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(54) **Title**: DEVICE FOR REMOVING MANURE FROM A FLOOR

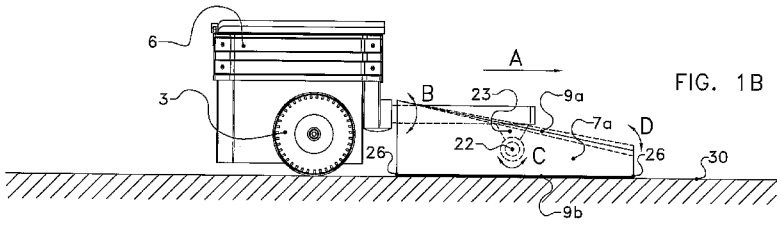

FIG. 1B

(57) **Abstract**: Device for removing manure present on a floor (30), comprising a frame, a drive for moving the device over the floor and at least one manure slide which has an upper edge (9a), wherein the manure slide is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located below at least a portion of the upper edge of a manure -pushing wall portion of the manure slide.

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Device for removing manure from a floor

BACKGROUND OF THE INVENTION

The invention relates to a device for removing manure present on a floor, in particular a passageway for animals, such as cattle. By manure is also meant other material, such as feed residues, which has to be removed from a floor.

DE 103 09 106 shows a trolley with a manure slide to be driven and steered by a person who has taken his position on the device, which manure slide is provided with two sliding walls which are located behind each other and which are fastened to a horizontal plate which defines a chamber with the sliding walls. The plate is fastened to the frame of the trolley by means of a parallelogram connection comprising upwardly and forwardly extending link rods, in order to be able to swivel upwards, with the sliding walls, in a vertical longitudinal plane of the trolley, in order to avoid a threshold or other obstacle. The known trolley is also provided with a mechanism for pre-setting the vertical position of the plate and thereby of the sliding walls.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a device of the type mentioned in the preamble, the manure slide of which is able to have, in many circumstances, an effective contact with the floor.

In order to achieve at least one of these objects, the invention, from one aspect, provides a device for removing manure present on a floor, comprising a frame, a drive for moving the device over the floor and at least one manure slide which has an upper edge, wherein the manure slide is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located below at least a portion of the

upper edge of a manure-pushing wall portion of the manure slide.

Hereby, while maintaining the rotatability, a low point of rotation is obtained, as a result of which the vertical moment arm of horizontal forces exerted on the manure slide, such as by the contact between floor and slide, is kept limited, and therewith a possibly occurring moment tending to lifting of the slide. Substantially horizontal for the first rotational centre line also relates to rotational centre lines which are at a small angle to the horizontal, such as for example an angle of approximately 20 degrees.

In such an arrangement, the connection structure can comprise a second rotational connection with a second, substantially horizontal rotational centre line which is at an angle, of preferably approximately 90 degrees, to the first rotational centre line, so that adjustment to local changes in a direction transverse thereto is improved. The second rotational centre line is preferably also located below at least a portion of the upper edge of a manure-pushing wall portion of the manure slide.

It is observed that from EP 1.690.450 a self-propelled trolley with a single manure slide is known, in which the manure slide is suspended at a location in front of the manure slide from a frame in such a manner that the slide is rotatable about a horizontal rotational centre line which is parallel to the direction of travel, for adjustment to local changes in the floor profile. The slide can also be suspended in such a manner that it can pivot about a rotational centre line perpendicular to the aforementioned rotational centre line, for example by means of a drawbar, a parallelogram construction or in general by means of two hinges. Both rotational movements take place about centre lines located above the upper edge of a manure-pushing wall portion of the manure slide.

The first rotational centre line can be transverse to a vertical central longitudinal plane of the device. The second rotational centre line can then be located in that plane.

In one embodiment, the location of the manure slide with respect to the first rotational centre line, in particular the horizontal distance, can be set. Hereby, the moment arm between manure slide and rotational centre line can be determined.

In a first further development of the device according to the invention, the manure slide is substantially U-shaped or V-shaped in order to define a manure-accommodating-space which opens in forward direction. In a compact embodiment, the first rotational centre line is then preferably located in front of a rear wall of the manure-accommodating-space, and preferably coincides in horizontal direction with the manure-accommodating-space, when viewed in projection on a vertical central longitudinal plane of the device. The moment generated by the frictional force in one or more planes parallel to the vertical central longitudinal plane, by which moment the pressure of the rear wall of the manure slide could otherwise be reduced, can then be kept limited.

In one embodiment thereof, the manure slide has two legs which have a length in the order of magnitude of the width of the rear wall of the manure slide.

In a second further development, the first rotational centre line is located behind the manure slide. Hereby, the forces exerted on the manure slide by the manure and the floor can improve the contact of manure slide with floor, however without that pressure may become too great and would hinder the travelling.

The manure slide can then be mounted on a, for example plate-shaped, holder and be movable therewith with respect to the frame as a unit about the first and, if present, the second rotational centre line, wherein the holder is provided with an added floor-treating member which is located in longitudinal direction at a distance from the manure slide, preferably therebehind. The added floor-treating member, which can be configured for a comparable function (manure slide) or for another function, such as sweeping or brushing, is preferably located behind the manure slide, to improve the stability. The added floor-treating member can form an upright pushing or sweeping strip which extends substantially in transverse direction, for example a brush by means of which a possible manure film layer is detached.

In one embodiment thereof, the manure slide and the added floor-treating member are located on both sides of the first rotational centre line, so that there is obtained an arrangement which is compact in longitudinal direction. In this embodiment, a settability of the distance, in particular the horizontal

distance, to the first rotational centre line of the manure slide and/or the added floor-treating member is favourable, because the abutment pressures of both of them can be set according to one's wishes, in particular if a part of the mass of the device is transferred, via the connection of the first rotational centre line, via the holder, to the floor. In one embodiment, in which the position of the holder itself is set with respect to the frame, displacement of the holder for that setting will result in an increased moment arm for one of them (for example the manure slide) and a decreased moment arm for the other one (for example the added floor-treating member), with respect to the first rotational centre line.

The front floor contact points of the manure slide, when viewed in longitudinal direction, can be located closer to the first rotational centre line than the rear floor contact points of the added floor-treating member. In a further embodiment thereof, the ratio of the distances in longitudinal direction between the front floor contact points of the manure slide and the first rotational centre line and the rear floor contact points of the added floor-treating member and the first rotational centre line amounts to approximately 1 to 2.

The stability in longitudinal direction is improved if the manure slide, the holder and the floor support, when viewed in a vertical longitudinal plane of the device, form a rigid unit.

The adjustment to the surface of the floor is improved if the manure slide and the added floor-treating member are rotatable with respect to each other about a rotational centre line which extends parallel to the longitudinal direction, so that, for example, one can assume an oblique position and the other one a purely horizontal position. That rotational centre line can coincide with the aforementioned second rotational centre line.

In an alternative, simple development, the manure slide, the holder and the floor support, when viewed in a vertical plane perpendicular to a vertical longitudinal plane of the device, form a rigid unit.

From a further aspect, the invention provides a device for removing material, such as manure, present on a floor, comprising a frame, a drive for moving the device over the floor and a first and a second floor-treating member, wherein the two floor-treating members extend substantially over the width of the device and are mounted on a holder, which is held by the frame by means of a

connection structure, wherein the first and the second floor-treating member are located in longitudinal direction at a distance from each other, wherein the connection structure comprises a first rotational connection with a first, substantially horizontal rotational centre line, about which the holder with the two floor-treating members is rotatable with respect to the frame, while changing the orientation of the holder in a vertical longitudinal plane of the device, the first rotational centre line being substantially transverse to said longitudinal plane.

The floor-treating members can be designed differently, wherein the front, first floor-treating member is in particular designed as a (manure) slide. The second floor-treating member can then in particular form a second slide or a brush.

The holder with the two floor-treating members can be connected to the device for rotation with respect thereto about a second rotational centre line which is substantially parallel to the vertical longitudinal plane.

As mentioned above, the holder with the two floor-treating members can be rotatable as a rigid unit about the first rotational centre line and/or the second rotational centre line.

The developments of the arrangement comprising holder with manure slide and floor-treating member described in the foregoing can also be applicable here.

