

(12)

A 01 D 84/02 (2006.01)

Oversættelse af europæisk patentskrift

A 01 D 43/04 (2006.01)

Patent- og Varemærkestyrelsen

Int.Cl.:

(51)

(74)

(54)

Oversættelsen bekendtgjort den: 2020-11-09 (45)Dato for Den Europæiske Patentmyndigheds (80)bekendtgørelse om meddelelse af patentet: 2020-10-14 Europæisk ansøgning nr.: 17206609.4 (86)Europæisk indleveringsdag: 2017-12-12 (86)Den europæiske ansøgnings publiceringsdag: 2018-06-13 (87)2016-12-12 DE 202016007555 U (30)Prioritet: 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 (84)MC MK MT NL NO PL PT RO RS SE SI SK SM TR Patenthaver: PÖTTINGER Landtechnik GmbH, Industriegelände 1, 4710 Grieskirchen, Østrig (73)Opfinder: Gadermayr, Andreas, Stögen 5, 4751 Dorf a. d. Pram, Østrig

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(56) Fremdragne publikationer:

Benævnelse: Landbrugsarbejdsmaskine

DE-A1- 3 047 878 GB-A- 1 274 372 US-A- 4 148 176 US-A- 4 149 364

Description

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The present invention relates to an agricultural work machine, in particular in the form of a haymaking machine for attachment to a tractor, with at least one work unit for processing agricultural material as well as an impact shield for limiting the shedding and/or deposition and/or scatter area of the material processed by the work unit, wherein the impact shield is designed to be movable between a working position and a transport and/or headland position.

In the case of haymaking machines in the form of mergers or transverse conveyors, for example, such as can be used behind mower units, or swathers, swath boards or swath curtains are used to deposit the harvested material processed by the work rotor or unit cleanly in a swath and to prevent harvested material from being flung too far sideways at a high rotor speed or high conveyor belt speeds. Similar impact shields are used on tedders to limit the scatter or shedding area of the tedder gyroscopes. In the case of tillage units such as rotary harrows also, similar impact shields or elements can be deployed to prevent stones, clods of earth or similar material from being flung out by the harrow tines.

Such impact shields can usually be moved from the working position close to the ground into a headland and/or transport position to reduce the dimensions of the machine and comply with traffic regulations. Depending on the design of the machine, the issue here can be the working width, in particular if the swath board on rotary swathers or mergers is arranged projecting sideways adjacent to the work rotor or conveyor belt. On the other hand, moving the impact shield into a headland and/or transport position also serves to increase the ground clearance. Since the impact shields generally run close to the ground in the working position, the impact shields must be raised for the headland or for road transport to prevent material from scattering through under the shield. Depending on the design of the work machine and arrangement of the impact shield, the impact shield can also be raised automatically when the work unit is raised, while separate lifting of the impact shield is necessary if the impact shield is not attached to the section of the work unit that is to be raised.

The impact shields can usually be pivoted into said transport and/or headland position, wherein the impact shields can also be articulated via linkages or link arrangements in order to hold the impact shield in a certain orientation or move it into a certain orientation on pivoting into the transport position. Pivotably hung impact shields of this kind are shown, for example, by the publications EP 0 845 199 B1, EP 2 756 749 A1, DE 20 2013 002 236 U1, DE 20 2010 006 406 U1, US 4,149,364 A and in particular GB 1 274 372 A, which discloses an agricultural work machine according to the preamble of claim 1.

The previously known impact shield suspensions range with their guide linkage over a relatively large space on pivoting into the transport position, however, and require a relatively large amount of room above their working position and above the work unit, as the impact shields are normally moved into a transport position above the work unit to reduce the machine width for road transport, which is required due to the lateral projection in the working position.

