(19) DANMARK

(10) **DK/EP 2248408 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***A 01 D 34/66 (2006.01)*** ***A 01 B 63/10 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2015-03-09**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-02-11**

(86) Europæisk ansøgning nr.: **10004424.7**

(86) Europæisk indleveringsdag: **2010-04-27**

(87) Den europæiske ansøgnings publiceringsdag: **2010-11-10**

(30) Prioritet: **2009-04-29 GB 0907357**

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

(73) Patenthaver: **Kverneland ASA, , 4344 Kvernaland, Norge**

(72) Opfinder: **Friis, Sven Aabjerg, Skyttegade 10, 5300 Kerteminde, Danmark**

(74) Fuldmægtig i Danmark: **NORDIC PATENT SERVICE A/S, Højbro Plads 10, 1200 København K, Danmark**

(54) Benævnelse: **Løftemekanisme**

(56) Fremdragne publikationer:
EP-A1- 0 839 443
EP-A2- 0 734 645
DE-U1- 20 109 019
DE-U1- 20 316 727
US-A- 4 048 789

Description

[0001] The present invention relates to a lifting mechanism and in particular, but not exclusively, to a lifting mechanism for a mower, such as an agricultural mower.

[0002] It is known to provide an agricultural mower comprising a cutter unit having a number of rotating cutter discs, a support arm for supporting the cutter unit and a mounting structure for mounting the mower on a tractor. The support arm is attached to the mounting structure through a pivot that allows the position of the cutter unit to be adjusted. The cutter unit may for example be adjusted to a cutting position in which it engages the ground, a headland position in which the cutter unit is slightly raised from the ground to allow the tractor to turn when it reaches the headland (the edge of a field), and a transport position in which the cutter unit is folded behind the tractor. When the cutter unit is in the cutting position, it usually extends outwards to one side of the tractor: lifting the cutter unit to the transport position allows the tractor to drive down a public road without the cutter unit extending outwards beyond the tractor.

[0003] A hydraulic cylinder is usually provided to lift the cutter unit from the cutting position to the headland position or the transport position. A support spring is also usually provided, which carries part of the weight of the cutter unit when it is in the cutting position. This allows the cutter unit to rest lightly on the ground (for example with a force of about 100kgs) and follow the contours of the ground during a mowing operation.

[0004] When the cutter unit is lifted to the headland position it engages a stop to prevent further movement beyond that point. The stop can be displaced (for example with a control cord) to allow the cutter unit to be lifted past the stop to the transport position. When the cutter unit is lifted to the headland position the arm is pressed against the stop with the full force of the hydraulic system. We have found that this places very high loads on the mechanism, which in time can cause components of the mechanism to fail.

[0005] When the cutter is lifted to the transport position it engages a second stop to limit movement. However, as the cutter is lifted to the transport position at a high speed, it has a large inertia and strikes the stop with a great force. This also results in large forces being distributed throughout the mechanism, which can again result in mechanical failure.

[0006] EP 0839443 discloses a cutting machine fitted with an automatic retractable stop.

[0007] It is an object of the present invention to provide a lifting mechanism that mitigates one or more of the aforesaid disadvantages.

[0008] According to the present invention there is provided a lifting mechanism comprising a mounting structure, an arm attached to the mounting structure through a pivot, said arm being arranged for movement about the pivot between a first position which is a working position and a second position which is a raised, non-working position, hydraulic drive means for rotating the arm about the pivot, a hydraulic circuit for supplying drive fluid to the hydraulic drive means, said hydraulic circuit including a valve for controlling the flow of hydraulic fluid through the circuit, said valve having a first operational condition in which flow is permitted and a second operational condition in which flow is prevented, and an actuator for actuating the valve, said actuator being constructed and arranged to move the valve from the first operational condition to the second operational condition when the arm moves from the first position to the second position.

[0009] The actuator is thus arranged to close the valve as the arm reaches the second position, thereby preventing further movement of the arm. A mechanical stop is not required and therefore the large stresses encountered in earlier mechanisms that use a mechanical stop are avoided. This makes the mechanism more reliable and less likely to fail. Although the valve closes as the arm reaches the second position, operation of the actuator and the valve is designed to ensure that when the pressure of the hydraulic drive fluid is reversed, the arm returns to the first position.

[0010] The lifting mechanism may be designed for use with an agricultural mower or any other suitable apparatus. Advantageously, the second arm position is a headland position.

[0011] Advantageously, the arm is arranged for movement to a third position, which may be a raised, non-working position. The third position may be a transport position. In the case of a mower, this allows the cutter unit to be folded behind the tractor, allowing it to be driven down a public road.

[0012] Preferably, the lifting mechanism includes a control means that is operable to allow movement of the arm beyond the second position to the third position. The control means thus over-rides normal operation of the valve, which prevents further movement when the arm reaches the second position. The control means may be constructed and arranged to move the valve to a third operational condition in which flow is permitted. Advantageously, the valve is arranged such that when it is in the third operational condition, the flow of hydraulic fluid is permitted at a reduced flow rate, as compared to the flow rate when the valve is in the first operational condition. Preferably, the valve is arranged such that when it is in the third operational condition, hydraulic fluid is directed through a flow restrictor. This

ensures that movement of the arm to the third position takes place at a relatively slow speed, to avoid placing excessive mechanical stresses on the mechanism.

[0013] The lifting mechanism may be designed for use with an agricultural mower or any other suitable apparatus, in which the first position is a working position and the second position is a raised non-working position. Advantageously, the third position is a raised non-working position. Advantageously, the arm is arranged to pivot about a substantially horizontal pivot axis.

[0014] The third position may be a transport position. In the case of a mower, this allows the cutter unit to be folded behind the tractor, allowing it to be driven down a public road. The second position may be a headland position. For a mower this allows the cutter unit to be raised slightly above the ground, allowing the tractor to make a sharp turn.

