

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 October 2010 (21.10.2010)

PCT

(10) International Publication Number
WO 2010/120197 A2

(51) International Patent Classification: Not classified
(21) International Application Number:
PCT/NZ2010/000070

(22) International Filing Date:
16 April 2010 (16.04.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
576294 17 April 2009 (17.04.2009) NZ

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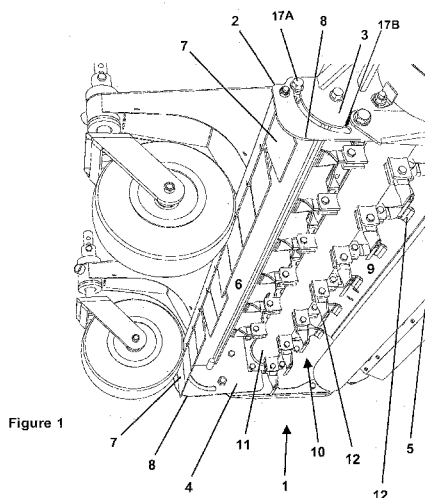
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: A MOWER



(57) Abstract: A flail mower is provided that is capable of cutting plant matter of different lengths. The mower includes a housing providing a cavity, flail mowing blades moveably secured within the cavity, a drive system to control movement of the flail mowing blades within the cavity, and is moveable between a first cutting configuration and a second cutting configuration.



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A MOWER

TECHNICAL FIELD

5 The present invention relates to a mower, and in particular a flail mower.

BACKGROUND ART

Mowers are used to cut grass, weeds, and other plants.

These mowers may either be integral to a vehicle, or an attachment configured to be secured to a vehicle. The vehicles are generally agricultural vehicles such as
10 tractors.

Flail mowers are a particularly important mower due to their versatility.

A flail mower is formed from a substantially horizontal axle mounted within a housing. Mowing blades are suspended from the substantially horizontal axle. A drive system controls rotation of the axle. Centrifugal force causes the mowing
15 blades to be thrown away from the axle.

The mowing blades generally have a flat or curved cross sectional shape, or a T / Y shape. This provides a large cutting area per blade.

Blades are offset from each other to ensure that cutting efficiency is improved and that areas of ground are not missed as a mower moves forward. This accounts for
20 differences in the forward movement of the mower and the rotation of the substantially horizontal axle.

Available flail mowers are used to cut either tall or short plants.

Flail decks for cutting short plant matter have a housing which extends substantially the ground. The housing acts to prevent cut matter and debris from being thrown away from the mower.

5 The shape of the housing facilitates rotation of the axle and blades creating air currents in the housing, and around the axle. Such air movement lifts plant material up, ensuring that it can be properly cut.

10 However once plant matter exceeds a certain height it contacts the mower's housing as the mower moves forward. Accordingly the material is bent over. If the plant matter is long enough the housing may push the matter down. The result is that the mowing blades do not efficiently cut the bent over plant matter. Rather, the blades may just strip leaves / flowers from the plant, and leave unsightly stalks.

15 Accordingly, mowers for cutting long grass and stalky plant material have a plurality of flaps which are pivotally mounted across a channel in the housing. In use the flail deck mower moves forward. Plants to be cut abut the flaps. The flaps pivot allowing the plants into the housing. The pivoting action of the flaps helps to ensure that plant matter is not bent over, which would limit efficiency of the cutting..

However the flaps are still able to prevent cut matter and debris being thrown away from the flail mower. Therefore the use of such an arrangement does not increase health and safety risks.

20 A problem of this type of mower is that the channel limits the creation of air movement to lift short grass into a position at which it can be cut. Therefore flail mowers with moveable flaps are less efficient at cutting short length plant matter.

25 The result of the foregoing is that the same flail mower is not ideal for cutting both tall and short plant matter. This is a significant limitation as contractors and local authorities may require different mowing machines / attachments depending on the

length of plant matter to be cut. This significantly increases the equipment costs. Therefore, it would be an advantage to have a flail mower which addresses the foregoing problems.

In addition, it would be beneficial if a solution to the foregoing problems were cost
5 effective and simple to manufacture.

Alternatively, it is an objective of the present invention to provide the public with a useful choice.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

10 All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a
15 number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

Throughout this specification, the word "comprise", or variations thereof such as "comprises" or "comprising", will be understood to imply the inclusion of a stated
20 element, integer or step, or group of elements integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

25 **DISCLOSURE OF THE INVENTION**

According to one aspect of the present invention, there is provided a flail mower, including a housing providing a cavity,

flail mowing blades moveably secured within the cavity,

a drive system to control movement of the flail mowing blades within the cavity

5 and wherein the mower is moveable between:

(a) a first cutting configuration that is used to cut plant matter with a length in the range of 150 – 1000mm from the ground; and

(b) a second cutting configuration that is used to cut plant matter with a length in the range of 20 – 300mm from the ground.

