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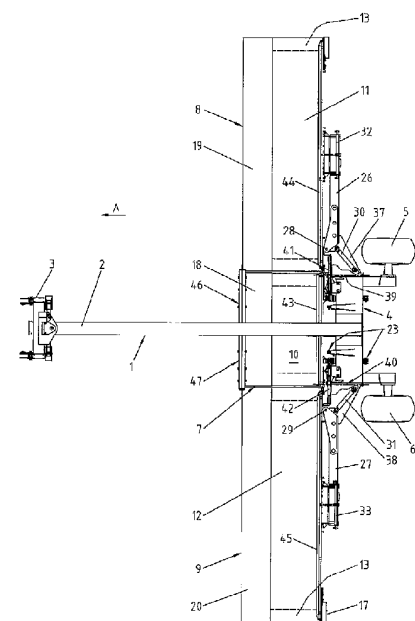
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(54) Title: AGRICULTURAL MACHINE FOR SWATHING PRODUCTS LYING ON THE GROUND

(54) Titre : MACHINE AGRICOLE POUR L'ANDAINAGE DE PRODUITS SE TROUVANT AU SOL



(57) Abstract: The invention concerns an agricultural machine for assembling swathes or for swathing products lying on the ground, comprising in particular a main frame bearing a central collecting and swathing device and two lateral collecting and swathing devices which are linked to carrier arms extending laterally in use. The invention is characterized in that each lateral carrier arm (26, 27) is articulated relative to the frame (1) on a substantially vertical pin (28, 29) about which it is foldable by an angle of about 90° for transport and in that each lateral collecting and swathing device (8, 9) is articulated on its carrier arm (26, 27) by means of a substantially horizontal pin (32, 33) about which it is foldable upwards by an angle of about 90°, in order to obtain a reduced machine width for transport.

(57) Abrégé : La présente invention se rapporte à une machine agricole pour regrouper des andains ou pour andainer des produits se trouvant au sol, comportant notamment un bâti principal portant un dispositif de ramassage et d'andainage central et deux dispositifs de ramassage et d'andainage latéraux qui sont reliés à des bras porteurs qui s'étendent latéralement au travail. Elle est remarquable en ce que chaque bras porteur latéral (26, 27) est articulé par rapport au bâti (1) sur un axe sensiblement vertical (28, 29) autour duquel il est repliable d'un angle d'environ 90° pour le transport et que chaque dispositif de ramassage et d'andainage latéral (8, 9) est articulé sur son bras porteur (26, 27) au moyen d'un axe (32, 33) sensiblement horizontal autour duquel il est repliable vers le haut d'un angle d'environ 90°, en vue d'obtenir une largeur de la machine réduite pour le transport.

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AGRICULTURAL MACHINE FOR SWATHING PRODUCTS LYING ON THE GROUND

The present invention relates to an agricultural
5 machine for combining windrows or for windrowing
products such as grass, hay or straw that are on the
ground. This machine comprises in particular a main
frame supporting a central pick-up and windrowing
10 device that is connected to said main frame and two
side pick-up and windrowing devices that are connected
to support arms that extend laterally relative to the
main frame, which side devices and central device are
substantially in line and extend substantially
15 perpendicular to the direction of travel of the machine
during work.

On a machine of this kind, the side pick-up and
windrowing devices may be folded upward for transport,
by means of their support arms, about substantially
20 horizontal shafts. This arrangement makes it possible
to reduce the width of the machine in order to help
with movements on tracks and roads. However, in this
position, the height of the machine is considerably
increased. This hampers rearward visibility and impairs
25 the stability of the machine due to the distance of its
center of gravity from the ground. It then risks
overturning when passing over major undulations or in a
bend.

30 The object of the present invention is to alleviate the
aforementioned disadvantages. It must notably propose a
machine that is as described in the introduction and
that can be transposed simply into a transport position
in which it retains good stability.

35 Accordingly, an important feature of the invention lies
in the fact that each side support arm of a side pick-
up and windrowing device is articulated relative to the

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main frame on a substantially vertical shaft about which it can be folded at an angle of approximately 90° into a transport position in which said side pick-up and windrowing devices are situated either side of the central pick-up and windrowing device and that each side pick-up and windrowing device is articulated on its support arm by means of a substantially horizontal shaft directed substantially perpendicular to the direction of travel in the working position, about which shaft it can be folded upward at an angle of approximately 90° for transport.

