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(54) **Wheel mounting**

(57) The wheel mounting according to the invention is intended to be used in working machines, for example carriages for lifting and moving and so-called straddle carriers, which move transport containers. The wheel mounting comprises at least two pairs of wheels arranged to be movable vertically with respect to the frame (R) of the working machine, and wherein the load to be supported is arranged to rest on the frame. The wheels (1) in the wheel mounting are pivoted to the frame by means

of a bearing means, such as a supporting bar (4), attached to each wheel, to move vertically with respect to the frame (R). In the wheels (1) of the wheel mounting, the bearing means, such as supporting bars (4), are connected pairs on the same side of the working machine with a rocking arm (8) pivoting in an articulated manner in the vertical plane. The middle part of the rocking arm (8) is connected in an articulated manner to a means (10) which is effective in the vertical direction and transmits the movements of the rocking arm.

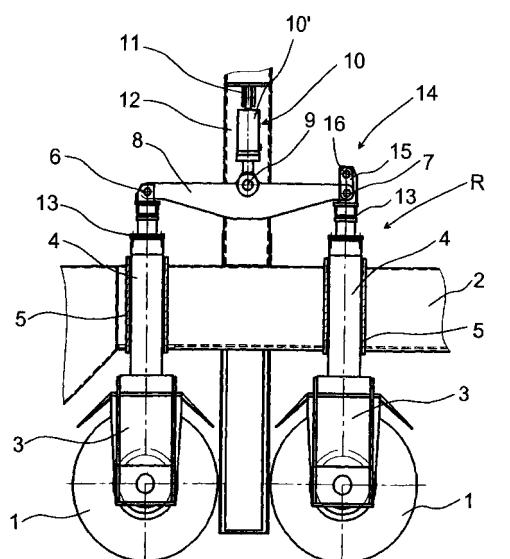


Fig. 1

Description

[0001] The invention relates to a wheel mounting to be used in working machines for moving loads and transport containers in particular, such as carriages for lifting and moving and so-called straddle carriers. The wheel mounting comprises at least two pairs of wheels arranged movable vertically with respect to the frame of the working machine. The load to be supported is arranged to rest on the frame.

[0002] As for prior art, reference is made to publications SE 459580 and US 3 348 711. The constructions presented in these publications are complex, and the requirements of effective load handling, especially wheel loadings and balancing requirements, are not taken into account.

[0003] The purpose of this invention is to present a wheel mounting by means of which the drawbacks present in the prior art can be eliminated to a large extent, thus improving the state of art prevailing in the field. The wheel mounting according to the invention is primarily characterized in that

- the wheels in the wheel mounting are pivoted to the frame with a bearing means, such as a supporting bar attached to each wheel, to move vertically with respect to the frame, that
- the bearing means, such as supporting bars, are connected in the wheels of the wheel mounting in pairs on the same side of the working machine with a rocking arm pivoting in an articulated manner in the vertical plane, and
- the middle part of the rocking arm is connected in an articulated manner to a means which is effective in the vertical direction and transmits the movements of the rocking arm.

[0004] First of all, an advantage attained with the present solution is that the loadings exerted on the wheel pairs in the horizontal direction either in the direction of motion of the wheels or in a direction transverse to the direction of motion of the wheels, and on the other hand the vertical loadings exerted on the wheels can be distributed in such a way that the horizontal loadings are received with vertical bearing means, especially with supporting bars, wherein the means which is effective in the vertical direction and is connected in an articulated manner to the middle part of the rocking arm, only receives the movements of the rocking arm, only receives the vertical loadings and movements exerted on the wheels, wherein the means in question can be advantageously used to balance the wheel loadings between the pairs of wheels located at the same point in the transverse direction of the working machine. The above-presented loading distribution makes it possible to achieve an optimal structure in view of the strength of materials.

[0005] The appended dependent claims present some advantageous embodiments of the wheel mount-

ing according to the invention.

[0006] In the description hereinbelow the invention will be described in more detail with reference to the embodiments shown in the appended drawings, wherein

Fig. 1 shows a first embodiment of the wheel mounting according to the invention in a side-view,

Fig. 2 shows the wheel mounting of Fig. 1 as seen in a direction perpendicular to the longitudinal direction of the machine,

Fig. 3 shows a second embodiment of the wheel mounting according to the invention as seen from the direction of Fig. 2,

Fig. 4 shows a top-view of a common turning mechanism of two wheel mountings located successively in a working machine, and

Fig. 5 shows a schematical perspective view of a so-called straddler carrier construction in which wheel mountings according to the invention are used to attain a so-called three-point support.