10. According to one aspect of the present invention, there is provided a mower, including

a housing providing a cavity,

a channel in the housing,

a mowing assembly operatively mounted in the cavity,

15 a drive system configured to control operation of the mowing assembly,

characterised in that the mower is moveable between:

(a) a first cutting configuration providing a rigid barrier across the channel; and

(b) a second cutting configuration providing a plurality of moveable flaps across the channel.

In a preferred embodiment, the present invention relates to a flail mowing attachment configured for connection to a vehicle.

However the present invention may be a mower integral to a vehicle, or a flail mower incorporated into a tractor or ride-on.

- 5 Throughout the present specification, reference to the term "housing" should be understood as meaning a body to which the components of the mower may be mounted.

The housing provides a cavity within which the components of the mower are mounted.

- 10 The cavity is open to ground below the mower in use, thereby allowing the mowing blades to cut plant material. However, the housing prevents debris from being thrown away from the mower by action of the blades. This should become clearer from the following description.

- In this embodiment, the bottom edges of the housing may be substantially near the ground over which the mower may be used. This helps to prevent cut material or debris being thrown away from the mower in-use as the housing provides.
- 15

In a preferred embodiment the housing may have at least one wheel mounted thereon to support the mower.

- The housing may also have rollers, skids at either side of the housing, or two or more wheels to help support the mower.
- 20

In a particularly preferred embodiment the housing may have an attachment assembly.

Throughout the present specification reference to the term "attachment assembly" should be understood as meaning one or more components which can secure the flail mowing attachment to a vehicle.

In a preferred embodiment the mowing attachment may be secured to a tractor
5 using a two point linkage if the mower is front mounted or a three point linkage if rear mounted.

However alternatives are envisaged so long as the attachment can be secured to the vehicle.

Throughout the present specification reference to the term "channel" should be
10 understood as meaning an opening into or through which an object can be directed.

In a preferred embodiment the channel may be an opening in a wall, or between walls, of the housing and into the cavity. The channel may be open to the ground below the mower. In other words, the channel is not bounded at its bottom edge
15 meaning there are no obstructions between the channel and the ground below.

This embodiment allows the mower to pass over plant material being cut while substantially decreasing disturbance of the material which may be caused by contact with the housing were the channel not present. This should become clearer from the following description.

20 In a preferred embodiment, the channel may be forward facing and at the forward most part of the housing in the mower's direction of movement in-use.

However, the foregoing should not be seen as limiting and alternatives are envisaged.

Preferably, the mowing blades may be a flail mowing assembly.

The flail mowing assembly may be a substantially horizontal axle moveably mounted inside the housing. The mowing blades may be secured to the substantially horizontal axle.

- 5 In use, rotation of the substantially horizontal axle causes the mowing blades to rotate around the axle. The centrifugal force created by rotation of the axle causes the mowing blades to be forced outwards.

However, the foregoing should not be seen as limiting as other types of mowing blades are envisaged as suitable for use with the present invention.

- 10 Throughout the present specification reference to the term "drive system" should be understood as meaning an assembly to control operation of the mowing assembly and to rotate the mowing blades.

- 15 Preferably the drive system may be a belt drive connected to a gear box. The gear box may be connected to a drive shaft on a work vehicle or tractor. This is as should be understood by one skilled in the art.

The mower may also include a power take off coupling configured to engage with a work vehicle or tractor. This is as should be known to those skilled in the art.

However, the foregoing should not be seen as limiting and alternatives are envisaged.

- 20 Alternatives envisaged include a hydraulic motor, or an independent electric drive motor.

Throughout the present specification reference to the terms "first and second cutting configurations" should be understood as referring to different configurations of the mower for cutting plant matter of different length from the ground.

Preferably, moving the mower between the first and second configurations does
5 not involve changing the height of mowing blades or a mowing assembly.

In a particularly preferred embodiment the first cutting configuration may have a barrier element in a storage position. In this embodiment the barrier element does not block the channel and does not prevent the flaps pivoting.

This is useful as the flaps may pivot to allow taller plant matter to enter into the
10 housing's cavity without substantially deforming or bending the plant matter.

In a particularly preferred embodiment the second cutting configuration may have a barrier element in an operative position. In this position the barrier element may block a substantial portion of the channel. This is beneficial as the barrier element provides a rigid barrier to substantially cover the channel. This assists movement
15 of the mowing blades in generating air currents with the housing. These currents assist in lifting plant matter to ensure that this is cut by the mowing blades.

