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(54) Transport device and method for transporting a vehicle

(57) A transport installation 1 for transporting a vehicle 9 has a movable platform 3 on which there are two extendible arms 7. Each arm 7 has two pairs of carrier shoes 27, for supporting the wheels of a vehicle 9.

The carrier shoes 27 can rotate between a swung-back position and a swung-out position. In addition, the carrier shoes 27 making up a pair can move away from each other and towards each other.

When rotating from the swung-back position to the swung-out position the carrier shoe 27 moves in a vertical direction downwards from a position above the floor to a position on the floor. Because of this, the weight of the vehicle is borne solely by the carrier shoes 27 and the arms 7 are not loaded.

Each extendible arm has two guides 11, 15 in which two guide elements 19, 23 connected to each other can move, each having a gear wheel 75, 77. The gear wheels cooperate with gear racks 79, 81 on the guides 11, 15 and are coupled to each other by means of a transmission mechanism 83.

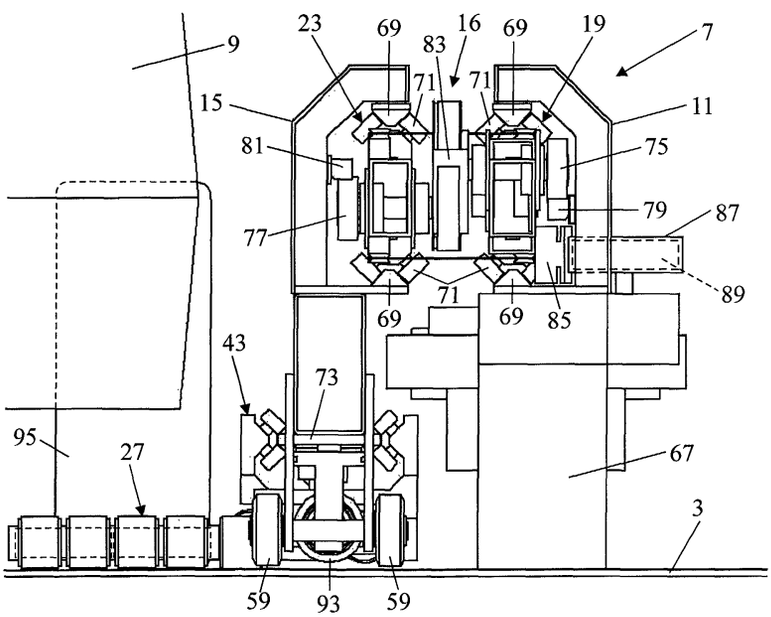

FIG. 2

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Description

BACKGROUND OF THE INVENTION:

Field of the invention

[0001] The invention relates to a transport installation for transporting a vehicle between a placement/removal position and a storage position, which transport installation comprises a moveable platform, as well as two parallel extendible arms, which are on the platform and at least one of which can be moved transversely with respect to the platform, which arms comprise two pairs of carrier shoes each, for supporting the wheels of the vehicle to be transported, and which carrier shoes of such a pair can move towards and away from each other. More particularly the invention relates to a transport installation for application to an automatic parking facility for vehicles, in particular passenger cars.

[0002] Automatically placing a vehicle in a parking facility takes place as follows. First of all, the platform is brought in front of a vehicle that is to be moved, which is in the placement position. Next the two arms slide out until they are extended on both sides of the vehicle. Then the arms are moved towards each other, bringing the carrier shoes in each pair in front of and behind a wheel of the vehicle. Subsequently, the carrier shoes are moved towards each other, lifting up the vehicle's wheels. Finally, the arms are retracted and the platform can be moved to the storage position. Here the arms extend, placing the vehicle in the storage position, after which the carrier shoes are moved away from each other, the arms are moved away from each other and are ultimately retracted. Removing a vehicle proceeds the same way, but in reverse order.

Prior art

[0003] A transport installation like this is known from the European patent application EP-A-0 563 663. In this known transport installation the carrier shoes consist of rollers, which extend at right angles to the arms and can move along the arms. There are transport wheels under the arms through which these arms are in contact with a floor. The rollers are situated at a distance above the floor. When a vehicle's wheels are lifted up, the full weight of the vehicle rests on the rollers and this weight is transmitted through the arms and the transport wheels to the floor. The rollers, arms and transport wheels are therefore heavily loaded and should be executed in a heavier form.