[0015] Advantageously, the control means comprises a manual control, for example a control cord operable from the cab of a tractor, which moves the valve to the third operational condition. Alternatively, the control means may comprise an electrical control, for example a control switch operable from the cab of a tractor, which operates an actuator to move the valve to the third operational condition

[0016] Advantageously, the actuator is constructed and arranged to hold the valve in the second condition if operation of the control means ceases while the arm is between the second and third positions. This provides a safety feature, which ensures that movement of the arm to and from the third position cannot take place accidentally, for example if the hydraulic controls are inadvertently actuated. Similarly, if the control means is released during movement of the arm between the second and third positions, movement of the arm will immediately cease.

[0017] Advantageously, the hydraulic drive means includes a lost motion mechanism that permits limited pivoting movement of the arm in the first position. In the case of a mower, this allows the cutter unit to follow the contours of the ground during a mowing operation.

[0018] Advantageously, the hydraulic drive means is constructed and arranged to act between the mounting structure and the arm.

[0019] Advantageously, the lifting mechanism includes a support element for supporting the arm in the first position. Preferably, the support element comprises a spring. The support mechanism carries some of the weight of the arm and any mechanism carried by the arm. In the case of a mower, this ensures that the cutter unit rests relatively lightly on the ground, to avoid excessive drag.

[0020] According to another aspect of the invention there is provided a mower including a lifting mechanism according to any one of the preceding statements of invention, and a cutter unit attached to and supported by the arm. Advantageously, the support structure is arranged for attachment to, or is attached to, a tractor.

[0021] An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1, 2 and 3 are front views showing a mower unit in a cutting position, a headland position and a transport position respectively;

Figures 4 and 5 are plan views showing the mower unit in a working position and a headland position respectively;

Figures 6, 7 and 8 are perspective views showing components of a lifting mechanism for the mower unit in a working position, a headland position and a transport position respectively, and

Figures 9, 10 and 11 are schematic diagrams of a hydraulic circuit for the lining mechanism, showing a control valve in a first condition, a second condition and a third condition respectively.

[0022] As shown particularly in Figures 1 to 8, the lifting mechanism 2 is attached to a conventional cutter unit 4, which may for example be similar to that described in WO99/18769A. The cutter unit 4 includes a housing that contains a number of rotating cutter discs (not shown). It may optionally also include a conditioner unit (not shown). The cutter unit 4 is attached through a pivot 6 to a support arm 8. The pivot 6 allows the cutter unit 4 to rock so that it can follow the contours of the ground during a mowing operation.

[0023] The arm 8 is attached through a pivot 10 to a mounting structure 12, which in use is mounted on a tractor (not shown). Usually, the mower unit is mounted on the rear of a tractor, although it can alternatively be mounted on the front or side of a tractor. The pivot 10 allows the arm 8 to be lifted from the working position shown in Figures 1, 4 and 6 to a headland position shown in Figures 2, .5 and 7 or a transport position shown in Figures 3 and 8. When the arm is in the working position shown in Figures 1, 4 and 6, the cutter unit 4 engages the ground so that the rotating cutters sever the standing crops close to ground level. In the headland position shown in Figures 2, 5 and 7 the cutter unit 4 is raised slightly above the ground, allowing the tractor to turn when it reaches the headland of the field. In the transport position shown in Figures 3 and 8, the arm 8 is lifted further so that the cutter unit 4 is folded behind the tractor. This allows the tractor to be driven down a public road without the cutter unit 4 extending outwards to one side of the tractor.

[0024] The lifting mechanism includes a hydraulic cylinder 14 that is attached at a first end 14a to a

pivot on the mounting structure 12. The second end 14b of the hydraulic cylinder 14 is attached to an actuating lever 15, which is attached to a pivot point 8a on the arm. A stop 8b is provided on the arm, for engagement with the lever 15 when the arm is lifted. The hydraulic cylinder 14 can be actuated to lift the cutter unit 4 from the working position to the headland position or the transport position. By reversing the flow of fluid through the hydraulic system, the cutter unit 4 can be returned to the working position.

[0025] The lifting mechanism also includes a strong coil spring 16, one end of which is attached to the support structure 12, the other end being attached through an adjustable chain 18 to the arm 8. When the mower is in the working position, the spring 16 is in tension and partially supports the weight of the cutter unit 4, so that the cutter unit rests only lightly against the ground. This allows the cutter unit to follow the contours of the ground during mowing. When the mower is in the working position, a gap is provided between the lever 15 and the stop 8b. This gap provides a lost motion mechanism in the connection between the hydraulic cylinder 14 and the arm 8 to allow for movement of the arm 8 during mowing.

[0026] The hydraulic cylinder 14 is connected to a hydraulic system that includes a control valve 20 having a control lever 22. The valve 20 controls the flow of hydraulic fluid to and from the cylinder 14, as will be described in more detail below.

[0027] The valve 20 is operated by an actuator rod 24 that is attached to the second end 14b of the piston rod. When the arm 8 is in the working position shown in Figure 6, the actuator rod 24 is withdrawn from contact with the lever 22, which is held in an anticlockwise-rotated direction by a biasing spring 26. This places the valve in a first operative condition, illustrated in Figure 9.

[0028] When the arm 8 is raised to the headland position shown in Figure 7, the actuator rod 24 engages the valve lever 22 and rotates it clockwise against the force of the biasing spring 26. This moves the valve 20 towards the second operating condition shown in Figure 10.

[0029] A control cord 28 is attached to the lever 22. This cord 28 extends to a position where it can be reached by an operator, for example within the cab of the tractor. Pulling the cord 28 allows the operator to rotate the valve lever 22 clockwise, thus overriding the biasing spring 26 and the actuator rod 24.

[0030] In order to lift the arm 8 to the transport position shown in Figure 8, the valve lever 22 must be rotated further in a clockwise direction to place the valve in a third operational condition as illustrated in Figure 11. This is achieved by pulling the control cord 28, as shown in Figure 8. If the control cord

28 is subsequently released, the valve lever 22 will rotate anticlockwise under action of the spring 26 until it contacts the actuator rod 24, thus returning the valve.20 to the second operational condition.