In the case of an embodiment of a floor-treating member as a brush, the latter can be stationary and comprise a series of brush bristles which are juxtaposed substantially in transverse direction, such as customary per se for a brush.

For removing manure residues deposited in transverse slots of a so-called slatted floor, the brush can comprise brush bristles of at least two different lengths, wherein longer brush bristles are bendable and extend further downwards than shorter brush bristles. The longer brush bristles can then extend into the slots in order to detach the manure residues, whereafter these residues can drop into the manure pit located therebelow. Shorter brush bristles can be present in greater number than longer brush bristles, wherein the longer brush bristles are preferably provided at a mutual distance from each other along the brush of a plurality of brush bristles. If the brush is concave, the series of brush

bristles will comprise trajectories which are at an angle to the transverse slots. The longer brush bristles can then be influenced in their movement by juxtaposed brush bristles in such a manner that said movement obtains a transverse component by which the cleaning effect is enhanced.

In one embodiment, the manure slide and/or the added floor-treating member are/is concave, preferably with the hollow side oriented forwardly.

From a further aspect, the invention provides a device for sweeping a stable floor, comprising a frame and a brush for sweeping contact with the floor, wherein the brush comprises a series of brush bristles which are juxtaposed substantially in transverse direction, and the brush is concave in top view, preferably with the hollow side oriented forwardly. The brush can comprise brush bristles of at least two different lengths, wherein longer brush bristles are bendable and extend further downwards than shorter brush bristles. Also in this case, shorter brush bristles can advantageously be present in greater number than longer brush bristles, wherein the longer brush bristles are preferably provided at a mutual distance from each other along the brush of a plurality of brush bristles.

From another aspect, the invention provides a device for removing material from a stable floor, wherein the device comprises a frame and a slide for the material, which slide is connected to the frame and has a lower edge for sliding contact with the stable floor, wherein the lower edge is located in a first horizontal plane, wherein the device is further provided with stationary, bendable brush bristles which extend downwards up to a distance below the first horizontal plane. These lengthwise extending brush bristles can extend into the slots in order to detach the manure residues, whereafter these residues can drop into the manure pit located therebelow. As mentioned above, they can form part of a brush which is for the remaining provided with shorter bristles, which rest on the floor or are added to another floor-treating member, such as the aforementioned manure slide or an additional manure slide. They can also be located, for example, between two floor-treating members, such as two manure slides.

From another aspect, the invention provides a device for removing material, such as manure, present on a floor, comprising a frame, a

drive for moving the device over the floor and at least one manure slide which has an upper edge, wherein the manure slide is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located behind the manure slide. As already mentioned, the first rotational centre line can be located below at least a portion of the upper edge of a manure-pushing wall portion of the manure slide.

The above-mentioned device can be configured in a manner known per se for unmanned self-propelling and preferably also for unmanned steering. By unmanned self-propelled and self-steering device are meant both at least substantially autonomously travelling and steering devices, whether or not programmed for this purpose, such as the Discovery (registered trademark) manure slide of the registered trademark Lely, and devices in which the travelling and/or steering are/is remotely controlled. In both cases, a motor for the travelling of the device is provided in the device.

The invention furthermore provides an assembly of a device according to the invention and a floor. The floor can have a closed upper surface or be provided with slots and/or form a passageway in a stable.

The aspects and features described in this description and the claims of the application and/or shown in the figures of this application may, where possible, also be used separately from each other. These separate aspects may be the subject of divisional patent applications related thereto. This holds in particular for the features and aspects which are described per se in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

The invention will be explained with reference to a number of exemplary embodiments shown in the accompanying figures, in which:

Figures 1A and 1B show a top and a side view, respectively, of a first exemplary embodiment of a device according to the invention;

Figures 2A and 2B show a top and a side view, respectively, of a

second exemplary embodiment of a device according to the invention;

Figures 3A and 3B show a top and a side view, respectively, of a third exemplary embodiment of a device according to the invention;

Figures 4A and 4B show a top and a side view, respectively, of a fourth exemplary embodiment of a device according to the invention, and

Figures 5A and 5B show a detail of a view of a brush adapted for use in a device according to the invention, in unloaded condition, and a view of a situation during use, respectively.

DETAILED DESCRIPTION OF THE FIGURES

The device 1 shown in Figures 1A and 1B for removing manure from a floor 30 of a passageway of a stable comprises a relatively heavy, block-shaped concrete housing 2. The device 1 is supported on two wheels 3 and on a manure slide 4. The housing 2 is provided on both sides with current collectors 6, by means of which an accumulator 16, included in the housing 2, can be charged at an external charging station, as used in the manure slide device which is offered by Lely (registered trademark) under the name Discovery (registered trademark). The manure slide 4 is wholly located in front of the housing 2 and thus in front of the drive, as is visible in Figures 1A and 1B, and viewed in projection on a central longitudinal plane M of the device 1.

The housing 2 accommodates a control unit 15 which is fed by the accumulator 16 and which controls, via the control line 18, a double electric motor 17, by means of which the wheels 3 can be driven individually. The control unit 15 is capable of being programmed remotely, so that the device 1 can follow autonomously a defined working route, in a repeating manner.

The manure slide 4 is made of stainless steel and U-shaped with two legs 7a,b and manure-pushing rear wall 8, which define a manure-accommodating-space 25, with a length L1 and a width B, which are substantially equal in this example. The legs 7a,b and the rear wall 8 are plate-shaped, the height of the legs 7a,b being greater at the rear than at the front. At their lower edge 9a they are provided with a polyurethane strip 26, for a sweeping contact

with the floor 30. The legs 7a,b can undergo some mutual upward/downward movement (direction C), so that their lower edges can properly follow the floor 30.

A longitudinal bar 10, which is bearing-supported in a freely rotatable manner, direction B, about its centre line in the housing 2, extends forwardly from the housing 2. At its front end there is mounted a bracket 23 in which a cross-bar 22 is bearing-supported in a freely rotatable manner, direction C. The ends 22a,b of the cross-bar 22 are rigidly attached to legs 7a,b of the manure slide 4, thus behind the front end of the (legs) of the manure slide. As a result of this cardan-like connection with the housing 2, it is possible for the manure slide 4 to follow in a proper manner slopes in longitudinal and transverse direction of the floor 30, so that the contact of the manure slide 4 with the wall 30 remains sufficient. The rotational centre lines for the longitudinal bar 10 and for the cross-bar 22 are located below the highest point of the upper edge 9b of the rear wall 8, the rotational centre line for the cross-bar 22 even below the upper edges of all walls 7,8.

During operation on a so-called closed floor 30 of the passageway of a stable, it is possible by means of the device 1 moving in forward direction A to move in an autonomous manner manure (or other material) present on the floor 30 to a manure pit opening located at the end of the passageway. The device 1 subsequently moves back to the other end of the passageway, to start a next stroke, for sweeping a strip of the floor 30 next to the strip that was swept in the previous stroke.

By way of example, L1 is greater than L2, the length of the housing 2 upto the wall 8. L1 can amount to more than 2/3 of the sum of L1 + L2, the overall length L of the device 1. L1 and B can, for example, amount to 1 m, whereby an amount of manure of 100 l can be accommodated without problems, which amount of manure is expected to land, in one hour, on a strip of 1 m of a passageway with a length of 100 m. In that case, the device 1 has to clean the same surface only 1 x per hour. Then, L2 can amount to 0.5 m.

The device 101 shown in Figures 2A and 2B corresponds, as regards the housing 2 and the drive, to the device 1 of Figures 1A and 1B. The manure slide 104, located under a hood 150, now forms part of a tandem arrangement with two floor-treating members, thus, in addition to the first floor-

treating member, the manure slide 104, a second sweeping floor-treating member 105, which can be designed as a manure slide, in this example, or as a brush, see the examples below. The device 101 is supported on two wheels 103 and on the two floor-treating members 104,105.

Each manure slide 104,105 has its mouth oriented concavely forwardly and has a lower edge 109a with polyurethane strip and an upper edge 109b. The manure slide 104,105 is fixed to a transverse plate 122a,b, which is fixed itself to a U-shaped holder 121a,b, which is rotatably mounted (direction C) on a central bar 120 which extends in longitudinal direction. The bar 120 is provided with a downwardly extending plate 112 which is bearing-supported by means of a pivot pin 114 in a fork 113 which is mounted on the front end of a bar 110 fastened to the housing 102. The pivot pin 114 has its centre line, which is transverse to the direction A, located below the upper edge 109b of the manure slides 104,105 and allows rotation of the bar 120 in the direction B, so that also in this embodiment a rotation about two horizontal centre lines which are perpendicular to each other is possible, each manure slide 104,105 individually in direction B and together and inversely in direction C.

