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(54) Benævnelse: **Indretning til spredning af partikler med roterende sliske**

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US-A- 4 469 210

DEVICE FOR SPREADING PARTICLES WITH ROTATY CHUTE

Technical field

The invention relates to the field of spreading, in the agricultural sector, particles or products in the form of grains, such as fertilisers or seeds. More specifically, the invention relates to centrifugal spreaders which use one or more rotating discs.

Prior art

Centrifugal spreaders have been known for a long time. They use or more rotating discs, fitted with blades. The product to be spread can be stored in a hopper, and fed or discharged over each disc via a chute, which allows the flow of particles to fall freely onto the disc so that it is projected by the blades onto the ground onto which it is to be deposited. An example of this approach is described in patent documents EP 0 170 605 or EP 2 454 928 in the name of the Applicant. Within the meaning of the present invention, a chute is defined as a conduit, or inclined channel, or slide, which is used for transporting particles by gravity from the hopper to the rotating disc. Another example of a spreader comprising a rotary chute is found in document US4469210 A which is considered to be the closest prior art.

In other existing spreaders, the product to be spread falls directly from the hopper onto the spreading disc, through one or more opening(s) arranged in the base of the hopper. The base of the hopper then rotates, and the spreading width is adjusted by pivoting the feed openings about the axis of rotation of plates, which changes the position of the point where the product is deposited onto the disc. An example of such a spreader is described in patent document FR 1 435 922.

In spreaders fitted with chutes, such as those designed and marketed by the Applicant, the spreading width is adjusted by pivoting the feed chute about an offset shaft fixed to the lower part of the metering base. Moving the chute causes a shift of the point at which the particles drop onto the spreading disc, and therefore changes the coverage area of the spreading pattern and its position relative to the spreader. The shift of the dropping point has a particular effect on the average ejection angle of the particles from each of the spreading discs, relative to the advancing axis of the spreader.

The use of a chute has a number of advantages over the use of a rotating base provided with openings for the passage of particles to be spread, including easier access for cleaning mechanical parts and a reduced risk of clogging. It also enables the spreading at the edges of fields to be managed effectively, due in particular to the Tribord® system of the Applicant: this edge spreading system is based on the radial displacement of the chute relative to the axis of rotation of the plates in order to feed a specific edge blade permanently fixed to the spreading disc on the right-hand side. It allows precision spreading, along a watercourse for example, or along a cultivated field, without any need to get out of the tractor by having an electrical control in the cab. Such a Tribord® system is described in particular in patent documents EP 1 955 579 B1 and EP 1 336 332 B1 in the name of the Applicant.

While this chute-based spreading system has many advantages, the Applicant has identified a need to improve the precision of the spreading performed by such a system. It has been found that, according to the position of the chute, the position and shape of the point at which the flow of particles drops onto the spreading disc changes, which has an effect on the shape of the spreading pattern and therefore on the quality of work (ease of adjustment).

This deformation of the dropping point is illustrated in figures Fig. 1A to Fig. 1C, which show three different positions of the chute 10 over the spreading disc 12 (chute reference 110 in Fig. 1A, and chute reference 130 in Fig. 1B and chute reference 150 in Fig. 1C). For each of these three positions, the corresponding geometry (position and shape) of the dropping point 151, 152, 153 of particles onto the disc 12 is shown. The particles to be spread, stored in the hopper 11, are discharged onto the disc 12 via the chute 10, then projected by the blades (not shown); the arrow 14 shows the direction of rotation of the spreading disc 12. It should be noted that there are two problems. On the one hand, the displacement of the chute 10 with reference 110 to reference 150 does not lead to a purely angular displacement of the dropping point onto the disc 12; on the other hand, this displacement of the chute 10 with reference 110 to reference 150 leads to a change of its shape on the disc: thus, in the intermediate position corresponding to the chute 10 in a reference position

130 (Fig. 1B), the dropping point 152 has a more elongated shaped than the dropping points 151 and 153 of the two other figures (Fig. 1A and Fig. 1C), which means that there is greater diversity of the exact position of the point of impact of the particles with the disc 12. This results in a greater standard deviation σ_θ on the spreading angle on the ground.

In other words, the curve linking the displacement of the chute to the mean angle θ_{moy} of ejection of the particles from the disc is not linear, and the same angular displacement of the chute does not always lead to the same variation of this angle, as a function of the position of the chute. This is illustrated by the curve referenced 201 in figure 2, which illustrates the variation in the value of the mean angle θ_{moy} as a function of the angular displacement of the chute (angle of the lever bearing the chute, expressed in degrees).

It is common practice to characterise the spreading pattern on the basis of the mean ejection angle θ of the particles from the disc, measured relative to advancing axis of the spreading machine. However, in the examples of figures 1A to 1C, for the same low dose delivered to the disc of 9 Kg/min, the standard deviation on the spreading angle to the ground σ_θ varies greatly from Fig. 1A to Fig. 1C, with a maximum value for Fig. 1B.

These variations in the angular standard deviation, caused by the change in geometry of the dropping point, lead to variations in the shape of the spreading pattern, and adversely affect the accuracy of the spreading control.

Patent document US 4 469 210 describes a particle spreader, referred to as a trailed spreader, comprising a chute that can be adjusted by rotation along an axis coinciding substantially with that of the rotating disc. Such a spreader is particularly bulky and is not compact: the particles to be spread are stored in a parallelepiped hopper, which has in its rear part an adjustable hatch, through which the particles to be spread flow before failing onto the belt of a conveyor. This conveyor extends over the length of the spreader, and carries the particles to the rear part of the spreader, where they fall by gravity from the rear end of the conveyor belt. They are then transported by a chute to the spreading disc.

While the particular structure of this chute makes it possible to avoid the aforementioned problems of deformation of the dropping point for conveyor spreaders, it cannot be adapted directly to mounted spreaders which need to meet demanding requirements by being very compact.

Therefore, a new particle spreading technique is needed using a chute for depositing the particles to be spread from the hopper towards the spreading discs, which does not have these various disadvantages of the prior art.

In particular, there is a need for such a technique, which makes it possible in a compact spreader to improve the precision of the spreading and the adjustment of its width, by minimising the deformation of the dropping point.

There is also a need for such a technique which is mechanically simple, inexpensive and less bulky in terms of height and length than the prior art.

Explanation of the invention

The invention addresses this need by proposing a device for spreading particles stored in at least one hopper having at least one outlet opening for delivering particles into at least one chute, one outlet end of which is placed above a rotary spreading disc receiving and projecting said particles.

According to the invention, such a chute is mounted in the extension of an adjustment lever which is rotatable about a substantially vertical axis of rotation coinciding with an axis of rotation of the spreading disc. In addition, a metering bottom forms the lower portion of the hopper and has a substantially horizontal circular section, referred to as a circular portion, around which the adjustment lever moves, on at least one portion of the bottom.

Thus, the invention is based on a completely new and inventive approach to compact chute-based spreading systems. The invention proposes advantageously, on the one hand, providing a hopper with a circular or cylindrical base, and, on the other hand, using advantageously the new shape of this base to guide the rotation of the chute. In other words, the invention proposes merging the axis of rotation of the chute with the axis of revolution of the plate, by mounting the chute on an adjustment lever that can be rotated about an axis corresponding to the axis of rotation of the spreading disc. In this manner, the displacement of the chute causes a displacement of the position of the point at which the particles drop onto the disc, but causes little change to its geometry. The variation in the angle and standard deviation of the spreading angle obtained on the ground is thus greatly reduced compared to the solutions of the prior art, allowing better control of the spreading accuracy.

The spreading technique of the Applicant, which enables users to be provided with a wide range of spreading width settings, is based on the theoretical assumption of a spreading pattern which is defined in relation to a central geometric reference point, which is rotated about the axis of the spreading plate or disc. In the solution of the prior art, the displacement of the chute around an axis which is offset relative to this axis of rotation leads, as explained above, to certain discrepancies between the theory and the reality of the spreading, particularly at the extreme positions of the chute.

The design of a chute in which the rotational movement takes place along an axis coinciding with the axis of rotation of the disc makes it possible to reduce these deviations, by coming closer to the theoretical assumptions used to produce the adjustment tables.

Furthermore, such a design of the rotation system of the chute makes it possible to maintain a constant distance between the lowest point of the chute and the spreading disc, regardless of the position of the chute. The system is therefore more compact, and takes up less space in terms of height than the solutions of the prior art, in which the displacement of the chute led to a variation in the height of the chute relative to the spreading disc and the blades.

Furthermore, the spreading device according to one embodiment of the invention advantageously uses the circular geometry of the metering bottom (for example the upper part of the base) to form a pivot connection with the adjustment lever supporting the chute, which further increases the compactness of the spreader compared to the solutions known from the prior art. The particles fall directly from the bottom of the hopper into the chute, which carries them by gravity to the spreading disc. It should be noted that to achieve this the hopper needs to be positioned precisely in relation to the spreading discs, to ensure that the circular metering bottom and the spreading plates are concentric.

This advantageous use of a specific circular shape of the metering bottom also makes it possible to avoid disturbing the functioning of the other spreading elements, such as the agitating mechanism.

According to another aspect of the invention, the adjustment lever is secured to a guide ring arranged under or on the periphery of the circular portion of the metering bottom. Such a ring extends along the circular portion of the base, and allows optimum guiding of the rotational movement of the adjustment lever supporting the chute about the axis of symmetry of the circular portion of the base which coincides with the axis of rotation of the disc.

According to one embodiment, the circular portion of the metering bottom bears support elements of the guide ring.

According to a first embodiment variant, such support elements are for example support elements made from a polymer material which are fixed at the bottom to the circular portion of the metering bottom, and the guide ring is guided in rotation between the support elements and the circular portion of said metering bottom.

Such support elements are therefore in the form of runners, forming flat bearing surfaces between the guide ring and the metering bottom, distributed around the circumference of the circular portion of the metering bottom. They allow an aerated design of the rotation mechanism of the chute, and therefore make it easier to clean the various components of the mechanism, in particular to extract the particle dust likely to accumulate there during operation.