[0031] The hydraulic circuit of the lifting mechanism is shown in Figures 9 to 11. The circuit includes the hydraulic cylinder 14, the valve 20, a number of fluid flow lines 30 and two connectors 32a, 32b for connecting the hydraulic circuit to the hydraulic drive system of a tractor (not shown). A number of flow restriction valves 34 are provided in certain of the fluid flow lines 30. The hydraulic cylinder 14 is conventional and comprises a piston 14c and a cylinder barrel 14d, wherein the piston 14c divides the internal volume of the cylinder barrel 14d into a left hand chamber 14' and a right hand chamber 14". The left hand chamber 14' is connected directly to the first connector 32a and the right hand chamber 14" is connected via the valve 20 to the second connector 32b.

[0032] As described previously, the valve-20 has three operational conditions. In Figure 9 the valve is shown in the first operational condition, in which hydraulic fluid can flow to and from the right hand chamber 14" of the hydraulic cylinder 14 through a first unrestricted flow line 30a. In Figure 10, the valve is shown in the second operational condition in which the valve is closed, preventing any flow of fluid to or from the right hand chamber 14". In Figure 11, the valve is shown in the third operational condition, in which hydraulic fluid can flow to and from right hand chamber 14" through a second flow line 30b that includes a flow restriction valve 34.

[0033] Operation of the lifting mechanism will now be described.

[0034] During mowing, the cutter unit 4 is placed in the working position shown in Figures 1, 4 and 6. The valve 20 is in the first operating condition illustrated in Figure 9, which permits unrestricted flow of hydraulic fluid to and from the hydraulic cylinder 14. This allows the cutter unit to be raised or lowered by adjusting the pressure in the left hand chamber 14' of the hydraulic cylinder through the first connector 32a. The fluid displaced from the right hand chamber 14" flows to and from an unpressurised reservoir through the second connector 32b. During mowing, the hydraulic drive system is usually set to extend the piston 14c fully, as shown in Figure 9. In this position, owing to the provision of a lost motion mechanism between the piston rod and the arm 8, the hydraulic cylinder does not exert any force on the arm. The arm can therefore rotate to a limited degree about the arm pivot 10. The weight of the cutter unit 4 is supported partially by the spring 16, so that the cutter unit rests lightly on the ground.

[0035] When the tractor reaches a headland, the hydraulic cylinder 14 is operated to lift the cutter unit 4 to the headland position shown in Figures 2, 5 and 7. Fluid is supplied under pressure to the left hand chamber 14' from the first connector 32a, forcing the piston 14c to the right and lifting the arm 8. As the arm 8 nears the headland position, the actuator rod 24 engages the valve lever 22 and rotates it

clockwise against the bias of the spring 26. This moves the valve 20 towards the second operational condition shown in Figure 10.

[0036] The actuator rod 24 is set so that when the arm 8 reaches the headland position, the valve 20 closes to prevent fluid escaping from the right hand chamber 14", thereby preventing further movement of the arm 8. This locks the arm in the headland position.

[0037] In order to lower the arm from the headland position, the pressure supplied to the left hand chamber 14' is reduced. The weight of the arm 8 and the cutter unit 4 is then sufficient to pull the piston 14c to the left, forcing fluid back through the first connector 32a and creating a partial vacuum in the right hand chamber 14". As the piston moves to the left, the actuator rod 24 disengages the valve 20, allowing it to return to the first operational condition shown in Figure 9. This allows the cutter unit 4 to be lowered again to the working position.

[0038] As mentioned previously, in order to raise the arm 8 to the transport position, the control cord 28 must be operated to move the valve 20 to the third operational condition as shown in Figure 11. This allows hydraulic fluid to flow to and from the hydraulic cylinder 14 through the restrictor valve 34 in the second flow line 30b. The restrictor valve 34 limits the flow rate of hydraulic fluid, ensuring that movement of the arm 8 between the headland position and the transport position is relatively slow. This in turn ensures that the stresses induced in the mechanism by operation of the lifting mechanism are greatly reduced, thereby reducing the risk of mechanical failure.

[0039] If the valve control cord 28 is released during movement of the arm between the headland position and the transport position (either when raising or lowering the arm), the valve 20 will return to the second operational condition shown in Figure 10 under the bias of the spring 26. This cuts off the flow of hydraulic fluid, preventing further movement of the arm. The arm cannot then be moved until the control cord 28 is pulled again, to move the valve 20 to the third operational condition. This acts as a safety feature ensuring that the mower cannot be lowered accidentally by inadvertently activating the tractor hydraulics. The mower will only move from the transport position if the control cord 28 is pulled and the tractor hydraulics are operated at the same time.

[0040] Various modifications of the mechanism described herein are of course possible. For example, the valve control cord 28 may be replaced by an electrical control, for example a switch operable from the cab that operates the valve via an electrical actuator.

Patentkrav

1. Løftemekanisme (2) omfattende en monteringsstruktur (12), en arm fastgjort til monteringsstrukturen (12) gennem en drejetap (10), hvilken arm (8) er indrettet til bevægelse omkring drejetappen (10) mellem en første position, der er en arbejdsposition, og en anden position, der er en hævet ikke-arbejdsposition, et hydraulisk drivmiddel (14) til at rotere armen (8) omkring drejetappen (10), en hydraulisk kreds til at forsyne det hydrauliske drivmiddel (14) med drivfluid, hvilken hydraulisk kreds indbefatter en ventil (20) til at styre strømmen af hydraulisk fluid gennem kredsen, hvilken ventil (20) har en første driftstilstand, hvor strømning er tilladt, og en anden driftstilstand, hvor strømning er forhindret, og en aktuator (24) til at aktivere ventilen (20), hvilken aktuator (24) er konstrueret og indrettet til at bevæge ventilen (20) fra den første driftstilstand til den anden driftstilstand, når armen (8) bevæges fra den første position til den anden position.

