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(54) Benævnelse: **MOWING MACHINE**

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Description

[0001] The invention relates to a mower for mowing agricultural stalks and leaves according to the preamble of claim 1. Such mowers are known in the prior art in various embodiments and are comprised in general of a cutterbar that is close to the ground in the working position and provided at its top side with cutting members that are rotatingly driven about approximately vertical axes. In their simplest embodiment, these moweres, which are generally referred to as disc mowers, are used for cutting stem crop wherein they can be coupled by front mount as well as rear mount to an agricultural traction and drive machine. For obtaining high output per unit area, today device combinations (triple mower combinations) are often used which are formed of a mowing machine in front mount as well as two mowing machines in rear mount. Newer tendencies regarding the configuration of mowing machines are based in this context on an enlargement of the working width for such device combinations. In order to be able to achieve this, it is in particular required to design the width dimensions of the mowing machine in front mount in such a way that a working width is made available for harvesting on the field that is above the dimensions which are set by law for the transport on roads.

[0002] From the publication DE 101 57 289 A1, a mower has become known with at least two coupled cutterbars which are connected to one another via a connecting joint. The connecting joint enables the outer cutterbar to pivot relative to the inner cutterbar, which is used in the transport position to slightly reduce the transport height by making the two outer cutterbars roof-shaped relative to the inner cutterbar. To supply the respective cutterbars with drive energy, pivot shafts are required which extend between the carrier bars of the cutterbars and therefore a lack of functionality and user-friendliness becomes apparent when the cutterbars are pivoted from the working position into an approximately vertical transport position. In this context, however, situations are also to be noted in which the cutting tools of the cutting members of neighbouring cutterbars may strike each other upon pivoting.

[0003] The publication DE 44 07 812 A1 discloses a drum mower with an arm which is pivotably and pendulum articulated at one end of a base cutterbar and on the underside of which one or more external mowing rotors are attached.

[0004] Object of the invention is therefore to propose a mower in which the deficiencies of the prior art are avoided.

[0005] In accordance with the invention, this object is achieved by the features of the characterizing part of claim 1. Advantageous further developments of the invention emerge from the further claims.

[0006] According to the invention, a mower is proposed with a number of cutting elements attached to a cutterbar and driven in rotation about an approximately vertical axis, which cutting elements are rotatably mounted on the upper face of the cutterbar, which is aligned in its longitudinal extension transversely to the travel and working direction of the mower, and can be driven in rotation by a drive arrangement which is housed within the cutterbar, wherein the cutterbar has, at at least one of its two ends which are spaced apart from one another transversely to the travel and working direction, a hinge and drive arrangement for holding a further, lateral cutterbar portion and for driving the at least one cutting element attached to the further lateral cutterbar portion and wherein the hinge and drive arrangement consists of two mounting elements, which are attached to one another in such a way that a pivoting movement of the further lateral cutterbar portion can be carried out within the plane of the cutterbar of the mower, the mounting elements of the hinge and drive arrangement being arranged at a small distance one above the other.

[0007] With this configuration according to the invention, it is achieved that a cutterbar of a mower is provided with an optimal enlargement of the working width by the addition of at least one further lateral cutterbar portion. This means that during work at least at one of the two ends of the cutterbar, extending with its longitudinal extension transverse to the travel and working direction, an further lateral cutterbar portion with at least one cutting member attached thereto is adjoined such that a continuously worked field or meadow strip is provided. In an advantageous further embodiment, it can also be foreseen that an further lateral cutterbar portion is arranged at both ends of the cutterbar of the mower. For optional arrangement of the at least one further lateral cutterbar portion at the end of the cutterbar of the mower, a hinge and drive assembly is provided according to the invention which is comprised of two mounting elements which are pivotally connected to each other at their ends facing away from the cutterbar and facing away from the at least one further lateral cutterbar portion. Due to this pivot connection it is achieved that the at least one further cutterbar portion, which in the working position of the mower is aligned with the cutterbar, can be pivoted into a transport position which in relation to the travel and working direction of the mower is located approximately behind the outer cutting members of the cutterbar. The invention thus creates a mower in which by a simple pivot movement of at least one further cutterbar portion within the plane of the cutterbar an enlargement of the working width in the working position as well as a reduction of the width dimensions of

the mower in the transport position can be realized. By way of example, it is thus possible in a simple way that the working width of the mowing machine in front mount is increased wherein then however at the same time the width dimensions of the mowing machine in the transport position can be maintained below the limit of 3 meters set by law.

[0008] For connecting at least one further lateral cutterbar portion to the cutterbar of the mower, a hinge and drive assembly is provided which is comprised of two mounting elements which, in the working position of the mower, are pivotably connected to each other about an approximately vertically oriented pivot axis. These mounting elements are furthermore configured such that within these mounting elements components are mounted with which a rotary drive of the cutting members of the at least one further lateral cutterbar portion originating at the cutterbar is achieved. This means that in the pivotably changeable connecting region of the two mounting elements a hinge point is provided which can transmit a drive movement for the cutting members.