Alternatively, such support elements could also be fixed from above to a rim arranged in the lower part of the circular portion of the base. Other materials could also be used, preferably friction-reducing materials. Advantageously, the guide ring has an area of linear contact with the support elements and/or the circular portion of the metering bottom. This thus facilitates the displacement of the guide ring, reducing friction and the risk of clogging the mechanism.

According to a first embodiment, the support elements comprise at least one portion having a substantially triangular cross-section so as to have an area of linear contact with the guide ring. Such support elements can consist of a support ring with a triangular cross-section enabling the guide ring to be in continuous contact with the base over the whole circumference of its circular portion: this contact area is however not a two-dimensional surface but a line of contact along the periphery.

According to a second embodiment, the guide ring has a substantially triangular section so as to have an area of linear contact with the support elements and/or the circular portion of said metering bottom.

According to another aspect of an embodiment of the invention, such a spreading device also comprises an oscillating agitator supported by a substantially horizontal shaft, arranged in said metering bottom. In such a spreading device, comprising two metering bottoms and two spreading discs, the substantially horizontal shaft bears two oscillating agitators arranged respectively in each of the two metering bottoms.

Thus, such a metering device makes it possible to improve the precision of the spreading, due to a clever chute rotation system, but without making the agitation line more complex than the solutions of the prior art. The agitation line has a simple design, comprising a fixed horizontal shaft driven by an oscillating movement. This shaft can also be shared by the two metering bottoms, which makes it very easy to integrate.

Description of the figures

Other aims, features and advantages of the invention will become clearer from reading the following description, which is given simply as an illustrative and non-limiting example, with reference to the figures, in which:

[Fig. 1A] shows the shape and position of the particle dropping point on a spreading disc according to a technique from the prior art, as well as the shape of the resulting spreading pattern, for a first position of the chute of the spreading device;

[Fig. 1B] shows the shape and the position of the particle dropping point on a spreading disc according to a technique from the prior art, as well as the shape of the resulting spreading pattern, for a second position of the chute of the spreading device;

[Fig. 1C] shows the shape and the position of the particle dropping point on a spreading disc according to a technique from the prior art, as well as the shape of the resulting spreading pattern, for a third position of the chute of the spreading device;

[Fig. 2] proposes a comparison of the variation of the average particle ejection angle θ_{moy} as a function of the angular displacement of the chute adjustment lever, according to the prior art on the one hand and according to an embodiment of the invention on the other hand;

[Fig. 3] illustrates a tractor, fitted with a spreading device according to an embodiment of the invention;

[Fig. 4] shows a top view of the tractor of Fig. 1, and spreading patterns obtained on the ground;

[Fig. 5] shows an overall view of a spreading device according to an embodiment of the invention;

[Fig. 6] illustrates the schematic diagram of the metering device of Fig. 5;

[Fig. 7A] is the companion figure of Fig. 1A, for the spreading device according to an embodiment of the invention;

[Fig. 7B] the companion figure of Fig. 1B, for the spreading device according to an embodiment of the invention;

[Fig. 7C] is the companion figure of Fig. 1C, for the spreading device according to an embodiment of the invention;

[Fig. 8] shows an exploded view of the various components of the spreading device of Fig. 5, and the principle of their assembly;

[Fig. 9] shows bottom view of the spreading device of Fig. 5;

[Fig. 10] illustrates an embodiment of the support elements of Fig. 8;

[Fig. 11] shows a cross-sectional view of the spreading device according to an embodiment of the invention comprising support elements as illustrated in Fig. 10;

[Fig. 12] shows an enlarged view of the detail A of Fig. 11;

[Fig. 13] illustrates the agitating mechanism of a spreading device according to an embodiment of the invention;

[Fig. 14] shows an embodiment of the spreading device in which the adjustment lever is provided with an actuator.

Description of embodiments

The general principle of the invention is based on improving the existing chute-based spreading system, in which the hopper has a circular metering bottom, the particular geometry of which enables the chute to be guided which can be rotated about an axis which coincides with the axis of rotation of the spreading disc. It is thus possible to displace the dropping point at which the particles to be spread fall onto the disc, for an optimal adjustment of the spreading width, without modifying the shape of the impact area of the particles on the disc. Thus, the curve 202 linking the angular displacement of the chute to the average ejection angle of the particles from the spreading discs is now linear, as illustrated in Fig. 2.

Such a spreading device is fitted to a machine for spreading solid fertilisers or seeds on a cultivable field, an example of which is illustrated schematically in Fig. 3. It is in the form of a tractor 100 fitted with a hopper 110 containing the fertilisers or seeds 17 to be spread.

The bottom of the hopper 110 comprises two openings, then two adjustable feed devices, then two devices for adjusting the distribution of the fertilisers, for example in the form of chutes 10 (only one is illustrated), allowing particles 17 contained in the hopper 110 to pass through, and placed above two distributors each comprising a rotating disc 12 bearing projection blades.

The discs 12 are usually arranged in a substantially horizontal position and their rotation about a substantially vertical axis 21 ensures that the contents 17 of the hopper are projected by centrifugal effect, in the form of a pattern, in the general shape of a crescent, extending to the rear of the spreading machine.

The two rotating discs rotate in opposite directions to one another which makes it possible to spread fertiliser and/or seeds over a large width, typically between 5 and 50 metres.

Spreading machines of this type make it possible to treat a piece of arable land, or a field, usually by following a predefined back and forth course over it, but also with no imposed trajectory (for example for spreading on grassland).

The machine operator can adjust certain spreading settings, such as, depending on the case, the quantity or metering of distributed particles, the shape of the coverage pattern and in particular its width, etc. The latter can also selectively open or close the feed device of the chute 10, so as to optimise the quantities of the spread particles, in particular at a safety zone, edge, end or tip of the field.

Fig. 4 shows a top view of the tractor of Fig. 3. In this figure, the tractor 100 transports means for distributing particles 120, for example granulated fertilisers or seeds. It is provided with two distributors supplying two discs 12_1 and 12_2, which project the particles onto surfaces 16_1 and 16_2 respectively, together defining a covering surface 16, 5 to 30 m away from the distribution means 120, and defining a general crescent shape. With reference to Fig. 5 a general view of a spreading device according to one embodiment of the invention is shown, and more particularly of the bottom 11 of the hopper 110. In the example of Fig. 5, the upper part of such a base has a substantially circular, bowl-shaped cross-section: it can be made from a plastic material, or be in the form of a steel receptacle. It is located in the lower part of the hopper 110. In the lower part of the base, a side wall of the latter has an opening 40, through which the particles to be spread can flow from the inside to the outside of the hopper 110, for example to be poured onto a chute 10, then deposited on a spreading disc. In one embodiment, this opening can be closed by means of a curved hatch which rotates about an axis. In this example, the curved hatch has a surface corresponding substantially to a portion of a cylinder. An actuator of the rotating hatch can be used to control the movement of the hatch from a position of maximum closure of the opening, in which the flow rate of the product to be spread by gravity is zero, to a position of maximum release of the opening in which the flow rate of the product to be spread by gravity is at a maximum.

In another embodiment, not shown, this opening can be closed by means of a flat hatch that can be moved in translation relative to the side wall of the base.

The particles 17 contained in the hopper flow through this opening and fall onto a chute 10, before being guided onto the spreading disc. This chute 10 is mounted on an adjustment lever 20, which can rotate about the bottom 11, along an axis 21 corresponding substantially to the axis of rotation of the disc 12, or plate.

The relative movements of the different components of the device of Fig. 5 will be understood better by referring to the schematic diagram in Fig. 6, which illustrates the kinematics of the device. The upper part of the bottom of the hopper 110 has a circular cross-section, an axis of central symmetry of which coincides with the axis 21 of rotation of the plate or disc 12. The chute 10 is supported by an adjustment lever 20, which is rotatable about the circular bottom, according to an axis which coincides with the axis 21 of rotation of the disc 12. When the adjustment lever 20 pivots about the bottom, it displaces the chute 10, which causes a displacement of the dropping point of the particles to be spread onto the disc 12. Such an adjustment lever 20 can therefore be used to adjust the spreading width.

The rotation of the chute 10 is along an axis coinciding with the axis of rotation 21 of the disc 12, however this movement causes little change in the geometry of the area of impact of the particles with the disc 12, and therefore little change in the shape of the spreading pattern 16. This results in an efficient and precise adjustment of the spreading width.

Fig. 6 also shows a horizontal shaft 30 which passes through the side wall of the bottom 11, and bears an agitating tooth 31. Optionally, such a shaft 30, is driven for example by an oscillating movement, and agitates the product to be spread to facilitate its gravitational flow.

The absence of any change in the geometry of the dropping point of particles according to the different embodiments of the invention can be seen more clearly in figures Fig. 7A to Fig. 7C, which should be compared with figures Fig. 1A to Fig. 1C of the prior art.

These figures Fig. 7A to Fig. 7C show three different positions of the chute 10 above the spreading disc 12, as shown by the movement of the adjustment lever 20 from one figure to the other. For each of these three positions, the corresponding geometry (position and shape) of the dropping point 154, 155, 156 of particles onto the disc 12 has been illustrated. The particles to be spread, stored in the hopper, are discharged onto the disc 12 via the chute, then projected by the blades; the arrow referenced 14 illustrates the direction of rotation of the spreading disc 12. As can be seen, the rotational movement of the chute causes an angular displacement of the position of the dropping point 154, 155, 156 onto the disc 12, but no further modification of its shape on the disc. The variation in the standard deviation on the spreading angle on the ground is therefore greatly reduced, and the angular standard deviation σ_θ is substantially constant and identical for the three figures Fig. 7A to Fig. 7C.

As a result, the corresponding spreading patterns on the ground, all three, have substantially the same shape, only their angular offset θ_{moy} with respect to the advancing axis of the tractor changes.