[0007] With reference to Figs. 1 and 2 in particular, the wheels 1 of the wheel mounting according to the invention, which are successive with respect to the frame R of a working machine, are mounted on bearings in the frame R of the working machine, especially in the presented embodiment in a case-like horizontal beam 2 extending in the longitudinal direction of the frame R, to move vertically with respect to the frame. On the upper part of the fixing parts 3 (mounting and bearing arrangement) of the wheels 1, vertical support bars 4 are fixed to function as bearing means, and on the horizontal beam 2 by the respective wheels 1, vertical sleeve parts 5 are placed, which sleeve parts 5 extend through the horizontal beam, wherein the inner surfaces of the supporting bars 4 and the sleeves 5 form a slide bearing arrangement therebetween, allowing the movement of the supporting bars 4 in the axial direction and the rotation of the same with respect to the frame to turn the wheels. The length of the slide bearing arrangement, i. e. the section in which the support bars 4 and the sleeves 5 face each other, can be approximately 1000 mm, preferably at least 700 to 800 mm. Thus, the vertical bearing arrangement receives the horizontal loadings exerted by the wheels 1 on the wheel mounting, and the rest of the parts of the wheel mounting which are located above the horizontal beam 2, are only subjected to the forces which are exerted on the wheels 1 in the vertical direction.

[0008] Further referring to Figs. 1 and 2, the bearing means, especially the supporting bars 4, are connected together in pairs in an articulated manner (articulation points 6 and 7) in the wheel mounting on the same lon-

gitudinal side of the working machine by means of a rocking arm 8, which is arranged to rotate around a horizontal joint 9 in the vertical plane. The horizontal joint 9 is detached from the frame R, and thus the rocking arm 8 also moves as a whole in the vertical direction in accordance with the wheel loadings. The middle part of the rocking arm 8, i.e. the horizontal joint 9 is connected to a member 10 which is effective in the vertical direction and transmits the movements of the rocking arm 8, the member 10 being attached with a horizontal joint 11 to the vertical beam 12 in the frame of the working machine according to the embodiment of Figs. 1 and 2. When unloaded, the rocking arm 8 extends in the horizontal direction, i.e. the articulation points 6 and 7 are on the same horizontal line. In the embodiment of Figs. 1 and 2, the member 10 which is effective in the vertical direction and transmits the movements of the rocking arm 8, is a cylinder piston-combination 10' which operates by means of a pressurized medium, especially by means of hydraulic fluid.

[0009] The bearing means, especially the supporting bars 4 are equipped with a horizontal bearing arrangement 13 in the upper part of the supporting bars, i.e. above the upper surface of the horizontal beam 2 and underneath the articulation points 6 and 7, wherein the lower part of the supporting bars 4 and the wheels connected thereto can be turned around the vertical axis of the supporting bars 4 by means of a turning apparatus which is attached to the supporting bars and corresponds to for example the apparatus shown in Fig. 4.

[0010] Further referring to Fig. 1 in particular, the upper part of the second bearing means, such as the supporting bar 4, is provided with a means 14 for balancing the movements of the rocking arm 8 and the supporting bars 4. (The rocking bar 8 performs a vertical movement and a rotary movement around the joint 9 in the vertical direction as a result of the loadings exerted on the wheels 1). The balancing means 14 is composed of a vertical (in the horizontal position of the rocking arm 8) articulated lug 15, which is journaled on one hand to the corresponding end of the rocking arm 8 with a joint 7, and on the other hand to the upper end of the supporting bar 4 with a horizontal joint 16. Thus, the rotary movements of the rocking arm 8 around the joint 9 do not produce a deflection or flexural stresses to the supporting bars 4 via the rocking arm 8, because the joint 7 is capable of moving sufficiently (while the articulated lug 15 rotates on the vertical plane) also in the horizontal direction in accordance with the rotation of the rocking arm 8, and this movement compensates for the horizontal deviation in the distance caused by the rotary movement of the ends (articulation points 6 and 7) of the rocking arm along the periphery of a circle.

[0011] With reference to Fig. 2 in particular, the wheel mounting according to the invention functions as an equalizer of the wheel loadings which are due to the unevenness of the ground on which the working machine is located in such a way according to the first embodi-

