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(54) **OUTRIGGER ASSEMBLY AND VEHICLE, SUCH AS A MOBILE CRANE, COMPRISING THE OUTRIGGER ASSEMBLY**

AUSLEGERVORRICHTUNG UND FAHRZEUG, WIE EIN MOBILER KRAN, MIT DER AUSLEGERVORRICHTUNG

ENSEMBLE STABILISATEUR ET VÉHICULE, TEL QU'UNE GRUE MOBILE, COMPRENANT L'ENSEMBLE STABILISATEUR

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Description

This document discloses the preamble of claim 1.

FIELD OF THE INVENTION

[0001] The invention relates to an outrigger assembly comprising an outrigger frame and an outrigger beam movable in a horizontal extension direction with respect to the outrigger frame in between a retracted position and an extended position. The outrigger beam is located inside the outrigger frame in the retracted position and is extended from the outrigger frame in the extended position. The outrigger beam has a proximal end and a distal end with respect to the outrigger frame in the extended position of the outrigger beam. The outrigger assembly further comprises an outrigger support coupled to the distal end of the outrigger beam to allow supporting the outrigger assembly in a supporting position of the outrigger support on a supporting surface in the extended position of the outrigger beam. The invention further relates to any vehicle, such as a mobile crane, provided with such an outrigger assembly with horizontally extendable outrigger beams.

BACKGROUND OF THE INVENTION

[0002] Mobile cranes and other vehicles having an outrigger assembly are generally known. The outrigger beams are extended from the outrigger frame and the vehicle, and the outrigger supports are lowered onto the ground at a location where a heavy load is to be handled. The extended outrigger beams provide a much higher stability to the mobile crane and higher loads can be handled with increasing width of the extended outrigger assembly. The width of the extended outrigger assembly is determined by the length of the outrigger beams, while the length of the outrigger beams is limited by the width of the vehicle in which the outrigger beams are housed in their retracted position. Present vehicles with outrigger assemblies, especially mobile cranes, have reached the limit of the maximum width of the extended outrigger assembly that can be achieved. A further increased width, however, would increase stability or the maximum load or load moment (load at a certain radius) that can be handled.

[0003] US 3,756,424 discloses a mobile crane having an outrigger assembly of which outrigger beams can be extended from an outrigger frame to provide an extended position of the outrigger beams and a supporting position of the outrigger assembly. In the supporting position, an end of the outrigger beam being supported on the ground induces a first torque that is balanced by a second torque provided by the outrigger beam extending over a certain length still within the outrigger frame of the outrigger assembly. The extension length of the outrigger beam from the outrigger frame is limited by the total length of the outrigger beam, which is limited by the width of the mobile crane, and the length of the outrigger beam remaining within the outrigger frame to induce the second torque.

SUMMARY OF THE INVENTION

[0004] It is an objective of the invention to provide an outrigger support having an increased width for a given width of the outrigger frame, and thus of the vehicle incorporating the outrigger assembly.

[0005] It is another or alternative objective of the invention to provide an outrigger support of which an outrigger beam can be extended to multiple positions for supporting a vehicle.

[0006] It is yet another or alternative objective of the invention to provide an outrigger assembly providing efficient and secure extension of an outrigger beam.

[0007] At least one of the above objectives is achieved by an outrigger assembly for supporting a vehicle on a supporting surface, the outrigger assembly comprising

- an outrigger frame;
- an outrigger beam,

the outrigger beam being movable along a horizontal extension direction with respect to the outrigger frame in between a retracted position, in which the outrigger beam is located within the outrigger frame, and an extended position, in which the outrigger beam is extended from the outrigger frame, and

the outrigger beam having a proximal end and a distal end with respect to the outrigger frame in the extended position of the outrigger beam; and

- an outrigger support coupled to the distal end of the outrigger beam to allow supporting the outrigger assembly on the supporting surface in a supporting position of the outrigger support,

the outrigger assembly being configured such that, in the extended position of the outrigger beam and the supporting position of the outrigger support,

-- a first torque acts on the outrigger beam, the first torque being determined by a first vertical force acting upwards at a first location on the distal end of the outrigger beam and a second vertical force acting downwards at a second location on the outrigger beam, the second location being separated from the first location by a first horizontal distance towards the proximal end of the outrigger beam, the first and second vertical forces acting as a result of the outrigger beam being supported by the outrigger support and the frame being supported by the outrigger beam, respectively, and

-- a second torque acts on the outrigger beam to balance the first torque, the second torque being determined by interaction between the outrigger frame and the outrigger beam,

wherein the second torque is at least substantially determined by a first horizontal force acting outwards at a third location on the outrigger beam with respect to the outrigger frame and a second horizontal force acting inwards at a fourth location on the outrigger beam with respect to the outrigger frame, the fourth location being separated from the third location by a first vertical distance in a downward direction.

Having the second torque being determined by horizontal forces provides that the outrigger beam can be extended further from the outrigger frame to allow an increased width of the outrigger assembly in the extended position. The (first and second) horizontal forces are to be understood as at least substantially horizontal forces. Additionally a vertical force component may be present, which could be due to practical implementation reasons. According to the invention the second torque is determined, or at least substantially determined, by substantially horizontal forces. To balance is to be understood as that the second torque, at least substantially, counteracts or neutralizes the first torque. Further, the distal end proximal ends are to be understood as distal and proximal end regions, and are not limited to the extreme ends only.

[0008] In an embodiment the second and third locations are at the proximal end of the outrigger beam, optionally at the extreme end of the proximal end.

[0009] In an embodiment the second and third locations are coinciding locations.

[0010] In an embodiment the outrigger beam is movable along the extension direction to a first semi-extended position in between the retracted position and the extended position,

the outrigger assembly being configured such that, in the first semi-extended position of the outrigger beam and the supporting position of the outrigger support,

-- a third torque acts on the outrigger beam, the third torque being determined by a third vertical force acting upwards at the first location on the distal end of the outrigger beam and a fourth vertical force acting downwards at a fifth location on the outrigger beam, the fifth location being separated from the first location by a second horizontal distance smaller than the first horizontal distance towards the proximal end of the outrigger beam, the third and fourth vertical forces acting as a result of the outrigger beam being supported by the outrigger support and the frame

being supported by the outrigger beam, respectively, and

-- a fourth torque acts on the outrigger beam to balance the third torque, the fourth torque being determined by interaction between the outrigger frame and the outrigger beam,

wherein the fourth torque is at least substantially determined by a third horizontal force acting outwards at a sixth location on the outrigger beam with respect to the outrigger frame and a fourth horizontal force acting inwards at a seventh location on the outrigger beam with respect to the outrigger frame, the seventh location being separated from the sixth location by a second vertical distance in a downward direction.

This efficiently provides for an additional position of the outrigger beam. Again, the (third and fourth) horizontal forces are to be understood as at least substantially horizontal forces, and the fourth torque is again to be understood as being determined, or at least substantially determined, by substantially horizontal forces. Additionally a vertical force component may be present, which could be due to practical implementation reasons. According to the invention the fourth torque is predominantly determined by substantially horizontal forces. To balance is to be understood as that the fourth torque, at least substantially, counteracts or neutralizes the third torque.

[0011] In an embodiment the fifth and sixth locations are coinciding locations.

[0012] In an embodiment the fourth and seventh locations are coinciding locations.

[0013] In an embodiment the outrigger beam is movable along the extension direction to a second semi-extended position in between the retracted position and the extended position,

the outrigger assembly being configured such that, in the second semi-extended position of the outrigger beam and the supporting position of the outrigger support,

-- a fifth torque acts on the outrigger beam, the fifth torque being determined by a fifth vertical force acting upwards at the first location on the distal end of the outrigger beam and a sixth vertical force acting downwards at an eighth location on the outrigger beam, the eighth location being separated from the first location by a third horizontal distance smaller than the first horizontal distance towards the proximal end of the outrigger beam, the fifth and sixth vertical forces acting as a result of the outrigger beam being supported by the outrigger support and the frame being supported by the outrigger beam, respectively, and

-- a sixth torque acts on the outrigger beam to balance the fifth torque, the sixth torque being deter-

mined by interaction between the outrigger frame and the outrigger beam,
 wherein the sixth torque is determined by a seventh vertical force acting downwards at a ninth location on the outrigger beam and an eighth vertical force acting upwards at a tenth location on the outrigger beam, the tenth location being separated from the ninth location by a fourth horizontal distance towards the proximal end of the outrigger beam.

This efficiently provides for yet another additional position of the outrigger beam.

[0014] In an embodiment the second semi-extended position is in between the retracted position and the first semi-extended position, and the third horizontal distance is smaller than the second horizontal distance.

[0015] In an embodiment the outrigger frame comprises a movable cam that is movable into a first or a second recess, respectively, corresponding with the second and the third location or the fifth and sixth location, respectively, such as to allow the second vertical force and first horizontal force or to allow the fourth vertical force and the third horizontal force, respectively, to act on the outrigger beam in the extended position or the first semi-extended position, respectively, of the outrigger beam, optionally the movable cam being a rotatable cam, optionally the movable cam being operable by a cam actuator, optionally an actuation cylinder, optionally a pneumatic, hydraulic, electrical or manual controlled actuation cylinder, optionally the first or second recess being provided in an upper surface of the outrigger beam, which provides a very fast and secure locking of the outrigger beam and transfer of outward horizontal and downward vertical forces onto the outrigger beam.

[0016] In an embodiment the outrigger frame comprises a movable cam that is movable into a first recesses corresponding with the second and the third location such as to allow the second vertical force and first horizontal force to act on the outrigger beam in the extended position of the outrigger beam, and movable into a second recesses corresponding with the fifth and the sixth location such as to allow the fourth vertical force and the third horizontal force to act on the outrigger beam in the first semi-extended position of the outrigger beam, optionally the movable cam being a rotatable cam, optionally the movable cam being operable by a cam actuator, optionally an actuation cylinder, optionally a pneumatic, hydraulic, electrical or manual controlled actuation cylinder, optionally the first and second recesses being provided in an upper surface of the outrigger beam, which also provides a very fast and secure locking of the outrigger beam and transfer of outward horizontal and downward vertical forces onto the outrigger beam.

[0017] In an embodiment the outrigger assembly comprises a slider element having first and second ends, the first end cooperating with the outrigger beam and the second end cooperating with the outrigger frame to allow extending the outrigger beam from the outrigger frame

and to allow the second horizontal force to act on the outrigger beam in the extended position of the outrigger beam, optionally the first end of the slider element being slidably coupled to the outrigger beam to allow moving of the slider element with respect to the outrigger beam, which provides for a secure transfer of horizontal inward forces onto the outrigger beam.

[0018] In an embodiment the outrigger frame comprises a first stop, the second end of the slider element is slidable with respect to the outrigger frame upon extension of the outrigger beam from the outrigger frame, and the second end cooperates with the first stop to allow the second horizontal force to act on the outrigger beam in the extended position of the outrigger beam.

[0019] In an embodiment the first end of the slider element cooperates with the outrigger beam and the second end cooperates with the outrigger frame to allow extending the outrigger beam from the outrigger frame and to allow the fourth horizontal force to act on the outrigger beam in the first semi-extended position of the outrigger beam, the outrigger frame comprises a second stop, and the second end of the slider element cooperates with the second stop to allow the fourth horizontal force to act on the outrigger beam in the first semi-extended position of the outrigger beam.

[0020] In an embodiment the first end of the slider element is slidably coupled to the outrigger beam to allow moving of the slider element with respect to the outrigger beam in between a first slider element position, in which the second end of the slider element is held by the outrigger beam, and a second slider element position, in which the second end is allowed to slide with respect to the outrigger frame, which allows that the slider element is housed within the outrigger beam to not take additional with in the retracted position and to allow cooperation with multiple stops on the outrigger frame.

[0021] In an embodiment the outrigger assembly comprises first and second outrigger beam actuators operable for moving the outrigger beam and the outrigger frame with respect to one another, and for moving the slider element and the outrigger beam with respect to one another.

[0022] In an embodiment the outrigger assembly is configured such that the first outrigger beam actuator is operable to allow moving the outrigger beam together with the second outrigger beam actuator and the slider element with respect to the outrigger frame, and the second actuator is operable to allow moving the outrigger beam with respect to the slider element and the outrigger frame.

[0023] In an embodiment the first outrigger beam actuator comprises a first outrigger actuation cylinder having a first cylinder part and a first piston part movable with respect to the first cylinder part and coupled to the outrigger frame, the second outrigger beam actuator comprises a second outrigger actuation cylinder having a second cylinder part and a second piston part movable with respect to the second cylinder part and couple to

the outrigger beam, and the first and second cylinder parts and the first end of the slider element fixedly coupled to one another.