Throughout the present specification reference to the term "barrier element" should be understood as meaning a component which can block all or a substantial part of the channel. The barrier element is able to block and provide a rigid barrier across
20 the channel.

In a particularly preferred embodiment this barrier elements extends substantially to the bottom edges of the housing.

In a preferred embodiment the barrier element may extend to within 25 – 50 mm of the bottom of an arc outlined by the mowing blades when rotating in use.

Preferably, the barrier element may be pivotally attached to the housing. Therefore, the barrier may be pivoted to define the first cutting configuration and
5 the second cutting configuration.

Preferably, the barrier element may be manually moved by a person.

It is also envisaged that the mower may include a lever or an actuator such as a hydraulic cylinder or electric actuator. These can move the barrier element with respect to the housing and thereby move the mower between the first and second
10 configurations.

In a preferred embodiment, a locking mechanism can be used to secure the barrier element with respect to the housing and therefore in the first or second configurations.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Further aspects of the present invention will become apparent from the ensuing description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 Is a front bottom perspective view of a mowing attachment in the first cutting configuration;

20 Figure 2 is the view of Figure 1 with the mowing attachment in the second cutting configuration, and

Figure 3 is a back bottom perspective of a mowing attachment in the first cutting configuration;

Figure 4 is the view of Figure 3 with the mowing attachment in the second cutting configuration;

Figure 5 is a top front perspective of the mowing attachment in the first cutting configuration; and

5 Figure 6 is the view of Figure 5 with the mowing attachment in the second cutting configuration.

BEST MODES FOR CARRYING OUT THE INVENTION

There is provided a tractor powered flail mowing attachment (1). Reference will be made herein to the mowing attachment (1).

10 The mowing attachment (1) has a housing (2) with side walls (3, 4) and a back wall (5). A channel (6) is defined by the space between the side walls (3, 4).

Flaps (7) are pivotally mounted to the housing (2). The pivotable mounting of the flaps (7) allows them to swing easily and independently of each other.

The flaps (7) extend across the channel (6). The flaps (7) have a length so that
15 they extend to bottom edge (8) of the side walls (3, 4).

For simplicity only selected flaps (7) are indicated in the drawings by numbering and leader lines. The remaining flaps are shown and equivalent.

The side walls (3, 4), back wall (5), and channel (6) define a cavity generally indicated as (9).

20 A flail mowing assembly (10) is secured inside the cavity (9). The flail mowing assembly (10) is formed from a substantially horizontal axle (11) rotatably mounted within the housing (2).

Flail mowing blades (12) are mounted on the substantially horizontal axle (11).

The mounting of the mowing blades (12) is such that they can pivot freely relative to the axle (11). This is as should be known by those skilled in the art.

A drive system is attached to the axle (11) to control its rotation. The drive system is a belt (not shown) driven by a right angled gear box (not shown). The gear box
5 is powered by a power take off from a tractor (not shown) to which the mowing attachment (1) may be secured.

A barrier element (13) is mounted on an axle (14) which is itself secured to the housing (2). The barrier element (13) is moveable between a first cutting configuration as shown in Figures 1, 3, and 5, and a second cutting configuration
10 as shown in Figures 2, 4, and 6.

To move the barrier element (13) between the first and second configurations a person loosens a nut (15). The nut is moved causing the barrier element to rotate about axle (14). Movement of the nut (15) is guided by a track (16). Once the nut (15) reaches point (17A) the nut (15) is tightened to secure the barrier element (13)
15 with respect to the housing (2). This is the first configuration of the mower.

Note that in the first configuration the barrier element (13) is retracted out of, and away from, the channel (6). This means that the barrier element (13) does not abut long plant matter as the mower moves forward in use. Rather, the plant matter can abut the flaps (7). The flaps (7) pivot to allow the plant matter into the
20 cavity (9) without being substantially deformed or bent over.

The nut (15) can be loosened and then moved along the track (16) to point (17B). The nut is tightened to secure the barrier element (13). This is the second cutting configuration.

In the second cutting configuration the barrier element (13) is across the channel
25 (6). Therefore the barrier element (13) provides a rigid barrier across the channel.

Note that in the second configuration the flaps (7) are maintained in the same position with respect to the housing (2) and channel (6) as in the first configuration.

It should be noted that in the second configuration the barrier element (13) blocks the channel (6) and substantially extends to the bottom edge (8) of the side walls (3, 4).

In use the barrier element (13) is moved to define the first or second cutting configurations. The choice of the cutting configuration will be determined based on the type and length of plant matter to be cut.