ment of the invention that when the wheel pair in the first wheel mounting PR1 on the right in Fig. 2 meets a bulge whose height is S, the supporting bar 4 moves a corresponding distance in the vertical direction with respect to the frame R, thus transmitting a vertical motion effect S/2 (leverage effect) to a pressurized medium operated cylinder-piston combination 10 via the rocking arm 8, which effect is transmitted in a corresponding downward directed movement S/2 to a cylinder-piston combination 10a of the second wheel mounting PR2 located in a corresponding point in the transverse direction of the working machine, wherein the supporting bars 4a move vertically downward with respect to the frame R. At the location point of the wheel mounting, the frame R of the working machine has a downward directed U-shape when viewed from the end of the working machine, wherein a change of length H-S/2 takes place at the location of the first wheel mounting PR1, and a change of length H + S/2 takes place at the second wheel mounting PR2. H is the height of the frame of the working machine when the frame is unloaded in the aforementioned way, i.e. the cylinder-piston combinations contain an equal amount of pressurized medium. The pressurized medium, especially hydraulic fluid, is transferred from one cylinder-piston combination to another along a transfer line 17 for the pressurized medium coupled therebetween, in such a way that the total space for the pressurized medium which is filled by the pressurized medium remains constant in both cylinder-piston combinations. In both cylinder-piston combinations, the transfer line 17 is coupled between the same parts in their cylinder volumes.

[0012] With reference to Fig. 3, the wheel mounting according to the invention has a second preferred embodiment for the part of the means transmitting the movements of the rocking arm, wherein the means which is effective in the vertical direction and transmits the movements of the rocking arm, is a vertical articulated arm 18 or the like connected to the joint 9 (cf. Figs. 1 and 2). According to Fig. 3, the articulated arms 18 are connected to the upper part the frame R, to rotate in the vertical plane by means of a centrally articulated connecting arm 19, a horizontal joint 20 being attached to the horizontal beam 21 of the frame R. The articulated arms 18 are articulated with horizontal joints 18a to the ends of the connecting arm 19 in such a way that they are effective in the vertical direction. Thus, an operating assembly corresponding to the one produced by the embodiment according to Fig. 2 is attained (cf. references).

[0013] In Figs. 2 and 3, arrows M indicate the effect of means intended for preventing the tilting of the frame R of the working machine, the more detailed structure of the means being described in connection with Fig. 5. The means for preventing the tilting of the frame within the range of the vertical margin of motion of the wheel mountings pair PR1 and PR2 produce a torque M, which resists the tilting of the frame R in the lateral direction and thus allows the above-described equalizing function

of the wheel mounting pairs PR1 and PR2.

[0014] Fig. 4 shows a common turning mechanism KM of two wheel mountings PR1a, PR1b, which are located successively on the same side of the working machine, the turning mechanism being coupled in connection with the horizontal beam 2. The turning mechanism is driven by a pressurized medium operated actuator, such as a hydraulic cylinder-piston combination 22, connected to the pressurized medium system of the working machine. The cylinder-piston combination 22 is articulated to the frame R in the horizontal direction. One end of the cylinder-piston combination 22 is connected to a lug 23, one end thereof being articulated to the frame R. The rotation of the lug 23 in the horizontal plane is transmitted to a transfer bar structure placed between the wheel mounting pairs PR1a, PR1b, especially to the lug 24 of the transfer bar structure, which is centrally articulated to rotate on the horizontal plane in accordance with the movements of the cylinder-piston combination 22 and the lug 23. In the free ends of the lug 24, there are horizontal transfer bars 25, 26 articulated therein, the opposite ends of which are connected in an articulated manner (vertical joint 28) to the turning apparatus 27 (transfer bar 25) of the wheel mounting PR1a and to the corresponding turning apparatus 27 (transfer bar 26) of the wheel mounting PR1b. The articulation 28, in turn, is connected to the lugs 29 in both turning apparatuses 27. The lug 29, in turn, is connected to the supporting bar 4 of the wheel mounting located at the point in question, underneath the bearing arrangement point as described above in connection with Fig. 1. Furthermore, both turning apparatuses 27 are provided with a transmission bar 30 which is articulated on one hand to the lug 29, and on the other hand to a lug 31 (articulation points 32 in the lug 29 and articulation point 33 in the lug 31), connected to the second wheel of the wheel mounting PR1a, PR1b in question. The lug 31, in turn, is connected rigidly to the supporting bar 4 in question in the manner described in connection with Fig. 1.

[0015] In the above-described manner a simultaneous turning of all the wheels is attained in the working machine equipped with four pairs of wheels when the lugs 29 and 31 are placed so that they face the same direction and the transfer bars 25 and 26 move in opposite directions.