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On some machine types, the space above the working position of the impact shield and also above the work unit is very limited, at least when the work unit is likewise raised in the headland or for transport. This is the case, for example, on so-called butterfly devices, on which two work units are arranged adjacent to one another and the impact shield is arranged between the two work units. Such butterfly devices can be haymaking machines such as swathers, for example, on which two swather rotors projecting right and left are supported on a central machine frame by means of pivot arms, so that the swather rotors can be pivoted upwards in the headland and for transport. In a similar manner, however, such butterfly devices can also be mowing machines with two mowing units arranged projecting right and left, to which transverse conveyors and/or conditioners, for example, can subsequently be connected, between which an impact shield of said type can then be provided. For example, the impact shield can be arranged in the working position approximately centrally between transverse conveyor belts or rake screens, by means of which the mowed harvested material is conveyed transversely and deposited centrally on the impact shield.

In the case of such double or butterfly devices with an impact shield in the central midarea between the lateral work units, the space above the impact shield is very limited. On the one hand, the work units themselves move towards one another and centrally together when they are pivoted upwards into their transport position. On the other hand, the central machine frame itself extends in the middle area between the laterally arranged work units, so that not much space is left for the impact shield, in particular not for the space that the link arrangement ranges over when the impact shield is to be moved from its working position into the headland or transport position.

The object of the present invention is therefore to create an improved agricultural work machine, which avoids the disadvantages of the prior art and develops the latter further in an advantageous manner. In particular, an improved impact shield is to be created that can be moved in a space-saving manner into its headland and/or transport position without requiring complex and expensive suspension structures and actuators for this.

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According to the invention, said object is achieved by an agricultural work machine according to claim 1. Preferred configurations of the invention form the subject matter of the dependent claims.

It is therefore proposed to collapse the impact shield into itself to create the necessary ground clearance for the headland and road transport and to be able to adhere to the traffic regulations. The impact shield reduces its dimensions, so to speak, or the impact surface spanned in the headland and/or transport position compared with the working position and no longer needs to be pivoted as a whole or with the bulky dimensions that the impact shield assumes in the working position. If the impact shield is nevertheless moved and/or pivoted additionally via a linkage or another mobile suspension from the working position into another headland and/or transport position, the space covered can be reduced by collapsing the impact shield itself.

According to the invention, the impact shield is divided into several shield segments, which are supported movably relative to one another such that the shield segments are collapsible from the working position, in which the shield segments lying adjacent to one another jointly form an impact surface, by movement relative to one another

into the transport and/or headland position. The impact shield thus has different shapes and/or dimensions in its working position on the one hand and its headland and/or transport position on the other, in particular the impact surface spanned by the shield segments is reduced when the shield segments are collapsed relative to one another into the headland and/or transport position. The body of the impact shield and its external dimensions are more compact in the headland and/or transport position than in the working position, the impact shield is more slender or smaller in terms of area.

The impact shield can be segmented here in different ways. For example, the shield segments can comprise surface parts in basic geometric shapes such as a rectangle, triangle or hexagon, or also comprise surface parts with irregular or free-form outlines in the manner of puzzle elements, which surface parts are complementary in order jointly to form an impact surface.

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In particular, the shield segments can be designed as elongated bars, which are lined up adjacent to one another in the working position of the impact shield and form a grid or a comb. The impact shield can thus be designed as a bar grid or bar comb, the bars of which can be moved into a collapsed headland and/or transport position. In the working position, said bars can be spaced from one another and advantageously aligned approximately parallel to one another and jointly define an envelope surface, which forms the aforesaid impact surface. In this case the bars can be arranged in a common plane, so that a level impact surface results when the bars are in their working position. It would also be possible in principle, however, to arrange the bars along a curved envelope surface, which can have a curvature perpendicular to the parallel bars. Alternatively or additionally, the bars can also be crossed in relation to one another and/or not aligned parallel to one another in the working position, for example in an intersecting arrangement, as is known per se in the case of extendable rechauds or trivets.

A comb-shaped bar arrangement can advantageously be provided as an impact shield in which the bars – at least in the working position – are articulated at their top end and project freely downwards, in a similar manner to that known from the rakes of

swather rotors. With such freely projecting, comb-shaped bar arrangements, in which the lower ends of the bars are free, no harvested material can get caught, or harvested material can be stripped off downwards again from the gaps between the free ends.

