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The present invention relates to an agricultural machine which can be configured as a hay-making machine, preferably in the form of a tedder or swather, having a transport frame which can be attached to a tractor and which is supported on the ground via a chassis and having at least one piece of working equipment for forage cultivation or for soil cultivation which is supported at a support frame which can be lifted relative to the transport frame together with the piece of working equipment by a pivoting/lifting apparatus into a headland position and into a transport position, wherein the pivoting lifting apparatus comprises an adjustment cylinder unit having a plurality of cylinders and pistons.

With larger hay-making machines which have larger working widths and which comprise a plurality of rotary rakes arranged next to one another and/or running in different tracks, it is known to arrange the hay-making units in a liftable manner at a transport frame supported on the ground via a chassis so that the hay-making units can be lifted at the headland or can be lifted even further and can optionally be folded together for the purpose of transport. For this purpose, the support frame which supports the hay-making units is typically pivotably hinged to the transport frame about a horizontal transverse axle so that the support frame can be pivoted to the front/to the top or can be lifted together with the hay-making units arranged thereat in the form of rotary rakes, with the support frame optionally being able to have side parts which can be folded down and which can be pivoted to the front in the transport position. Such hay-making machines in the form of tedders are known, for example, from the documents EP 1 859 670 A1m EP 2 179 641 A1 or WO 2010/074558 A1.

The rotary rakes then stand with the rake prongs outward in the transport position with such hay-making machines. The rotary rake axes of the rotary rakes folded to the front at the transport frame are tilted in the named transport position so that the named rotary rake axes are aligned approximately horizontally transversely to the direction of travel. Such a tilting of the rotary rakes in the transport position is necessary per se to achieve

a sufficiently narrow road transport width in the desired manner. This can be achieved, for example, in that the support frame is first upwardly pivoted in total about a horizontal transverse axis so that the rotary rakes first face in the direction of transport with the rotary axes horizontal, whereupon the side parts of the support frame can then be folded forwards to reach the desired transport position in which the hay-making units extend along the transport frame.

In order to support the side parts then folded forward or the pieces of working equipment fastened thereto and to secure them against blows from bumps and road irregularities, the support frame can again be pivoted a little further about the named horizontal transverse axis after the folding in of the side parts so that the carrier frame side parts or the pieces of working equipment fastened thereto move into support depressions and are supported there. The adjustment movement, which the lifting pivoting apparatus has to carry out, hereby, however, becomes relatively complicated since the pivot movement about the horizontal transverse axis has to be stopped before reaching the complete final position to be able to fold the side parts inward so that a corresponding adjustment cylinder cannot simply be moved into its end position, but rather has to be stopped beforehand.

The control of the adjustment cylinder unit furthermore becomes yet more complicated if the support frame should not only be moved to and fro between the work position and the transport position, but should also be moved into a headland position. The interchangeable equipment items are as a rule only raised a little from the ground at the edge of the field or at the headland in order, for example, already to be able to move over swaths already raked together. In this respect, the lifting should be relatively limited so that the drive can continue to run and the articulated shafts in this respect do not undergo any excessive kinking. If the lifting into the headland position is effected by the same adjustment cylinder unit, it must be able to travel to a further intermediate position. For this purpose, either relatively complex hydraulic control means such as

blocking valves, control valves and the like can be used or mechanically inwardly pivotable abutments can be provided so that the adjustment movement can be stopped or interrupted without having to provide a corresponding pressure control. However, both are unsatisfactory.

It is the underlying object of the invention to provide an improved agricultural machine of the initially named kind which avoids disadvantages of the prior art and further develops the latter in an advantageous manner. A precise traveling to both the headland position and the transport position should in particular be made possible with a pressure control which is as simple as possible without any complex valve arrangements, with a fine, two-stage travel to the transport position in particular also being made possible.

This object is achieved by an agricultural machine in accordance with claim 1. Preferred embodiments of the invention are the subject of the dependent claims.

It is therefore proposed that at least two pistons are each displaceably associated with a one piston rod in the same cylinder so that the piston rod is displaceable relative to each of the two pistons, wherein a different adjustment path and thus a different adjustment movement of the piston rod accruing to each of the pistons. In accordance with the invention, a plurality of pistons are received in at least one of the cylinders of the adjustment cylinder unit and are displaceably supported relative to a piston rod displaceable received in the cylinder, wherein the plurality of pistons have different respectively restricted displacement ranges relative to the piston rod. Different adjustment movements can also be implemented despite a compact, simple configuration of the adjustment cylinder unit without any complicated pressure control means such as hydraulic valves or corresponding inwardly pivotable flip stops due to the displaceability of the two pistons relative to the piston rod with a simultaneous reception in the same cylinder. Since each piston has a different displacement range relative to the piston rod, adjustment paths of the piston rod corresponding to the

displacement ranges can be generated by actuating the pistons without the adjustment path generated by the one piston being impeded or limited by the limited displaceability of the other piston.

In a further development of the invention, the displacement paths of the two pistons received in the same cylinder can be configured as free of overlap on or relative to the common piston rod. Not only a collision-free operation of the two pistons is hereby achieved, but also a supplement of the achievable adjustment paths which is the largest possible. On the other hand, the freedom from overlap of the displacement paths allows an individual adaptation of the piston cross-sections as well as a section-wise adaptation of the piston rod cross-sections to the respective adjustment work. In a further development of the invention, the pistons can, but do not have to, have the same outer diameter. The piston rod diameter can equally be individually adapted to only one of the two pistons for an adaptation to the desired adjustment forces by the effective cross-sectional surface which results fro this and on which the fluid pressure acts.

In an advantageous further development of the invention, two mutually independent adjustment paths of the piston rod relative to the named cylinder can be generated by the two pistons received in the same cylinder, in particular such that a first adjustment path can be generated by the action on the one of the piston independently of the action on the other piston and another adjustment path can be generated by the action on the other piston independently of the action on the above-named one piston. The respectively generated adjustment paths can in particular have different lengths to be able to satisfy different lifting problems by acting on the different pistons.

In an advantageous further development of the invention, one of the two pistons received in the same cylinder can be provided for extending the piston rod, whereas the other one of the two pistons received in the same cylinder is provided for retracting the piston rod into the named cylinder.

In order not to limit or impede the displacement path of the piston rod relative to the cylinder by the limitation of the displacement paths of the two displaceable pistons, provision is made that one of the two pistons received in the same cylinder is releasable from the piston rod and is removable in an axial direction so that the rod end of the piston rod is movable beyond the end position of the named piston or away therefrom. The named piston advantageously has an axial pressure surface facing the piston rod for pressing away, in particular for extending, the piston rod. Once the named piston has reached its end position provided in the direction of the adjustment path, the piston rod can nevertheless continue to move, for example when a corresponding force acts on the adjustment cylinder unit from the piece of working equipment and/or while controlling the further adjustment path by the other displaceable piston.

In addition to a piston releasable from the piston rod, the named cylinder receives a piston which is displaceably seated on the piston rod and which is secured against slipping off the piston rod. For this purpose, the piston rod has an end abutment surface in front of or directly at its free end which end abutment surface prevents a sliding down of the named piston beyond the free end of the piston rod. Said end abutment surface is advantageously provided at the piston rod between the two pistons displaceably received in the named cylinder.

The piston rod in this respect advantageously has a free end between the two pistons, wherein the piston rod can have a thickened portion, for example a shoulder or the like, in the region of the free end of the piston rod. The named free end can in this respect form an axial pressure surface against which the piston arranged releasably from the piston rod can axially press to extend the piston rod. The named thickened portion in the region of the piston rod end can, on the other hand, prevent the other displaceable piston from slipping down from the piston rod.

