(19) DANMARK

(10) **DK/EP 3973756 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***A 01 B 63/16 (2006.01)*** ***A 01 B 73/04 (2006.01)*** ***B 60 B 27/00 (2006.01)***
B 60 B 35/10 (2006.01) *A 01 B 73/00 (2006.01)* *A 01 D 57/20 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2024-10-07**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-07-31**

(86) Europæisk ansøgning nr.: **21197028.0**

(86) Europæisk indleveringsdag: **2021-09-16**

(87) Den europæiske ansøgnings publiceringsdag: **2022-03-30**

(30) Prioritet: **2020-09-29 FR 2009865**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Kuhn SAS, 4 impasse des Fabriques, 67700 Saverne, Frankrig**

(72) Opfinder: **HALTER, Cédric, , 67310 WASSELONNE, Frankrig**

(74) Fuldmægtig i Danmark: **Patrade A/S, Ceresbyen 75, 6., 8000 Århus C, Danmark**

(54) Benævnelse: **BUGSERET LANDBRUGSHØSTMASKINE MED JUSTERBAR AKSEL**

(56) Fremdragne publikationer:
EP-A1- 2 042 023
EP-A1- 3 707 983
EP-A2- 2 168 786
DE-A1- 4 407 695
US-A- 5 464 243

Description

Title of the invention: Trailed agricultural harvesting machine with adjustable axle

[0001] The present invention relates to the field of agricultural machinery, more particularly to trailed agricultural harvesting machines, and concerns a two-unit trailed agricultural machine and its implementation method.

[0002] More particularly, the invention relates to a trailed agricultural machine for harvesting a plant product such as grass, normally moving in a direction of advance A.

[0003] Such a machine generally comprises a chassis on which are mounted, on the one hand, an axle device connecting two wheels to the chassis, and, on the other hand, two processing units, each equipped with a respective grouping element. Each processing unit is articulated with the chassis at least around a folding axis so as to be able to selectively occupy at least: i) a working position, in which it extends transversely to a direction of advance and rests at least partially on the ground, ii) a maneuvering position in which its weight is fully supported by the chassis and in which its outer end is further away from the chassis than the outer end of each wheel, and iii) a transport position in which it extends transversely to the rolling axis of the respective wheel.

[0004] A trailed agricultural machine comprising two processing units as described above is known from document EP 2 042 023 A1. Thanks to these two units, this machine has a wide working width, enabling it to harvest an entire field in fewer passes. When the processing units are raised, as for example in the maneuvering (or intermediate) position, the weight of both units (which rests entirely on the wheels) can cause the machine to tip to the side, particularly on slopes and/or tight bends, or on bumpy roads. Such tilting brings the machine to a standstill, and can cause damage to the machine and/or tractor, as well as serious injury to bystanders.

[0005] In addition, the amount of product displaced by the machine, respectively the grouping elements, is proportional to the working width. A wider working

width means that the amount of product displaced by the machine is greater. When the product is directed to the center of the machine by the grouping elements, it is confined by the wheels, chassis and/or axle device. Depending on conditions (size, type, density of standing product, etc.), the volume of product can be such that the swath becomes compacted, resulting in slower, more uneven drying and poorer fodder quality. The wheels also run a greater risk of rolling over the swath, resulting in even greater compacting of the product at the treads.

[0006] The essential aim of the present invention is to overcome the main drawbacks of the above-mentioned known solution, namely to offer an agricultural machine, in particular but not limited to a swather-mower, which compacts the product less or not at all, without compromising its stability, particularly when maneuvering. In addition, this machine should preferably not have an increased width or length during transport.

[0007] To this end, an important feature of the invention is that, in an agricultural machine as presented in the introduction, the axle device is configured in such a way that the distance between wheels is adjustable, at least between a tight configuration and a spaced configuration of these wheels.

[0008] The invention will be better understood through the following description, which refers to preferred embodiments given as non-limiting examples and explained with reference to the attached schematic drawings, in which:

[0009] [Fig. 1] is a schematic top view of an agricultural machine, in the form of a swather-mower as an illustrative example, with an axle device and two processing units according to the invention;

[0010] [Fig. 2] is a front elevation view, on a different scale, of the agricultural machine shown in Fig. 1, with both processing units in the maneuvering position;

[0011] [Fig. 3] is a top view, at a different scale, of the agricultural machine shown in Figures 1 and 2, with both processing units in the transport position;

[0012] [Fig. 4] is a top view of a combination comprising a tractor to which is coupled another embodiment variant of the agricultural machine shown in Figures 1 to 3, this machine being in the maneuvering position, with a front-end machine also being coupled to the tractor;

[0013] [Fig. 5A] and

[0014] [Fig. 5B] are partial bottom views, at different scales, of the axle device forming part of the agricultural machine of Figures 1 to 3, with the wheels in the tight (5A) and spaced (5B) positions respectively;

[0015] [Fig. 6] is a partial cross-sectional view, in a vertical plane including the swivel axes of the wheels and the longitudinal axes of the movable parts, of an embodiment variant of the axle device of an agricultural machine as shown in Figures 1 to 4, with the wheels in the spaced configuration (as in Figure 5B);

[0016] [Fig. 7] is a top view of an embodiment variant of the agricultural machine shown in Figures 1 to 3, in which the spacing between grouping elements is greater, and

[0017] [Fig. 8] is a top view of an agricultural machine of the same type as shown in Figures 1 to 3, comprising an axle device and a wheel-distance adjustment device in accordance with another embodiment of the invention.

[0018] Figures 1 to 4, 7 and 8 show an agricultural machine (1) for harvesting a plant product such as grass or the like. During work, the machine (1) is moved in a direction of advance (A). This trailed machine (1) comprises a chassis (2) on which is mounted an axle device (4) connecting two wheels (5, 5') to the chassis (2). Also mounted on the chassis (2) are two processing units (20, 20'), each equipped with a grouping element (14, 14'). Each processing unit (20, 20') is articulated with the chassis (2) at least around a folding axis (30, 30') so as to be able to selectively occupy one position from at least: a work position in which it extends transversely to the direction of advance (A) and rests at least partially on the ground (S), a maneuvering position in which its weight is entirely supported by the chassis (2) and in which its outer end (21, 21') is further away from the chassis (2) than the

outer end (27, 27') of each wheel (5, 5'), and a transport position in which it extends transversely to the rolling axis (AR, AR') of the respective wheel (5, 5'). To say that a processing unit (20, 20') extends in one direction is to say herein that its longitudinal or main dimension extends in the said direction.

[0019] As can be seen from Figures 1 and 3, the first processing unit (20) and the second processing unit (20') are mounted on the chassis (2) and articulated with it around a respective folding axis (30, 30'). The chassis (2), respectively the machine (1), is crossed by a midplane (M) parallel to the direction of advance (A). The midplane (M) divides the said machine (1) into two substantially identical halves and thus constitutes at least globally a plane of symmetry. The second processing unit (20') is located on the opposite side of the chassis (2), respectively of the midplane (M), compared to the first unit (20). The second processing unit (20') is substantially identical to the first processing unit (20). It is mounted on the chassis (2) symmetrically to the first processing unit (20) with respect to the midplane (M). The chassis (2), respectively its longitudinal dimension, preferably extends parallel to the direction of advance (A). Each wheel (5, 5') can be pivoted relative to the chassis (2) around its respective rolling axis (AR, AR').

[0020] Each folding axis (30, 30') is transverse to the direction of advance (A), at least in the work position of the respective processing unit (20, 20'). Preferably, each folding axis (30, 30') is substantially parallel to the direction of advance (A) in the work position of the respective processing unit (20, 20').

[0021] Each processing unit (20, 20') is equipped with a respective grouping element (14, 14'). The grouping element (14, 14') is intended to move the product transversely to the direction of advance (A). Each grouping element (14, 14') is configured to deposit the product on the ground (S) in a swath longitudinal to the direction of advance (A). On most trailed machines (1) of this type, the grouping elements (14, 14') can deposit the product on the ground (S) between them, and preferably between the wheels (5, 5'). In this case, we speak of central deposition. In Figure 1, each processing unit (20, 20') occupies a work position in which it extends transversely, and preferably

orthogonally, to the direction of advance (A) and rests at least partially on the ground (S).

[0022] In Figures 2 and 4, each processing unit (20, 20') occupies a maneuvering position in which it extends transversely to the direction of advance (A). The maneuvering position of the processing units (20, 20') allows easy movement between two work phases without disturbing the surfaces already processed, and enabling movements that would be impossible in a work position of a unit (20, 20'). In the maneuvering position, the outer end (21, 21') of a processing unit (20, 20') is further away from the chassis (2), respectively from the midplane (M), than the outer end (27, 27') of each wheel (5, 5'). Moreover, in this position, the weight of each processing unit (20, 20') is fully supported by the chassis (2). In other words, the processing unit (20, 20') in question is not in contact with the ground (S). In the maneuvering position, the outer end (21, 21') of a processing unit (20, 20') is preferably further away from the ground (S) than its inner end (22, 22'), increasing the risk of tipping.