In this example, the pivot pin 114 is located behind the front slide 104, at a distance of approximately 1/3 of the intermediate distance between the slides 104 and 105. The location of the slides 104,105 with respect to the pivot pin 114 can be set. This is possible, for example, by making the connection between the holders 121a,b and the bar 120 adjustable, whereby, possibly, the mutual distance between the slides 104,105 can also be set. This can also be done, for example, by extending the plate 112 in longitudinal direction and to provide same with a plurality of apertures for the pin 114.

In an alternative embodiment, the bar 120 is located at a lower level, so that it is located below the upper edges 109b. The ends of the bar 120 can then be connected, relatively rotatably about its centre line, to the slides 104,105.

The device 201 shown in Figures 3A and 3B corresponds, as regards the housing 2 and the drive, to the device 1 of Figures 1A and 1B. The manure slide 204 provided with a sweeping strip 206 of synthetic material (first floor-treating member), located under a hood 250, now forms part of a rigid

arrangement with a second sweeping support member 205 (second floor-treating member) which is designed as a fixed brush 207, for example with nylon bristles 208. The device 201 is supported on two wheels 203 and on the two floor-treating members 204,205.

The two members 204,205 are fixed to a plate 220 of stainless steel and form therewith a rigid unit. The plate 220 is provided with two slots 211 for passing the two plates of a fork 213 which is fixed to the front end of a horizontal bar 210 which projects from the front of the housing 202 and which is bearing-supported in a manner in which it is rotatable about its centre line (direction B). By a pivot pin 214 located below the plate 220, the fork 213 is attached rotatably, in the direction C, to a downwardly extending plate 212 which is fastened to the lower side of the plate 220, so that the plate 220 with the members 204,205 can tilt in that direction. If desired, the slots 211 can be extended in order to set displacement of the position of the pivot pin 214 with respect to the members 204,205, in which case locking means will be provided for this purpose. The pivot pin 214 can then be located closer to the front member 204 than to the rear member 205.

The device 301 shown in Figures 4A and 4B corresponds, as regards the housing 2 and the drive, to the device 1 of Figures 1A and 1B. The manure slide 304, provided with a sweeping strip 306 of synthetic material, located under a hood 350, forms again part of a rigid arrangement with a second sweeping support member 305 which is designed as a fixed brush 307, for example with nylon bristles 308. The device 301 is supported on two wheels 303 and on the two floor-treating members 304,305.

The members 304,305 are concave and have their opening oriented forwardly, and are interconnected near the lateral sides of the 301 by plates 320, so as to form a rigid unit, when viewed in a vertical longitudinal plane and a vertical plane perpendicular thereto, which, by means of a bearing bush or bearing case 316, rotatably about a substantially horizontal rotational centre line (direction B) is fastened to the front end of a longitudinal girder 310 which is rigidly attached to the housing 302. By the rigid arrangement undesired tilting as a result of wear in bearing bush 316 is counteracted. Near the lateral sides of the device 301, the support member 305 provided with a brush is fastened to

downwardly bent ends 313 of a transverse strip 312 fastened to the bearing bush 316, i.e. rotatably about pins 314 in direction C. The pins 314 are located below the upper edges 309b of the members 304,305.

For use on a so-called slatted floor, in an embodiment with transverse slots vertically throughgoing to the manure pit located therebelow, schematically indicated in Figures 4A and 4B as a floor 130 with transverse slots 131, in the devices 201 and 301 use can be made of a fixed brush 407 with bristles 408a and 408b of different lengths, which are fixed at their upper ends in the member 305, which has for this purpose, for example, an inversed U-profile for receiving these upper ends with glue. The length of the bristles 408b is greater (for example 1.5 cm or more, for example 4 cm greater, than that of the bristles 408a. The bristles 408b are provided in smaller number, solitary or in small groups, at a regular distance from each other, in alternation with groups of shorter bristles 408a, see Figures 5A and 5B. For illustrative reasons, the bristles 408a,b are depicted in Figure 5A as exaggeratedly thin ones. However, the bristles 408a,b are located in succession against each other. Figure 5A shows the unloaded condition, indicating that the lower ends of the shorter bristles 408a are located in a horizontal plane H. During use, the plane H will coincide with the floor surface and the long bristles 408b will drag in bent condition over the floor. It is observed that these long bristles 408b, instead of with a brush, can also be combined with another sort of floor-treating member, in particular with a manure slide itself.

During operation, the lower ends of the bristles 408a push on the floor 130, in order to prevent possible film formation of spread-out manure which may occur at higher temperatures, or to break film which has been formed. The longer bristles 408b are then dragged, in bent condition. As soon as the longer bristles 408b arrive above a slot 131, they can bend into it with force, in which case they detach possible manure residues from the opening of the slot and/or push downwards and clear the opening again. They are automatically bent upwards again by the edge of the opening of the slot.

The shape of the series of bristles 408a,b, which is curved in this example, can result in parts that are in an oblique position with respect to the direction A in that the movement of the long bristles 408b to the curved position

and back is affected by adjacent bristles, in such a manner that said movement will obtain a directional component transverse to the direction A. As a result thereof, the long bristles will also undergo a displacement in the direction of the slot, so that the clearing effect will be increased.

The space between the manure slide and support member, such as brush, both shown in Figures 2A,B, 3A,B and 4A,B, can be used for exerting influence on the floor, for example by spraying. Said space can, for example, also be used for installing long bristles, which extend below the horizontal plane defined by the lower edge of the manure slide and/or brush, in order, as described above, to be able to move downwards at the location of the slots in the floor in order to detach manure from the slots.

The above-mentioned description serves to illustrate the operation of preferred embodiments of the invention, and not to limit the scope of the invention. On the basis of the above-mentioned explanation, it will be obvious for a person skilled in the art that there are many variations falling within the spirit and scope of the present invention.

CLAIMS

1. Device (1,101,201,301) for removing manure present on a floor (30,130), comprising a frame, a drive for moving the device (1,101,201,301) over the floor (30,130) and at least one manure slide (4,104,204,304,105,205,305) which has an upper edge (9b,109b,309b), wherein the manure slide (4,104,204,304,105,205,305)\ is held by the frame by means of a connection structure, **characterized in that** the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located below at least a portion of the upper edge (9b,109b,309b) of a manure-pushing wall portion of the manure slide (4,104,204,304,105,205,305).

2. Device (1,101,201,301) according to claim 1, wherein the connection structure comprises a second rotational connection with a second, substantially horizontal rotational centre line which is at an angle to the first rotational centre line, preferably at an angle of approximately 90 degrees.

3. Device (1,101,201,301) according to claim 2, wherein the second rotational centre line is located below at least a portion of the upper edge (9b,109b,309b) of a manure-pushing wall portion of the manure slide (4,104,204,304,105,205,305).

4. Device (1,101,201,301) according to claim 1, 2 or 3, wherein the first rotational centre line is substantially transverse to a vertical central longitudinal plane (M) of the device.

5. Device (1,101,201,301) according to claim 2, 3 or 4, wherein the second rotational centre line is located in a vertical central longitudinal plane (M) of the device (1,101,201,301).

6. Device (1,101,201,301) according to any one of the preceding claims, wherein the location of the manure slide (4,104,204,304,105,205,305), in particular the horizontal distance with respect to the first rotational centre line, is settable.

7. Device (1,101,201,301) according to any one of the preceding claims, wherein the manure slide (4,104,204,304,105,205,305) is substantially U-shaped or V-shaped in order to define a manure-accommodating-space (25) which opens in forward direction.

8. Device (1,101,201,301) according to claim 7, wherein the first rotational centre line is located in front of a rear wall (8) of the manure-accommodating-space (25), preferably coincides in horizontal direction with the manure-accommodating-space (25), when viewed in projection on a vertical central longitudinal plane (M) of the device.