The first cutting configuration should be used to cut plant matter with a length in the range of 150 – 1000 mm. The second cutting configuration should be used to cut plant matter with a length in the range of 20 – 300 mm.

The tractor is turned on and the drive system moves the mowing assembly. The substantially horizontal axle rotates in the direction shown by arrow (18) in the Figures.

The mowing blades are forced outwards by centrifugal force created by rotation of the substantially horizontal axle (11).

The tractor moves forward and mowing is performed as should be understood by one skilled in the art.

To mow plant matter of a different length the barrier element (13) is moved to define the other configuration. Again mowing is performed as should be understood by one skilled in the art.

Note that moving the mower (1) between the first and second configurations does not involve changing the height of the mowing blades with respect to the ground.

When cutting in the first configuration the barrier element (13) is substantially away

from the channel (6). Cutting is performed and as the mowing attachment moves over long grass or plant material this abuts the flaps (7). The flaps (7) can pivot to allow plant material to enter the cavity (9) without being substantially deformed or bent over.

- 5 In addition this configuration allows the plant material to be cut efficiently as less air movement is created than with the barrier element (13) blocking the channel (6).

When mowing in the second configuration the barrier element (13) substantially blocks the channel (6). This provides a rigid barrier across the channel (6). This
10 allows the present invention to efficiently cut short length grass and/or plant matter. This is because the housing extends substantially down to the ground underneath the mower, thereby allowing greater and faster air movement to be created by rotation of the axle (11). That air movement lifts grass and plant matter to a position from which it can be cut.

- 15 Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

WHAT WE CLAIM IS:

1. A flail mower, including
a housing providing a cavity,
flail mowing blades moveably secured within the cavity,
a drive system to control movement of the flail mowing blades within the cavity,
and wherein the mower is moveable between:
 - (a) a first cutting configuration that is used to cut plant matter with a length in the range of 150 to 1000mm from the ground;
 - (b) a second cutting configuration that is used to cut plant matter with a length in the range of 20 to 300mm from the ground.
2. The flail mower as claimed in claim 1, wherein moving the flail mower between the first cutting configuration and the second cutting configuration does not involve changing the height of the mowing blades.
3. A mower, including
a housing providing a cavity,
a channel in the housing,
wherein the channel is the forward most part of the housing in the mower's direction of travel when in use,
a mowing assembly operatively mounted within the cavity,

- a drive system configured to control operation of the mowing assembly,
characterised in that the mower is moveable between:
- (a) a first cutting configuration providing a rigid barrier to substantially cover the channel; and
 - (b) a second cutting configuration providing a plurality of moveable flaps across the channel.
4. The mower as claimed in claim 3, wherein the cavity has a bottom edge that is adjacent to the ground over which the mower moves in use.
 5. The mower as claimed in either one of claims 3 or 4, including a barrier element moveably mounted to the housing such that it can be moved to provide the rigid barrier when the mower is in the second configuration.
 6. The mower as claimed in claim 5, wherein the barrier element is locked in position to substantially cover the channel when the mower is in the first configuration.
 7. The mower as claimed in any one of claims 3 to 6, wherein the mowing assembly is flail mower blades mounted on an axle.
 8. The mower as claimed in any one of claims 3 to 7, wherein at least one of the plurality of flaps are configured such that when the mower is in the second cutting configuration the flaps do not substantially deform plant matter to be cut by the mower as it moves forward.
 9. The mower as claimed in any one of claims 3 to 8, wherein the rigid barrier is configured to promote the generation of air currents by movement of the mowing blades in the housing.

10. The mower as claimed in any one of claims 3 to 8, wherein the rigid barrier completely covers the channel when the mower is in the first cutting configuration.
11. The mower as claimed in any one of claims 3 – 10, wherein the plurality of moveable flaps are permanently mounted to the housing.
12. The mower as claimed in any one of claims 3 to 11, wherein the channel is an opening in the housing.
13. The mower as claimed in any one of claims 3 to 12, wherein the opening has an unbounded bottom edge.
14. The mower as claimed in any one of claims 3 to 12, wherein the plurality of moveable flaps are configured to prevent plant material cut by the mower from being thrown from the cavity.
15. The mower as substantially described and illustrated herein by reference to the best modes section of the attached description and drawings.

