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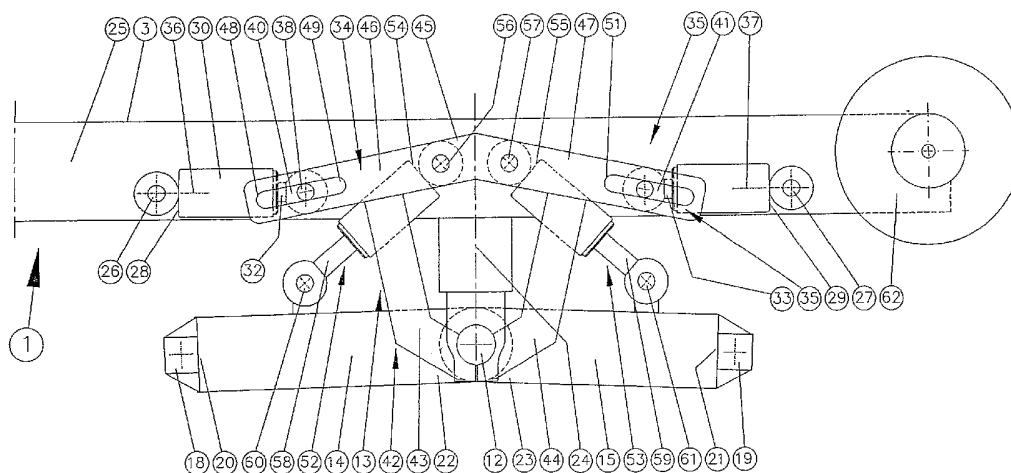
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(54) Title: **ADJUSTABLE WHEEL SUSPENSION FOR UTILITY VEHICLES**



(57) Abstract: Adjustable wheel suspension for a utility vehicle with two wheels located on the same side of the vehicle (1), suspended on a vehicle frame (3). The wheels are mounted on separate supporting arms (14, 15) in such a way that they can rotate on separate wheel axles (18, 19) and can assume different height positions in relation to each other. The wheel suspension has a suspension part (13) arranged on the frame (3) on each side, mounted on a pivot axle (12) in such a way that it can pivot. This is mounted on the supporting arms (14, 15), in such a way that it can pivot, at a distance from the bearing axle (18, 19) of the respective wheel. Linear force devices (30, 31) are arranged between the frame and the movable suspension part, for controlling the position of the suspension part. Linear force devices (52, 53) are arranged between the supporting arms and the suspension part for controlling the rotational position of each supporting arm in relation to the suspension part and hence the height of each wheel axle in relation to the frame.

ADJUSTABLE WHEEL SUSPENSION FOR UTILITY VEHICLES

TECHNICAL FIELD

The present invention relates to an adjustable wheel suspension for utility
5 vehicles according to the preamble to the following Claim 1.

BACKGROUND ART

In, for example, EP 1 180 474, an arrangement for adjustable wheel
suspensions is already known, but, in the past, complicated solutions have
10 been used that have a large number of moving parts in order to obtain an
integral height adjustment function, in particular with multi-wheel suspensions
of the bogie type.

DISCLOSURE OF INVENTION

15 The object of the invention is to create a simple mechanism for adjustment
between different height positions and working positions of a multi-wheel
suspension for a utility vehicle.

This object is achieved by means of the wheel suspension according to the
20 invention, with the characteristics that are described in the following Claim 1.

DESCRIPTION OF DRAWINGS

The invention will be described below in greater detail, with reference to the
attached drawings, in which

- 25 Figure 1 is a view from the back of a trailer of a type that can be provided
with the wheel suspension according to the invention,
Figure 2 is a view from the side of the same trailer in a tipping position
and provided with an interchangeable open container,
Figures 3-5 show schematically the wheel suspension in different working
30 positions in large scale, and

Figures 6-9 show the wheel suspension in smaller scale, from the side and from above in different views of a rear part of the left side of a trailer.