A free end of the piston rod is advantageous, but not compulsory, between the two pistons. In general it would likewise also be possible to be able to push the named releasable piston a little onto the piston rod, with here a thickened portion of the piston rod between the two pistons being able to provide that the two pistons can act on the piston rod in opposite directions. For example, a blind-hole-like recess can be provided at the one piston or also a passage bore if the piston rod is sufficiently long, optionally passes through the cylinder at both sides. However, the aforesaid configuration with a free end of the piston rod between the two pistons is preferred since here, on the one hand, double fits are avoided and, on the other hand, a short, compact construction can be achieved.

In a further development of the invention, the displaceabilities of the two pistons in the common cylinder are separate from one another or the named pistons are received in mutually delineated chambers of the cylinder. In an advantageous further development of the invention, the cylinder can have at least one radially inwardly projecting abutment between the pistons which bounds and mutually separates the adjustment paths of the pistons. The named abutment is in this respect advantageously configured such that the free end of the piston rod and/or its abutment securing the one piston can be moved past the named inwardly projecting abutment of the cylinder so that the division of the cylinder or the limitation of the adjustment paths of the pistons in the cylinder does not impede the movability of the piston rod.

In an advantageous further development of the invention the plurality of pistons in the common cylinder can be pressurized on mutually remote sides of the pistons, in particular such that the piston rod can be held tight or clamped by the two pistons in an intermediate position relative to the cylinder. The named intermediate position in this respect means a position of the piston rod which is between the maximum retracted and the maximum extended position of the named piston rod relative to the cylinder. Three different positions of the adjustment cylinder unit which are defined by the maximum

retracted position of the piston rod, by the maximum extended position of the piston rod and by the said intermediate position of the piston rod can hereby be achieved with only one cylinder and the two displaceable pistons received therein.

To allow a simple hydraulic control of said intermediate position, the pressure chambers connected in parallel and provided at the mutually remote sides of the pistons can be acted on by pressure from a common pressure line in a further development of the invention.

Beyond the named cylinder in which a plurality of pistons are received which are each displaceable with respect to the piston rod, the adjustment cylinder unit comprises at least one further cylinder which, in a further development of the invention, can be formed in a conventional manner per se as a dual action cylinder. In a further development of the invention, a piston can in particular be received in the other cylinder and can be axially fixedly connected to the piston rod. The cylinder can in this respect, in a further development of the invention, have two pressure chambers disposed on oppositely disposed sides of the named piston so that the piston rod can be retracted and extended by an action on the oppositely disposed pressure chambers. Depending on the lifting work to be carried out, however, a only singly acting cylinder configuration can also be provided, for example when it is ensured that a sufficient pulling force, or also compression force, acts on the cylinder during the adjustment path to be carried out by the cylinder, for example as a result of the weight of the piece of working equipment to be adjusted. A dual-action configuration is, however, preferred to be able to actively carry out adjustment movements in both directions.

In a further development of the invention, the adjustment cylinder unit can have two cylinders which are seated on a common piston rod, wherein the named piston rod can be retracted and/or extended by mutually independent adjustment movements relative

to the one cylinder, on the one hand, and can, on the other hand, be retracted and/or extended relative to the other cylinder.

Alternatively to such a configuration of the adjustment cylinder unit, two cylinders could also be connected to one another, so-to-say back-to-back, wherein two piston rods can be provided which are each individually associated with one of the two cylinders.

Different phases of the lifting pivoting movement of the piece of working equipment can be run through or controlled due to the special configuration of the cylinder piston unit without any complex and/or expensive hydraulic control means. In a further development of the invention, one of the two cylinders can effect an adjustment path between the headland position and the transport position, while the other cylinder provides an adjustment path between the working position and the headland position, on the one hand, and an adjustment path directly into or from the transport position, on the other hand. The adjustment path into the transport position can therefore be split or divided, in particular such that a lowering or lifting into or out of the transport position is controlled by a different piston than the remaining adjustment path between the transport position and the headland position.

Such a multi-stage or divided movement into the transport position can in particular be advantageous if the pieces of working equipment or the support frame carrying the pieces of working equipment are supported on a support surface or in a support depression in the transport position, for example to absorb blows and vibrations from bumps and to prevent excessive loads on the lifting pivoting apparatus.

Alternatively or additionally, a stage-wise or divided movability into the transport position can also be advantageous when a further additional piece of equipment should be actuated or moved on or after reaching the transport position, in particular by the piece of working equipment moving into the transport position or by the actual support frame

carrying the piece of working equipment, i.e. when the piece of working equipment or the support frame should so-to-say act as an adjustment actuator for the named additional piece of working equipment. Such additional pieces of equipment can be of various natures; a protective barrier can in particular be moved in front of the piece of working equipment when the piece of working equipment has reached its transport position to prevent collisions with the piece of working equipment.

In a further development of the invention, the pieces of working equipment can be secured in the transport position by a protective element positioned in front as a shield and the protective element can be supported such that it can be moved away in order not to impede the movement of the pieces of working equipment into and out of the transport position and to be able to maintain the conventional kinematics for bringing them into the transport position. Thanks to the ability of the collision protection to be moved away, it can moreover herewith be arranged in the optimum position in front of the pieces of working equipment without having to consider possible collisions. In this respect, a protective barrier is movably supported at the transport frame and can be moved between a protective position in which the protective barrier is arranged transverse to the direction of travel viewed from in front of the pieces of working equipment located in the transport position and an inactive position in which the pieces of working equipment located in the transport position are exposed transverse to the direction of travel. In its protective position, the protective barrier extends in front of the interchangeable equipment items of the pieces of working equipment such that, viewed in the direction of travel, no persons can run into the interchangeable equipment items from the side and the interchangeable equipment items can also not catch at other obstacles such as trees or building edges since the protective barrier prevents this in the manner of a guard rail or of a bumper. In the inactive position, in contrast, the - pieces of working equipment located in the transport position are exposed transverse to the direction of travel so that the pieces of working equipment can be folded outwardly away from the transport position transverse to the direction of travel. The protective

barrier is located outside the pivot path or orbit of movement of the pieces of working equipment from the transport position into the headland position or working position and vice versa.

In an advantageous further development of the invention, a mechanical actuator is provided for the adjustment of the protective barrier and is coupled to the protective barrier and can be brought into engagement by a hay-making unit part and/or a support frame part when the hay-making units are moved to or arrive at their transport position. The named actuator can in this respect act in the manner of an abutment against which the hay-making unit part or the support frame part travels in order then to displace the actuator and then hereby to generate the movement of the protective barrier. In this case, the hay-making units so-to-say themselves form the actuator to move the protective barrier into the protective position.

The named mechanical actuator can in particular comprise a pivot lever which is pivotable by a vertical movement and/or a transverse movement of the hay-making units and generates the movement of the protective barrier. In an advantageous further development of the invention, the named pivot lever can be supported pivotable about a horizontal axis facing approximately in the direction of travel, whereby simple drive kinematics result in particular with a likewise pivotable support of the protective barrier.

In a further development of the invention, the named mechanical actuator can form a rocker together with the protective barrier which converts a pressing down of the actuator into a raising of the protective barrier and/or conversely converts a pressing down of the protective barrier into a raising of the actuator.