[0023] In Figure 3, each processing unit (20, 20') occupies a transport position in which it extends transversely to the rolling axis (AR, AR') of the respective wheel (5, 5'). In a simple design, the rolling axes (AR, AR') of the two wheels (5, 5') are orthogonal to the direction of advance (A). The rolling axes (AR, AR') are preferably coincident. In the transport position, each processing unit (20, 20') preferably extends parallel to the direction of advance (A), at least when viewed from above.

[0024] In accordance with the invention, the machine (1) is characterized in that the axle device (4) is configured in such a way that the distance (EV) between wheels (5, 5') is adjustable, at least between tight and spaced configurations. The wheels (5, 5') can thus selectively occupy at least one tight configuration and one spaced configuration. In the spaced configuration, the distance (EV) between wheels (5, 5') is greater than in the tight configuration. The distance (EV) between the wheels (5, 5') is measured transversely to the direction of advance (A), and preferably parallel to the rolling axes (AR, AR') of the wheels (5, 5').

[0025] The fact that, in the maneuvering position of at least one processing unit (20, 20'), its or their weight is entirely supported by the chassis (2) and that, in addition, the outer end (21, 21') of the said processing unit (20, 20') is further away from the chassis (2) than the outer end (27, 27') of each wheel (5, 5'), means that the machine (1) presents an increased risk of tipping over. This drawback is not considered in the aforementioned document EP 2 042 023. However, this risk is reduced (in the maneuvering position) by increasing the distance (EV) by moving at least one wheel (5, 5') relative the chassis (2). Tipping or tilting over means that one of the wheels (5, 5') is no longer in contact with the ground (S). After tilting over, the machine (1) rests on one of the processing units (20, 20'), thus damaging the plant cover on the ground (S). The tilting over of the machine (1) therefore slows down the agricultural operation. It can also cause damage, particularly to the machine (1), or even injury.

[0026] In accordance with a first construction variant of the invention, the machine (1) comprises at least one joint (8, 8') incorporating a rod (9, 9') articulated, on the one hand, with one or each wheel (5, 5') and, on the other hand, with the chassis (2), the adjustment of the distance (EV) between wheels (5, 5') being achieved by pivoting the said joint (8, 8').

[0027] In accordance with a second construction variant of the invention, the axle device (4) comprises a fixed part (7) rigidly fastened to the chassis (2), or integrated therein, and at least one movable part (6, 6'), the distance (EV) between the wheels (5, 5') being adjusted by sliding the or each movable part (6, 6') relative to the fixed part (7).

[0028] In accordance with a third construction variant of the invention, the machine (1) comprises at least one pivoting joint (8, 8') incorporating a linkage rod (9, 9') and an axle device (4) with a fixed part (7) and at least one movable part (6, 6') mounted so as to be able to slide relative to the said fixed part (7). This third variant thus combines the means of the above-mentioned first and second variants.

[0029] In connection with the above-mentioned second or third variant, it is advantageously provided that each wheel (5, 5') is rigidly fastened to a

respective movable part (6, 6') of the axle device (4), which movable part (6, 6,) is connected so as to be able to slide along a corresponding longitudinal axis (AL, AL') transversely to the direction of advance (A) to a fixed part (7) of the said axle device (4) rigidly fastened to the chassis (2), the distance (EV) between the wheels (5, 5') being adjustable by sliding at least one of the said movable parts (6, 6') relative to the said fixed part (7). This fixed part (7) may also constitute an element belonging to the said chassis (2).

[0030] As previously indicated, the wheels (5, 5') occupy a spaced configuration in the maneuvering position of at least one processing unit (20, 20'), advantageously reducing the risk of the machine (1) tilting over, particularly on slopes and/or when making sharp turns, thus improving the safety of the machine (1) during use.

[0031] The wheels (5, 5') also occupy the spaced configuration in the work position of at least one processing unit (20, 20'), enabling the machine (1), respectively the grouping elements (14, 14'), to deposit a greater volume of product between the wheels (5, 5') while reducing the risk of the wheels (5, 5') rolling over it. As a result, the product is less compacted and dries more quickly and evenly. Ultimately, this improves fodder quality. In addition, the product from one grouping element (14, 14') is not or is less intermingled with that from the other grouping element(s) (14, 14'), which facilitates easy pickup by a machine equipped with a pickup device of the type known as a "pickup".

[0032] When the processing units (20, 20') are in the transport position, the wheels (5, 5') occupy the tight configuration to comply with road traffic regulations.

[0033] The use of two processing units (20, 20') increases the working width of the machine (1) and therefore its productivity. Providing an arrangement of the two processing units (20, 20') with a gap (I) between the grouping elements (14, 14') in the work position furthermore makes it possible to use the machine in an agricultural combination which also has a front-end processing unit (24). Such a combination with a trailed machine (1) coupled to the rear of a tractor (T) to which a front-end processing unit (24) is also

coupled is illustrated in Figure 4. Preferably, the front-end processing unit (24) also comprises a central grouping element (25) arranged to deposit the product between the wheels (5, 5') of the trailed machine (1). As can be seen from Figure 4, in the spaced configuration of the wheels (5, 5'), the distance (EV) between the wheels (5, 5') is substantially equal to the width of the tractor (T).

[0034] As shown in Figure 4, the machine (1) is designed to be trailed by the tractor (T) in the direction of advance (A). For this purpose, it is connected to the tractor (T) by a coupling device (3), preferably located at the front of the machine (1). In the work and maneuvering position, each processing unit (20, 20') is located in front of the wheels (5, 5'), as seen according to the direction of advance (A). In the transport position (Figure 3), the processing units (20, 20') are located above the wheels (5, 5'), according to a side view. To ensure good stability, the wheels (5, 5') are moreover located on either side of the chassis (2). The wheels (5, 5') are also located laterally beyond the chassis (2), respectively at a distance on either side of the midplane (M). The concepts of "inner" and "outer" are to be considered in relation to the chassis (2), respectively in relation to the midplane (M). In relation to the direction of advance (A), "inner" and "outer" are to be considered laterally. In the present document, these concepts are considered in the work position of the processing unit (20, 20') concerned.

[0035] In the preferred embodiment, each of the wheels (5, 5') can be displaced, along the respective rolling axis (AR, AR'), by a distance at least equal to half the width (L5, L5') of the respective wheel (5, 5'). More preferably, each wheel (5, 5') can be displaced, along the respective rolling axis (AR, AR'), by a distance at least equal to three-quarters of the respective width (L5, L5'), and even more preferably at least equal to the width (L5, L5') of the respective wheel (5, 5').

[0036] In the work and maneuvering positions of the machine (1), the total width (LT) of the machine (1) is defined by the distance between the outer ends (21, 21') of the processing units (20, 20'). In the transport position, the total width (LT) of the machine (1) is advantageously at most equal to the base

distance (LE) between the outer ends (27, 27') of the wheels (5, 5'). The total width (LT) of the machine (1) is orthogonal to the direction of advance (A). Preferably, each rolling axis (AR, AR') of the wheels (5, 5') is parallel to the total width (LT) of the machine (1). Preferably, in the maneuvering or work position of the processing units (20, 20'), the total width (LT) of the machine (1) is greater than 8 meters, preferably greater than 10 meters, and even more preferably greater than 12 meters.

[0037] The distance separating the outer ends (27, 27') of the wheels (5, 5') is called the base distance (LE). To ensure optimized stability with a construction resulting in an increased working width, it is advantageously provided that, in the spaced configuration of the wheels (5, 5') and in the maneuvering position of the processing units (20, 20'), the base distance (LE) is greater than one fifth of the total width (LT) of the machine (1). Preferably, in the spaced configuration of the wheels (5, 5'), the base distance (LE) is greater than a third of the total width (LT), and even more preferably greater than a quarter of the total width (LT) of the machine (1).

[0038] It can be seen from the above that only one of the two processing units (20, 20') can be in the maneuvering position. In this case, the processing unit (20, 20') not in the maneuvering position can be in either the work position or the transport position. In fact, with only one processing unit (20, 20') in the maneuvering position, the machine (1) is unbalanced. The greater the total width (LT) of the machine (1), the greater the imbalance. On this trailed machine (1) with a single processing unit (20, 20') in the maneuvering position, with the center of gravity of the machine (1) remote from the midplane (M) and/or the chassis (2), in a direction parallel to the rolling axis (AR, AR') of the wheels (5, 5'), the machine (1) is less stable. Thus, on a machine (1) where only one of the two processing units (20, 20') can be in the maneuvering position, it is all the more important to ensure its stability.