Fig. 8 shows an exploded view of the spreading device of Fig. 5 according to one embodiment which advantageously uses the circular geometry of the upper part of the bottom 11 to produce the pivot connection between the bottom 11 and the adjustment lever 20.

As illustrated, the adjustment lever 20 bears a guide ring 50, which bears under the lower part of the circular portion of the bottom 11. Alternatively, this guide ring 50 could pivot around the periphery of this circular portion. Guides or supports 51, made of polymer material for example, have a T-shaped cross-section. They are fixed by means of screws or rivets 52 under the circular portion of the bottom 11. When the adjustment lever 20 is rotated, the guide ring 50 slides between the circular portion of the bottom and these support elements 51, which can be connected two by two to increase rigidity.

These support elements form small flat bearing surfaces (for example of a few centimetres) for the guide ring 50. They are preferably distributed evenly around the circumference of the circular portion of the bottom. Fig. 9 shows a view from below after the assembly of the device of Fig. 8.

In an alternative embodiment, not shown, the support elements 51 are not in the form of runners, but of a guide ring, which has a linear contact area with the guide ring 50. This guide ring is mounted for example below the circular portion of the bottom 11.

In order to facilitate the sliding of the surface of the guide ring 50 on the support elements 51, or on the guide ring, it is possible that the guide ring 50 has a substantially triangular cross-section so as to have a linear contact area with the guides 51 and/or the guide ring and/or the circular portion of the bottom 11. It is also possible to provide that the guide ring has a triangular cross-section to reduce the contact surface with the guide ring 50.

Fig. 10 shows an embodiment of support elements 51, according to which they have at least one portion 510 with a substantially triangular cross-section, in order to have a linear contact area with the guide ring 50, and thus reduce the risks of clogging and friction.

Fig. 11 shows a cross-sectional view of the spreading device according to one embodiment of the invention, comprising support elements 51 as illustrated in Fig. 10. Fig. 12 shows an enlarged view of detail A shown in the cross-section of Fig. 11.

Such a design makes it possible to retain the strengths of a metering device with a rotating curved hatch, without complicating the agitation line (horizontal arm 30), which is best illustrated by Fig. 13. A single shaft 30 bears two agitating teeth which are arranged respectively in each of the two bottoms 11, arranged above the two spreading discs. This arm is driven by an oscillating movement which due to the agitating teeth 31 makes it possible to agitate the product 17 to be spread to facilitate its flow by gravity.

Lastly, as illustrated in Fig. 14, it is possible to provide a servo-control 80 (motor or electric actuator) for the movement of the adjustment lever 20, in order to enable the spreading width to be adjusted from the tractor cab, without the operator having to get out. The spreading device according to these different embodiments allows increased precision of the spreading, due to the integration of the axis of rotation of the chute 10 on the axis of rotation of the spreading plate 12, which makes it possible to maintain the geometry of the spreading pattern, regardless of the width adjustment.

The good functioning of other components of the device, such as the agitation or the spreading mechanism at the edges, is neither disrupted nor made more complex than with the previous solution. The various components are accessible, which makes them easier to clean. The low impact of the width adjustment on the standard deviation of the angle of projection means that the system is not very sensitive to the type of product to be spread and to the spreading rate.

Furthermore, compared with the previous solution, the rotation of the chute along the axis of rotation of the discs, i.e. substantially vertical, eliminates any variation in the inclination of the chute as it moves, allowing better flow of the particles to be spread, and makes it possible to achieve greater spreading rates. The modelling and editing of the spreading adjustment tables provided to users are simplified by the fact that there is no variation in the shape of the spreading pattern when the chute moves.

PATENTKRAV

1. Indretning til spredning af partikler (17) lagret i mindst én tragt (110) med mindst én udløbsåbning, der leverer partikler ind i mindst én sliske (10), hvoraf den ene udløbsende er placeret over en roterende spredeskive (12), der modtager og projicerer nævnte partikler, **kendetegnet ved, at** slisken (10) er monteret i forlængelse af en justeringsarm (20), som er bevægelig i rotation omkring en i det væsentlige lodret rotationsakse, der falder sammen med en rotationsakse (21) for spredeskiven, **og i ved at** den omfatter en doseringsbund (11), der danner den nedre del af den mindst ene tragt (110) og har en i det væsentlige vandret cirkulær sektion, kaldet cirkulær del, omkring hvilken justeringsarmen (20) er forskudt, på mindst en del af bunden.

2. Spredningsindretning ifølge krav 1, **kendetegnet ved, at** justeringsarmen (20) er fastgjort til en føringsring (50), der er anbragt under eller på periferien af den cirkulære del af doseringsbunden (11).

3. Spredningsindretning ifølge krav 2, **kendetegnet ved, at** den cirkulære del af doseringsbunden bærer støtteelementer (51) for føringsringen (50).

4. Spredningsindretning ifølge krav 3, **kendetegnet ved, at** støtteelementerne (51) er støtteelementer fremstillet af polymermateriale, som er fastgjort nedefra til den cirkulære del af doseringsbunden (11), og **ved at** føringsringen (50) styres i rotation mellem støtteelementerne (51) og den cirkulære del af doseringsbunden (11).

5. Spredningsindretning ifølge krav 3, **kendetegnet ved, at** føringsringen (50) har et område med lineær kontakt med støtteelementerne (51) og/eller den cirkulære del af doseringsbunden (11).

6. Spredningsindretning ifølge krav 5, **kendetegnet ved, at** støtteelementerne (51) omfatter mindst én del, der har en i det væsentlige trekantet sektion, således at de har et område med lineær kontakt med føringsringen (50).

7. Spredningsindretning ifølge krav 5, **kendetegnet ved, at** føringsringen (50) har en i det væsentlige trekantet sektion, således at de har et område med lineær kontakt med støtteelementerne (51) og/eller den cirkulære del af doseringsbunden (11).

8. Spredningsindretning ifølge et hvilket som helst af kravene 1 til 7, **kendetegnet ved, at** den også omfatter en oscillerende omrører (31) båret af en i det væsentlige vandret aksel (30), der er anbragt i doseringsbunden.

9. Spredeindretning ifølge krav 8, omfattende to doseringsbunde (11) og to spredeskiver (12), **kendetegnet ved, at** den i det væsentlige vandrette aksel (30) bærer to oscillerende omrørere (31), der er anbragt henholdsvis i hver af de to doseringsbunde.

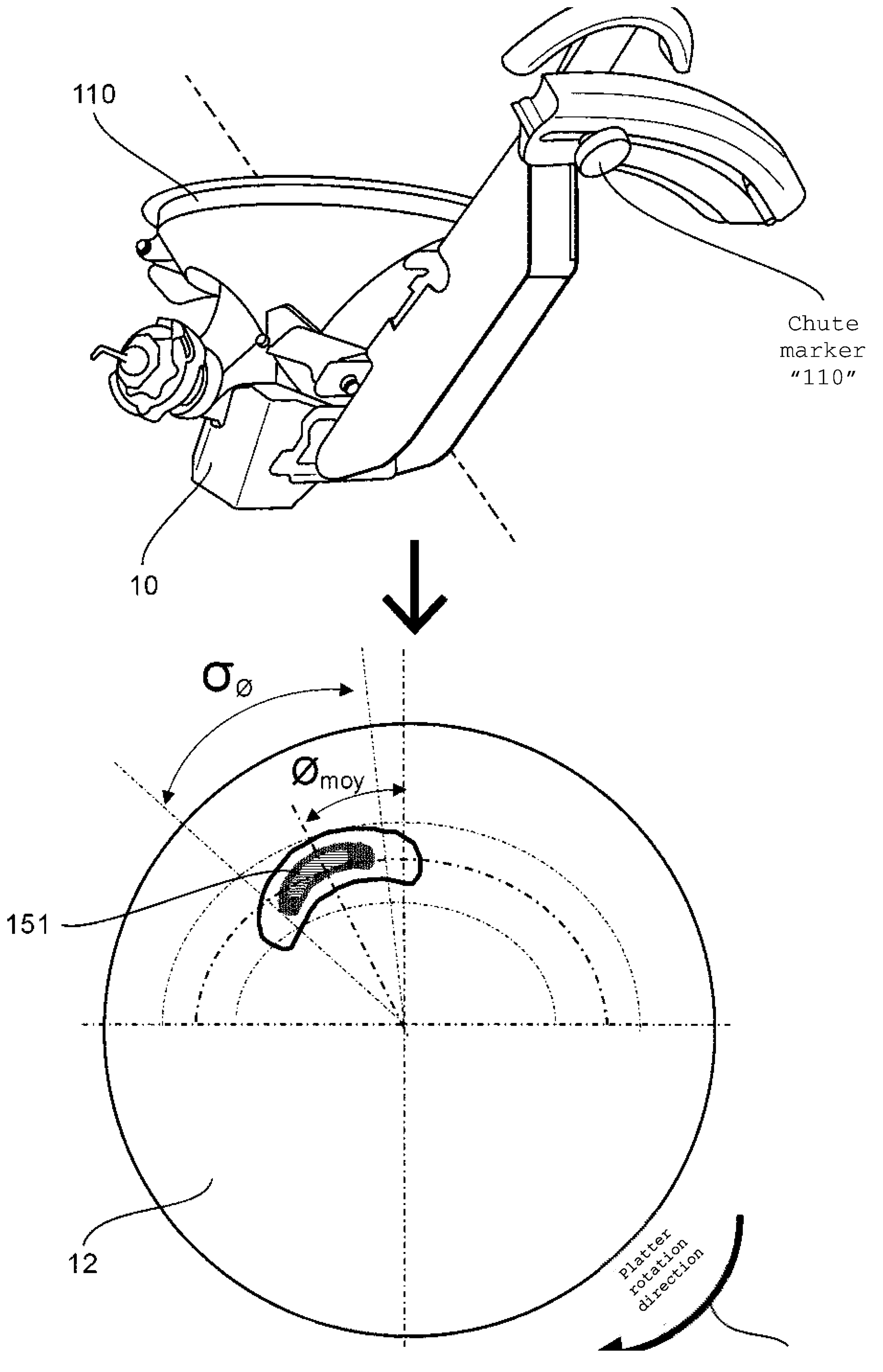
110
Chute
marker
"110"
10
$\sigma_{\varnothing}$
$\varnothing_{moy}$
151
12
Platter
rotation
direction