[0024] In another aspect the invention provides for a vehicle comprising an outrigger assembly as referred to above.

[0025] In an embodiment the vehicle is a mobile crane.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Further features and advantages of the invention will become apparent from the description of the invention by way of non-limiting and non-exclusive embodiments. These embodiments are not to be construed as limiting the scope of protection. The person skilled in the art will realize that other alternatives and equivalent embodiments of the invention can be conceived and reduced to practice without departing from the scope of the invention. Embodiments of the invention will be described with reference to the accompanying drawings, in which like or same reference symbols denote like, same or corresponding parts, and in which

Figure 1 shows a side view of an outrigger assembly of the prior art;

Figure 2 shows a mobile crane having an outrigger assembly according to the invention;

Figure 3 shows a perspective view of an embodiment of an outrigger assembly according to the invention; Figures 4A to 4D show side views of the outrigger assembly of figure 3 with a single outrigger beam shown in cross-section from the retracted position in figure 4A through intermediate positions in figures 4B and 4C to the extended position with the outrigger support in the supporting position on a supporting surface in figure 4D;

Figures 5A to 5C show side views of the outrigger assembly of figure 3 with a single outrigger beam shown in cross-section from the retracted position in figure 5A through an intermediate positions in figures 5B to the first semi-extended position with the outrigger support in the supporting position on a supporting surface in figure 5C; and

Figure 6A and 6B show side views of the outrigger assembly of figure 3 with a single outrigger beam shown in cross-section from the retracted position in figure 6A to the second semi-extended position with the outrigger support in the supporting position on a supporting surface in figure 6B.

DETAILED DESCRIPTION OF EMBODIMENTS

[0027] Figure 2 shows a mobile crane in a position for operating the crane part. The outrigger beams 200 of the outrigger assemblies 10 are extended from the outrigger frame 100 that is part of the mobile crane, and the outrigger supports 300 are put in a supporting position on the supporting surface S, which may be road surface but

can be any other generally horizontal surface. The outrigger support in the extended position provides stability to the crane so as to allow manipulating heavy loads. Figure 3 shows an outrigger assembly 10 according to the invention in more detail, with both outrigger beams 200 in the extended position and the outrigger supports 300 in the supporting position to support the outrigger beams on the supporting surface S.

[0028] Figures 4A to 4D show four stages to provide the outrigger beam 200 from the retracted position P4 of figure 4A, in which the outrigger beam is located within the outrigger frame 100, to the extended position P1 of figure 4D, in which the outrigger beam is fully extended from the outrigger frame. Figures 4B and 4C show intermediate positions of the outrigger beam 200 when moving along the horizontal extension direction E with respect to the outrigger frame 100 to the extended position of figure 4D. The outrigger beam is movable by operating the outrigger beam actuators 150, 160.

[0029] The outrigger frame 100 comprises a movable cam 400 that is moved into the recess 211 provided in the top side surface of the outrigger beam in the fully extended position P1 shown in figure 4D. The cam is rotatable around a rotation axis 410 and can be rotated into and out of the recess 211 by a cam actuator 450 in the embodiment shown, but can also be moved in any other suitable manner into and out of the recess. The cam actuator 450 is a pneumatic controlled actuation cylinder in the embodiment shown, but can be any other suitable actuator such as, for instance, a hydraulic, manual or electrical controlled actuation cylinder. At its bottom side the outrigger beam is coupled to the outrigger frame through a slider element 500. The slider element, in the form of a slider rod in the embodiment shown, has first and second ends 501, 502. The first end 501 of the slider element is held in an elongated slot 250 in the bottom region of the outrigger beam 200 by a projection of the slider element extending into the slot. The projection at the first end 501 of the slider element can slide along the slot between first and second slot ends 251, 252. Figure 4D of the extended position of the outrigger beam shows that the projection at the first end 501 of the slider element cooperates with the first slot end 251. A projection at the second end 502 of the slider element 500 cooperates with a first stop 111 in the bottom region of the outrigger frame 100.

[0030] The outrigger support 300 is in its support position SP in the extended position P1 of the outrigger beam of figure 4D. In the support position the footplate 310 of the outrigger support has been lowered onto the supporting surface S by operating the actuation cylinder 320 of the outrigger support. Figures 4A to 4C show the footplate 310 of the outrigger support 300 in a raised position, which enables moving the outrigger beam in and out in between the retracted position P4 of figure 4A and the extended position P1 of figure 4D. The outrigger support 300 is coupled to the distal end 202 of the outrigger beam 200, while the outrigger beam at its proximal

end 201 is coupled to the outrigger frame 100. The proximal and distal ends 201, 202 of the outrigger beam are defined with respect to the outrigger frame. In the extended position the distal end 202 of the outrigger beam 200 is positioned away from the outrigger frame, while the proximal end 201 is positioned close to the outrigger frame. The proximal and distal ends are each intended to indicate a zone at the ends and not to indicate the extreme end.

[0031] In the extended position of the outrigger beam 100 of figure 4D the outrigger support 300 supports, together with the other outrigger support(s) coupled to the other outrigger beam(s), the weight of the vehicle, such as a mobile crane, of which it is a part, and its load and load moment. The outrigger support 300 causes a first vertical force F_{v1} acting upwards at a first location L1 on the distal end 202 of the outrigger beam. The outrigger frame is supported on the outrigger beam through the cam 400 that is inserted into the first recess 211, which causes a second vertical force F_{v2} acting downwards at a second location L2 on the outrigger beam. The second location L2 is separated from the first location L1 by a first horizontal distance D_{h1} towards the proximal end of the outrigger beam. In the embodiment shown, the second location L2 is near the extreme end of the proximal end of the outrigger beam. Actually, the forces may be distributed over a zone, but can be regarded to act on a single location on the frame and are shown as such in the figures. The first and second vertical forces F_{v1} , F_{v2} separated by the first horizontal distance D_{h1} cause a first torque to act on the outrigger beam.

[0032] The first torque is balanced by a second torque determined by interaction between the outrigger frame and the outrigger beam through the cam 400 and slider element 500. The cam 400 coupled to the outrigger frame 100 and inserted into the first recess 211 causes a first horizontal force F_{h1} acting outwards at a third location L3 on the outrigger beam. Actually, the second and third locations are the same, or virtually the same, as the second vertical force F_{v2} and the first horizontal force F_{h1} are both caused by the cam 400 acting on the outrigger beam. Generally, the second and third locations L2, L3 need not be the same. The slider element 500 by the projection at its first end 501 inserted into the slot 250 and cooperating with the first slot end 251 causes a second horizontal force F_{h2} acting inwards at a fourth location L4 on the outrigger beam next to the first slot end 251. The horizontal forces are defined as outward or inward with respect to the outrigger frame, an outward direction being directed away from the outrigger frame and an inward direction being directed to the inside of the outrigger frame. The second horizontal force F_{h2} can be exerted by the slider element since its second end 502 cooperates with the first stop 111 on the outrigger frame 100. The fourth location L4 is separated from the third location L3 by a first vertical distance D_{v1} in a downward direction. The first and second horizontal forces F_{h1} , F_{h2} separated by the first vertical distance D_{v1} cause the

second torque to act on the outrigger beam. The slider element 500 also causes a minor downward vertical force component acting on the outrigger beam, which is due to the practical implementation of the embodiment shown. The same may be the case for providing the first horizontal force. However, these forces are substantially horizontal. Substantially the horizontal force components act to cause the second torque.

[0033] Figure 1 shows an outrigger assembly of the prior art with the outrigger beam 200 in its extended position from the outrigger frame 100 and the outrigger support 300 in the support position on the supporting surface. In the prior art outrigger assembly a torque caused by vertical forces F_{vA} and F_{vB} acting on locations LA and LB, respectively, is balanced by another torque caused by vertical forces F_{vC} and F_{vD} acting on locations LB and LC, respectively. The locations LA and LB are separated by a horizontal distance D_{hA} , and the locations LB and LC are separated by a horizontal distance D_{hB} . The torque by vertical forces F_{vA} , F_{vB} and horizontal distance D_{hA} compares to the first torque by the first and second vertical forces F_{v1} , F_{v2} and first horizontal distance D_{h1} , while the torque by vertical forces F_{vC} , F_{vD} and horizontal distance D_{hB} is replaced by the second torque by the first and second horizontal forces F_{h1} , F_{h2} and first vertical distance D_{v1} in the outrigger assembly according to the invention. The prior art outrigger assembly requires a considerable length of outrigger beam to remain inserted inside the outrigger frame to allow for the torque by vertical forces F_{vC} and F_{vD} and horizontal distance D_{hB} , which is not required by the outrigger assembly according to the invention.

[0034] Figures 5A to 5C show three stages to provide the outrigger beam 200 from the retracted position P4 of figure 5A, in which the outrigger beam is located within the outrigger frame 100, to a first semi-extended position P2 of figure 5C, in which the outrigger beam is partly extended from the outrigger frame. The first semi-extended position P2 is in between the retracted position P4 and the extended position P1 of figure 4D. Figure 5B shows an intermediate position of the outrigger beam 200 when moving along the horizontal extension direction E with respect to the outrigger frame 100 to the first semi-extended position of figure 5C.

[0035] The outrigger support 300 is in the supporting position SP in the first semi-extended position P2 shown in figure 5C to support the outrigger assembly on the supporting surface S. The rotatable cam is further rotated to be inserted into the second recess 212 provided in the top side surface of the outrigger beam 200 in the first semi-extended position. At its bottom side the outrigger beam is again coupled to the outrigger frame through the slider element 500. The first end 501 of the slider element is held in the elongated slot 250 in the bottom region of the outrigger beam 200 by the projection of the slider element extending into the slot. Figure 5C of the first semi-extended position of the outrigger beam shows that the projection at the first end 501 of the slider element

cooperates with the first slot end 251. The projection at the second end 502 of the slider element 500 cooperates with a second stop 112 in the bottom region of the outrigger frame 100.

[0036] In the first semi-extended position of the outrigger beam of figure 5C the outrigger support 300 supports the outrigger beam and outrigger frame. The outrigger support 300 causes a third vertical force F_{v3} acting upwards at the first location L1 on the distal end 202 of the outrigger beam. The outrigger frame is again supported on the outrigger beam through the cam 400 that is now inserted into the second recess 212, which causes a fourth vertical force F_{v4} acting downwards at a fifth location L5 on the outrigger beam. The fifth location L5 is separated from the first location L1 by a second horizontal distance D_{h2} towards the proximal end 201 of the outrigger beam. The second horizontal distance D_{h2} is smaller than the first horizontal distance D_{h1} , and the second location L5 is at a horizontal position in between the first and second locations L1, L2. The third and fourth vertical forces F_{v3} , F_{v4} separated by the second horizontal distance D_{h2} cause a third torque to act on the outrigger beam.

[0037] The third torque is balanced by a fourth torque determined by interaction between the outrigger frame and the outrigger beam through again the cam 400 and slider element 500. The cam 400 coupled to the outrigger frame 100 and inserted into the second recess 212 causes a third horizontal force F_{h3} acting outwards at a sixth location L6 on the outrigger beam. The fifth and sixth locations L5, L6 are the same, or virtually the same, as the fourth vertical force F_{v4} and the third horizontal force F_{h3} are both caused by the cam 400 acting on the outrigger beam. Generally, the fifth and sixth locations L5, L6 need not be the same. The slider element 500 by the projection at its first end 501 inserted into the slot 250 and cooperating with the first slot end 251 causes a fourth horizontal force F_{h4} acting inwards at a seventh location L7 on the outrigger beam next to the first slot end 251. Actually, the fourth and seventh locations L4, L7 are the same locations in the embodiment shown. The fourth horizontal force F_{h4} can be caused by the slider element since its second end 502 cooperates with the second stop 112 on the outrigger frame 100. The seventh location L7 is separated from the sixth location L6 by a second vertical distance D_{v2} in a downward direction. The first and second vertical distances D_{v1} , D_{v2} are the same in the embodiment shown. The third and fourth horizontal forces F_{h3} , F_{h4} separated by the second vertical distance D_{v2} cause the fourth torque to act on the outrigger beam. Again, as has been described for the extended position P1, vertical force components might be present in addition to the horizontal forces. It is substantially the horizontal force components acting to cause the fourth torque.

[0038] Figures 6A and 6B show two stages to provide the outrigger beam 200 from the retracted position P4 of figure 6A, in which the outrigger beam is located within

the outrigger frame 100, to a second semi-extended position P3 of figure 6B, in which the outrigger beam is partly extended from the outrigger frame. No intermediate positions are shown. In the second semi-extended position of figure 6B the outrigger beam 200 extends less far from the outrigger frame 100 than in the first semi-extended position of figure 5C.