This arrangement makes it possible to fold the side pick-up and windrowing devices into a position in which they are directed in the direction of travel and in which their width is reduced. In this position, the machine is compact. Its narrow width makes it possible to move it on roads and its center of gravity that remains relatively low gives it good stability.

According to another feature of the invention, the frame comprises mechanisms for immobilizing the side pick-up and windrowing devices in the transport position. Each of these immobilization mechanisms consists advantageously of an arm that is fixedly attached to the frame and on which is articulated a hook actuated by a system of levers. This system forms an articulation of the ball and socket type that is controlled by means of a hydraulic cylinder.

Other features and advantages of the invention will emerge from the following description that refers to the appended drawings which represent, as a nonlimiting example, an embodiment of the machine according to the invention.

In these drawings:

- figure 1 represents a top view, with partial sections, of a machine according to the invention in the working position,
 - 5 - figure 2 represents a side view, on a larger scale, of a side pick-up and windrowing device in the working position,
 - figure 3 represents a view similar to that of figure 10 2 with the side pick-up and windrowing device raised,
 - figure 4 represents a top view of the machine according to the invention in the transport position,
 - 15 - figure 5 represents a side view of the machine according to the invention in the transport or setting down position,
 - figure 6 represents a detail view of an 20 immobilization mechanism in the released position,
 - figure 7 represents a detail view of the immobilization mechanism in the locked position.
- 25 As represented in figure 1, the machine according to the invention comprises a main frame (1). The latter consists of a central beam (2) which has at its front end a coupling head (3) for coupling it to a tractor making it possible to drive and move the machine in the 30 direction of travel (A). The beam (2) has at its rear end a cross member (4) to which are connected two transport wheels (5 and 6) which rest on the ground. Said cross member (4) supports a central pick-up and windrowing device (7) and two side pick-up and 35 windrowing devices (8 and 9). The latter are substantially in line and extend substantially perpendicular to the direction of travel (A) during work.

In the example shown, the pick-up and windrowing devices (7, 8 and 9) comprise conveyor belts (10, 11 and 12) for windrowing. The latter are guided on rollers (13) that are supported by support frames (14) furnished with wheels (15 and 16). These rollers (13) may be rotated by means of hydraulic motors (17) in order to move the conveyor belts (10, 11 and 12) to the right or to the left.

10 The pick-up and windrowing devices (7, 8 and 9) also comprise pick-ups (18, 19 and 20) to pick up the products on the ground. The latter are situated in front of the conveyor belts (10, 11, 12) and are attached to the support frames (14). Each pick-up (18, 15 19, 20) has rake tines (21) that are rotated about a horizontal shaft (22) in order to pick up the forage on the ground and place it on the corresponding conveyor belt (10, 11 or 12). This drive may be provided by means of a hydraulic motor not shown.

20 Said drive of the conveyor belts (10, 11 and 12) and of the pick-ups (18, 19, 20) may also be provided by mechanical means connected to a power take-off shaft of the tractor.

25 The central pick-up and windrowing device (7) is connected to the main frame (1) by means of a lift mechanism (23). The latter consists of hydraulic cylinders (24) and levers (25). The latter are articulated on said device (7) and on the main frame (1) and are arranged in the shape of parallelograms. The hydraulic cylinders (24) are connected to the frame (1) and act on the levers (25) so as to use them to move the central pick-up and windrowing device (7) up and down. 35

Each side pick-up and windrowing device (8, 9) is connected to a support arm (26, 27) which extends laterally relative to the main frame (1). As emerges in

particular from figures 1 and 5, each side support arm (26, 27) is articulated relative to the frame (1) on a substantially vertical shaft (28, 29). It can be folded about this shaft (28, 29) at an angle of approximately 90° forward for transport, by means of a hydraulic cylinder (30, 31) that is situated between the frame (1) and the corresponding support arm (26, 27).

Each side pick-up and windrowing device (8, 9) is articulated on its support arm (26, 27) by means of a shaft (32, 33) that is substantially horizontal and substantially perpendicular to the direction of travel (A) in the working position. Each shaft (32, 33) is situated above the corresponding support arm (26, 27). Each one is guided into lugs (34) that are attached to the top face of said support arm (26, 27). Finally, each side pick-up and windrowing device (8, 9) comprises, on its rear side, bent lugs (35) that are articulated on these shafts (32 and 33).