2. Løftemekanisme ifølge krav 1, hvor den anden armposition er en foragerposition.

3. Løftemekanisme ifølge et hvilket som helst af de foregående krav, hvor armen er indrettet til bevægelse til en tredje position, der er en hævet ikke-arbejdsposition.

4. Løftemekanisme ifølge krav 3, hvor den tredje armposition er en transportposition.

5. Løftemekanisme ifølge krav 3 eller krav 4, hvilken løftemekanisme indbefatter et styreorgan, der kan fungere til at tillade bevægelse af armen ud over den anden position til den tredje position.

6. Løftemekanisme ifølge krav 5, hvor styreorganet er konstrueret og indrettet til at bevæge ventilen til en tredje driftstilstand, hvor strømning er tilladt.

7. Løftemekanisme ifølge krav 6, hvor ventilen er indrettet således, når den er i den tredje driftstilstand, at strømmen af hydraulisk fluid er tilladt ved en reduceret strømningshastighed.

8. Løftemekanisme ifølge krav 7, hvor ventilen er indrettet således, når den er i den tredje driftstilstand, at hydraulisk fluid ledes gennem en strømningsbegrænser.

9. Løftemekanisme ifølge et hvilket som helst af kravene 5 til 8, hvor styreorganet omfatter en manuel styring.

10. Løftemekanisme ifølge et hvilket som helst af kravene 5 til 8, hvor styreorganet omfatter en elektrisk styring.

11. Løftemekanisme ifølge et hvilket som helst af kravene 5 til 10, hvor aktuatoren er konstrueret og indrettet til at holde ventilen i den anden tilstand, hvis betjening af styreorganet ophører, mens armen er mellem den anden og den tredje position.

12. Løftemekanisme ifølge et hvilket som helst af de foregående krav, hvor det hydrauliske drivmiddel indbefatter en tomgangsmekanisme, der tillader begrænset drejebevægelse af armen i den første position.

13. Løftemekanisme ifølge et hvilket som helst af de foregående krav, hvor det hydrauliske drivmiddel er konstrueret og indrettet til at virke mellem monteringsstrukturen og armen.

14. Løftemekanisme ifølge et hvilket som helst af de foregående krav, hvilken løftemekanisme indbefatter et støtteelement til at understøtte armen i den første position.

15. Løftemekanisme ifølge krav 14, hvor støtteelementet en fjeder.

16. Slåmaskine indbefattende en løftemekanisme ifølge et hvilket som helst af de foregående krav, og en skæreenhed, der er fastgjort til og understøttet af armen.

17. Slåmaskine ifølge krav 16, hvor støttestrukturen er indrettet til fastgørelse til, eller er fastgjort til, en traktor.