Figure 1

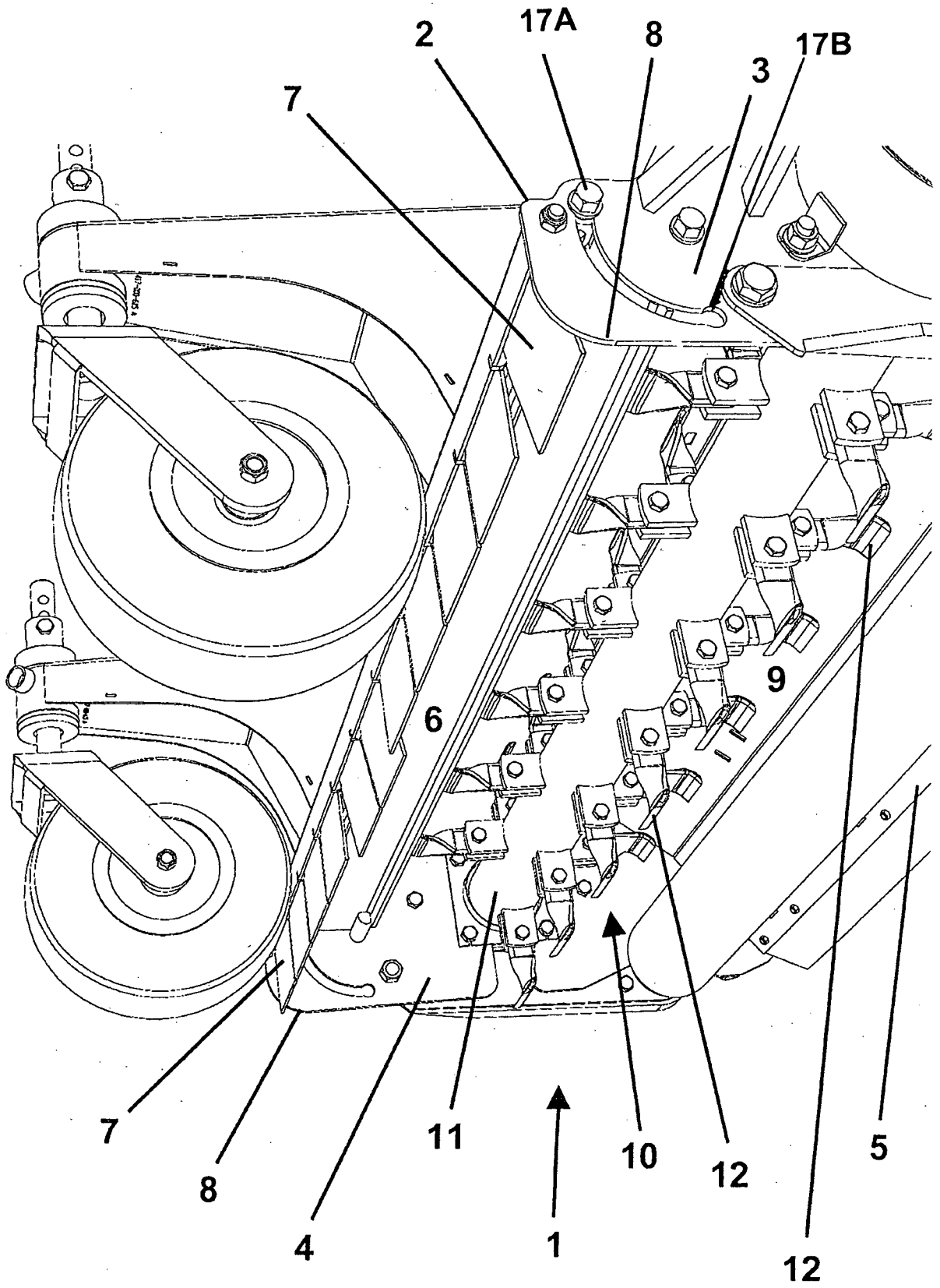


Figure 2

