(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 May 2001 (25.05.2001)

PCT

(10) International Publication Number
WO 01/36312 A1

(51) International Patent Classification[7]: B66C 23/42, 23/70 // 23/16

(21) International Application Number: PCT/FI00/00908

(22) International Filing Date: 19 October 2000 (19.10.2000)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
19992467 17 November 1999 (17.11.1999) FI

(71) Applicant *(for all designated States except US)*: **TIMBERJACK OY** [FI/FI]; P.O. Box 474, FIN-33101 Tampere (FI).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **LEHTINEN, Riku** [FI/FI]; Järvikatu 8-10 J 78, FIN-33710 Tampere (FI).

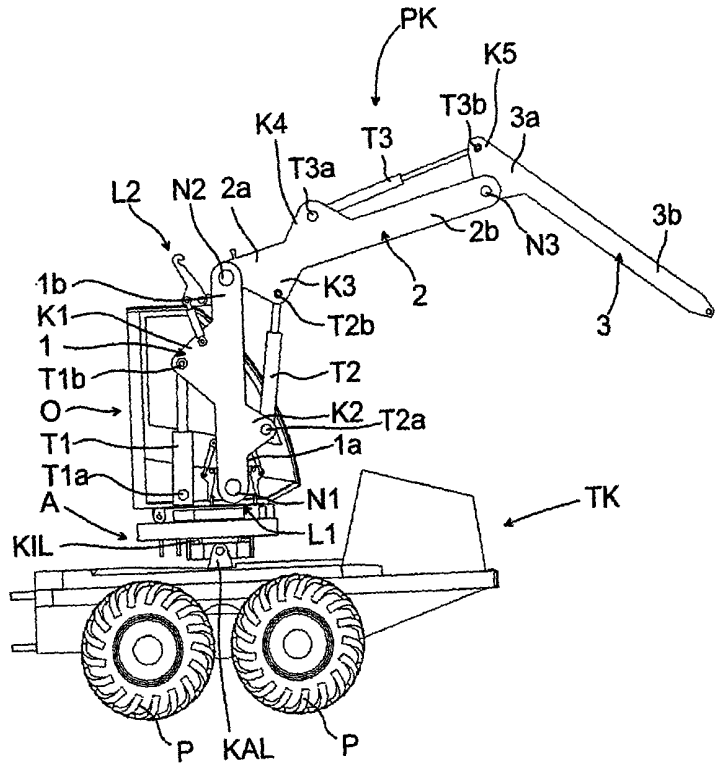
(74) Agent: **TAMPEREEN PATENTTITOIMISTO OY**; Hermiankatu 6, FIN-33720 Tampere (FI).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD IN A BOOM ASSEMBLY LOADER AND A BOOM ASSEMBLY LOADER



(57) Abstract: The invention relates to a method in a boom loader, and a boom loader in connection with a work machine (TK). A first boom part (1) in the boom assembly is articulated with a first joint (N1) to the frame of a work machine (TK) driving the boom loader (PK), to be rotatable with respect to the frame by a first actuator (T1). A second boom part (2) in the boom assembly is articulated to the second end (1b) of the first boom part (1) by means of a second joint (N2), to be rotatable in relation to the first boom part (1) by means of a second actuator (T2). When applying the method, the boom loader is used optionally in at least two modes (A, B), wherein when operating in mode (A), the first joint (N1) is locked, and loading is performed with the second boom part (2) and with means for carrying the load (3...) by using the second actuator (T2) at least partly, the second joint (N2) being active; and wherein when operating in mode (B), the second joint (N2) is locked, and loading is performed with a combination of the first (1) and the second (2) boom parts as well as with the means for carrying the load (3...) by using the first actuator (T1) at least partly, the first joint (N1) being active.

WO 01/36312 A1

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD IN A BOOM ASSEMBLY LOADER AND A BOOM ASSEMBLY LOADER

The invention relates to a method in a boom loader in which articulated parts forming a boom assembly are moved in relation to each other to implement loading operations.

The boom loader according to the invention is intended to be used particularly, but not solely, in connection with a forest work machine.

In modern harvesting, usually two work machines are used, namely a harvester and a forwarder. The harvester is used for felling, delimbing and cutting of a tree. The cut logs are placed preferably next to each other on the ground, in the same line from which the forwarder lifts up the logs by means of a grapple at the end of the boom assembly of the forwarder to a transportation space in the forwarder. The harvester is equipped with a boom assembly which is provided with a harvesting head to perform the above-mentioned harvesting operations. Consequently, in the harvesting method presently in use, based on two work machines, two different boom constructions must be used, because the work operations to be performed by the harvester on one hand and by the forwarder on the other hand differ from each other.

On the other hand, also so-called combined machines are presently under intensive development. The combined machines are equipped with a harvesting head which is constructed in such a way that the harvesting head can be used for optionally performing either the above-mentioned operations related to the harvesting stage, or loading operations. A basic starting point for this combined machine solution is, for example, the construction presented in the publication SE-507930, in which the transfer rolls required for the harvester functions are arranged to have positions adjustable in relation to the grapple jaws movable in relation to the harvester frame. Thus, in their first position, said transfer rolls are in contact with the tree trunk during the harvesting functions, and in their second position, they are placed inside the contact surface of the grapple jaws, thereby making it possible to use the grapple jaws to grip the tree trunk. However, the boom structures

presently in use are not satisfactory in view of the use of the so-called combined machine.

Thus, problems of prior art presently include, on one hand, the fact that two different boom assemblies must be used in harvesting with two work machines, and, on the other hand, in so-called combined machines the problem is that boom assemblies have not been developed to be suitable for the full utilization of the combined machines.

The purpose of the present invention is to present such a method in a boom loader that the problems of prior art can be eliminated to a major extent and thereby to improve the state of art in the field. To attain these purposes, the method according to the invention is primarily characterized in what will be presented in the characterizing part of claim 1 related to the method.

Consequently, with the solution complying with the characteristic part of claim 1, the same boom assembly can be used optionally either as a loader for a forwarder or as a loader for a harvester. This is achieved with very simple operations; by locking one joint of the boom assembly either by locking the joint and/or by locking an actuator crossing the joint. In this way, the other joints and actuators of the boom assembly can be used to carry out loading according to the use in question.