[0009] In a first advantageous embodiment, it can be foreseen that the mounting element adjoining the end of the cutterbar forms a lower plane of the hinge and drive arrangement. The second mounting element of the hinge and drive arrangement then extends in an upper plane. However, since the cutterbar and the at least one further lateral cutterbar portion must be arranged in a uniform plane in the working position, it is necessary that one of the mounting elements of the hinge and drive arrangement has to compensate for a height offset. In this embodiment, this height offset can be accommodated in the mounting element which extends from the hinge point to the at least one further lateral cutterbar portion. The distance between the respective planes of the mounting elements of the hinge and drive arrangement is designed in such a way that during the pivoting movement of the mounting elements relative to one another there is just no contact between the mounting elements. This design is advantageously accompanied by a low overall height of the hinge and drive arrangement.

[0010] According to a further conceivable embodiment, the mounting element of the hinge and drive arrangement facing the at least one further lateral cutterbar portion can be arranged in a lower plane at the height of the at least one further lateral cutterbar portion. In the upper one of the two planes of the hinge and drive arrangement, the second mounting element of the hinge and drive arrangement, facing the cutterbar, is to be attached with the height offset.

[0011] To transmit drive power from the cutting members of the cutterbar to the at least one cutting member of the at least one further lateral cutterbar portion, the mounting elements of the hinge and drive arrangement are designed such that in the interior of the holding elements a plurality of spur gears are arranged which are engaging each other, which are in engagement with the drive wheel of the outer cutting member of the cutterbar and which extend to the hinge point of the hinge and drive assembly. At this hinge point of the hinge and drive assembly, a spur gear shaft or a similar drive element is accommodated which compensates the height offset between the two mounting elements of the hinge and drive assembly. According to a further advantageous embodiment of the invention, this vertical spur gear shaft can also be designed so that both the drive of the cutting elements of the cutterbar and the drive of the cutting elements of the at least one further lateral cutterbar portion is initiated on this spur gear shaft. The number of spur gears that are housed within the mounting elements of the hinge and drive arrangement between the cutterbar and the hinge point depends on whether the mower is only to be used for cutting stalks or whether the mower is to be used with a processing unit mounted behind the cutting elements for cutting and conditioning the stalks should be used. The use of a processing unit behind the cutting members of the cutterbar naturally requires a larger construction distance when the at least one further, lateral cutterbar portion is to be pivoted behind the cutter members in the transport position. Furthermore, the selection of the number of spur gears inserted in the mounting elements serves to influence the direction of rotation of the cutting members of the at least one further, lateral cutterbar portion.

[0012] In a further advantageous embodiment of the invention it can be foreseen that the pivoting of the at least one further cutterbar portion between the working position and the transport position is initiated by an actuating device. A wide variety of drive means, such as a hydraulically or pneumatically driven actuator, can be used for this purpose.

[0013] An advantageous exemplary embodiment of the invention is described below with reference to a drawing. In the drawing shows:

Fig. 1: a perspective view of a mower according to the invention in the working position;

Fig. 2: a perspective view of the mower of Figure 1 in the transport position;

Fig. 3: a perspective view of a further embodiment of the mower of Figure 2 in the transport position;

Fig. 4: a partial, broken away view from above onto the mower of Figure 1;

Fig. 5: a partial, broken portional view of the mower according to portion V-V in Fig. 4;

Fig. 6: a perspective view of a mower according to the invention in the working position with processing device attached;

[0014] In FIG. 1 a mower is presented according to the invention with a plurality of cutting members 1, which are mounted on a cutterbar 2 to rotate about an approximately vertical axis and which are employed for mowing stalks and leaves close to the ground. At their outer periphery, the cutting elements 1 are equipped with at least two pivoting cutting knives 3, which produce a cutting effect when the cutting elements rotate at high speeds in a free cut when the mower is moved slidingly over a field or meadow in the direction of travel and working direction F. As can also be seen from FIG. 1, the two outer cutting members 1 are attached to at least one further lateral cutterbar portion 4, which is attached to the lateral end of the cutterbar 2 via a hinge and drive arrangement 5. As a result of this attachment, the at least one further lateral cutterbar portion 4 can be pivoted within a horizontal pivot plane from the working position according to FIG. 1 into a transport position according to FIG. 2. In the working position, the cutterbar 2 with the at least one further lateral cutterbar portion forms a continuous mowing device with which streak-free mowing of agricultural stalks and leaves is continuously possible. From FIG. 2, on the other hand, it can be seen that, in the transport position, the at least one further, lateral cutterbar portion 4 is located behind the two outer cutting members 1 of the cutterbar 2 in relation to the travel and working direction F. With this mower according to the invention, a significant reduction in the width dimensions in the transport position can be achieved in an advantageous manner. In a further advantageous embodiment, the cutterbar of the mower can be supplemented at both ends of the cutterbar with a further lateral cutterbar portion 4 so that a significantly larger change in width of the mower can be realized between the working position and the transport position.

[0015] From FIGS. 1 and 2 it can further be seen that the hinge and drive arrangement 5 is formed of two mounting elements 6, 7, each of which is connected at one end to the cutterbar 2 or to the at least one further, lateral cutterbar portion 4, while a hinge point 8 is formed at the other end of the mounting elements 6, 7. This hinge point 8 is designed in such a way that the mounting elements 6, 7 can be pivoted relative to one another in planes that are arranged above each other at a small distance from one another. The invention understands a small distance to mean that, during the pivoting movement of the mounting elements 6, 7 relative to one another, mutual contact between the mounting elements 6, 7 is precisely avoided.