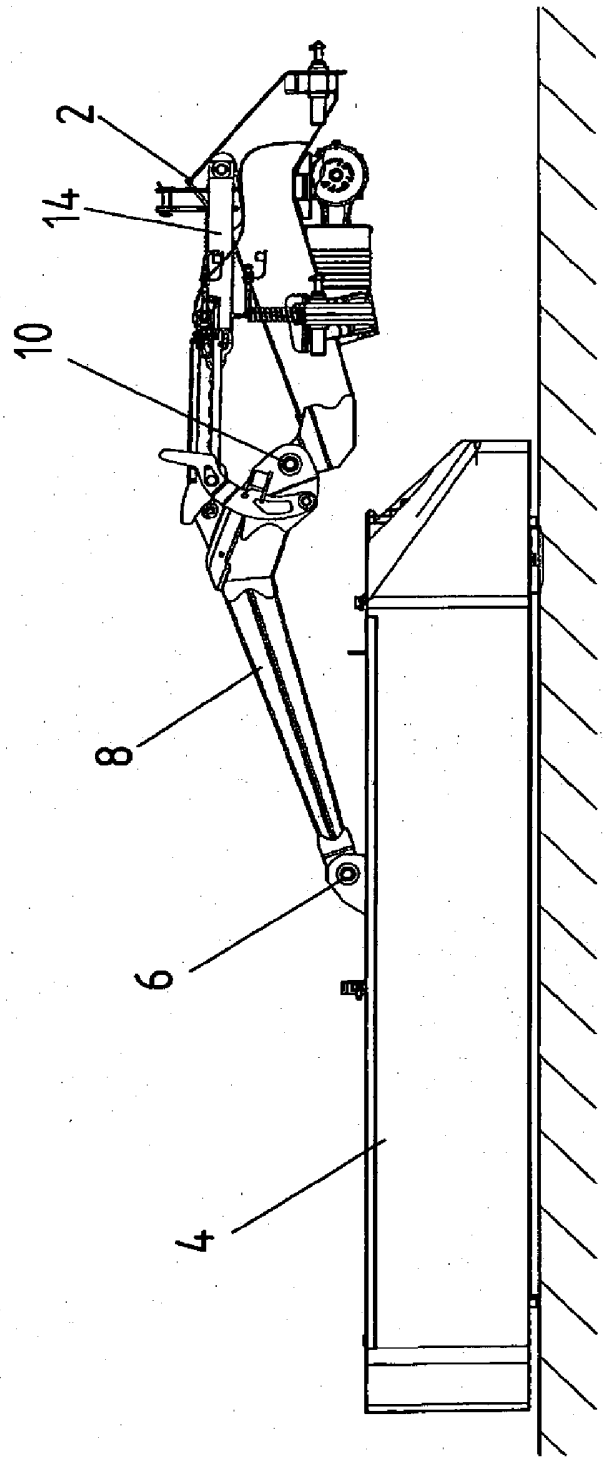

Fig. 1

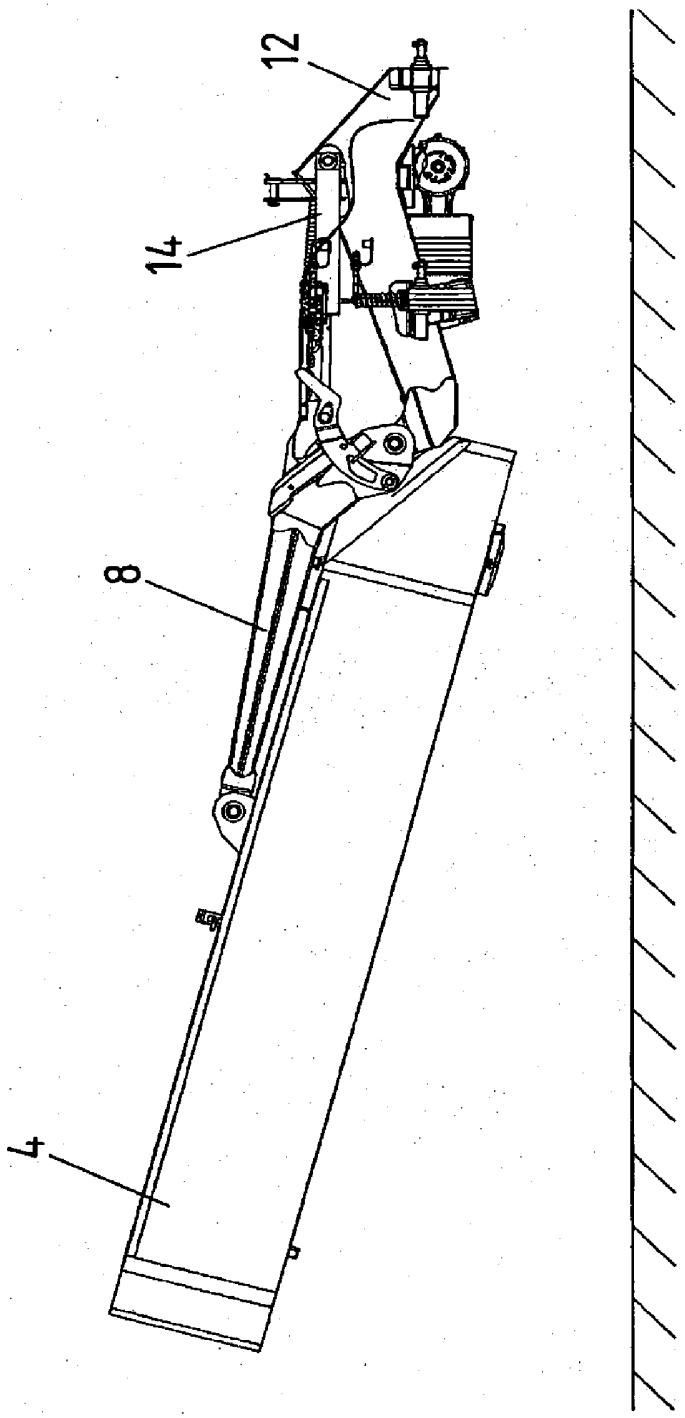

Fig. 2

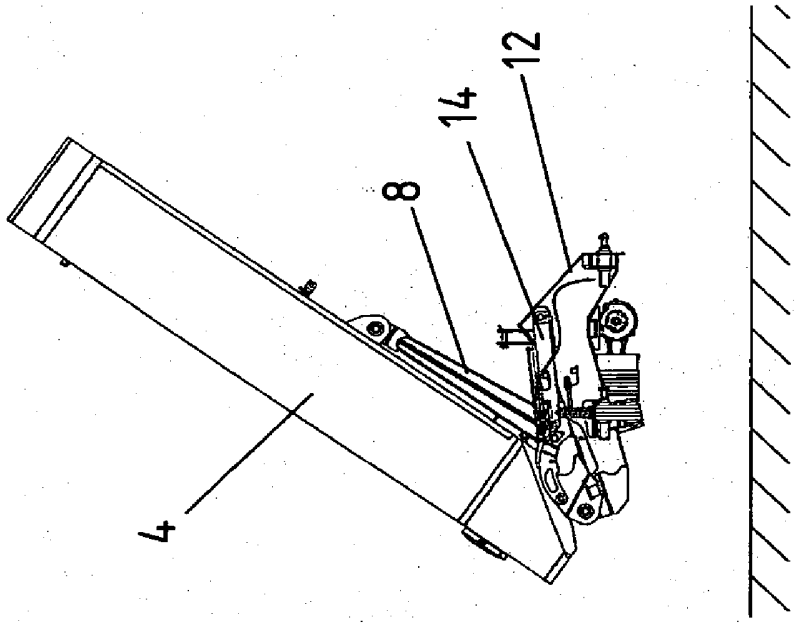