Summary of the invention

[0004] An objective of the invention is to provide a transport installation of the type described in the preamble in which the construction is lighter and therefore less expensive than that of the known transport installation. For this purpose the transport installation according to the invention is characterized in that the carrier shoes can rotate between a first position, in which the carrier shoes are mainly parallel to the arms, and a second position, in which the carrier shoes are practically at right angles to the arms, and that each carrier shoe is coupled to a rotation mechanism that moves the carrier shoe when rotating from the first position to the second position in a vertical direction downwards from a first position at a distance above a floor, on which the vehicle to be transported is situated, to a second position on or just above the floor. While rotating from the first position to the second position, the carrier shoes can come in contact with the floor. However, it is also possible to raise the arm first so that the carrier shoes can rotate without coming in contact with the floor, and after that to lower it, as a result of which the carrier shoes come onto the floor. In both cases, the carrier shoes, after lifting the vehicle, are situated on the floor and transmit the vehicle's weight directly to the floor, with the result that the arms are not loaded with the weight of the vehicle.

[0005] It is noted that carrier shoes that can swing out and are provided with wheels for transport over a floor are in theory known from the international patent application WO-A-88/04350. However, in this patent application the carrier shoes are in the swung-back and swung-out position respectively on the same level as the floor and the arms cannot be moved transversely.

[0006] An embodiment of the transport installation according to the invention is characterized in that each arm is provided with at least one transverse wheel, for supporting the arm when moving transversely, which transverse wheel can be moved by means of a lifting mechanism between a first position on a floor, on which the vehicle to be transported is situated, and a second position at a distance above the floor, where in the first position the arm with the carrier shoes is at a distance above the floor, and the carrier shoes can rotate without coming into contact with the floor. In this case, the arm is raised first so that the carrier shoes can rotate without coming in contact with the floor. In this way, the rotation mechanism for rotating the carrier shoes is less heavily loaded as a result of which it can be executed in a lighter form.

[0007] In order to assure that the vehicle's weight is not at all and that it is not even partially transmitted to the floor through the arms, a further embodiment of the transport installation according to the invention is characterized in that when the carrier shoes are in the second position, if the carrier shoes are on the floor, the arms will be at a distance above the floor due to the vertical position of the carrier shoes with respect to the arms. Because the arm has been raised from the floor, one is assured that the vehicle's weight will be transmitted fully through the carrier shoes to the floor.

[0008] Still a further embodiment of the transport installation according to the invention is characterized in that each arm comprises a first guide that is connected

to the platform and an extendible second guide which can move with respect to the first guide, where there is a coupling device between the two guides, which coupling device comprises a first and a second guide element connected to each other, which guide elements are guided in the first and second guide respectively, and which guide elements comprise a gear wheel each, which gear wheels cooperate with gear racks situated on the first and second guide respectively, and which gear wheels are coupled to each other by means of a transmission mechanism, and which transport installation comprises a drive mechanism, which is on the first guide, for moving the first guide element, so that when moving the first guide element over a first distance, by means of the gear wheels and the transmission mechanism, the second guide is moved over a second distance that is greater than the first distance. In this way it is possible for the second guide to be extended fully, as a result of which the arms have a large reach.

[0009] It is noted that this embodiment of the arm of the transport installation can also be applied separately from the rotation and lifting mechanisms for the carrier shoes that can swing out and back, and that with this the possibility is expressly kept open to claim this embodiment independently from the earlier embodiments in a separate patent application.

[0010] For further favourable embodiments of the transport installation, refer to the description of an embodiment and the claims which follow.

[0011] The invention also relates to a method for transporting a vehicle. As to the method according to the invention, also refer to the description of an embodiment and the claims which follow.

Brief description of the drawings

[0012] The invention will be elucidated more fully below on the basis of drawings in which an embodiment of the transport installation according to the invention is shown. In these drawings:

Figure 1 is a view from above of an embodiment of the transport installation according to the invention;
Figure 2 is a rear view of an arm of the transport installation;
Figure 3 is a view in perspective of a transmission mechanism of the arm;
Figure 4 is a view from underneath of a carrier shoe in a first position;
Figure 5 is a view from underneath of the carrier shoe in a second position;
Figures 6, 7 and 8 show a pair of carrier shoes of the transport installation seen from underneath in a swung-back position, a swung-out position at a distance from one another, and in a swung-out position close to each other;
Figure 9 is a view in perspective from above of a carrier shoe; and
Figure 10 is a view in perspective from underneath of the carrier shoe.