[0039] Furthermore, on such a machine (1) with at least one processing unit (20, 20') in maneuvering position, the greater the base distance (LE), the less risk of the machine (1) tipping over. Therefore, the lower the ratio of the total width (LT) to the base distance (LE), the more stable the machine (1) will be

with at least one processing unit (20, 20') in the maneuvering position. Preferably, in the spaced wheel (5, 5') configuration and with a total width (LT) greater than 10 meters, the base distance (LE) separating the outer ends (27, 27') of the wheels (5, 5') is greater than 3 meters, preferably greater than 3.5 meters, and even more preferably greater than 4 meters. More specifically, when a single processing unit (20, 20') is in the maneuvering position and the total width (LT) of the machine (1) is greater than 10 meters, the base distance (LE) separating the outer ends (27, 27') of the wheels (5, 5') is greater than 3 meters.

[0040] As shown in Figure 5B, each wheel (5, 5') has a respective width (L5, L5'). Preferably, the widths (L5, L5') of the wheels (5, 5') are equal. Each wheel (5, 5') can be made in one piece, or can be formed by combining several casters (60) of equal diameter and assembled together. In this case, the width (L5, L5') of a wheel (5, 5') is taken to be the sum of the widths of the individual casters (60) that make it up. The width (L5, L5') of each wheel (5, 5') is related to the weight of the processing units (20, 20'). A minimum width (L5, L5') is required in order not to exert too much pressure on the ground (S), thus avoiding compacting the ground (S) and/or damaging the plant cover. Note that the base distance (LE) is equal to the sum of the distance (EV) between wheels (5, 5'), the width (L5) of the first wheel (5) and the width (L5') of the second wheel (5'). In the tight configuration, the base distance (LE) is less than 4 meters, more preferably less than 3.5 meters, and even more preferably less than 3 meters.

[0041] As can be seen from Figures 5A and 5B, the switch from the tight configuration to the spaced configuration involves advancing the or each swivel axis of the wheels (5, 5') relative to the corresponding longitudinal axis (AL, AL'). Because of the joint(s) (8, 8') between the movable part(s) (6, 6') and the fixed part (7), this switch from the tight configuration to the spaced configuration also involves lowering the or each longitudinal axis (AL, AL'). As can be seen from the above, the chassis (2) is lower in the spaced configuration than in the tight configuration. This makes the machine (1) even more stable in the spaced configuration. In the maneuvering position, with the distance (EV) between wheels (5, 5') set to the spaced configuration,

the machine's center of gravity (1) is lower in the maneuvering position than in the transport position. This makes the machine (1) even more stable in the maneuvering position.

[0042] In order to make it possible to increase the volume of product grouped between the wheels (5, 5') without compacting the swath, it is advantageously provided that, in the spaced configuration of the wheels (5, 5'), the distance (EV) between wheels (5, 5') is greater than a sixth of the total width (LT) of the machine (1). Preferably, in the spaced configuration of the wheels (5, 5'), the distance (EV) between wheels (5, 5') is greater than a quarter of the total width (LT), and even more preferably greater than a third of the total width (LT) of the machine (1). As can be seen from Figure 4, in the spaced configuration of the wheels (5, 5'), the distance (EV) between the wheels (5, 5') is substantially equal to the distance between the wheels of the tractor (T).

[0043] In accordance with one embodiment of the invention, and as shown in particular in Figures 5, 6 and 7, the machine (1) comprises at least one adjustment control actuator (11, 11') configured to adjust the distance (EV) between the two wheels (5, 5'). Of course, the or each adjustment control actuator (11, 11') influences the base distance (LE) separating the outer ends (or faces) (27, 27') of the said wheels (5, 5'). As illustrated, the or each adjustment control actuator (11, 11') is made by at least one cylinder, preferably translating and hydraulic. To prevent damage to the plant cover, the or each adjustment control actuator (11, 11') is activated as the machine (1) advances. Therefore, the or each adjustment control actuator (11, 11') is preferably controllable from the tractor (T).

[0044] In the embodiment shown in Figure 6, a single adjustment control actuator (11) is rigidly fastened to each of the wheels (5, 5'), respectively connects the two movable parts (6, 6'). In the preferred embodiment (Figures 5), the machine (1) has two adjustment control actuators (11, 11'). Each adjustment control actuator (11, 11') is rigidly fastened to the corresponding movable part (6, 6') on the one hand, and to the chassis (2), respectively the fixed part (7), on the other hand.

[0045] As shown in Figure 7, the gap (I) is the distance between the two grouping elements (14, 14'). The machine (1) includes at least one adjustment control actuator (23, 23') for the gap (I) between the two grouping elements (14, 14'). Preferably, each processing unit (20, 20') has its own transverse actuator (23, 23'). Adjustment of the gap (I) between the grouping elements (14, 14') is preferably carried out independently of the adjustment of the distance (EV) between the wheels (5, 5'). For example, the adjustment of the gap (I) between the grouping elements (14, 14') can vary between 2 and 4 meters.

[0046] Figure 7 also shows that the machine (1) can be fitted with two deflector plates (26, 26') rigidly fastened to the chassis (2), to further prevent swaths from becoming entangled. Each is preferably associated with the grouping element (14, 14') of a processing unit (20, 20'). Each deflector plate (26, 26') extends substantially orthogonally to the ground (S). Each deflector plate (26, 26') is oriented in the direction of advance (A). Preferably, the rear end (28, 28') of each deflector plate (26, 26') is further away from the midplane (M) than the front end of the deflector plate (26, 26') concerned, when viewed from above. Each deflector plate (26, 26') thus preferably forms an angle with the midplane (M) of between 10° and 30°. The rear end (28, 28') of each deflector plate (26, 26') lies between the inner end of the respective grouping element (14, 14') and the midplane (M), when viewed from above and in the work position of the processing unit (20, 20') concerned. Such an orientation enables the deflector plates (26, 26') to deposit the product on either side of the product deposited by the central grouping element (25) of the front-end machine (24) and, by thus avoiding interference between the different swaths, the aforementioned plates contribute to the formation of a wider, more airy swath.

[0047] Each processing unit (20, 20') is also equipped with a respective harvesting element (16, 16') located in front of the associated grouping element (14, 14'), at least in the work position of the processing unit (20, 20') concerned. In the case of a swather-mower, each harvesting element (16, 16') is a mowing element designed to mow the standing product. Alternatively or additionally, each processing unit (20, 20') can be equipped

with a roller fitted with fingers on the periphery, such as a conditioning implement mounted between the mowing element and the grouping element (14, 14'). In the case of a windrower type trailed machine (1) (not shown), the roller is a means of picking-up the product from the ground (S) arranged at the front of the associated grouping element (14, 14').

[0048] As shown in Figure 6, in the preferred embodiment, the axle device (4) connecting the two wheels (5, 5') to the chassis (2) is a telescopic axle. Preferably, each wheel (5, 5') is rigidly fastened to a movable part (6, 6') which is connected so as to be able to slide along a respective longitudinal axis (AL, AL') transverse to the direction of advance (A), to a fixed part (7) rigidly fastened to the chassis (2). Preferably, each wheel (5, 5') is rigidly fastened to the corresponding movable part (6, 6') via a respective hub (10, 10') with a corresponding rolling axis (AR, AR'). The distance (EV) between wheels (5, 5') can be adjusted by sliding at least one, and preferably both, movable parts (6, 6') relative to the fixed part (7) along the associated longitudinal axis (AL, AL'). At least in the spaced configuration, the longitudinal axes (AL, AL') are located above the axes (AR, AR') of the hubs (10, 10') so as to increase the surface delimited by the ground (S), the wheels (5, 5') and the axle device (4), thereby reducing compacting of the product deposited on the ground (S). Preferably, the longitudinal axes (AL, AL') of the movable parts (6, 6') are aligned with each other. In the preferred embodiment, the longitudinal axes (AL, AL') are parallel to the rolling axes (AR, AR') of the wheels (5, 5').

[0049] Such a simple, stress-resistant construction of the axle device (4) makes it possible to maintain a reasonable diameter and width of the wheels (5, 5'), while at the same time allowing a larger product to be deposited, but without being packed or compacted.

[0050] According to the preferred embodiment, each movable part (6, 6'), with its corresponding longitudinal axis (AL, AL'), is further mechanically connected to the chassis (2) by a respective joint (8, 8'), each of the said joints (8, 8') being articulated, on the one hand, with the movable part (6, 6')

by a first articulation (12, 12') and, on the other hand, with the chassis (2) by a second articulation (13, 13').