5 MODES FOR CARRYING OUT THE INVENTION

The wheel suspension according to the invention can be used on different types of wheeled vehicles for transporting loads, where there is need of a bogie that is adjustable between a movable and fixed state and where a vehicle frame is required that is adjustable between different height positions, such as, for example, in the case of trailers of the cargo shifter type 1, examples of which are shown in Figures 1 and 2. The basic construction of a trailer of this type comprises a chassis 2 with a frame 3 and wheel suspension 4 for the wheels 5-8, of which there are at least two on each side, forming a combined unit, commonly called a bogie. On heavy vehicles, trailers or tractors there are also front wheels, but, in principle, a trailer with a bogie according to the invention can consist of two pairs of wheels and a towing device arranged at the front end of the frame. In addition, the trailer in the example has a superstructure in the form of a shifter unit 9 with tipping frame 10 and open interchangeable container 11, that is a loose container that can be tipped off and positioned for loading, and exchanged for a new container. For this purpose, a height-adjusting function is advantageous, so that it is possible to lower the frame to a lower height in the unloading and loading positions, that gives a less steep incline for pulling the container onto the trailer, and to raise it to a greater height in the driving position.

25

The wheel suspension 4 according to the invention is, as shown by for example Figure 1, constructed, on each side of the trailer, of a rigid suspension part 13 mounted on the frame 3 of the trailer in such a way that it can pivot around a horizontal shaft 12, and two supporting arms 14, 15, one for each wheel 16, 17, arranged so that they can pivot around the same bearing shaft, one forward-directed supporting arm 14 for the front wheel 16 and one backward-directed supporting arm 15 for the rear wheel 17. The

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wheels are mounted, in such a way that they can rotate, on separate wheel axles 18, 19 at the outer end 20, 21 of each supporting arm, the inner end 22, 23 of which is mounted on the frame 3 of the trailer. Each supporting arm can, in principle, have a separate pivot point, that in addition is separate from
5 the pivot axle 12 of the suspension part 13, but common axles have great advantages.

Due to the fact that the rigid suspension part 13 can be pivoted around its horizontal pivot axle 12 and can either swing freely or be locked in a
10 symmetrical position or inclined in one direction or the other, and due to the fact that the supporting arms 14, 15 can, in addition, be connected rigidly to the suspension part or angled in relation to each other and to the suspension part, a number of operating positions and modes are made possible.

15 The controlled positions and modes of the suspension part 13 are achieved due to the fact that linear force devices are arranged between the frame 3 and the suspension part, which linear force devices are arranged either to allow the pivoting movement of the suspension part within a limited angular range or to lock the part in a selected rotational position. In the example, two
20 piston cylinders 30, 31, of for example pneumatic or hydraulic type, are arranged symmetrically on each side of the trailer around the imaginary vertical plane 24 and are attached by one end, in the example the cylinder end 28, 29, to the longitudinal frame member 25 of the frame 3 in such a way that they can pivot on separate horizontal bearing shafts 26, 27. At its other
25 end, in the example the piston rod end 32, 33, each piston cylinder is connected to the pivoting suspension part 13 at separate locations 34, 35 that are at a distance from each other and at a distance from the pivot axle 12 of the suspension part and are positioned in such a way that the longitudinal axes 36, 37 of the piston cylinders do not intersect the pivot axle
30 12, in order to create a turning moment.

- It can be said that the pivot axle 12 and the connection points 34, 35 form the corners of an imaginary triangle with its apex pointing downwards. The connection points 34, 35 are movable, due to the fact that the ends of the piston rods have spindles 38, 39 or rollers that can run in guides 40, 41 respectively on the suspension part 13. The two guides extend in such a way that the two opposing piston cylinders are essentially horizontal, that is they extend with essentially horizontal longitudinal axes 36, 37 in a neutral position and can be angled upwards and downwards in other positions.
- 10 In the example, the suspension part 13 has a selected configuration, but it can have a completely different design. It consists of a rigid unit, that is arranged on the pivot axle 12 in such a way that it can pivot and comprises, in the example, a rigid bracket 42 with two arms 43, 44, that meet at the bottom at the pivot point 12 and that have an upper part 45 at the top, which
- 15 upper part, in the example, is in the form of a slightly angled inverted V, with two arms 46, 47, that can be constructed as box girders, in which the piston cylinders 30, 31 are inserted, and that have guides 40, 41 that can be constructed as elongated slots in the walls of the girders. Each slot is delimited at its ends by outer and inner stops 48-51, against which the
- 20 spindles 38, 39 make contact to limit the pivoting movement of the suspension part or to lock it completely in a selected position, determined by the positions of the piston cylinders 30, 31.
- According to the invention, a second pair of linear force devices 52, 53 is
- 25 arranged, each of which is arranged between the suspension part 13 and the respective supporting arm 14, 15. These consist of piston cylinders, that are attached at one end, for example the cylinder end 54, 55, to the upper part 46 in such a way that they can rotate around a spindle 56, 57 and, at the other end, in the example the piston rod end 58, 59, are attached to the
- 30 respective supporting arm by means of a spindle 60, 61 at a distance from the pivot point 12, in such a way that they can rotate. The piston cylinders are arranged to control the angular positions of the supporting arms in relation to

the suspension part or alternatively to allow a movement in relation to this, for example a springing movement if such a function is selected, for example by the piston cylinders being allowed to change length during the springing movement, for example by means of compressed air.

