom upper pivot point 27 to move towards the top and then the rear of the chassis 2. The projection P2 of the bottom upper pivot point 27 then moves rearwards towards the projection P3 of the top lower pivot point 26 (Figure 8). While the bottom upper pivot point 27 effects its movement, the main link rod 30 pivots again with respect to the bottom lower pivoting point 25, but in the

opposite direction, such that the top upper pivot point 28 moves towards the rear of the chassis 2 in a substantially horizontal translational movement, moving beyond the relative position thereof that it occupies when the frame 20 is in the lowered position, until the upper pivot point 27 moves beyond the relative position of the top lower pivot point 26.

When the projection P2 of the bottom upper pivot point 27 moves rearwards towards the projection P3 of the top lower pivot point 26, the bottom upper pivot 27 reaches an unstable equilibrium point of the deformable quadrilateral 24, for which the projections P2 and P3 are coincident. The projection P1 of the bottom lower pivoting point 25 moves towards the rear of the chassis 2 beyond the projection P4 of the bottom lower pivot point 25 in order to return to the relative position thereof that it occupies when the frame 20 is in the lowered position, between the projections P3 and P4. The projection P2 of the bottom upper pivot point 27 moves towards the rear of the chassis 2 and moves beyond the projection P3 of the top lower pivot point 26 (Figure 9).

In this position, the frame 20, and therefore the main hopper 11, is in the raised position, blocked by the top end of the main link rod 30 being brought into abutment in contact with the frame 20 or with an element forming a stop or against a wall of the main hopper 11, locking the frame 20 and the main hopper 11 in this position without the use of other additional blocking means.

To transfer the frame 20, and therefore the main hopper 11, from the top position to the lowered position, the deformable quadrilateral 24 folds according to movements opposite to those described for the opening thereof. The main link rod 30 pivots with respect to the bottom lower pivoting point 25, such that the top upper pivot point 28 moves towards the front of the chassis 2 in a substantially horizontal translational movement, while the secondary link rod 31 moves horizontally towards the front of the chassis 2 and then obliquely towards the bottom of the chassis 2 such that the bottom upper pivot point 27 moves towards the front and then the bottom of the chassis 2. The projection P1 moves towards the front of the chassis 2 towards the projection P4 and moves beyond it, while the projection P2 also moves towards the front of the chassis 2 towards the projection P4 and moves beyond the projection P3 of the top lower pivot

point 26. While the bottom upper pivot point 27 effects its movement, the main link rod 30 pivots again with respect to the bottom lower pivoting point 25, but in the opposite direction, such that the top upper pivot point 28 moves towards the rear of the chassis 2 in a substantially horizontal translational movement to restore its relative position, the frame 20 and therefore the main hopper 11 being in the lowered position. The projections P1 and P2 are aligned substantially on the same vertical between the projections P3 and P4.

In embodiments in which the first distribution means 18 are fastened to an arm 21 of the frame 20, the raising of the frame 20 towards its raised position allows the free end 22 of the arm 21 to disengage from its means 23 for fastening to the chassis 2, and the transfer into the lowered position of the frame 20 allows the free end 22 to engage with the means 23 for fastening to the chassis 2, thus locking the frame 20 in its lowered position.

Preferably, the tilting means comprise a deformable double quadrilateral, two adjacent quadrilaterals, parallel and not in series, sharing a common side (Figures 10 and 11), disposed substantially perpendicularly with respect to the chassis 2. It may also be a deformable double parallelogram, two adjacent parallelograms forming a deformable parallelepiped.

In embodiments in which the tilting means comprise a deformable double quadrilateral, the lower arm 29 comprises a first lateral portion 291 and a second lateral portion 292, opposite and disposed substantially parallel to the first lateral section 291, each comprising means for receiving a pivot shaft 38, preferably comprise or having the shape of open-ended holes, the pin of which forms the top lower pivot point 26. The upper arm 32 comprises a first lateral portion 321 and a second lateral portion 322, opposite and disposed substantially parallel to the first lateral section 321, and comprises means for receiving a pivot shaft 39, preferably comprise or having the shape of open-ended holes, the pin of which forms the bottom upper pivot point 27. The secondary link rod 31 comprises, preferably at each of these ends, receiving means, preferably an open-ended hole, engaging on one side with the pivot shaft 38 and on the other side with the pivot shaft 39. The main link rod 30 comprises a first lateral portion 301 and a second lateral

portion 302, opposite and disposed substantially parallel to the first lateral section 301, and comprises means for receiving a lower pivot shaft 40, the pin of which forms the bottom lower pivot point 25, and means for receiving an upper pivot shaft 41, the pin of which forms the top upper pivot point 28 (Figure 11).

Preferably, the main link rod 30 is fastened to the frame 20, by a fastening tab 42, which is itself fastened directly to the frame 20, preferably by a fastening plate 43 fastened to the frame 20 itself, or to a wall of the main hopper 11. Advantageously, the fastening tab 42 comprises a first lateral portion 421 and a second lateral portion 422, opposite and disposed substantially parallel to the first lateral section 422, comprising means, for example open-ended holes, receiving the shaft 41.