Detailed description of the drawings

[0013] In Figure 1 an embodiment of the transport installation according to the invention is shown in a view from above while in operation. The transport installation 1 has a platform 3 that can move in the direction indicated by the arrow a. There are two extendible arms 5, 7, shown in the extended position on the platform 3. The arm 5 can move transversely (arrow b) with respect to the platform 3. The other arm 7 is fastened to the platform 3.

[0014] The transport installation 1 is situated in an automatic parking facility and brings vehicles from a placement and removal position to a storage position and the reverse. In this installation the vehicle 9 is lifted up off a floor 10 from one of the positions mentioned and put onto the platform 3 and at the other position is removed from the platform 3 and set down on a floor.

[0015] Each arm 5, 7 has two guides 11, 13 and 15, 17, one of which 11, 13 is connected to the platform 3, and the other one 15, 17 can be extended (arrow c). The guides 11 and 15, 13 and 17 respectively are coupled to each other by means of coupling devices 16 and 18. These coupling devices will be elucidated more fully further on by means of Figure 3. Each coupling device 16, 18 has two guide elements 19 and 23, 21 and 25 respectively which are connected to each other and can move in the guides 11-17.

[0016] Furthermore, each arm 5, 7 has four carrier shoes 27-33 and 35-41. Each carrier shoe 27-41 is connected in such a way to a carriage 43-57 that it can rotate. The carriage 43-57 can move along the guide 15, 17. For the purpose of illustration the carrier shoes 35-41 are shown in a first swung-back position and the carrier shoes 27-33 in a second swung-out position. In reality, the carrier shoes 27-33 of arm 7 are in the same position as the carrier shoes 35-41 of arm 5.

[0017] The guides 15 and 17 have longitudinal wheels 59-65 which function when retracting and extending the arms.

[0018] In Figure 2 the arm 7 is shown from the rear. The guide 11 is attached to the platform 3 by means of a support 67, while the other guide 15 is movable and is provided with longitudinal wheels 59. There are guide rails 69 on both guides 11, 15 over which the guide elements 19, 23 with running wheels 71 can move. Furthermore, there is an additional guide rail 73 on the guide 15 along which the carriages 43 can move.

[0019] Each guide element 19, 23 has a gear wheel 75, 77 which cooperates with a gear rack 79, 81 situated on the guide concerned 11, 15. The gear wheels 75 and 77 are coupled to each other by means of a transmission mechanism 83 which will be elucidated more fully further on by means of Figure 3. A geared belt 87 is attached to the guide element 19 by means of a clamping block

85. This geared belt 87 passes over the pulleys 89 and 91, one of which is driven by an electric motor (not shown) that is fastened to the arm 7 (see Figure 1 also).

[0020] In order to extend and retract the arm 7 the guide element 19 is moved by means of a drive mechanism, of which the electric motor is a part, through the driving disk 89 and the geared belt 87. As a result, the gear wheel 75 rolls over the gear rack 79, see Figure 2. The rotation of the gear wheel 75 is transmitted to the gear wheel 77 by the transmission mechanism 83 with a transmission ratio greater than one, so that the gear wheel 77 rotates more than the gear wheel 75. The gear wheel 75 drives the gear rack 81, as a result of which the guide 15 is extended or retracted.

[0021] In addition to the longitudinal wheels 59 the guide 15 also has transverse wheels 93 at both ends. When the arm 7 is moved transversely with respect to the floor (by moving the platform 3 to which the arm 7 is fastened), the transverse wheels 93 are lowered by a lifting mechanism (not shown) to a level where the running surface of the transverse wheel 93 is lower than that of the running surface of the longitudinal wheels 59. As a result, the longitudinal wheels 59 and the carrier shoes 27-41 are lifted from the floor and the carrier shoes can rotate clear of the floor.

[0022] In the position shown in Figure 2 the carrier shoe 27 has been swung out and along with carrier shoe 29 (not visible in Figure 2) lifts up the vehicle's wheel 95. When the carrier shoe 27 swings out it moves downwards at the same time. After the transverse wheels 93 have been lifted up, the carrier shoes 27 and 29 are situated on the floor and the guide 15 with the longitudinal wheels 59 is at a distance above the floor.