5

By means of the wheel suspension according to the invention, adjustment of the two pairs of wheels 5-8 between different operating positions and modes is made possible, for example for adjusting the vehicle for different terrains by, for example, letting the wheel suspension float freely, so that the pairs of
10 wheels are allowed to follow the surface irregularities and by selecting different clearances, either with floating or locked suspension, with the wheels at the same axle distance or different axle distances to the frame. The wheels have been omitted from the side views for the sake of clarity.

15 Figure 3 shows the operating mode with floating bogie with the supporting arms in the neutral position, when the horizontal piston cylinders 30, 31 are in a central position and do not lock the suspension part 13 that is thus able to float, and the inclining piston cylinders 52, 53 are similarly in a central position as far as their linear change of length is concerned. In this position,
20 all four piston cylinders can be locked by means of their hydraulic fluid. Alternatively, the horizontal piston cylinders 30, 31 can be unloaded and allowed to follow the floating movement, when the spindles 38, 39 make contact with the respective stops 48-51, whereby a damped floating movement is obtained. The lower, vertical or inclined piston cylinders 52, 53
25 can also either be locked or can move with hydraulic medium damping or with a spring function.

Figure 4 shows an operating mode in which the upper, horizontal piston cylinders 30, 31 are extended to their inner stops 49, 51 and remain in this
30 position by the action of the hydraulic fluid pressure. The suspension part 13 is thereby locked and creates fixed positions for the upper attachment points of the inclined piston cylinders 52, 53, whereby the piston cylinders can be

set in selected extended positions, that are locked by means of the hydraulic fluid pressure, illustrated in Figure 4 as a central position for a medium height of the trailer frame 3 and with both pairs of wheels in an active load-bearing position, on a horizontal surface.

5

Figure 5 shows a floating bogie, that is a suspension part 13, similar to the operating mode in Figure 3, but in fully deflected position, where the end position is reached by the outer stop 30 of the front guide 40 coming into contact with the spindle 32 of the front horizontal piston cylinder 30, while at
10 the same time, the hydraulic system locks the same piston cylinder. The front wheel is accordingly in its highest position, on account of the unevenness of the ground.

Figure 6 shows a locked bogie similar to the position in Figure 4, but where
15 the front wheel is raised to the top position by the front inclined piston cylinder 52 being maximally retracted and accordingly by the front supporting arm 14 being pivoted up around the pivot axle 12.

Figure 7 is a partial view from above of the rear part of the trailer, showing
20 more clearly the supporting arms 14, 15 and their mounting on the pivot axle 12, that can be physically constructed in the form of a tube that extends under the trailer and, at its opposite end at the right side of the trailer, forms a corresponding mounting for the supporting arms and suspension part of the right wheel suspension. These parts and the piston cylinders have been
25 omitted in Figures 7 and 8 for the sake of clarity.

Figures 8 and 9 are views corresponding to Figures 6 and 7, but with the piston cylinders and the suspension part omitted.

30 The invention is not limited to the examples described above and shown in the drawings, but can be varied within the framework of the following claims. The piston cylinders can be comprised in a pressurized medium system, that

- is advantageously hydraulic, but can be solely pneumatic or combined with air suspension, where the inclined piston cylinders can be given a spring function. The bogie can alternatively be a so-called triple bogie. The bogies on the left and right sides of the trailer are suitably mounted separately so
- 5 that they can float individually in response to the unevenness of the ground, but they are advantageously synchronously controlled in an integrated operating system, for example a hydraulic system. The horizontal piston cylinders can alternatively be connected to the frame in such a way that they can move.

