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(54) Collapsible towed carriage for on-road-off-road machines

(57) In a collapsible towed carriage for on-road-off-road machines, mainly for rotary mowers, a beam (2) is connected with drawbar (3) in a single hinging point through vertical bolt (26) operated by an adjusting cylinder (23) – when the beam (2) and drawbar (3) are turned from operating position to transport position and back. Furthermore, at the end of the beam (2) a frame (4) supporting at least one auxiliary wheel (6, 6') is hinged, the height position of which relative to the beam (2) is adjusted preferably by way of cylinder (29). Also, the auxiliary wheel (6') is spaced (T) from the longitudinal centreline (X) of the beam (2) and the height position of the wheels (5, 5') relative to the beam is adjustable preferably by way of cylinder (28, 28').

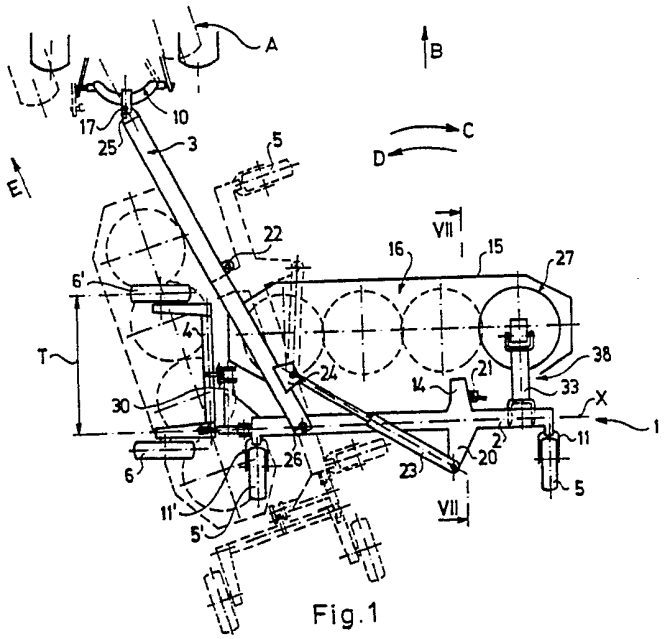

Fig.1

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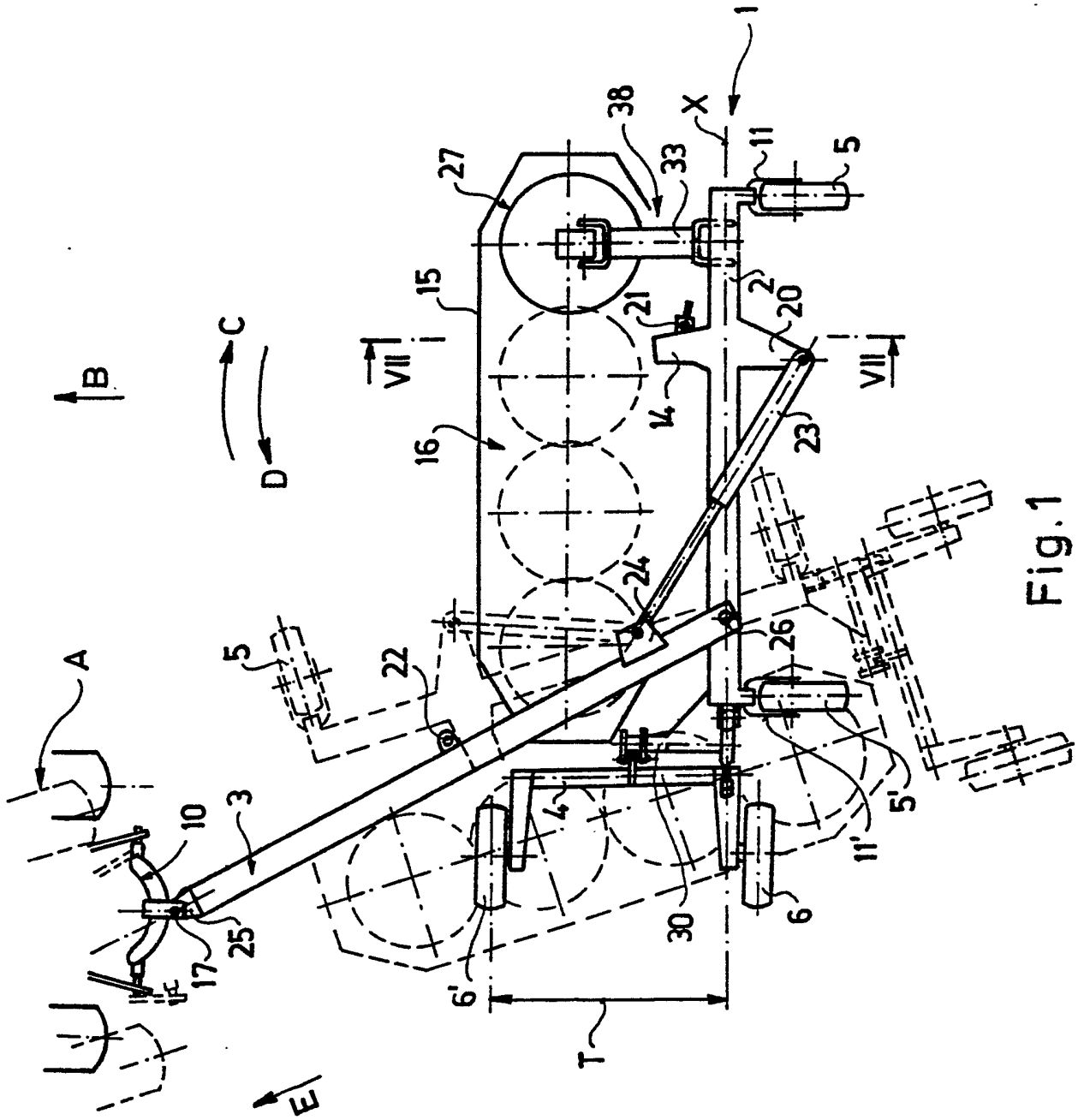
1
X
38
33
27
11
5
15
21
2
20
VIII
VIII
C
D
B
16
14
23
24
26
22
5
A
10
3
4
5'
11'
25
17
6
6'
30
T
E