In a further development of the invention, a support surface can be provided at the transport frame and the pieces of working equipment can be placed onto it in the transport position. Such a support surface can be provided at or connected to the

support frame to support the pieces of working equipment in the transport position and, for example, to absorb vibrations and blows from bumps. The named support surface can advantageously be configured as a lowering depression to intercept a section of the piece of working equipment disposed at the bottom in the transport position and to intercept in the vertical direction and optionally also transversely thereto. The named lowering depression can in particular be associated with a protective hoop of the hay-making units which typically extends in front of the named pieces of working equipment in the working position of the pieces of working equipment. The lifting of the piece of working equipment or of the support frame out of the named lowering depression can advantageously take place by one of the two pistons provided in the same cylinder, in particular by the piston which is releasable from the piston rod and which can extend the named piston rod a little.

To be able to move the pieces of working equipment along the transport frame from the working position in which the pieces of working equipment can advantageously extend offset transversely to the direction of travel, in particular arranged next to one another, into the transport position, the support frame can, in an advantageous further development of the invention, be connected to the transport frame pivotably about at least one horizontal transverse axis and can comprise side parts which can be folded down and which are pivotally connected to a center part of the support frame, which is pivotable about the horizontal transverse axis in the named manner, such that the named side parts can be hinged in the lowered working position about axes facing in the direction of transport and can be folded to the front to the transport frame in the raised transport position together with the pieces of working equipment supported thereat. On such a biaxial or multiaxial suspension of the support frame, the pieces of working equipment can in particular be moved into the transport position in that first the support frame is pivoted upwardly in total about the named horizontal transverse axis until the named hinge axis of the side parts no longer extends horizontally, but rather in

an upright manner so that the side parts can then be folded to the front to the transport frame about the hinge axes standing upright.

In order to mechanically actuate the protective barrier with such kinematics and to be able to move it into the protective position, the named mechanical actuator can be arranged and configured such that the hay-making units and/or the support frame press against the actuator on a folding forward to the transport frame. Alternatively or additionally, the piece of working equipment can still be lowered a little in the forward-folded position to press the mechanical actuator downward and hereby to move the protective barrier upward. This lowering or the converse raising which allows the protective barrier to move downward again can be effected in an advantageous manner by one of the two pistons provided in the common cylinder, in particular by the piston which can be released from the piston rod, which can extend the piston rod a little and which can thereby lift the piece of working equipment a little.

The pivotal connection of the support frame in this respect, however, does not have to be configured in the named manner pivotable about a horizontal transverse axis. For example, to prevent a piercing of the interchangeable equipment items on an initial raising into the headland position, multiaxial pivot connections or multi-part designs of the support frame or of the named middle part can also be provided. For example, the named support frame does not have to be pivotally connected directly at the transport frame, with a multiaxial joint connection advantageously being able to be provided between the transport frame and the support frame. For example, an intermediate frame can be provided between the transport frame and the support frame supporting the work units which is, on the one hand, connected to the transport frame pivotably about a first horizontal transverse axis and, on the other hand, is connected to the support frame pivotably about a second horizontal transverse axis. The lifting pivoting apparatus for raising the support frame can in this respect be configured such that the support frame and the intermediate frame are, on the one hand, pivotable relative to one another to

vary the angular position of the working units relative to the ground and, on the other hand, are pivotable together relative to the transport frame to be brought into the headland position or transport position.

The present invention will be explained in more detail in the following with reference to a preferred embodiment and to associated drawings. There are shown in the drawings:

Fig. 1: a perspective view of a hay-making machine in the form of a tedder in accordance with an advantageous embodiment of the invention, with the hay-making units being shown in the form of rotary rakes in their lowered working position;

Fig. 2: a schematic side view of the hay-making machine from Fig. 1, with the hay-making units being shown in their raised transport position and the protective barrier being shown in the protective position before the raised hay-making units;

Fig. 3: a side view of the hay-making machine of the preceding Figures, with the hay-making units being shown in the lowered working position;

Fig. 4: a side view of the hay-making machine similar to Fig. 3, with the working units being shown in the headland position;

Fig. 5: a perspective sectional representation of the protective barriers provided at the right and at the left for securing the hay-making units in the transport position,

Fig. 6: a rear view of the hay-making machine with hay-making units brought into the transport position, with the protective barrier being moved into its protective position;

Fig.7: a rear view of the hay-making machine similar to Fig. 6, with the working units being shown in the working position and the protective barrier 22 being shown in the lowered inactive position; and

Fig. 1: a longitudinal section through the adjustment cylinder unit for adjusting the support frame, with the adjustment cylinder unit being shown in the fully retracted position corresponding to the transport position of the piece of working equipment.

The hay-making machine 1 advantageously comprises an elongate transport frame 2 whose front end can be attached by an attachment apparatus 3 typical per se to a tractor, not shown, and is supported at the ground by a chassis 4 which can advantageously be arranged at a section of the transport frame 2 at the rear. The named attachment apparatus 3 can in this respect have different configurations and can advantageously allow a pivoting of the transport frame 2 with respect to the tractor about an upright axle so that the transport frame 2 can run behind the tractor in the manner of a trailer.

A plurality of rotary rakes 5 are pivotally connected to the named transport frame in a manner still be to be explained in detail; they can be rotationally driven about approximately upright rake axes 6 in the working position and comprise revolving rake prongs by means of which harvest lying on the ground, such as grass or hay, can be raked together, swathed, teddered or processed in another manner. The drive for the rotational drive of the rotary rakes 5 can have different configurations, for example can

comprise an articulated shaft, optionally with a transfer case to drive the rotary rakes 5 from a spigot shaft of the tractor.

The named rotary rakes 5 are in this respect suspended at a support frame 7 which can be lifted and pivoted with respect to the transport frame 2. The rotary rakes 5 are in this respect advantageously supported at the ground by stabilizer wheels 8 or jockey wheels, with such a stabilizer wheel 8 being provided beneath every rotary rake 5 in the embodiment shown.

The side parts of the support frame 7 projecting laterally in the working position are advantageously divided into a plurality of support frame parts which can be hinged relative to one another about hinge axes which face horizontally in the direction of travel in the working position to allow a corresponding ground adaptation over the width of the device. The total side part of the support frame 7 with the rotary rakes 5 pivotally connected thereto can be pivoted to the front in this respect by the hinge axis 9 shown in Fig. 2 so that the side parts of the support frame with the rotary rakes 5 pivotally connected thereto extend to the front along the transport frame approximately parallel to the transport frame 2, cf. Fig. 2, in order correspondingly to reduce the working width.

A central center part of the named support frame 7 in this respect comprises a pivotal connection part 10 which engages over the rotary rakes 5, faces to the front toward the transport frame 2 in the working position and serves for the pivotal connection of the support frame 7 at the transport frame 2.

More precisely, the named pivotal connection part 10 of the support frame 7 is pivotally connected to an intermediate frame 11 which extends between the transport frame 2 and the support frame 7. As a comparison of Figures 1 to 3 shows, the named intermediate frame 11, on the one hand, is pivotally connected to the transport frame 2 about a first horizontal transverse axle 12, with the named first transverse axle 12

extending in the region of the chassis 4, preferably directly above the chassis 4, so that the weight of the rotary rakes 5 introduced into the transport frame on the lifting can be led off directly over the chassis 4.

On the other hand, the named intermediate frame 11 is pivotally or kinkably connected to the pivotal connection part 10 of the support frame 7 about a second horizontal transverse axle 13 so that the intermediate frame 11 and the support frame 7 can be kinked with respect to one another as a comparison of Figures 4 and 5 shows.

The lifting/pivoting apparatus 19 furthermore comprises an adjustment actuator 20 between the transport frame 2 and the intermediate frame 11 for raising the support frame 7 and the rotary rakes 5 pivotally connected thereto into a headland position or transport position to be able to pivot and raise the intermediate frame 11 with respect to the transport frame 2. The named adjustment actuator 20 can, for example, be a hydraulic cylinder which is pivotally connected, on the one hand, to the transport frame 2 or to a console connected thereto and, on the other hand, to the intermediate frame 11 or to a console fastened thereto, and indeed in each case spaced apart from the first transverse axle 12 to have a corresponding lever.