[0051] In an alternative embodiment not shown, the or each joint (8, 8') comprises an actuator, for example of the hydraulic cylinder type, in addition to the adjustment control actuator (11, 11'), and which is configured to pivot the corresponding movable part (6, 6') around the corresponding longitudinal axis (AL, AL'), so as to advance the respective rolling axis (AR, AR') and/or so as to lower the respective longitudinal axis (AL, AL').

[0052] As each joint (8, 8') is rigidly fastened to the corresponding movable part (6, 6'), it should be noted that, in an alternative embodiment shown in Figure 8, the or each adjustment control actuator (11, 11') can also be articulated with the joint (8, 8') so as to be rigidly fastened to the wheel (5, 5'), on the one hand, and be rigidly fastened to the chassis (2), on the other hand.

[0053] An axle device (4) with the above mentioned features is described in greater detail in the French patent application filed today under number FR2009860, the contents of which are incorporated herein by reference.

[0054] According to a preferred embodiment of the invention, the two wheels (5, 5') are moved apart simultaneously and symmetrically (with the same amplitude) as soon as a processing unit (20, 20') switches from the transport position to another position (maneuvering or work position). The switch from the transport position to one of the maneuvering and work positions of each processing unit (20, 20') can be detected by a position sensor of the or of each adjustment control actuator (11, 11'), or even by a position sensor between each processing unit (20, 20') and the chassis (2).

[0055] In the preferred embodiment, the chassis (2) comprises a rocker (32) articulated with a central beam (33) around an elevation axis (34). The elevation axis (34) is parallel to the rolling axes (AR, AR') of the wheels (5, 5'). The central beam (33) thus forms part of the chassis (2). Each processing unit (20, 20') is articulated to the rocker (32) around a respective folding axis (30, 30'). In the transport position, the rocker (32) is oriented vertically. As shown in Figure 3, the folding axes (30, 30') are also oriented vertically in the transport position of the processing units (20, 20'). In order

to switch a processing unit (20, 20') from the transport position to the maneuvering and/or work position, the rocker (32) is pivoted relative to the central beam (33) from a vertical position to a horizontal position around the elevation axis (34).

[0056] In addition, a folding actuator (31, 31') is associated with each processing unit (20, 20') and is configured to make it pivot around the respective folding axis (30, 30'). The folding actuator (31, 31') thus enables a processing unit (20, 20') to be transposed at least between the work and maneuvering positions. In the work position, the or each folding actuator (31, 31') is configured to allow each processing unit (20, 20') to pivot relative to the chassis (2) around the respective folding axis (30, 30'), depending on differences in the level of the ground (S). Each folding actuator (31, 31') is fixed, on the one hand, to the corresponding processing unit (20, 20') and, on the other hand, to the chassis (2), respectively to the rocker (32).

[0057] In a simple embodiment, to switch a processing unit (20, 20') from its work position to a maneuvering position, the said processing unit (20, 20') is pivoted upwards around the respective folding axis (30, 30'), preferably through an angle of between 5° and 40°. And, to switch it from its maneuvering position to the transport position, the processing unit (20, 20') in question continues to pivot around the folding axis (30, 30') until it reaches a position in which it is oriented substantially perpendicular to the ground (S). In this embodiment, to switch a processing unit (20, 20') from its transport position to the work position, the aforementioned pivotings are performed in the opposite direction. However, in this embodiment, with processing units (20, 20') of considerable longitudinal dimensions, not all the standards of the highway code are necessarily met, particularly those concerning the height of the machine (1) during transport.

[0058] In a further embodiment shown in Figure 8, it can be provided that only one of the wheels (5, 5') may be moved away from the chassis (2), respectively the midplane (M), in the spaced configuration. The same wheel (5 or 5') can be moved away from the chassis (2) regardless of the processing unit (20, 20') in the maneuvering or work position. Alternatively,

it can be provided that, as soon as a processing unit (20, 20') is in the maneuvering position, the wheel (5, 5') closest to the unit in maneuvering position can be moved away from the midplane (M).

[0059] Nevertheless, in order to ensure greater stability in most cases, in the preferred embodiment each of the wheels (5, 5') is at the same distance from the chassis (2) in the spaced configuration of the wheels (5, 5'). Preferably, in the spaced configuration, each of the wheels (5, 5') is at the same distance from the midplane (M).

[0060] The invention also relates to a method for implementing a trailed agricultural machine (1) for harvesting a plant product such as grass, the said machine comprising a chassis (2) on which are mounted an axle device (4) connecting two wheels (5, 5') to the chassis (2), and two processing units (20, 20') equipped with a respective grouping element (14, 14').

[0061] Each processing unit (20, 20') is articulated with the chassis (2) at least around a folding axis (30, 30') so as to be able to selectively occupy at least: a work position in which it extends transversely to a direction of advance (A) and rests at least partially on the ground (S), a maneuvering position in which its weight is entirely supported by the chassis (2) and in which its outer end (21, 21') is further away from the chassis (2) than the outer end (27, 27') of each wheel (5, 5'), and a transport position in which it extends substantially transversely to the rolling axis (AR, AR') of the respective wheel (5, 5').

[0062] The said method involves, once at least one processing unit (20, 20') is switched into the maneuvering position, moving the wheels (5, 5') apart from one another, in particular by switching them from a tight configuration to a spaced configuration. In other words, once at least one processing unit (20, 20') is transferred to the maneuvering position, the distance (EV) between wheels (5, 5') is set to the spaced configuration of the wheels (5, 5'), possibly automatically. Such a method makes it possible to ensure the stability of the machine (1) once a risk of tipping it over is present. Switching between the tight and spaced configurations, automatically controlled when at least one processing unit (20, 20') is switched into the maneuvering position, has the

advantage of ensuring safe operation of the machine (1) if the driver should forget to adjust the distance (EV) between the wheels (5, 5'), and avoids the need for additional action.

[0063] The method for implementing the machine (1) also consists in automatically adjusting the distance (EV) between wheels (5, 5') in the spaced configuration, once at least one processing unit (20, 20') is switched into the work position. The method for implementing the machine (1) also consists in automatically adjusting the distance (EV) between wheels (5, 5') in the spaced configuration, once both processing units (20, 20') are in the work or maneuvering position.

[0064] Conversely, the method for implementing the machine (1) also consists in automatically adjusting the distance (EV) between wheels (5, 5') in the tight configuration, once both processing units (20, 20') are in the transport position. Switching from the spaced configuration into the tight configuration, and more generally an (automatic) adjustment in the tight configuration, is automatically controlled when both processing units (20, 20') are in the transport position. This has the advantage of ensuring that the machine (1) has a reduced width, ensuring safe operation of the machine (1) if the driver should forget to adjust the distance (EV) between the wheels (5, 5'), and also avoids the need for additional action.

[0065] Obviously, the invention is not limited to the embodiments described and shown in the attached drawings. Modifications remain possible, in particular as regards the composition of the various elements or the substitution by technical equivalents without however departing from the scope of protection of the claims.

Patentkrav

1. Bugseret landbrugsmaskine (1) til høst af et planteprodukt som f.eks. græs, hvor maskinen omfatter et chassis (2), hvorpå der dels er monteret en akselanordning (4), der forbinder to hjul (5, 5') med chassiset (2), og dels to behandlingsenheder (20, 20'), der hver er udstyret med et respektive grupperingselement (14, 14'), idet hver behandlingsenhed (20, 20') er leddelt med chassiset (2) mindst omkring en foldeakse (30, 30') for selektivt at kunne indtage mindst i) en arbejdsstilling, hvor den strækker sig på tværs af en fremføringsretning (A) og hviler i det mindste delvist på jorden (S), ii) en manøvreposition, hvor dens vægt er fuldt understøttet af chassiset (2), og hvor dens ydre ende (21, 21') er længere væk fra chassiset (2) end den ydre ende (27, 27') af hvert hjul (5, 5'), og iii) en transportposition, hvor den strækker sig på tværs af hjulaksen (AR, AR') for det respektive hjul (5, 5'),

landbrugsmaskine (1), kendetegnet ved, at akselanordningen (4) er konfigureret på en sådan måde, at afstanden (EV) mellem hjulene (5, 5') kan justeres i det mindste mellem en smal konfiguration og en bred konfiguration, og
at hjulene (5, 5') indtager den brede konfiguration i manøvrepositionen og i arbejdspositionen for mindst en behandlingsenhed (20, 20').

2. Landbrugsmaskine ifølge krav 1, kendetegnet ved, at den omfatter mindst et led (8, 8') med en forbindelsesstang (9, 9'), der dels er leddelt til et eller hvert hjul (5, 5') og dels til chassiset (2), idet afstanden (EV) mellem hjulene (5, 5') justeres ved at dreje leddet (8, 8').