Fig. 1

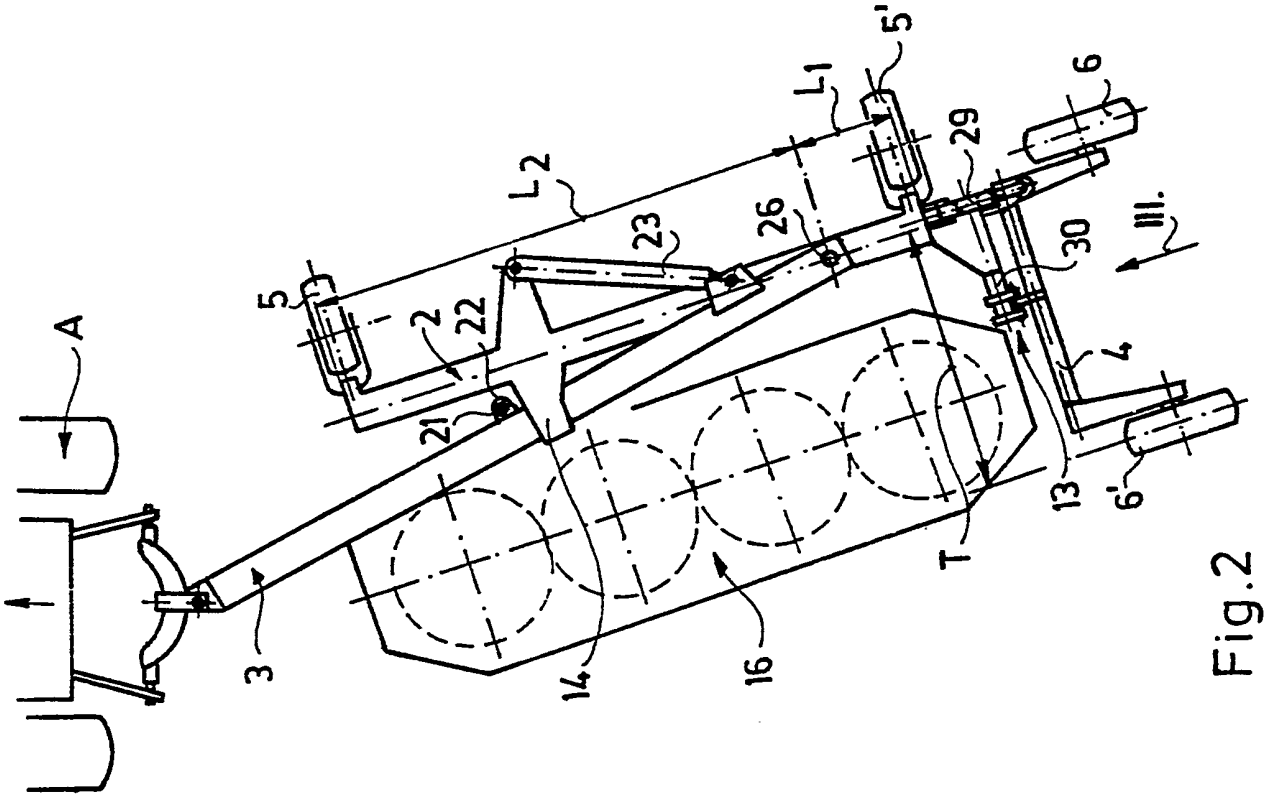

Fig.2

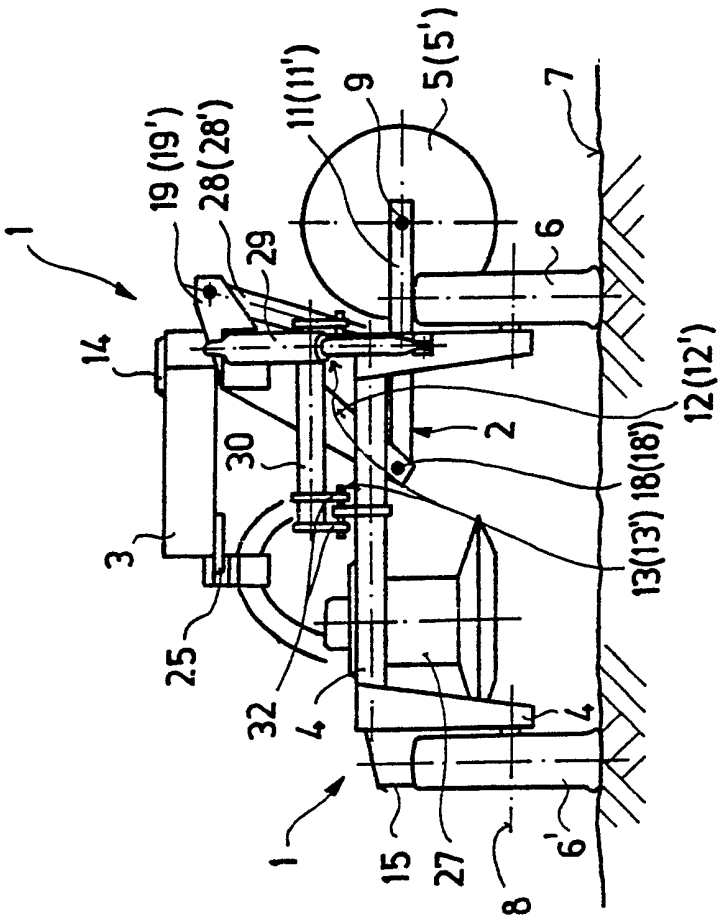
1
19 (19')
28(28')
29
11(11')
9
5(5')
7
6
14
12(12')
2
30
18(18')
13(13')
3
25
32
4
4
1
15
27
8
6'