[0016] A first embodiment of a hinge and drive arrangement 5 is shown in FIGS. 1 and 2. A housing portion 9, which is connected directly to the cutterbar 2 and extends as far as the hinge point 8, extends in the plane of the cutterbar 2 close to the ground. So that a pivoting movement of the mounting elements 6, 7 can take place, the mounting element 7 must contain a height offset, which arises from the fact that a housing portion 10 connected to the at least one further, lateral cutterbar portion 4 is connected to a spur gear 11, which also extends up to the hinge point 8. The housing portions 10, 11 each form, with the cutterbar 2 or with the at least one further, lateral cutterbar portion 4, an oil-tight sealed transmission housing.

[0017] A further, conceivable embodiment of the hinge and drive arrangement 5 with its mounting elements 6a, 7a can be understood from FIG. 3. There, a housing portion 9a is connected to the at least one further, lateral cutterbar portion 4 in a plane close to the ground and which extends as far as the hinge point 8. Likewise analogous to the embodiment according to FIGS. 1 and 2, the mounting element 7a also contains a height offset here, which is caused by the fact that a housing portion 10a adjoining the cutterbar 2 is connected to a spur gear 11 in a plane above the cutterbar 2.

[0018] In FIG. 4, the manner of the drive connection between the cutterbar 2 and the at least one further, lateral cutterbar portion 4 is illustrated in more detail in a view from above of the hinge and drive arrangement 5. It can be clearly seen from this that the drive connection between the cutterbar 2 and the at least one further, lateral cutterbar portion 4 is formed from spur gears 12, 13 which are lined up and housed inside the housing portions 9, 10. The number of spur gears 12, 13 accommodated in this drive connection depends on how far the at least one further, lateral cutterbar portion 4 is to be located behind the cutterbar 2 in the transport position (FIGS. 2 and 3). Another criterion in selecting the number of spur gears in the drive connection of the hinge and drive arrangement 5 is the definition of the direction of rotation 14 of the outer cutting element 1. If the outer cutting element 1 of the cutterbar 2 is to rotate outwardly, it is necessary that the drive connection has an even number of spur gears 12, 13. However, if the direction of rotation of the outer cutting element 1 of the cutterbar 2 is also to be directed inwards, then an odd number of spur gears 12, 13 is to be selected.

[0019] From FIG. 5, the structure of the hinge point 8 of the hinge and drive arrangement 5 can be seen in a detailed portional illustration. Starting from the housing portion 9 of the mounting element 6, a spur gear 12 is illustrated here in greater detail, as it is rotatably mounted in the housing portion 9. In this way, a kinematic chain is formed in the housing

portion 9, which chain extends between the outer cutting element 1 of the cutterbar 2 and the hinge point 8 of the hinge and drive arrangement 5. In the further course of the drive connection between the outer cutting element 1 of the cutterbar 2 and the hinge point 8, a spur gear shaft 15 is arranged, which serves to initiate the drive movement in a plane above the plane of the cutterbar 2. The spur gear 11 also contains several spur gears 12 which lead to a drive shaft 16 of the hinge point 8. This drive shaft 16 brings about two advantageous properties of the hinge and drive arrangement 5. First, the drive shaft 16 ensures that the drive movement of the spur gears 12 from the spur gear 11 from the upper plane is transferred back to the plane of the at least one further lateral cutterbar portion. Secondly, the drive shaft 16 also forms the hinge axis 17 of the hinge point 8, so that a pivoting movement of the mounting elements 6, 7 of the hinge and drive arrangement 5 about the approximately vertically aligned pivot axis 18 is made possible. To ensure reliable lubrication, both the spur gear 11 and the housing portions 9, 9a, 10, 10a connected to the cutterbar 2 and to the at least one further lateral cutterbar portion 4 are oil-tightly sealed against one another.

[0020] Furthermore, FIG. 5 shows an advantageous development of the invention. By designing the drive shaft 16 with a power take-off shaft profile 19, the drive shaft 16 can also be used to introduce via the power take-off shaft profile 19 the entire drive power for the cutting elements 1 of the cutterbar 2 and the at least one other lateral cutterbar portion at the hinge point 8. This ensures in an advantageous way that drive parts will never come into contact with mowed stem and leaf material.

[0021] A mower which is provided with an attached processing device 20 is illustrated in FIG. 6 in more detail. This illustration makes clear that the at least one further, lateral cutterbar portion 4 is designed such that the two cutting members 1 of the at least one further, lateral cutterbar portion 4 due to the inwardly oriented rotational direction 14 transport the mowed stem and leaf material of the additional working width into the processing device 20. When also looking at FIGS. 2 and 3 in combination with FIG. 5, it is also clear that by transferring the at least one further, lateral cutterbar portion 4 into the transport position an advantageous adaptation of the width dimensions of the mower is realized. Transferring the at least one further, lateral cutterbar portion 4 into the transport position can be initiated in a further advantageous embodiment by an actuating device 21 which consists of a hydraulic drive motor 22 and engages a ring gear 23.