3. Landbrugsmaskine ifølge krav 1, kendetegnet ved, at akselanordningen (4) omfatter en fast del (7), der er fast forbundet med chassiset (2) eller integreret i sidstnævnte, og mindst en bevægelig del (6, 6'), idet justeringen af afstanden (EV) mellem hjulene (5, 5') sker ved at glide den eller mindst en bevægelig del (6, 6') i forhold til den faste del (7).

4. Maskine ifølge krav 2 eller 3, kendetegnet ved, at den omfatter mindst et drejeligt led (8, 8') med en leddelt forbindelsesstang (9, 9') og en akselanordning (4) med en fast del (7) og mindst en bevægelig del (6, 6'), der er monteret, så den kan glide i forhold til den faste del (7).

5. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 4, kendetegnet ved, at i den konfiguration, hvor hjulene (5, 5') er adskilt fra hinanden, er hvert af hjulene (5, 5') placeret i samme afstand fra chassiset (2), fortrinsvis fra et midterplan (M) af maskinen (1).

6. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 5, kendetegnet ved, at rammen (2) er lavere i den adskilte konfiguration end i den smalle konfiguration.

7. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 6, kendetegnet ved, at i konfigurationen, hvor hjulene (5, 5') er adskilt og i manøvrepositionen for de to behandlingsenheder (20, 20'), er basisafstanden (LE), som svarer til afstanden, der adskiller de respektive ydre ender (27 og 27') af de to hjul (5 og 5'), større end en femtedel af den samlede bredde (LT) af maskinen (1), som svarer til afstanden, der adskiller de to modsatte ydre ender (21 og 21') af de nævnte behandlingsenheder (20, 20').

8. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 7, kendetegnet ved, at i behandlingsenhedernes (20, 20') manøvre- eller arbejdsstilling, er afstanden mellem de to modsatte ydre ender (21 og 21') af behandlingsenhederne (20, 20') eller den samlede bredde (LT) af maskinen (1) større end 8 meter, fortrinsvis større end 10 meter og endnu mere fortrinsvis større end 12 meter.

9. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 8, kendetegnet ved, at når en enkelt behandlingsenhed (20, 20') er i manøvreposition, og maskinens (1) samlede bredde (LT) er større end 10 meter, er basisafstanden (LE), der adskiller de ydre ender (27, 27') af hjulene (5, 5'), større end 3 meter.

10. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 9, kendetegnet ved, at den omfatter mindst en styreaktuator (23, 23') til justering af intervallet (I) mellem de to grupperingselementer (14, 14').

11. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 10, kendetegnet ved, at hvert grupperingselement (14, 14') i hver behandlingsenhed (20, 20') er forbundet med en deflektorplade (26, 26'), der er fastgjort til chassiset (2) og orienteret stort set i maskinens (1) kørselsretning (A), når den bevæger sig.

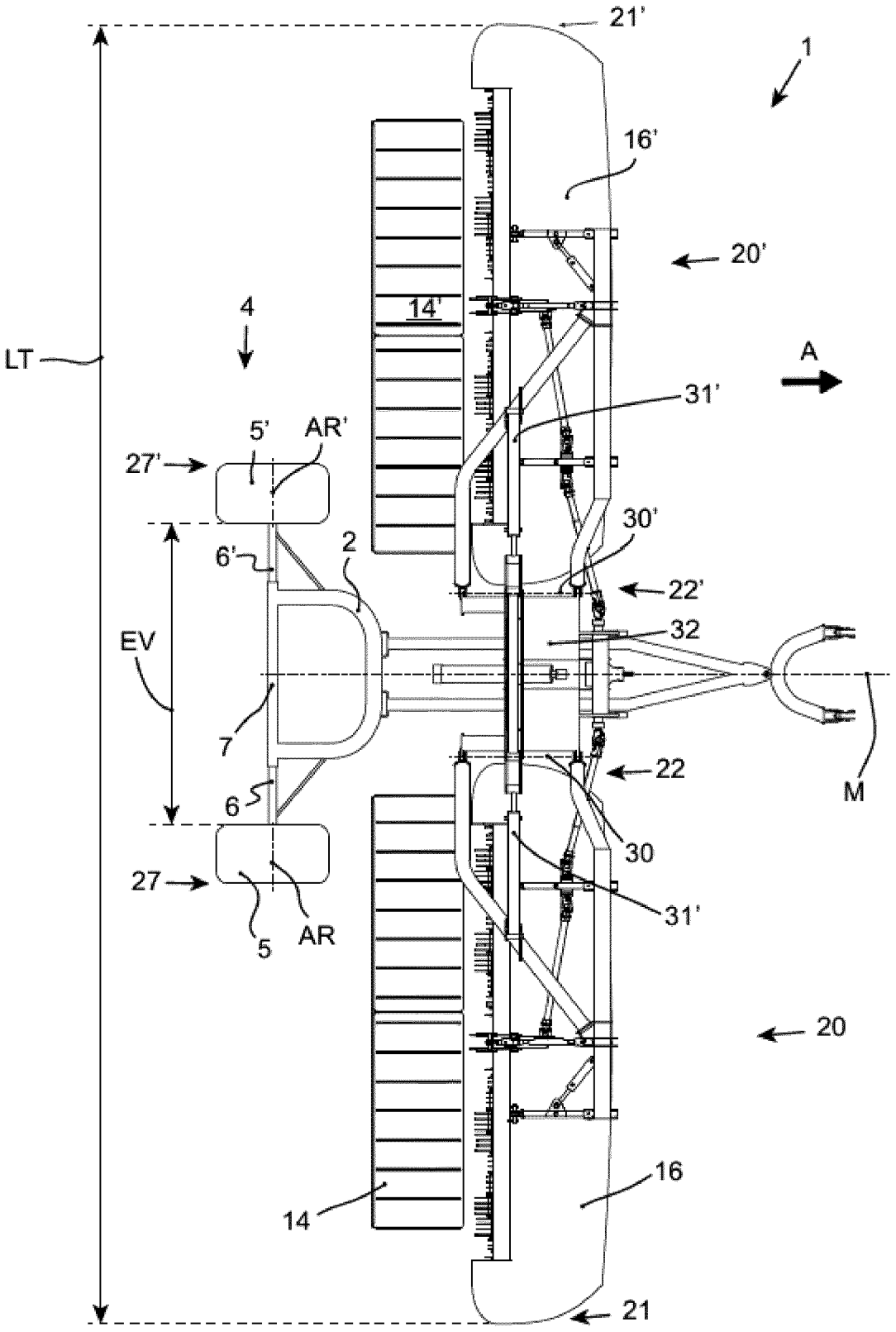
12. Landbrugsmaskine ifølge et hvilket som helst af kravene 1 til 11, kendetegnet ved, at hvert hjul (5, 5') er fast forbundet med en bevægelig del (6, 6') af akselanordningen (4), som er forbundet på en glidende måde langs en tilsvarende længdeakse (AL, AL') på tværs af kørselsretningen (A), til en fast del (7) af akselanordningen (4), der er fast forbundet med chassiset (2), idet afstanden (EV) mellem hjulene (5, 5') kan justeres ved at glide mindst en af de bevægelige dele (6, 6') i forhold til den faste del (7).

13. Metode til betjening af en bugseret landbrugsmaskine (1) til høst af et planteprodukt såsom græs, idet maskinen omfatter et chassis (2), på hvilket der er monteret en akselanordning (4), der forbinder to hjul (5, 5') med chassiset (2), og to behandlingsenheder (20, 20'), der hver er udstyret med et respektive grupperingselement (14, 14'), hvor hver behandlingsenhed (20, 20') er leddelt med chassiset (2) mindst omkring en foldeakse (30, 30') for selektivt at kunne indtage mindst : i) en arbejdsposition, hvor den strækker sig på tværs af fremføringsretningen (A) og hviler i det mindste delvist på jorden (S), ii) en manøvreposition, hvor dens ydre ende (21, 21') er længere væk fra chassiset (2) end den ydre ende (27, 27') af hvert hjul (5, 5'), og iii) en transportposition, hvor den strækker sig i det væsentlige på tværs af hjulaksen (AR, AR') for det respektive hjul (5, 5'), idet metoden er kendetegnet ved, at den består i at tilvejebringe en akselanordning (4), der er konfigureret på en sådan måde, at afstanden (EV) mellem hjulene (5, 5') kan justeres, i det mindste mellem en smal konfiguration og en adskilt konfiguration, og, så snart mindst en behandlingsenhed (20, 20') er i manøvreposition eller i arbejdsposition, at flytte hjulene (5, 5') længere væk fra hinanden, hvilket får dem til at bevæge sig ind i den adskilte konfiguration.