[0023] Referring to Figure 3, the coupling mechanism 16 with the transmission mechanism 83 will now be described. The two guide elements 19 and 23 are connected to each other by means of leaf springs 97. Because of this they can move vertically over a small distance with respect to each other, which is desirable when lifting the guide 23 while the carrier shoes swing out. The gear wheels 75 and 77 are connected to pulleys 99 and 101. The pulleys 99 and 101 are fitted with a geared belt 103. In addition, two tension rollers 105 see to it that the geared belt 103 passes over a large part of the circumference of the pulley 99. The guide element 19 is moved by means of the geared belt 87 attached to the clamping block 85. Because of this the gear wheel 75 rotates. This rotation is transmitted through the pulleys 99 and 101 and the geared belt 103 in an amplified form to the gear wheels 77, which drive the extendible guide. By coupling the gear wheels 75 and 77 to each other by means of a geared belt 103 it is possible to move the guide elements 19 and 23 vertically with respect to each other.

[0024] In Figures 4 and 5 one of the carrier shoes with a carriage is shown from underneath in a first swung-back position (Figure 4) and a second swung-out position (Figure 5) respectively. The carrier shoe 27 has six wheels 105 for moving over the floor and two rollers 107 for lifting up a vehicle's wheel. The carrier shoe can rotate about a shaft 109 on the carriage 43. The shaft 109 is provided with a trapezoid outside screw thread 111, which cooperates with a trapezoid internal screw thread situated in an opening 113 in the carriage 43. Because of this screw thread 111, the carrier shoe 27 when rotated with respect to the carriage 43 will move vertically with respect to that carriage 43.

[0025] The carriage 43 can slide along the guide rails 73 of the guide 15 and is moved by means of a piston and cylinder combination, one end of which is connected to the carriage 43 by a pin 115. The piston and cylinder combination is part of a mechanism for moving the carrier shoes. A plate 117 is connected to the carriage 43 by a spring 118. There is an additional pin 119 and a projection 121 on the plate 117. The pin 119 cooperates with a slot 123 in the carrier shoe 27, and the projection 121 cooperates with a recess 125 in the carrier shoe 27. The shaft 109, opening 113, screw thread 111, plate 117 with pin 119 and the slot 123 are all part of a rotation mechanism for rotating and lifting/lowering the carrier shoe.

[0026] When in the swung-back position (Figure 4) the pin 119 is situated in the slot 123 and the projection 121 is situated outside the recess 125. The spring 118 is in a stretched state and the plate 117 is stopped by a pin 127 on the guide 15. When moving the carriage 43 in the direction of the arrow d, the wall of the slot 123 is pressed against the pin 119. The spring 118 sees to it that the plate 117 stays pulled against the pin 127. Because of this the carrier shoe 27 rotates in the direction of the arrow e into the swung-out position. In the swung-out position (Figure 5) the projection 121 is situated in the recess 125, as a result of which the carrier shoe 27 is blocked from rotating. The spring 118 is fully retracted and no longer exercises any force on the plate 117. When the carriage 43 moves further in the direction of the arrow d, the plate 117 moves along with it.

[0027] When swinging back the carrier shoe 27 the carriage 43 is moved and initially the plate 117 moves along with the carriage 43. The plate 117 moves together with the carriage 43 until it is stopped by the pin 127 on the guide 15 (as shown in Figure 5). On moving the carriage 43 further, it moves with respect to the plate 117 and the pin 119 enters the slot 123 as a result of which the carrier shoe 27 rotates about the shaft 109 and at the same time is moved upwards.

[0028] The various stages in moving a pair of carrier shoes are elucidated in Figures 6, 7, and 8. Figure 6 shows the pair of carrier shoes 27, 29 swung back (this position corresponds to that shown in Figure 4). The carriages 43 and 45 to which these carrier shoes are connected in such a way that they can rotate, are situated at a distance from each other and are coupled to each other by means of a piston and cylinder combination 129. By pulling the piston into the cylinder the carriages 43 and 45 are moved towards each other and the carrier shoes 27 and 29 swing out, as shown in Figure 7 (this

position corresponds to that in Figure 5). After that the carriages 43 and 45 are moved closer to each other and the carrier shoes 27 and 29 lift up the vehicle's tyre.