To raise the hay-making units 5 from the working position shown in Figures 1 and 3, the named adjustment actuator 20 is first actuated to pivot the total support frame 7 upwardly about the named horizontal transverse axes 12 and 13, with a stop being able to be made - depending on the working situation - in the headland position shown in Fig. 3. If, however, the hay-making units 5 are to be brought into the transport position in accordance with Fig. 2, the support frame 7 is pivoted upwardly beyond the headland position shown in Fig. 4 via the named lifting/pivoting apparatus 19 until the previously named hinge axes 9 stand approximately upright.

The side parts 31 of the support frame 7 are then preferably folded to the front by means of adjustment actuators, for example in the form of pressure medium cylinders, provided between the side parts 31 and the center part of the support frame 7 about the named hinge axes 9, which now stand upright, until the hay-making units 5 are approximately folded to the transport frame 2 and extend behind one another along it. In this transport position shown in Fig. 2, the rotary rake axes extend substantially horizontally transverse to the direction of travel, with the interchangeable equipment items or rake prongs each facing outward, as Fig. 2 shows.

To avoid a risk of injury here, two protective barriers 22 are provided to the right and to the left of the transport frame 2 and each have a substantially U-shaped protective hoop 29, with each of the named protective hoops 29 having a barrier limb 30 which extends approximately in parallel with the transport frame 2 and is configured as sufficiently long to laterally cover the hay-making units folded in parallel to the transport frame 2. The named barrier limb 30 can be a beam, a pipe or also a metal sheet in the form of a shield or the like, with advantageously a configuration it the manner of an elongate beam being able to be provided such as the Figures show.

The barrier limb 30 is fastened to the transport frame 2 and/or to holding consoles connected thereto via support limbs 33 which can extend transversely to the direction of travel, with a pivotable support about horizontal pivot axes 24 being able to be provided, as Fig. 5 illustrates. The named pivot axis 24 for the protective hoop 29 advantageously extends from the central longitudinal plane 25 of the hay-making machine 1 transversely spaced apart and substantially parallel to the direction of travel so that the transversely projecting protective hoops 29 can be pivoted up and down. The named pivot axis 24 can in this respect be arranged substantially beneath the hay-making units 5 when they are in the transport position, with the named pivot axis 24 in particular being able to extend somewhat beneath the rotary rake support arms of the rotary rakes.

To be able to pivot the named protective hoops 29 up and down, mechanical actuators 27 are fastened to the bearing limbs 33 and are connected thereto to form a rocker which can be pivoted about the respective pivot axis 24.

As Fig. 5 shows, the named mechanical actuators 27 can be provided in the region of support surfaces 28 on which the hay-making units 5 can be lowered in the transport position. The named support surfaces 28 can be provided at a support console which can project transversely obliquely upwardly from the transport frame 2 and form at their ends a reception depression into which the hay-making units can preferably be lowered with their protective hoops 34.

The arrangement and configuration of the named mechanical actuators 27 is in this respect made such that in the lowered starting position of the protective barrier 22, the actuators 27 project upwardly over the support surface 28 so that, on a lowering of the hay-making units 5, the mechanical actuator 27 moves into engagement with the hay-making units 5 and can be pressed down by them. Due to the named rocker-like configuration, the pressing down of the mechanical actuators 27 results in a moving upward of the protective barrier 22 by pivoting about the named pivot axis 24.

The complete traveling to the transport position can advantageously again comprise a lowering of the side parts 31 of the support frame 7. If the named side parts 31 are completely folded to the front, the support frame 7 can again be tilted a little to the front via the lifting/pivoting apparatus 19, whereby the side parts 31 of the support frame 7 projecting to the front are lowered a little and press against the named actuators 27 or press them down until the support surfaces 28 are fully reached.

As a comparison of Figures 6 and 7 shows, the arrangement can be made such that the protective barriers 22 can extend outwardly with their support limbs 33 in the lowered starting position approximately horizontally from the support surfaces 28 or disposed

slightly below. The protective barrier 22 can in particular lie completely beneath the pivot path swept over by the side parts 31 and the hay-making units 5 fastened thereto in the lowered starting position so that the hay-making parts 5 can be folded to the front to the transport frame 2 without colliding with the protective barrier 22 and can be traveled to the support surfaces 28. The mechanical actuators 27 are then pressed down by the named lowering of the side parts 31 in the folded-forward position, whereby the bearing limbs 33 and thus the total protective hoop 29 of the protective barriers 22 are each upwardly pivoted, with here the named bearing limbs 33 advantageously being able to be brought into a position extending obliquely upwardly outwardly from the pivot axes 24, preferably at an angle of inclination of approximately 30° to 60°, in particular approximately 30° to 45°, as Fig. 6 shows. The pivot procedure is advantageously dimensioned such that the protective barriers 22 extend with their barrier limbs 30 at the level of the rotary rakes 5 to the right and to the left outside the rotary rake prongs to prevent a running into the rake prongs, cf. Fig. 6.

To be able to carry out the named lifting pivoting movements between the working position, the headland position and the transport position, the named adjustment actuator 20 can have the configuration shown in Fig. 8. In a further development of the invention, the adjustment actuator can in particular be configured as an adjustment cylinder unit having a plurality of cylinders and pistons, with advantageously two cylinders 40 and 41 formed separately from one another being able to be seated on a common piston rod 42 so that the cylinders 40 and 41 can each move independently of one another relative to the piston rod 42.

The one cylinder 40 can in this respect be configured in a conventional manner per se as a dual action cylinder and can receive a piston 43 which is axially fixedly connected to the piston rod 42, in particular to its end. The piston 43 in this respect divides the cylinder 40 into two pressure chambers 46 and 47 which are arranged at oppositely disposed sides of the piston 43 and which can each be pressurized via pressure

connections 48 and 49 to be able to effect a retraction or extension of the piston rod 42 relative to the cylinder 40.

The other cylinder 41 receives two pistons 44 and 45 displaceably in each case, with the two pistons 44 and 45 also each being arranged displaceably with respect to the piston rod 42.

As Fig. 8 shows, one of the two named pistons 44 is seated on the piston rod 42 and is displaceable relative to it. At its free end 50, which is located in the interior of the cylinder 41 between the two pistons 44 and 45, the piston rod 42 has an end abutment 51 in the form of a thickened portion which secures the named pistons 44 against slipping down from the piston rod 42. The named end abutment 51 can, for example, be in the form of an end pin axially which is screwed into the piston rod 42 and whose head has a larger diameter than the piston rod 42, cf. Fig. 8.

The other piston 45, which is received in the named cylinder 41, abuts the free end 50 of the piston rod 42 at the end face, but without being fixedly connected thereto, i.e. the piston rod 42 can be released from the piston 45 and move away from the piston 45 to the left - in accordance with Fig. 8. The named piston 45 is provided to press against the piston rod 42 at the end face in order to be able to extend it a little out of the cylinder 41. Conversely, the piston 44 is provided to retract the piston rod 42 into the cylinder 41.

As Fig. 8 illustrates, pressure chambers 52 and 53 can be provided at mutually remote sides of the two pistons 44 and 45 in the cylinder 41 to be able to act on the two pistons 44 and 45 in mutually opposite directions.

In an advantageous further development of the invention, the named pressure chambers 52 and 53 can in this respect be acted on in a manner connected in parallel by a common pressure connection 54 to move the pistons 44 and 45 toward one

another and hereby to clamp the piston rod 42 via the named end abutment 51 in an intermediate position.