Fig. 3

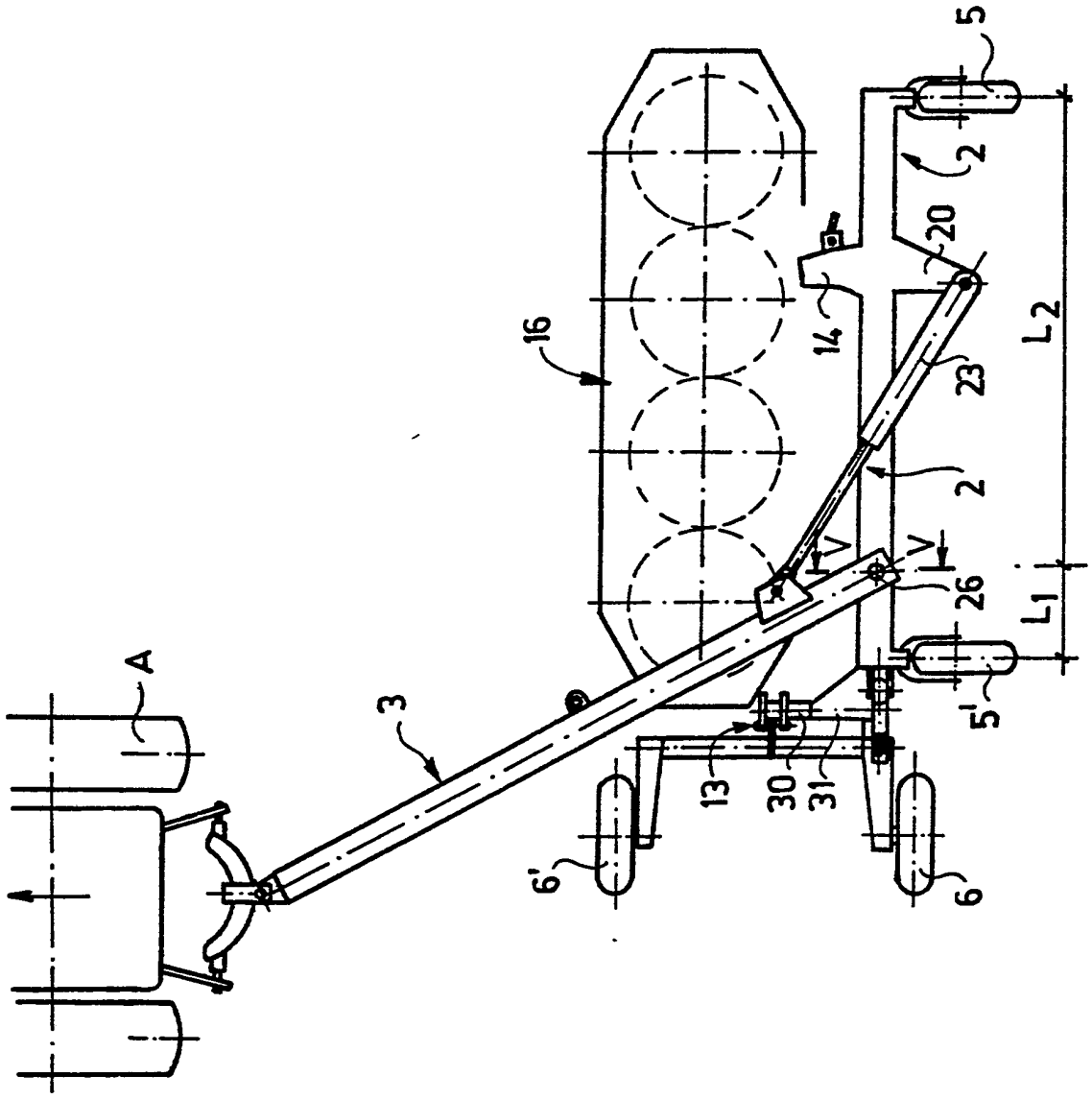

Fig.4

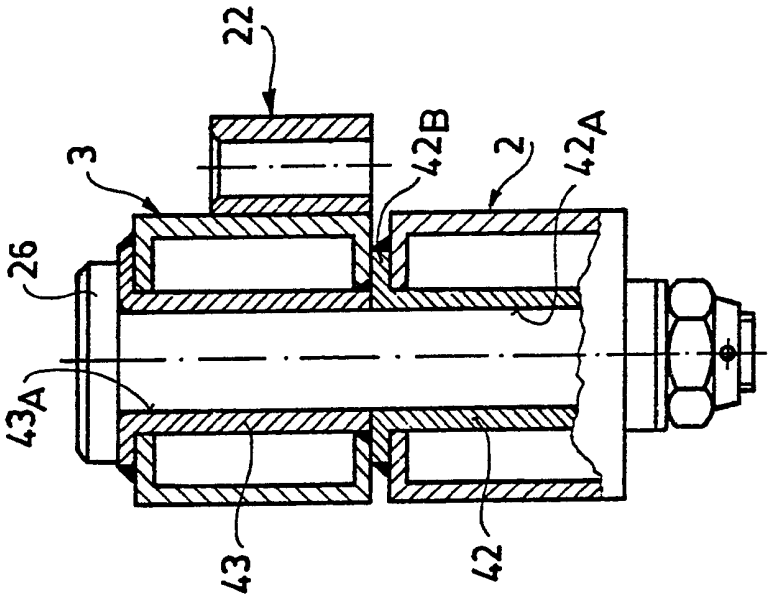

Fig.5

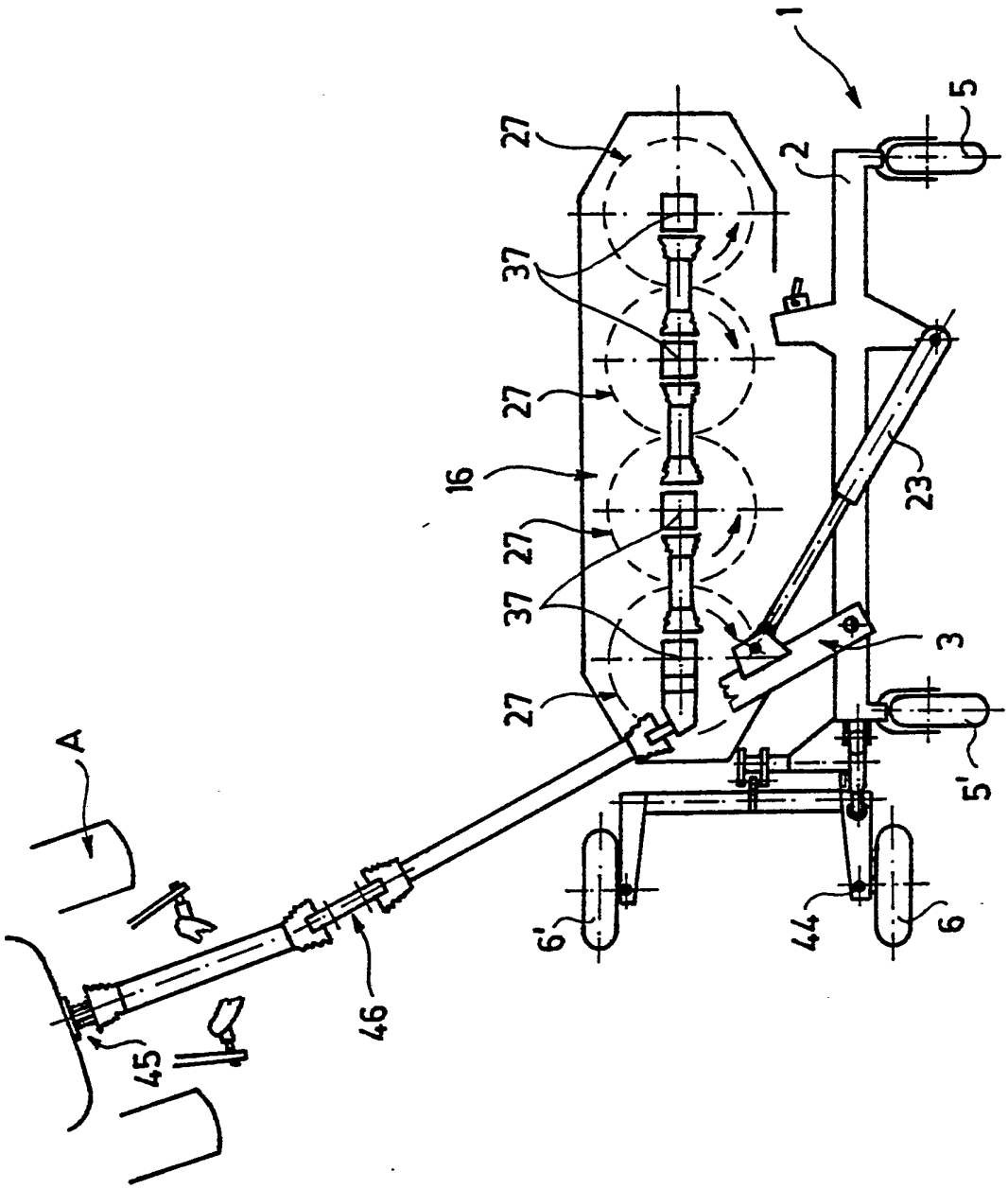

Fig.6

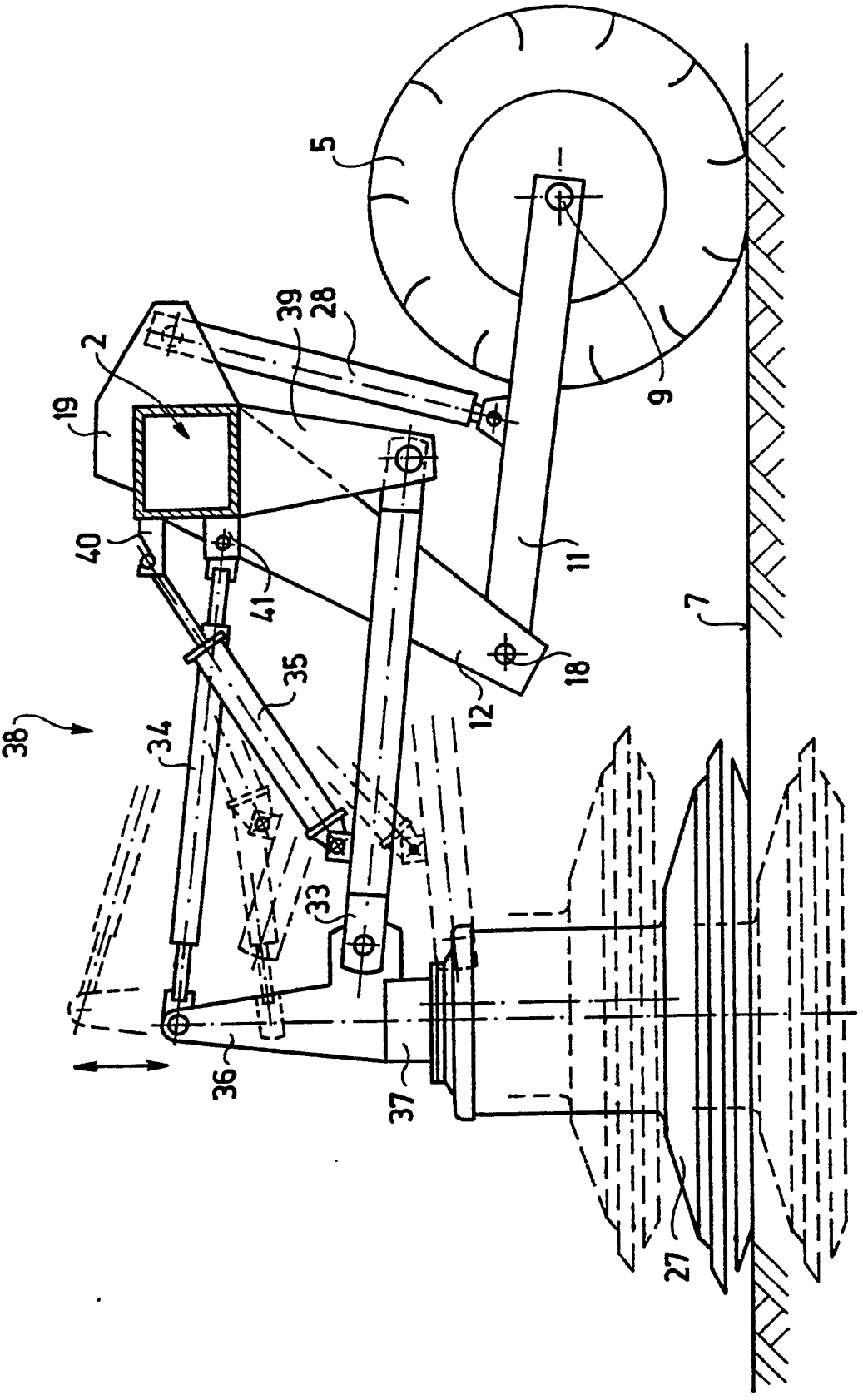

Fig.7

COLLAPSIBLE TOWED CARRIAGE FOR PLOUGH-LAND MACHINES

MAINLY FOR ROTARY MOWERS

The invention relates to collapsible towed carriage for plough-land machines, mainly for rotary mowers.

As known, the agricultural machines, e.g. the various alternating and rotary mowers, windrowers, cultivators, harrows, swath-turners, rakers, etc. are pro-duced with as wide working width as possible to increase the capacity, and they are generally towed both in operating and transport position. In operating position as wide working width as possible is desirable, in transport position however, it implies more serious problem.

In the known collapsible towed carriages several methods are used for changing over from operating position to transport position. For example according to the method of the French patent specification No. 2 