[0039] The outrigger support 300 is in the supporting position SP in the second semi-extended position P3 shown in figure 6B to support the outrigger assembly on the supporting surface S. The outrigger support 300 causes a fifth vertical force F_{v5} acting upwards at the first location L1 on the distal end 202 of the outrigger beam. The outrigger frame is in the second semi-extended position P3 directly supported on the outrigger beam at an eighth location L8 to cause a sixth vertical force F_{v6} acting downwards at the eighth location L8 on the outrigger beam. The eighth location L8 is separated from the first location L1 by a third horizontal distance D_{h3} towards the proximal end 201 of the outrigger beam. The third horizontal distance D_{h3} is smaller than the first horizontal distance D_{h1} , and the eighth location L8 is at a horizontal position in between the first and second locations L1, L2. In the embodiment shown, the third horizontal distance D_{h3} is also smaller than the second horizontal distance D_{h2} , and the eighth location L8 is at a horizontal position in between the first and fifth locations L1, L5. The fifth and sixth vertical forces F_{v5} , F_{v6} separated by the third horizontal distance D_{h3} cause a fifth torque to act on the outrigger beam.

[0040] The fifth torque is balanced by a sixth torque determined by direct interaction between the outrigger frame and the outrigger beam. The outrigger frame causes a seventh vertical force F_{v7} acting downwards at a ninth location L9 on the outrigger beam. The eighth and ninth locations L8, L9 are actually the same, or virtually the same, in the embodiment shown, as there is a limited contact area between the upper side of the outrigger beam and the outrigger frame. Generally, the eighth and ninth locations L8, L9 need not be the same. Further, the outrigger frame causes an eighth vertical force F_{v8} acting upwards at a tenth location L10 on the outrigger beam. The tenth location L10 is separated from the eighth location L8 by a fourth horizontal distance D_{h4} in a direction toward the proximal end 201 of the outrigger beam. The seventh and eighth vertical forces F_{v7} , F_{v8} separated by the fourth horizontal distance D_{h4} cause the sixth torque to act on the outrigger beam. Since, the sixth and seventh vertical forces F_{v6} , F_{v7} act on (virtually) the same location L8, L9, they will add to a single vertical force $F_{v6}+F_{v7}$. However, still two torques act on the outrigger beam to balance one another.

[0041] The outrigger assembly comprises first and second outrigger beam actuators 150, 160 operable for moving the outrigger beam 200 and the outrigger frame 100 with respect to one another, and for moving the slider element 500 and the outrigger beam 200 with respect to one another. The first outrigger beam actuator 150 op-

erates to move the outrigger beam 200 together with the second outrigger beam actuator 160 and the slider element 500 with respect to the outrigger frame 100. The second actuator 160 operates to move the outrigger beam 200 with respect to the slider element 500 and the outrigger frame 100. In the embodiment shown the first outrigger beam actuator 150 comprises a first outrigger actuation cylinder having a first cylinder part 151 and a first piston part 152 movable with respect to the first cylinder part and coupled to the outrigger frame 100, and the second outrigger beam actuator 160 comprises a second outrigger actuation cylinder having a second cylinder part 161 and a second piston part 162 movable with respect to the second cylinder part and couple to the outrigger beam 200. The first and second cylinder parts 151, 161 and the first end of the slider element are fixedly coupled to one another.

[0042] In the retracted position P4 shown in figures 4A, 5A and 6A the slider element 500 is in a first slider element position SE1, in which the second end 502 of the slider element is held by the outrigger beam 200. In the first slider element position SE1 the first end 501 of the slider element is at the second slot end 252 of the slot 250, while the second end 502 of the slider element 500 is kept in a slider element recess 260 at the extreme end of the proximal end of the outrigger beam 200. To arrive in the second semi-extended position P3, the first outrigger beam actuator 160 is operated to extend the first piston part 152 out of the first cylinder part 151 to move and extend the outrigger beam 200 out of the outrigger frame 100, while the slider element 500 is kept in the first slider element position SE1, as is shown in figure 6B. The support foot 310 of the outrigger support 300 is then lowered onto the supporting surface S by operation of the support cylinder 320 to support the outrigger assembly on the supporting surface and to finally arrive in the position as shown in figure 6B.

[0043] To arrive in the first semi-extended position P2 of figure 5C, the second outrigger beam actuator 160 is operated to extend the second piston part 162 out of the second cylinder part 161 to move and extend the outrigger beam 200 out of the outrigger frame 100, as is shown for the intermediate position in figure 5B. In this action the slider element 500 does not move with respect to the outrigger frame 100 since the first end 501 of the slider element 500 is fixedly connected to the first and second cylinder parts 151, 161. Subsequently, the first outrigger beam actuator 150 is operated to extend the first piston part 152 out of the first cylinder part 151 to further move and extend the outrigger beam 200 out of the outrigger frame 100 to arrive in the outrigger beam position as is shown in figure 5C. Operation of the first and second outrigger beam actuators 150, 160 may also overlap to arrive in the first semi-extended position P2 of figure 5C. The second end 502 of the slider element 500 will slide over the outrigger frame 100 and end up abutting against the second stop 112 on the outrigger frame. When the first and second outrigger beam actuators 150, 160 have

been operated to move the outrigger beam in a position corresponding to the first semi-extended position P2, the cam actuator 450 is operated to rotate the cam 400 around its rotation axis 410 to move the cam into the second recess 212 in the top side of the outrigger beam. The support foot 310 of the outrigger support 300 is then lowered onto the supporting surface S by operation of the support cylinder 320 to support the outrigger assembly on the supporting surface and to finally arrive in the position as shown in figure 5C.

[0044] To arrive in the extended position P1 of figure 4D, the first outrigger beam actuator 160 is operated to extend the first piston part 152 out of the first cylinder part 151 to move and extend the outrigger beam 200 out of the outrigger frame 100, while the slider element 200 is kept in the first slider element position SE1, as has been described earlier with respect to figure 6B. The second end 502 of the slider element should be at a horizontal position in between first and second stops 111, 112 or, preferably, above the second stop 112, as shown in figure 4B, when the second outrigger beam actuator 160 is operated to extend the second piston part 162 out of the second cylinder part 161 to further move and extend the outrigger beam 200 out of the outrigger frame 100. In case only the second outrigger beam actuator 160 is operated from the intermediate position shown in figure 4B, one arrives at the intermediate position shown in figure 4C. In this action the slider element 500 does not move with respect to the outrigger frame 100 since the first end 501 of the slider element 500 is fixedly connected to the first and second cylinder parts 151, 161, as has been described earlier with respect to figure 5B. Subsequently, the first outrigger beam actuator 150 is operated to extend the first piston part 152 out of the first cylinder part 151 to further move and extend the outrigger beam 200 out of the outrigger frame 100 to arrive in the outrigger beam position as is shown in figure 4D. Operation of the first and second outrigger beam actuators 150, 160 may also overlap to arrive from the outrigger beam position of figure 4C into the outrigger beam position of figure 4D. This is equivalent to what has been described earlier with respect to figure 5C. The second end 502 of the slider element 500 will slide over the outrigger frame 100 and end up abutting against the first stop 111 on the outrigger frame. When the first and second outrigger beam actuators 150, 160 have been operated to move the outrigger beam in a position corresponding to the extended position P1, the cam actuator 450 is operated to rotate the cam 400 around its rotation axis 410 to move the cam into the first recess 211 in the top side of the outrigger beam. The support foot 310 of the outrigger support 300 is then lowered onto the supporting surface S by operation of the support cylinder 320 to support the outrigger assembly on the supporting surface and to finally arrive in the position as shown in figure 4D.

[0045] Retracting the outrigger beam 100 from the extended position P1 of figure 4D, or one of the first and second semi-extended positions P2, P3 of figures 5C

and 6B, respectively, into the retracted position P4 of figures 4A, 5A and 6A requires an appropriate reversal of the above steps, which is apparent from the above description.

Claims

1. An outrigger assembly (10) for supporting a vehicle on a supporting surface (S), the outrigger assembly comprising

- an outrigger frame (100);
- an outrigger beam (200),

the outrigger beam (200) being movable along a horizontal extension direction (E) with respect to the outrigger frame (100) in between a retracted position (P4), in which the outrigger beam is located within the outrigger frame, and an extended position (P1), in which the outrigger beam is extended from the outrigger frame, and the outrigger beam (200) having a proximal end (201) and a distal end (202) with respect to the outrigger frame (100) in the extended position of the outrigger beam; and

- an outrigger support (300) coupled to the distal end of the outrigger beam (200) to allow supporting the outrigger assembly (10) on the supporting surface (S) in a supporting position (SP) of the outrigger support,

the outrigger assembly being configured such that, in the extended position of the outrigger beam (200) and the supporting position of the outrigger support (300),
 -- a first torque acts on the outrigger beam (200), the first torque being determined by a first vertical force (Fv1) acting upwards at a first location (L1) on the distal end (202) of the outrigger beam and a second vertical force (Fv2) acting downwards at a second location (L2) on the outrigger beam, the second location being separated from the first location by a first horizontal distance (Dh1) towards the proximal end (201) of the outrigger beam, the first and second vertical forces acting as a result of the outrigger beam being supported by the outrigger support (300) and the outrigger frame (100) being supported by the outrigger beam, respectively, and
 -- a second torque acts on the outrigger beam (200) to balance the first torque, the second torque being determined by interaction between the outrigger frame (100) and

the outrigger beam,

characterised in that the second torque is at least substantially determined by a first horizontal force (Fh1) acting outwards at a third location (L3) on the outrigger beam with respect to the outrigger frame and a second horizontal force (Fh2) acting inwards at a fourth location (L4) on the outrigger beam with respect to the outrigger frame, the fourth location being separated from the third location by a first vertical distance (Dv1) in a downward direction.

2. The outrigger assembly according to the preceding claim, wherein the second and third locations (L2, L3) are at the proximal end (201) of the outrigger beam (200), optionally at the extreme end of the proximal end.
3. The outrigger assembly according to any one of the preceding claims, wherein the second and third locations (L2, L3) are coinciding locations.
4. The outrigger assembly according to any one of the preceding claims, wherein the outrigger beam (200) is movable along the extension direction (E) to a first semi-extended position (P2) in between the retracted position (P4) and the extended position (P1),

the outrigger assembly being configured such that, in the first semi-extended position of the outrigger beam (200) and the supporting position of the outrigger support (300),

-- a third torque acts on the outrigger beam (200), the third torque being determined by a third vertical force (Fv3) acting upwards at the first location (L1) on the distal end (202) of the outrigger beam and a fourth vertical force (Fv4) acting downwards at a fifth location (L5) on the outrigger beam, the fifth location being separated from the first location by a second horizontal distance (Dh2) smaller than the first horizontal distance (Dh1) towards the proximal end (201) of the outrigger beam, the third and fourth vertical forces acting as a result of the outrigger beam being supported by the outrigger support and the outrigger frame being supported by the outrigger beam, respectively, and

-- a fourth torque acts on the outrigger beam (200) to balance the third torque, the fourth torque being determined by interaction between the outrigger frame (100) and the outrigger beam,

wherein the fourth torque is at least substantially determined by a third horizontal force (Fh3) acting outwards at a sixth location (L6) on the outrigger beam (200) with respect to the outrigger frame (100) and a fourth horizontal force (Fh4)

acting inwards at a seventh location (L7) on the outrigger beam with respect to the outrigger frame, the seventh location being separated from the sixth location by a second vertical distance (Dv2) in a downward direction, optionally the fifth and sixth locations (L5, L6) being coinciding locations, optionally the fourth and seventh locations (L4, L7) being coinciding locations.