The bars or shield segments can be supported here movably relative to one another in a fundamentally different way. It would be possible, for example, to support the bars slidably so that they can be pushed together in the manner of a curtain. According to the invention, the shield segments are supported in particular pivotably so that the shield segments can be pivoted between working position and headland and/or transport position. In particular, due to a pivotable support, the shield segments can be pivoted together into a more compact, two-dimensionally smaller headland and/or transport position and conversely pivoted out into the working position, in which the shield segments jointly span the impact surface.

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According to the invention, the shield segments are supported pivotably about pivot axes, which extend transversely to the impact surface formed in the working position, wherein said pivot axes can advantageously be parallel to one another. It would also be conceivable, however, to pivot the pivot axes slightly towards one another or to orient them skewed, in order to pivot the shield segments away in different directions so that they do not stand in each other's way when they are pivoted together into the headland and/or transport position.

Due to the extension or orientation of said pivot axes transversely to the impact surface of the impact shield in its working position, the impact shield can be pivoted together into itself, so to speak. The shield segments can be folded together in the plane of the impact shield to move the impact shield into its headland and/or transport configuration. A particularly compact transport or headland position can be realised hereby.

In a further development of the invention, each shield segment can have its own pivot axis, it also being alternatively possible, however, to combine shield segments in groups and pivot them in groups jointly about a particular pivot axis. For example, two or three bars can be combined and pivoted about a common pivot axis, so that with 15 bars, for example, a total of five groups with five pivot axes can be provided, wherein other grouped subdivisions would also be possible, however. Each bar can

advantageously have its own pivot axis, however, whereby a particularly compact transport position can be achieved.

Said pivot axes of the shield segments can advantageously be lined up or arranged along a straight or curved line, which line can advantageously extend roughly parallel or tangentially to a main axis of the impact shield in its working position and/or transversely to its longitudinal axis of the shield segments in their working position. In particular, the pivot axes can be lined up along a horizontal line extending in the direction of travel.

In an advantageous further development, the pivot axes can be provided on end sections of the elongated shield segments, so that the shield segments can be pivoted about their end sections. It would also be possible in principle to provide the pivot axes centrally, for example, on the shield segments, so that these can be rotated in the manner of a compass needle, so as to require as little space as possible for the rotation or pivoting. In particular, the elongated bars or the shield segments can be suspended pivotably at their top end sections when viewed in the working position, so that the shield segments can be pivoted upwards into the headland and/or transport position. By such supporting at the upper end sections, an especially large gain with regard to ground clearance can be achieved - compared with the central articulation described previously - when the shield segments are pivoted upwards into the headland and/or transport position.

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The shield segments can advantageously be suspended pivotably on a common shield carrier, wherein said shield carrier can advantageously extend roughly parallel to the impact shield along an edge, in particular the top edge of the impact shield. Said shield carrier can be designed in this case as a profiled support, for example in the manner of a beam or a tube or an edge profile or an extruded profile to which the shield segments, in particular said bars, can be articulated pivotably.

If collapsing the impact shield is not sufficient, said shield carrier can itself be articulated movably to a machine frame part and/or the work unit, for example by means of a pivot bearing and/or a linkage and/or a link arrangement, in order to be able to move the collapsed impact shield even further upwards and/or in a different

direction, for example to be able to reduce the lateral distance from a work unit. For example, said shield carrier can be attached to a telescopic or slidably supported and/or pivotably suspended support arm so as to be able to set and/or change the distance from the work unit and/or to be able to move or pivot the impact shield upwards and downwards.

To be able to move the shield segments between their working position and headland and/or transport position, the shield segments can advantageously be connected articulately to a common operating element, which is actuatable by a common actuator. All or at least several shield segments can be actuated hereby by a common actuator.