PATENTKRAV

1. Mejemaskine med et antal skæreelementer (1), der er anbragt på en skærebjælke (knivbjælke) (2) og drevet i rotation omkring en vertikal akse, hvilke skæreelementer er roterbart monteret på oversiden af skærebjælken (2), som i sin længdeudstrækning er orienteret på tværs af køre- og arbejdsretningen (F) for mejemaskinen og kan drives i rotation ved hjælp af et drivarrangement, der rummes i skærebjælken (2), **kendetegnet ved, at** skærebjælken (2) på mindst en af sine to ender, som har en indbyrdes afstand på tværs af køre- og arbejdsretningen (F), omfatter et hængsel- og drivarrangement (5) til fastholdelse af et yderligere, lateralt skærebjælkeafsnit (4) og til drivning af det mindst ene skæreelement (1), der er fastgjort til det yderligere, laterale skærebjælkeafsnit (4), og **ved, at** hængsel- og drivarrangementet (5) er dannet af to monteringselementer (6, 7, 6a, 7a), som er fastgjort til hinanden på en sådan måde, at en svingbevægelse af det yderligere, laterale skærebjælkeafsnit (4) kan gennemføres i mejemaskinens skærebjælkeafsnit (2), hvorved monteringsorganer (6, 7, 6a, 7a) for hængsel- og drivarrangementet (5) er arrangeret i planer med en lille afstand over hinanden.

2. Mejemaskine ifølge krav 1, **kendetegnet ved, at,** i arbejdsstillingen, det mindst ene yderligere, laterale skærebjælkeafsnit (4) er orienteret som flugtende med skærebjælken (2).

3. Mejemaskine ifølge krav 1, **kendetegnet ved, at,** i transportstillingen, det mindst ene yderligere, laterale skærebjælkeafsnit (4) er arrangeret i en position mindst cirka bag ved de ydre skæreelementer (1) på skærebjælken (2).

4. Mejemaskine ifølge mindst et af kravene 1 til 3, **kendetegnet ved, at** monteringselementerne (6, 7, 6a, 7a), tilordnet til skærebjælken (2) og det mindst ene yderligere, laterale skærebjælkeafsnit (4), svingbart er forbundet til hinanden via et hængselpunkt (8), som har en mindst cirka vertikalt orienteret svingakse (18).

5. Mejemaskine ifølge mindst et af kravene 1 til 4, **kendetegnet ved, at** monteringselementet (6), der vender mod skærebjælken (2), sammen med skærebjælken (2) danner et gearkassehus, som er olie-tæt tætnet.

6. Mejemaskine ifølge mindst et af kravene 1 til 4, **kendetegnet ved, at** monteringselementet (7), som er tilordnet til det yderligere, laterale skærebjælkeafsnit (4), omfatter et cylindrisk tandhjul (11), der er arrangeret i et plan oven over det yderligere, laterale skærebjælkeafsnit (4) og er forbundet stationært til det yderligere, laterale skærebjælkeafsnit (4).

7. Mejemaskine ifølge krav 6, **kendetegnet ved, at** det cylindriske tandhjul (11) er udformet på en sådan måde, at drivkraften kan overføres til det yderligere, laterale skærebjælkeafsnit (4) via en med tilnærmelse vertikalt orienteret aksel (15) for det cylindriske tandhjul, hvorved det cylindriske tandhjul (11) er olietæt tætnet mod det yderligere skærebjælkeafsnit (4).

8. Mejemaskine ifølge mindst et af kravene 1 til 4, **kendetegnet ved, at** monteringselementet (6a), som er tilordnet til det yderligere laterale skærebjælkeafsnit (4), sammen med det yderligere, laterale skærebjælkeafsnit (4) danner et gearkassehus, som er olietæt tætnet.

9. Mejemaskine ifølge mindst et af kravene 1 til 4, **kendetegnet ved, at** monteringselementet (7a), som vender mod skærebjælken (2), omfatter et cylindrisk tandhjul (11), der er arrangeret i et plan oven over skærebjælken (2) og er stationært forbundet til skærebjælken (2).

10. Mejemaskine ifølge krav 9, **kendetegnet ved, at** det cylindriske tandhjul (11) er udformet på en sådan måde, at drivkraften kan overføres til skærebjælken (2) via en med tilnærmelse vertikalt orienteret aksel (15) for det cylindriske tandhjul, hvorved det cylindriske tandhjul (11) er tætnet på olietæt måde mod skærebjælken (2).

11. Mejemaskine ifølge mindst et af kravene 1 til 10, **kendetegnet ved, at** det mindst ene skæreelement (1) for det mindst ene yderligere, laterale skærebjælkeafsnit (4) drives fra drivarrangementet for skæreelementerne (1) på skærebjælken (2) via indvendige cylindriske tandhjul (12) i monteringselementerne (6, 7, 6a, 7a), der er dannet som en gearkasse.

12. Mejemaskine ifølge mindst et af kravene 1 til 11, **kendetegnet ved, at** der er tilvejebragt en drivaksel (16) med henblik på kobling af monteringselementerne (6, 7, 6a, 7a) for hængslet og drivarrangementet (5), hvilken drivaksel er udformet som en hængselstift (17) i hængselpunktet (8) for hængsel- og drivarrangementet (5).