5. The outrigger assembly according to any one of the preceding claims, wherein the outrigger beam (200) is movable along the extension direction (E) to a second semi-extended position (P3) in between the retracted position (P4) and the extended position (P1),

the outrigger assembly being configured such that, in the second semi-extended position of the outrigger beam (200) and the supporting position of the outrigger support (300), -- a fifth torque acts on the outrigger beam (200), the fifth torque being determined by a fifth vertical force (Fv5) acting upwards at the first location (L1) on the distal end (202) of the outrigger beam and a sixth vertical force (Fv6) acting downwards at an eighth location (L8) on the outrigger beam, the eighth location being separated from the first location by a third horizontal distance (Dh3) smaller than the first horizontal distance (Dh1) towards the proximal end (201) of the outrigger beam, the fifth and sixth vertical forces acting as a result of the outrigger beam being supported by the outrigger support (300) and the outrigger frame (100) being supported by the outrigger beam, respectively, and -- a sixth torque acts on the outrigger beam (200) to balance the fifth torque, the sixth torque being determined by interaction between the outrigger frame (100) and the outrigger beam, wherein the sixth torque is determined by a seventh vertical force (Fv7) acting downwards at a ninth location (L9) on the outrigger beam (200) and an eighth vertical force (Fv8) acting upwards at a tenth location (L10) on the outrigger beam, the tenth location being separated from the ninth location by a fourth horizontal distance (Dh4) towards the proximal end (201) of the outrigger beam, optionally the second semi-extended position (P3) being in between the retracted position (P4) and the first semi-extended position (P2), and the third horizontal distance (Dh3) being smaller than the second horizontal distance (Dh2).

6. The outrigger assembly according to any one of the preceding claims, wherein the outrigger frame (100) comprises a movable cam (400) that is movable into a first or a second recess (211, 212), corresponding

with the second and the third location (L2, L3) or the fifth and sixth location (L5, L6), respectively, such as to allow the second vertical force (Fv2) and the first horizontal force (Fh1) or to allow the fourth vertical force (Fv4) and the third horizontal force (Fh3), respectively, to act on the outrigger beam (200) in the extended position (P1) or the first semi-extended position (P2), respectively, of the outrigger beam, optionally the movable cam (400) being a rotatable cam, optionally the movable cam being operable by a cam actuator (450), optionally an actuation cylinder, optionally a pneumatic, hydraulic, electrical or manual controlled actuation cylinder, optionally the first or second recess being provided in an upper surface of the outrigger beam (200).

7. The outrigger assembly according to any one of the preceding claims, wherein the outrigger frame (100) comprises a movable cam (400) that is movable into a first recess (211) corresponding with the second and the third location (L2, L3) such as to allow the second vertical force (Fv2) and first horizontal force (Fh1) to act on the outrigger beam in the extended position (P1) of the outrigger beam, and movable into a second recesses (212) corresponding with the fifth and the sixth location (L5, L6) such as to allow the fourth vertical force (Fv4) and the third horizontal force (Fh3) to act on the outrigger beam (200) in the first semi-extended position (P2) of the outrigger beam, optionally the movable cam (400) being a rotatable cam, optionally the movable cam being operable by a cam actuator (450), optionally an actuation cylinder, optionally a pneumatic, hydraulic, electrical or manual controlled actuation cylinder, optionally the first and second recesses being provided in an upper surface of the outrigger beam (200).
8. The outrigger assembly according to any one of the preceding claims, wherein the outrigger assembly comprises a slider element (500) having first and second ends (501, 502), the first end (501) cooperating with the outrigger beam (200) and the second end (502) cooperating with the outrigger frame (100) to allow extending the outrigger beam from the outrigger frame and to allow the second horizontal force (Fh2) to act on the outrigger beam in the extended position (P1) of the outrigger beam, optionally the first end of the slider element being slidably coupled to the outrigger beam to allow moving of the slider element with respect to the outrigger beam.
9. The outrigger assembly according to the preceding claim, wherein the outrigger frame (100) comprises a first stop (111), the second end (501) of the slider element is slidable with respect to the outrigger frame upon extension of the outrigger beam (200) from the outrigger frame, and the second end (502) cooperates with the first stop to allow the second

horizontal force (Fh2) to act on the outrigger beam in the extended position (P1) of the outrigger beam.

10. The outrigger assembly according to the preceding claim as dependent on claim 4, wherein the first end (501) of the slider element (500) cooperates with the outrigger beam (200) and the second end (502) cooperates with the outrigger frame (100) to allow extending the outrigger beam from the outrigger frame and to allow the fourth horizontal force (Fh4) to act on the outrigger beam in the first semi-extended position (P2) of the outrigger beam, the outrigger frame comprises a second stop (112), and the second end (502) of the slider element cooperates with the second stop to allow the fourth horizontal force (Fh4) to act on the outrigger beam in the first semi-extended position (P2) of the outrigger beam.
11. The outrigger assembly according to the preceding claim, wherein the first end (501) of the slider element (500) is slidably coupled to the outrigger beam (200) to allow moving of the slider element with respect to the outrigger beam (200) in between a first slider element position (SE1), in which the second end (502) of the slider element is held by the outrigger beam, and a second slider element position (SE2), in which the second end is allowed to slide with respect to the outrigger frame (100).
12. The outrigger assembly according to the preceding claim, wherein the outrigger assembly comprises first and second outrigger beam actuators (150, 160) operable for moving the outrigger beam (200) and the outrigger frame (100) with respect to one another, and for moving the slider element (500) and the outrigger beam with respect to one another.
13. The outrigger assembly according to the preceding claim, wherein the outrigger assembly is configured such that the first outrigger beam actuator (150) is operable to allow moving the outrigger beam (200) together with the second outrigger beam actuator (160) and the slider element (500) with respect to the outrigger frame (100), and the second actuator is operable to allow moving the outrigger beam with respect to the slider element and the outrigger frame.
14. The outrigger assembly according to the preceding claim, wherein the first outrigger beam actuator (150) comprises a first outrigger actuation cylinder having a first cylinder part (151) and a first piston part (152) movable with respect to the first cylinder part and coupled to the outrigger frame (100), the second outrigger beam actuator (160) comprises a second outrigger actuation cylinder having a second cylinder part (161) and a second piston part (162) movable with respect to the second cylinder part and coupled to the outrigger beam (200), and the first and second

cylinder parts and the first end of the slider element fixedly coupled to one another.

15. A vehicle comprising an outrigger assembly (10) according to any one of the preceding claims, optionally the vehicle being a mobile crane.

Patentansprüche

1. Auslegervorrichtung (10) zum Abstützen eines Fahrzeugs auf einer Stützfläche (S), wobei die Auslegervorrichtung Folgendes umfasst:

- einen Auslegerrahmen (100);
- einen Auslegerbalken (200),

wobei der Auslegerbalken (200) entlang einer horizontalen Ausfahrriichtung (E) in Bezug auf den Auslegerrahmen (100) zwischen einer eingefahrenen Position (P4), in der sich der Auslegerbalken innerhalb des Auslegerrahmens befindet, und einer ausgefahrenen Position (P1), in der der Auslegerbalken von dem Auslegerrahmen ausgefahren ist, beweglich ist, und wobei der Auslegerbalken (200) in der ausgefahrenen Position des Auslegerbalkens ein proximales Ende (201) und ein distales Ende (202) in Bezug auf den Auslegerrahmen (100) aufweist; und

- eine Auslegerstütze (300), die mit dem distalen Ende des Auslegerbalkens (200) gekoppelt ist, um die Abstützung der Auslegervorrichtung (10) auf der Stützfläche (S) in einer Stützposition (SP) der Auslegerstütze zu ermöglichen,

wobei die Auslegervorrichtung so konfiguriert ist, dass in der ausgefahrenen Position des Auslegerbalkens (200) und der Stützposition der Auslegerstütze (300)

- ein erstes Drehmoment auf den Auslegerbalken (200) wirkt, wobei das erste Drehmoment durch eine erste vertikale Kraft (Fv1) bestimmt wird, die an einer ersten Stelle (L1) am distalen Ende (202) des Auslegerbalkens nach oben wirkt, und eine zweite vertikale Kraft (Fv2), die an einer zweiten Stelle (L2) auf dem Auslegerbalken nach unten wirkt, wobei die zweite Stelle von der ersten Stelle durch einen ersten horizontalen Abstand (Dh1) in Richtung des proximalen Endes (201) des Auslegerbalkens getrennt ist, wobei die ersten und zweiten vertikalen Kräfte dadurch wirken, dass der Auslegerbalken durch die Auslegerstütze (300) gestützt wird bzw. der Ausleger-

rahmen (100) durch den Auslegerbalken gestützt wird, und

- ein zweites Drehmoment auf den Auslegerbalken (200) wirkt, um das erste Drehmoment auszugleichen, wobei das zweite Drehmoment durch die Interaktion zwischen dem Auslegerrahmen (100) und dem Auslegerbalken bestimmt wird,

dadurch gekennzeichnet, dass das zweite Drehmoment zumindest im Wesentlichen durch eine erste horizontale Kraft (Fh1), die an einer dritten Stelle (L3) auf dem Auslegerbalken in Bezug auf den Auslegerrahmen nach außen wirkt, und eine zweite horizontale Kraft (Fh2), die an einer vierten Stelle (L4) auf dem Auslegerbalken in Bezug auf den Auslegerrahmen nach innen wirkt, bestimmt wird, wobei die vierte Stelle von der dritten Stelle durch einen ersten vertikalen Abstand (Dv1) in Abwärtsrichtung getrennt ist.

2. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei sich die zweite und dritte Stelle (L2, L3) am proximalen Ende (201) des Auslegerbalkens (200) befinden, optional am äußersten Ende des proximalen Endes.

3. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei die zweite und die dritte Stelle (L2, L3) übereinstimmende Stellen sind.

4. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei der Auslegerbalken (200) entlang der Ausfahrrichtung (E) in eine erste halb ausgefahrene Position (P2) zwischen der eingefahrenen Position (P4) und der ausgefahrenen Position (P1) beweglich ist,

wobei die Auslegervorrichtung so konfiguriert ist, dass in der ersten halb ausgefahrenen Position des Auslegerbalkens (200) und der Stützposition der Auslegerstütze (300)

- ein drittes Drehmoment auf den Auslegerbalken (200) wirkt, wobei das dritte Drehmoment durch eine dritte vertikale Kraft (Fv3), die an der ersten Stelle (L1) am distalen Ende (202) des Auslegerbalkens nach oben wirkt, und eine vierte vertikale Kraft (Fv4), die an einer fünften Stelle (L5) auf dem Auslegerbalken nach unten wirkt, bestimmt wird, wobei die fünfte Stelle von der ersten Stelle durch einen zweiten horizontalen Abstand (Dh2) getrennt ist, der kleiner als der erste horizontale Abstand (Dh1) in Richtung des proximalen Endes

(201) des Auslegerbalkens ist, wobei die dritten und vierten vertikalen Kräfte dadurch wirken, dass der Auslegerbalken durch die Auslegerstütze gestützt wird bzw. der Auslegerrahmen durch den Auslegerbalken gestützt wird, und

- ein viertes Drehmoment auf den Auslegerbalken (200) wirkt, um das dritte Drehmoment auszugleichen, wobei das vierte Drehmoment durch die Interaktion zwischen dem Auslegerrahmen (100) und dem Auslegerbalken bestimmt wird,

wobei das vierte Drehmoment zumindest im Wesentlichen durch eine dritte horizontale Kraft (Fh3), die an einer sechsten Stelle (L6) auf dem Auslegerbalken (200) in Bezug auf den Auslegerrahmen (100) nach außen wirkt, und eine vierte horizontale Kraft (Fh4), die an einer siebten Stelle (L7) auf dem Auslegerbalken in Bezug auf den Auslegerrahmen nach innen wirkt, bestimmt wird, wobei die siebte Stelle von der sechsten Stelle durch einen zweiten vertikalen Abstand (Dv2) in Abwärtsrichtung getrennt ist, optional die fünfte und die sechste Stelle (L5, L6) übereinstimmende Stellen sind, optional die vierte und die siebte Stelle (L4, L7) übereinstimmende Stellen sind.

5. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei der Auslegerbalken (200) entlang der Ausfahrrichtung (E) in eine zweite halb ausgefahrene Position (P3) zwischen der eingefahrenen Position (P4) und der ausgefahrenen Position (P1) beweglich ist,

wobei die Auslegervorrichtung so konfiguriert ist, dass in der zweiten halb ausgefahrenen Position des Auslegerbalkens (200) und der Stützposition der Auslegerstütze (300)

- ein fünftes Drehmoment auf den Auslegerbalken (200) wirkt, wobei das fünfte Drehmoment durch eine fünfte vertikale Kraft (Fv5), die an der ersten Stelle (L1) am distalen Ende (202) des Auslegerbalkens nach oben wirkt, und eine sechste vertikale Kraft (Fv6), die an einer achten Stelle (L8) auf dem Auslegerbalken nach unten wirkt, bestimmt wird, wobei die achte Stelle von der ersten Stelle durch einen dritten horizontalen Abstand (Dh3) getrennt ist, der kleiner als der erste horizontale Abstand (Dh1) in Richtung des proximalen Endes (201) des Auslegerbalkens ist, wobei die fünften und sechsten vertikalen Kräfte dadurch wirken, dass der Auslegerbalken durch die Auslegerstütze (300) und den

Auslegerrahmen (100) gestützt wird, die jeweils vom Auslegerbalken getragen werden, und

- ein sechstes Drehmoment auf den Auslegerbalken (200) wirkt, um das fünfte Drehmoment auszugleichen, wobei das sechste Drehmoment durch die Interaktion zwischen dem Auslegerrahmen (100) und dem Auslegerbalken bestimmt wird,

wobei das sechste Drehmoment durch eine siebte vertikale Kraft (Fv7), die an einer neunten Stelle (L9) auf dem Auslegerbalken (200) nach unten wirkt, und eine achte vertikale Kraft (Fv8), die an einer zehnten Stelle (L10) auf dem Auslegerbalken nach oben wirkt, bestimmt wird, wobei die zehnte Stelle von der neunten Stelle durch einen vierten horizontalen Abstand (Dh4) in Richtung des proximalen Endes (201) des Auslegerbalkens getrennt ist, optional die zweite halb ausgefahrene Position (P3) zwischen der eingefahrenen Position (P4) und der ersten halb ausgefahrenen Position (P2) liegt und der dritte horizontale Abstand (Dh3) kleiner als der zweite horizontale Abstand (Dh2) ist.

6. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei der Auslegerrahmen (100) einen beweglichen Nocken (400) umfasst, der in eine erste oder eine zweite Aussparung (211, 212) bewegt werden kann, die der zweiten und dritten Stelle (L2, L3) bzw. der fünften und sechsten Stelle (L5, L6) entspricht, um zu ermöglichen, dass die zweite vertikale Kraft (Fv2) und die erste horizontale Kraft (Fh1) bzw. die vierte vertikale Kraft (Fv4) und die dritte horizontale Kraft (Fh3) auf den Auslegerbalken (200) in der ausgefahrenen Position (P1) oder der ersten halb ausgefahrenen Position (P2) des Auslegerbalkens einwirken, wobei optional der bewegliche Nocken (400) ein drehbarer Nocken ist, optional der bewegliche Nocken durch einen Nockenbetätiger (450), optional einen Betätigungszylinder, optional einen pneumatischen, hydraulischen, elektrischen oder manuell gesteuerten Betätigungszylinder betätigt werden kann, wobei optional die erste oder zweite Aussparung in einer oberen Oberfläche des Auslegerbalkens (200) vorgesehen ist.
7. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei der Auslegerrahmen (100) einen beweglichen Nocken (400) umfasst, der in eine erste Aussparung (211) bewegt werden kann, die der zweiten und der dritten Stelle (L2, L3) entspricht, so dass die zweite vertikale Kraft (Fv2) und die erste horizontale Kraft (Fh1) in der ausgefahrenen Position (P1) des Auslegerbalkens auf den Auslegerbalken wirken können, und in eine zweite Aussparung

(212) bewegt werden kann, die der fünften und sechsten Position (L5, L6) entspricht, um zu ermöglichen, dass die vierte vertikale Kraft (Fv4) und die dritte horizontale Kraft (Fh3) auf den Auslegerbalken (200) in der ersten halb ausgefahrenen Position (P2) des Auslegerträgers wirken, wobei optional der bewegliche Nocken (400) ein drehbarer Nocken ist, optional der bewegliche Nocken durch einen Nockenbetätiger (450), optional einen Betätigungszylinder, optional einen pneumatischen, hydraulischen, elektrischen oder manuell gesteuerten Betätigungszylinder betätigt werden kann, wobei optional die erste und zweite Aussparung in einer oberen Oberfläche des Auslegerbalkens (200) vorgesehen sind.

8. Auslegervorrichtung nach einem der vorhergehenden Ansprüche, wobei die Auslegervorrichtung ein Gleitelement (500) mit ersten und zweiten Enden (501, 502) umfasst, wobei das erste Ende (501) mit dem Auslegerbalken (200) zusammenwirkt und das zweite Ende (502) mit dem Auslegerrahmen (100) zusammenwirkt, um das Ausfahren des Auslegerbalkens vom Auslegerrahmen zu ermöglichen und um zu ermöglichen, dass die zweite horizontale Kraft (Fh2) in der ausgefahrenen Position (P1) des Auslegerbalkens auf den Auslegerbalken wirkt, wobei optional das erste Ende des Gleitelements verschiebbar mit dem Auslegerbalken gekoppelt ist, um eine Bewegung des Gleitelements in Bezug auf den Auslegerbalken zu ermöglichen.
9. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei der Auslegerrahmen (100) einen ersten Anschlag (111) aufweist und das zweite Ende (501) des Gleitelements beim Ausfahren des Auslegerbalkens (200) aus dem Auslegerrahmen in Bezug auf den Auslegerrahmen verschiebbar ist, und das zweite Ende (502) mit dem ersten Anschlag zusammenwirkt, um der zweiten horizontalen Kraft (Fh2) zu ermöglichen, in der ausgefahrenen Position (P1) des Auslegerbalkens auf den Auslegerbalken zu wirken.
10. Auslegervorrichtung nach dem vorhergehenden Anspruch in Abhängigkeit von Anspruch 4, wobei das erste Ende (501) des Gleitelements (500) mit dem Auslegerbalken (200) zusammenwirkt und das zweite Ende (502) mit dem Auslegerrahmen (100) zusammenwirkt, um das Ausfahren des Auslegerbalkens aus dem Auslegerrahmen zu ermöglichen und die Einwirkung der vierten horizontalen Kraft (Fh4) auf den Auslegerbalken in der ersten halb ausgefahrenen Position (P2) des Auslegerbalkens zu ermöglichen, wobei der Auslegerrahmen einen zweiten Anschlag (112) umfasst und das zweite Ende (502) des Gleitelements mit dem zweiten Anschlag zusammenwirkt, um zu ermöglichen, dass die vierte horizontale Kraft (Fh4) auf den Auslegerbalken in der

ersten halb ausgefahrenen Position (P2) des Auslegerbalkens wi rkt.

11. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei das erste Ende (501) des Gleitelements (500) verschiebbar mit dem Auslegerbalken (200) verbunden ist, um eine Bewegung des Gleitelements in Bezug auf den Auslegerbalken (200) zwischen einer ersten Gleitelementposition (SE1), in der das zweite Ende (502) des Gleitelements durch den Auslegerbalken gehalten wird, und einer zweiten Gleitelementposition (SE2), in der das zweite Ende relativ zum Auslegerrahmen (100) gleiten kann, zu ermöglichen. 5
12. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei die Auslegervorrichtung erste und zweite Auslegerbalken-Aktuatoren (150, 160) umfasst, die zum Bewegen des Auslegerbalkens (200) und des Auslegerrahmens (100) relativ zueinander und zum Bewegen des Gleitelements (500) und des Auslegerbalkens relativ zueinander betreibbar sind. 10
13. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei die Auslegervorrichtung so konfiguriert ist, dass der erste Auslegerbalken-Aktuator (150) betreibbar ist, um das Bewegen des Auslegerbalkens (200) zusammen mit dem zweiten Auslegerbalken-Aktuator (160) und dem Gleitelement (500) in Bezug auf den Auslegerrahmen (100) zu ermöglichen und der zweite Aktuator betreibbar ist, um das Bewegen des Auslegerbalkens in Bezug auf das Gleitelement und den Auslegerrahmen zu ermöglichen. 15
14. Auslegervorrichtung nach dem vorhergehenden Anspruch, wobei der erste Auslegerbalken-Aktuator (1150) einen ersten Ausleger-Betätigungszyylinder mit einem ersten Zylinderteil (151) und einem ersten Kolbenteil (152) umfasst, der in Bezug auf den ersten Zylinderteil beweglich ist und mit dem Auslegerrahmen (100) gekoppelt ist, wobei der zweite Auslegerbalken-Aktuator (160) einen zweiten Ausleger-Betätigungszyylinder mit einem zweiten Zylinderteil (161) und einem zweiten Kolbenteil (162) umfasst, der in Bezug auf den zweiten Zylinderteil beweglich ist und mit dem Auslegerbalken (200) gekoppelt ist, und die ersten und zweiten Zylinderteile und das erste Ende des Gleitelements fest miteinander gekoppelt sind. 20
15. Fahrzeug, das eine Auslegervorrichtung (10) nach einem der vorhergehenden Ansprüche umfasst, wobei optional das Fahrzeug ein mobiler Kran ist. 25

Revendications

1. Ensemble stabilisateur (10) pour supporter un véhi-

cule sur une surface de support (S), l'ensemble stabilisateur comprenant

- un cadre stabilisateur (100) ;
- une poutre stabilisatrice (200),

la poutre stabilisatrice (200) étant mobile le long d'une direction d'extension horizontale (E) par rapport au cadre stabilisateur (100) entre une position rétractée (P4), dans laquelle la poutre stabilisatrice est située à l'intérieur du cadre stabilisateur, et une position étendue (P1), dans laquelle la poutre stabilisatrice est étendue à partir du cadre stabilisateur, et

la poutre stabilisatrice (200) ayant une extrémité proximale (201) et une extrémité distale (202) par rapport au cadre stabilisateur (100) dans la position étendue de la poutre stabilisatrice ; et

- un support stabilisateur (300) couplé à l'extrémité distale de la poutre stabilisatrice (200) pour permettre de supporter l'ensemble stabilisateur (10) sur la surface de support (S) dans une position de support (SP) du support stabilisateur,

l'ensemble stabilisateur étant configuré de sorte que, dans la position étendue de la poutre stabilisatrice (200) et la position de support du support stabilisateur (300),

-- un premier couple agit sur la poutre stabilisatrice (200), le premier couple étant déterminé par une première force verticale (Fv1) agissant vers le haut à un premier emplacement (L1) sur l'extrémité distale (202) de la poutre stabilisatrice et une deuxième force verticale (Fv2) agissant vers le bas à un deuxième emplacement (L2) sur la poutre stabilisatrice, le deuxième emplacement étant séparé du premier emplacement par une première distance horizontale (Dh1) vers l'extrémité proximale (201) de la poutre stabilisatrice, les première et deuxième forces verticales agissant en conséquence de la poutre stabilisatrice étant supportée par le support stabilisateur (300) et du cadre stabilisateur (100) étant supporté par la poutre stabilisatrice, respectivement, et

-- un deuxième couple agit sur la poutre stabilisatrice (200) pour équilibrer le premier couple, le deuxième couple étant déterminé par l'interaction entre le cadre stabilisateur (100) et la poutre stabilisatrice,

caractérisé en ce que le deuxième couple est au moins sensiblement déterminé par une première force horizontale (Fh1) agissant vers l'extérieur à un troisième empla-

- cement (L3) sur la poutre stabilisatrice par rapport au cadre stabilisateur et par une deuxième force horizontale (Fh2) agissant vers l'intérieur à un quatrième emplacement (L4) sur la poutre stabilisatrice par rapport au cadre stabilisateur, le quatrième emplacement étant séparé du troisième emplacement par une première distance verticale (Dv1) dans une direction vers le bas.
2. Ensemble stabilisateur selon la revendication précédente, où les deuxième et troisième emplacements (L2, L3) sont à l'extrémité proximale (201) de la poutre stabilisatrice (200), facultativement à l'extrémité extrême de l'extrémité proximale.
3. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où les deuxième et troisième emplacements (L2, L3) sont des emplacements coïncidents.
4. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où la poutre stabilisatrice (200) est mobile le long de la direction d'extension (E) jusqu'à une première position semi-étendue (P2) entre la position rétractée (P4) et la position étendue (P1),
- l'ensemble stabilisateur étant configuré de sorte que, dans la première position semi-étendue de la poutre stabilisatrice (200) et la position de support du support stabilisateur (300),
- un troisième couple agit sur la poutre stabilisatrice (200), le troisième couple étant déterminé par une troisième force verticale (Fv3) agissant vers le haut au premier emplacement (L1) sur l'extrémité distale (202) de la poutre stabilisatrice et une quatrième force verticale (Fv4) agissant vers le bas à un cinquième emplacement (L5) sur la poutre stabilisatrice, le cinquième emplacement étant séparé du premier emplacement par une deuxième distance horizontale (Dh2) inférieure à la première distance horizontale (Dh1) vers l'extrémité proximale (201) de la poutre stabilisatrice, les troisième et quatrième forces verticales agissant en conséquence de la poutre stabilisatrice étant supportée par le support stabilisateur et du cadre stabilisateur étant supporté par la poutre stabilisatrice, respectivement, et
- un quatrième couple agit sur la poutre stabilisatrice (200) pour équilibrer le troisième couple, le quatrième couple étant déterminé par l'interaction entre le cadre stabilisateur (100) et la poutre stabilisatrice,
- où le quatrième couple est au moins sensiblement déterminé par une troisième force horizontale (Fh3) agissant vers l'extérieur à un sixième

emplacement (L6) sur la poutre stabilisatrice (200) par rapport au cadre stabilisateur (100) et une quatrième force horizontale (Fh4) agissant vers l'intérieur à un septième emplacement (L7) sur la poutre stabilisatrice par rapport au cadre stabilisateur, le septième emplacement étant séparé du sixième emplacement par une deuxième distance verticale (Dv2) dans une direction vers le bas,

facultativement les cinquième et sixième emplacements (L5, L6) étant des emplacements coïncidents,

facultativement, les quatrième et septième emplacements (L4, L7) étant des emplacements coïncidents.

5. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où la poutre stabilisatrice (200) est mobile le long de la direction d'extension (E) jusqu'à une deuxième position semi-étendue (P3) entre la position rétractée (P4) et la position étendue (P1),

l'ensemble stabilisateur étant configuré de sorte que, dans la deuxième position semi-étendue de la poutre stabilisatrice (200) et la position de support du support stabilisateur (300),

-- un cinquième couple agit sur la poutre stabilisatrice (200), le cinquième couple étant déterminé par une cinquième force verticale (Fv5) agissant vers le haut au premier emplacement (L1) sur l'extrémité distale (202) de la poutre stabilisatrice et une sixième force verticale (Fv6) agissant vers le bas à un huitième emplacement (L8) sur la poutre stabilisatrice, le huitième emplacement étant séparé du premier emplacement par une troisième distance horizontale (Dh3) inférieure à la première distance horizontale (Dh1) vers l'extrémité proximale (201) de la poutre stabilisatrice, les cinquième et sixième forces verticales agissant en conséquence de la poutre stabilisatrice étant supportée par le support stabilisateur (300) et du cadre stabilisateur (100) étant supporté par la poutre stabilisatrice, respectivement, et

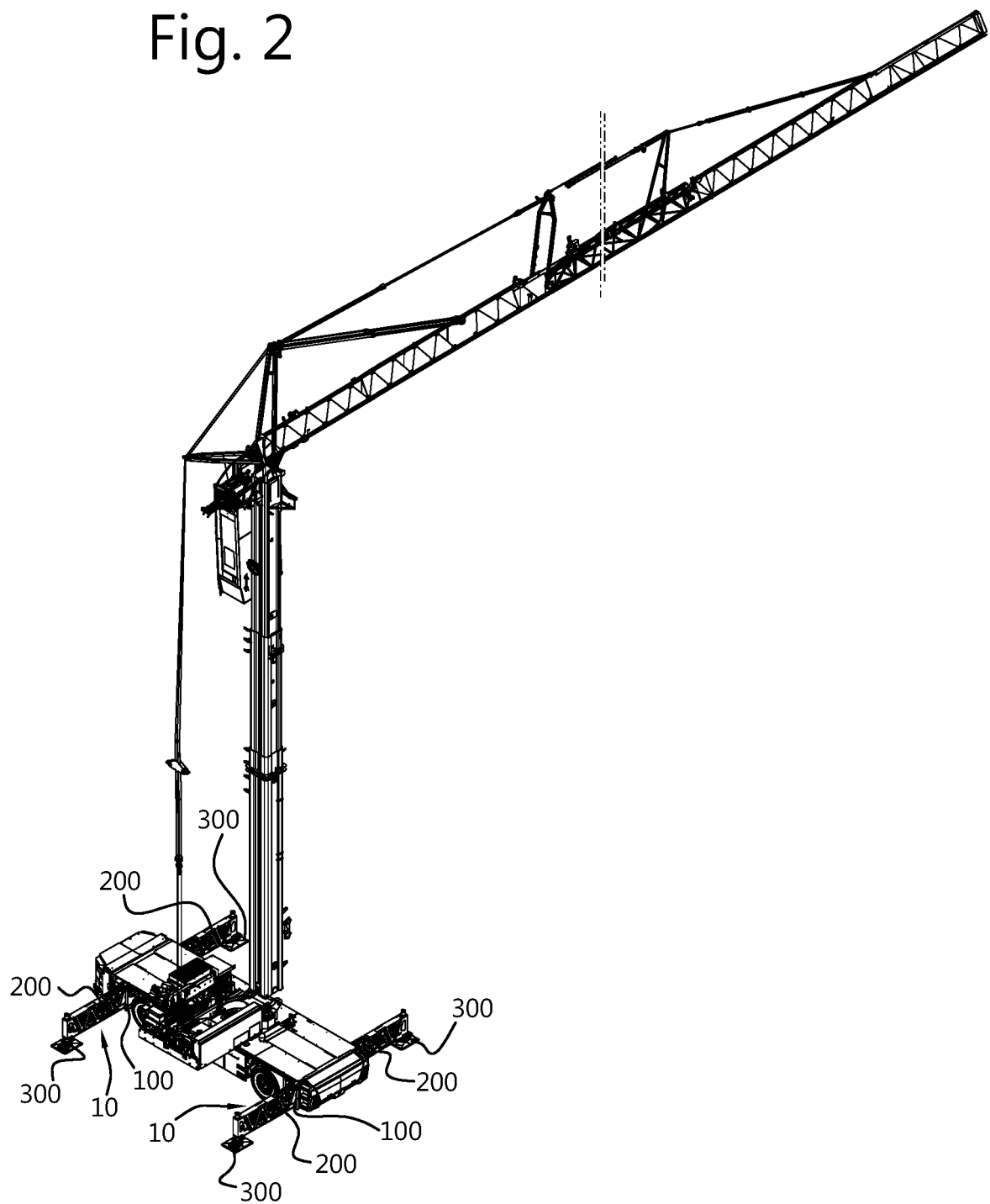
-- un sixième couple agit sur la poutre stabilisatrice (200) pour équilibrer le cinquième couple, le sixième couple étant déterminé par l'interaction entre le cadre stabilisateur (100) et la poutre stabilisatrice,

où le sixième couple est déterminé par une septième force verticale (Fv7) agissant vers le bas à un neuvième emplacement (L9) sur la poutre stabilisatrice (200) et une huitième force verticale (Fv8) agissant vers le haut à un dixième emplacement (L10) sur la poutre stabilisatrice, le dixième emplacement étant séparé du neuvième emplacement par une quatrième distance

- horizontale (Dh4) vers l'extrémité proximale (201) de la poutre stabilisatrice, facultativement, la deuxième position semi-étendue (P3) étant située entre la position rétractée (P4) et la première position semi-étendue (P2), et la troisième distance horizontale (Dh3) étant inférieure à la deuxième distance horizontale (Dh2).
6. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où le cadre stabilisateur (100) comprend une came mobile (400) qui est mobile dans un premier ou un deuxième renforcement (211, 212), correspondant au deuxième et au troisième emplacement (L2, L3) ou au cinquième et au sixième emplacement (L5, L6), respectivement, de manière à permettre à la deuxième force verticale (Fv2) et à la première force horizontale (Fh1) ou à permettre à la quatrième force verticale (Fv4) et à la troisième force horizontale (Fh3), respectivement, d'agir sur la poutre stabilisatrice (200) dans la position étendue (P1) ou dans la première position semi-étendue (P2), respectivement, de la poutre stabilisatrice, facultativement la came mobile (400) étant une came rotative, facultativement la came mobile pouvant être opérable par un actionneur de came (450), facultativement un cylindre d'actionnement, facultativement un cylindre d'actionnement à commande pneumatique, hydraulique, électrique ou manuelle, facultativement le premier ou le deuxième renforcement étant prévu dans une surface supérieure de la poutre stabilisatrice (200).
 7. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où le cadre stabilisateur (100) comprend une came mobile (400) qui est mobile dans un premier renforcement (211) correspondant au deuxième et au troisième emplacement (L2, L3) de manière à permettre à la deuxième force verticale (Fv2) et à la première force horizontale (Fh1) d'agir sur la poutre stabilisatrice dans la position étendue (P1) de la poutre stabilisatrice, et est mobile dans un deuxième renforcement (212) correspondant au cinquième et au sixième emplacement (L5, L6) de manière à permettre à la quatrième force verticale (Fv4) et à la troisième force horizontale (Fh3) d'agir sur la poutre stabilisatrice (200) dans la première position semi-étendue (P2) de la poutre stabilisatrice, facultativement la came mobile (400) étant une came rotative, facultativement la came mobile étant opérable par un actionneur de came (450), facultativement un cylindre d'actionnement, facultativement un cylindre d'actionnement à commande pneumatique, hydraulique, électrique ou manuelle, facultativement les premier et deuxième renforcements étant prévus dans une surface supérieure de la poutre stabilisatrice (200).
 8. Ensemble stabilisateur selon l'une quelconque des revendications précédentes, où l'ensemble stabilisateur comprend un élément coulissant (500) ayant des première et deuxième extrémités (501, 502), la première extrémité (501) coopérant avec la poutre stabilisatrice (200) et la deuxième extrémité (502) coopérant avec le cadre stabilisateur (100) pour permettre l'extension de la poutre stabilisatrice à partir du cadre stabilisateur et pour permettre à la deuxième force horizontale (Fh2) d'agir sur la poutre stabilisatrice dans la position étendue (P1) de la poutre stabilisatrice, facultativement la première extrémité de l'élément coulissant étant couplée de manière coulissante à la poutre stabilisatrice pour permettre le déplacement de l'élément coulissant par rapport à la poutre stabilisatrice.
 9. Ensemble stabilisateur selon la revendication précédente, où le cadre stabilisateur (100) comprend un premier arrêt (111), la deuxième extrémité (501) de l'élément coulissant est coulissante par rapport au cadre stabilisateur lors de l'extension de la poutre stabilisatrice (200) du cadre stabilisateur, et la deuxième extrémité (502) coopère avec le premier arrêt pour permettre à la deuxième force horizontale (Fh2) d'agir sur la poutre stabilisatrice dans la position étendue (P1) de la poutre stabilisatrice.
 10. Ensemble stabilisateur selon la revendication précédente comme dépendant de la revendication 4, où la première extrémité (501) de l'élément coulissant (500) coopère avec la poutre stabilisatrice (200) et la deuxième extrémité (502) coopère avec le cadre stabilisateur (100) pour permettre l'extension de la poutre stabilisatrice à partir du cadre stabilisateur et pour permettre à la quatrième force horizontale (Fh4) d'agir sur la poutre stabilisatrice dans la première position semi-étendue (P2) de la poutre stabilisatrice, le cadre stabilisateur comprend un deuxième arrêt (112), et la deuxième extrémité (502) de l'élément coulissant coopère avec le deuxième arrêt pour permettre à la quatrième force horizontale (Fh4) d'agir sur la poutre stabilisatrice dans la première position semi-étendue (P2) de la poutre stabilisatrice.
 11. Ensemble stabilisateur selon la revendication précédente, où la première extrémité (501) de l'élément coulissant (500) est couplée de manière coulissante à la poutre stabilisatrice (200) pour permettre le déplacement de l'élément coulissant par rapport à la poutre stabilisatrice (200) entre une première position d'élément coulissant (SE1), dans laquelle la deuxième extrémité (502) de l'élément coulissant est maintenue par la poutre stabilisatrice, et une deuxième position d'élément coulissant (SE2), dans laquelle la deuxième extrémité est autorisée à coulisser par rapport au cadre stabilisateur (100).