Each side pick-up and windrowing device (8, 9) can be moved about its articulation shaft (32, 33) with the support arm (26, 27) by means of a hydraulic cylinder (36) that is situated beneath said device (8, 9). Said hydraulic cylinder (36) is connected to the frame (14) and to the corresponding support arm (26, 27) (see figures 2 and 3).

The substantially vertical articulation shaft (28, 29) of each support arm (26, 27) is situated behind the corresponding side pick-up and windrowing device (8, 9) and in the vicinity of its end closest to the central pick-up and windrowing device (7). Each of said articulation shafts (28, 29) is housed in the top and bottom walls of a side beam (37, 38) of the main frame (1) (see figures 1 and 5). The hydraulic cylinders (30, 31) provided to fold the support arms (26, 27) about the articulation shafts (28, 29) are advantageously housed in said side beams (37, 38). They are

articulated at one of their ends on one of the walls of this beam (37, 38) and at their other end on the corresponding support arm (26, 27). Each side beam (37, 38) comprises a pivot shaft (39, 40) that is
5 substantially horizontal and directed in the direction of travel (A). This shaft allows each side pick-up and windrowing device (39, 40) and the corresponding support arm (26, 27) to move up and down for example to follow the ground undulations. A hydraulic cylinder
10 (41, 42) may be associated with each side beam (37, 38) in order to be able to lift the corresponding pick-up and windrowing device (8, 9) if there is a larger obstacle to pass.

15 Behind the conveyor belts (10, 11 and 12) are disposed deflectors (43, 44 and 45) for the guidance of the products. These deflectors (43, 44 and 45) are articulated on the frames (14) and can be moved from a position substantially perpendicular to the conveyor
20 belts (10, 11 and 12) in work into a position substantially parallel to said conveyor belts in transport.

The main frame (1) comprises mechanisms (46 and 47) for
25 the immobilization of the side pick-up and windrowing devices (8 and 9) in the transport position. As is shown in figure 4, these mechanisms (46 and 47) extend either side of the central beam (2) and connect the side pick-up and windrowing devices (8 and 9) to this
30 central beam (2) in transport and for setting down. Each of these mechanisms (46 and 47) consists of an arm (48) that is fixedly attached to the central beam (2) of the frame (1) and on which a hook (49) is articulated by means of a shaft (50) (see figures 6 and
35 7). This hook (49) hooks onto a shackle (51) provided on the corresponding side pick-up and windrowing device (8, 9) in order to immobilize the latter. For this purpose, the hook (49) may be moved about the shaft (50) by a system of levers (52, 53) controlled by means

of a hydraulic cylinder (54). The system of levers (52, 53) forms an articulation of the self-locking ball and socket type in the position of immobilization of the side pick-up and windrowing devices (8 and 9). It comprises a first lever (52) that is bent and a second straight lever (53) that are articulated with one another by means of a shaft (55). Said straight lever (53) is also articulated on the hook (49) by means of a shaft (56). The bent lever (52) is articulated on the corresponding arm (48) by means of a shaft (57) and on the rod of the hydraulic cylinder (54) by means of a shaft (58). The body of said hydraulic cylinder (54) is, for its part, articulated on the corresponding arm (48) by means of a shaft (59).

Figure 7 shows that the disposition of the articulation shafts (55, 56 and 57) of the levers (52 and 53) is such that, when the immobilization device is in the locked position, the articulation shaft (55) between the two levers (52 and 53) is situated beneath a plane (P) passing through the other two articulation shafts (56 and 57) of said levers (52 and 53). In this position, the hook (49) is held in the locked position by the levers (52 and 53), independently of the action of the hydraulic cylinder (54). In the unlocked position (figure 6), the articulation shaft (55) between the two levers (52 and 53) is situated above the plane (P). This position is obtained by pulling on the bent lever (52) by means of the hydraulic cylinder (54) in order to make it pivot on its articulation shaft (57). The articulation shaft (55) and the second lever (53) then move upward and operate the hook (49) that they cause to rotate about its articulation shaft (50) so that its end disengages downward. The return to the locked position is achieved by exerting a pressure on the first lever (52) with the hydraulic cylinder (54) so that the levers (52 and 53) move in a manner converse to that described hereinabove.

The hydraulic cylinders (24, 30, 31, 36, 41, 42 and 54) of the machine are advantageously connected to the hydraulic system of the tractor by means of pipes and may be controlled from the latter.