CLAIMS

1. Adjustable wheel suspension for a utility vehicle with at least two wheels (5-8) located on the same side of the vehicle (1), suspended on a vehicle frame (3), which wheels are mounted, in such a way that they can rotate, on separate wheel axles (18, 19) on separate supporting arms (14, 15) and are arranged to assume different height positions in relation to each other, characterized in that the wheel suspension comprises a rigid suspension part (13) arranged on the frame (3) on each side and mounted on a pivot axle (12) in such a way that it can pivot, on which suspension part the supporting arms (14, 15) are mounted at a distance from the bearing axle (18, 19) of the respective wheels (5-8) in such a way that they can pivot, and also first linear force devices (30, 31) arranged between the frame and the movable suspension part for controlling the position of the suspension part and second linear force devices (52, 53) arranged between the supporting arms and the suspension part for controlling the rotational position of each supporting arm in relation to the suspension part and hence the height of each wheel axle in relation to the frame.

20

2. Wheel suspension according to Claim 1, characterized in that the first linear force devices (30, 31) are adjustable between a first operating mode in which the suspension part (13) is allowed to pivot around its pivot axle (12) between two end positions, and a second operating mode, in which the suspension part is locked in a selected rotational position.

25

3. Wheel suspension according to Claim 2, characterized in that the force devices (30, 31, 52, 53) consist of piston cylinders controlled by pressurized medium, that are arranged as symmetrically located pairs with the two piston cylinders in the first force devices adjustable between a movable and fixed connection between the frame (39) of the vehicle and the suspension part (13).

30

4. Wheel suspension according to any one of the preceding claims, characterized in that the pivot axle of the supporting arms (14, 15) coincides with the pivot axle (12) of the suspension part (13) and in that, in a neutral
5 position, the suspension device is symmetrical around an imaginary vertical plane through the common pivot axle.

5. Wheel suspension according to Claim 4, characterized in that the pivot axle (12) extends parallel to the axles (18, 19) of the wheels (5-8) and
10 coaxially in relation to the corresponding pivot axle on a corresponding wheel suspension located on the opposite side of the trailer.

6. Wheel suspension according to Claim 5, characterized in that the two wheel suspensions on each side of the vehicle (1) are individually
15 mounted.

7. Wheel suspension according to Claim 6, characterized in that the two wheel suspensions on each side of the vehicle are synchronously controlled in a common pressurized medium system for control of all the
20 piston cylinders (30, 31, 52, 53).

8. Wheel suspension according to Claim 7, characterized in that all the piston cylinders (30, 31, 52, 53) extend with their longitudinal axes in a vertical plane that forms a radial plane to the pivot axle (12).
25

9. Wheel suspension according to Claim 3, characterized in that the suspension part (13) has a part (46), that has two symmetrically located slots (40, 41) with stops (48, 49, 50, 51) that form the movable connection for control devices (38, 39) associated with one pair of piston cylinders (31, 32).
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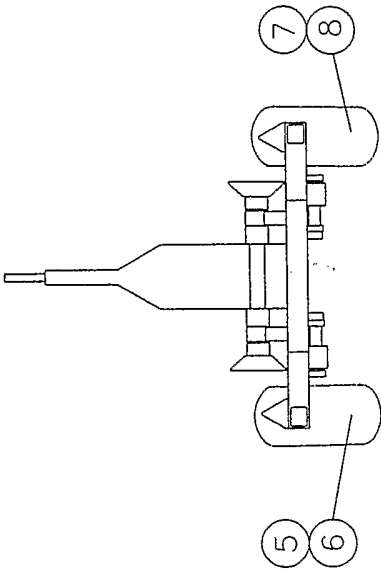