397 780, the mower in operation is situated side-ways at the rear wheels of the power machine, whereas in transport position crosswise symmetrically behind the power machine. According to the experiences in the practice, the shortcoming of above solution is that the working width of the mower is limited by the traffic restrictions, furthermore, changing over from transport position to operating position is area-demanding

due to manoeuvre for position of the power machine, which may involve considerable treading damage.

According to the British patent specification No. 1 5o5 872 the V-beams of the hay-gatering machines's carriage are unfolding and folding up by way of hinge. When in folded up position, the outer elements of the beams are fixed by lock bolts. This method requires very complicated manual intervention for the changeover which involves accident hazard. Further shortcoming is that the length of the carriage beams is limited by the size of the middle boam permissible in respect of transport.

A towed carriage is known from the French patent specification No. 83 11485, where the frame carrying the rotors of the hay gathering machine can be folded up and unfolded with a drawbar by way of hinge.
According to the experiences, this method is problematic in that the drawbar and supporting members of the transport wheels are directly connected with each other, consequently if the rotors as cultivation implement have to be lifted up from the ground,then folding up of the carriage may occur unintentionally, and to put it right manually is very complicated. In addition to the complication, this operation involves serious loss of time and accident hazard.

The present invention is aimed at the elimination of above shortcomings, i.e. at the realization of such improved carriage, wherein hanging over from operat-ing position to

transport position is simple and quick, with minimal manual intervention and exempt from accident hazard, furthermore which maintains its adequate stability even while carrying out the change-over.