5

During work, the machine is coupled to a tractor which operates it and moves it in the direction of travel (A). The central pick-up and windrowing device (7) is lowered by means of the lift mechanism (23) so that its wheels (15 and 16) move on the ground. The support arms (26 and 27) and the side pick-up and windrowing devices (8 and 9) extend either side of the central beam (2). The wheels (15 and 16) of said devices (8 and 9) also move on the ground. The three pick-up and windrowing devices (7, 8 and 9) are then substantially in line and extend substantially perpendicular to the direction of travel (A). Their pick-ups (18, 19 and 20) are driven so that the rake tines (21) pick up the forage on the ground and deposit it on the conveyor belts (10, 11 and 12). The latter are driven so that they move this forage laterally, transmitting it from one to the other without it returning to the ground and depositing it on one of the sides of the machine in the form of a large volume windrow. The direction of movement of the conveyor belts (10, 11 and 12) may be chosen according to the side on which the forage is to be deposited.

It is also possible to raise the central pick-up and windrowing device (7) by means of the lift mechanism (23) and to work only with the side devices (8 and 9). Their conveyor belts (11 and 12) may then be driven in the reverse direction so that they move the forage toward the middle of the machine to form a central windrow.

35

For transport, the central pick-up and windrowing device (7) is raised with the lift mechanism (23) in order to move it away from the ground. Then the side pick-up and windrowing devices (8 and 9) are pivoted by

means of hydraulic cylinders (36) about their articulation shafts (32 and 33) to a substantially vertical position. They are then situated substantially above the support arms (26 and 27). The latter are then
5 folded forward, by means of the hydraulic cylinders (30 and 31), to a position in which they are directed in the direction of travel (A). The side pick-up and windrowing devices (8 and 9) are then substantially parallel to the central beam (2) of the frame (1) and
10 are situated either side of the central pick-up and windrowing device (7). The width of the machine is thus considerably reduced and its ground clearance is sufficient for movements on tracks and roads (figures 4 and 5).

15 In this transport position, the side pick-up and windrowing devices (8 and 9) are locked relative to the frame (1) by means of the immobilization mechanisms (46 and 47). Before these side devices (8 and 9) reach the
20 transport position, the hooks (49) are held down in the unlocked position by the levers (52 and 53) and the hydraulic cylinders (54) that are in the closed position (see figure 6). When said side devices (8 and 9) reach the vicinity of the arms (48), the hydraulic
25 cylinders (54) are actuated so that they extend. As a result, they push the levers (52 and 53) downward so that the latter move the hooks (49) upward so that they hook onto the yokes (51) provided on the side devices (8 and 9) (see figure 7). Thanks to the disposition of
30 the levers (52 and 53) in this position, the latter hold the hooks (49) in the locked position even if the hydraulic pressure were to diminish in the cylinders (54) due to a leak for example.

35 For the return to the working position, the hydraulic cylinders (54) are operated so that they disengage the hooks (49) downward. Then, the support arms (26 and 27) may be pivoted outward and rearward by the hydraulic cylinders (30 and 31) and the pick-up and windrowing

27 Apr 2006

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- 10 -

5 devices (8 and 9) may be lowered to the ground by means of the hydraulic cylinders (36). The actions of these various hydraulic cylinders (24, 30, 31, 36 and 54) may be initiated automatically with the aid of directional flow valves controlled from detectors of the positions of the support arms (26 and 27) and pick-up and windrowing devices (7, 8 and 9).

10 It is evident that the invention is not limited to the embodiments described and shown in the appended drawings. Modifications are still possible, particularly as concerns the constitution of the various elements or by substitution of technical equivalents, without, for all that, departing from the
15 field of protection.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form or suggestion that the prior art forms part of the common general knowledge in Australia.