Fig 1

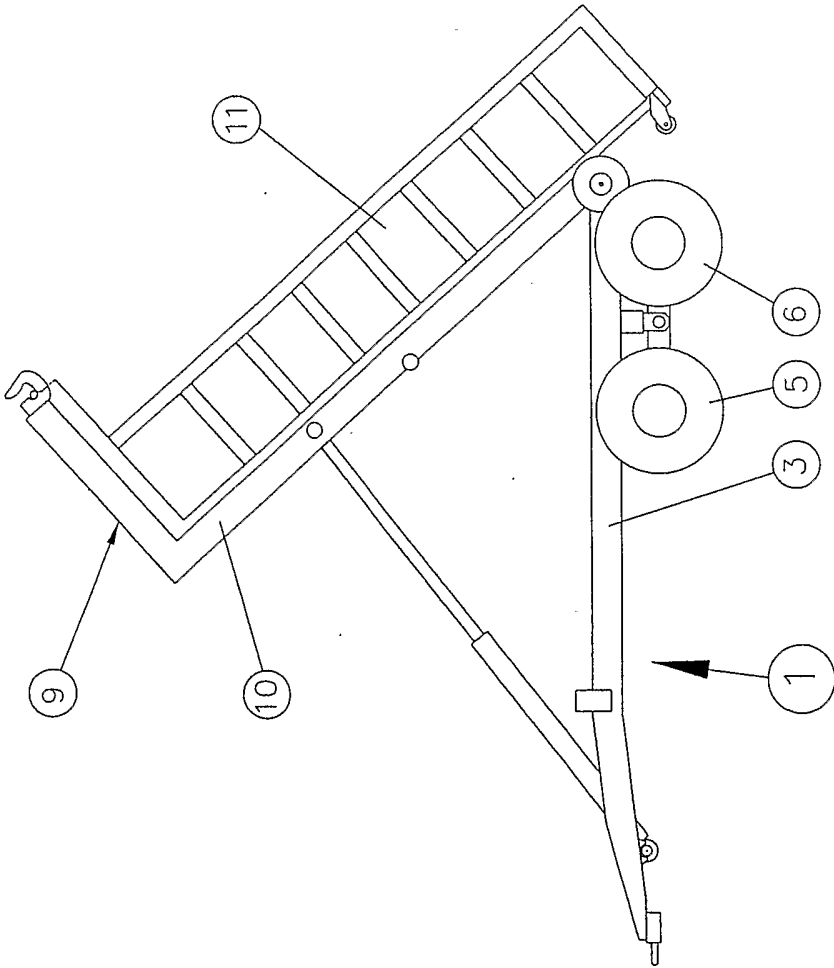


Fig 2

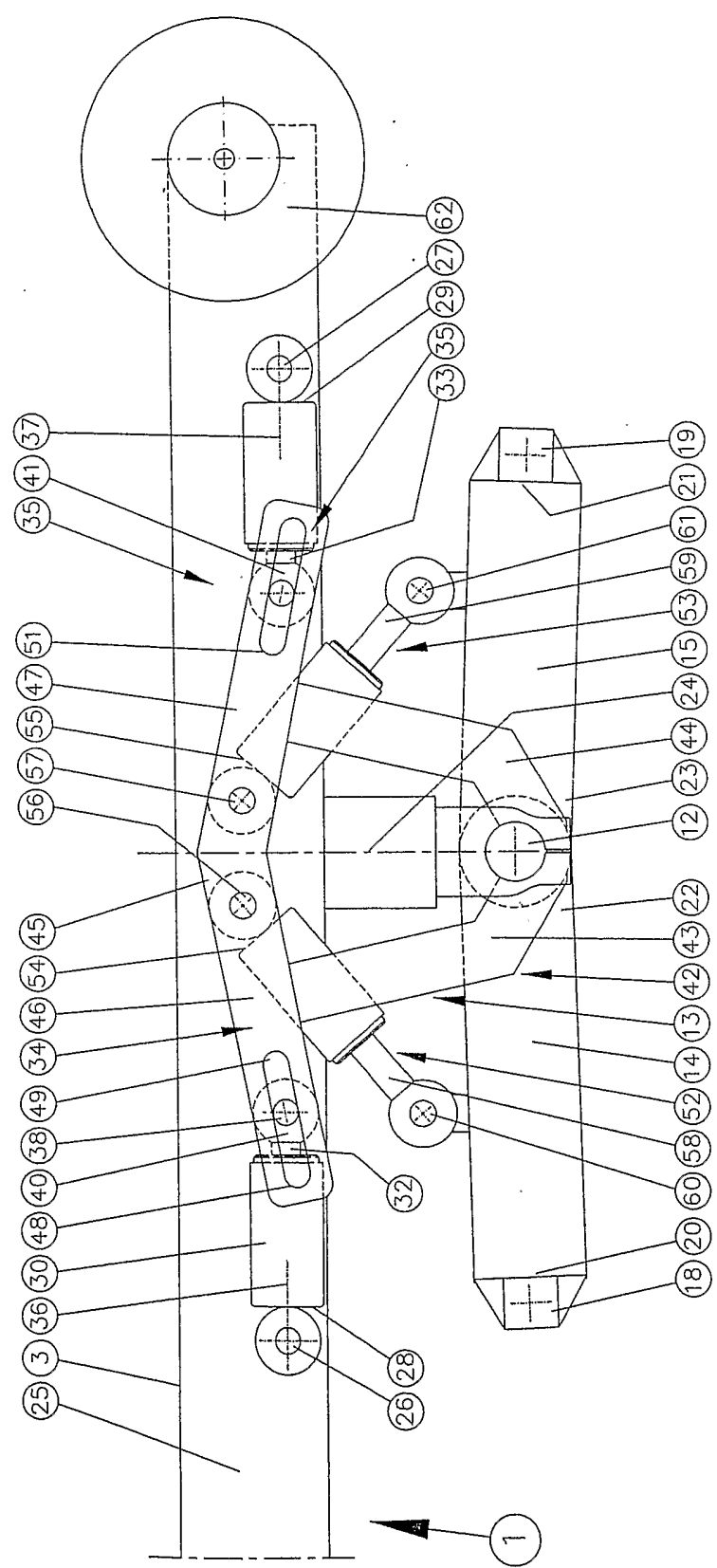


Fig 3

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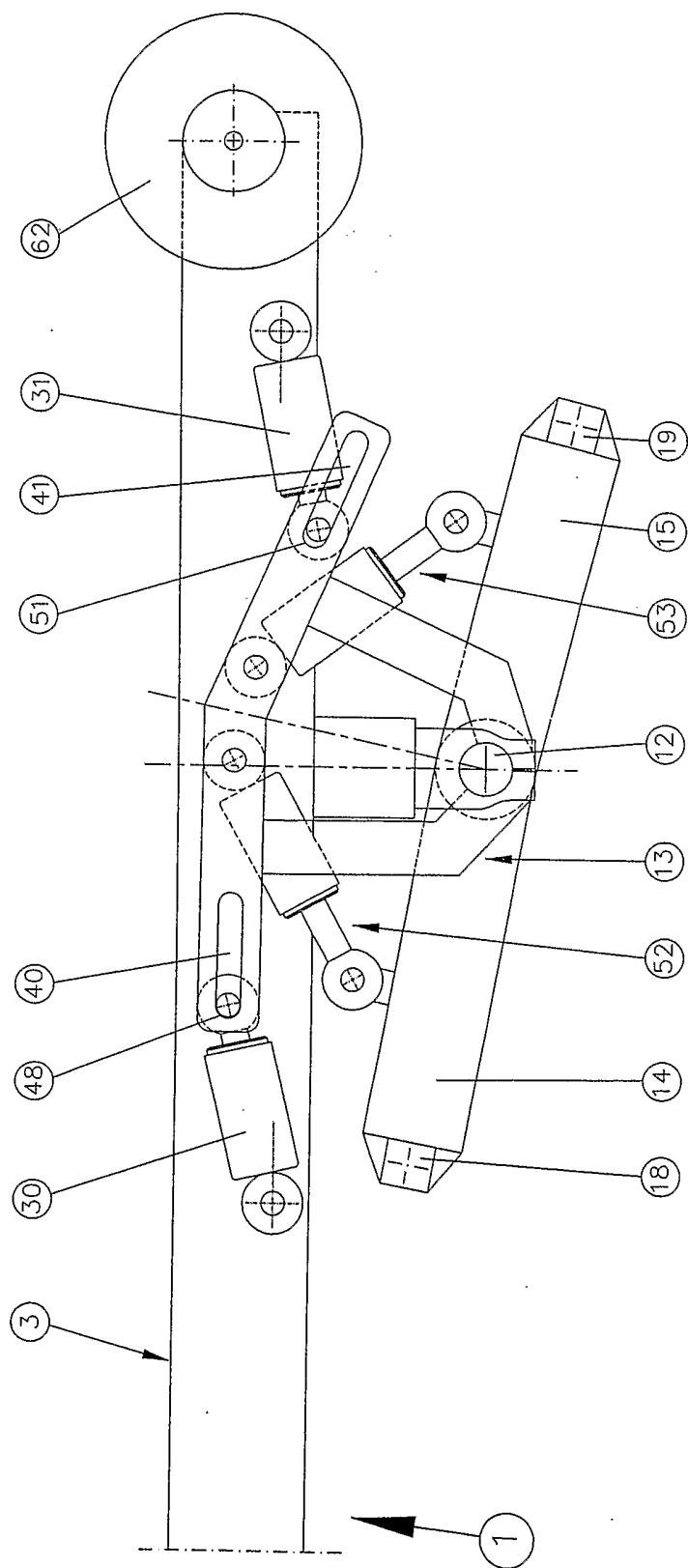
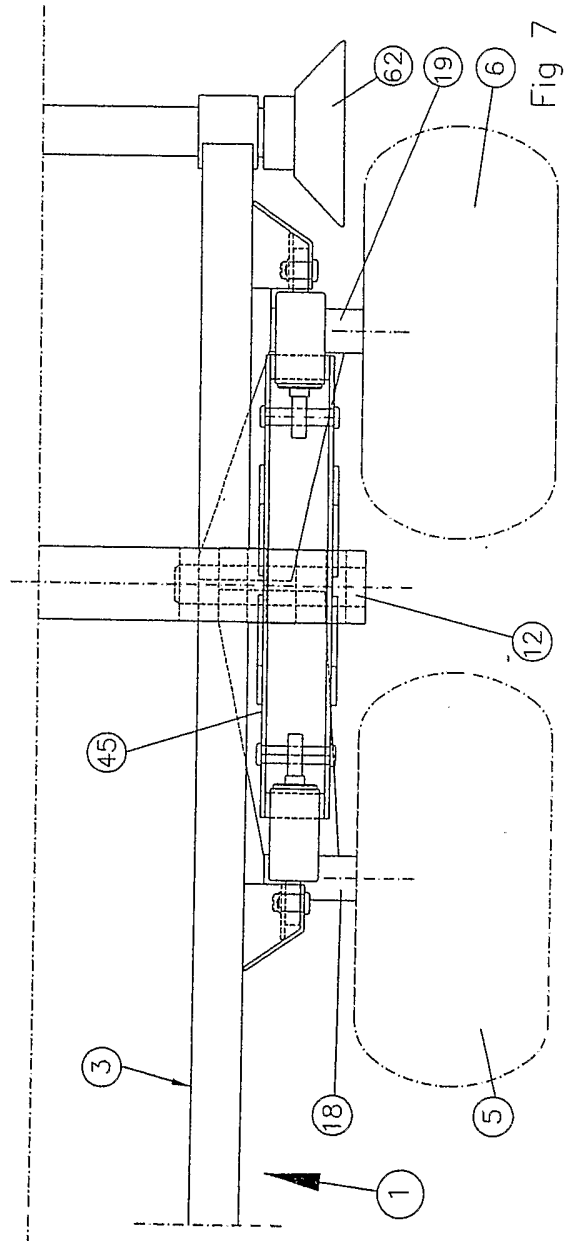