The cylinder 41 can comprise an inwardly projecting end abutment 55, for example in the form of a restriction of the cylinder 41, between the two pistons 44 and 45, which end abutment 55 bounds the adjustment paths of the pistons 44 and 45 in the cylinder 41 and separates them from one another. The named end abutment 55 is in this respect advantageously configured, however, such that the piston rod 42 can move past the named end abutment 55 at the cylinder side despite its thickened end section, i.e. despite the end abutment 51, to be completely extended.

The following functional possibilities hereby result: To lift the total support frame 7 with the pieces of working equipment suspended thereat from the working position shown in Fig. 1 into the headland position shown in Fig. 4, the pressure chambers 52 and 53 of the cylinder 41 are acted on so that the piston rod 42 is retracted through the piston 44 into the cylinder 41 until the piston 44 reaches the named end abutment 55. This intermediate position of the piston rod 42 is held tight since the piston 45 presses against the piston rod 42 from the other side.

To lift the pieces of working equipment further and to move them into the transport position, the other cylinder 40 is pressurized to retract the piston rod 42 into the cylinder 40. The geometrical relationships are in this respect designed such that, with a completely retracted cylinder 40 and with the cylinder 41 held in the intermediate position in the named manner, the pivot axles 9 are approximately upright at the support frame 7 and the side parts 31 can be folded to the front toward the transport frame 2 - by further hydraulic cylinders, wherein the pieces of working equipment, in particular the protective hoops 29, come to lie a little above the support surfaces 28. To set the pieces of working equipment down completely into the transport position, i.e. to move them onto the support surfaces 28 and in this respect to pivot up the protective barrier 22, the

cylinder 41 is switched to no pressure so that the pieces of working equipment can lower a further amount, which is effected by the forward-pulling weight of the pieces of working equipment themselves.

In order conversely to move the pieces of working equipment back into the headland position or work position from the transport position, the cylinder 41 is first pressurized again, whereby the piston 45 pushes out the piston rod 42 a little and hereby lifts the pieces of working equipment a little so that the pieces of working equipment are released from the support surfaces 28 and the protective barrier 22 is lowered again. The side parts can be folded outwardly again afterward and the support frame 7 can then be pivoted back by extending the cylinder 40 until the headland position is reached. The support frame 7 can be lowered into the work position by a repeat switching of the cylinder 41 to no pressure, with this being able to take place in a controlled manner by controlling the outflow from the cylinder 41.

Patentkrav

1. Landbrugsmaskine, fortrinsvis høvender med flere rotorer, med en kørerramme (2), der kan tilkobles til en traktor, og som støtter på jorden via et stel (4), og med mindst et arbejdsaggregat (5) til foder- og/eller jordbearbejdning, der er monteret på en bæreramme (7), som sammen med arbejdsaggregatet (5) i forhold til kørerammen (2) kan hæves af en løftedrejeindretning (19) fra en arbejdsstilling til en forpløjningsstilling og videre til en transportstilling, hvor løftedrejeindretningen (19) omfatter en indstillingscylinderenhed (20) med flere cylindere (40, 41) og flere stempler (43, 44, 45), **kendetegnet ved, at** der i mindst en af indstillingscylinderenhedens (20) cylindre (41) er optaget flere stempler (44, 45), der er monteret forskydeligt i forhold til en stempelstang (42), der er optaget forskydeligt i cylinderen, hvor de flere stempler (44, 45) har forskellige, hver især begrænsede forskydningsområder i forhold til stempelstangen, hvor et af stemplerne (44) sidder på stempelstangen (42) og kan forskydes i forhold til denne, og det andet stempel (45) er beregnet til at presse mod stempelstangen (42), hvor cylinderen (41) har et endeanslag (55), der rager frem indad, og stempelstangen (42) i sin frie ende har et endeanslag (51), der sikrer nævnte stempel (44) mod at glide ned af stempelstangen (42).

2. Landbrugsmaskine ifølge et af de foregående krav, hvor bærerammen (7) er ledforbundet med kørerammen (2) drejeligt omkring mindst en vandret tværgående akse (12; 13), og hvor bærerammen (7) omfatter mindst en sidedel, der kan klappes ned, og som er drejeligt ledforbundet med en midterdel (10) af bærerammen (7) på en sådan måde, at den nævnte sidedel i den sænkede arbejdsstilling kan drejes omkring vandrette akser, der peger i kørselsretningen, og i den løftede transportstilling kan klappes fremad på kørerammen (2) med arbejdsaggregatet (5), der er monteret på sidedelen.

3. Landbrugsmaskine ifølge det foregående krav, hvor der er tilvejebragt en støtteflade (28), især -fordybning, til understøtning af den mindst ene sidedel (31) og/eller det derpå monterede mindst ene arbejdsaggregat (5), og anbringelse af sidedelen (31) og/eller arbejdsaggregatet (5) på støttefladen (28) og hævning af sidedelen (31) og/eller arbejdsaggregatet (5) fra støttefladen (28) kan styres ved påvirkning af et af de to stempler (45), der er monteret

forskydeligt i forhold til stempelstangen (42).

4. Landbrugsmaskine ifølge krav 2 eller 3, hvor der bevægeligt på kørerammen (2) er monteret en beskyttelsesbarriere (22), der kan bevæges mellem en beskyttelsesstilling, hvor beskyttelsesbarrieren (22) set på tværs af kørselsretningen (23) er anbragt foran arbejdsaggregaterne (5), der befinder sig i transportstillingen, og en inaktiv stilling, hvor arbejdsaggregaterne (5), der befinder sig i transportstillingen, ligger frit på tværs af kørselsretningen (23), hvor beskyttelsesbarrieren (22) kan betjenes og bringes i beskyttelsesstillingen ved at sænke bærerammens (7) sidedele, der er klappet fremad på kørerammen (2).

5. Landbrugsmaskine ifølge det foregående krav, hvor betjeningen af beskyttelsesbarrieren (22) kan styres ved påvirkning af et af de to stempler (45), der er monteret forskydeligt i forhold til stempelstangen (42).

6. Landbrugsmaskine ifølge et af de to foregående krav, hvor en mekanisk aktuator (27), fortrinsvis i form af en drejearm, der er samlet med beskyttelsesbarrieren til en vippe, er sammenkoblet med beskyttelsesbarrieren (22) og er anbragt og udformet på en sådan måde, at aktuatoren (27) kan gå i indgreb med en arbejdsaggregatdel og/eller en bærerammedel, når det mindst ene arbejdsaggregat (5) bevæges mod sin transportstilling og/eller havner i transportstillingen.

7. Landbrugsmaskine ifølge et af de foregående krav, hvor forskydningsvejene af de to stempler (44, 45), der er optaget i den samme cylinder (41), er udformet overlapningsfrit på og/eller i forhold til stempelstangen (42).

8. Landbrugsmaskine ifølge et af de foregående krav, hvor der via de to stempler (44, 45), der er optaget i den samme cylinder (41), kan genereres to indstillingsveje af stempelstangen (42), der er uafhængige af hinanden, i forhold til den nævnte cylinder (41), især på en sådan måde, at der kan genereres en første indstillingsvej ved påvirkning af det ene stempel (44) uafhængigt af påvirkningen af det andet stempel og en anden indstillingsvej ved påvirkning af det andet stempel (45) uafhængigt af påvirkningen af det før-

nævnte første stempel (44).

9. Landbrugsmaskine ifølge det foregående krav, hvor de to indstillingsveje, der kan genereres af de to stempler (44, 45), der er optaget i den samme cylinder (41), ikke er lige lange, hvor en indstillingsvej fortrinsvis er mindre end en tredjedel af den anden indstillingsvej.