Said operating element, to which the shield segments are jointly articulated, can advantageously be designed as a profiled support, which can extend substantially parallel to the shield carrier on which the shield segments are supported articulately. Alternatively or in addition, said operating element can be movable roughly parallel to said shield carrier and/or roughly parallel to the impact surface of the impact shield, in order to be able to move the shield segments back and forth by said traversing movement between their working and transport or headland positions.

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In particular, the aforesaid operating element and/or the aforesaid actuator can be arranged and/or movable in the plane of the impact surface of the impact shield and/or parallel to said plane of the impact surface of the impact shield. In particular, said operating element and/or said actuator can be arranged parallel along one of the borders or edges of the impact shield, whereby a particularly compact and space-saving arrangement is achieved.

Said actuator can be a pressure-medium cylinder, for example, which can be articulated on the one hand to said operating element and on the other hand to a frame part or the aforesaid shield carrier, for example, in order to pivot the shield segments relative to the shield carrier.

In an advantageous further development of the invention, the at least one work unit can be lifted out of a lowered working position into a raised headland and/or transport position, for example by means of a support arm, which can extend transversely to the travel direction, for example, and be articulated to a frame pivotably about a horizontal support arm axis pointing in the travel direction.

In a further development of the invention, the actuating drive for collapsing the impact shield or for moving and/or pivoting the shield segments of the impact shield can have a control connection to the movement of the work unit that moves the work unit between working and transport position, so that on lifting of the work unit into its headland and/or transport position, the impact shield is also collapsed into its headland and/or transport position.

Here the actuator for collapsing or adjusting the impact shield can advantageously be connected hydraulically to the actuator for lifting the work unit, so that a hydraulic control coupling is provided. For example, the actuator of the impact shield and the actuator for raising the work unit can be hydraulically connected to one another in the manner of a master-slave arrangement. If the lifting cylinder for lifting the work unit is acted upon by pressure, which leads to lifting, the pressure can also be provided to the actuator of the impact shield so that the shield segments are collapsed.

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The invention is explained in greater detail below on the basis of a preferred exemplary embodiment and associated drawings. The drawings show:

- Fig. 1: A rear view in perspective of an agricultural work machine in the form of a mowing machine with associated mergers or swathers, wherein the work units are arranged in a butterfly arrangement to right and left of a machine frame, between which units an impact shield according to an implementation of the invention is provided,
- Fig. 2: A rear view of the implement from Fig. 1, which shows the central arrangement of the impact shield between the transverse conveyor belts of the lateral merger units, which arrangement is upright in the working position and parallel to the direction of travel,
- Fig. 3: A rear view in perspective of the implement similar to Fig. 1, wherein the impact shield is moved by collapsing its bars upwards into its headland and transport position,

- Fig. 4: A partial, enlarged depiction of the impact shield of the implement from the preceding figures that shows the shield segments in the form of elongated bars in their extended working position and their suspension on a shield carrier in the form of a profiled support, and
- Fig. 5: A partial depiction in perspective of the impact shield similar to Fig. 4, wherein the elongated shield segments in the form of bars are pivoted upwards into their headland and transport position.

As Fig. 1 shows, the agricultural work machine 1 can be designed as an implement for attachment to a tractor and comprise a machine frame 2, which can be attached via a headstock and a three-point linkage to a tractor, which is not shown. It would also be possible in principle, however, to design the implement as a semi-mounted implement, on which the machine frame is supported via its own chassis on the ground and is attached to the tractor via a drawbar.

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In particular, the work machine 1 can be designed in the form of a butterfly device, on which two work units 3 and 4 are arranged projecting laterally to right and left of said machine frame 2.

As the figures show, the work units 3 and 4 can comprise mowing units, to each of which a conditioner and/or a transverse conveyor can be connected downstream, wherein the transverse conveyor belts shown in the drawing, for example, can be provided as transverse conveyors 5 and 6. Alternatively, transverse augers or circulating belt rakes can also be provided as transverse conveyors. Alternatively or in addition, swathing rakes with raking rotors circulating about upright axes can also be provided.