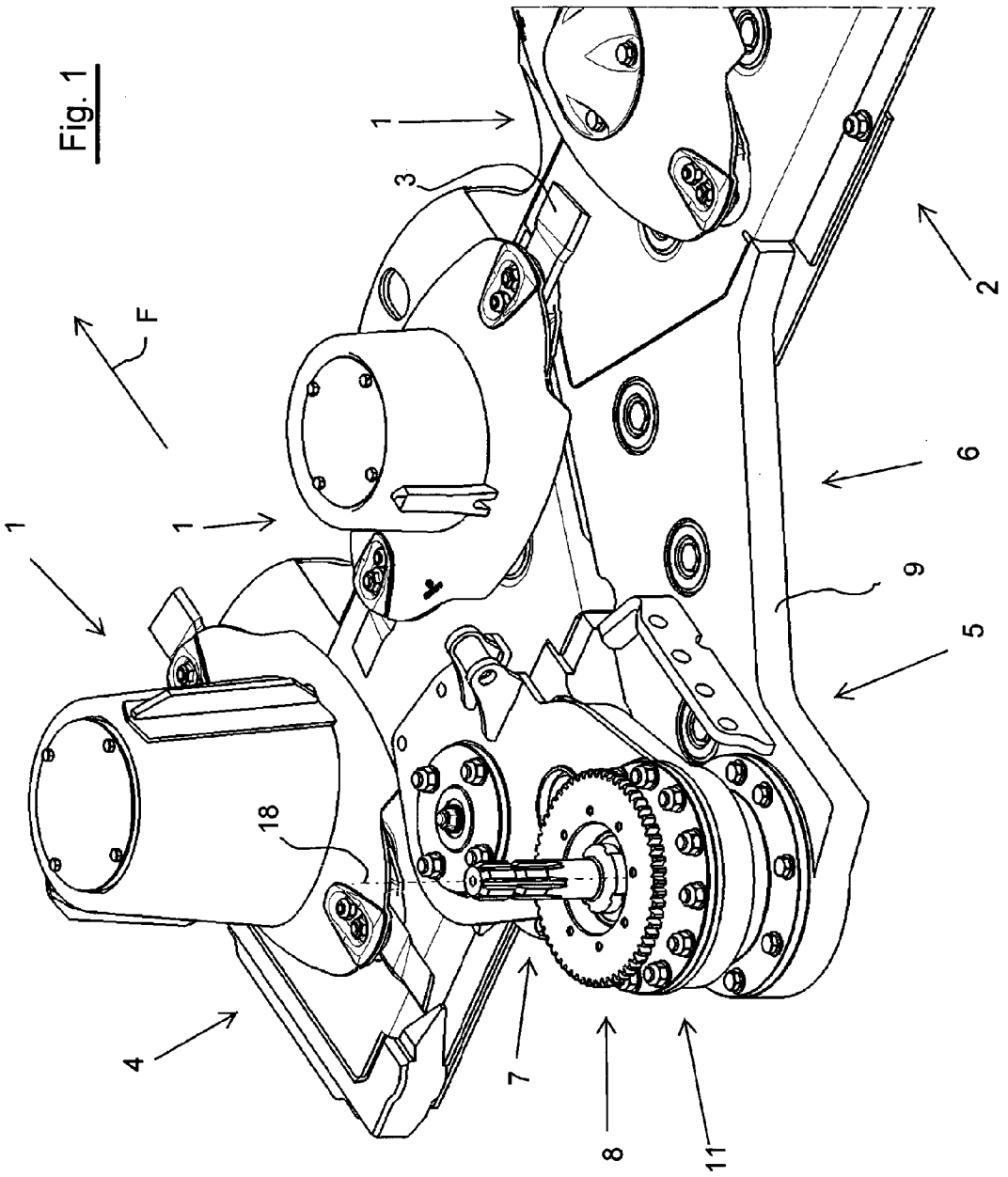
13. Mejemaskine ifølge krav 12, **kendetegnet ved, at** drivakslen (16), der er udformet som en hængselstift (17) i hængselpunktet (8) for hængsel- og drivarrangementet (5), er tilvejebragt med henblik på at tilføre drivkraft til skæreelementerne (1) på skærebjælken (2) og det mindst ene yderligere skærebjælkeafsnit (4).

14. Mejemaskine ifølge mindst et af kravene 1 til 8, **kendetegnet ved, at** monteringselementerne (6, 7, 6a, 7a), dannet som en gearkasse, for hængsel- og drivarrangementet (5) er olie-tæt tætnet mod hinanden i området ved hængselpunktet (8).

15. Mejemaskine ifølge mindst et af kravene 1 til 3, **kendetegnet ved, at** en aktiveringsindretning (21) er konfigureret til at bevæge det mindst ene yderligere, laterale skærebjælkeafsnit (4) fra arbejdspositionen (fig. 1) til en transportposition (fig. 2 og 3) og omvendt.