In order to solve the problem, the described collapsible towed carriage was used as starting point, which has a beam carrying the cultivation tools, it can be changed over from transport position to operating position and back, and provided with drawbar and impellers. The essence of the present invention lies in that, the beam is connected to the drawbar in a single hinging point through vertical bolt, forming at the same time the axis of rotation of the relative turn by way of an adjusting unit - mainly cylinder - when the beam and drawbar are turned from operating position to transport position and back. Furtheremore,at the end of the beam closest to the hinging point - where the beam is in cross direction to the towing direction in operating position - a frame supporting at least one auxiliary wheel perpendicular to the beam is hinged, the height position of which relative to the beam is adjustable preferably by way of cylinder.

According to a further characteristic of the invention, the hydraulic cylinder changing over the carriage is hinged to the console of the beam reaching back, and to the connecting head of the drawbar. This way the changing over from transport position to operating position and

back will become simple and automatic.

Furthermore, it serves the purpose if the impeller-embedding forks are turnably suspended on each pin of the consoles arranged at the beam ends, where each upper console branch and forks are connected with a height adjusting cylinder.

For adequate stability it is advisable to provide the beam with a crossbeam suspending the frame by hinge where the frame is connected with the crossbeam through a hinging mechanism.

The cylinders are suitably hydraulically operated, and remote controlled independently from each other.

Preferably the beam has a front support releasably fixing the drawbar through its clamping sleeve to the beam in transport position. This results in more favourable load transfer.

Finally such construction is also preferred, where the working tools are connected to the beam through ground-following parallel suspension, such as the rotary cutters arranged before the beam and below the horizontal plane of movement to change over the drawbar.

The invention is described in detail with the aid of the enclosed drawing presenting the embodiment of the solution according to the invention by way of example, in which:

Fig.1.: Schematic top view of the rotary mower provided

with collapsible towed carriage according to the invention in operating position,

Fig.2.. Top view showing the last phase of changing over to towing position according to Fig.1.,

Fig.3.: Rear view looking towards arrow III shown in Fig.2.,

Fig.4.: Operating position of the solution according to Fig.1.,

Fig.5.. Section along V-V marked in Fig.4., drawn to relatively larger scale,

Fig.6.. A version of Fig.4., showing the driving chain of the cultivation implements in detail,

Fig.7.. Section along VII-VII marked in Fig.1., drawn to relatively larger scale.

As shown in Fig.1., a collapsible towed carriage 1 of a rotary mower is hinged to tractor A. The carriage 1 according to the invention is in operating position in Fig.1. It is provided with a beam 2 perpendicularly arranged to the direction of progress B, which can be changed over from operating position - marked with continuous line - to transport position - marked with dashed line - as described in the following. Purpose of the beam 2 is to carry cultivation tools.

The beam 2 is provided with drawbar 3 connected to the beam 2 in a single vertical axial hinging point, at the same time forming the axis of rotation of the change over.

The left part of Fig.1. illustrates a frame 4 perpendicular to and connected with the beam 2 by way of hinge the height position of which is adjustable. In this case, the beam 2 at its two ends is provided with impellers 5 and 5' the height of which is also adjustable as described subsequently. Furthermore, in this case, the frame 4 is provided with auxiliary wheels 6 and 6' the centreline of which is perpendicular to the centreline of impellers 5 and 5'. The ground surface is marked with reference number 7 (Fig.3.). Centreline of the auxiliary wheels 6 and 6' is marked with 8, and centreline of the impellers 5 and 5' in raised transport position is marked with 9 in Fig.3.

The drawbar 3 is connected with tractor A through a conventional three-point suspension 10.

Fig.1 and 3. show that impellers 5 and 5' are embedded in forks 11 and 11' respectively, and connected with consoles 12 and 12' by way of hinge. The hinging connection is secured by pins 18 and 18' (Fig.3.). Hydraulic cylinders 28 and 28' are built between the upper branches 19 and 19' of consoles 12 and 12' and forks 11 and 11' for the purpose of raising and lowering the impellers 5 and 5'.

As shown in Fig.3. in detail, the frame 4 is connected to the crossbeam 30 of the beam 2 through hinge mechanism 13 and 13' arranged perpendicularly to the longitudinal centreline of the beam 2 marked with X in Fig.1.

As seen in Fig.1., the auxiliary wheel 6' is spaced T

from the longitudinal centreline X of the beam 2, the role of which will be dealt with subsequently.

According to Fig.4., the crossbeam 30 is braced to beam 2 by tie plate 31 which are welded to one another. Fig.1. clearly shows that a single hinging point is arranged in the longitudinal centreline X of beam 2, through which the drawbar 3 and beam 2 are relatively turnable. This single hinging point is formed according to the invention by vertical bolt 26. The enlarged section of Fig.5. clearly shows this hinge connection. Accordingly the drawbar 3 is provided with bush 43, and the beam 2 underneath with bush 42. The bolt 26 is leading through central holes 43_A and 42_A of bushes 42 and 43. Suitably the bush 42 is firmly fixed in the beam 2 and provided with an upper shoulder 42_B.

As shown in Fig. 3. in this case the crossbeam 30 at both ends is provided with lugs 32, connected by way of hinge - through mechanisms 13 and 13' -with the frame 4. Hydraulic cylinder 29 is used for moving the frame up and down, the lower end of which is hinged to the frame 4, and its upper end to the beam 2.

According to Fig.1,2,3., the beam 2 is provided with console-type front support 14 for the purpose of fixing a clamping sleeve 22 of the drawbar 3 by way of lock pin 21 in transport position (Fig.2.). Thus, in this condition the support 14 partially relieves the bolt 26. In folded up condition, the lock pin 21 can be led into the hole of the

clamping sleeve 22. Furthermore, the beam 2 has also a rear console 20 connected with hydraulic cylinder 23 - that carries out the folding - by way of hinge. The piston rod top of cylinder 23 is hinged to a connecting head 24 firmly fixed to the drawbar 3. It is noted here,that the hydraulic cylinders 23,29,28 and 28' are connected to a common hydraulic supply unit (not shown) and they can be independently remote controlled from the operator's cab of the tractor A.