The enclosed dependent claims related to the method present some advantageous embodiments of the method.

The invention also relates to a boom loader whose primary characteristics are disclosed in the independent claim related to the boom loader.

The appended dependent claims related to the boom loader present some advantageous embodiments of the boom loader according to the invention.

In the following specification, the method and boom loader according to the invention will be described in more detail with reference to the

appended drawings showing an application of the boom loader. In the drawings,

Fig. 1 shows a side view of a boom loader mounted on the frame of a work machine, in an application complying with a first mode,

Fig. 2 shows the boom loader of Fig. 1 mounted on the frame of a work machine, in an application complying with a second mode,

Fig. 3 shows an application of a locking means for a first joint in a boom structure in a schematic perspective view,

Fig. 4 shows, in a schematic side view, an application of a means intended for locking of a second joint according to Figs. 1 and 2, with the second joint locked, and

Fig. 5 shows, in a schematic side view, the boom loader according to the invention, and a hydraulic circuit intended for its control.

With reference to the drawings, a boom loader PK, in which the articulated boom parts 1, 2 and 3 forming the boom assembly are coupled to the frame TK of a work machine equipped with wheels P. The first boom part 1 is articulated at its first end 1a with a first joint N1 to the frame of a work machine driving the boom loader PK, in this case a platform A that can be slewed and tilted in relation to the frame of the work machine together with a cabin O. The first boom part 1 is arranged to be rotatable in a vertical plane in relation to the frame of the work machine by a first actuator T1 which is placed to be effective between the platform A (more widely, the frame of the work machine) and the first boom part 1 in such a way that the first end T1a of the first actuator is articulated with the frame A and its second end T1b is articulated with a lug K1 in connection with the first boom part 1.

Further, the boom assembly comprises a second boom part 2 which is articulated at its first end 2a to the second end 1b of the first boom part 1 by means of a second joint N2, to be rotatable in a vertical plane in relation to the first boom part 1 by means of a second actuator T2. The second actuator T2 is arranged to be effective between the first and the second boom parts 1, 2. The ends T2a, T2b of the second actuator T2 are articulated, on one hand, to a lug K2 in the first boom part 1 (first end T2a) and, on the other hand, to a lug K3 in the second boom part 2 (second end T2b).

The above-mentioned parts form the basic equipment required for applying the method of the invention, but in most applications, the actual work machine, *e.g.* a combined harvester (not shown in the drawings), is placed at the second end 3b of a third, preferably telescopic boom part 3, wherein the third boom part 3 is articulated at its first end 3a to the second end 2b of the second boom part 2 by means of a joint N3, to be rotatable in the vertical plane in relation to the second boom part 2. The ends T3a, T3b of a third actuator T3 are thus articulated, on one hand, to act, between a lug K4 in connection with the second boom part 2 (first end T3a), and a lug K5 in connection with the first end 3a of the third boom part 3 (second end T3b).

The actual tool, which is used to operate the boom loader shown in the drawings, is not illustrated in the drawings, because *e.g.* a person skilled in the art has access to numerous references *e.g.* in prior art patent publications describing how said tool can be placed at the end of the third boom part in both harvester and forwarder operations.

Applying the method in a situation of Fig. 1, when the boom loader is used in mode A, the first joint N1 is first locked and, on the other hand, loading is performed with the second boom part 2 and with means for bearing the load at least partly by using the second actuator T2, the second joint N2 being active. On the other hand, when the boom loader is used in mode B according to Fig. 2, the second joint N2 is first locked and loading is performed with a combination of the first and second

boom parts 1 and 2 as well as with means for bearing the load at least partly by using the first actuator T1, the first joint N1 being active.

Consequently, the method is based on the fact that in mode A, the first boom part 1 is arranged to be substantially vertical, wherein the boom loader is used as a loader in a forwarder. In a corresponding manner, when the position between the first and second boom parts 1 and 2 is kept constant in mode B, the boom loader PK is used as a harvester loader. Particularly in mode B, the first and second boom parts 1 and 2 form, in a combination, a "first boom unit" which is rotated around the first joint N1, driven by the first actuator T1.

Naturally, it is obvious that in the above-mentioned modes A or B, the first joint N1 and the second joint N2 can be locked optionally in such a way that said joint N1 or N2 is locked with a separate locking means L1 or L2 (Figs. 3 and 4) or by using an actuator T1 or T2 placed across the respective joint (Fig. 5) to achieve the locking, by preventing the circulation of hydraulic fluid in said actuator or, further, by using both of the above-mentioned operations in a combination.

The platform A can be advantageously provided with a slewing device KIL and a tilting device KAL between the frame and the platform A of the work machine TK. A cabin O is preferably placed in connection with the platform A. The slewing device KIL can be used to slew the boom loader together with the cabin around a vertical axis placed centrally in relation to the platform. With the tilting device KAL, the platform A can be levelled to be horizontal even if the work machine TK were placed on an inclined ground according to the demands of the work task in question. The tilting device KAL couples the platform A to the frame of the work machine TK, and the slewing device KIL is placed between the tilting device and the platform A. For a man skilled in the art, the tilting and slewing devices are known from prior art to such an extent that they will not be described in more detail in this context, except for the general description of Figs. 1 and 2.

The locking means L1 of Fig. 3 is used to lock the first joint N1 in the following way. To the first end 1a of the first boom part 1, on both sides of the same, hook-like plunger means 4' are articulated by means of a joint 5' to swivel in the vertical plane by lugs K6. In a corresponding manner, lugs 6' are fixed to the platform A on both sides of the first joint N1. The locking means 4a' of said plunger means 4' grips the lugs 6' in the locking position which is shown in Figs. 1 and 3. Both of the plunger means 4' are provided with a lug 4b', and the first end 1a of the first boom part 1 is provided with lugs K7. A hydraulic actuator T4 is placed in connection with the plunger means 4', between the lugs 4b' and K6.

The locking means L2 of Fig. 4 is used to lock the second joint N2 in the following way. At the second end 1b of the second boom part 1, above the lug K1, a hook-like plunger means 4" is articulated with a joint 5" to swivel in the vertical plane. In a corresponding manner, a lug 6" is fixed to the first end 2a of the second boom part 2. The locking means 4a" of said plunger means 4" grips the lug 6" in the locking position which is shown in Figs. 2 and 4. A hydraulic actuator T5 is placed between the first lug K1 and the lug 4b" of the plunger means 4", to drive the locking means L2. The locking means L2 for locking the second joint N2 is shown in the opened position in Fig. 1.