Zeichnung

Fig. 1



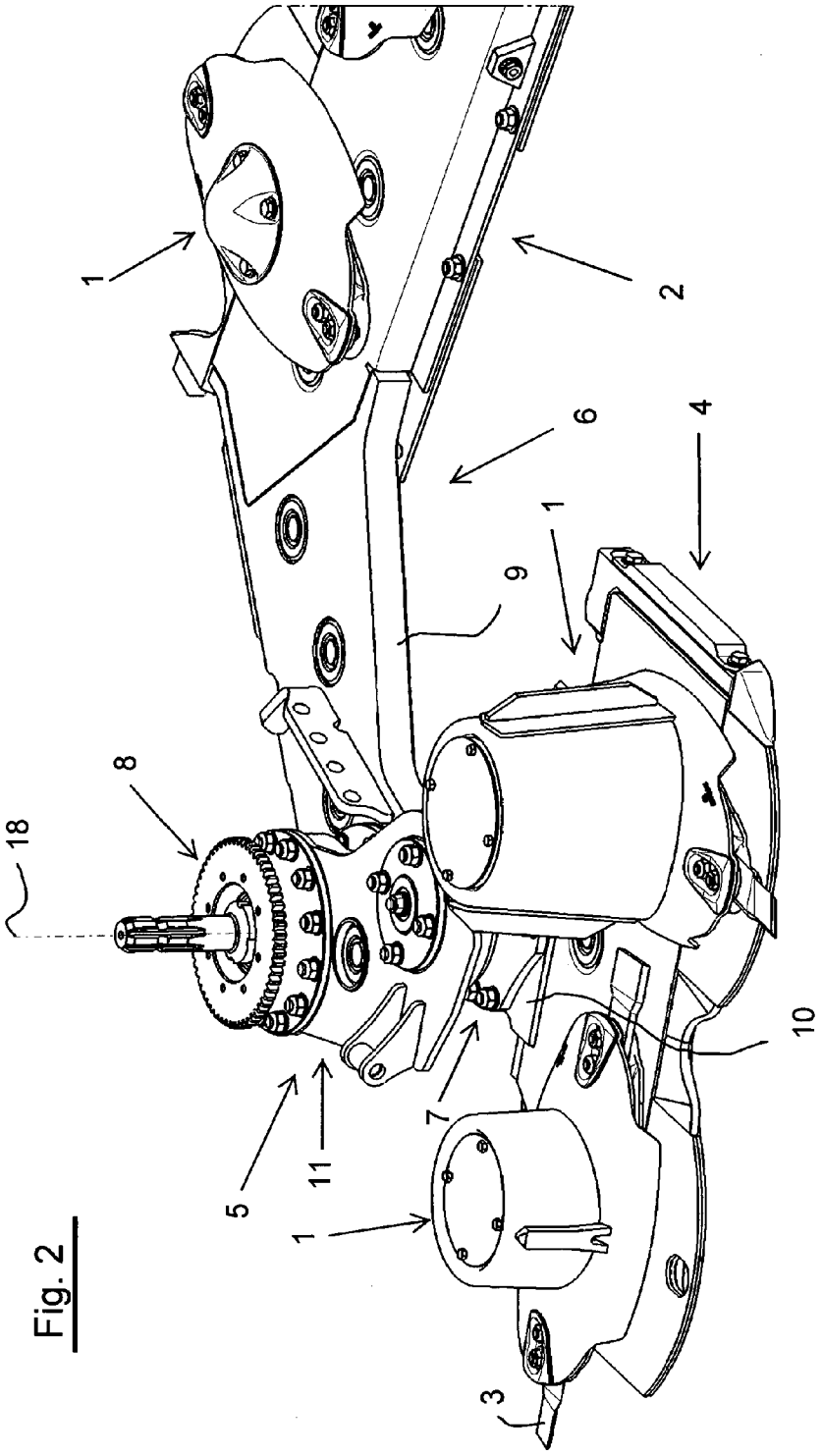


Fig. 2

Fig. 3