10. Landbrugsmaskine ifølge et af de foregående krav, hvor et af de to stempler (44), der er optaget i den samme cylinder (41), er beregnet til at køre stempelstangen (42) ud, og det andet af de to stempler (45), der er optaget i den samme cylinder (41), er beregnet til at køre stempelstangen (42) ind i den nævnte cylinder (41).

11. Landbrugsmaskine ifølge et af de foregående krav, hvor cylinderen (41), hvori de flere stempler (44, 45) er optaget, mellem stemplerne (44, 45) har mindst et anslag, der rager radialt indad, og som begrænser stemplernes (44, 45) indstillingsveje og adskiller dem fra hinanden, hvor det nævnte anslag er udformet på en sådan måde, at stempelstangen (42) med sin frie ende kan køre forbi det nævnte anslag.

12. Landbrugsmaskine ifølge et af de foregående krav, hvor cylinderen (41), der optager de flere stempler (44, 45), på sider af stemplerne (44, 45), der vender bort fra hinanden, har to trykkamre, hvor de to trykkamre fortrinsvis af en fælles trykledning parallelforbundet kan påvirkes med tryk på en sådan måde, at stempelstangen (42) fastholdes og/eller klemmes fast i en mellemposition af de to stempler (44, 45) i deres endeposition.

13. Landbrugsmaskine ifølge et af de foregående krav, hvor der i mindst en af cylindrene (40) er tilvejebragt et stempel, der kan påvirkes fra to sider, og som fortrinsvis er fastgjort aksialt ikke-forskydeligt på stempelstangen, og/eller hvor to cylindre (40, 41) sidder på en fælles stempelstang (42), hvor den nævnte stempelstang (42) ved indstillingsbevægelser, der kan udføres uafhængigt af hinanden, kan føres ud og ind i forhold til den ene cylinder (40) og kan føres ud og ind i forhold til den anden cylinder (41), og/eller hvor en af cylindrene er tilvejebragt til en indstillingsvej mellem forpløjningsstillingen og transportstillingen, og en anden cylinder er tilvejebragt til en indstillingsbe-

vægelse mellem arbejdsstillingen og forpløjningsstillingen og til en indstillingsvej, der grænser op til transportstillingen.