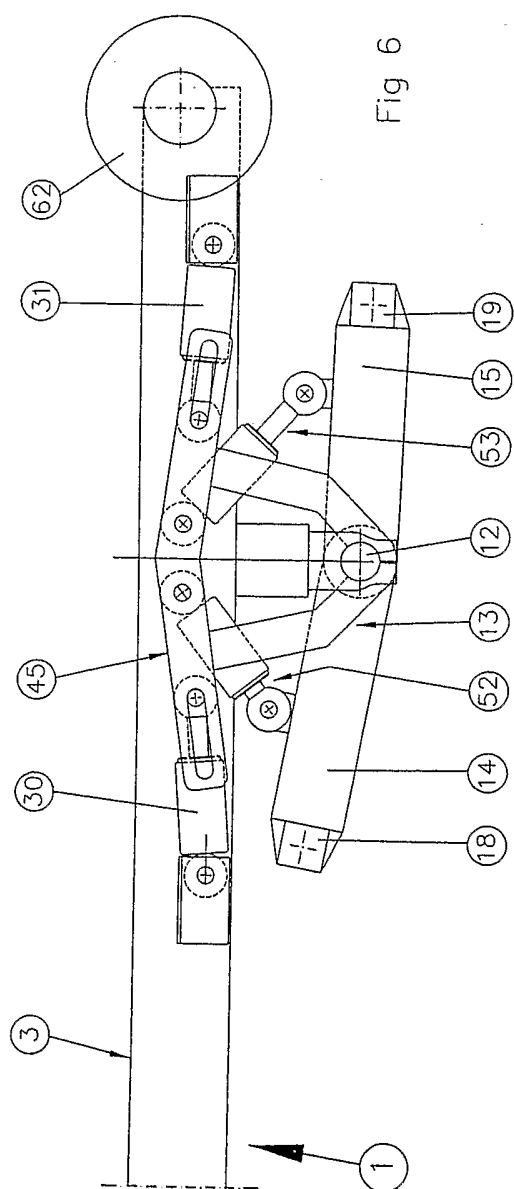
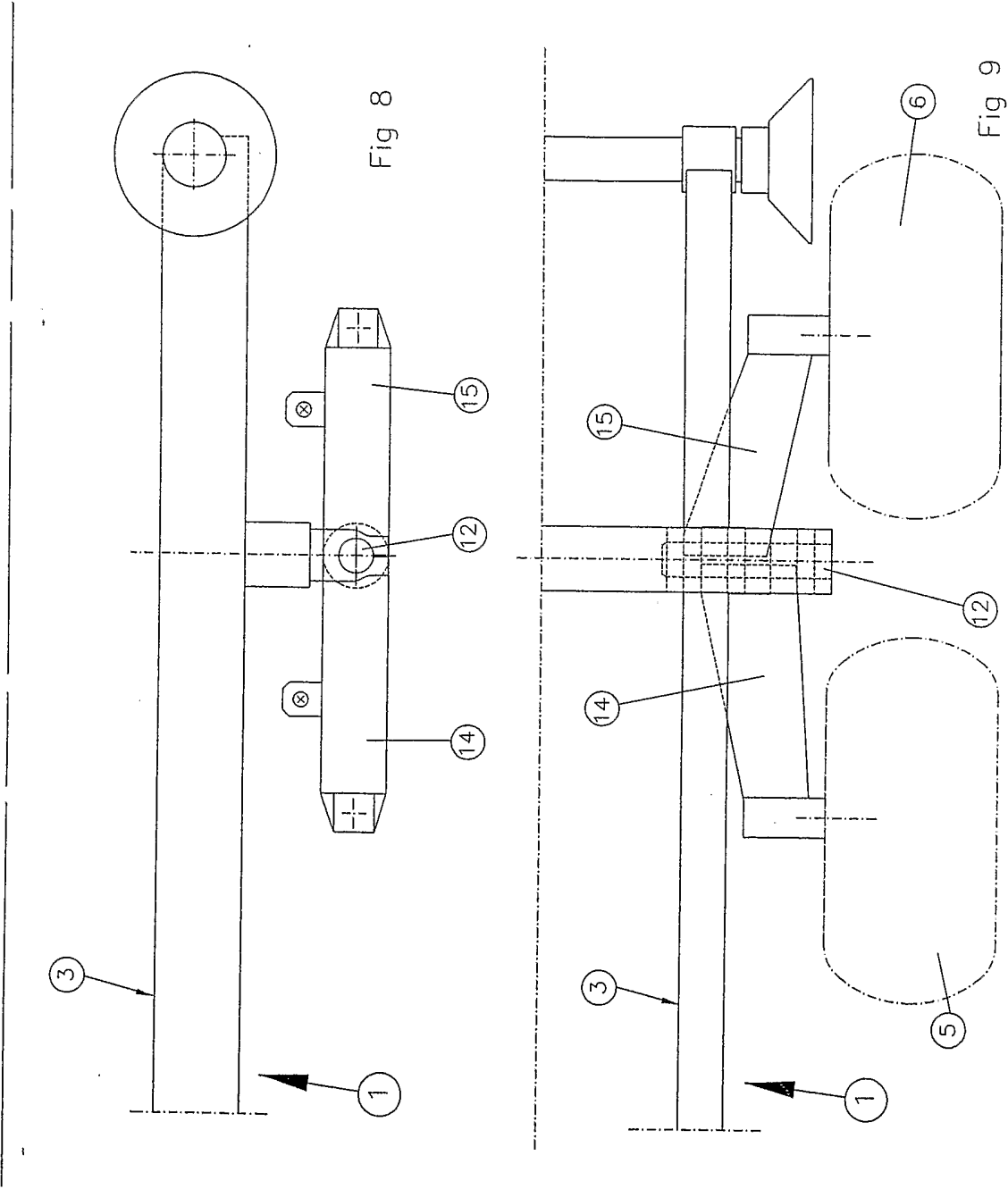


Fig 5

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/000626

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60G

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3618971 A (RONALD WRAGG), 9 November 1971 (09.11.1971), the whole document ---	1-9
A	US 2398248 A (FREDERICK M REID), 9 April 1946 (09.04.1946), the whole document --	1-9
A	US 3471166 A (EDMUND G CLARK), 7 October 1969 (07.10.1969), the whole document -- -----	1-9

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

04/03/2006

International application No.

PCT/SE2006/000626

US	3618971	A	09/11/1971	DE	2024713 A,B	26/11/1970
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