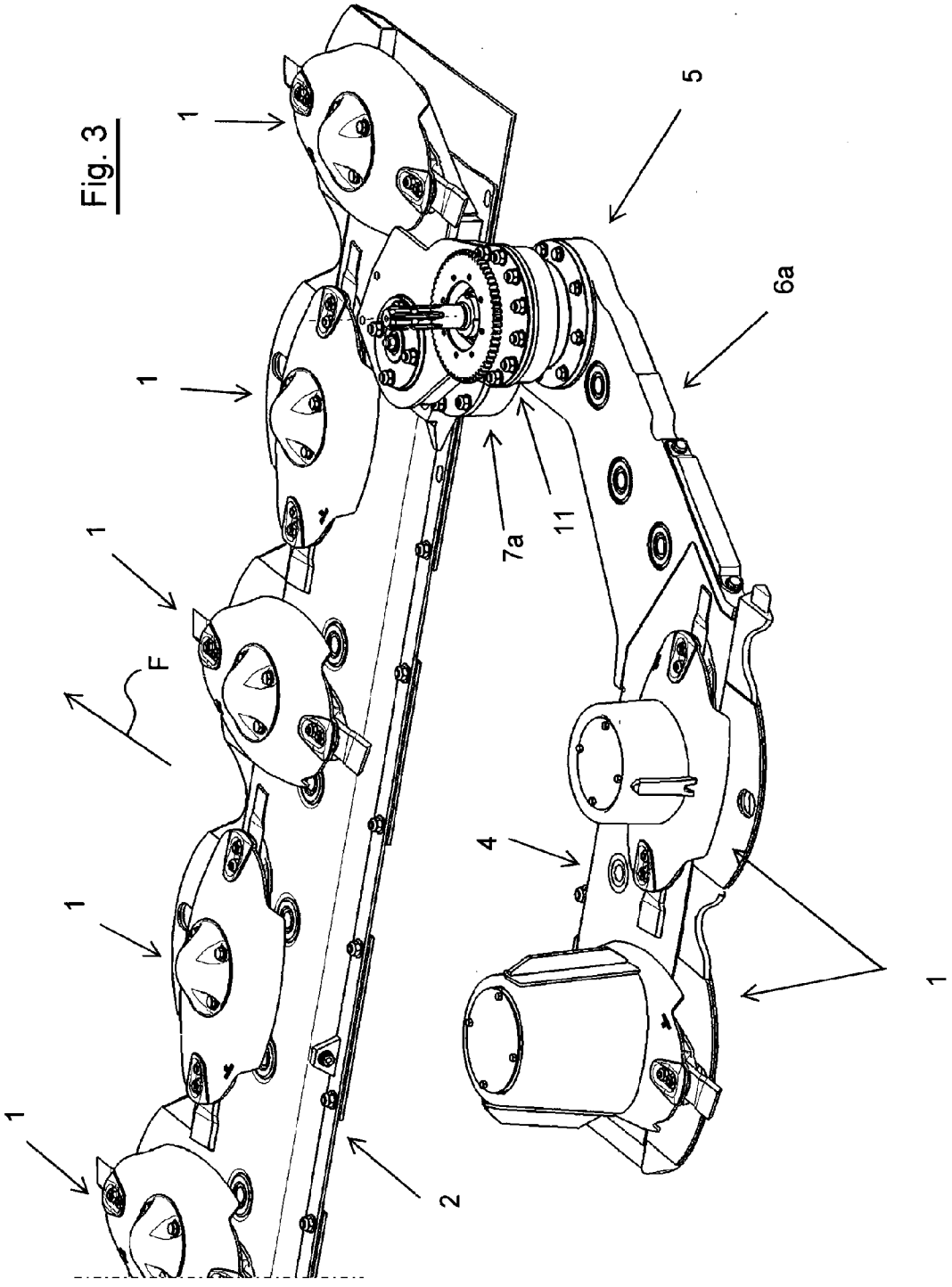
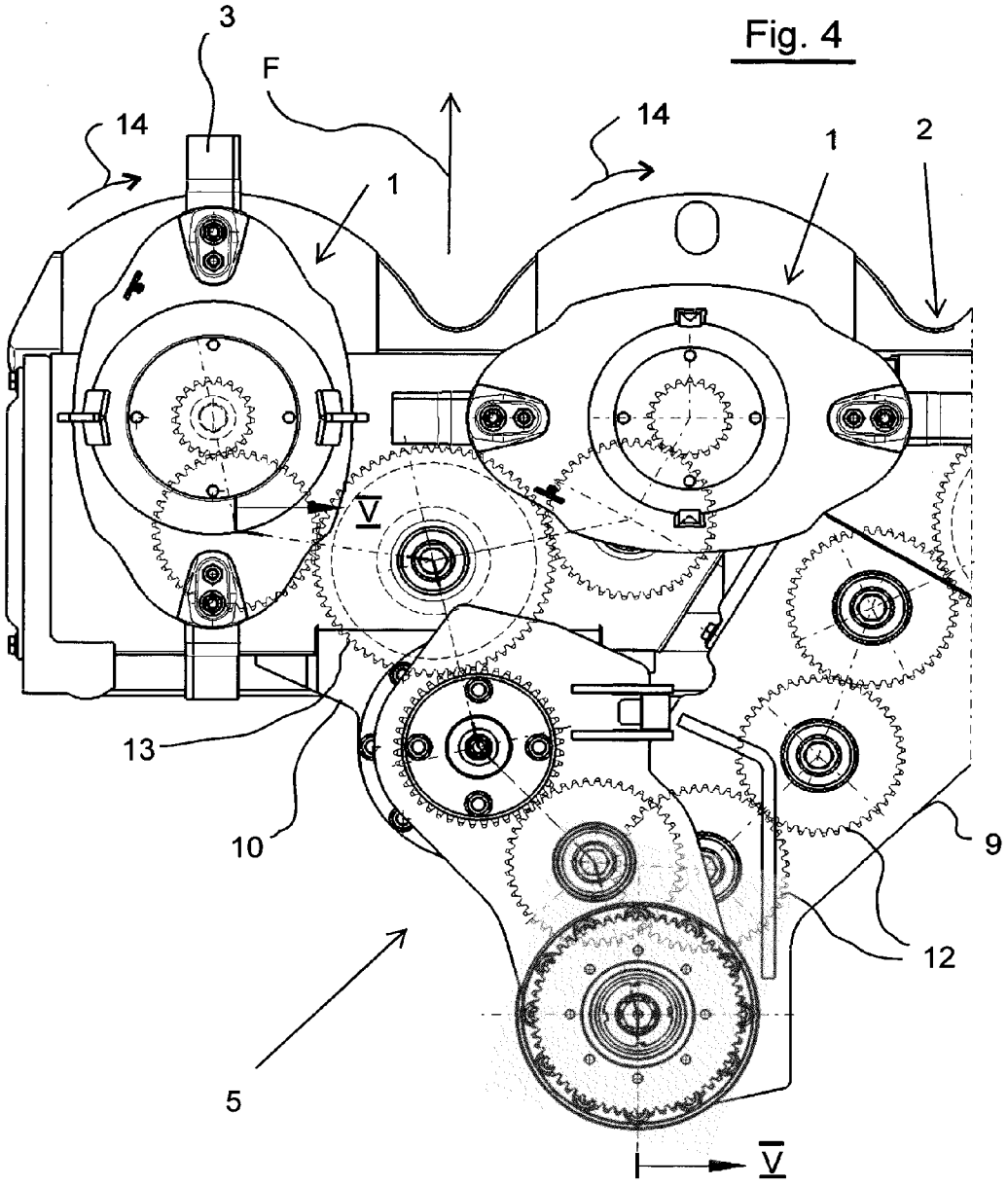