[0029] For the sake of clarity, the carrier shoe 27 in Figures 9 and 10 is shown in perspective from above and below.

[0030] Transporting a vehicle 9 between a placement/removal position and a storage position takes place as follows. First of all, the vehicle 9 is placed on the floor 10 with the front wheels at a predetermined distance from the platform 3. Then the vehicle 9 is brought parallel to the longitudinal direction of the platform 3. Both of these steps take place on the floor 10 at the placement and removal position and can be carried out, for example, by placing the vehicle 9 on a movable plate and aligning it automatically with respect to the platform 3.

[0031] After that, the platform 3 is moved towards the vehicle 9 and centred on it's front. Then the two arms 5, 7 are extended on both sides of the vehicle, after which the platform 3 is moved until the arm 7, which is fastened to the platform 3, is at the distance desired from the side of the vehicle 9. After that, the other arm 5 is moved transversely b (see Figure 1) with respect to the platform 3 until this arm is also at the distance desired from the other side of the vehicle 9. Moving the arms 5, 7 up to the distance desired from the sides of the vehicle takes place with the help of sensors on the arms (not shown in the Figures).

[0032] The pairs of carrier shoes 27, 29 and 35, 37 are now close to the front wheels. The pairs of carrier shoes 31, 33 and 39, 41 are then moved to a point next to the rear wheels of the vehicle 9. This takes place by first swinging out the rear carrier shoes 33 and 41 and placing them against the rear wheels of the vehicle 9.

[0033] Then the other carrier shoes 27-31 and 35-39 are swung out from a position parallel to the arms (see Figure 1, arm 5) to a position at right angles to the arms (see Figure 1, arm 7). At the same time this takes place the carrier shoes are moved downwards.

[0034] After that, the carrier shoes 27-41 are moved towards each other in pairs and the wheels of the vehicle 9 are lifted up. The arms 5, 7 are now retracted, and the vehicle 9 is ridden onto the platform 3 by the carrier shoes 27-41.

[0035] The platform 3 is then brought to the storage position where the vehicle 9 is removed from the platform 3. This takes place first of all by extending the arms 5, 7, then by moving the carrier shoes 27-41 in each pair away from each other and then swinging them back, at the same time lifting them up. Finally, the arms 5, 7 are retracted.

[0036] It is not necessary to bring the vehicle's front wheels first to a predetermined distance from the platform. If this is not the case, first the front carrier shoes 27 and 35 should also be swung out and moved up against the front wheels of the vehicle 9. Furthermore, the vehicle is permitted to be out of alignment to a small extent with respect to the platform if this is so little that it is possible for the carrier shoes to get under the vehicle's wheels.

[0037] Although in the above the invention is explained on the basis of the drawings, it should be noted that the invention is in no way limited to the embodiment shown in the drawings. The invention also extends to all embodiments deviating from the embodiment shown in the drawings within the context defined by the claims.

Claims

1. Transport installation (1) for transporting a vehicle (9) between a placement/removal position and a storage position, which transport installation (1) comprises a movable platform (3), as well as two parallel extendible arms (5, 7), which are situated on the platform, at least one of which can move transversely with respect to the platform, which arms (5, 7) comprise two pairs of carrier shoes (27-41) each, for supporting the wheels of the vehicle (9) to be transported, and which carrier shoes of such a pair can move towards and away from each other, **characterized in that** the carrier shoes (27-41) can rotate between a first position, in which the carrier shoes are mainly parallel to the arms (5, 7), and a second position, in which the carrier shoes are practically at right angles to the arms, and that each carrier shoe (27-41) is coupled to a rotation mechanism that moves the carrier shoe (27-41) when rotating in a vertical direction from the first position to the second position downwards from a first position at a distance above a floor (10), on which the vehicle (9) to be transported is situated, to a second position on or just above the floor.

2. Transport installation (1) according to claim 1, **characterized in that** each of the arms (5, 7) is provided with at least one transverse wheel (93), for supporting the arm when moving transversely, which transverse wheel can be moved by a lifting mechanism between a first position on the floor, on which the vehicle (9) to be transported is situated, and a second position at a distance above the floor, where in the first position the arm with the carrier shoe is at a distance above the floor and the carrier shoes can rotate without coming in contact with the floor.