In the case of the butterfly arrangement shown in the figures, the transverse conveyors 5 and 6 can convey harvested material to one another running counter to one another and deposit it in a central area between the two work units 3 and 4. In order not to overlap the swath components coming from right and left, an impact shield 7 is provided in the area between the work units 3 and 4, which shield extends in its working position, shown in Fig. 1, upright and parallel to the direction of travel and is arranged laterally spaced in each case from the two work units 3 and 4, wherein the

impact shield 7 can be arranged in particular in the discharge area of the transverse conveyors 5 and 6 or can limit this discharge area.

Alternatively to the arrangement shown in the drawings, however, it is also possible to use the impact shield 7 in connection with just one work unit, wherein the impact shield is then arranged laterally adjacent to the one work unit so as to limit the discharge area of the transverse conveyor in said manner.

Said work units 3 and 4 including their mower units and the conditioners or transverse conveyors 5 and 6 connected downstream can be suspended on support arms 8 and 9, for example, which are arranged projecting from the central machine frame 2 transversely to the direction of travel and can be pivoted upwards about horizontal pivot axes pointing in the direction of travel, for example, in order to be able to lift the work units 3 and 4 from the lowered working position shown in Fig. 1 upwards into a headland and/or transport position. Lifting actuators 10, for example in the form of pressure-medium cylinders, can be provided for this, which can be articulated on the one hand to the machine frame 2 and on the other hand to one of the support arms 8 and 9.

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The aforesaid impact shield 7 can be suspended on the central machine frame 2.

As Figures 4 and 5 show, the impact shield 7 can be divided into several shield segments 11, which can be designed in particular as elongated, prong-shaped bars 12. Said bars 12 can form thin, straight profile bars, which in the working position shown in Fig. 4 are arranged parallel to one another and spaced at a distance from one another in the manner of a comb.

In particular, said bars 12 can be attached by their top end sections to a shield carrier 13 in the form of a profiled support, which carrier can extend horizontally approximately parallel to the direction of travel and can be mounted rigidly or movably on the central machine frame 2.

In particular, said bars 12 are respectively supported articulately on said shield carrier 13, wherein the support articulations 14 of each bar 12 can have pivot axes 15, which can extend horizontally transversely to the direction of travel. Said pivot axes 15 can

be arranged in parallel to one another and spaced at a distance from one another and/or be lined up along the longitudinal axis of said shield carrier 13 and/or a line at least approximately parallel to the direction of travel.

As Fig. 4 shows, the shield segments 11 in the form of bars 12 can be supported projecting freely, wherein in particular only the upper end sections can be supported, from which the shield segments extend projecting freely. Harvested material can hereby fall out of the gaps, which are open downwards, and not get caught on the bar grid or comb.

As Fig. 5 shows, the shield segments 11 in the form of bars 12 can be pivoted upwards into a headland and/or transport position. The shield segments 11 move in this case in the plane of the impact shield 7, so that the impact shield 7 is collapsed into itself, so to speak. While the bars 12 extend in the working position in an upright orientation, they can assume a horizontal orientation in the transport and/or headland position, in which the bars 12 extend approximately parallel or only slightly inclined at an acute angle to the line along which the pivot axes 15 are arranged. In particular, the bars 12 can extend approximately parallel or only slightly inclined at an acute angle to the elongated shield carrier 13 on which the bars 12 are suspended articulately.

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To adjust the shield segments 11 in the form of bars 12, an actuator 16 actuated by external energy can advantageously be provided, which can be articulated on the one hand to the shield carrier 13 or a frame part connected thereto and on the other hand to an operating element 17, which operating element 17 is coupled in turn to the bars 12. In particular, said operating element 17 can be connected articulately to all bars 12.

Said operating element 17 can be an on the whole elongated carrier, which can advantageously extend approximately parallel to the shield carrier 13. Alternatively or in addition, the actuator 16 can also extend approximately parallel to the shield carrier 13, so that an on the whole compact arrangement can be achieved.