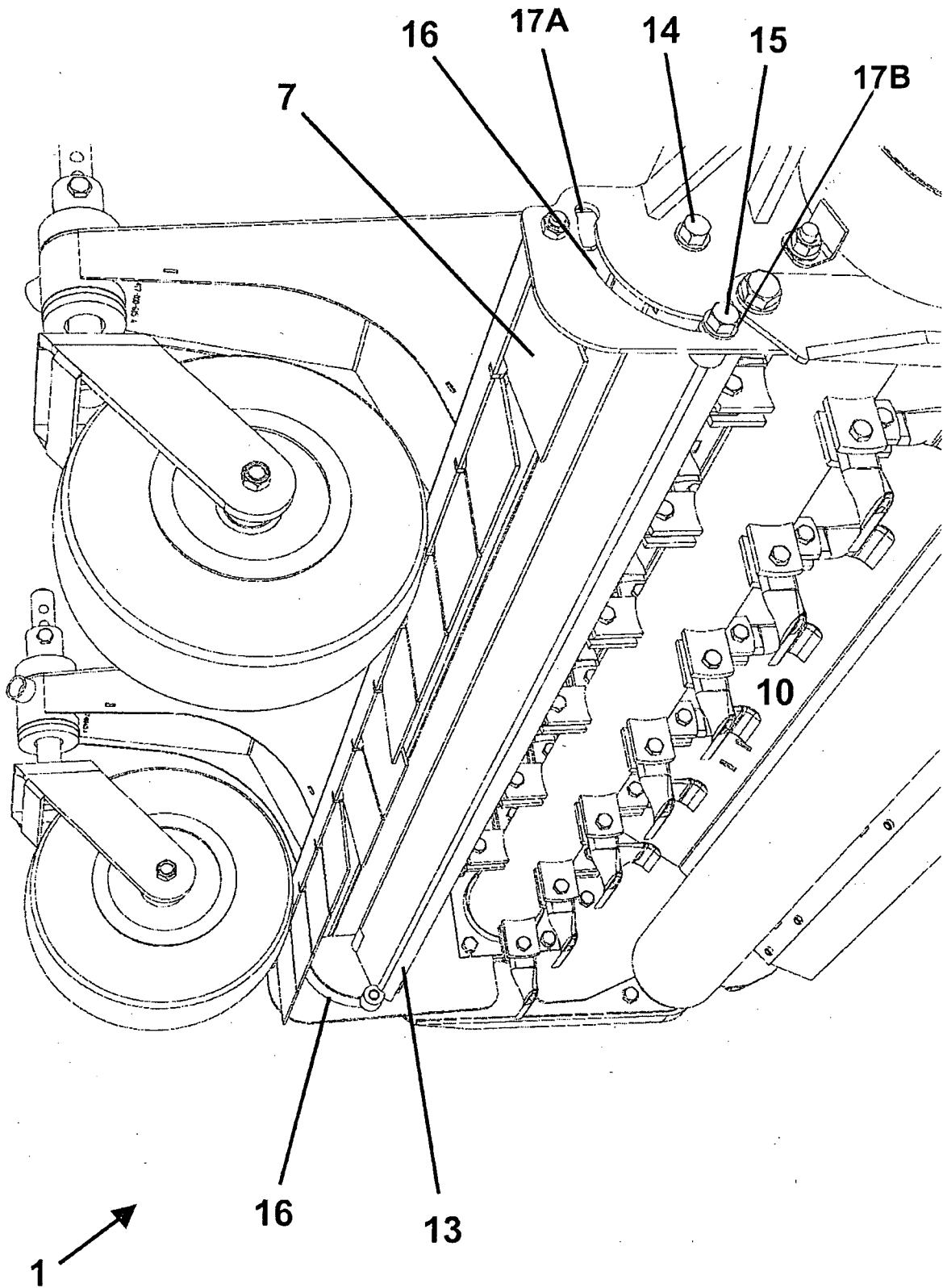


Figure 3

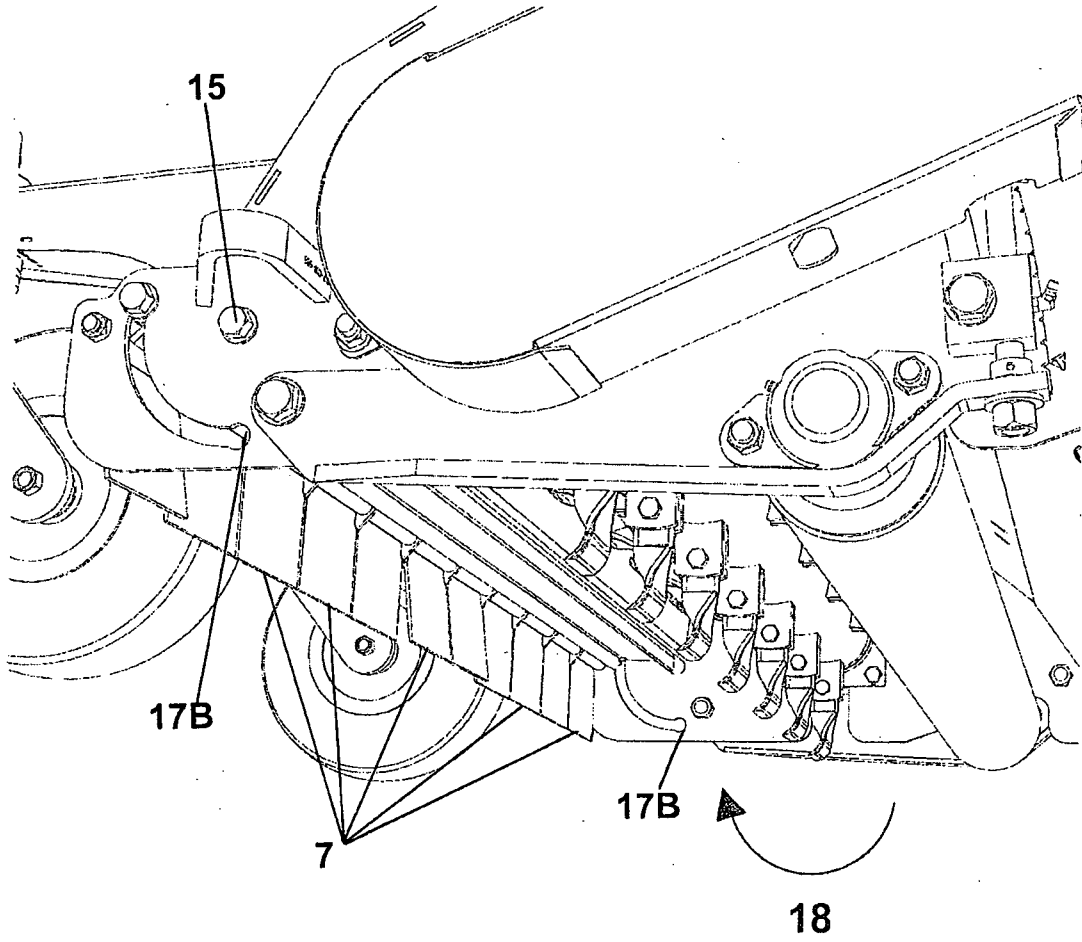