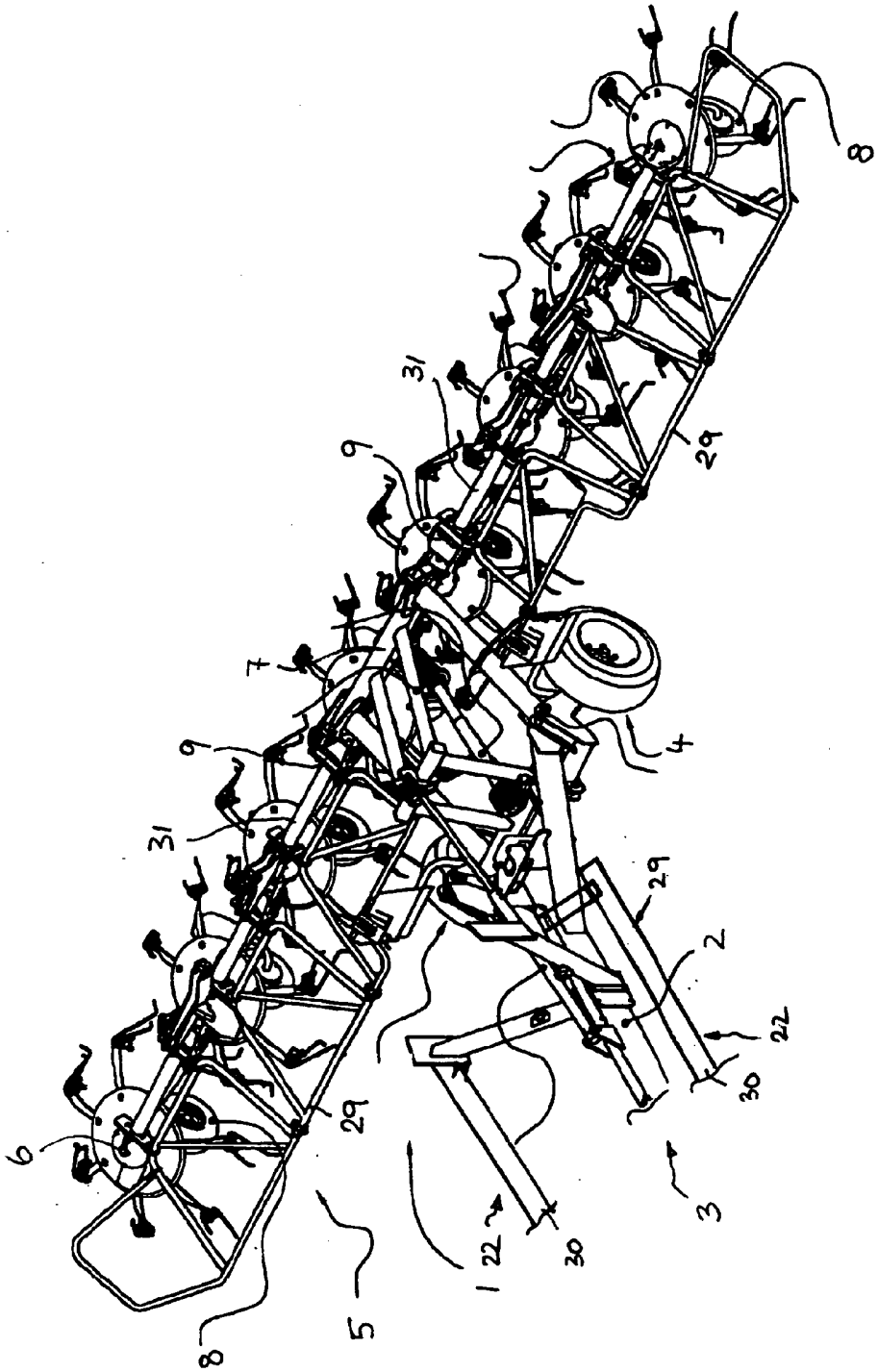

Fig. 1

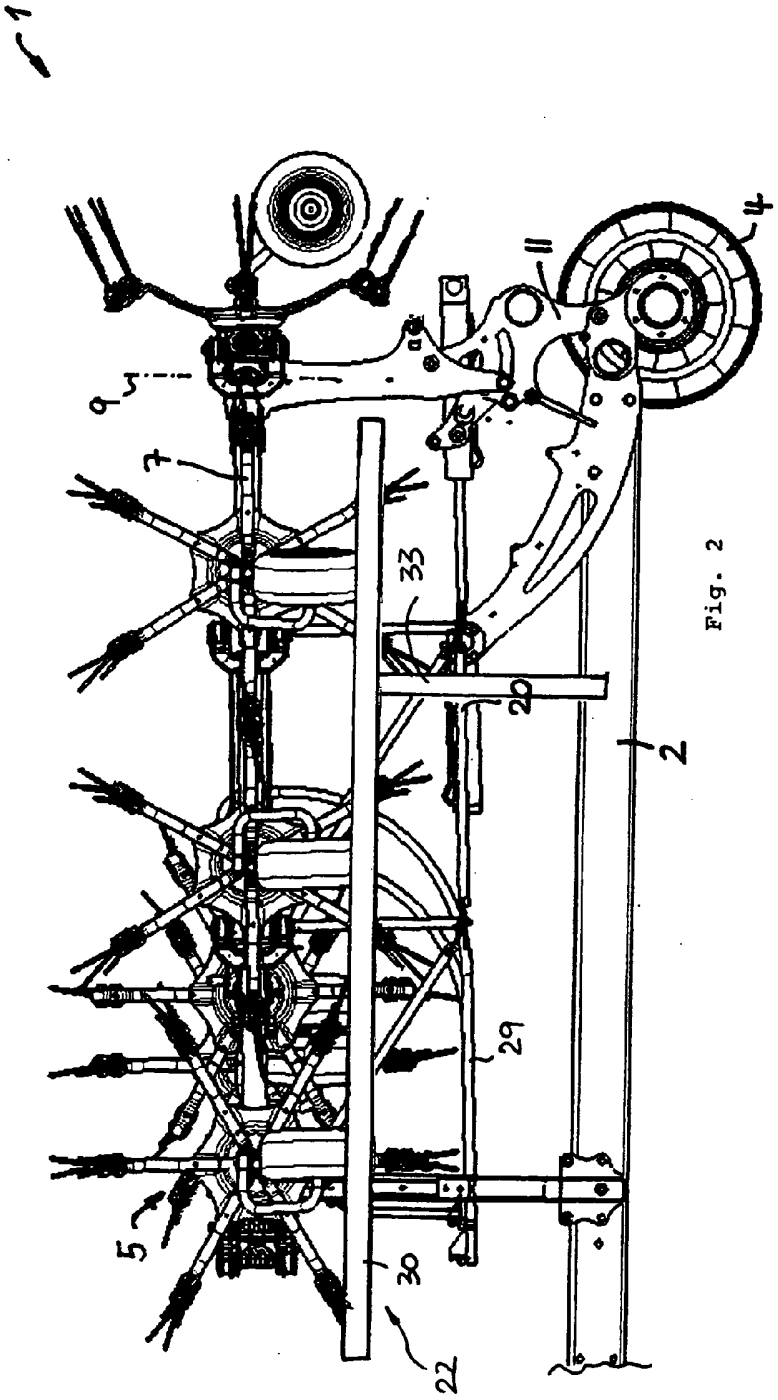

Fig. 2

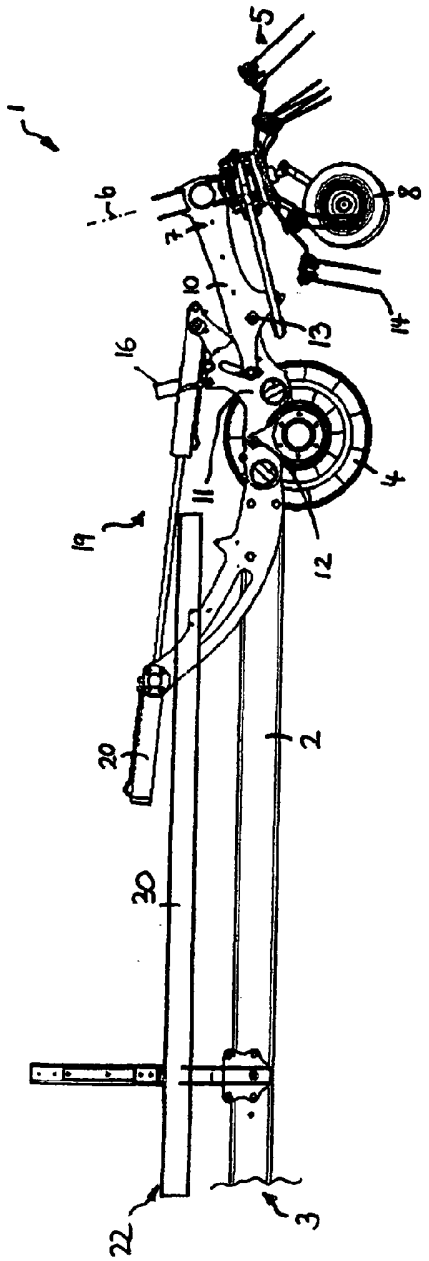

Fig. 3

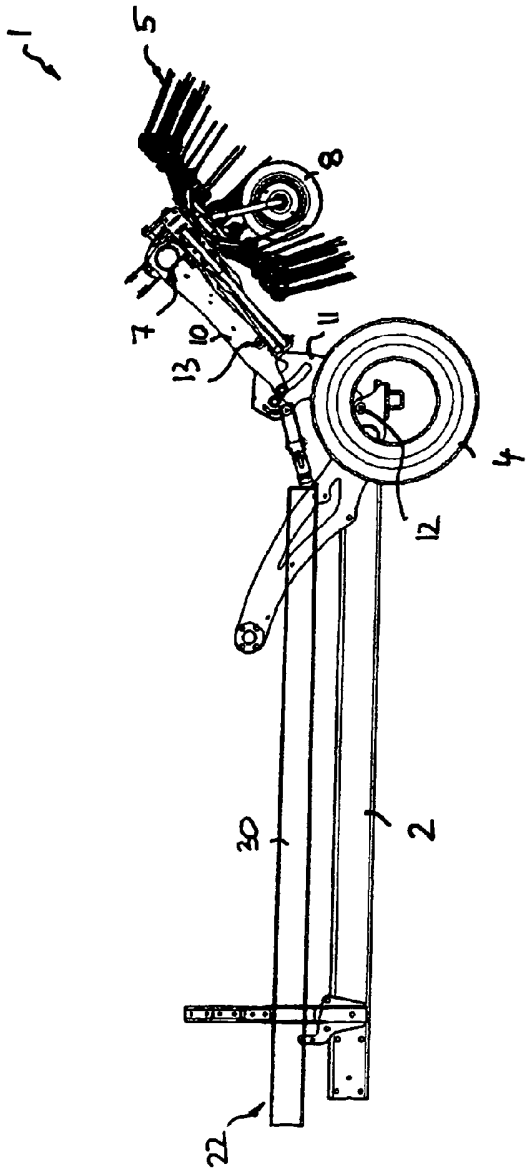

Fig. 4