9. Device (1,101,201,301) according to claim 8, wherein the manure slide (4,104,204,304,105,205,305) has two legs (7a,b) which have a length in the order of magnitude of the width of the rear wall (8) of the manure slide (4,104,204,304,105,205,305).

10. Device (1,101,201,301) according to any one of claims 4 – 7, wherein the first rotational centre line is located behind the manure slide (4,104,204,304,105,205,305).

11. Device (1,101,201,301) according to claim 10, wherein the manure slide (4,104,204,304,105,205,305) is mounted on a holder (121a,b), which can be plate-shaped, and is with respect to the frame movable therewith as a unit about the first and, if desired, the second rotational centre line, wherein the holder (121a,b) is provided with an added floor-treating member (4,104,204,304,105,205,305) which is located in longitudinal direction at a distance from the manure slide (4,104,204,304,105,205,305), preferably therebehind.

12. Device (1,101,201,301) according to claims 4 and 11, wherein the manure slide (4,104,204,304,105,205,305) and the added floor-treating member (4,104,204,304,105,205,305) are located on both sides of the first rotational centre line, wherein, preferably, when viewed in longitudinal direction, the distance, in particular the horizontal distance, of the manure slide (4,104,204,304,105,205,305) and/or of the added floor-treating member (4,104,204,304,105,205,305) to the first rotational centre line is settable, preferably by setting the position of the holder (121a,b) with respect to the frame.

13. Device (1,101,201,301) according to claim 12, wherein the front floor contact points of the manure slide (4,104,204,304,105,205,305), when viewed in longitudinal direction, are located closer to the first rotational centre line than the rear floor contact points of the added floor-treating member (4,104,204,304,105,205,305).

14. Device (1,101,201,301) according to claim 13, wherein the ratio of the distances in longitudinal direction between the front floor contact points of the manure slide (4,104,204,304,105,205,305) and the first rotational centre line and the rear floor contact points of the added floor-treating member (4,104,204,304,105,205,305) and the first rotational centre line amounts to approximately 1 to 2.

15. Device (1,101,201,301) according to any one of claims 10 - 14, wherein the manure slide (4,104,204,304,105,205,305), the holder (121a,b) and the added floor-treating member (4,104,204,304,105,205,305), when viewed in a vertical longitudinal plane of the device, form a rigid unit.

16. Device (1,101,201,301) according to any one of claims 10 – 15, wherein the manure slide (4,104,204,304,105,205,305) and the added floor-treating member (4,104,204,304,105,205,305) are rotatable with respect to each other about a rotational centre line which extends parallel to the longitudinal direction.

17. Device (1,101,201,301) according to claims 2 and 16, wherein the said rotational centre line is the second rotational centre line.

18. Device (1,101,201,301) according to any one of claims 10 – 17, wherein the added floor-treating member (4,104,204,304,105,205,305) forms an upright strip (206,306) which extends substantially in transverse direction and which has a sweeping function.

19. Device (1,101,201,301) for removing material, such as manure, present on a floor (30,130), comprising a frame, a drive for moving the device over the floor (30,130) and a first and a second floor-treating member (4,104,204,304,105,205,305), wherein the two floor-treating members (4,104,204,304,105,205,305) extend substantially over the width of the device and are mounted on a holder (121a,b), which is held by the frame by means of a connection structure, wherein the first and the second floor-treating member (4,104,204,304,105,205,305) are located in longitudinal direction at a distance from each other, wherein the connection structure comprises a first rotational connection with a first, substantially horizontal rotational centre line, about which the holder (121a,b) with the two floor-treating members (4,104,204,304,105,205,305) is rotatable with respect to the frame, while

changing the orientation of the holder (121a,b) in a vertical longitudinal plane of the device, the first rotational centre line being substantially transverse to said longitudinal plane.

20. Device (1,101,201,301) according to claim 19, wherein the front floor-treating member forms a manure slide (4,104,204,304,105,205,305).

21. Device (1,101,201,301) according to claim 19 or 20, wherein the two floor-treating members (4,104,204,304,105,205,305) are located on both sides of the first rotational centre line.

22. Device (1,101,201,301) according to claim 21, wherein the front floor contact points of the front floor-treating member (4,104,204,304,105,205,305), when viewed in longitudinal direction, are located closer to the first rotational centre line than the rear floor contact points of the rear floor-treating member (4,104,204,304,105,205,305).

23. Device (1,101,201,301) according to any one of claims 19 – 24, wherein the holder (121a,b) with the two floor-treating members (4,104,204,304,105,205,305) is connected to the device for rotation with respect thereto about a second rotational centre line which is substantially parallel to the vertical longitudinal plane.

24. Device (1,101,201,301) according to any one of claims 19 - 23, wherein the holder (121a,b) and the two floor-treating members (4,104,204,304,105,205,305) form, when viewed in a vertical longitudinal plane of the device and/or in a vertical plane perpendicular thereto, a rigid unit.

25. Device (1,101,201,301) according to any one of claims 19 – 22, wherein the two floor-treating members (4,104,204,304,105,205,305) are rotatable with respect to each other about a second, substantially horizontal rotational centre line which is located in the vertical longitudinal plane.

26. Device (1,101,201,301) according to any one of claims 19 – 24, wherein the holder (121a,b) is plate-shaped.

27. Device (1,101,201,301) according to any one of claims 19 – 26, when depending on claim 20, wherein the first and/or the second rotational centre line is located below a manure-pushing wall portion of the first floor-treating member (4,104,204,304,105,205,305).

28. Device (1,101,201,301) according to any one of claims 19 - 27,

wherein the location of at least one of the two floor-treating members (4,104,204,304,105,205,305) is settable with respect to the first rotational centre line, in particular as regards the horizontal distance.

29. Device (1,101,201,301) according to any one of claims 10 - 28, wherein the second floor-treating member forms a second manure slide (4,104,204,304,105,205,305).

30. Device (1,101,201,301) according to any one of claims 10 – 28, wherein the second floor-treating member forms a brush (207,307,407) which preferably comprises a series of brush bristles (208,308,408a,408b) which are juxtaposed substantially in transverse direction.

31. Device (1,101,201,301) according to claim 30, wherein the brush (207,307,407) comprises brush bristles (208,308,408a,408b) of at least two different lengths, wherein longer brush bristles (408b) are bendable and extend further downwards than shorter brush bristles (408a).

32. Device (1,101,201,301) according to claim 31, wherein shorter brush bristles (408a) are present in greater number than longer brush bristles (408b), wherein the longer brush bristles (408b) are preferably provided at a mutual distance of a plurality of brush bristles (208,308,408a,408b) from each other along the added floor-treating member (4,104,204,304,105,205,305).

33. Device (1,101,201,301) according to any one of claims 10 – 32, wherein the manure slide and/or the added floor-treating member (4,104,204,304,105,205,305) are/is concave, preferably with the hollow side oriented forwardly.

34. Device (1,101,201,301) for sweeping a stable floor (30,130) comprising a frame and a brush (207,307,407) for sweeping contact with the floor (30,130), wherein the brush (207,307,407) comprises a series of brush bristles (208,308,408a,408b) which are juxtaposed substantially in transverse direction, and the brush (207,307,407) is concave in top view, preferably with the hollow side oriented forwardly.

35. Device (1,101,201,301) according to claim 34, wherein the brush (207,307,407) comprises brush bristles (208,308,408a,408b) of at least two different lengths, wherein longer brush bristles (408b) are bendable and extend further downwards than shorter brush bristles (408a).

36. Device (1,101,201,301) according to claim 35, wherein shorter brush bristles (408a) are present in greater number than longer brush bristles (408b), wherein the longer brush bristles (408b) are preferably provided at a mutual distance of a plurality of brush bristles (208,308,408a,408b) from each other along the brush (207,307,407).

37. Device (1,101,201,301) for removing material from a stable floor (30,130), wherein the device (1,101,201,301) comprises a frame and a slide for the material, which slide is connected to the frame and has a lower edge (9a,109a) for sliding contact with the stable floor (30,130), wherein the lower edge (9a,109a) is located in a first horizontal plane, wherein the device (1,101,201,301) is further provided with stationary, bendable brush bristles (208,308,408a,408b) which extend downwards up to a distance below the first horizontal plane.