The claims defining the invention are as follows:

1. An agricultural machine for grouping windrows together or for windrowing products that are lying on the ground, said machine including a main frame supporting a central gathering and windrowing device that is connected to said main frame by means of a lifting device and two side gathering and windrowing devices that are connected to support arms that extend laterally relative to said frame, which side devices and central device are substantially in line and extend substantially perpendicular to the direction of travel of the machine during work, wherein each side support arm of a side gathering and windrowing device is articulated relative to said frame on a substantially vertical axis about which it is foldable at an angle of approximately 90° into a transport position in which said side gathering and windrowing devices are situated either side of said central gathering and windrowing device and wherein each said side gathering and windrowing device is articulated on its support arm by means of a substantially horizontal axis directed substantially perpendicular to the direction of travel in the working position, about which axis of articulation it is foldable upwards at an angle of approximately 90° for transport.
2. The machine as claimed in claim 1, wherein said substantially horizontal axis of articulation of each side gathering and windrowing device is situated above the corresponding support arm.
3. The machine as claimed in claim 1 or claim 2, wherein each side gathering and windrowing device is adapted to be moved about its substantially horizontal axis of articulation by means of a hydraulic cylinder arranged between said device and the corresponding support arm.
4. The machine as claimed in claim 3, wherein said hydraulic cylinder is situated beneath the corresponding side gathering and windrowing device.
5. The machine as claimed in any one of the preceding claims, wherein said substantially vertical axis of articulation of each side support arm is situated at the rear of the corresponding side gathering and windrowing device and in the vicinity of

its end closest to said central gathering and windrowing device.

- 5 6. The machine as claimed in claim 5, wherein said substantially vertical axis of articulation of each side support arm is situated on a side beam of said frame, which side beam is articulated on a substantially horizontal axis and directed in the direction of travel.
- 10 7. The machine as claimed in claim 5 or claim 6, wherein each side support arm is adapted to be moved about its substantially vertical axis of articulation by means of a hydraulic cylinder.
- 15 8. The machine as claimed in any one of the preceding claims, wherein said frame includes mechanisms for immobilizing said side gathering and windrowing devices in the transport position.
- 20 9. The machine as claimed in claim 8, wherein each immobilization mechanism consists of an arm that is rigidly fastened to said frame and on which is articulated a hook actuated by a system of levers controlled by means of a hydraulic cylinder.
- 25 10. The machine as claimed in claim 9, wherein said system of levers forms an articulation of the knuckle-joint type which is self-locked in the position of immobilization of the side gathering and windrowing devices.
11. The machine as claimed in any one of the preceding claims, wherein said products include grass, hay or straw.
12. An agricultural machine for grouping windrows together or for windrowing products, substantially as described herein with reference to the accompanying drawings.

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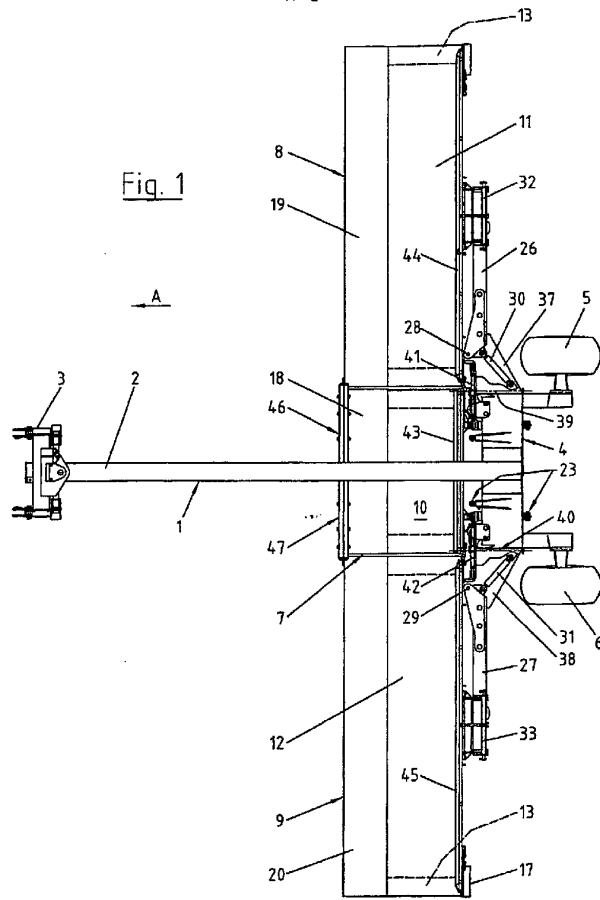