According to Fig.1., the drawbar 3 at its end is provided with towing plate 25 connected by towing pin 17 to the three-point suspension 10 of the tractor A. In this case the working tool of the rotary mower is a rotary cutter 16, this however is a conventional part which does not belong to the essence of the invention. Cover of the rotary cutter 16 is marked with 15 and in this case it has four rotors 27. The sense of rotation of the rotors 27 is marked with arrows in Fig. 6., indicating counter-rotation per pair, thus they are suitable to form a swath from each mown crop. Each rotor 27 has ground-following parallel suspension marked with 38 in Fig. 7. As seen, the rotor 27 as rotary cutting unit is suspended by rotor suspender 36 and associated with angle drive 37 . The rotor suspender 36 is hinged by adjusting spindle 34 to adjusting support 41 fixed to the beam 2, on the other hand, a rocker essentially parallel with this is connected by way of hinge to a rocker pedestal 39 reaching

down from the beam 2 and to the rotor suspender 36. Relieving spring 35 is connected to the rocker 33 per rotor, the upper end of which is engaged with the spring lug 40 welded to the beam 2. This arrangement allows the rotors 22 to follow the dislevelments of the ground 7 individually, i.e. independently from one another, in other words, they are capable to move vertically parallel with themselves against the relieving spring 35. (Possible upper and sub-surface positions of the rotor 27 are marked with dashed line in Fig.7.)

Driving chain of the rotors is schematically illustrated in Fig.6. As mentioned before, each rotor 27 is provided with an angle drive 37. These are driven by the power transmission shaft 45 of the tractor A through the cardan mechanism of the driving chain 46. As seen in Fig.6., the adjacent angle drives 37 are driven by each other from an intermediate cardan shaft. This driving gear ensures the vertical movement of the rotors 27 in relation to each other.

According to Fig. 1,3 and 5. the rotary cutter 16 is arranged before the beam 2 so that it is situated below the plane of horizontal displacement of the drawbar 3. Thus the folding up and unfolding are simple and unobstructed.

Fig.4. schematically illustrates that spacing L_1 between the bolt 26 and left side end of the beam 2 is considerably less than the spacing L_2 measured from the other end. In

this case, L_1 is in proportion to L_2 as 1 to 4.5. Naturally this always depends on the construction of the machine mounted on the carriage 1 and on its centre of mass, etc.

Changing over the carriage 1 from operating position to transport position or back takes place as follows:

To change over to operating position, the starting point is the transport position shown in Fig.2 and 3. In this case only the auxiliary wheels 6 and 6' are on the ground, the impetlers 5 and 5 ' are raised with cylinders 28 and 28' to a position where their centreline 9 is much higher than the centreline 8 of the auxiliary wheels 6 and 6', The rotors 27 are also raised from the ground level 7 during transport, by lifting the beam 2 through the frame 4 with hydraulic cylinder 29.

Change over to operating position begins with lowering the cutter 16 and beam 2 by counter-operation of the cylinder 29 to have the auxiliary wheels 6 and 6' on the ground. Thus, the auxiliary wheels 6 and 6' remain on the ground, but the impellers 5 and 5' will also be in contact with the ground. Thereafter, the lock pin 21 is pulled manually , whereby locking of the beam 2 and drawbar 3 in folded up condition is released. This condition is shown in Fig.2., and marked with dashed line in Fig.1. Then by pushing out the cylinder 23, the beam 2 turns out in the direction of arrow C to the operating position marked with continuous line.

Prior to commencement of the work, the frame 4 together with the auxiliary wheels 6 and 6' are tipped up by actuation of the cylinder 29, and as a result, the centre-line 8 of the auxiliary wheels 6 and 6'get above the centreline 9 of the impellers 5 and 5'. The work begins by switching on the drive of the cutter 16. It is noted, that with the cylinders 28 and 28'pertaining to the impellers 5 and 5', the cutter 16 can be raised from the ground during operation if necessary, e.g. when turning at the end of the plot.

When changing back from operating position to transport position the order is reversed. First the auxiliary wheels 6 and 6' are lowered to the ground 7 by counter-operating the cylinder 29, but the impellers 5 and 5' and the cutter 16 are kept still on the ground. Then for the relative turn of the locked beam 2 and drawbar 3, the dual-action cylinder 23 is actuated in the sense of pulling in, resulting in turn of the beam 2 in the direction of arrow D and its support 14 gets below the drawbar 3 (Fig.2.). In this case, the lock pin 21 can be pushed manually into the clamping sleeve 22 of the drawbar 3, and thus link up for the transport position is accomplished.

Prior to beginning the transport, the cutter 16 is lifted into the position shown in Fig.3., so that at the same time the centreline 9 of the impellers 5, 5' is raised above the centreline 8 of the auxiliary wheels 6 and 6'.

This lifting is accomplished by pushing out the cylinder 29 further.

In this position the beam 2 rests on the drawbar 3 by way of support 14, thereby considerably relieving the bolt 26. At this point the towing may begin.