Fig.1A

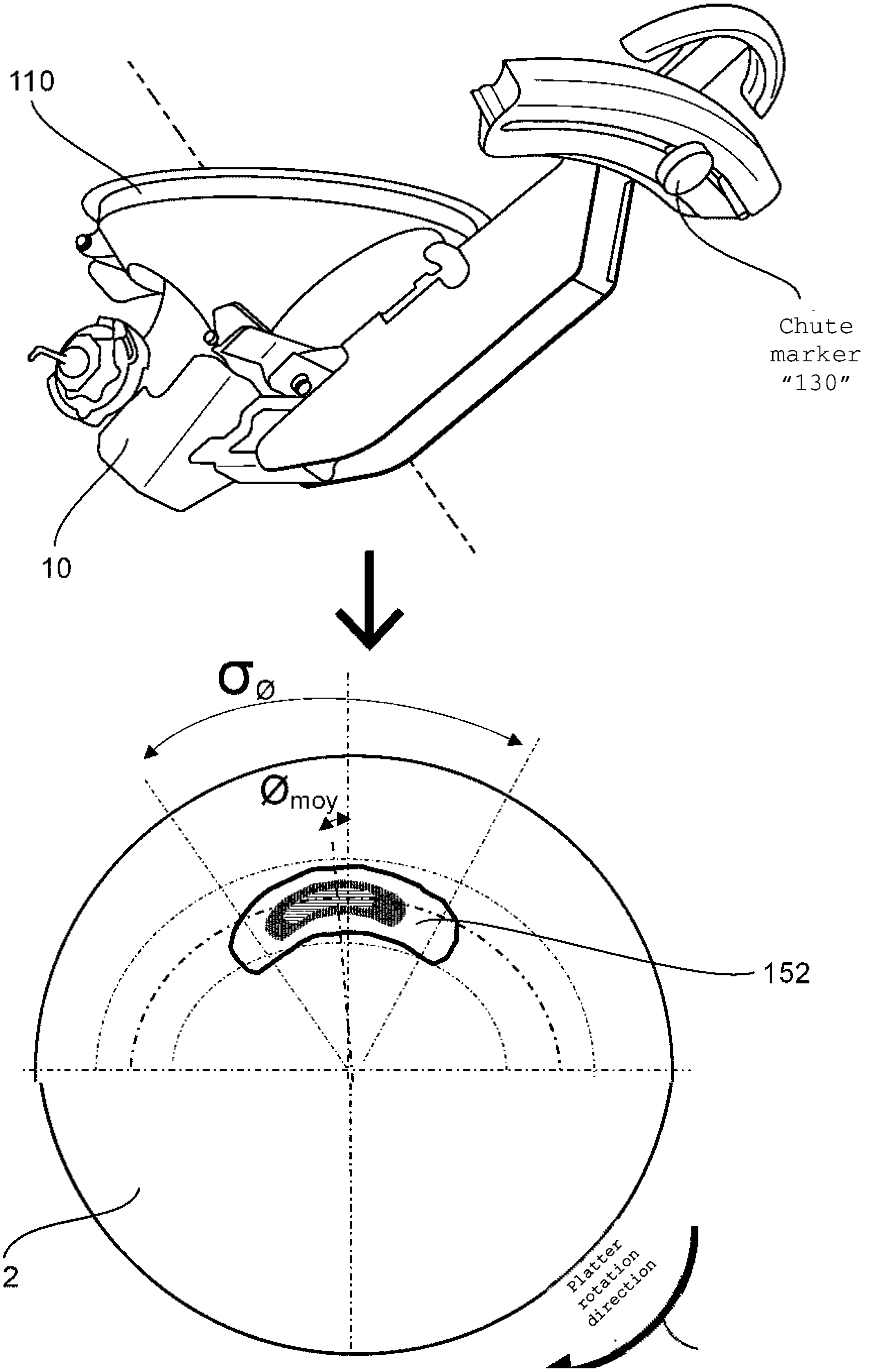
110
Chute
marker
"130"
10
$\sigma_{\varnothing}$
$\varnothing_{moy}$
152
12
Platter
rotation
direction

Fig.1B

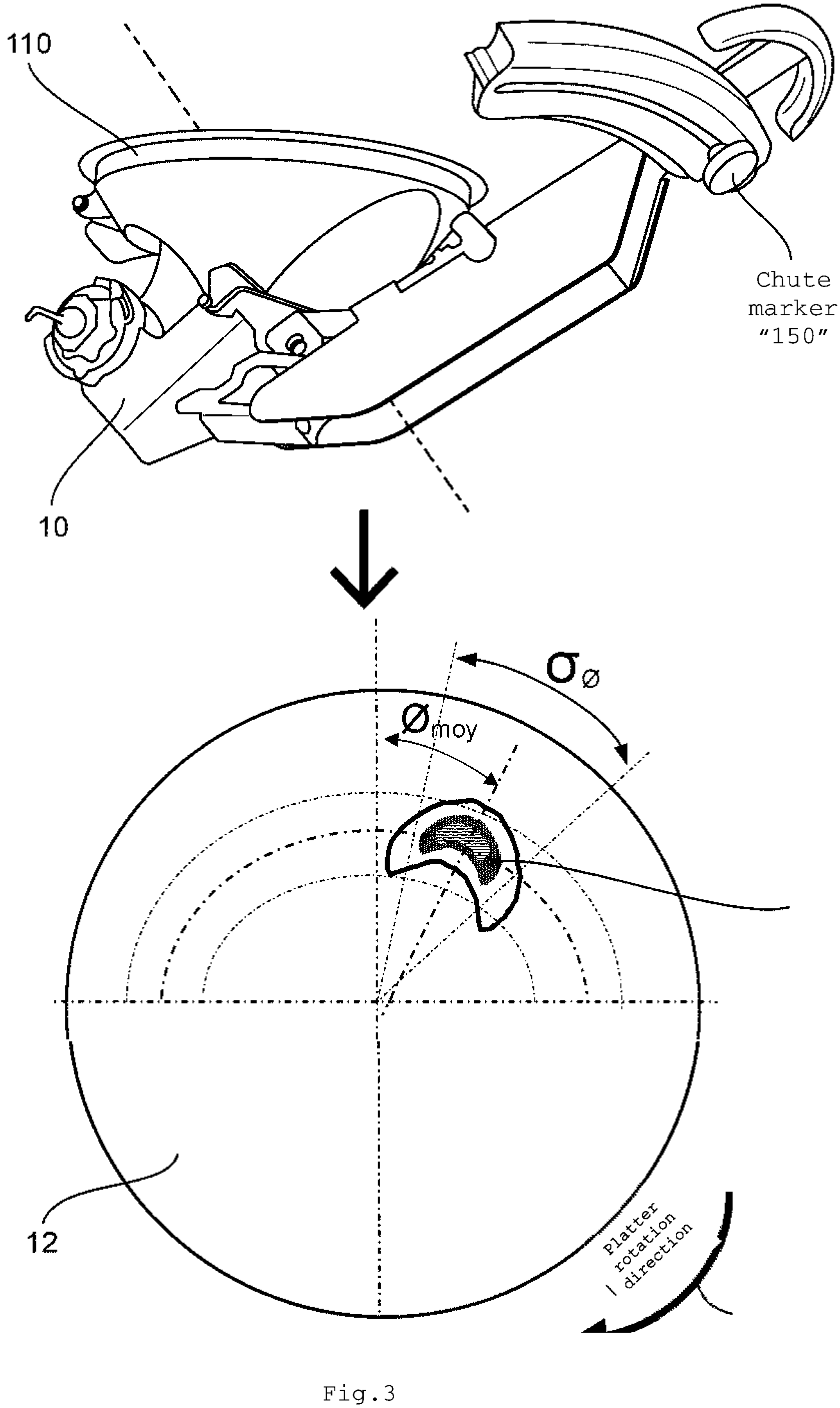
110
Chute
marker
"150"
10
$\sigma_{\varnothing}$
$\varnothing_{moy}$
12
Platter
rotation
direction