Figure 5 shows an application of a hydraulic control circuit for the boom loader, with the parts that are essential for applying the invention. The boom assembly and the actuators are shown in a line drawing with the previous reference numerals. The hydraulic circuit comprises two proportional 4/3 control valves 7 and 8, of which the first valve 7 controls the second actuator T2 and the second valve 8 controls the third actuator T3, when the method is applied in mode A. When the method is applied in mode B, the first actuator T1 is controlled with both the control valves 7 and 8, and the third actuator T3 is controlled with the second control valve 8.

To the working connections 7A and 7B of the first control valve 7 are connected 3/2 distribution valves 9 and 10 (first valve 9 and second valve 10), whose first working connections 9A and 9B are connected to pressure spaces on opposite sides of a piston in a hydraulic cylinder-piston combination used as the second actuator T2. Correspondingly, the second working connections 9B and 10B of the distribution valves 9 and 10 are connected to pressure spaces on opposite sides of a piston in a hydraulic cylinder-piston combination used as the first actuator T1 (later positive side and negative side, *i.e.* the sides of expansion and contraction of the actuator; also indicated with the signs "+" and "-" in Fig. 5). Consequently, in the situation of Fig. 5, the first actuator T1 is locked, wherein the boom loader is thus used in mode A. By connecting the second working connections 9B and 10B of the distribution valves 9 and 10 with the working connections 7A and 7B of the control valve 7 (the first working connections 9A and 10A are thus closed simultaneously), the operation shifts to mode B, with regard to the first control valve 7.

The second control valve 8 is, with regard to the first working connection 8A, directly coupled to the positive side of the piston in the hydraulic cylinder-piston combination used as the third actuator T3, and the second working connection 8B is coupled, via a 2/2 distribution valve 11 (fifth distribution valve 11), on one hand via the first working connection 11A of the distribution valve to the negative side of the piston of the hydraulic cylinder-piston combination used as the actuator T3, and on the other hand to a 2/2 distribution valve 11 (third distribution valve 12) coupled to the negative side of the piston of the first actuator T1. The second working connection 8B of the second control valve 8 is also coupled via a 2/2 distribution valve 13 (fourth distribution valve 13) to the positive side of the piston of the first actuator T1. The first working connections 12A and 13A of the distribution valves 12 and 13 are closed, when operating in mode A.

In the situation of Fig. 5 (mode A), the proportional control valves 7 and 8 can be used in a way required by the work situation, wherein the control valve 7 is used to control the second actuator T2, and the sec-

ond actuator 8 is used to control the third actuator T3. The second working connections 9B and 10B of the distribution valves 9 and 10, as well as the first working connections 12A and 13A of the distribution valves 12 and 13, are closed, preventing the passage of hydraulic fluid to the pressure spaces in the first actuator T1.

When the functional positions of the distribution valves 9–13 are simultaneously changed (*e.g.* by an electric control, not shown; mode B), the first control valve 7 is shifted to control, via the working connections 9B and 10B of the distribution valves 9 and 10, the first actuator T1, as the first working connections 9A and 10A coupled to the second actuator T2 are closed, wherein the second actuator T2 is thus locked in the position it had at the moment of closing of the working connections 9A and 10A, thereby determining the relative placement of the first and second boom parts 1 and 2 in a situation of applying the method accoding to said mode B. The distribution valves 12 and 13 are opened, *i.e.* the working connections 12B and 13B come into use and the distribution valve 11 is closed (the working connection 11B comes into use), wherein the first and third actuators T1 and T3 are coupled in a serial coupling in such a way that the second control valve 8 can be used in the control of horizontal movements of the boom loader and the first control valve 7 can be used in the control of vertical movements of the boom loader. By using both control valves 7 and 8 simultaneously, it is possible to implement combined movements of said vertical and horizontal movements, *i.e.* series of slanted movements.

When the second control valve 8 is driven by the right block, the hydraulic fluid is led under pressure to the positive side of the third actuator T3 (the actuator is expanded), wherein hydraulic fluid is led from the negative side of the third actuator T3 to the negative side of the first actuator T1 via the distribution valve 12, and it exits via the distribution valve 13 from the positive side of the first actuator T1 to the return port of the second control valve 8. Thus, the boom loader moves the second end 3b of the third boom part 3 in the horizontal direction (the joint N3 is turned clockwise and the joint N1 is turned counter-

clockwise in the situation of Fig. 5) towards the working machine, *i.e.* the extension of the boom assembly is reduced.

In a corresponding manner, by driving the left block of the control valve 8, the hydraulic fluid is led under pressure to the positive side of the first actuator T1 via the distribution valve 13, wherein hydraulic fluid is led from the negative side of the first actuator T1 via the distribution valve 12 to the negative side of the third actuator T3, and correspondingly from the positive side of the third actuator T3 to the return port of the control valve 8. Thus, the boom loader moves the second end 3b of the third boom part 3 in the horizontal direction (the joint N3 is turned counter-clockwise and the joint N1 is turned clockwise in the situation of Fig. 5) away from the work machine, *i.e.* the extension of the boom assembly is increased.

As solely the right block of the first control valve 7 is driven in mode B, the hydraulic fluid is led to the positive side of the first actuator T1 via the distribution valve 9, and the return flow to the return duct of the control valve 7 is led via the distribution valve 10 from the negative side of the first actuator T1. In this way, it is possible to descend the second end 3b of the third boom part 3 of the boom loader downwards (the joint N1 is turned clockwise).

In a corresponding manner, by driving the left block of the control valve 7, the hydraulic fluid is led under pressure via the distribution valve 10 to the negative side of the first actuator T1, and the return flow to the return duct of the control valve 7 is led via the distribution valve 9 from the positive side of the first actuator T1. In this way, it is possible to lift the second end 3b of the third boom part 3 of the boom loader upwards (the joint N1 is turned counter-clockwise).

The proportional control valves 7 and 8, as well as the distribution valves 9–13 operating by the on-off principle, can be electrically controlled.