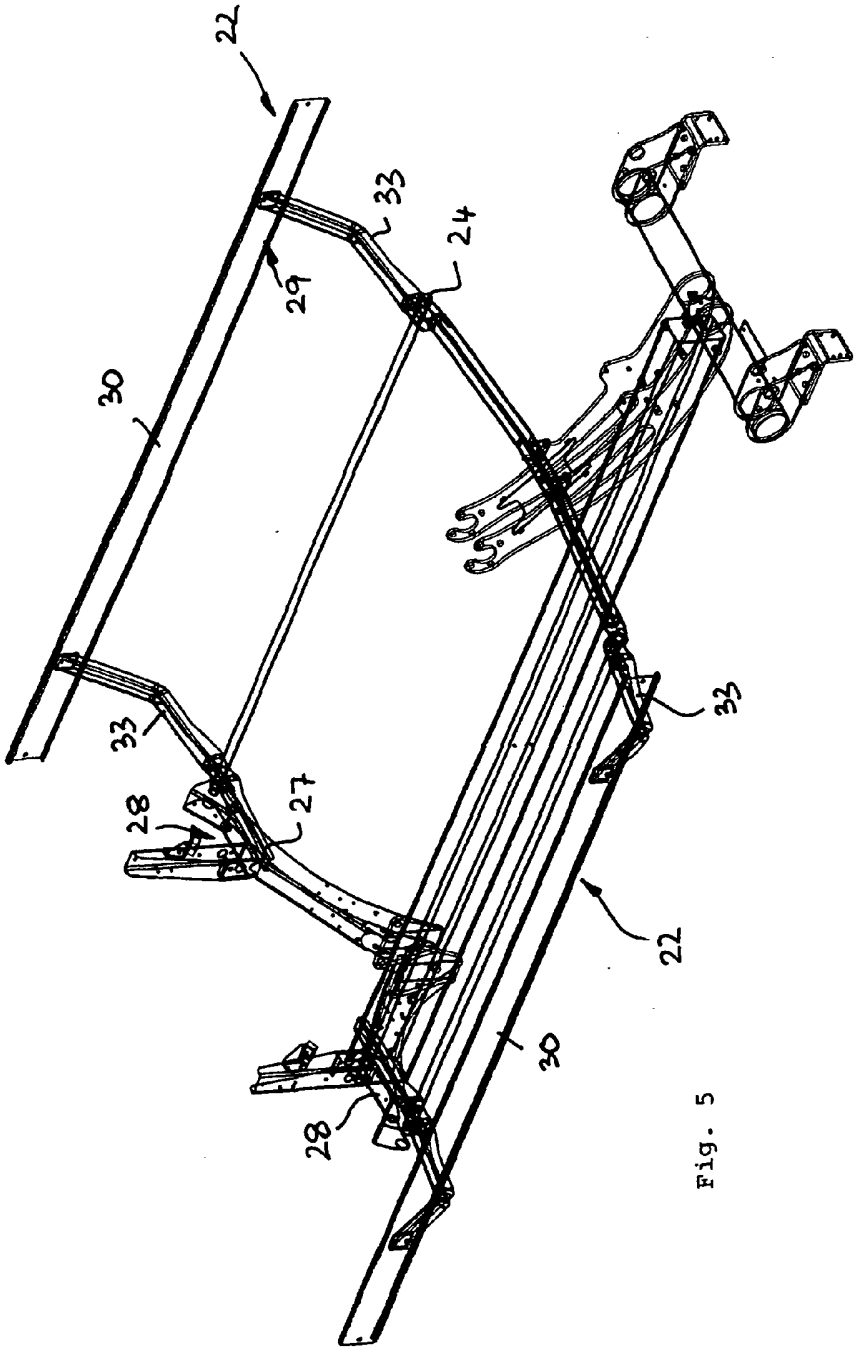

Fig. 5

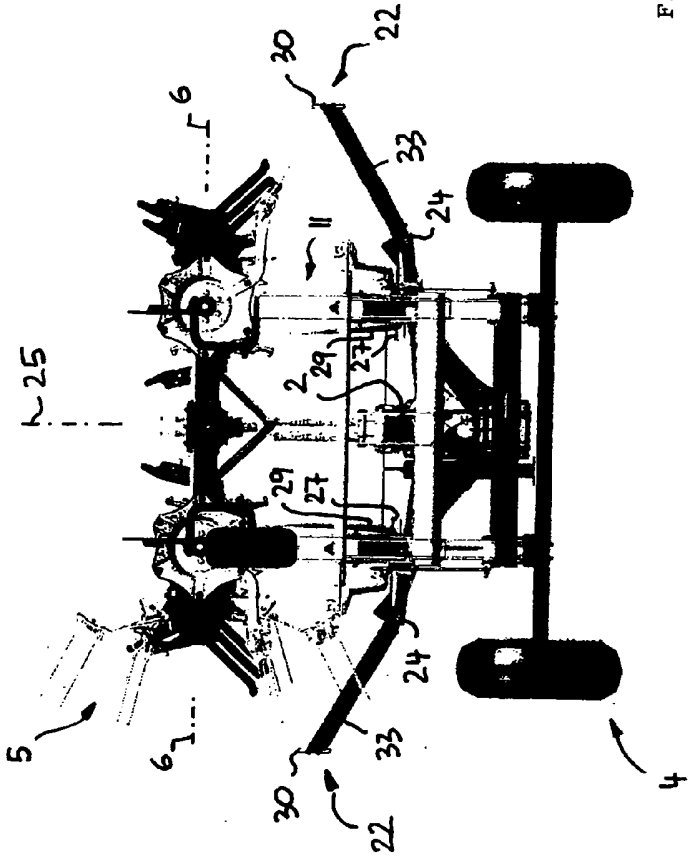

Fig. 6

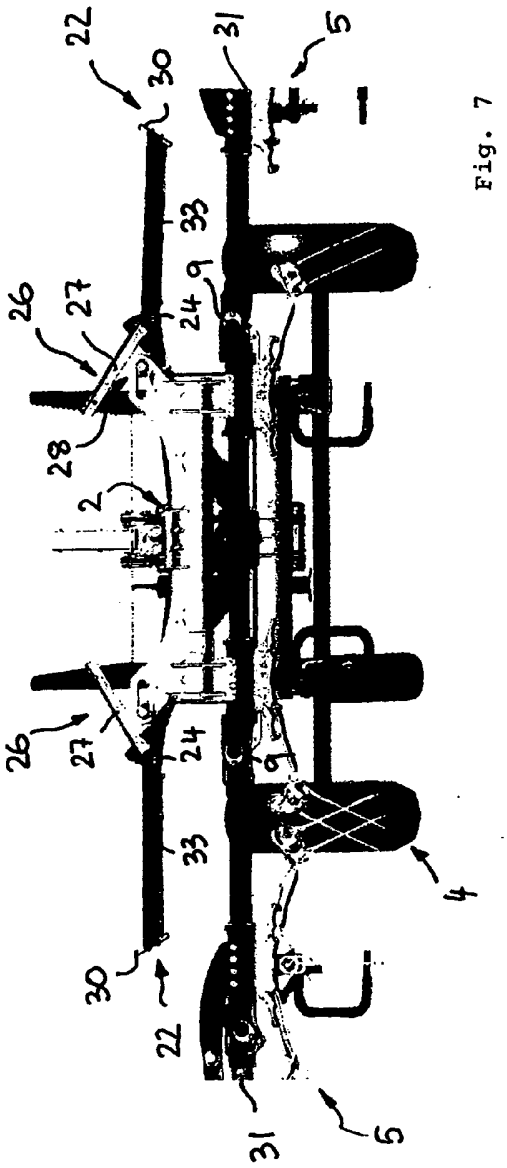

Fig. 7

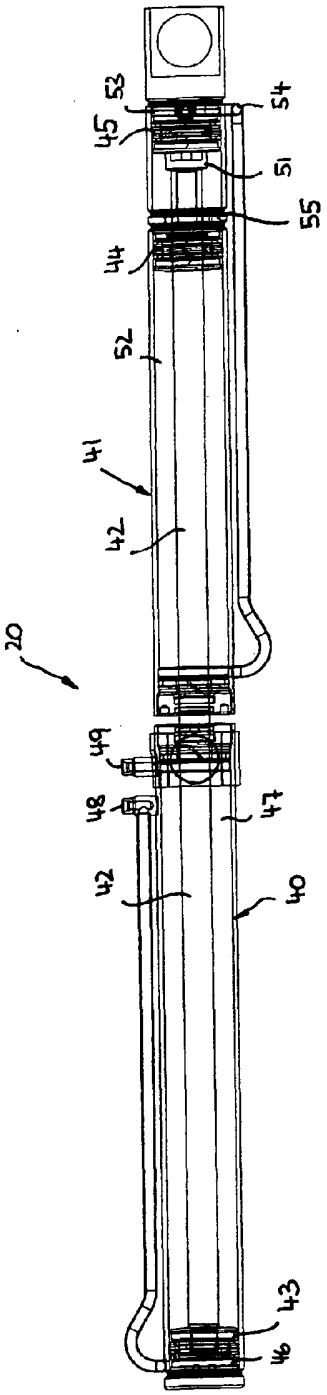

Fig. 8