Fig. 3

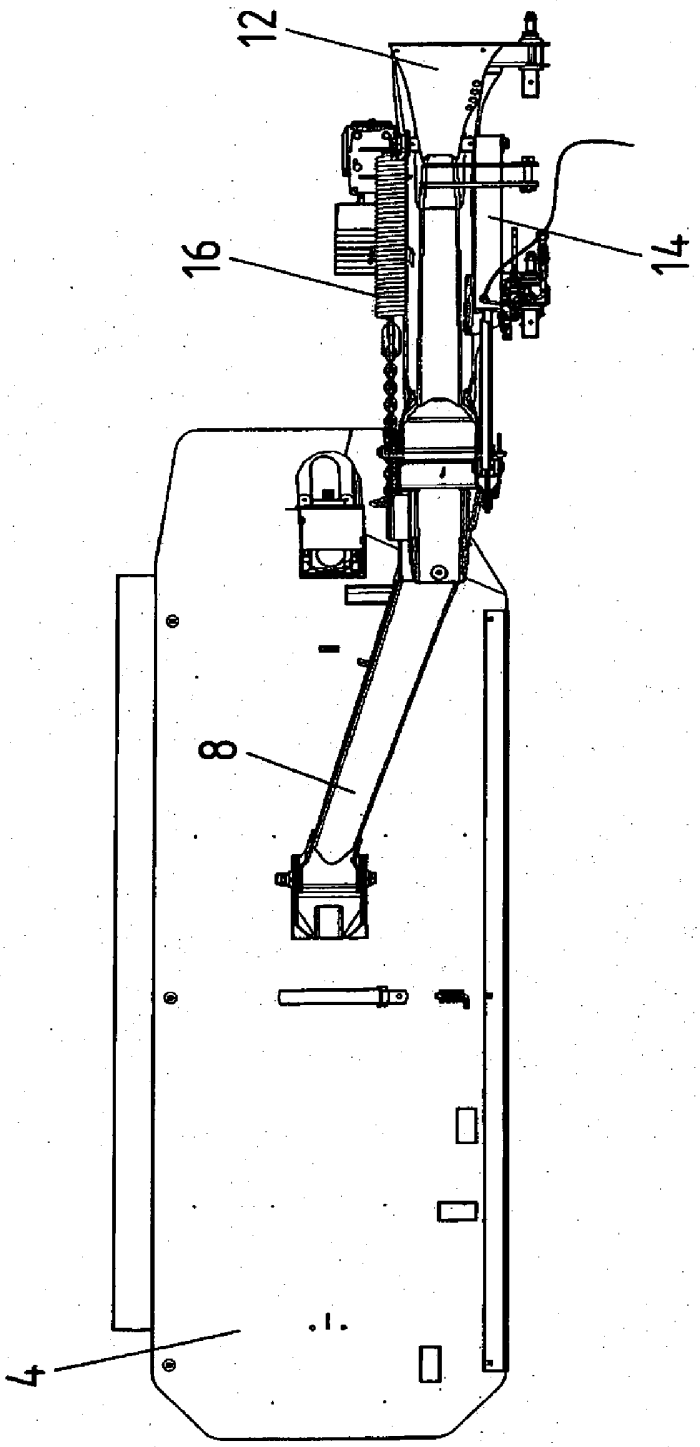

Fig. 4

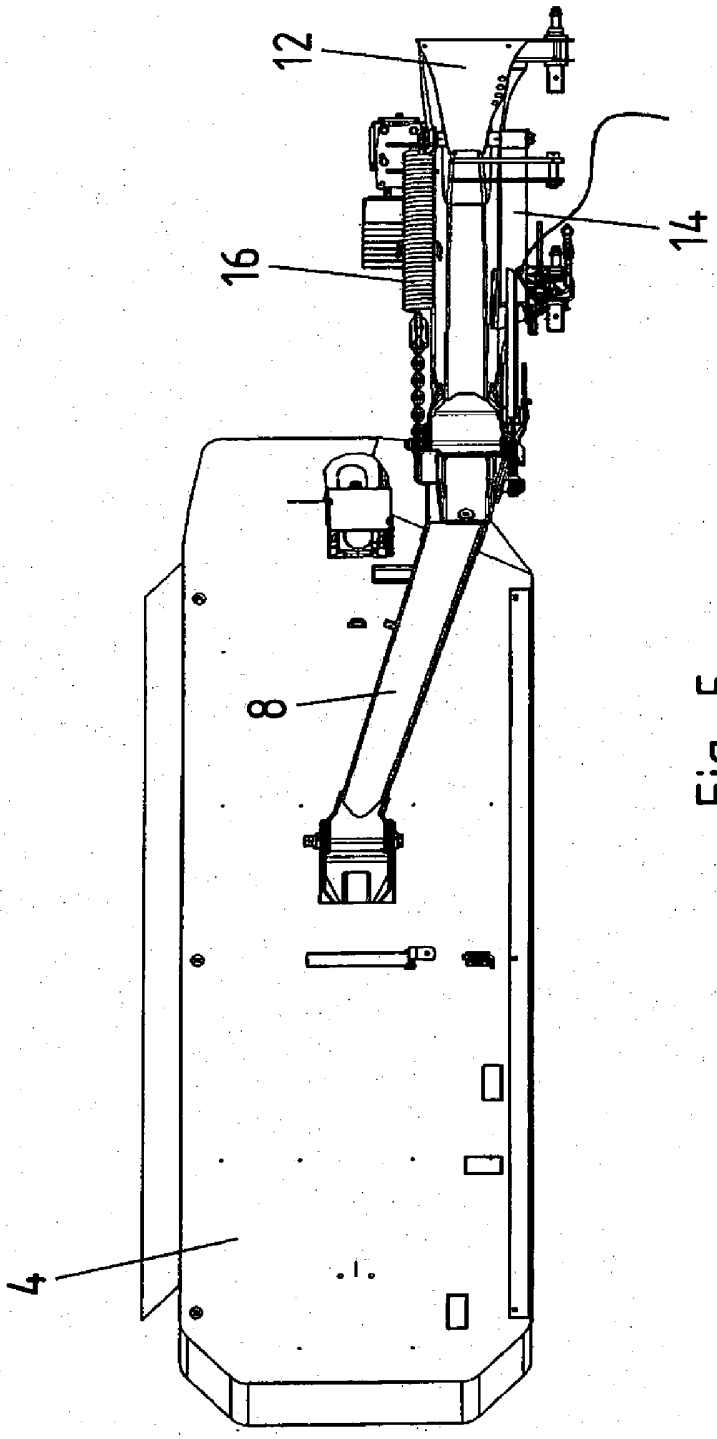

Fig. 5