The hydraulic circuit of Fig. 5 can also be used in other ways, for example temporarily so that the distribution valves 11, 12 and 13 are held in the position of Fig. 5 and the distribution valves 9 and 10 are coupled to the working connections 9B and 10B, wherein the actuator T1 can be used in a reaching movement. The above-mentioned situation occurs in practice when the operation is normally performed in mode A but there is a momentary need for an additional extension.

The actuators T4 and T5 can be coupled to the hydraulic circuit of Fig. 5 (coupling not shown), or they may have a drive that is separate from the circuit of Fig. 5.

Claims:

1. A method in a boom loader, in which articulated boom parts (1, 2, 3...) forming a boom assembly are moved in relation to each other to implement loading operations, **characterized** in that the boom assembly applying the method comprises:

- a first boom part (1) which is articulated at its first end (1a) by a first joint (N1) to the frame of a working machine (TK) driving the boom loader (PK) to be rotatable with respect to the frame by means of a first actuator (T1) which is arranged to be effective between the frame of the working machine (TK) and the first boom part (1),
- a second boom part (2) which is articulated at its first end (2a) by a second joint (N2) to the second end (1b) of the first boom part (1), to be rotatable in relation to the first boom part (1) by means of a second actuator (T2) which is placed to be effective between the first (1) and second (2) boom parts, and
- means (3...) for carrying a load, connected to the second end (2b) of the second boom part (2), wherein
- upon applying the method, the boom loader is optionally used in at least the following modes (A, B):

A)
- by locking the first joint (N1), and
- by performing loading with the second boom part (2) and with the means (3...) for carrying a load by using at least partly the second actuator (T2), the second joint (N2) being active; and

B)
- by locking the second joint (N2), and
- by performing loading with a combination of the first (1) and second (2) boom parts and with the means (3...) for carrying a load by using at least partly the first actuator (T1), the first joint (N1) being active.

2. The method according to claim 1, **characterized** in that in mode A), the first boom part (1) is arranged to be substantially vertical, wherein the boom loader is used as a loader of a forwarder.

3. The method according to claim 1, **characterized** in that in mode B), the position between the first (1) and second (2) boom parts is kept constant, wherein the boom loader is used as a loader of a harvester.

4. The method according to claim 1, **characterized** in that in mode A), the first joint (N1) is locked by means of a locking means (L1) in connection therewith, and/or by locking the first actuator (T1).

5. The method according to claim 1, **characterized** in that in mode B), the second joint (N2) is locked by means of a locking means (L2) in connection therewith, and/or by locking the second actuator (T2).

6. The method according to claim 1, **characterized** in that the boom assembly is placed in connection with the boom loader (PK) in such a way that the first joint (N1) and the first actuator (T1) are mounted to a platform (A) in connection with the frame of the work machine (TK), the platform (A) being moved in relation to the frame of the work machine (TK) in connection with the use of the boom loader.

7. The method according to claim 1 or 6, **characterized** in that a slewing device (KIL) is placed between the frame and the platform (A) of the work machine (TK).

8. The method according to claim 1 or 6, **characterized** in that a device (KAL) for tilting the platform (A) is placed between the frame and the platform (A) of the work machine (TK).

9. The method according to claim 1 or 6, **characterized** in that a cabin (O) is placed in connection with the platform (A).

10. The method according to claim 1, **characterized** in that means for carrying a load are substantially formed of the third boom part (3) which is articulated at its first end (3a) to the second end (2b) of the second boom part (2) by a third joint (N3), wherein a third actuator (T3) is placed between the second (2) and the third (3) boom parts, wherein a tool for carrying a load and/or working is placed at the second end (3b) of the third boom part (3), and wherein the third actuator (T3) is used both in mode A) and in mode B).

11. The method according to claim 1, **characterized** in that the boom loader (PK) is provided with a hydraulic circuit, distribution valves (9–13) being placed between the control valves (7, 8) and the actuators (T1–T3) of the hydraulic circuit, wherein in the first position of the distribution valves (9–13), the control valves (7, 8) are used to control the actuators (T1–T3) to operate in mode A) and in the second position of the distribution valves (9–13), the control valves (7, 8) are used to control the actuators (T1–T3) to operate in mode B).

12. The method according to claim 1 or 11, **characterized** in that first and second distribution valves (9, 10) are placed between the first control valve (7) as well as the first and second actuators (T1, T2), respectively, in such a way that in their first position, the circulation of the hydraulic fluid to the first actuator (T1) is prevented, and the circulation of the hydraulic fluid to the second actuator (T2) is simultaneously connected, when operating in mode A), and *vice versa* when operating in mode B).

13. The method according to claim 1 or 11, **characterized** in that third and fourth distribution valves (12, 13) are placed between the second control valve (8) and the first actuator (T1) in such a way that in their first position, the circulation of the hydraulic fluid to the first actuator (T1) is prevented, and the circulation of the hydraulic fluid directly from the second control valve (8) to the third actuator (T3) is simultaneously connected via a fifth distribution valve (11) coupled to the negative side of the open third actuator (T3) when operating in mode A), and

that when shifting to operate in mode B), the circulation of the hydraulic fluid between the second control valve (8) and the first actuator (T1) is opened by the second position of the third and fourth distribution valves (12, 13), and the fifth distribution valve (11) is closed, wherein the first and third actuators (T1, T3), coupled in series, are operated by the second control valve (8).

14. A boom loader, in which articulated boom parts (1, 2, 3...) forming a boom assembly are arranged to be movable in relation to each other to implement loading operations, **characterized** in that the boom assembly applying the method comprises:

- a first boom part (1) which is articulated at its first end (1a) by a first joint (N1) to the frame of a work machine driving the boom loader to be rotatable with respect to the frame by a first actuator (T1) which is placed to be effective between the frame of the work machine and the first boom part (1),
- a second boom part (2) which is articulated at its first end (2a) by a second joint (N2) to the second end (1b) of the first boom part (1), to be rotatable in relation to the first boom part (1) by means of a second actuator (T2) which is placed to be effective between the first (1) and second (2) boom parts, and
- means (3...) for carrying a load, connected to the second end (2b) of the second boom part (2), wherein
- the boom loader comprises means (L1, L2, 9–13) for optionally locking the first joint (N1) or the second joint (N2).

15. The assembly loader according to claim 14, **characterized** in that the first means for locking the first joint (N1) comprise a locking device (L1) in connection with the first joint (N1) and/or means (9–13) for preventing the flow of the pressurized medium in the first actuator (T1).