Even if the upper connecting arm 32 can be connected to the frame 20 at the top upper pivot point 28, for example by an open-ended hole engaging with the shaft 41 disposed at the end thereof opposite the one bearing the bottom upper pivot point 27, therefore opposite the end comprising the open-ended hole receiving the shaft 39, it is, preferably, fastened directly to the frame 20, advantageously by the fastening plate 43 receiving the fastening tab 42.

In embodiments in which the first distribution means 18, and possibly also, if they are present, the means for transferring first granular products to the first conveying means 19, are fastened to the arm 21 of the frame 20, the secondary link rod 31 may be bent or curved, such that in the low position of the frame 20 it is housed against the first distribution means 18, this having the advantage of having a more compact sowing unit 1.

It is also advantageous to provide for the use of automatic connection and disconnection means between the first distribution means 18, or the means for transferring granular products if they are present, and the first conveying means 19, and/or between the first distribution means 18 and the pneumatic means allowing granular products to be fed from the main hopper 11 to the first distribution means 18.

The sowing unit 1 may further comprise a second assembly for distributing a second granular product, which may also be a grain or seeds, but of a different nature to those of the first granular product allowing a coculture planting mode. Nevertheless, preferably, the second granular product is not a grain or a seed, but a granular phytosanitary product, or a mixture of granular phytosanitary products, such as fertilizers, herbicides, insecticides, nematicides, fungicides, anti-slug pellets or other equivalent pesticides.

The second distribution assembly is capable of distributing the second granular product on the ground at least in front of the means 6 for opening the furrow, preferably behind the debris removal means 9 if they are present, and/or between the means 6 for opening the furrow.

The second distribution assembly comprises a first hopper, referred to as first ancillary hopper, able to adopt all the possible or suitable dimensions and forms, defining an internal volume, and capable of containing, and when in operation containing, one or more granular phytosanitary products. This first ancillary hopper is preferably disposed in the upper part of the chassis 2, above, in line with or at the rear of the means 6 for opening the furrow, at the front of the means 10 for closing the furrow, advantageously it is disposed at the front of the main hopper 11, coupled to the latter, the two hoppers advantageously being able to share a common wall, or the first ancillary hopper may be an integral part of, or be integrated in, the main hopper 11. Thus, the ancillary hopper is secured to the frame 20.

The second distribution assembly comprises second distribution means 33 for the unitary distribution of a second granular product on the ground, which are, in operation, connected with the first ancillary hopper, for example by an opening, preferably closable, formed in the lower wall of said ancillary hopper. Preferably, these second unitary distribution means 33 cooperate in operation with, comprise, or are, also second conveying means, and possibly also comprise transfer means for transferring the second granular product from the second unitary distribution means 33 to the second conveying means.

The second unitary distribution means 33 of the second distribution assembly may be secured to the chassis 2; however, preferably, they are also fastened to the frame 20, by any suitable means. Thus, the raising of the frame 20 from its low position to its high position also allows the user of the sowing unit 1 according to the invention to be able to easily access the second unitary distribution means 33 in order to inspect them, carry out maintenance thereof or replace them. Preferably, in these embodiments, it is also advantageous to provide for the use of automatic connection and disconnection means between the second unitary distribution means 33 and the second conveying means.

The sowing unit 1 may further comprise a third assembly for distributing a third granular product, which is preferably not a grain or a seed, but a granular phytosanitary product, or a mixture of granular phytosanitary products.

The third distribution assembly is capable of distributing the second granular product on the ground at least between the means 6 for opening the furrow and/or after the means 10 for closing the furrow, and/or after the means 8 for packing the furrow.

The third distribution assembly comprises a second ancillary hopper 34 able to adopt all the possible or suitable dimensions and forms, defining an internal volume, which is capable of containing, and when in operation containing, one or more granular phytosanitary products. This second ancillary hopper is preferably disposed in the upper part of the chassis 2, above, in line with or at the rear of the means 10 for closing the furrow, advantageously disposed at the rear of the main hopper 11 and coupled to the latter, the two hoppers 11 and 34 advantageously being able to share a common wall.

The third distribution assembly comprises third distribution means 35 for the unitary distribution of a third granular product on the ground, which are, in operation, connected with the second ancillary hopper 34, for example by an opening, preferably closable, formed in the lower wall of said hopper 34. Preferably, these third distribution means 35 cooperate with, comprise, or are, also third conveying means 36, and possibly also comprise transfer means for transferring the second granular product from the third distribution means 35 to the third conveying means 36.

The third unitary distribution means 35 may be secured to the chassis 2; however, preferably, they are fastened, by any suitable means, directly to the frame 20 or to the second ancillary hopper 34, which is itself secured to the main hopper 11, which is secured to the frame 20. Thus, the raising of the frame 20 from its low position to its high position also allows the user of the sowing unit 1 according to the invention to be able to easily access the third unitary distribution means 35 in order to inspect them, carry out maintenance thereof or replace them. Preferably, in these embodiments, it is also advantageous to provide for the use of automatic connection and disconnection means between the third distribution means 35 and the third conveying means 36.