38. Device (1,101,201,301) according to claim 37, further provided with a brush (207,307,407) with a series of brush bristles (208,308,408a,408b) which are juxtaposed substantially in transverse direction, wherein the brush (207,307,407) comprises brush bristles (208,308,408a,408b) of at least two different lengths, wherein longer brush bristles (408b) are bendable and extend further downwards than shorter brush bristles (408a), wherein the shorter brush bristles (408a) have their ends located in or near the first horizontal plane.

39. Device (1,101,201,301) for removing material, such as manure, present on a floor (30,130), comprising a frame, a drive for moving the device (1,101,201,301) over the floor and at least one manure slide (4,104,204,304,105,205,305) which has an upper edge (9a,109a), wherein the manure slide (4,104,204,304,105,205,305) is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located behind the manure slide (4,104,204,304,105,205,305).

40. Device (1,101,201,301) according to claim 39, wherein the first rotational centre line is located below at least a portion of the upper edge (9b,109b,309b) of a manure-pushing wall portion of the manure slide (4,104,204,304,105,205,305).

41. Device (1,101,201,301) according to any one of the preceding claims, wherein the device (1,101,201,301) is configured for unmanned self-

propelling and, preferably, also for unmanned steering.

42. Assembly of a device according to any one of the preceding claims and a floor (30,130).

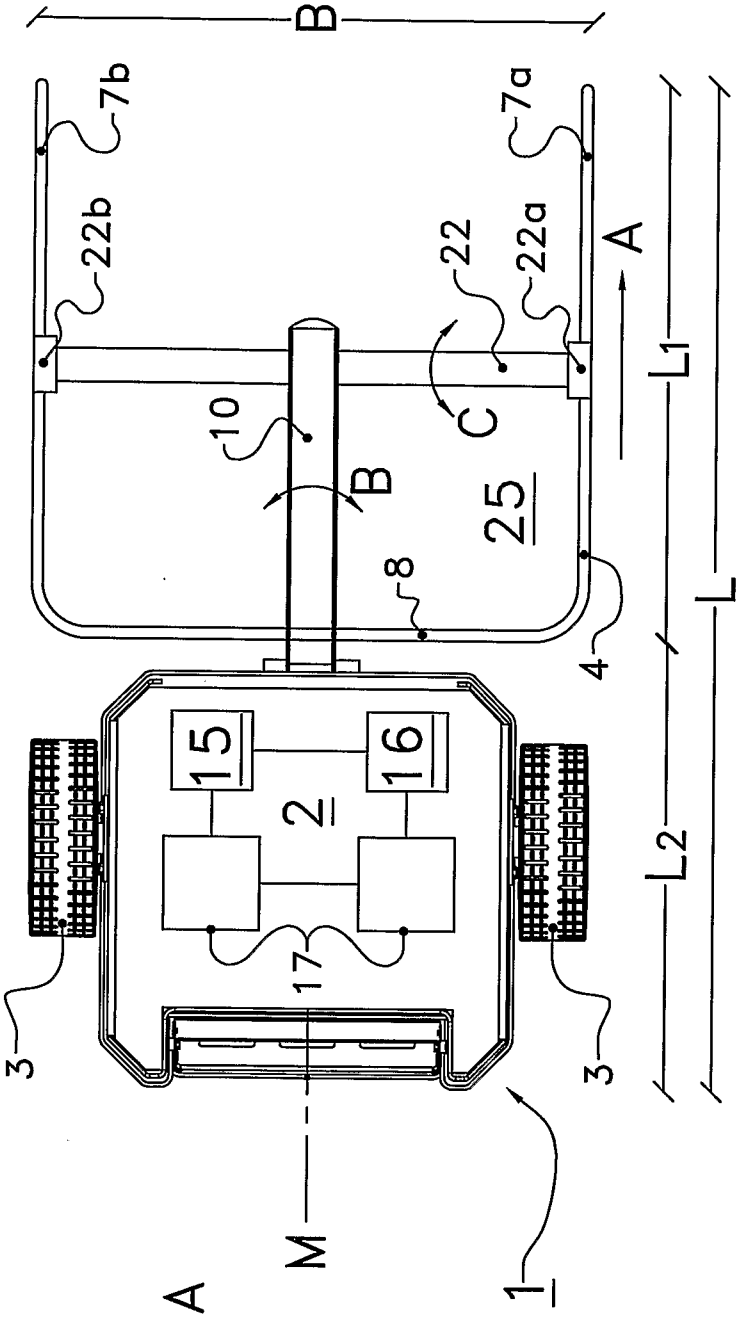
43. Assembly according to claim 42, wherein the floor (30,130) has a closed upper surface.

44. Assembly according to claim 42, wherein the floor (30,130) forms a slatted floor with transverse slots (131).

45. Assembly according to claim 43 or 44, wherein the floor (30,130) forms a passageway in a stable.

46. Stable provided with an assembly according to any one of claims 41 - 45.

47. Device (1,101,201,301) provided with one or more of the characterizing features described in the attached description and/or shown in the attached figures.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7b
7a
22b
22
22a
A
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B
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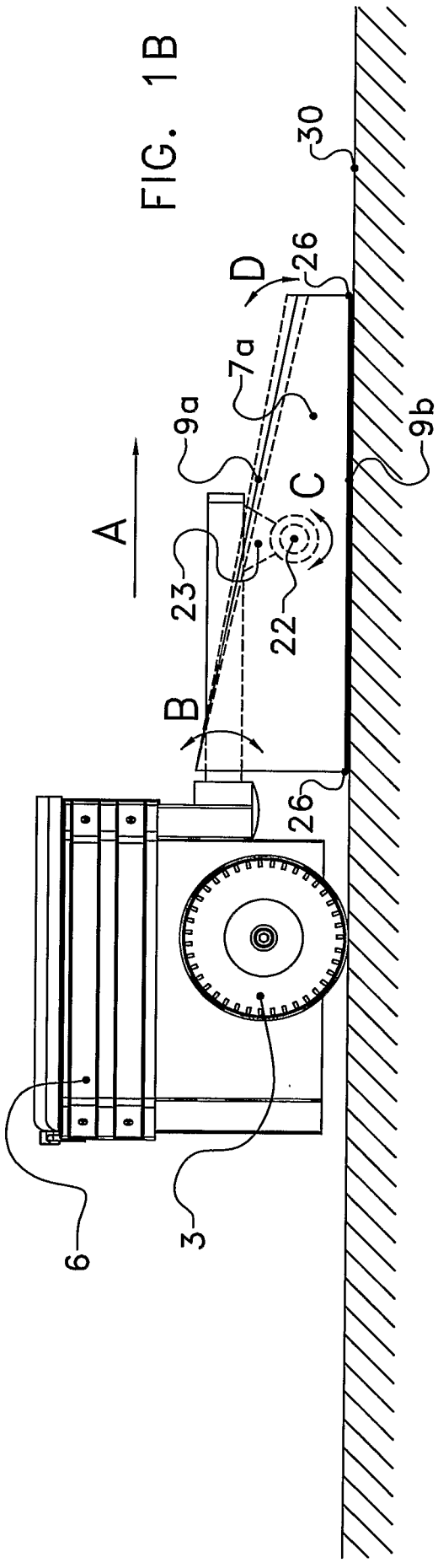
8
4
L1
L
L2
15
16
2
17
3
3
M
1