[0016] In the structure of Fig. 4, e.g. the wheel mounting PR1a can constitute a part of the balancing structure of Figs. 1 to 3 for wheel loadings. The second wheel mounting PR1b, in turn, functions for example in a structure according to Fig. 5 as a part of the means for preventing the tilting of the frame, wherein the rocking arm 8 is directly journaled to the vertical beam 12 of the frame at the location of the joint 9, wherein the joint 9 is rigidly connected and stationary with respect to the frame, and at the location of the wheel mounting PR1b in question, there are no means 10 of Figs. 1 to 3 to transmit the vertical movements of the rocking arm. Thus, together with the corresponding wheel mounting

on the other side of the frame R, the wheel mounting PR1b resists the tilting of the frame R and produces a torque effect, shown with an arrow M in Figs. 2 and 3 to produce the development of the balancing function. In the above-presented manner a so-called three-point support is attained in the frame of the working machine, i.e. the wheel mountings PR1a on the balancing end of the wheel mountings produce a support reaction, which is shown with an arrow TT in Fig. 5, and which is located centrally in the horizontal beam 21 located at the respective wheel mounting pair PR1a of the frame R, the horizontal beam 21 extending horizontally between the vertical beams 12. The three-point supports and other supporting points are produced at the location of the wheels of the wheel mounting pair PR1b. These supporting effects are shown with arrows TT1 and TT2. At the location of the wheel mounting pair PR1b there is a corresponding tier of beams (parts 12', 21') which has the shape of an upside-down turned U and which forms a part of the frame R. The horizontal beams 2 connect the lower parts of the vertical beams 12, 12' to each other. Correspondingly, the transverse horizontal beams 21, 21' in the upper part of the frame R are connected to each other with at least one longitudinal and horizontal ridge beam 34.

[0017] Fig. 5 shows schematically a so-called straddle carrier, which is a working machine moving independently with a motorization of its own. It is obvious that the wheel mounting according to the invention can also be utilized in carriages for lifting and moving, in which the wheel mountings PR1b (Fig. 5) are replaced with a wheelwork of a driving vehicle, such as a forklift which is driven underneath the frame R. It is advantageous to equip the wheel mounting PR1, PR2 of Figs. 2 and 3 with locking devices to lock the frame R and the means 10 immovable with respect to each other when necessary.

Claims

1. Wheel mounting to be used in working machines for moving loads and transport containers in particular, such as carriages for lifting and moving and so-called straddle carriers, wherein the wheel mounting comprises at least two pairs of wheels arranged movable vertically with respect to the frame (R) of the working machine, and wherein the load to be supported is arranged to rest on the frame, **characterized** in that

- the wheels (1) in the wheel mounting are pivoted to the frame by means of a bearing means, such as a supporting bar (4) attached to each wheel, to move vertically with respect to the frame (R),
- the bearing means, such as supporting bars (4), are connected in the wheels (1) of the wheel

- mounting in pairs on the same side of the working machine with a rocking arm (8) pivoting in an articulated manner in the vertical plane, and
- the middle part of the rocking arm (8) is connected in an articulated manner to a means (10) which is effective in the vertical direction and transmits the movements of the rocking arm.
2. Wheel mounting according to claim 1, **characterized** in that the means (10) which is effective in the vertical direction and transmits the movements of the rocking arm is a cylinder-piston combination (10') fixed at its upper part to the frame (R) of the working machine.
 3. Wheel mounting according to claim 1, **characterized** in that the means (10) which is effective in the vertical direction and transmits the movements of the rocking arm is an articulated arm (18) or the like mounted on bearings in the frame (R).
 4. Wheel mounting according to any of the claims 1 to 3, **characterized** in that wheel mountings (PR1, PR2) on the opposite sides of the working machine are connected together and that the frame (R) of the working machine comprises means for preventing the tilting of the frame of the working machine within the vertical range of motion of the wheel mountings.
 5. Wheel mounting according to any of the claims 1, 2 or 4, **characterized** in that the pressurized medium volumes of the pressurized medium operated cylinder-piston combinations in the wheel mounting pair (PR1, PR2) are connected with a flow channel (17) for the pressurized medium.
 6. Wheel mounting according to any of the claims 1, 3 or 4, **characterized** in that the articulated arms (18) of the wheel mounting pair (PR1, PR2) are connected to the frame (R) with a connecting arm (19) articulated rotatable in the vertical plane.
 7. Wheel mounting according to claim 1 or 4, **characterized** in that the means for preventing the tilting of the frame comprise second wheel pairs (PR1b) of the working machine or of the vehicle operating the working machine, or other wheel pairs (PR1b) not belonging to the wheel mounting pair, which are rigidly connected to the frame (R) and which prevent the tilting of the frame (R) with a support reaction exerted on the ground.
 8. Wheel mounting according to claim 1, **characterized** in that the bearing means, such as supporting bars (14) are equipped with a horizontal bearing arrangement (13) for turning the lower part of the bearing means, such as supporting bars (4) and the wheels connected thereto around a vertical axis by means of a turning apparatus (K) fixed to the bearing means, such as supporting bars (4).
 9. Wheel mounting according to claim 1, **characterized** in that the rocking arm (8) is placed above a horizontal beam (2) located in the lower part of the frame (R).
 10. Wheel mounting according to claim 1, **characterized** in that the vertical bearing arrangement of the bearing means, such as supporting bars (4), with respect to the frame (R) is approximately 1000 mm, preferably at least 700 to 800 mm.
 11. Wheel mounting according to claim 8 or 9, **characterized** in that the horizontal bearing arrangement (13) is, as seen in the vertical direction, placed between the articulation point (6, 7) of the rocking arm (8) and the horizontal beam (2) located in the lower part of the frame.
 12. Wheel mounting according to claim 1, **characterized** in that in connection with the rocking arm (8), a balancing means (14) is arranged to compensate for the horizontal deviations in the distance between the ends of the rocking arm (8) caused by the rotating movements of the rocking arm (8).