Preferably, the third conveying means 36 are borne by a fixed arm 37 which is secured to the chassis 2 and extends from the chassis 2 advantageously obliquely towards the top and the rear of the chassis 2.

The seeder according to the invention comprises one or more sowing units 1 according to the invention, preferably mounted on a supporting chassis, borne or drawn by an agricultural vehicle. The supporting chassis then comprises hitching means in order to reversibly connect it with the agricultural vehicle, which bears it or tows it. Preferably, the seeder comprises one or more wheels, preferably mobile in order to be raisable or retractable, such that they are not in contact with the ground, for example during manoeuvres or the transport of the seeder.

The scope of protection of the present invention is defined by the attached claims.

Patentkrav

1. Såelement (1) til såning af produkter i kornform, der skal fordeles på jorden, hvilket element omfatter et chassis (2), en første fordelingsenhed til fordeling af et første produkt i kornform, hvilken enhed omfatter en hovedtragt (11), som er fastgjort til en ramme (20), der er bevægelig i forhold til chassiset (2), og som kan indtage en såkaldt "sænket" position, der er såelementets (1) arbejdsposition, og en såkaldt "hævet" position, der er såelementets (1) vedligeholdelsesposition, og kan bevæge sig fra den "sænkede" position til den "hævede" position og omvendt, kendetegnet ved, at såelementet (1) i øvrigt omfatter vippemidler til at vippe rammen (20), hvilke midler omfatter en deformerbar firkant (24) eller en dobbelt deformerbar firkant, der forbinder rammen (20) med chassiset (2), hvilke vippemidler er anbragt i det væsentlige vinkelret på det i det væsentlige vandrette forlængelsesplan, som dannes af chassiset (2) og strækker sig langs aksen X-X', og holdes i det væsentlige vinkelret på forlængelsesplanet i den "sænkede" og den "hævede" position og ved skift fra den ene til den anden og omvendt.

2. Såelement (1) ifølge krav 1, hvor vippemidlerne til at vippe rammen (20) omfatter en nedre arm (29), der er stationær og fast forbundet med chassiset (2), og som bærer to stationære nedre omdrejningspunkter (25, 26), omkring hvilke henholdsvis en hovedsvingarm (30) og en sekundær svingarm (31) er leddelt, hvilken ramme (20) er leddelt i forhold til hovedsvingarmen (30) ved et første øvre omdrejningspunkt (28), og den sekundære svingarm (31) er leddelt i forhold til en øvre forbindelsesarm (32) ved et andet øvre omdrejningspunkt (27), idet den øvre

forbindelsesarm (32) er forbundet med rammen (20) eller hovedsvingarmen (30), idet det første og det andet øvre omdrejningspunkt (27, 28) er bevægelige i forhold til chassiset (2).

3. Såelement (1) ifølge krav 2, hvor afstanden mellem den nedre arms (29) lave nedre omdrejningspunkt (25) og høje nedre omdrejningspunkt (26) er større end afstanden mellem den øvre forbindelsesarms (32) lave øvre omdrejningspunkt (27) og rammens (20) høje øvre omdrejningspunkt (28).

4. Såelement (1) ifølge et hvilket som helst af kravene 2 eller 3, hvor afstanden mellem den nedre arms (29) høje nedre omdrejningspunkt (26) og den sekundære svingarms (31) lave øvre omdrejningspunkt (27) er mindre end afstanden mellem den nedre arms (29) lave nedre omdrejningspunkt (25) og rammens (20) høje øvre omdrejningspunkt (28).

5. Såelement (1) ifølge et hvilket som helst af kravene 2 til 4, hvor den nedre arm (29) omfatter midler til at modtage en omdrejningsaksel (38), hvis akse danner ét af de to nedre omdrejningspunkter (26), og hvor den øvre forbindelsesarm (32) omfatter midler til at modtage en omdrejningsaksel (39), hvis akse danner det andet øvre omdrejningspunkt (27), idet det sekundære svingarm (31) omfatter midler til indgreb med omdrejningsakslerne (38, 39).

6. Såelement (1) ifølge et hvilket som helst af kravene 2 til 5, hvor hovedsvingarmen (30) omfatter midler til at modtage en nedre omdrejningsaksel (40), hvis akse danner det ene af de nedre omdrejningspunkter (25), og midler til at modtage en øvre omdrejningsaksel (41), hvis akse danner det høje øvre omdrejningspunkt (28).

7. Såelement (1) ifølge et hvilket som helst af kravene 2 til 6, hvor hovedsvingarmen (30) er fast forbundet med rammen (20) ved hjælp af et fastgørelsesbeslag (42).

8. Såelement (1) ifølge et hvilket som helst af de foregående krav, der i øvrigt omfatter sammenkoblingsmidler (4), som omfatter en værktøjsstang (41), hvortil chassiset (2) er forbundet, og som i øvrigt omfatter midler til justering af såelementets lodrette position, hvilke midler omfatter et deformerbart parallelogram (44) eller et deformerbart parallelepipedum, der er anbragt i det væsentlige vandret, og som er leddelt i forhold til chassiset (2) gennem mindst ét omdrejningspunkt, som også er et omdrejningspunkt for vippemidlerne til at vippe rammen (20).