16. The assembly loader according to claim 14, **characterized** in that the second means for locking the second joint (N2) comprise a

locking device (L2) in connection with the second joint (N2) and/or means (9–13) for preventing the flow of the pressurized medium in the second actuator (T2).

17. The boom loader according to claim 14, **characterized** in that the hydraulic circuit of the boom loader (PK) comprises distribution valves (9–13) which are arranged to couple the circulation of the hydraulic circuit optionally to the first or second actuator (T1, T2) and simultaneously to prevent the circulation of the hydraulic fluid to the second or first actuator (T2, T1).

18. The boom loader according to any of the claims 14 to 17, **characterized** in that first and second distribution valves (9, 10) are placed between the first control valve (7) as well as the first and second actuators (T1, T2) in such a way that in their first position, the circulation of the hydraulic fluid to the first actuator (T1) is prevented, and the circulation of the hydraulic fluid to the second actuator (T2) is simultaneously connected, when operating in mode A), and *vice versa* when operating in mode B).

19. The boom loader according to any of the claims 14 to 18, **characterized** in that third and fourth distribution valves (12, 13) are placed between the second control valve (8) and the first actuator (T1) in such a way that in their first position, the circulation of the hydraulic fluid to the first actuator (T1) is prevented, and the circulation of the hydraulic fluid directly from the second control valve (8) to the third actuator (T3) is simultaneously connected via a fifth distribution valve (11) coupled to the negative side of the open third actuator (T3) when operating in mode A), and that operating in mode B), the circulation of the hydraulic fluid between the second control valve (8) and the first actuator (T1) is opened by the second position of the third and fourth distribution valves (12, 13), and the fifth distribution valve (11) is closed, wherein the first and third actuators (T1, T3), coupled in series, are operated by the second control valve (8).

20. The boom loader according to claim 14, **characterized** in that the boom assembly is placed in connection with the boom loader (PK) in such a way that the first joint (N1) and the first end (T1a) of the first actuator (T1) are mounted to a platform (A) in connection with the frame of the work machine (TK), the platform (A) being moved in relation to the frame of the work machine (TK) in connection with the use of the boom loader (PK).

21. The boom loader according to claim 14 or 20, **characterized** in that a device (KIL) for slewing the platform (A) around a vertical axis is placed between the frame and the platform (A) of the work machine (TK).

22. The boom loader according to claim 14 or 20, **characterized** in that a device (KAL) for tilting the platform (A) is placed between the frame and the platform (A) of the work machine (TK), particularly to maintain the horizontal position of the platform.

23. The method according to claim 14 or 20, **characterized** in that a cabin (O) is placed in connection with the platform (A).

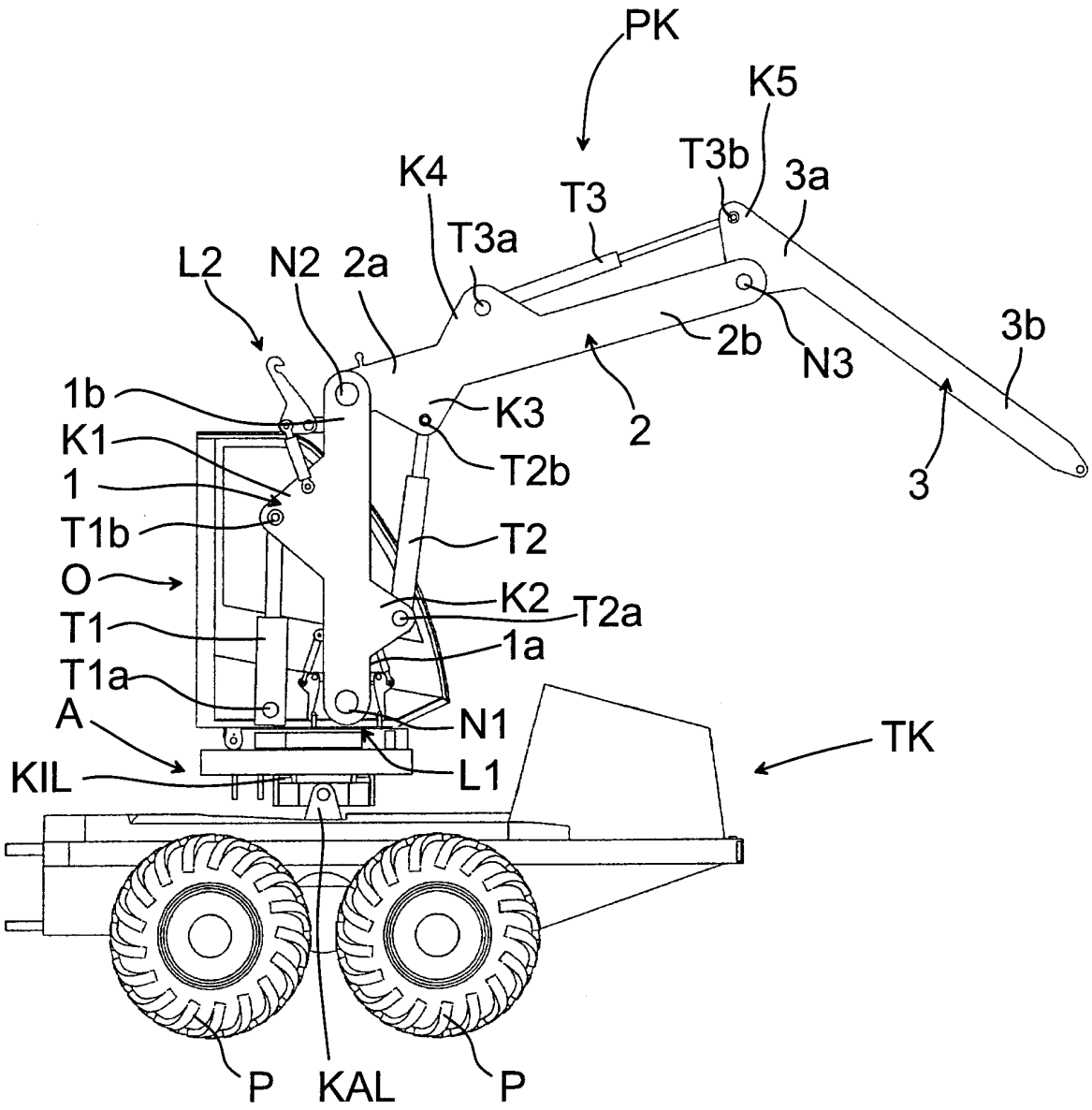

PK
K5
T3b
3a
K4
T3
T3a
L2
N2
2a
2b
N3
3b
1b
K1
1
T1b
O
T1
T1a
A
KIL
K3
T2b
2
T2
K2
T2a
1a
N1
L1
TK
3
P
KAL
P