FIG. 1A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D
26
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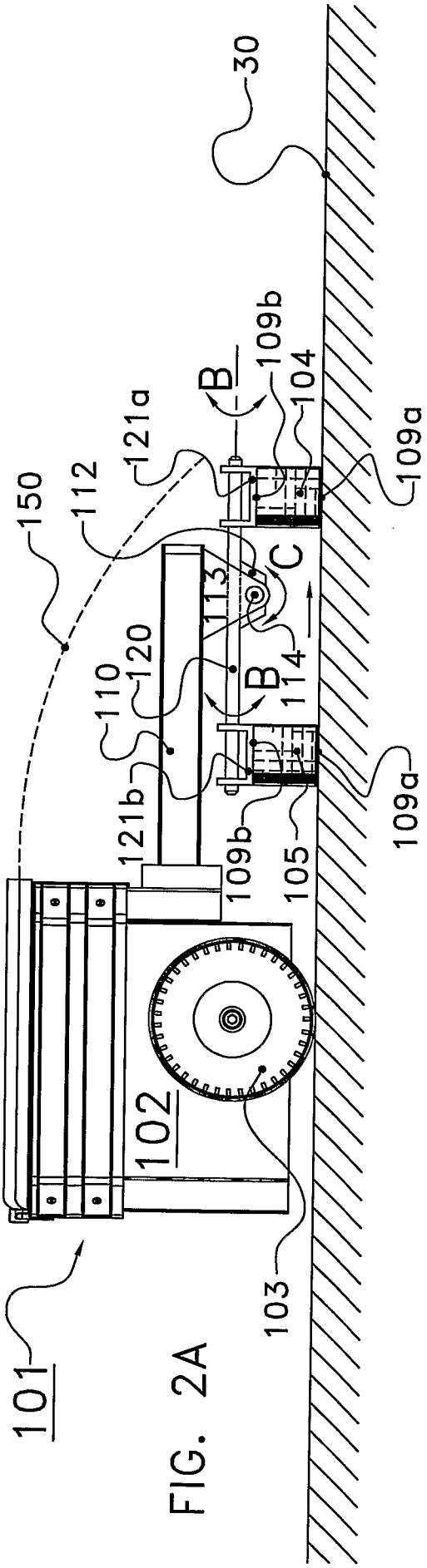
9a
9b
A
C
23
22
B
26
6
3

FIG. 1B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109b
104
B
121a
109a
150
112
C
113
120
110
B
114
121b
109b
105
109a
102
103
101

FIG. 2A

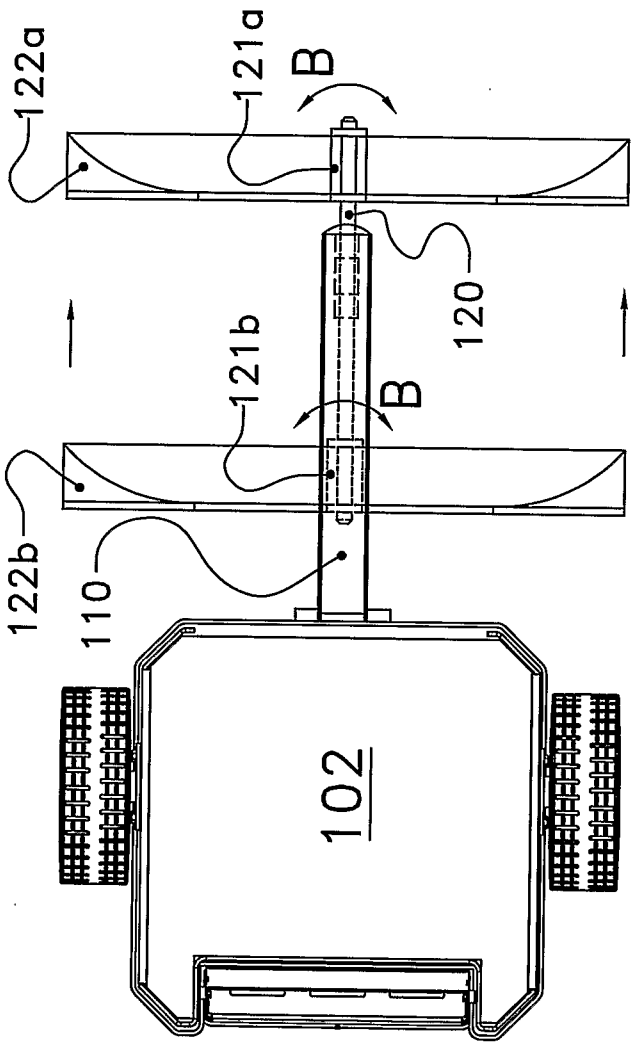

122a
121a
B
120
121b
B
122b
110
102

FIG. 2B

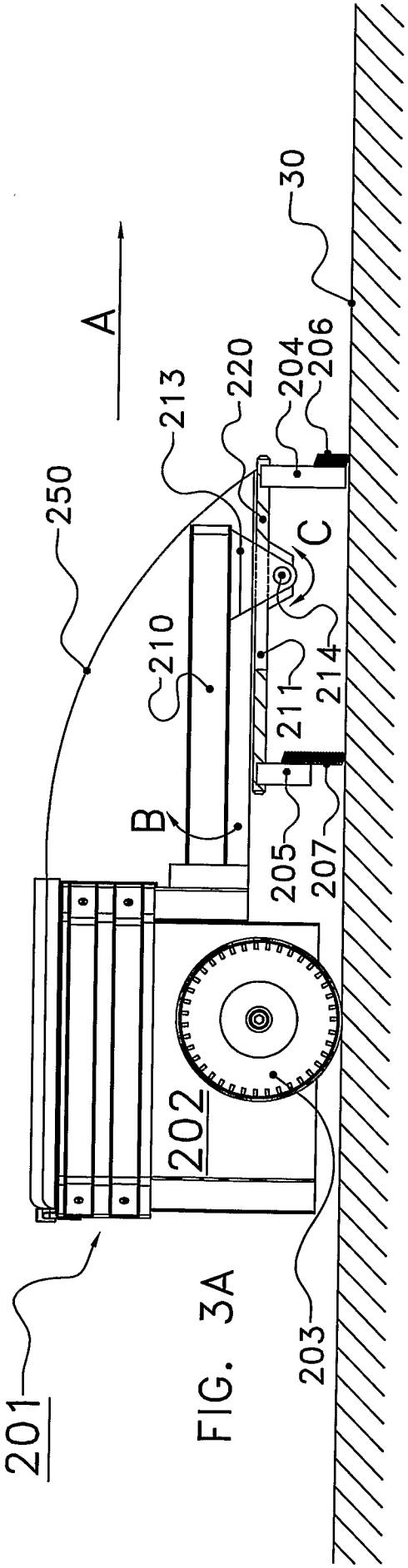
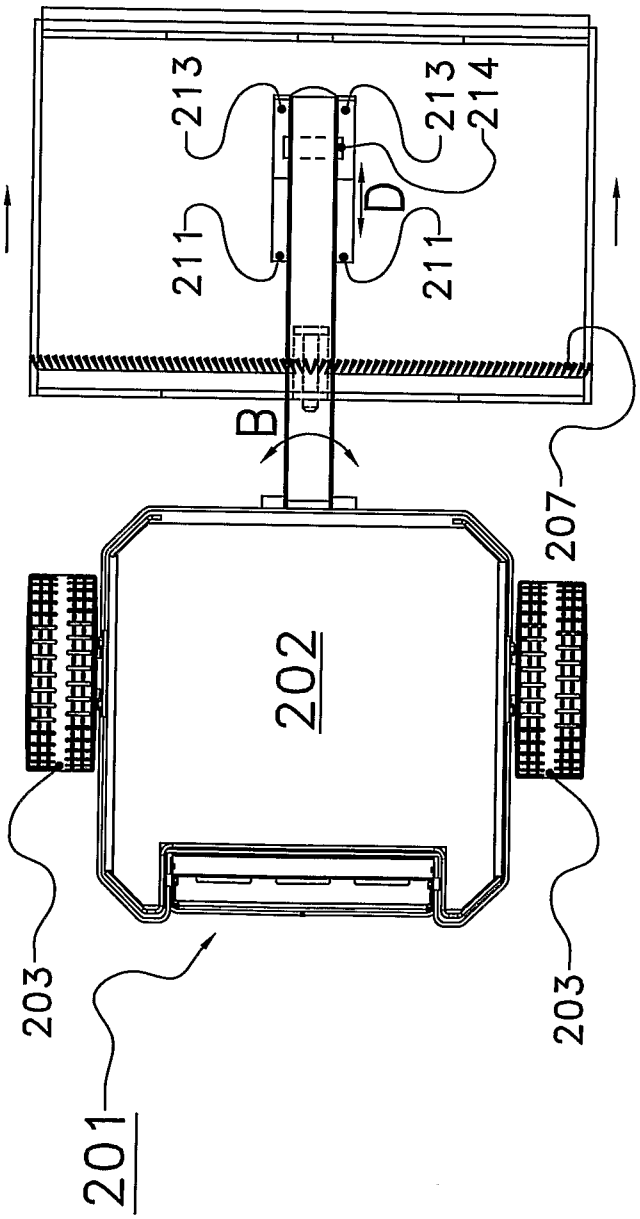