Fig. 2

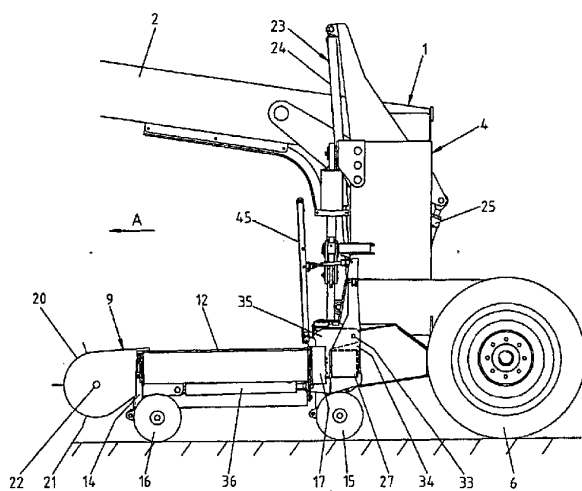


Fig. 3

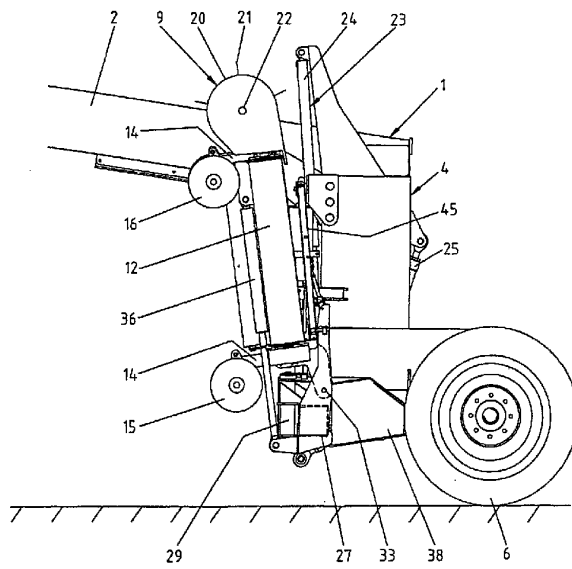


Fig. 4

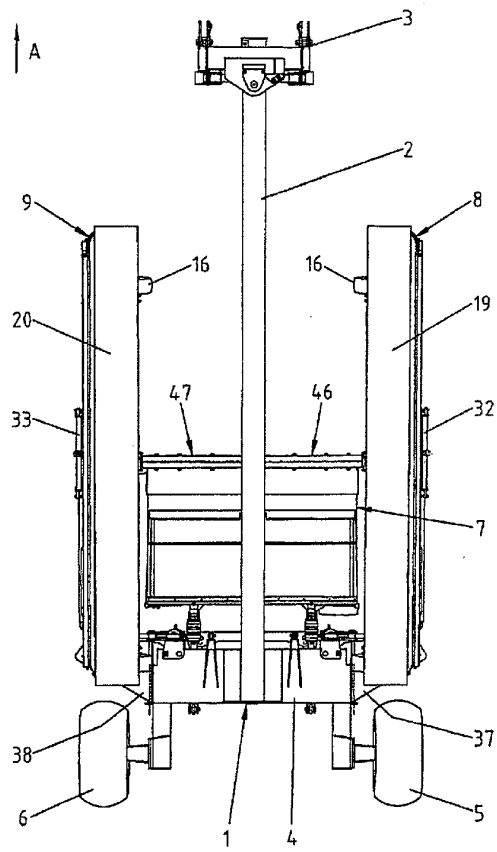


Fig. 5

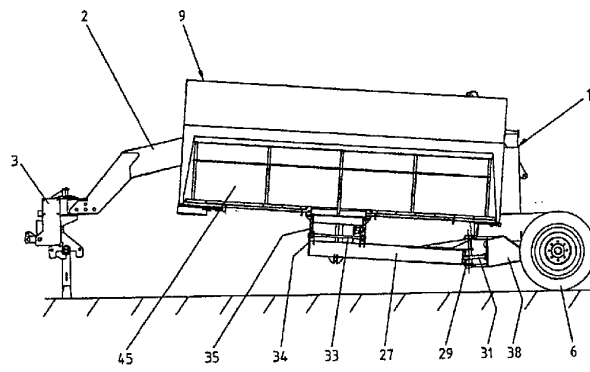


Fig. 6

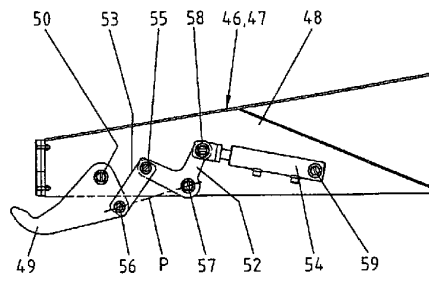


Fig. 7