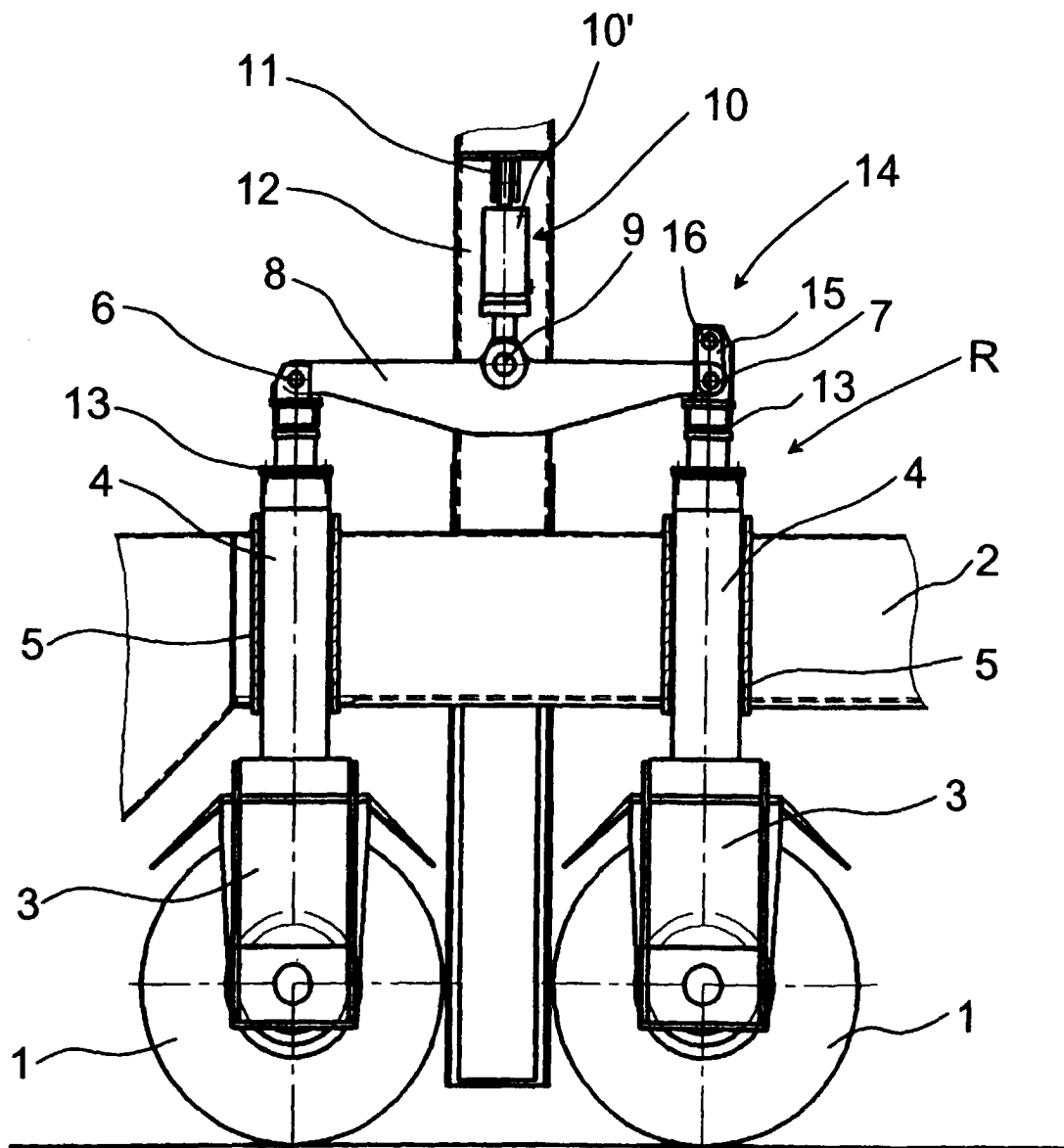


Fig. 1