A
30
213
220
204
206
250
C
210
211
214
B
205
207
202
203
201

FIG. 3A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213
214
D
211
211
B
207
202
203
203
201

FIG. 3B

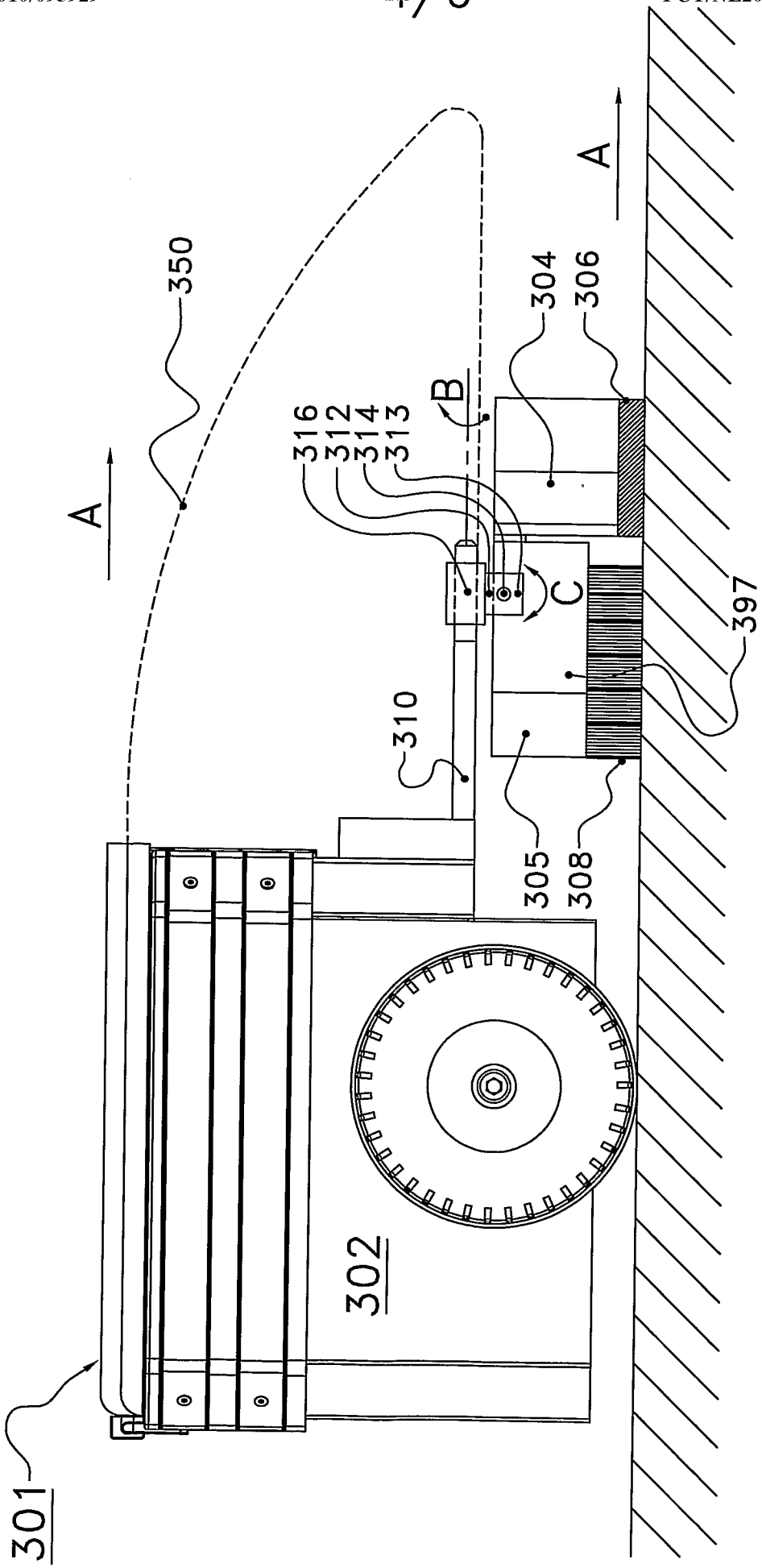
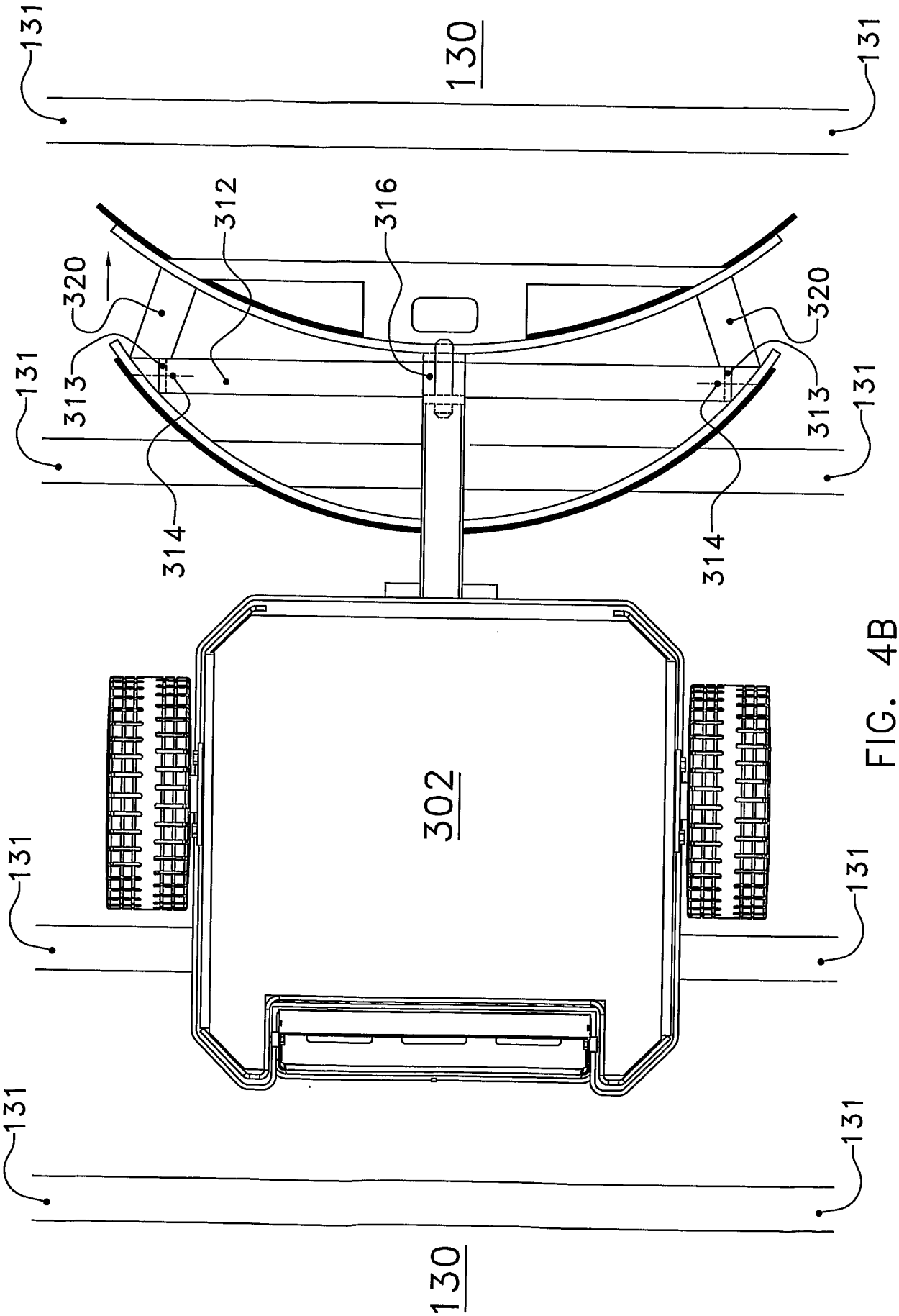


FIG. 4A


131
130
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320
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131
131
314
314
302
131
131
131
131
130