9. Såelement (1) ifølge et hvilket som helst af de foregående krav, hvor den første fordelingsenhed til fordeling af det første produkt i kornform i øvrigt omfatter første midler til enhedsfordeling (18) af det første produkt i kornform, hvilke midler er fast forbundet med rammen (20) og derfor er bevægelige med rammen (20), hvilket såelement i øvrigt omfatter første midler (19) til at transportere det første produkt i kornform til jorden, hvilke midler er fast forbundet med chassiset (2) og derfor er stationære i forhold til chassiset (2).

10. Såelement (1) ifølge krav 9, hvor de første midler til enhedsfordeling (18) af et første produkt i kornform er fastgjort til en arm (21), der er fastgjort til rammen (20), og som strækker sig fra rammen (20) mod chassiset (2), hvilken arm (21) er bevægelig i forhold til chassiset (2) og kan gå i indgreb med og frigøres fra fastgørelsesmidler

(23), der er tilvejebragt på chassiset (2), og som kan modtage armen (21).

11. Såelement (1) ifølge et hvilket som helst af de foregående krav, der i øvrigt omfatter en anden fordelingsenhed til fordeling af et andet produkt i kornform, hvilken enhed omfatter en første hjælpetragt, der er fast forbundet med rammen (20), og som derfor er bevægelig i forhold til chassiset (2).

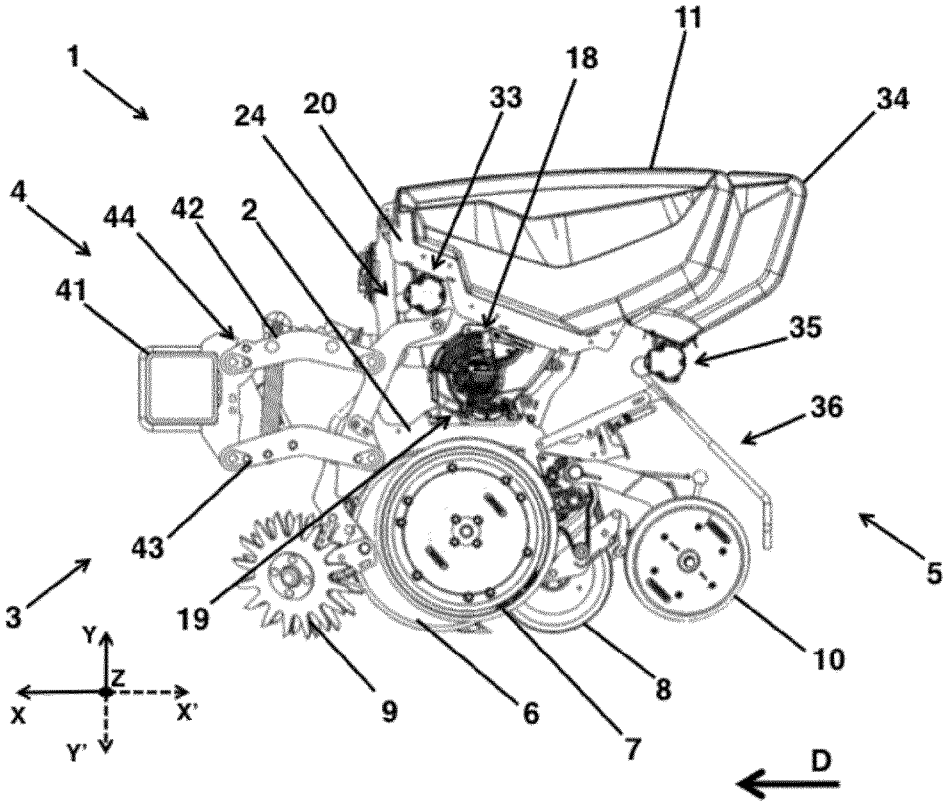
12. Såelement (1) ifølge krav 11, hvor den anden fordelingsenhed til fordeling af et andet produkt i kornform omfatter andre midler til enhedsfordeling (33), der er fast forbundet med rammen (20), og som derfor kan bevæges i forhold til chassiset (2), og som eventuelt kan omfatte andre midler til at transportere det andet produkt i kornform til jorden.

13. Såelement (1) ifølge et hvilket som helst af kravene 11 eller 12, der i øvrigt omfatter en tredje fordelingsenhed til fordeling af et tredje produkt i kornform på jorden, hvilken enhed omfatter en anden hjælpetragt (34), der er fast forbundet med rammen (20), og som derfor er bevægelig i forhold til chassiset (2).

14. Såelement (1) ifølge krav 13, hvor den tredje fordelingsenhed til fordeling af et tredje produkt i kornform på jorden i øvrigt omfatter tredje midler til enhedsfordeling (35), som er fast forbundet med rammen (20) eller den anden hjælpetragt (34), og som derfor er bevægelige i forhold til chassiset (2), hvilket såelement i øvrigt omfatter tredje midler (36) til at transportere det tredje produkt i kornform til jorden, hvilke midler er fast forbundet med chassiset (2) og derfor er stationære i

forhold til chassiset (2).