The most important advantage of the solution according to the invention is that change over of the carriage 1 is accomplished mechanically, when the carriage 1 does not have to be disengaged from the tractor A, and no complicated and accident hazardous manoeuvring of the tractor A is necessary. The whole change-over operation can be carried out by the driver of the tractor A with remote control from the driver's cab. In case of the illustrated embodiment, the single manual intervention is to pull out or push back the lock pin 21. It is noted however, that in a given case, remote control of the lock pin 21 is conceivable with electromagnetic or hydraulic method. Further advantage of the solution according to the invention is that the change-over can be accomplished simply and quickly without accident hazard, with a relatively simple construction, and thus the so far necessary and lengthy and inevitable downtimes can be reduced to minimum. This way productivity of the machine and efficiency of the farming can be considerably improved.

By use of the invention, the working width of the machine is no longer inhibited by the traffic restrictions, since the folded up transport position complies with the

traffic regulations even in case of any working width.

In respect of operation, it is stressed that the cylinders 28,28' and 29 carry out several functions. With the cylinder 29 partly the cultivation tools, in this case the cutter 16 can be moved up and down if the auxiliary wheels 6 and 6' are on the ground, and partly the auxiliary wheels 6 and 6' can be lifted from the ground, when the cutter 16 and the impellers 5 and 5' are on the ground. Furthermore, with the cylinders 28 and 28' the cutter 16 can be lifted when turning at the end of the plot, or in any other necessary event, and partly the impellers 5 and 5' can be further raised for safer transport. It is noted that a different type of control of the cylinders 28 and 28' might be necessary, e.g. when instead of rotary cutter 16, other cultivation tools such as cultivators, harrows, swath-turners, rakers, windrowers, etc. are mounted on the carriage 1.

According to the experiences gained from the experiments, in the course of opening or locking ope ration, mainly the auxiliary wheel 6 slips on the ground, while the auxiliary wheel 6' partly slips and partly rolls down, at the same time the impellers 5 and 5' roll down essentially along an arc, and somewhat slip. The arc of rotation is fixed for the impellers 5 and 5' by spacing L_1 and L_2 determined by the bolt 26. In hard and grassy soils this displacement does not cause special overloading for the

mechanism. But in loose soils, or when other cultivation implements are mounted, such construction of the carriage 1 would be appropriate, where the auxiliary wheels 6 and 6', but at least the auxiliary wheel 6 is embedded by way of self-alignment through a vertical pin 44, thus it functions as self-aligning wheel in opening and locking displacement.

Naturally in such construction separate locking is required to avoid sidling of the auxiliary wheels 6 and 6'in transport position.

Returning to Fig.1., it is mentioned that after finishing the folding up, the carriage 1 - following the start of the tractor A - slightly skids on a short stretch, i.e. taking up the transport position jointly as shown by arrow E in Fig.1.

The stability during change-over can be considerably influenced by selecting the spacing T between the carriage 1 and auxiliary wheels 6 and 6', thereby preventing incidental tipping forward of the machine. From this point of view, the distance between the auxiliary wheel 6' and beam 2 is very important. Finally it is noted that although two impellers and two auxiliary wheels are presented in the drawing, in given case their number can be increased as necessary.

C L A I M S .

1. Collapsible towed carriage for plough-land machines, mainly for rotary mowers, built as a mecha-nism changing over from transport position to operat-ing position, comprising a cultivation tools-car-rying beam, drawbar and impellers, wherein in that beam (2) is connected to the drawbar (3) through a vertical bolt (26) in a single hinging point , forming at the same time the axis of rotation of the relative turn by way of an adjusting unit - mainly cy-linder (23) - when the beam (2) and the drawbar (3) are turned from operating position to transport position and back, furthermore at the end of the beam (2) closest to the hinging point - where the beam (2) is crosswise to the towing direction in operating position - a frame (4) supporting at least one auxiliary wheel (6,6') perpen-dicular to the beam (2) is hinged, the height position of which relative to the beam (2) is adjustable preferably by way of cylinder (29), furthermore, one of the auxiliary wheels (6') is spaced (T) from the longitudinal centreline (X) of the beam (2), furthermore the height position of impellers (5,5') relative to the beam (2) is adjustable preferably by way of cylinder (28,28').

2. Carriage according to claim 1., characterized in that the beam (2) is provided with console (20) reaching back, connected with one end of the turning cylinder (23) by way

of hinge, the other end of this cylinder (23) is hinged to connecting head (34) of the drawbar (3).

3. Carriage according to claim 1 or 2., characterized in that impellers (5,5') are embedded in forks (11,11'), these are turnably suspended on pins (18,18') of consoles (12,12') arranged at the end of the beam (2), where height adjusting cylinders (28,28') are built between the upper branches (19,19') of the consoles (12, 12') and the forks (11,11').

4. Carriage according to any of claims 1-3., characterized in that the beam (2) is provided with a crossbeam (30) suspending the frame (4) by way of hinge, and the frame (4) is connected with the crossbeam (30) through a hinging mechanism (13,13').

5. Carriage according to any of claims 1-4., characterized in that the cylinders (23,28,28',29) are made as dual-action hydraulic cylinders remote controlled independently from one another.

6. Carriage according to any of claims 1-5., characterized in that the beam (2) has a support (14) reaching forward, releasably locking the drawbar (3) in transport position by way of lock pin (21) through clamping sleeve (22) fixed to the drawbar (3).

7. Carriage according to any of claims 1-6.,characterized in that rotors (27) of the cutter (16) are individually connected with the beam (2) through ground-following parallel suspension (38) and said cutter (16) in

operating position is arranged before the beam (2) and below the horizontal plane of rotation of the drawbar (3).

8. Carriage substantially as shown and described.

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