12. Ensemble stabilisateur selon la revendication précédente, où l'ensemble stabilisateur comprend premier et deuxième actionneurs de poutre stabilisatrice (150, 160) opérables pour déplacer la poutre stabilisatrice (200) et le cadre stabilisateur (100) l'un par rapport à l'autre, et pour déplacer l'élément coulissant (500) et la poutre stabilisatrice l'un par rapport à l'autre. 5
13. Ensemble stabilisateur selon la revendication précédente, où l'ensemble stabilisateur est configuré de sorte que le premier actionneur de poutre stabilisatrice (150) est opérable pour permettre de déplacer la poutre stabilisatrice (200) conjointement avec le deuxième actionneur de poutre stabilisatrice (160) et l'élément coulissant (500) par rapport au cadre stabilisateur (100), et le deuxième actionneur est opérable pour permettre de déplacer la poutre stabilisatrice par rapport à l'élément coulissant et au cadre stabilisateur. 10
15
20
14. Ensemble stabilisateur selon la revendication précédente, où le premier actionneur de poutre stabilisatrice (1150) comprend un premier cylindre d'actionnement stabilisateur ayant une première partie de cylindre (151) et une première partie de piston (152) mobile par rapport à la première partie de cylindre et couplée au cadre stabilisateur (100), le deuxième actionneur de poutre stabilisatrice (160) comprend un deuxième cylindre d'actionnement stabilisateur ayant une deuxième partie de cylindre (161) et une deuxième partie de piston (162) mobile par rapport à la deuxième partie de cylindre et couplée à la poutre stabilisatrice (200), et les première et deuxième parties de cylindre et la première extrémité de l'élément coulissant couplées de manière fixe l'une à l'autre. 25
30
35
15. Véhicule comprenant un ensemble stabilisateur (10) selon l'une quelconque des revendications précédentes, facultativement, le véhicule étant une grue mobile. 40
45
50
55