15. Såmaskine, der omfatter ét eller flere såelementer (1) ifølge et hvilket som helst af kravene 1 til 14.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18
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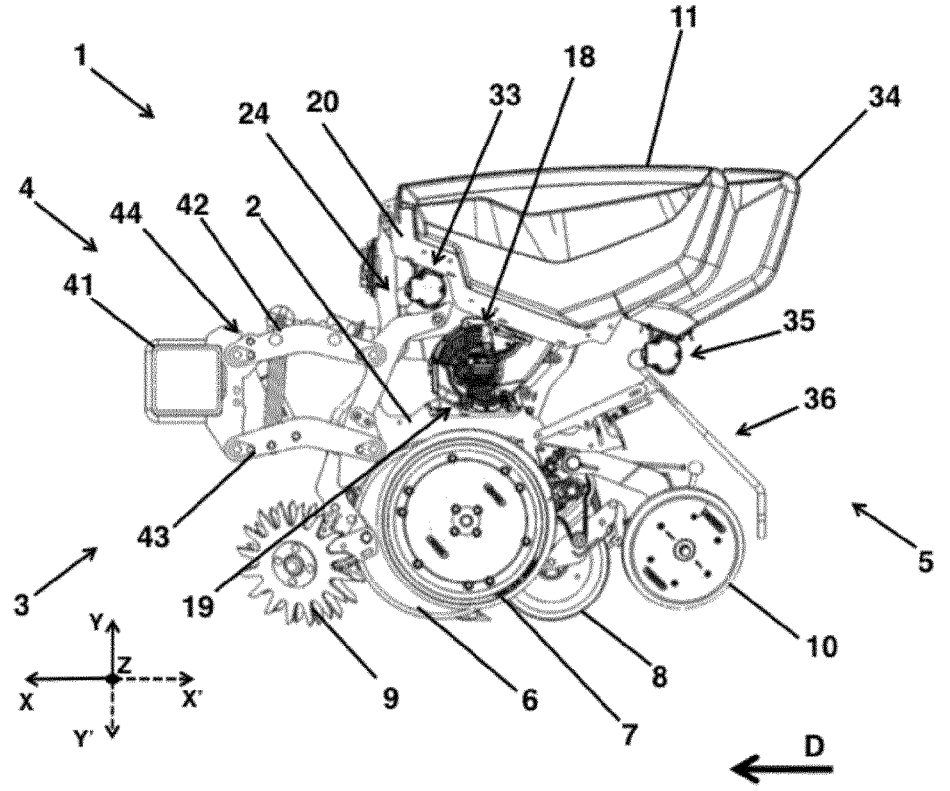
34
24
20
4
44
42
2
41
35
36
43
5
3
19
10
Y
Z
X
X'
Y'
9
6
8
7
D

Fig. 1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2
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9
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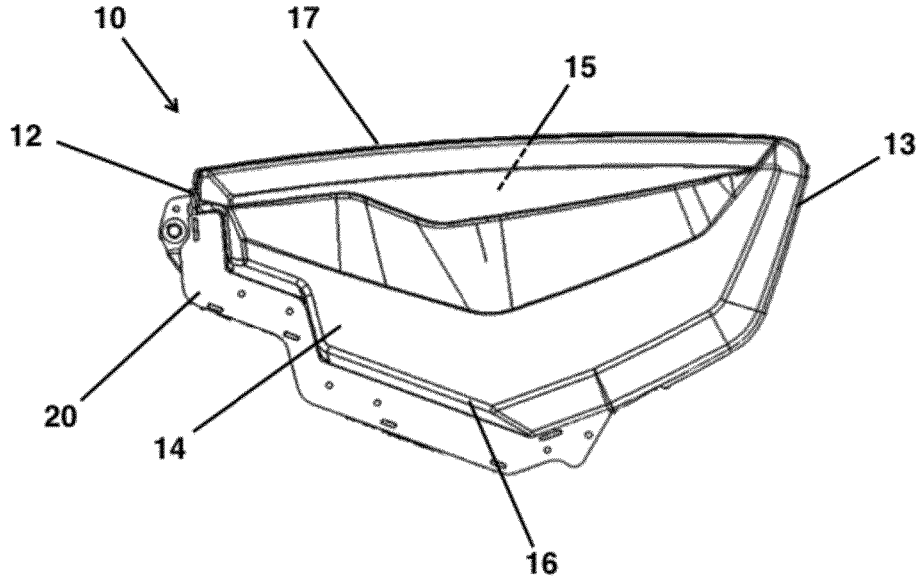
8
7
D