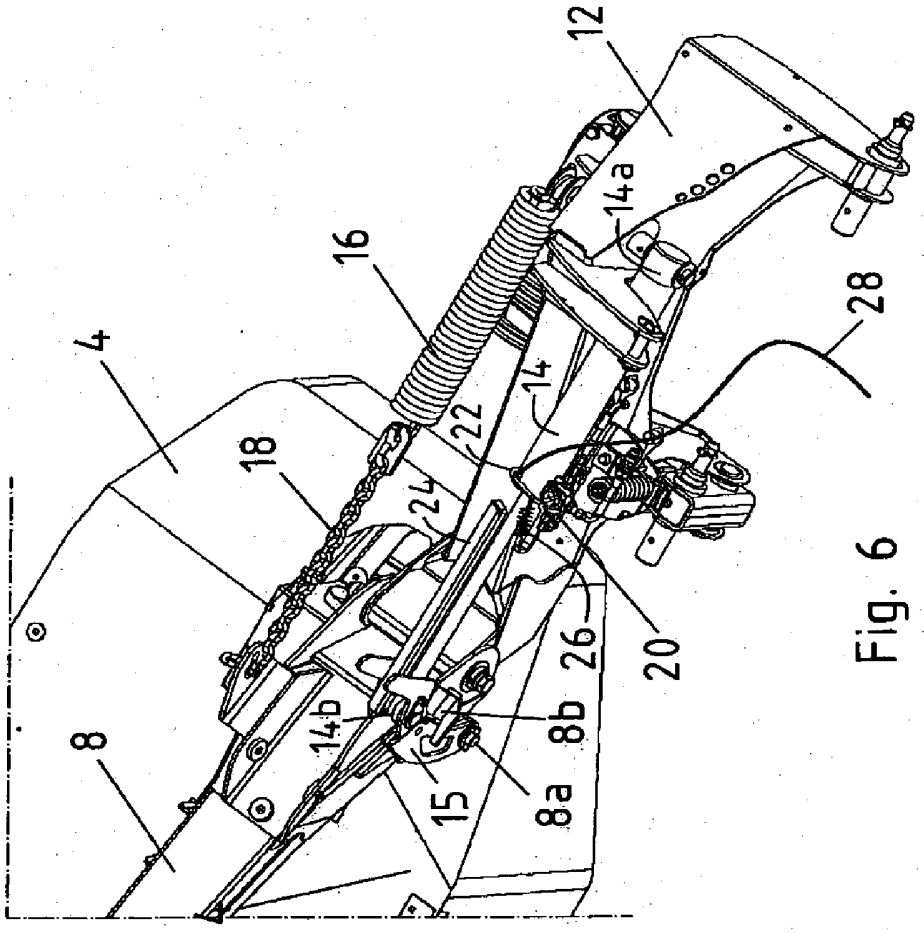

Fig. 6

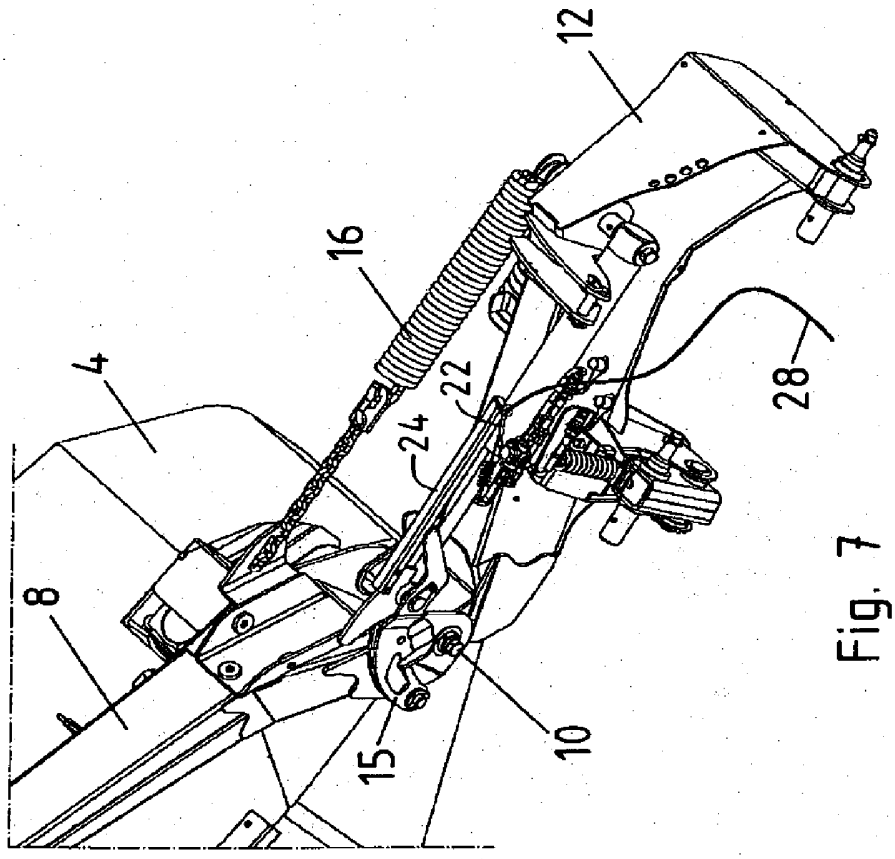

Fig. 7

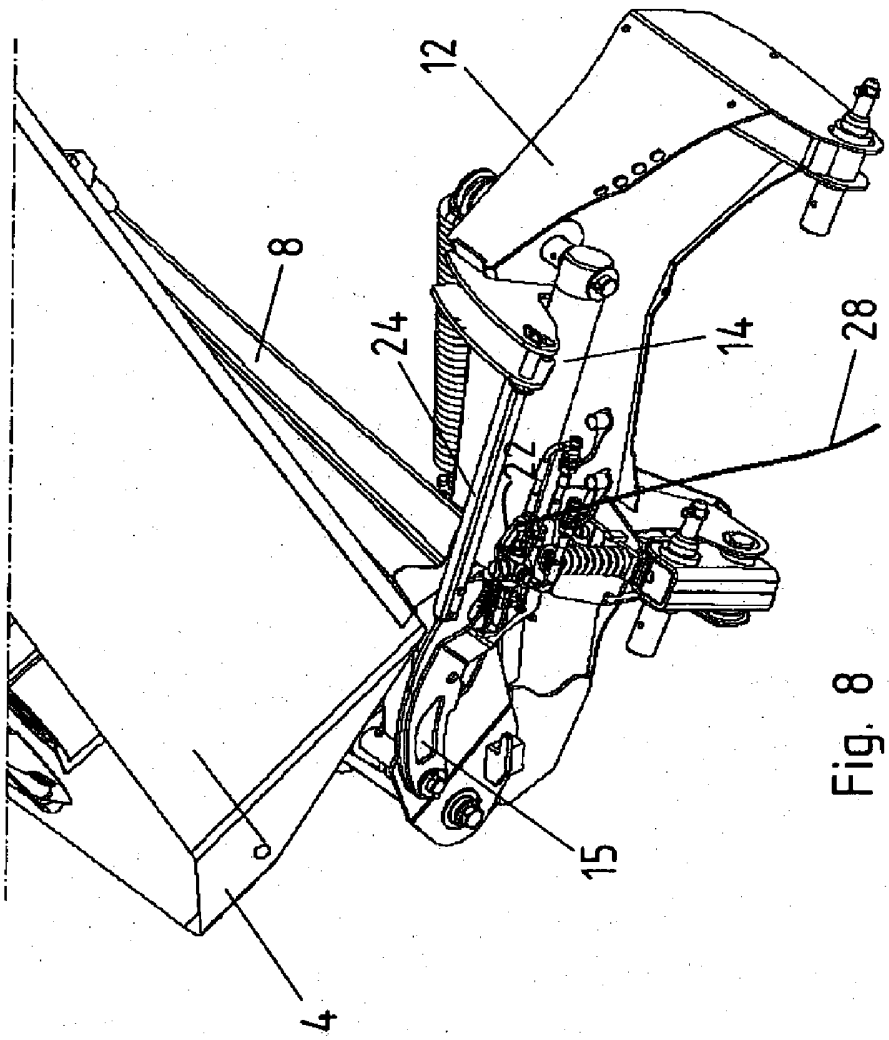