Fig. 2



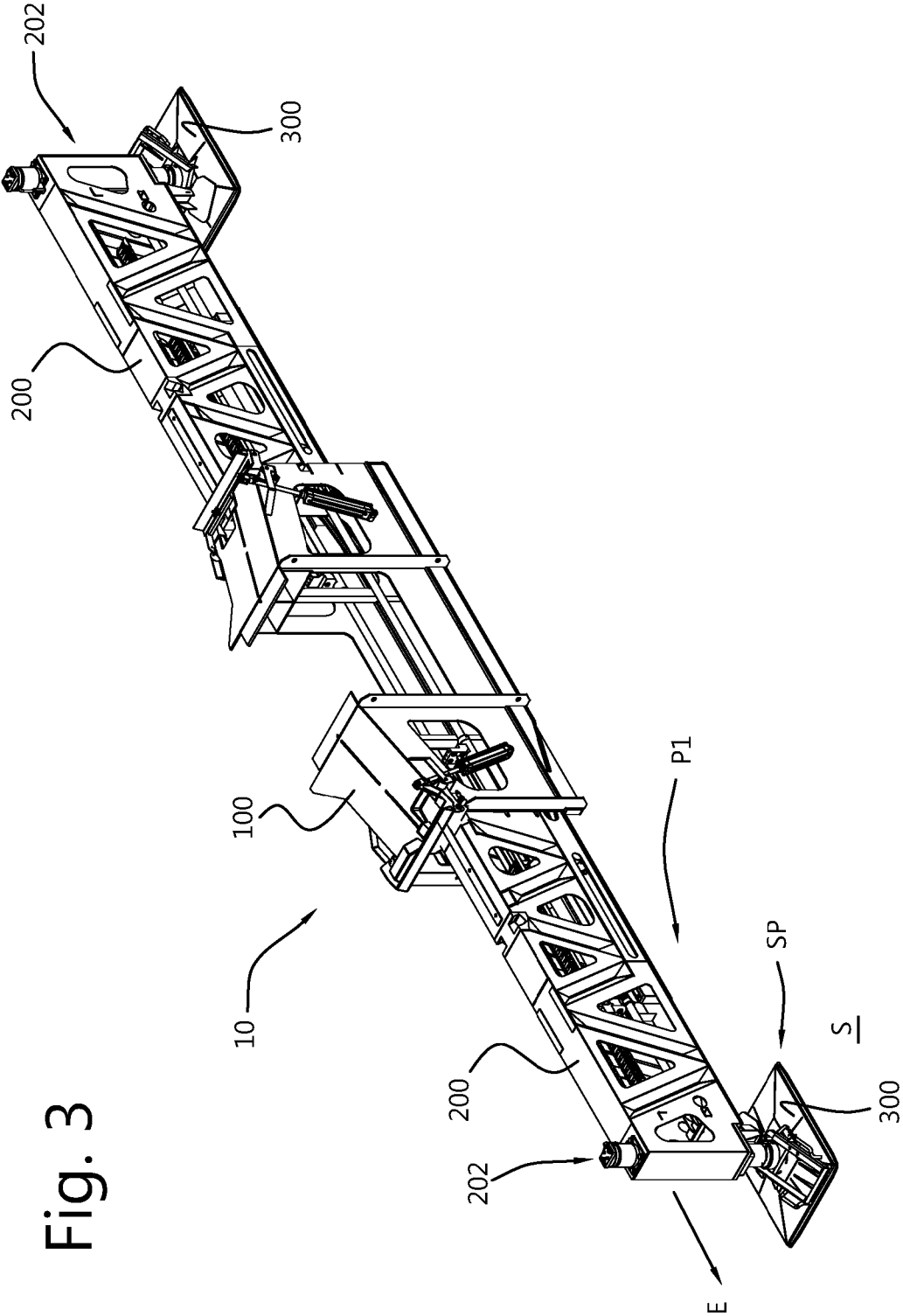


Fig. 3

Fig. 4A

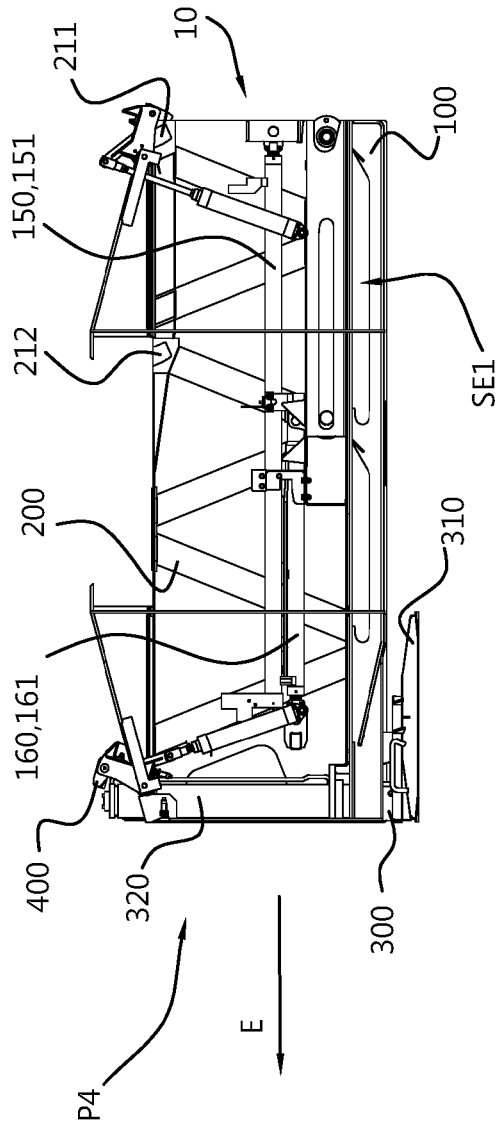


Fig. 4B

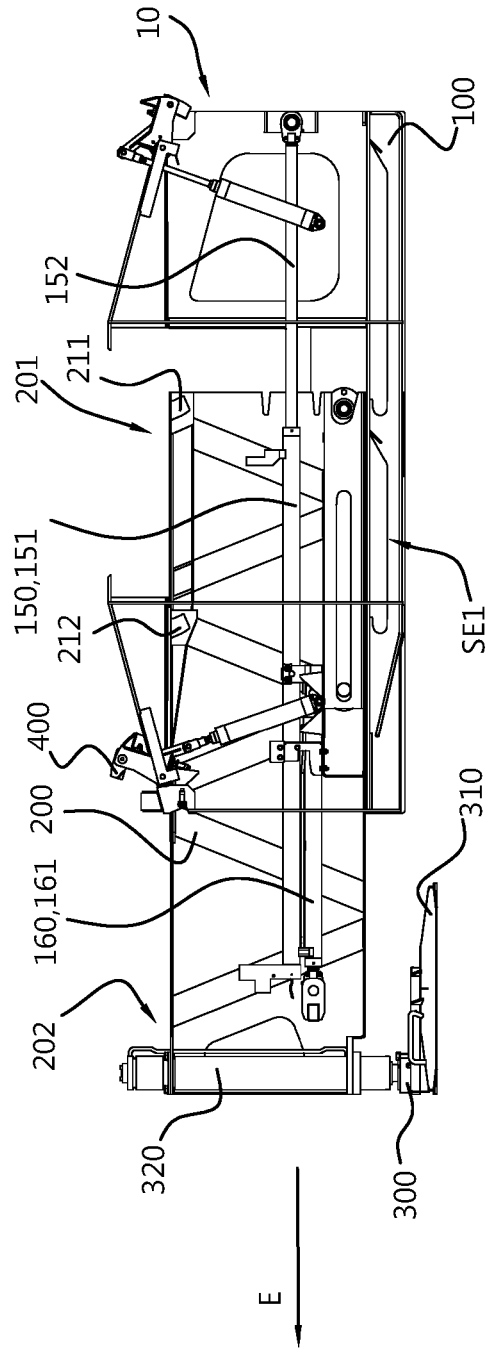


Fig. 4C

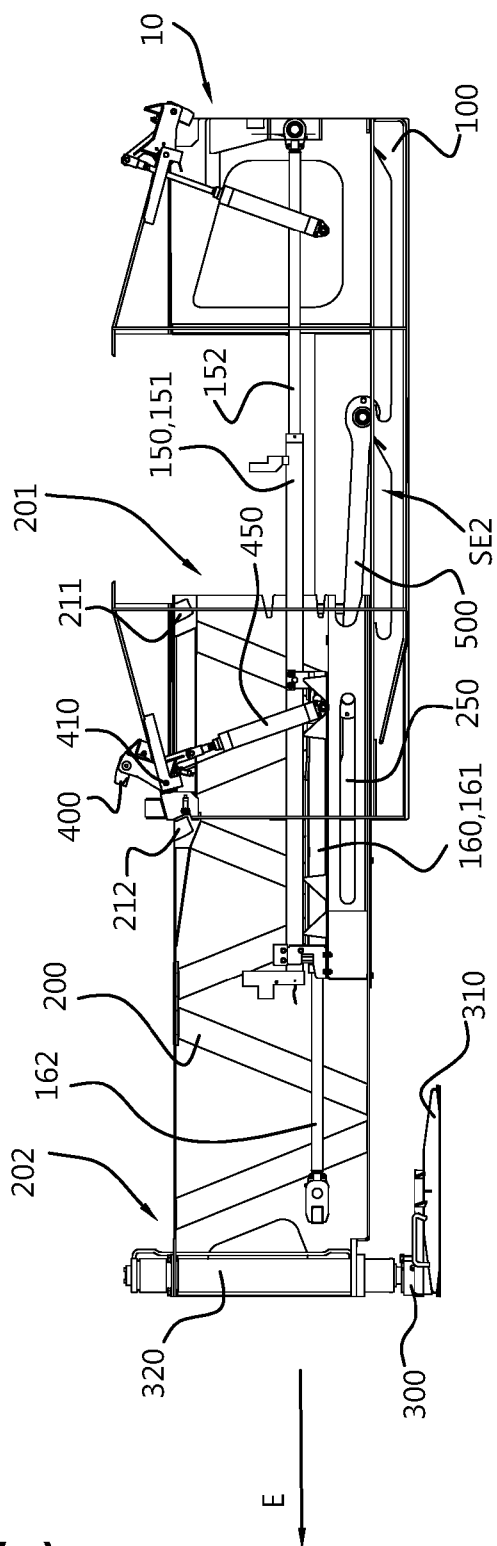


Fig. 4D

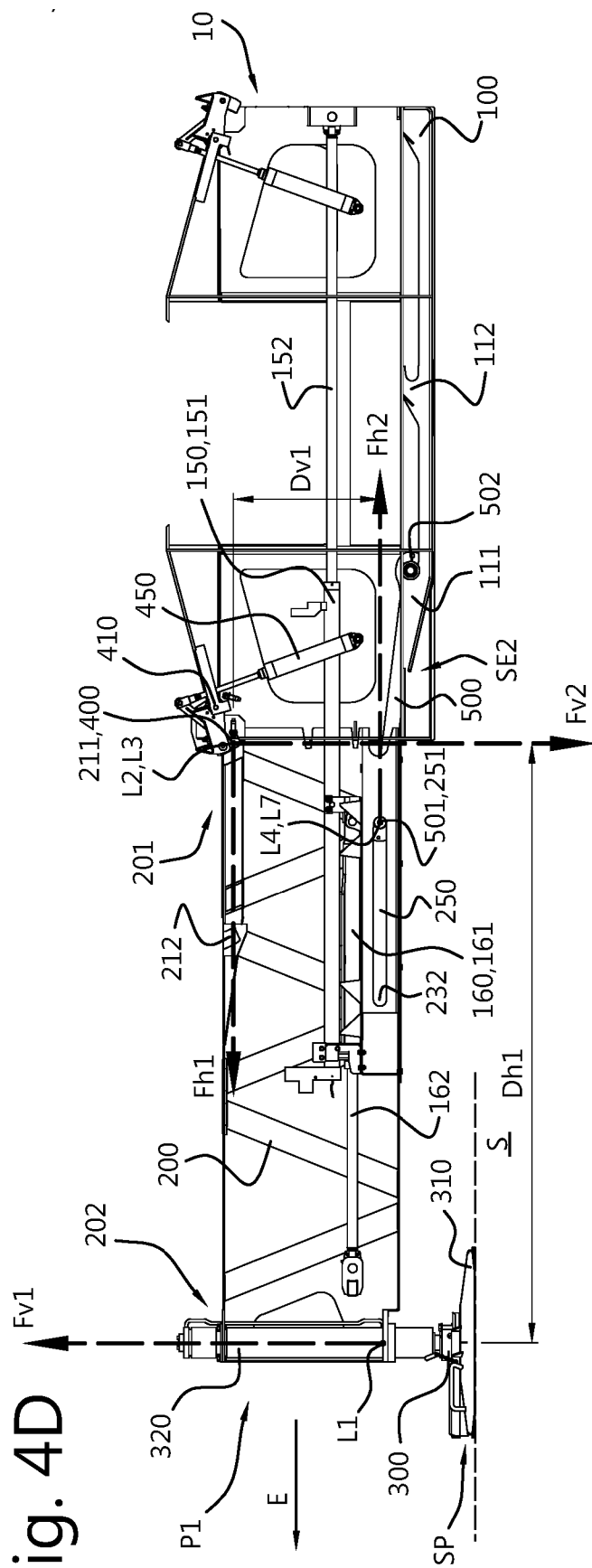


Fig. 5A

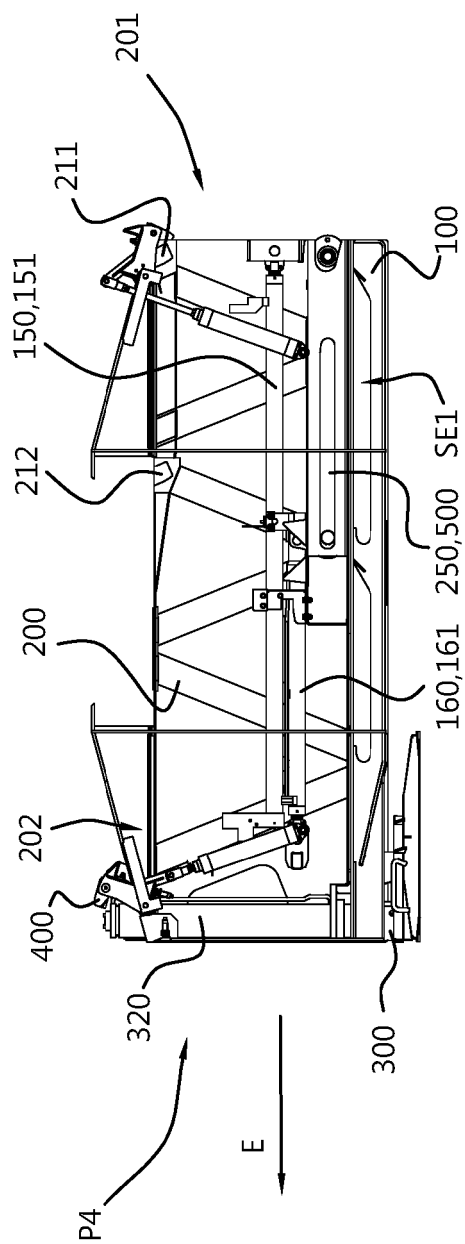


Fig. 5B

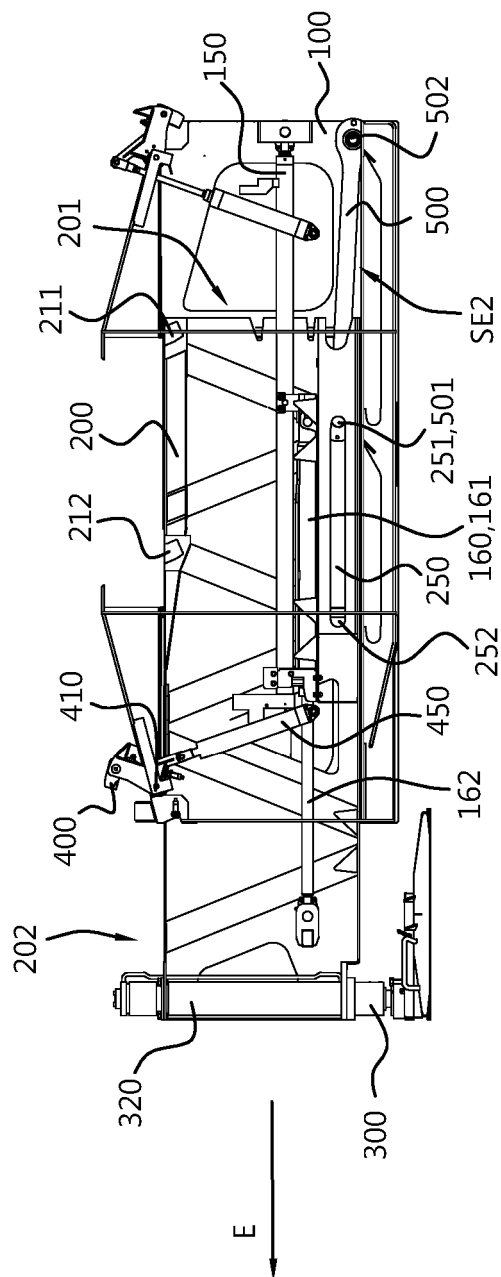


Fig. 5C

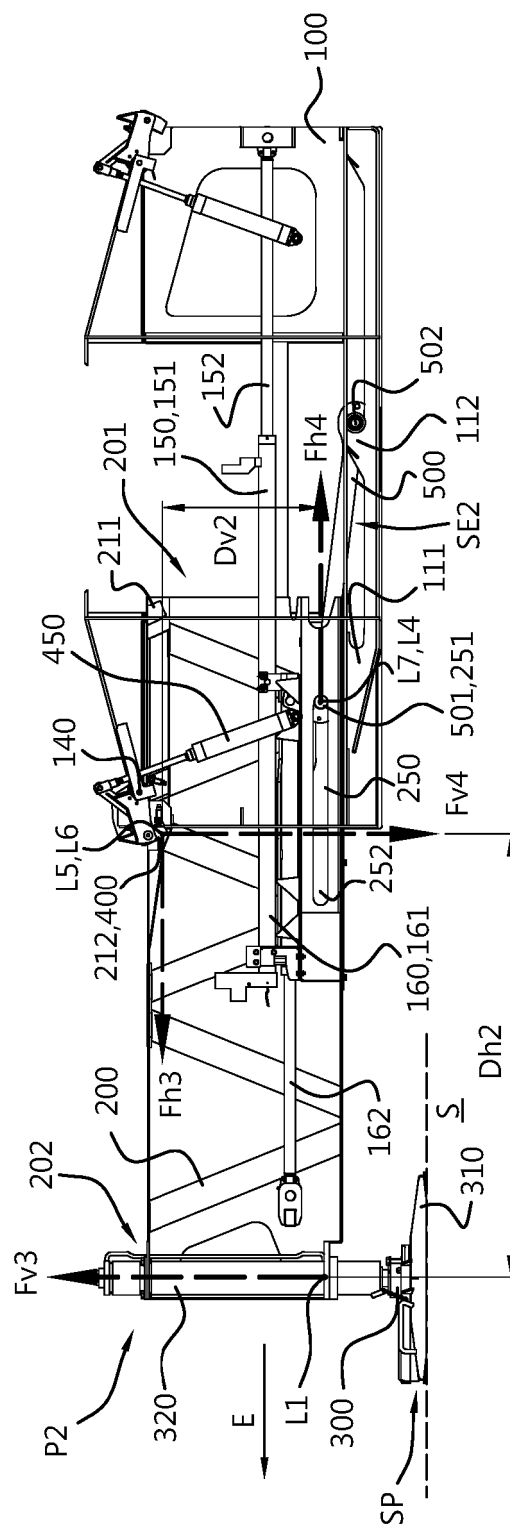


Fig. 6A

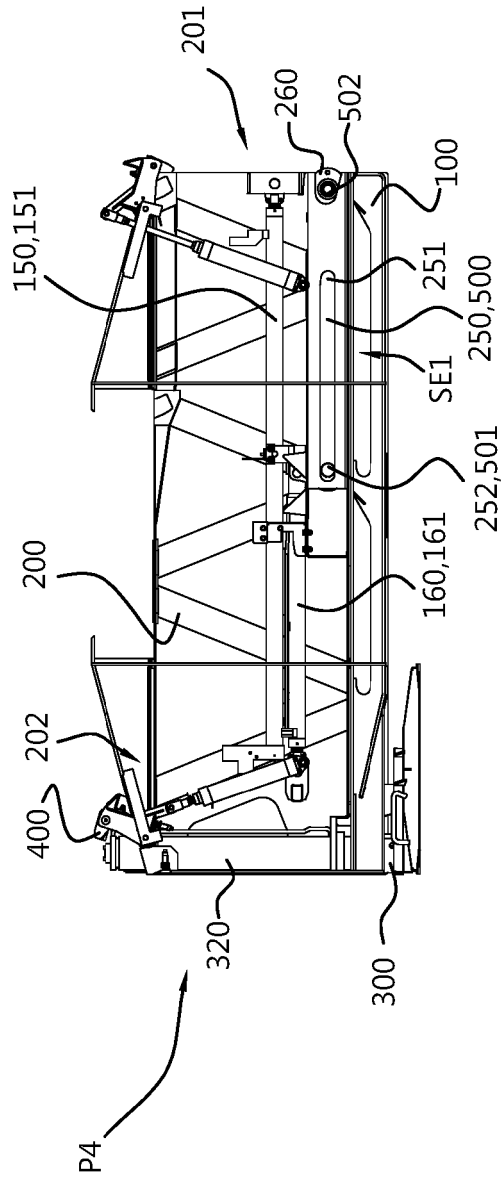
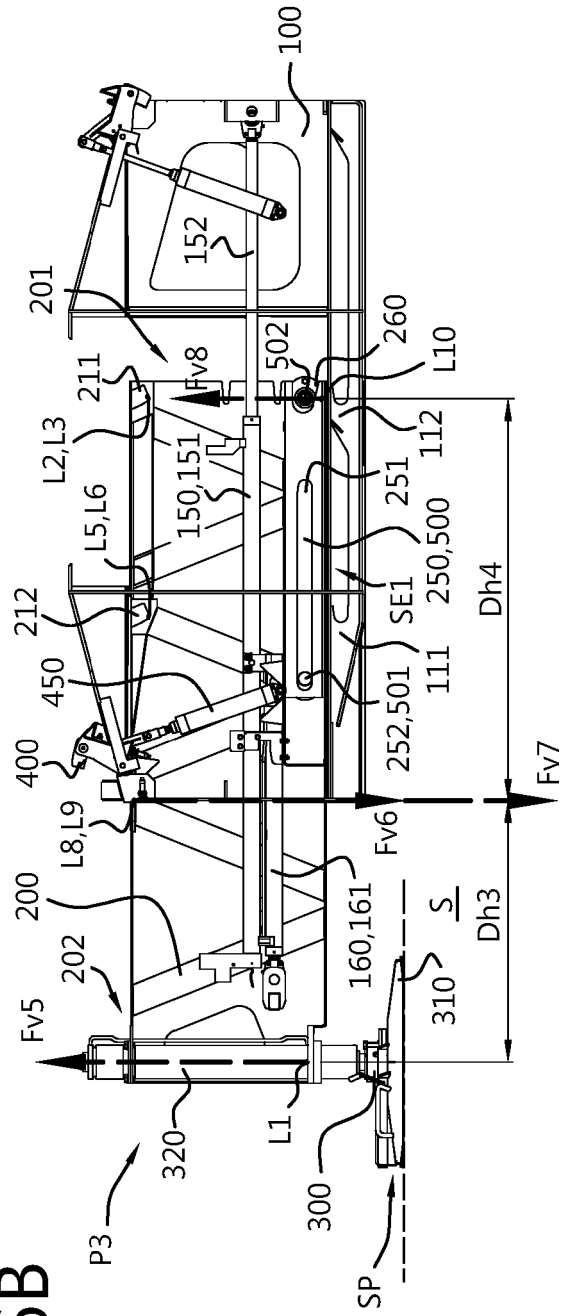


Fig. 6B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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