Fig. 2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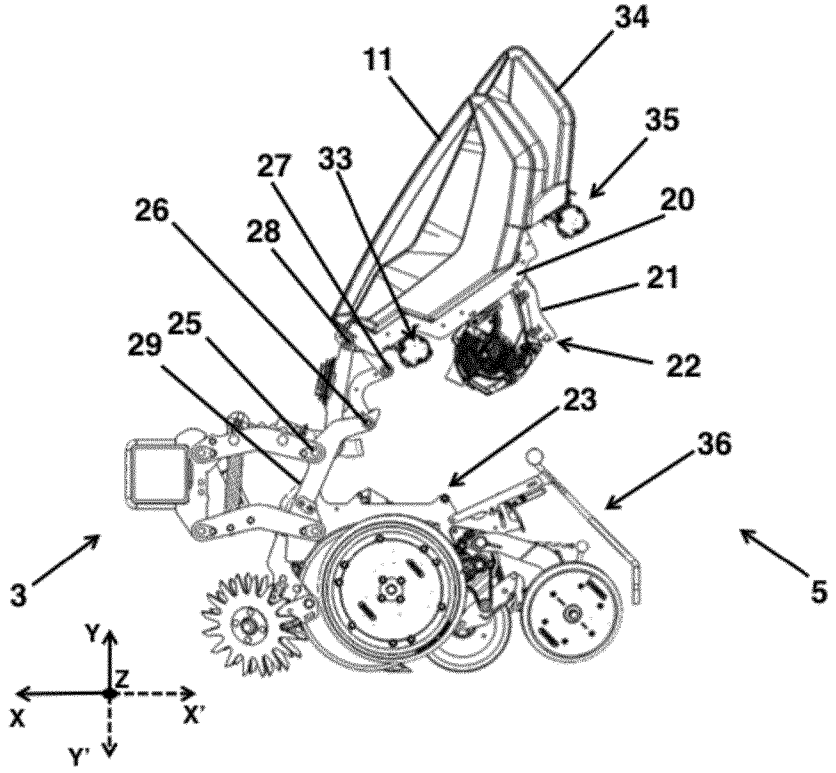
12
13
20
14
16

Fig. 3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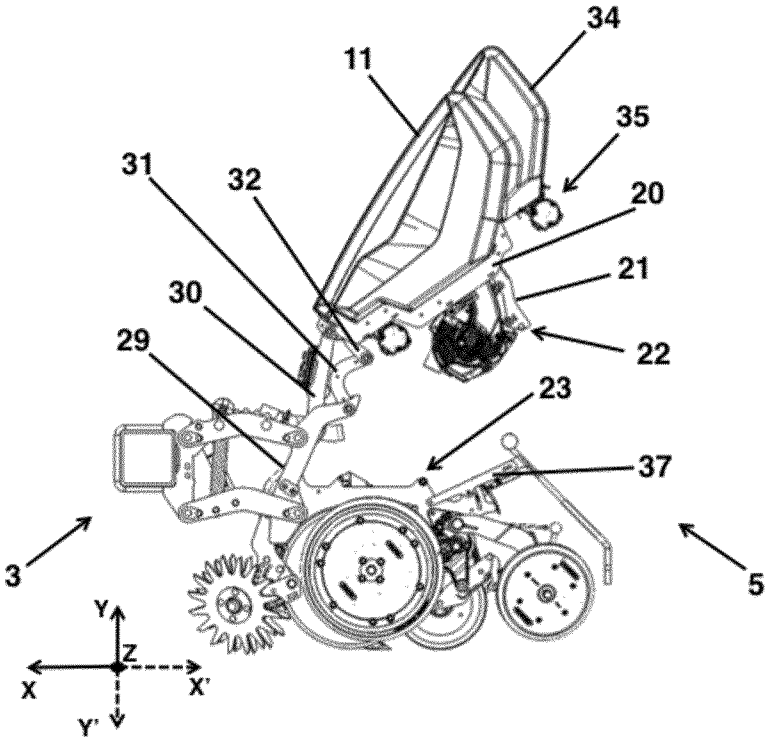
X
X'
Y'

Fig. 4


34
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35
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23
37
3
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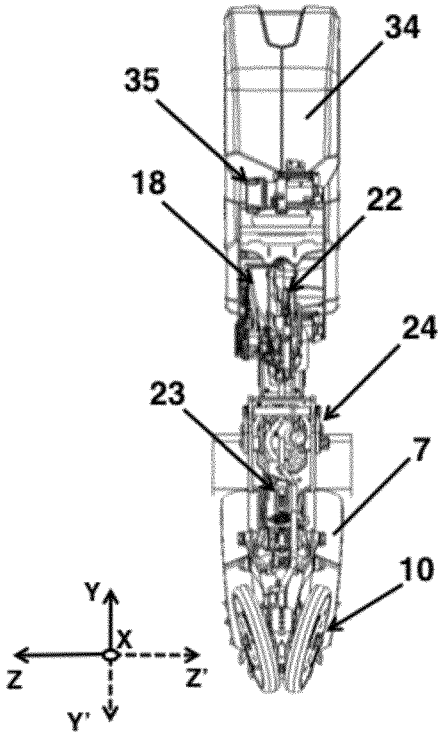
X
X'
Y'