Fig. 8

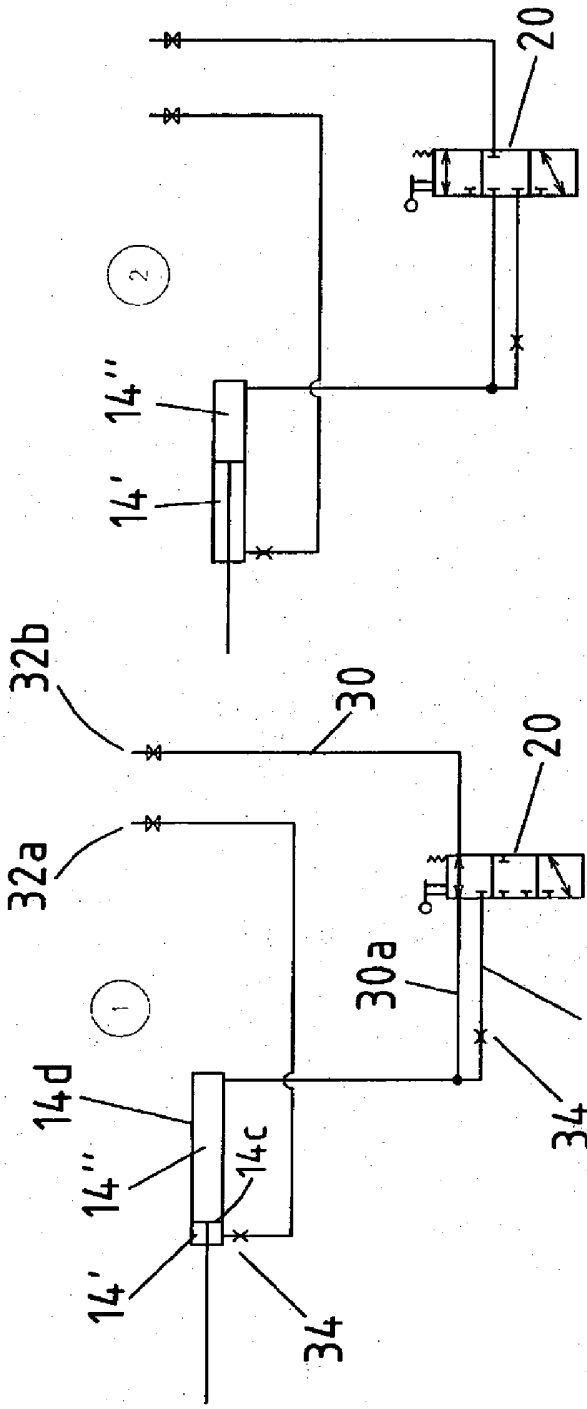

Fig. 10

Fig. 9

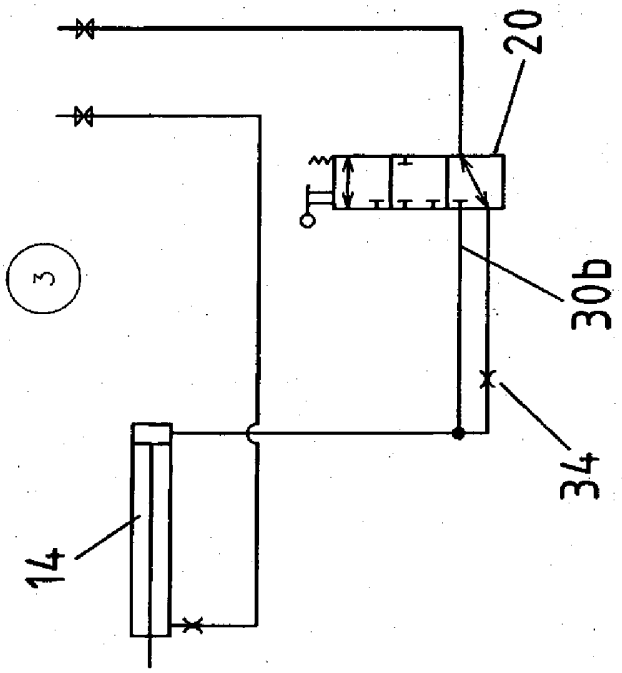

Fig. 11