Said operating element 17 is movable relative to the shield carrier 13, to be precise slidable in particular in the longitudinal direction of the shield carrier 13 relative to this. Put more precisely, the operating element 17 is slidable relative to the shield carrier

13 in parallel on a curved actuating path that is defined by the crank motions that the bar sections to which the operating element 17 is articulated execute about their pivot axes 15.

As Figures 4 and 5 show, the operating element 17 can be pretensioned by a pretensioning device 18, for example in the form of a spring device, into a position in which the bars 12 extend in their working position. Due to said actuator 16, the operating element 17 can be moved, overcoming the pretensioning force, and thus the bars 12 can be moved into the headland or transport position.

A blocking and/or latch device 19 can advantageously be provided, by means of which the operating element 17 can be held against the pretensioning force of the pretensioning device 18 in a predetermined position. Said blocking and/or latch device 19 can advantageously be designed adjustably here, so that the working position can optionally be defined and the bars 12 held in their headland and/or transport position, even without the actuator 16 having to be energised for this. For example, the blocking and/or latch device 19 can have a displaceable positioning pin, against which the operating element 17 can stop as a limit stop, cf. Fig. 5.

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Patentkrav

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- 1. Landbrugsarbejdsmaskine, især mejemaskine med tværtransportør og/eller høbjergningsmaskine til montering på en traktor med mindst et arbejdsaggregat (3,4) til bearbejdning af et landbrugsmateriale samt en prelskærm (7) til begrænsning af afkastnings- og/eller aflægnings- og/eller spredningsområdet af materialet, der bearbejdes af arbejdsaggregatet (3,4), hvor prelskærmen (7) er udformet således, at den kan anbringes mellem en arbejdsstilling og en transport- og/eller forpløjningsstilling, hvor prelskærmen (7) er opdelt i flere skærmsegmenter (11), som er monteret bevægeligt i forhold til hinanden på en sådan måde, at skærmsegmenterne (11) fra arbejdsstillingen, hvor skærmsegmenterne, som ligger ved siden af hinanden, sammen danner en prelflade for landbrugsmaterialet, kan sammenkøres til transport- og/eller forpløjningsstillingen ved relativ bevægelse i forhold til hinanden, kendetegnet ved, at skærmsegmenterne (11) er monteret svingbart omkring svingakser (15), som strækker sig på tværs af prelfladen, der er dannet i arbejdsstillingen, således at skærmsegmenterne er sammenklappelige i det mindste tilnærmelsesvist i prelskærmens plan.
- 2. Landbrugsarbejdsmaskine ifølge det foregående krav, hvor skærmsegmenterne (11) er udformet som aflange stave, som i arbejdsstillingen danner et prelgitter eller en prelkam.
 - 3. Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor hvert skærmsegment (11) har sin egen svingakse (15).
 - **4.** Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor svingakserne (15) er anbragt fordelt langs en linje (20), som strækker sig ca. parallelt eller tangentielt i forhold til en hovedakse af prelskærmen (7) i dens arbejdsstilling og/eller på tværs af de langsgående akser af skærmsegmenterne (11) i deres arbejdsstilling.
 - **5.** Landbrugsarbejdsmaskine ifølge det foregående krav, hvor den nævnte linje (20), langs hvilken svingakserne (15) er anbragt, strækker sig på en sådan

måde, at den ligger tilnærmelsesvist parallelt med kørselsretningen.

- **6.** Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor skærmsegmenterne (11) er monteret svingbart på deres endeafsnit øverst i arbejdsstillingen.
- 7. Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor skærmsegmenterne (11) er svingbart ophængt på en fælles skærmbærer (13), som strækker sig cirka parallelt med prelskærmen (7) langs en rand af prelskærmen (7).