Fig. 4



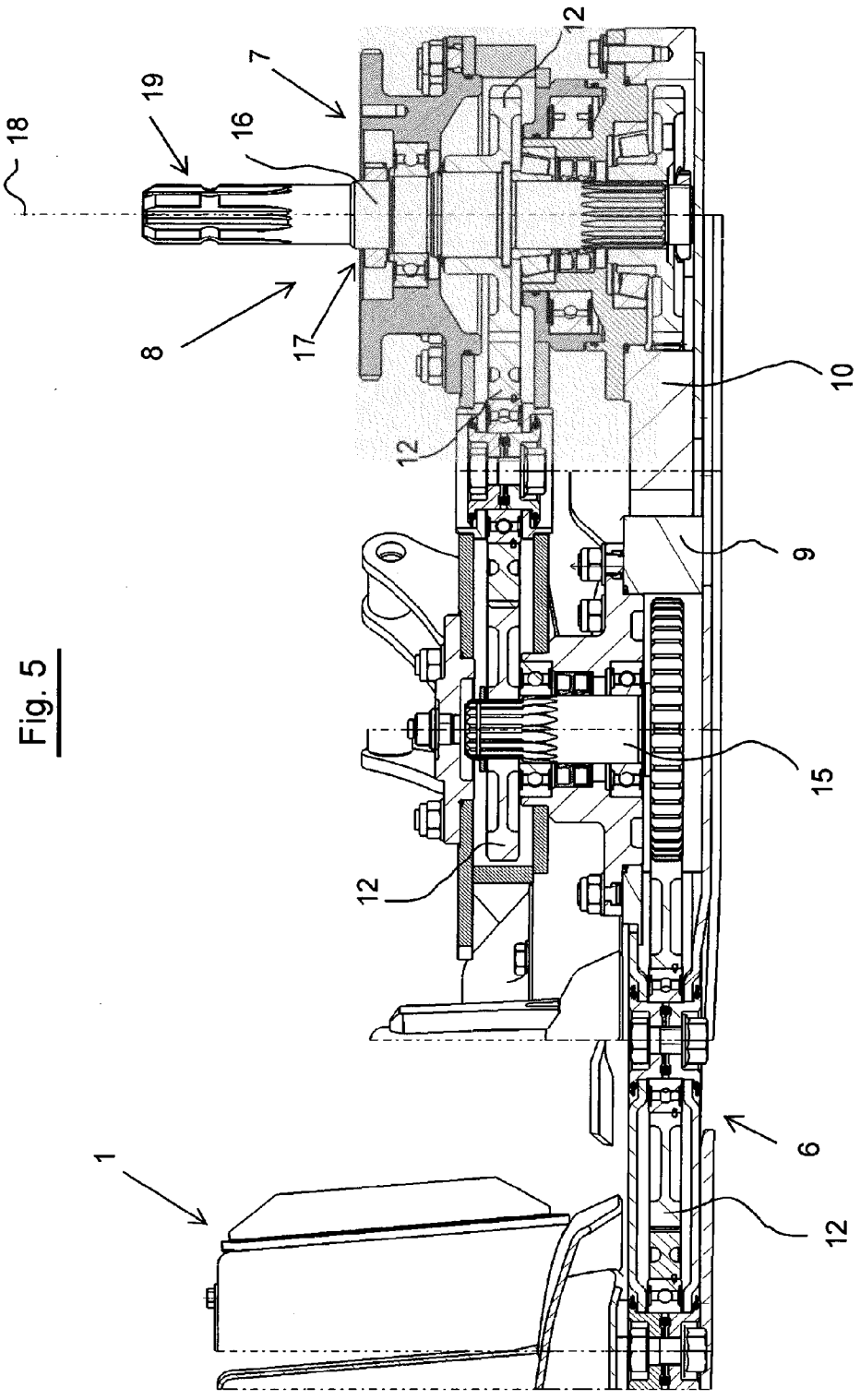


Fig. 5

Fig. 6