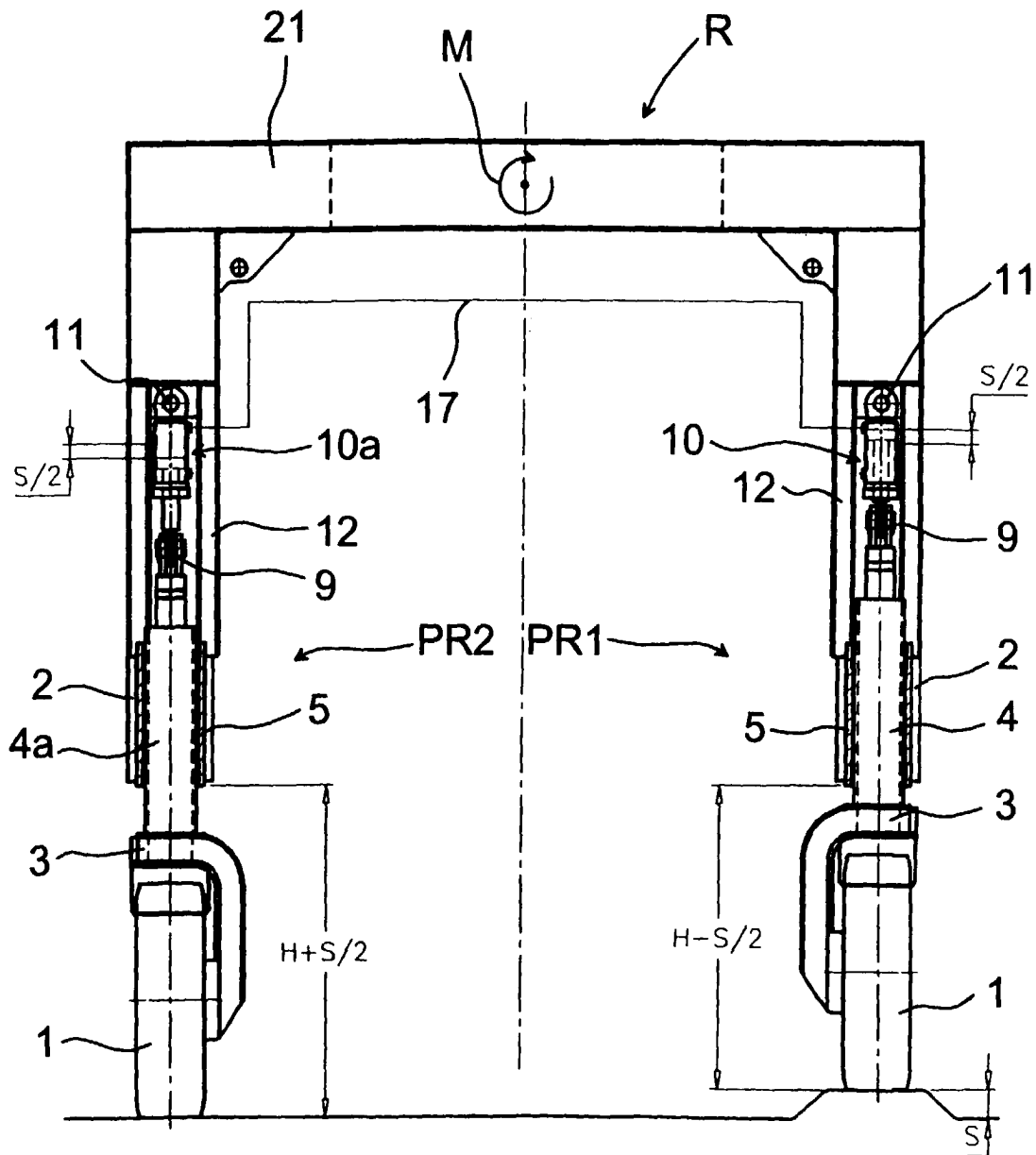


Fig. 2

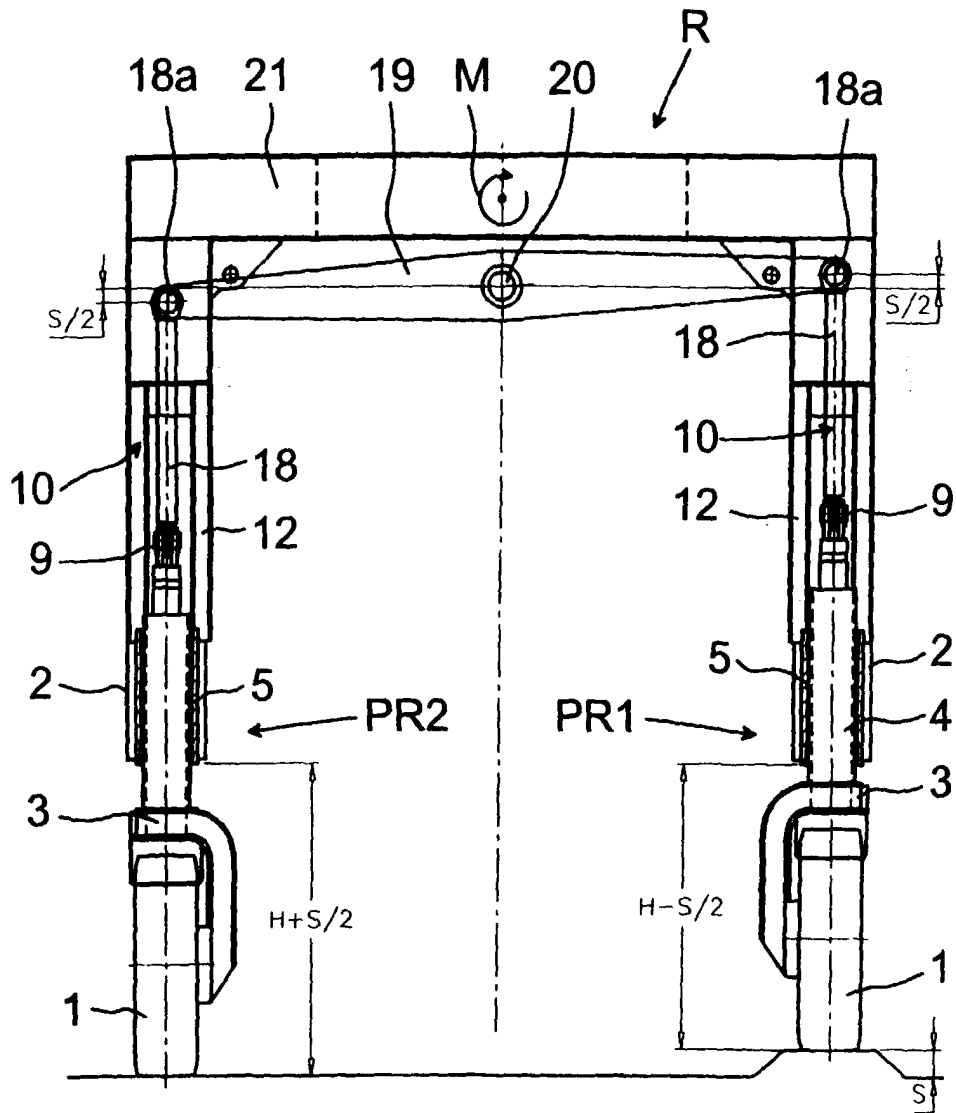