Fig. 1

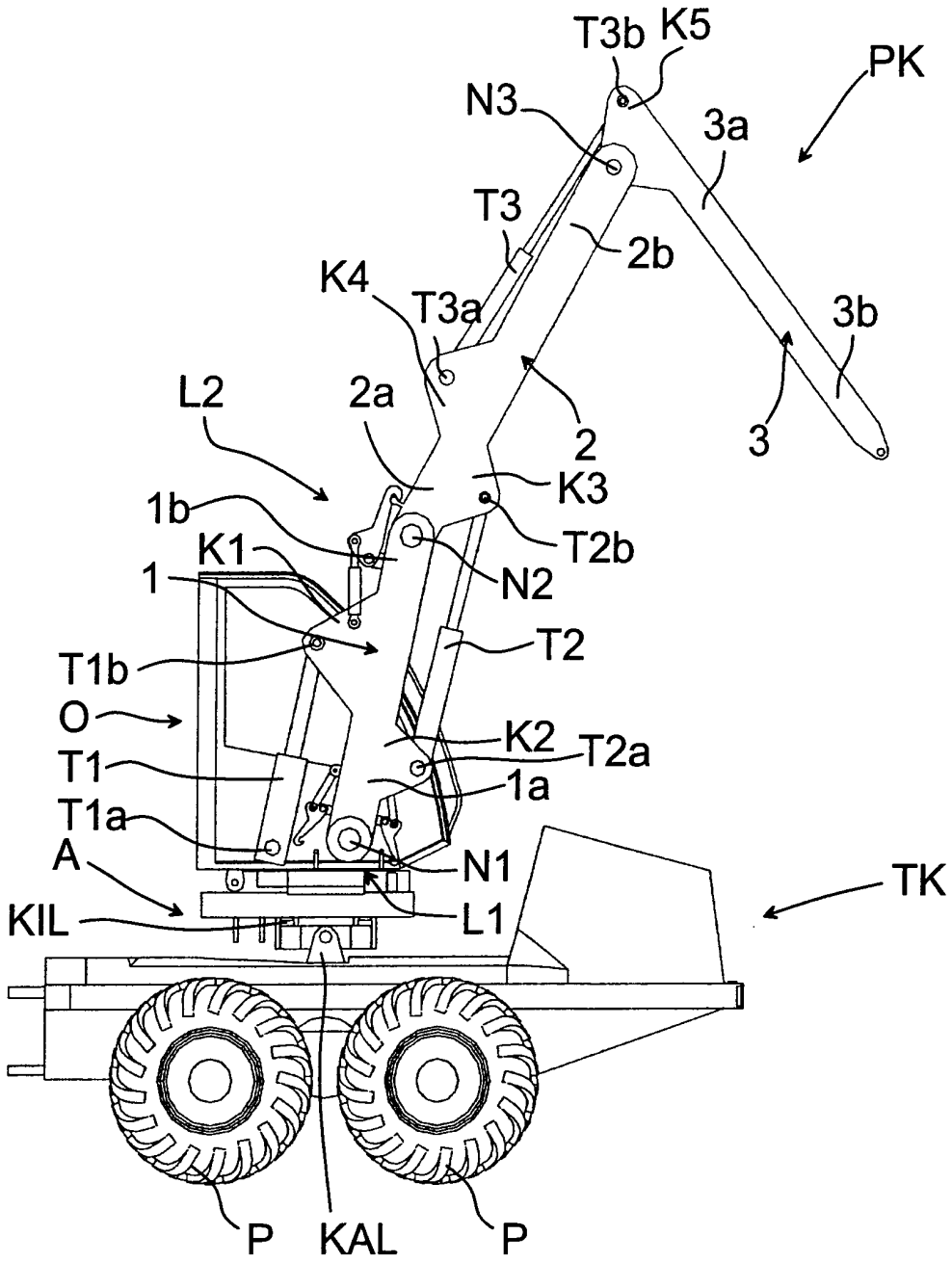

T3b
K5
PK
N3
3a
T3
2b
K4
T3a
3b
L2
2a
2
3
K3
1b
K1
T2b
1
N2
T2
T1b
O
K2
T2a
T1
1a
T1a
A
N1
TK
KIL
L1
P
KAL
P