Fig. 5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22
24
23
7
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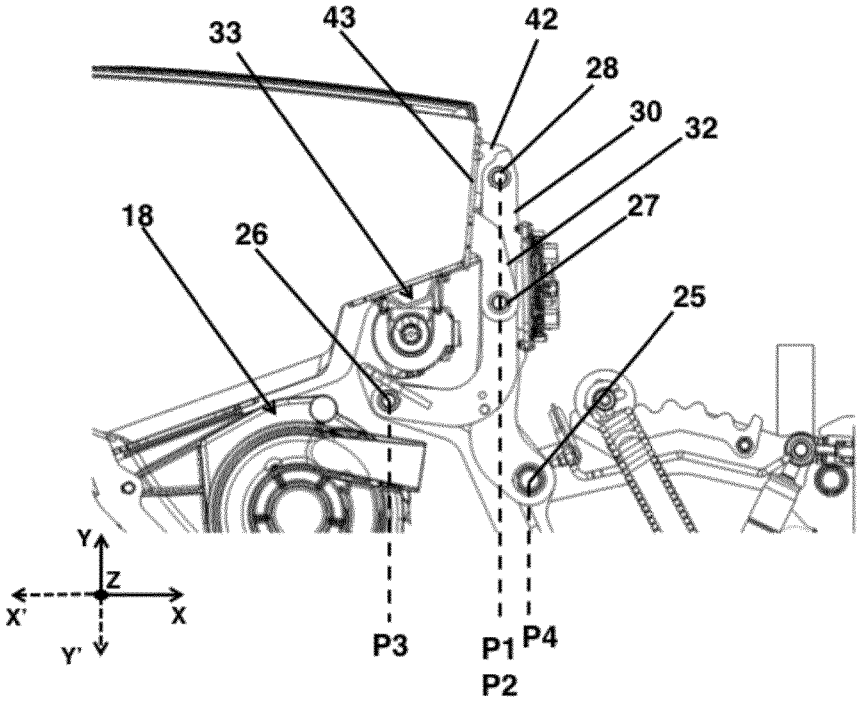
X
Z
Z'
Y'

Fig. 6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43
42
28
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18
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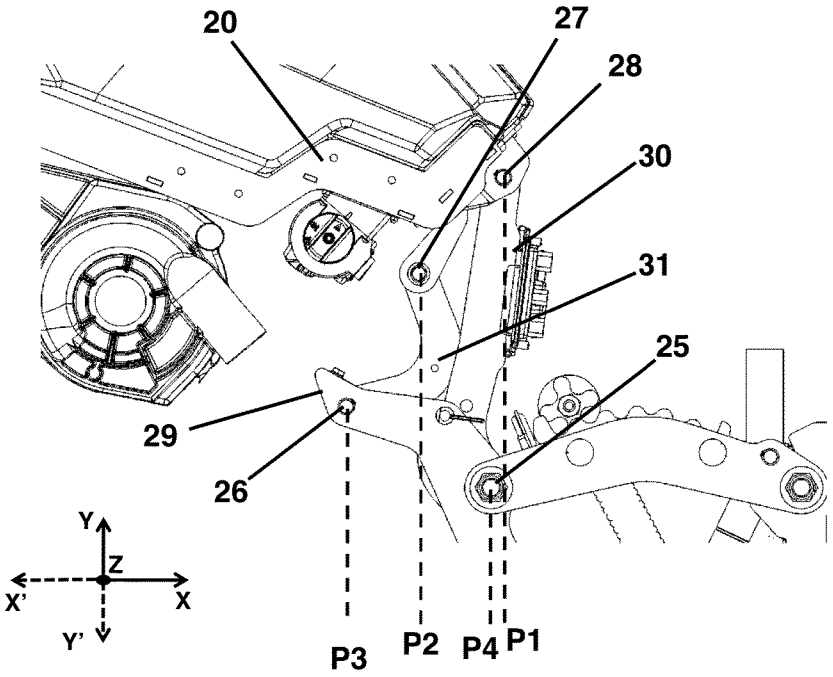
X
Y'
P3
P1
P2
P4

Fig. 7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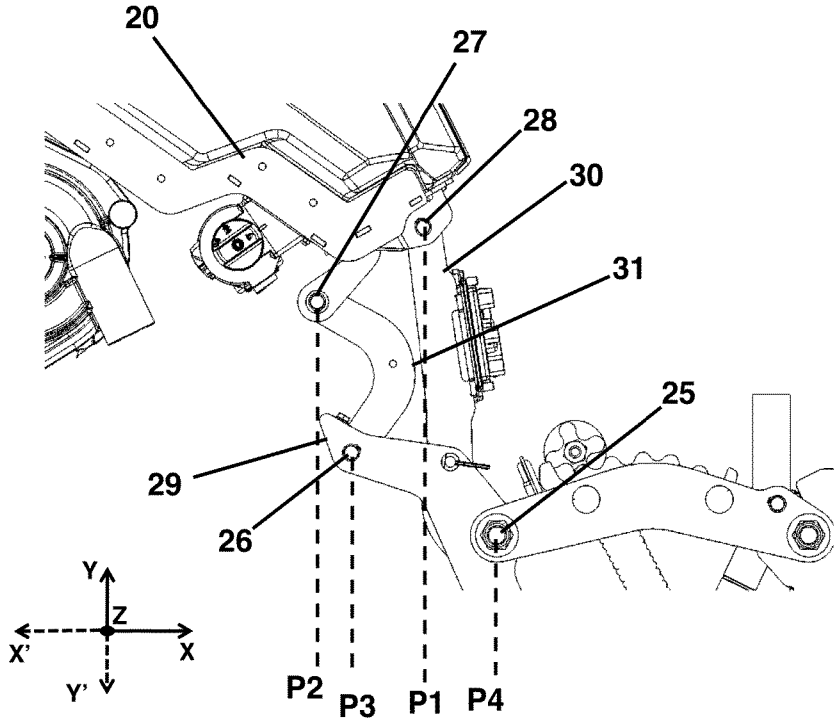
X'
X
Y'
P3
P2
P4
P1