Fig. 3

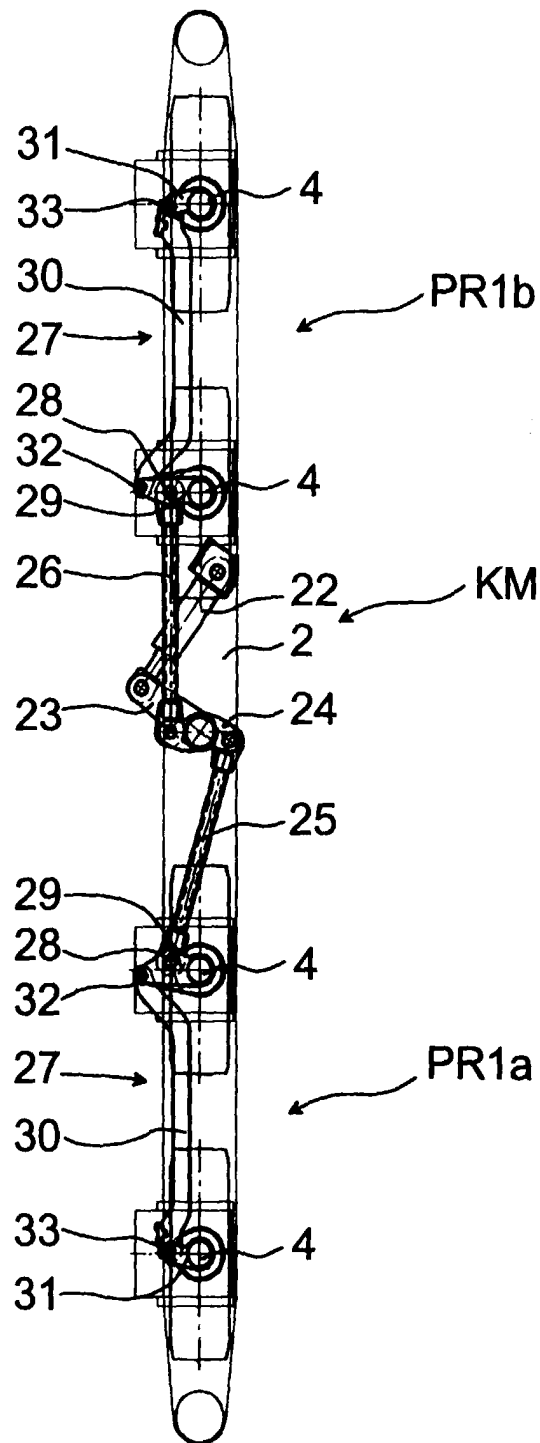