Fig. 2

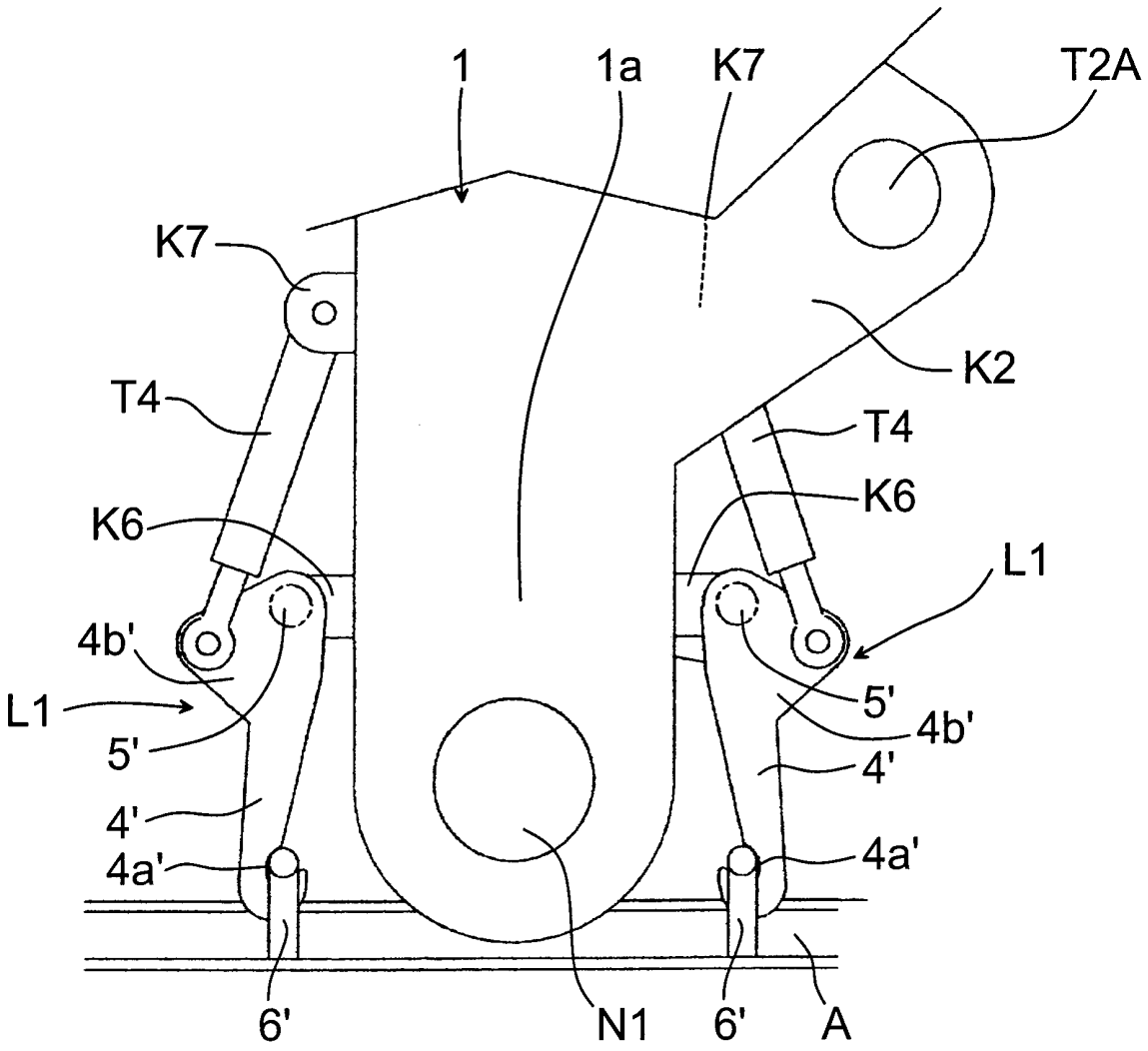


Fig. 3

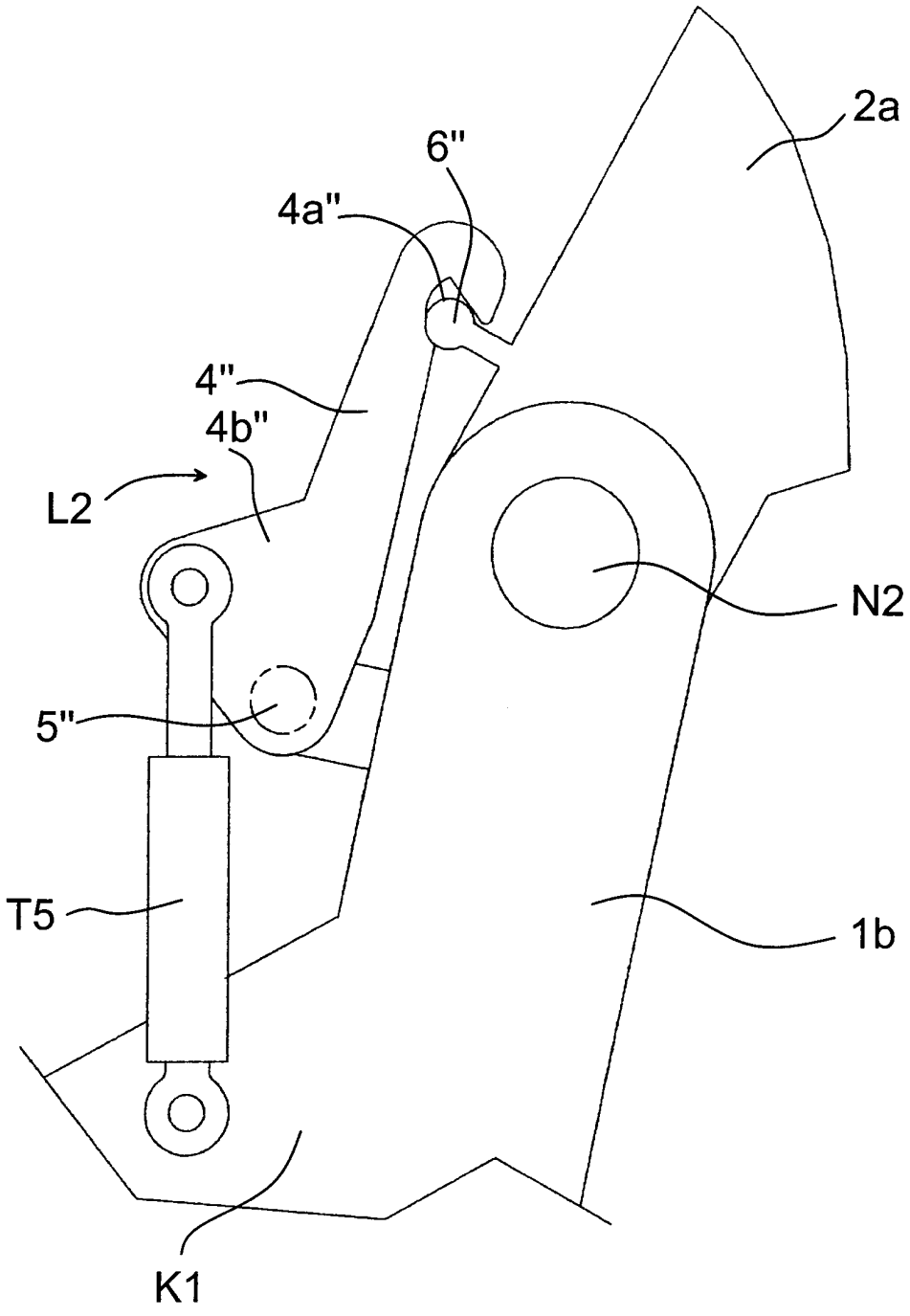


Fig. 4

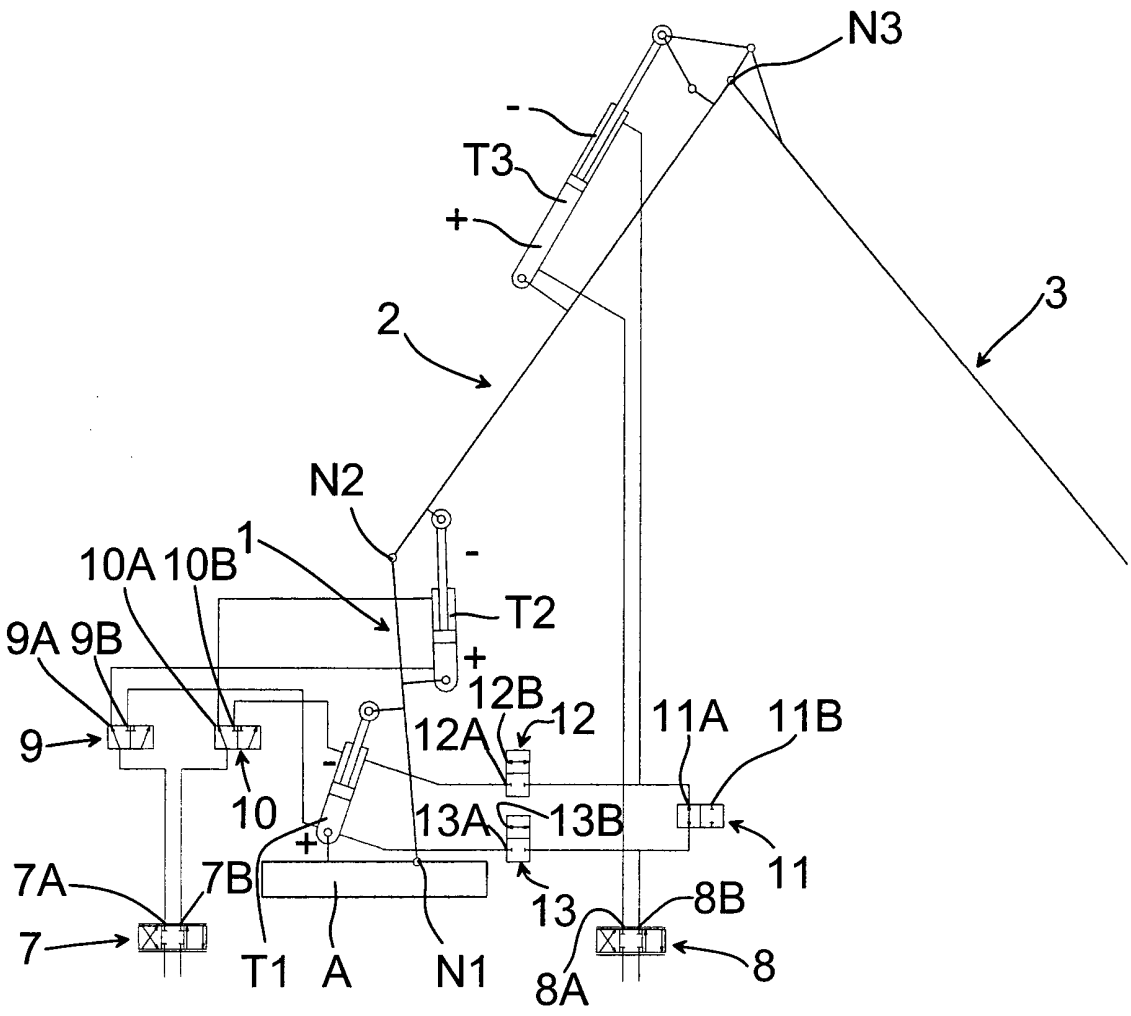

N3
-
T3
+
2
3
N2
1
10A
10B
-
T2
9A
9B
+
12B
12
12A
11A
11B
9
10
-
13A
13B
11
+
7A
7B
13
8B
7
T1
A
N1
8A
8

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00908

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B66C 23/42, B66C 23/70 // B66C 23/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B66C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0731054 A1 (KOMATSU LTD ET AL), 11 Sept 1996 (11.09.96), the whole document	1-7,9-10, 14-16,20-23
Y		8,11-13, 17-19
	--	
X	SE 336206 B (HIAB-FOCO AB), 28 June 1971 (28.06.71), page 7, line 12 - line 14, figure 1	1,4-5,10, 14-16
	--	
Y	US 4365927 A (SCHENCK), 28 December 1982 (28.12.82), figure 1	8
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 February 2001	01 -03- 2001
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Mariana Eddin/LS Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00908