Fig. 8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25
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26
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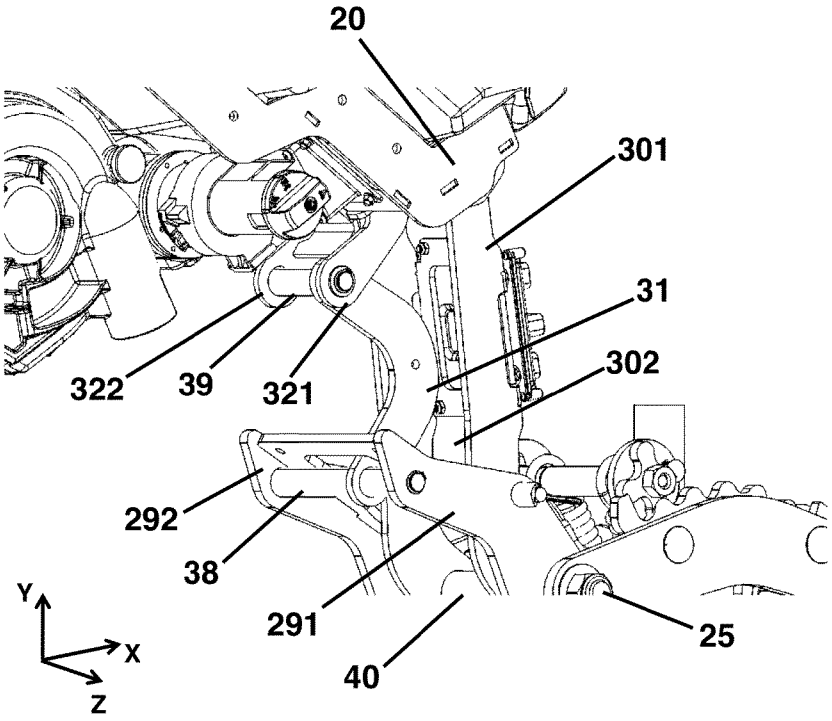
X'
X
Y'
P2
P3
P1
P4

Fig. 9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321
302
292
38
291
25
40
Y
X
Z

Fig. 10

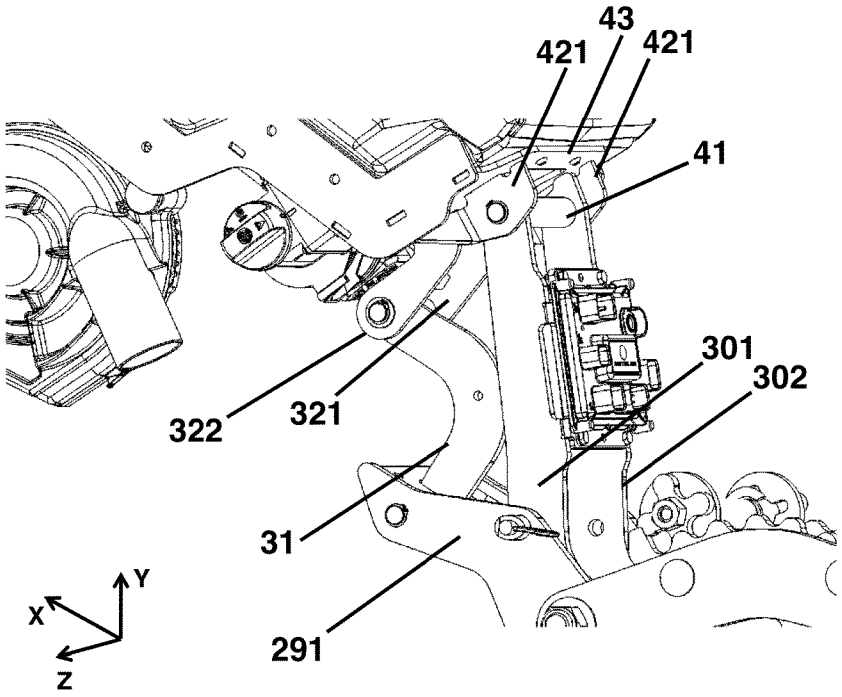

Fig. 11