Fig. 4

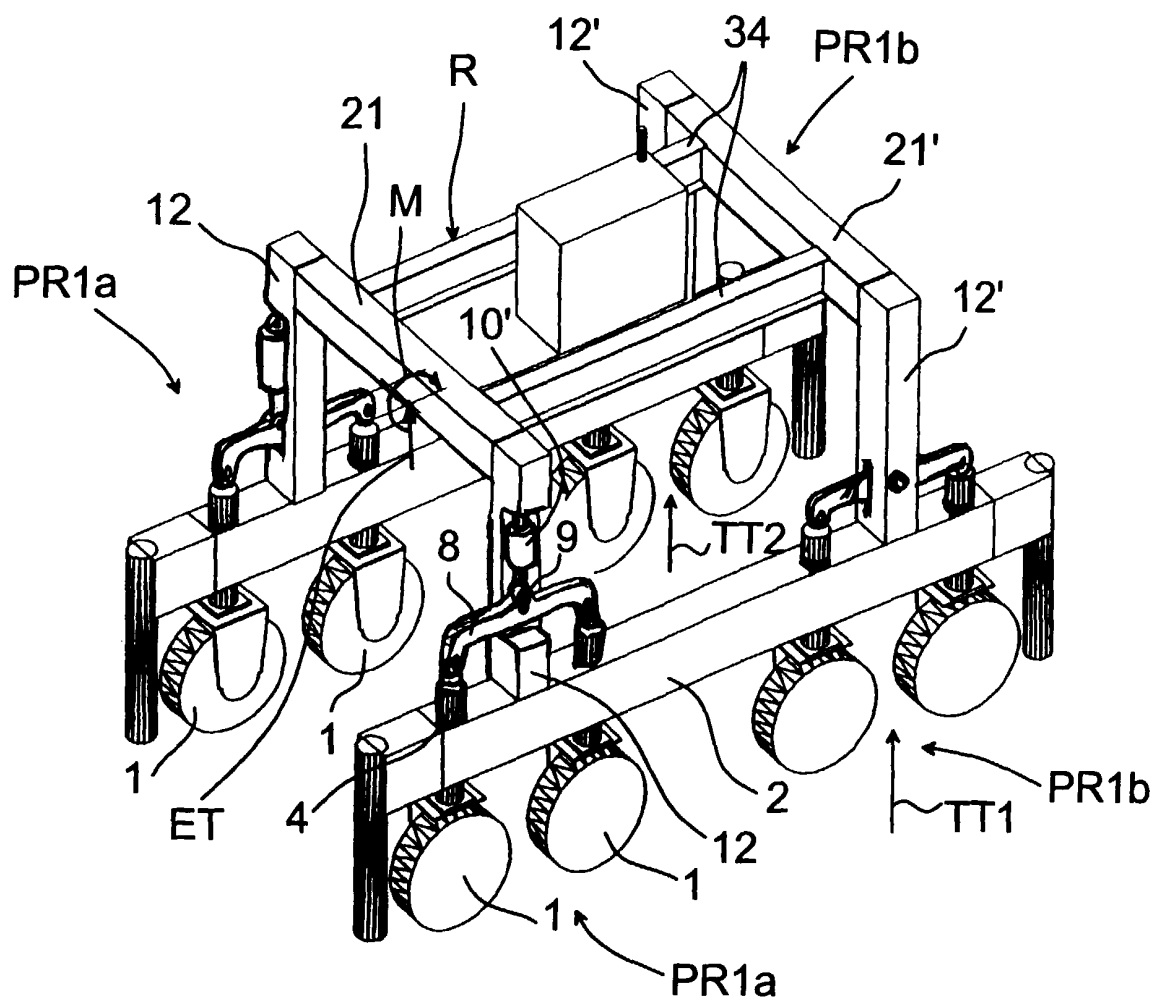


Fig. 5