Figure 4

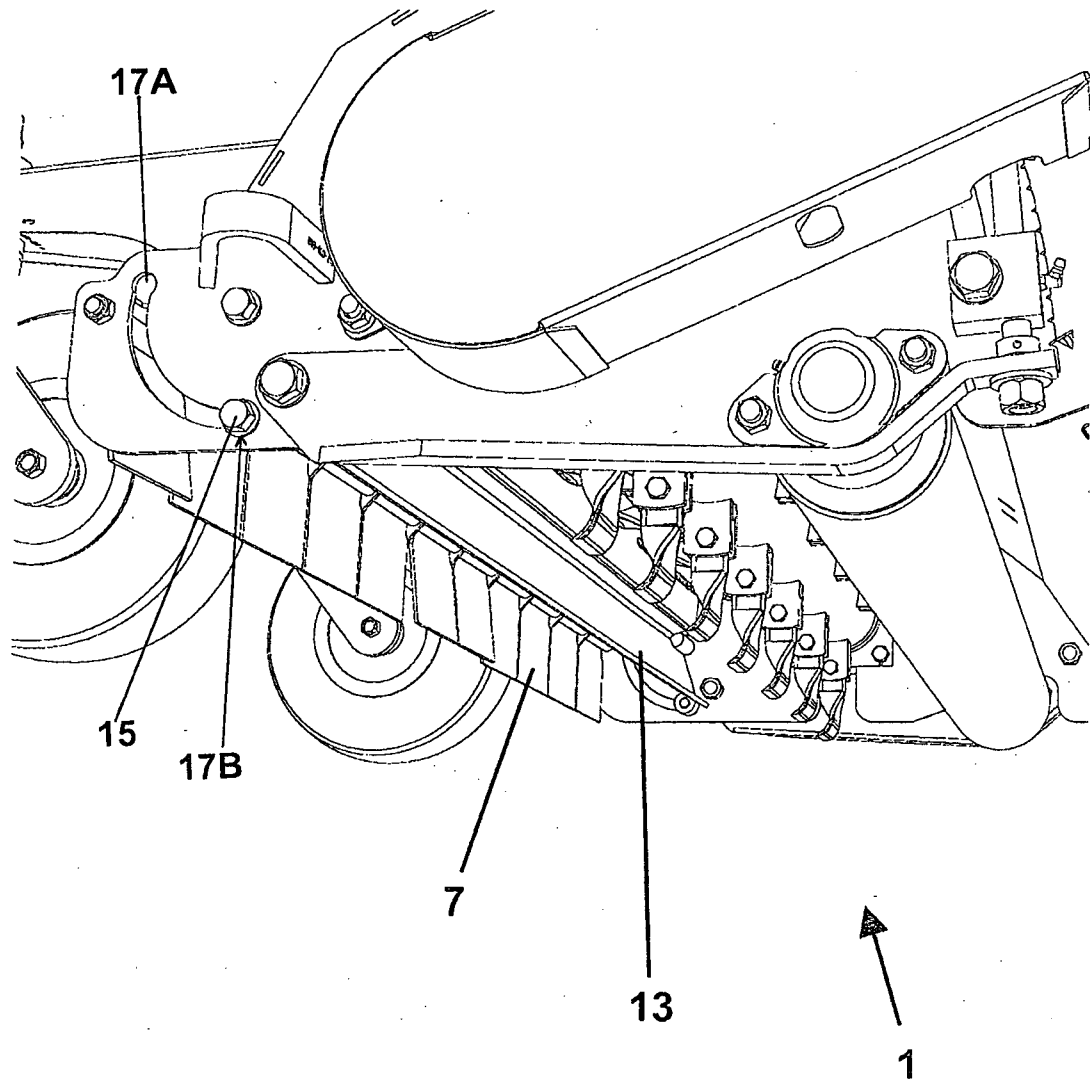