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4828125 A (SVEDAKER), 9 May 1989 (09.05.89), column 2, line 58 - column 3, line 6, figure 2	11-13,17-19
	--	
A	US 5704498 A (SMITH ET AL.), 6 January 1998 (06.01.98), column 7, line 14 - line 59, figures 10-12	1
	--	
A	US 4505397 A (ISOGAI ET AL.), 19 March 1985 (19.03.85), figures 1,3,8, abstract	1
	--	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/FI 00/00908

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0731054 A1	11/09/96	CN 1037425 B	18/02/98
		CN 1136304 A	20/11/96
		JP 7144884 A	06/06/95
		WO 9514632 A	01/06/95
SE 336206 B	28/06/71	DE 2049853 A,B	29/04/71
		FR 2064367 A,B	23/07/71
		GB 1327402 A	22/08/73
		SU 440816 A	25/08/74
US 4365927 A	28/12/82	NONE	
US 4828125 A	09/05/89	AU 7879787 A	24/03/88
		FI 881946 A	26/04/88
		NO 881809 A	29/04/88
		SE 454351 B,C	25/04/88
		SE 8603660 A	02/03/88
		WO 8801600 A	10/03/88
US 5704498 A	06/01/98	AU 714344 B	23/12/99
		AU 3919697 A	02/04/98
		BR 9704876 A	01/08/00
		CA 2216081 A	25/03/98
		CN 1185413 A	24/06/98
		EP 0832841 A	01/04/98
		JP 10203783 A	04/08/98
		KR 254362 B	01/05/00
US 4505397 A	19/03/85	NONE	