Fig.3

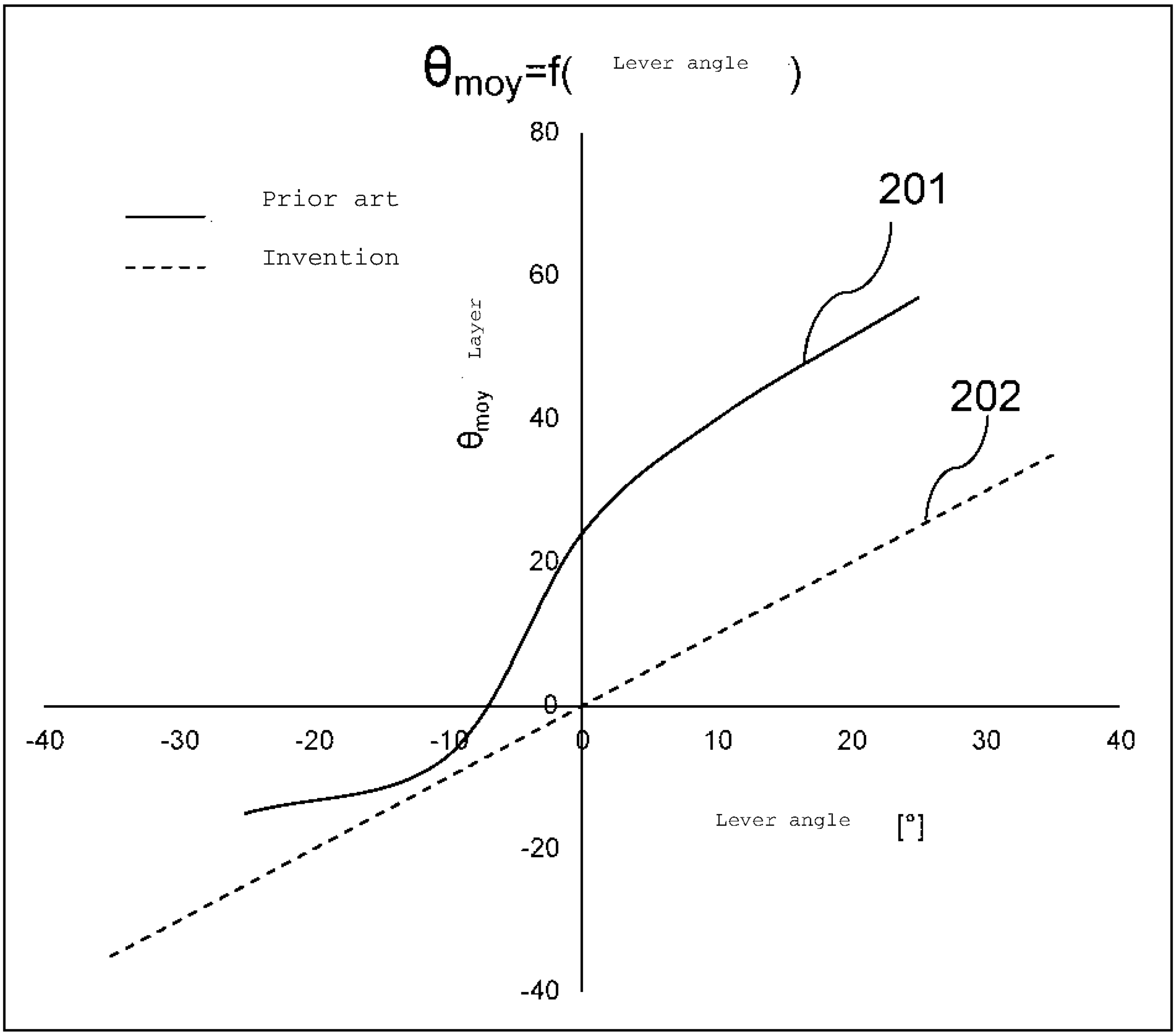
θmoy=f(Lever angle)
Prior art
Invention
201
202
θmoy Layer
80
60
40
20
0
-20
-40
-40
-30
-20
-10
0
10
20
30
40
Lever angle [°]