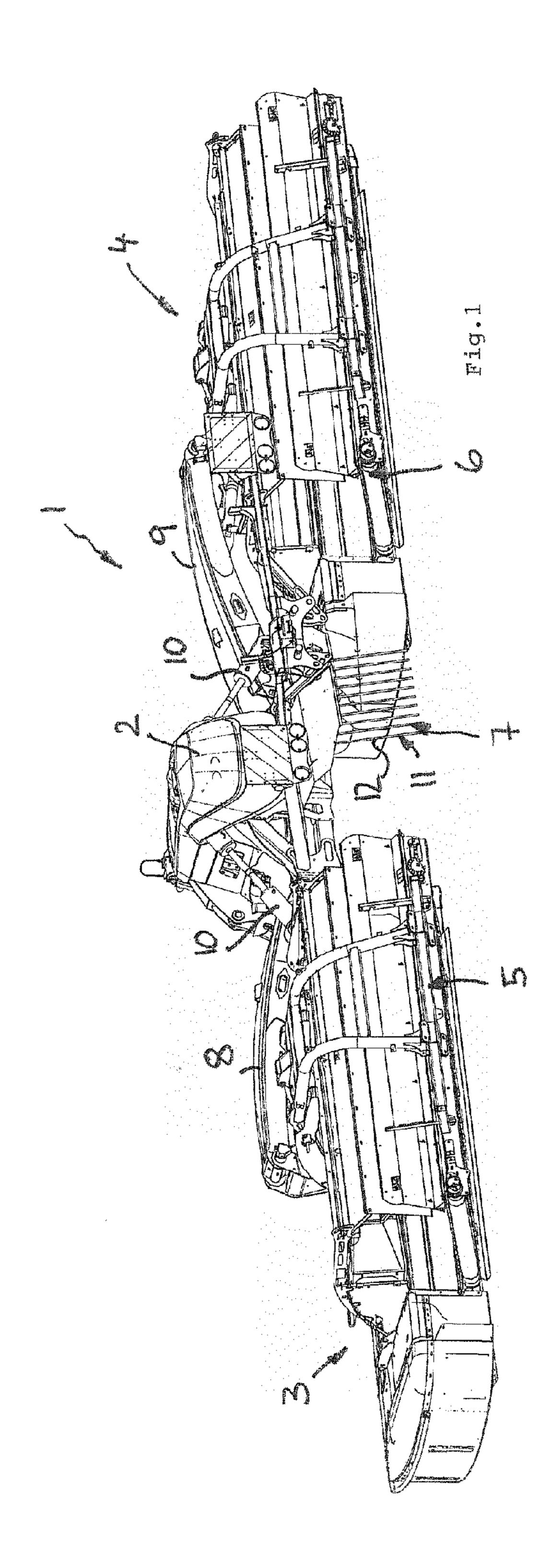
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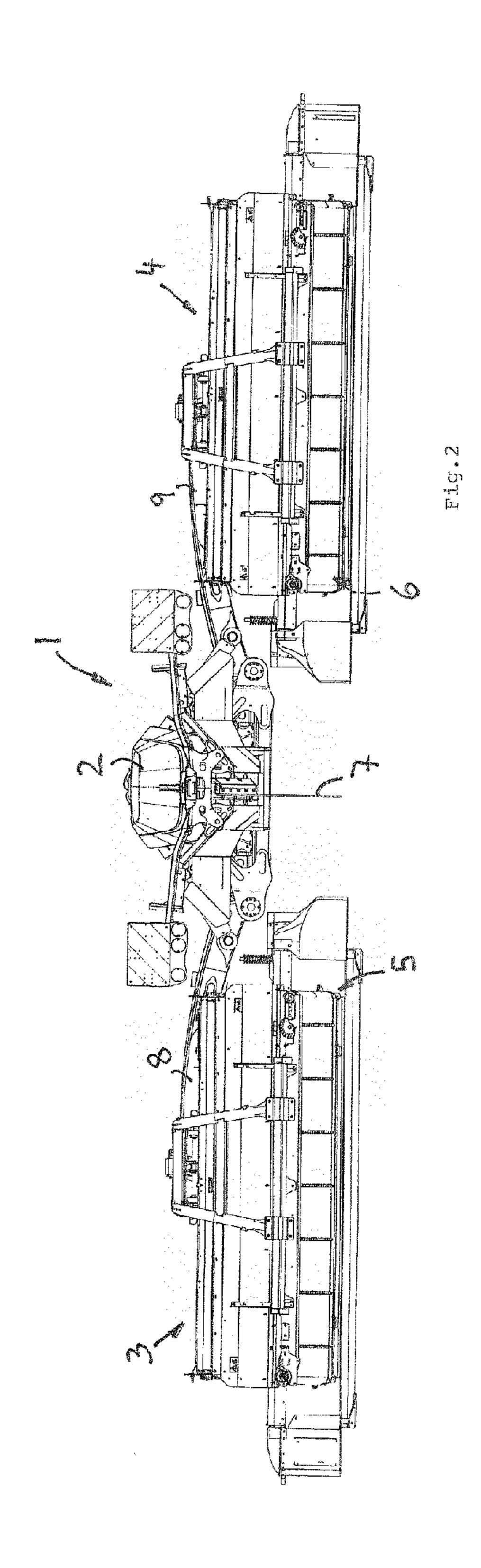
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- 8. Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor skærmsegmenterne (11) er ledmæssigt forbundet med en fælles indstillingsdel (17), som kan bevæges af en indstillingsaktuator (16) med henblik på indstilling af skærmsegmenterne (11), hvor indstillingsdelen (17) i det mindste tilnærmelsesvist strækker sig parallelt med en rand af prelskærmen (7) og/eller kan bevæges i planet, som er opspændt af prelskærmen (7), og/eller parallelt med det nævnte plan, som er opspændt af prelskærmen (7), og/eller indstillingsdelen (17) og skærmbæreren (13) strækker sig parallelt med hinanden, og indstillingsdelen (17) kan bevæges i forhold til skærmbæreren (13) i et plan, som strækker sig parallelt med den aflange skærmbærer (13).
- **9.** Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor det mindst ene arbejdsaggregat (3,4) er udformet således, at det kan hæves fra en nedsænket arbejdsstilling til en hævet forpløjnings- og/eller transportstilling, og der er tilvejebragt en styreindretning til aktivering af indstillingsaktuatoren med henblik på sammenkøring af prelskærmen (7) automatisk afhængigt af hævningen af arbejdsaggregatet (3,4).