FIG. 4B

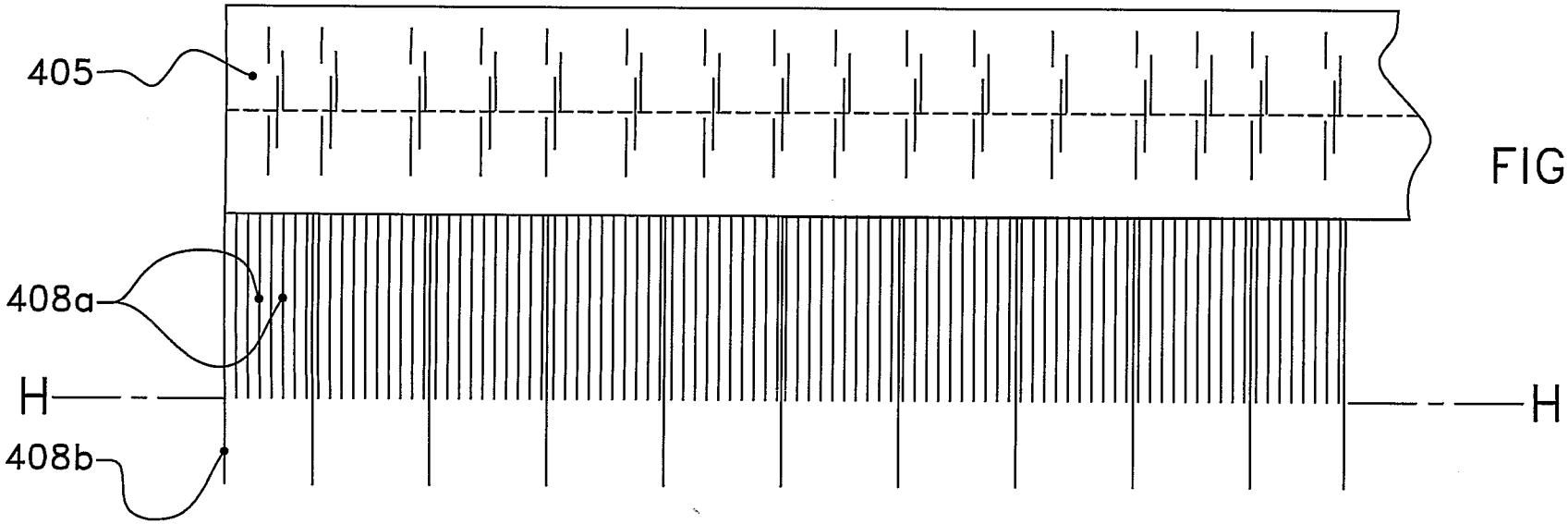

FIG. 5A

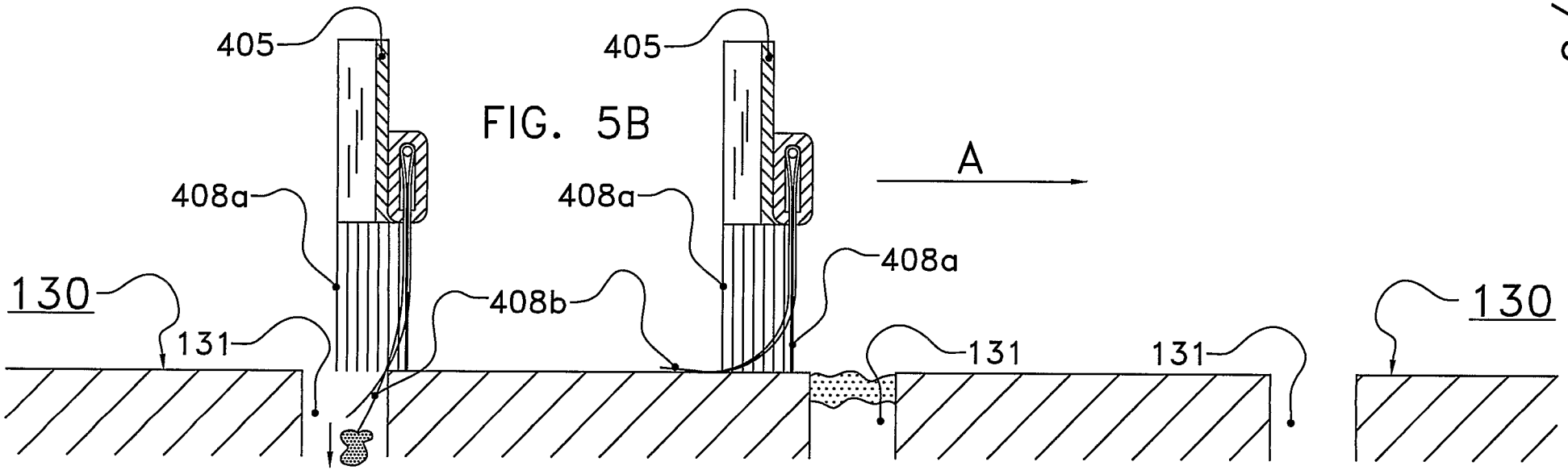

FIG. 5B

PCT/NL2010/000024

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2010/000024

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01K1/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01K A01J B62B A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 966 256 A (MCLELAND) 27 December 1960 (1960-12-27) column 4, lines 5-40 column 5, lines 34-38 column 6, line 45 - column 7, line 3; figures 1-11	1-10, 41-46
A	EP 1 690 450 A (LELY ENTERPRISES AG) 16 August 2006 (2006-08-16) cited in the application abstract column 3, paragraph 15; figure 1	1-10
A	DE 20 2006 007378 U (WESTERMANN GMBH & CO) 27 July 2006 (2006-07-27) the whole document	1,10, 29-32, 41-46

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 April 2010	30/06/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	von Arx, Vik

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2010/000024

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 203 09 156 U1 (BJJ KLEINMASCHINEN GMBH [DE]) 9 October 2003 (2003-10-09) abstract; figures 1-6	1

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 47

Claim 47 contains a reference to the description and the drawings. Claims should not contain such references except where absolutely necessary, which is not the case here, Rule 6.2(a) PCT.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2)PCT declaration be overcome.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NL2010/000024

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 47
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-18(completely); 29-33, 41-46(partially)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18(completely); 29-33, 41-46(partially)

Device for removing manure present, comprising a frame, a drive for moving the device and at least one manure slide, wherein a first rotational connection has a first substantially horizontal rotational centre line which is located below at least a portion of the upper edge of a manure-pushing wall portion of the manure slide.

---

2. claims: 19-28(completely); 29-33, 42-46(partially)

Device for removing material, comprising a frame, a drive and a first and a second floor-treating member, wherein the two floor-treating members are mounted on a holder, which is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first, substantially horizontal rotational centre line, about which the holder with the two floor-treating members is rotatable with respect to the frame, while changing the orientation of the holder in a vertical longitudinal plane of the device, the first rotational centre line being substantially transverse to said longitudinal plane.

---

3. claims: 34-36(completely); 41-46(partially)

Device for sweeping a stable floor comprising a frame and a brush, wherein the brush comprises a series of brush bristles which are juxtaposed substantially in transverse direction, and the brush is concave in top view.

---

4. claims: 37, 38(completely); 41-46(partially)

Device for removing material, wherein the device comprises a frame and a slide for the material, which slide is connected to the frame, wherein the lower edge of the slide is located in a first horizontal plane, wherein the device is further provided with stationary, bendable brush bristles which extend downwards up to a distance below the first horizontal plane.

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5. claims: 39, 40(completely); 41-46(partially)

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Device for removing material, comprising a frame, a drive for moving the device and at least one manure slide, wherein the manure slide is held by the frame by means of a connection structure, wherein the connection structure comprises a first rotational connection with a first substantially horizontal rotational centre line which is located behind the manure slide.

INTERNATIONAL SEARCH REPORT

— Information on patent family members

International application No
PCT/NL2010/000024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2966256 A	27-12-1960	NONE	
EP 1690450 A	16-08-2006	AT 388630 T	15-03-2008
		DE 602006000662 T2	02-04-2009
		DK 1690450 T3	14-07-2008
		NL 1028259 C2	14-08-2006
		US 2006180089 A1	17-08-2006
DE 202006007378 U	27-07-2006	NL 1033821 C1	12-11-2007
DE 20309156 U1	09-10-2003	NONE	