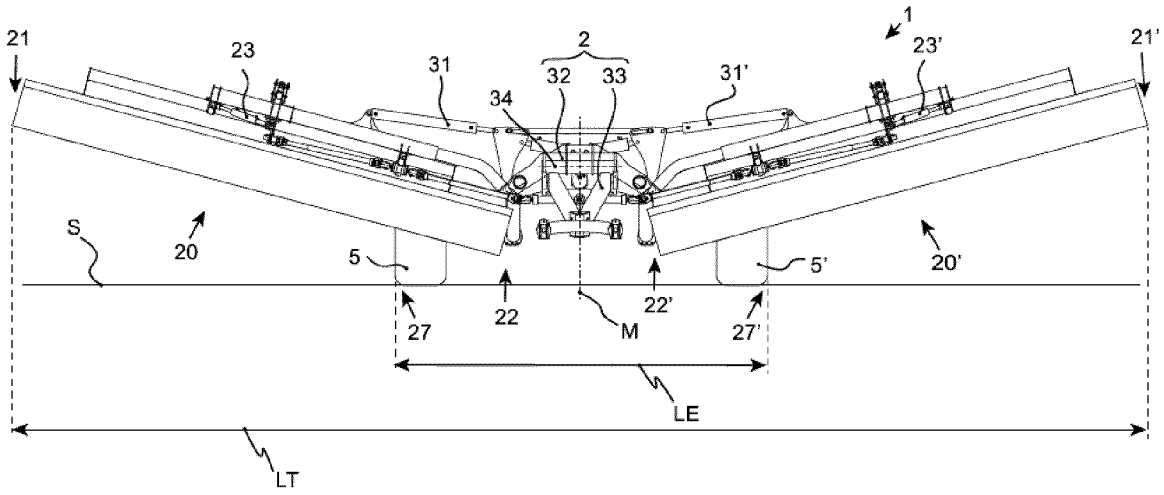
14. Fremgangsmåde til betjening af en maskine (1) ifølge krav 13, kendetegnet ved, at afstanden (EV) mellem hjulene (5, 5') automatisk justeres til den adskilte konfiguration af hjulene (5, 5'), så snart mindst en behandlingsenhed (20, 20') overføres til arbejdspositionen.

15. Fremgangsmåde til betjening af en maskine (1) ifølge et af kravene 13 eller 14, kendetegnet ved, at afstanden (EV) mellem hjulene (5, 5') automatisk justeres til en smal konfiguration, så snart de to behandlingsenheder (20, 20') er i transportpositionen.

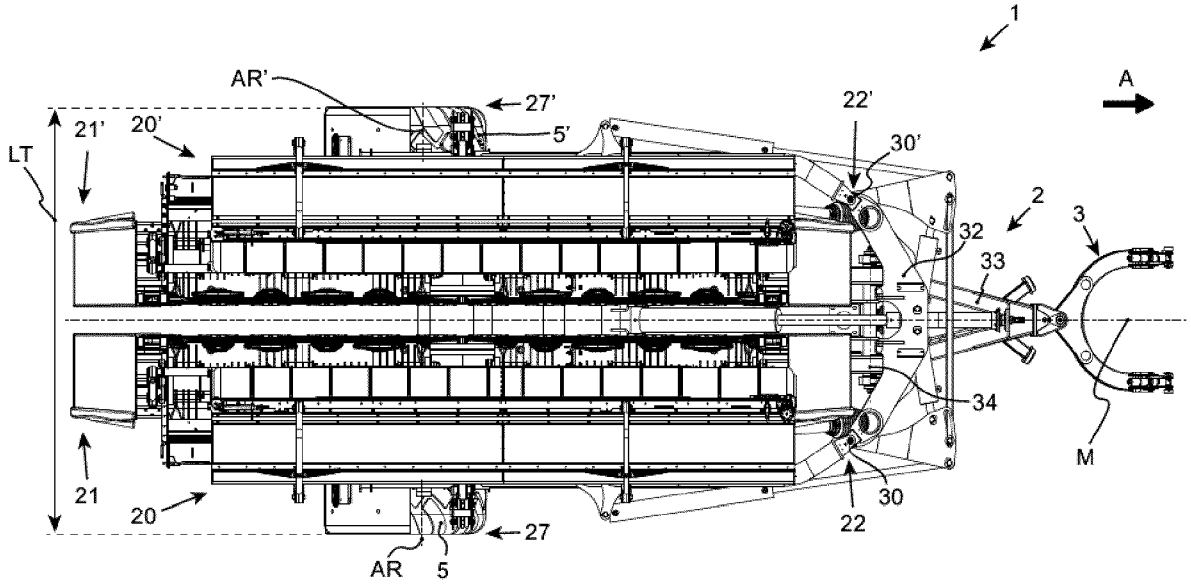
[Fig. 1]


21'
1
16'
20'
4
14'
LT
A
31'
5'
AR'
27'
30'
6'
2
22'
32
EV
7
22
M
6
30
27
31'
5
AR
20
16
14
21

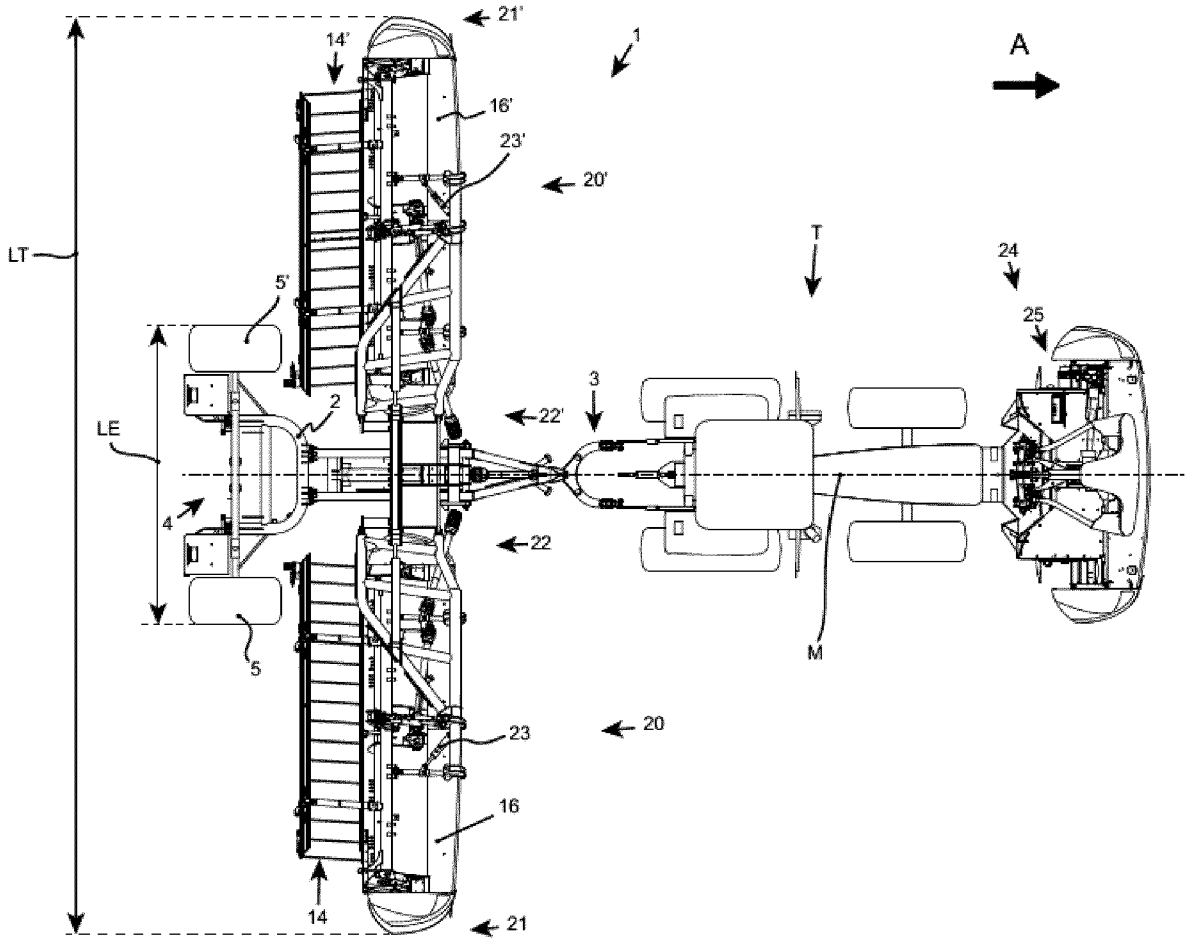
[Fig. 2]