Fig. 2

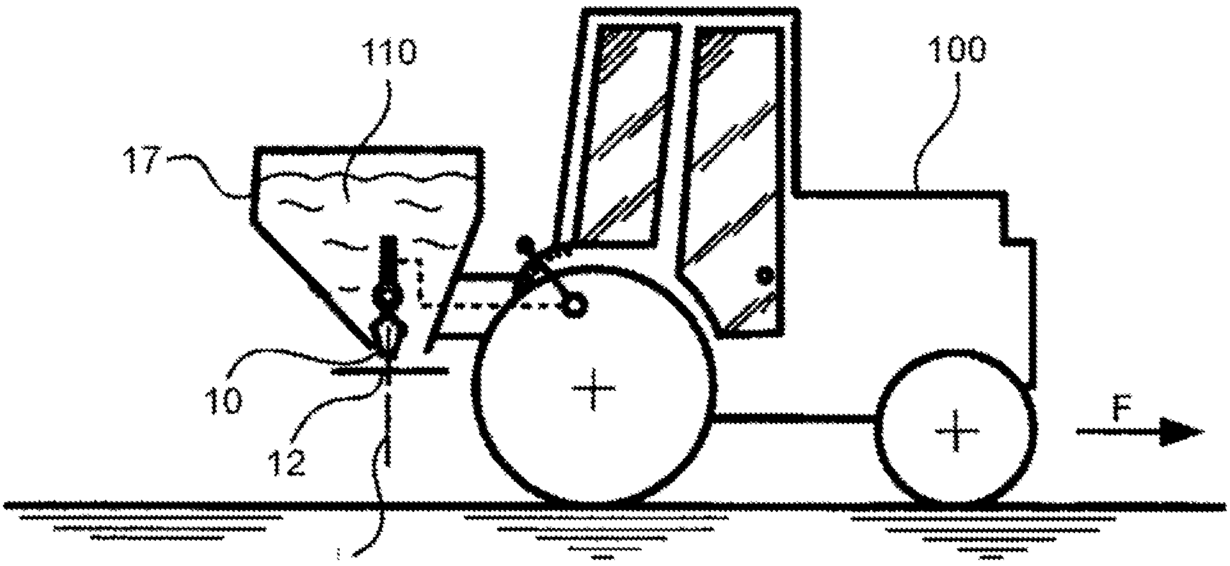
110
100
17
10
12
F

Fig.3

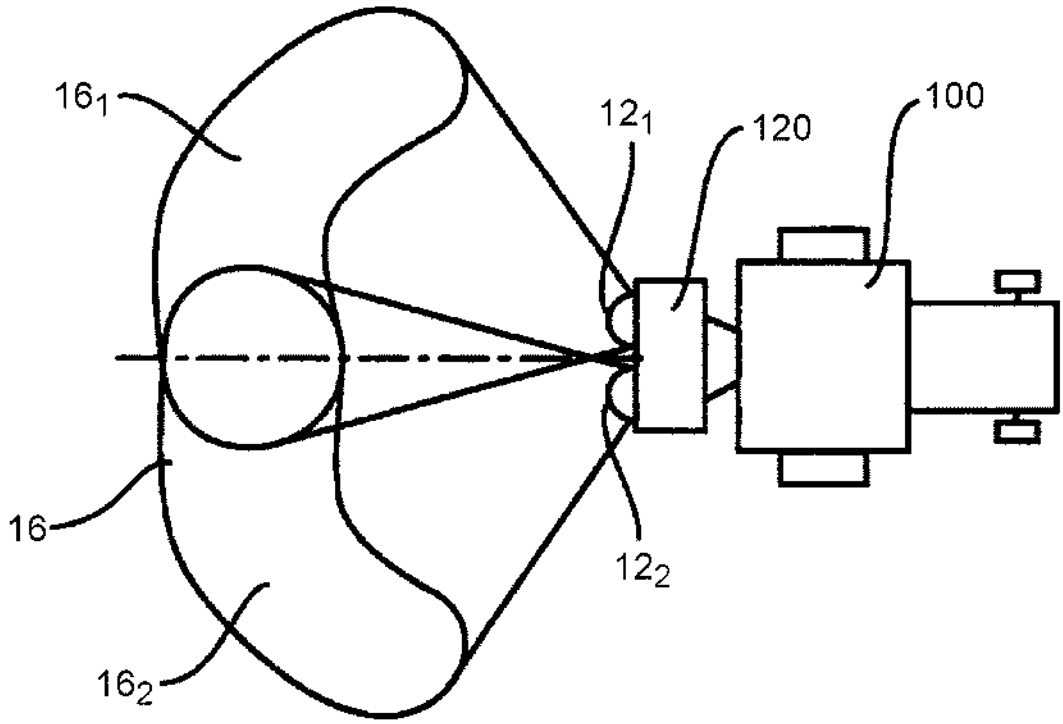

Fig.4

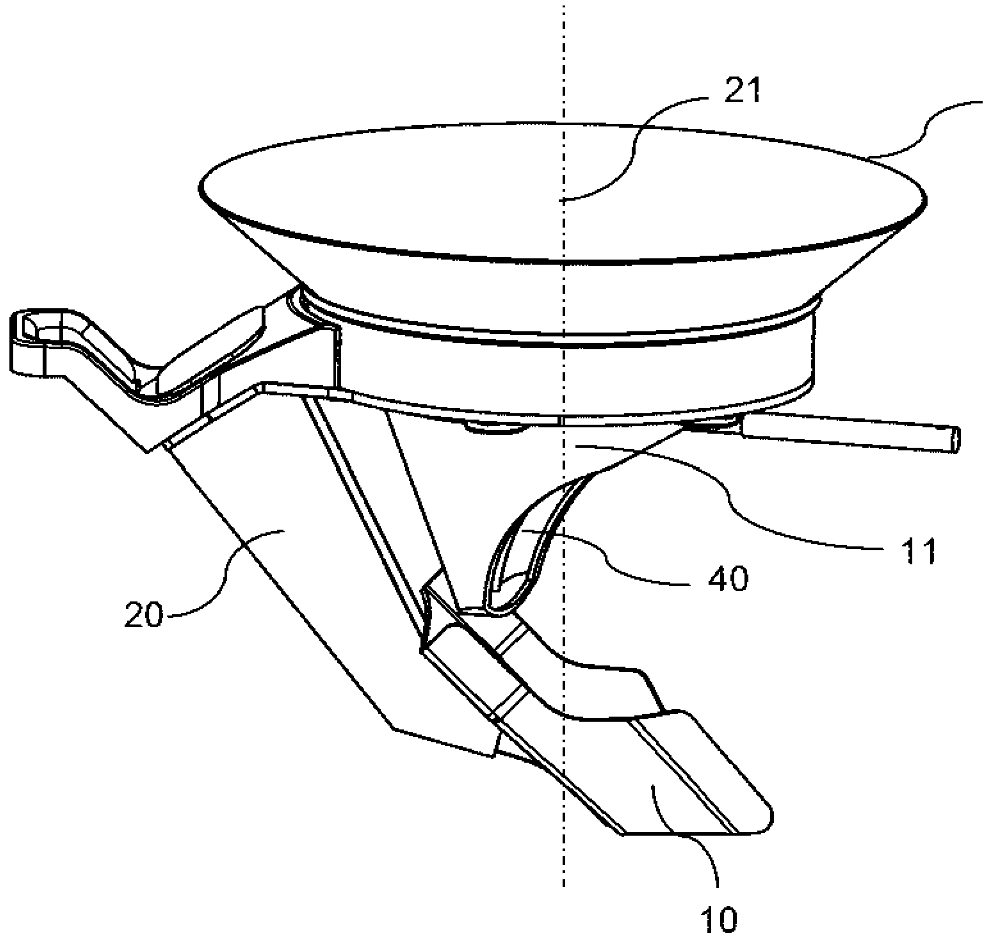

Fig.5

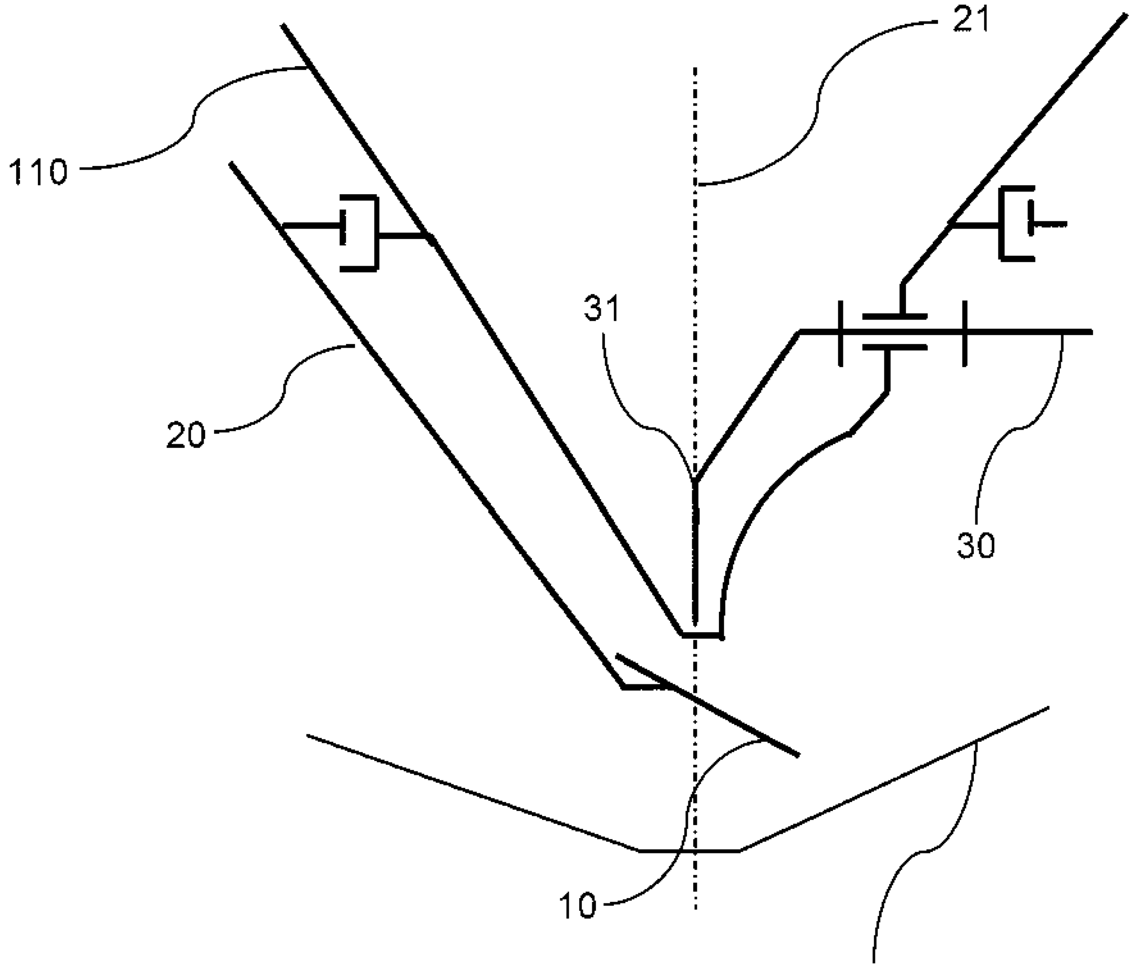