- **10.** Landbrugsarbejdsmaskine ifølge det foregående krav, hvor styreindretningen omfatter en hydraulisk kobling af indstillingsaktuatoren (16) til sammenkøring af prelskærmen (7) til en hæveaktuator til hævning af arbejdsaggregatet (3,4).

- **11.** Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor prelskærmen (7) i sin arbejdsstilling danner en skårlægningskam, der er dannet af en stanganordning, som er åben nedad.
- 12. Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor to arbejdsaggregater (3, 4) er tilvejebragt i en butterfly-anordning og er anbragt således, at de rager ud til højre og venstre fra en central maskinramme (2), hvor prelskærmen (7) er anbragt mellem de to arbejdsaggregater (3, 4).
- 13. Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor det mindst ene arbejdsaggregat (3,4) har en mejeenhed og en tværtransportør (5,6), som er efterkoblet mejeenheden, til tværtransportering af høstmaterialet, som mejes af mejeenheden, og aflægning af høstmaterialet i en sideskårlægning ved siden af mejeenhedens kørespor, hvor prelskærmen (7) er anbragt i tværtransportørens (5,6) udkastnings- og/eller aflægningsområde og/eller begrænser dette aflægningsområde.
 - **14.** Landbrugsarbejdsmaskine ifølge et af de foregående krav, hvor det mindst ene arbejdsaggregat (3,4) omfatter en skårlægningsenhed til skårlægning af høstmateriale.





DK/EP 3332628 T3