21
23
31
2
32
33
34
31'
1
23'
21'
S
20
5
5'
20'
27
22
M
22'
27'
LE
LT

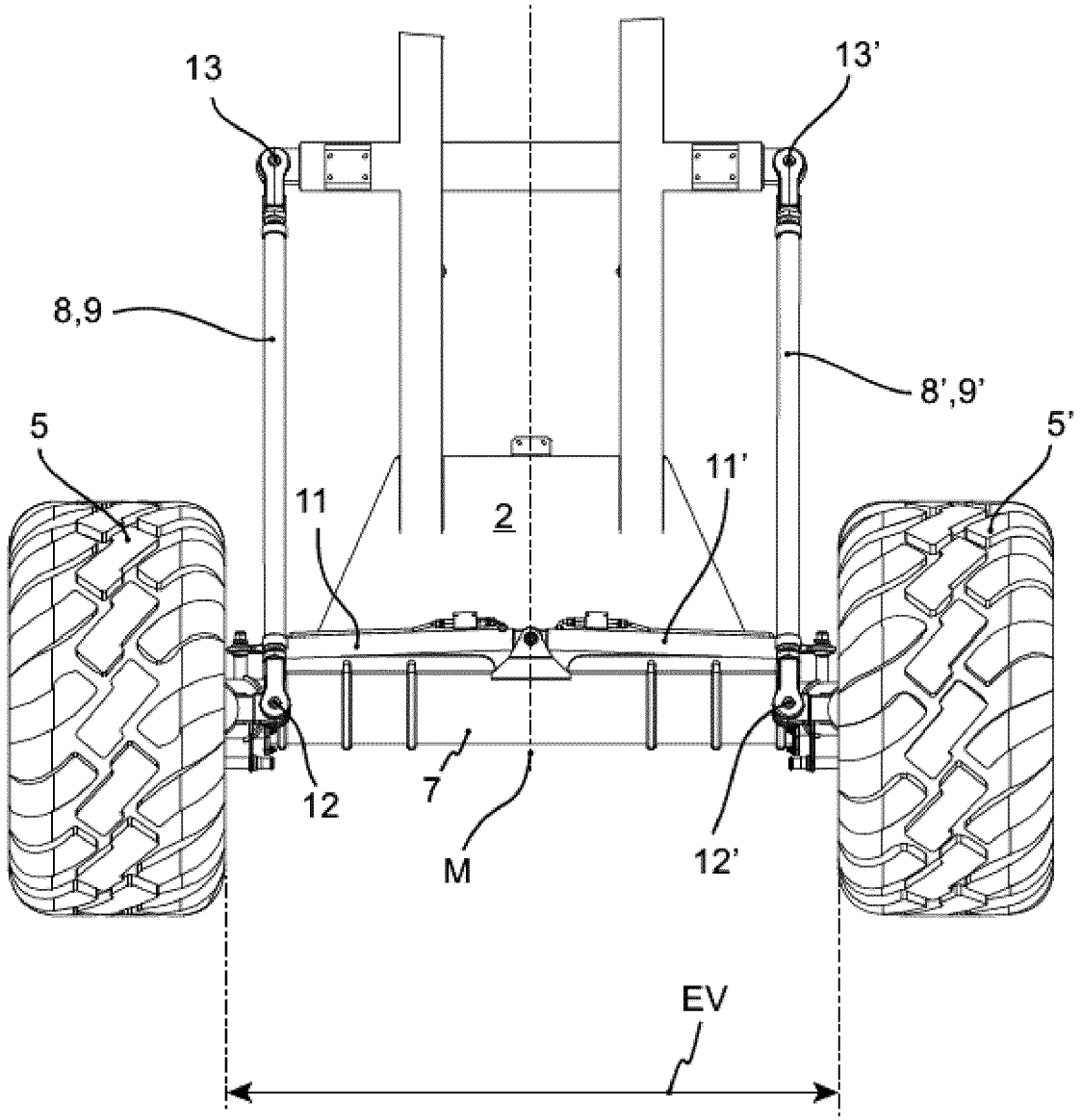
[Fig. 3]


1
AR'
27'
5'
22'
30'
A
LT
21'
20'
2
3
32
33
34
M
21
20
27
AR
5
30
22

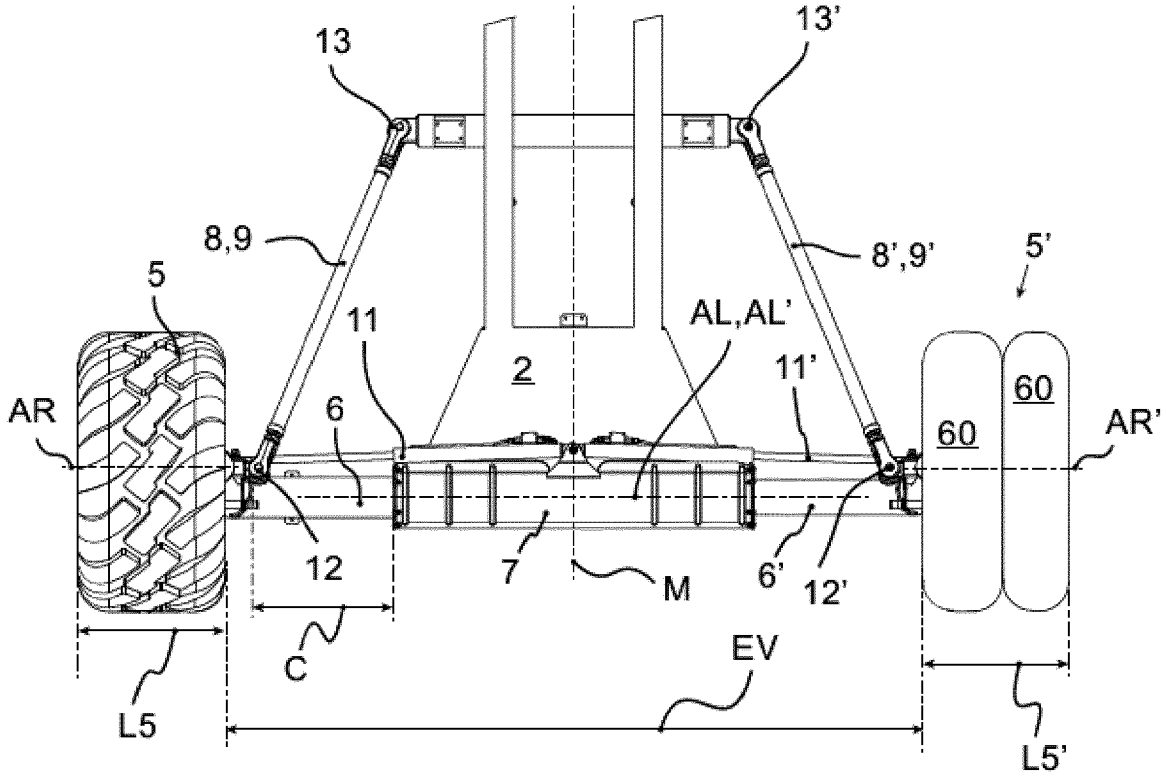
[Fig. 4]



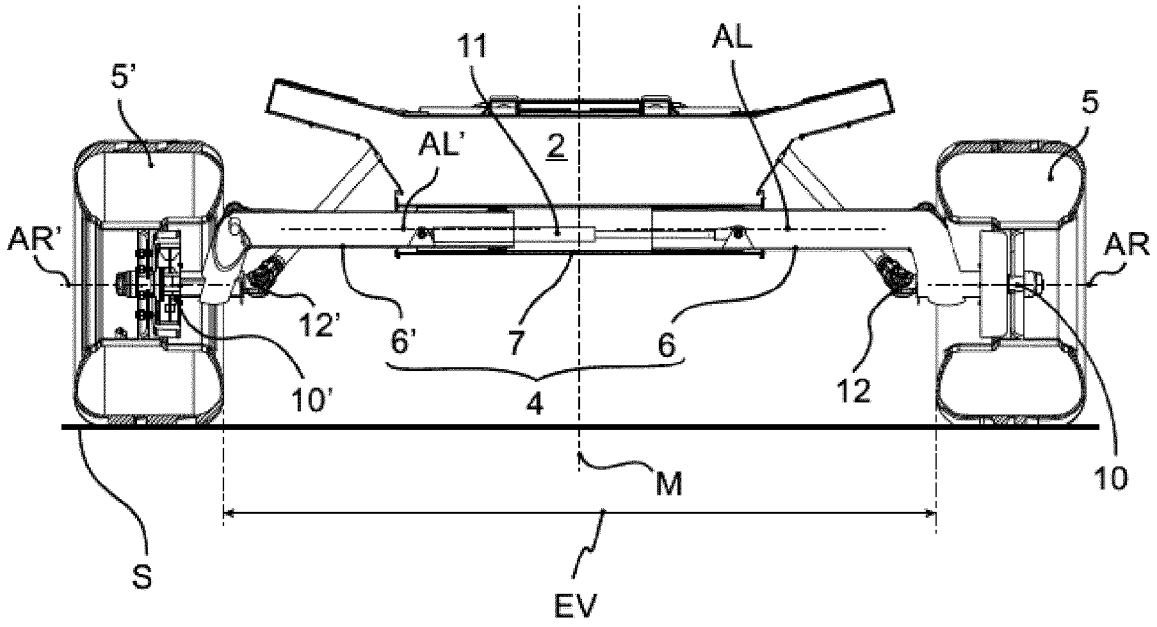
[Fig. 5A]