Fig.6

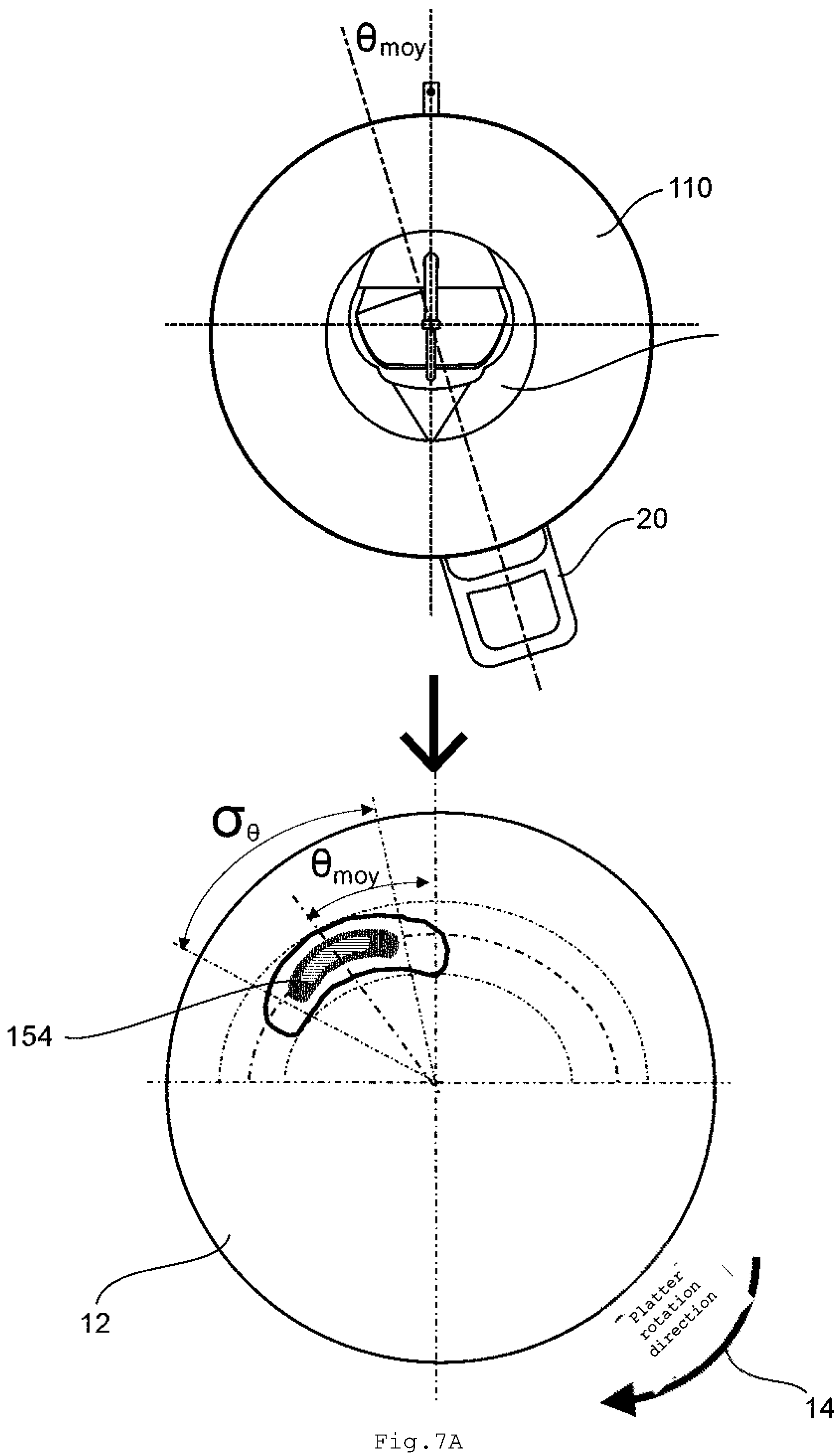

Fig.7A

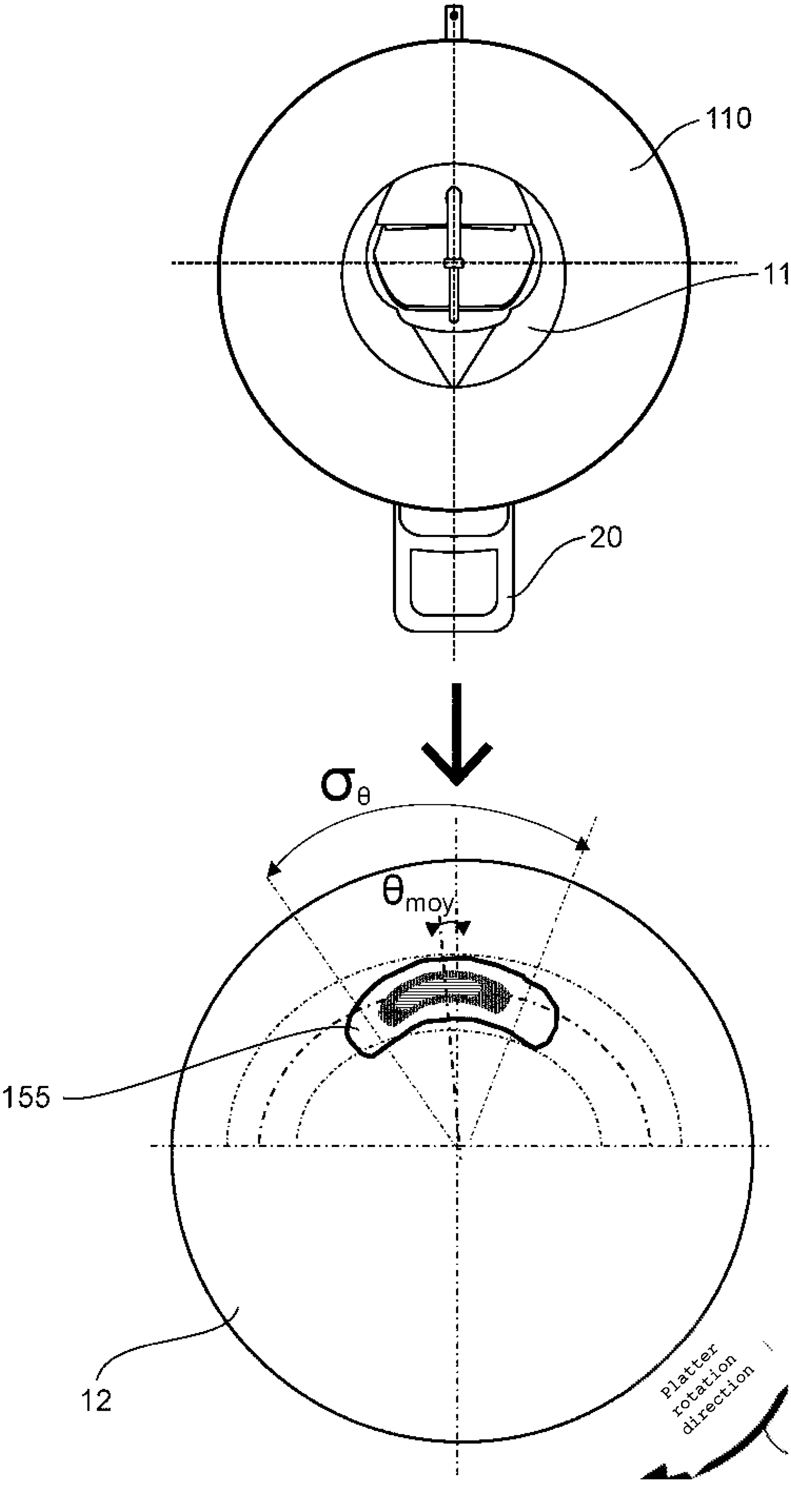

Fig.7B

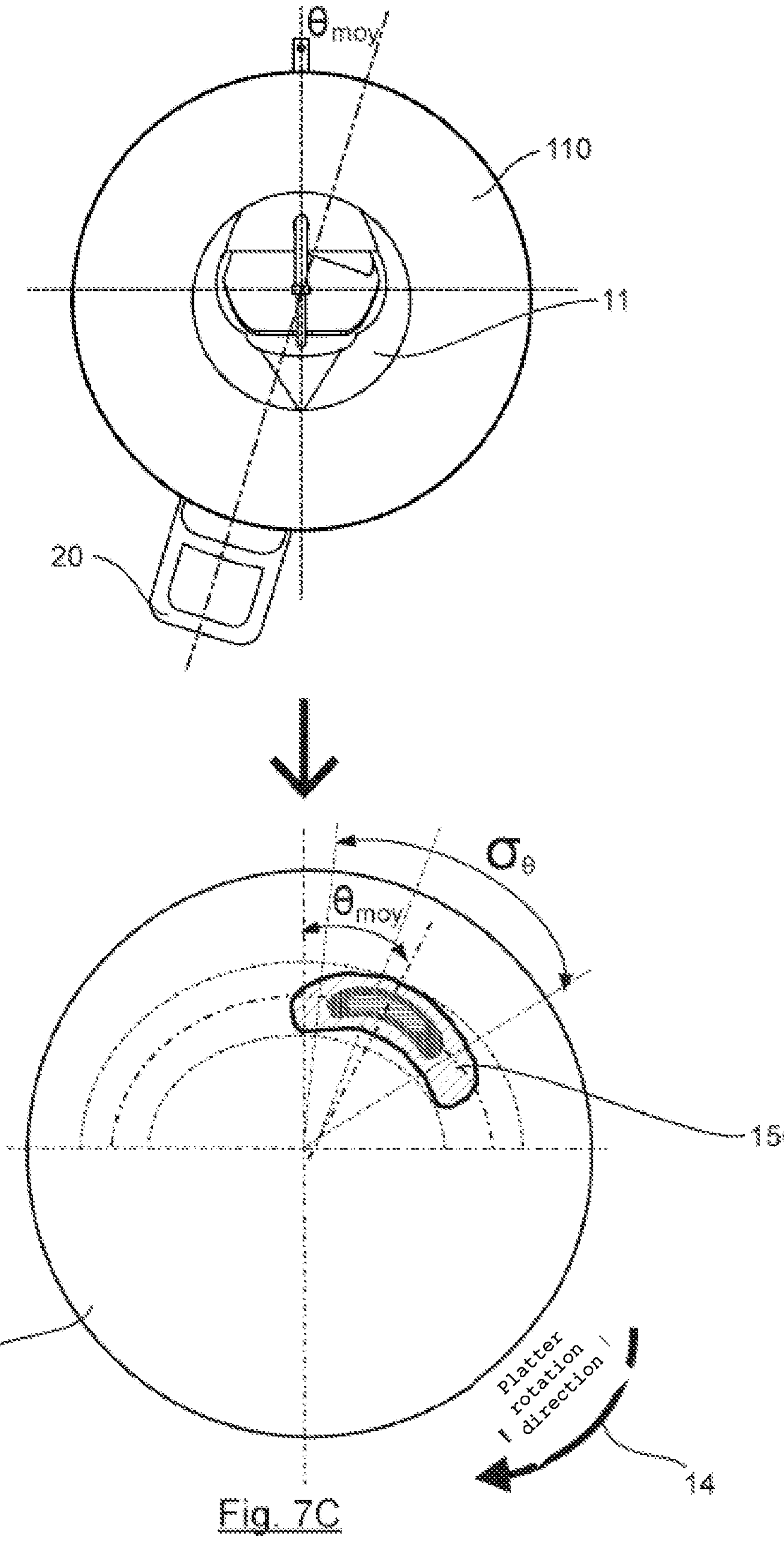
θ_{moy}
110
11
20
σ_θ
θ_{moy}
156
12
Platter rotation direction
14