Figure 5

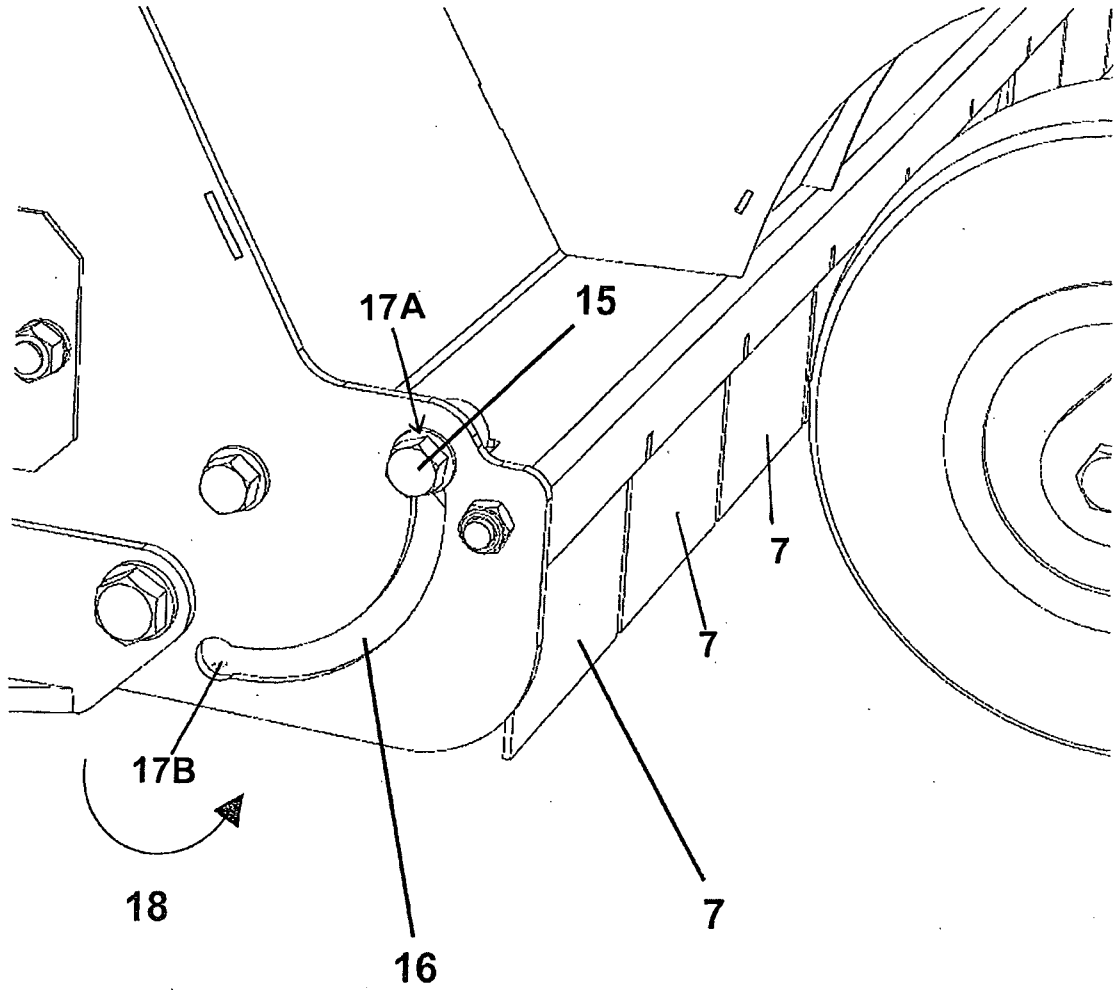


Figure 6