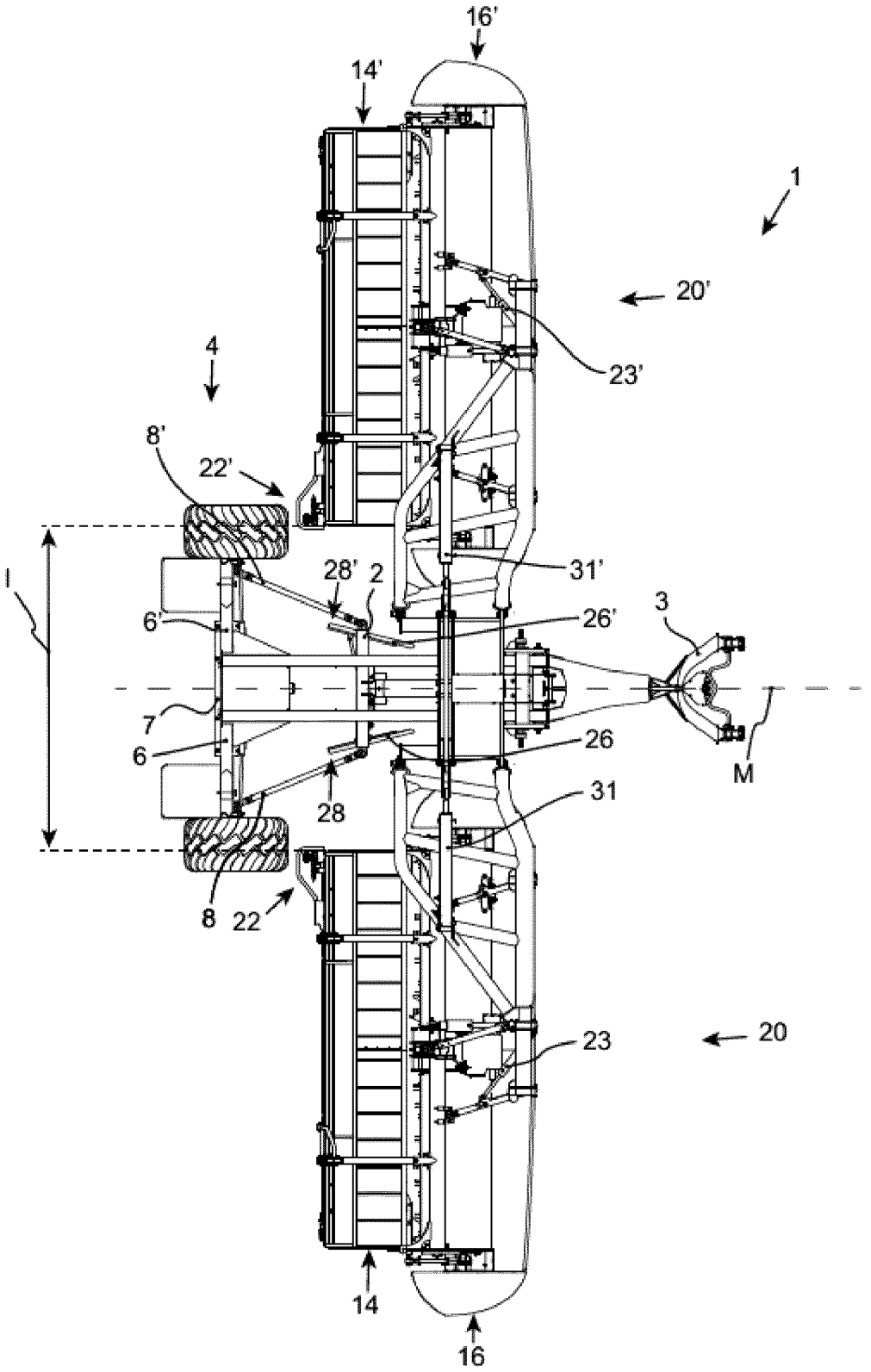
[Fig. 5B]


13
13'
8,9
8',9'
5'
5
11
AL,AL'
2
11'
60
60
AR
AR'
6
12
7
M
6'
12'
C
EV
L5
L5'

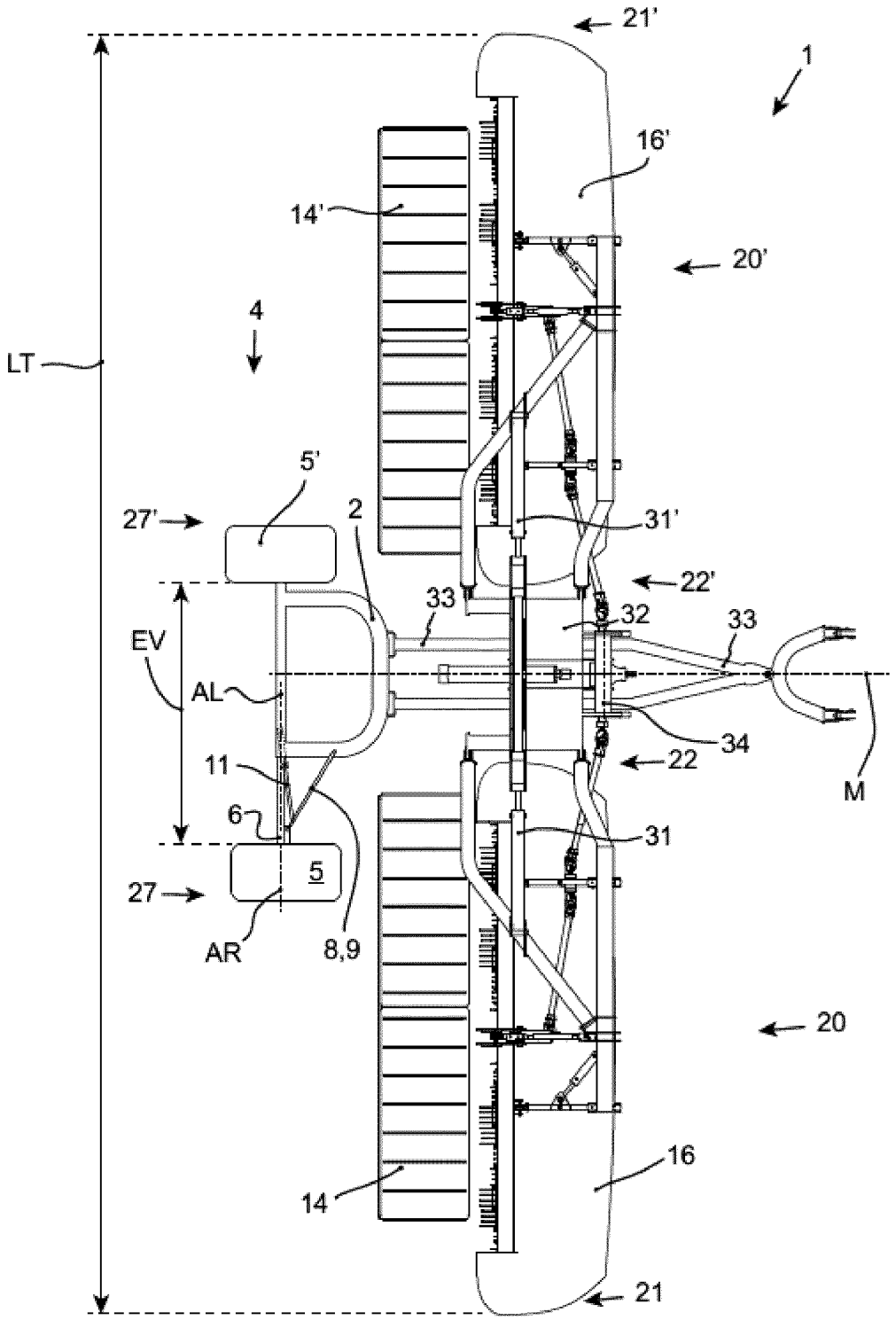
[Fig. 6]


11
AL
5'
5
AL'
2
AR'
AR
12'
6'
7
6
10'
4
12
10
M
S
EV

[Fig. 7]



[Fig. 8]


21'
1
16'
14'
20'
4
LT
5'
27'
2
31'
22'
33
32
33
EV
AL
34
22
11
M
6
31
5
27
AR
8,9
20
16
14
21