Fig. 7C

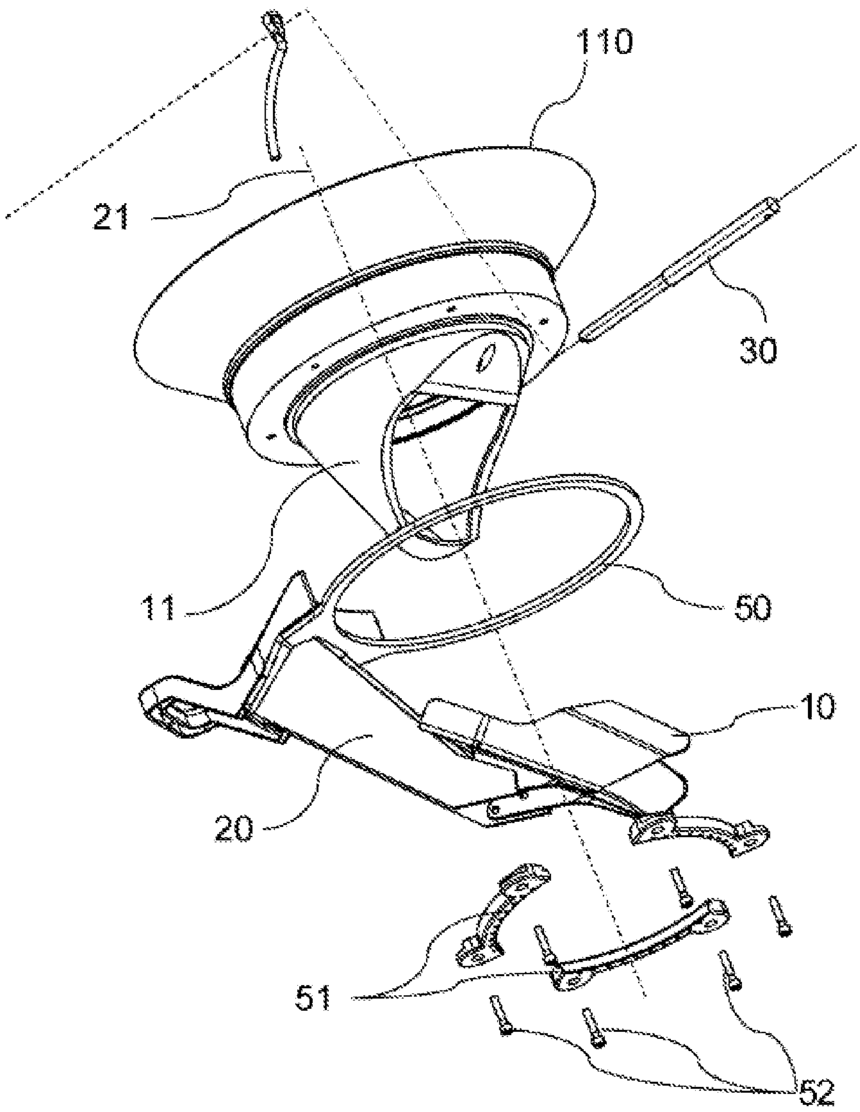

Fig. 8

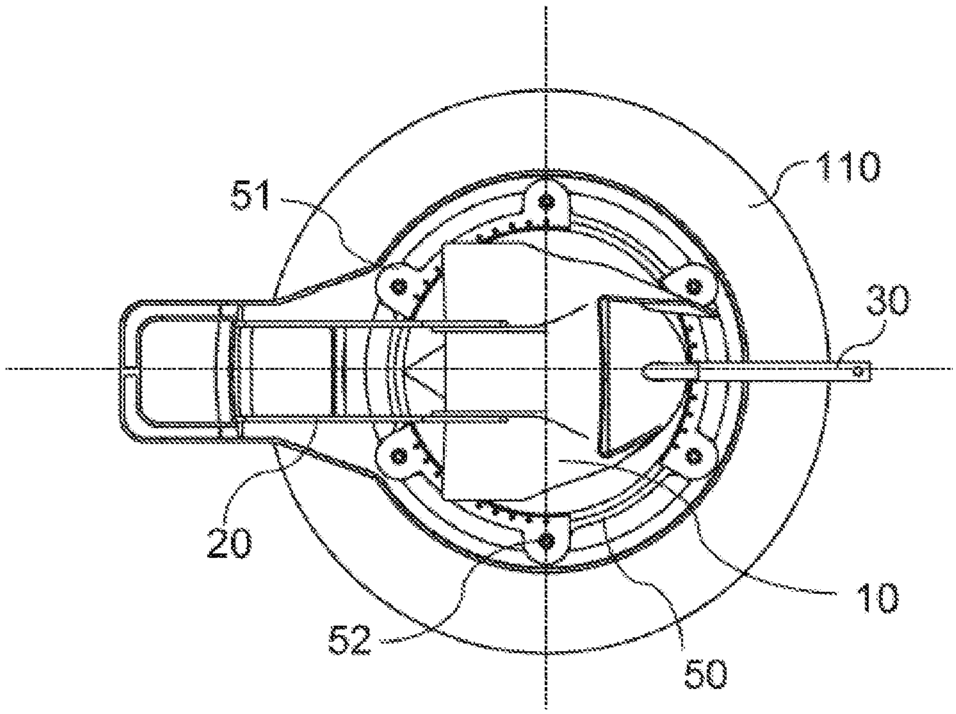

Fig. 9

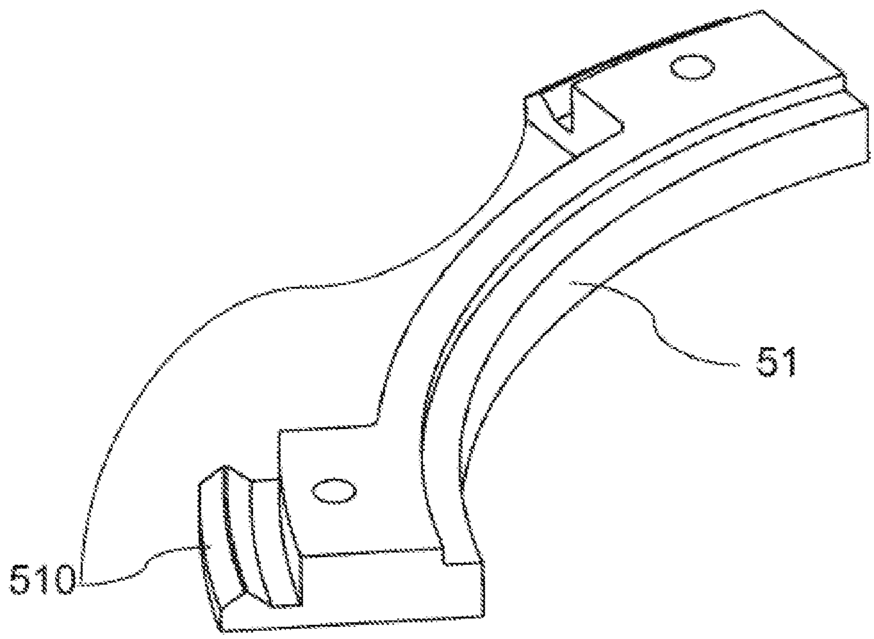

Fig. 10

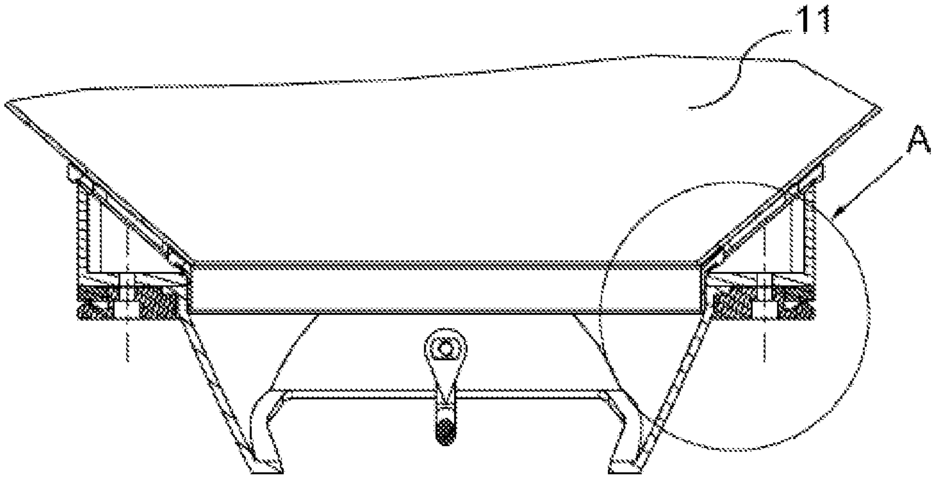

Fig. 11

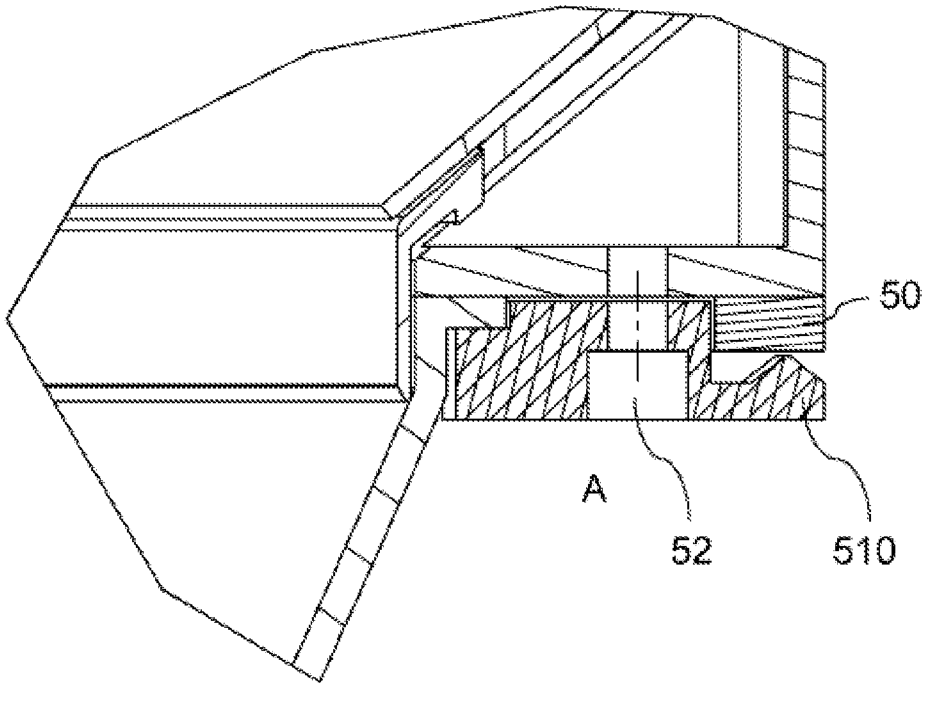

Fig. 12

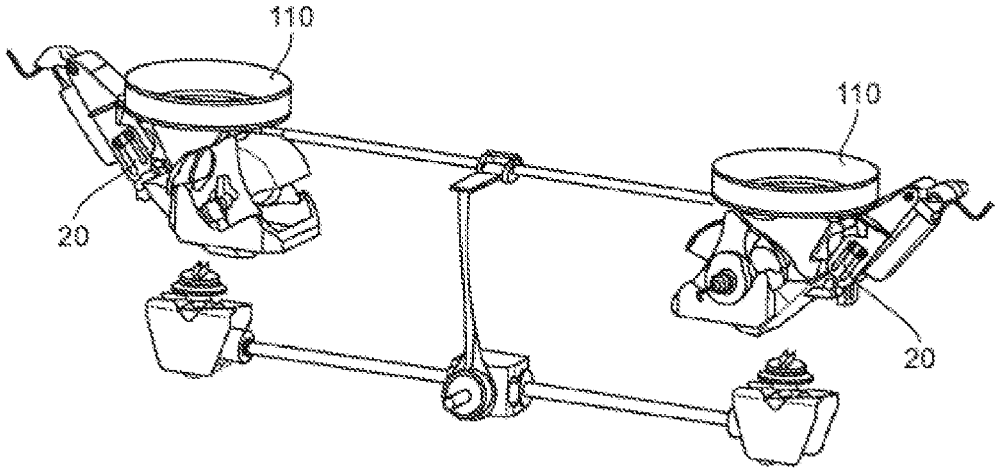

Fig. 13

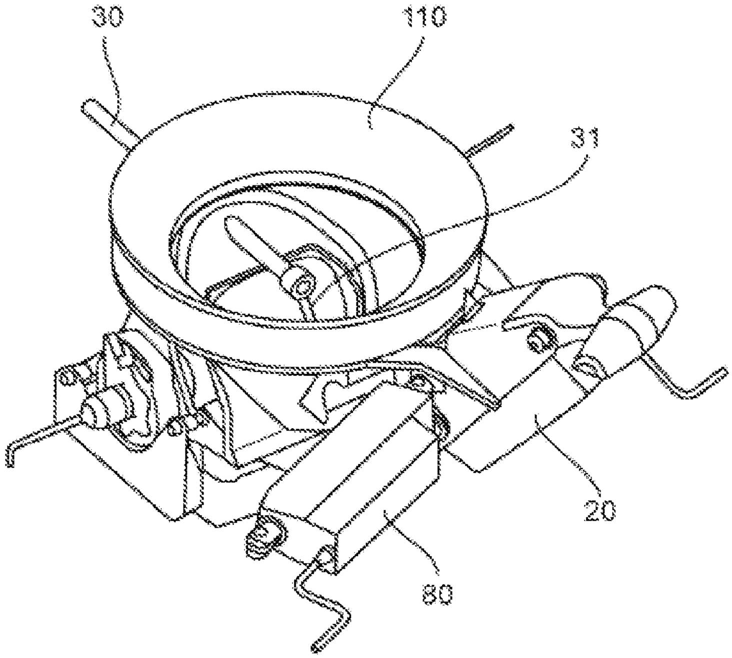

Fig. 14