3. Transport installation (1) according to claim 1 or 2, **characterized in that** when the carrier shoes (27-41) are in the second position, if they are on the floor, the arms (5, 7) will be at a distance above the floor (10) due to the vertical position of the carrier shoes with respect to the arms.

4. Transport installation (1) according to claim 1, 2 or 3, **characterized in that** each carrier shoe (27-41)

comprises a first set of wheels (105) for making contact with a floor, on which the vehicle to be transported is situated, as well as a second set of wheels (107) for making contact with a tyre of a vehicle that is to be transported.

5. Transport installation (1) according to one of the preceding claims, **characterized in that** the rotation mechanism comprises an opening (113) with an internal screw thread, as well as a rotatable shaft (109) with an outside screw thread (111) **in that** opening, and either the shaft or the opening is situated on or in the carrier shoe (27-41).

6. Transport installation (1) according to one of the preceding claims, **characterized in that** the transport installation comprises mechanisms for moving the carrier shoes (27-41) making up a pair, in which each carrier shoe can rotate and is situated on a carriage (43-57) which can move along the arm (5, 7) concerned, which mechanism can move the two carriages of a pair of carrier shoes towards and away from each other, which when moving the carriages, pins (119) come in contact with parts of the carrier shoes and when moving the carriages further stop these parts as a result of which the carrier shoes rotate.

7. Transport installation (1) according to one of the preceding claims, **characterized in that** each arm (5, 7) comprises a first guide (11, 13) that is connected to the platform (3) and an extendible second guide (15, 17) that can move with respect to the first guide, where there is a coupling device (16, 18) between the two guides, which coupling device comprises a first and a second guide element that are connected to each other (19, 21 and 23, 25 respectively), which guide elements are guided in the first, and second guide respectively, and which guide elements comprise a gear wheel (75, 77) each, which gear wheels cooperate with gear racks (79, 81) situated on the first and second guide respectively, and which gear wheels (75, 77) are connected to each other by means of a transmission mechanism (83), and which transport installation (1) comprises a drive mechanism, situated on the first guide (11, 13), for moving the first guide element (19, 21), so that when moving the first guide element (19, 21) over a first distance, by means of the gear wheels (75, 77) and the transmission mechanism (83), the second guide (15, 17) is moved over a second distance which is greater than the first distance.

8. Transport installation (1) according to claim 7, **characterized in that** the transmission mechanism (83) comprises a first pulley (99), which is connected to the first gear wheel (75), for conveying a belt or chain, as well as a second pulley (101), which is connected to the second gear wheel (77), and that the transmission mechanism (83) comprises a belt (103) or chain, which is conveyed by the two pulleys (99, 101) and couples the two pulleys to each other.

9. Transport installation (1) according to claim 7 or 8, **characterized in that** the guide elements (19, 21 and 23, 25) can move in a vertical direction with respect to each other and are connected to each other.

10. Method for transporting a vehicle (9) between a placement/removal position and a storage position, comprising the moving of a platform (3) to a vehicle (9), the extending of two arms (5, 7) situated on the platform to both sides of the vehicle, the moving of at least one arm (5) transversely (b) with respect to the platform (3) until it is at the distance desired from a side of the vehicle (9), the moving of at least one pair of carrier shoes (31, 33 and 39, 41) on each arm (5, 7) to a point next to a wheel of the vehicle (9), the moving of the carrier shoes (27-41) making up a pair towards each other, as a result of which the vehicle's wheels are lifted up, the retracting of the arms (5, 7), as a result of which the vehicle (9) is ridden onto the platform (3) by the carrier shoes (27-41), the moving of the platform (3) to a position desired and the removing of the vehicle (9) from off the platform (3), **characterized in that** after extending the arms (5, 7) the platform (3) is moved until one of the arms (7), which is fastened to the platform, is at the distance desired from a side of the vehicle (9), after which the other arm (5) is moved transversely (b) with respect to the platform (3) until it is at the distance desired from the other side of the vehicle (9), and that after moving the carrier shoes (31, 33 and 39, 41) to a point next to the wheels of the vehicle (9), the carrier shoes (27-41) are swung out from a position parallel to the arms to a position at right angles to the arms, and at the same time the carrier shoes (27-41) are moved downwards.

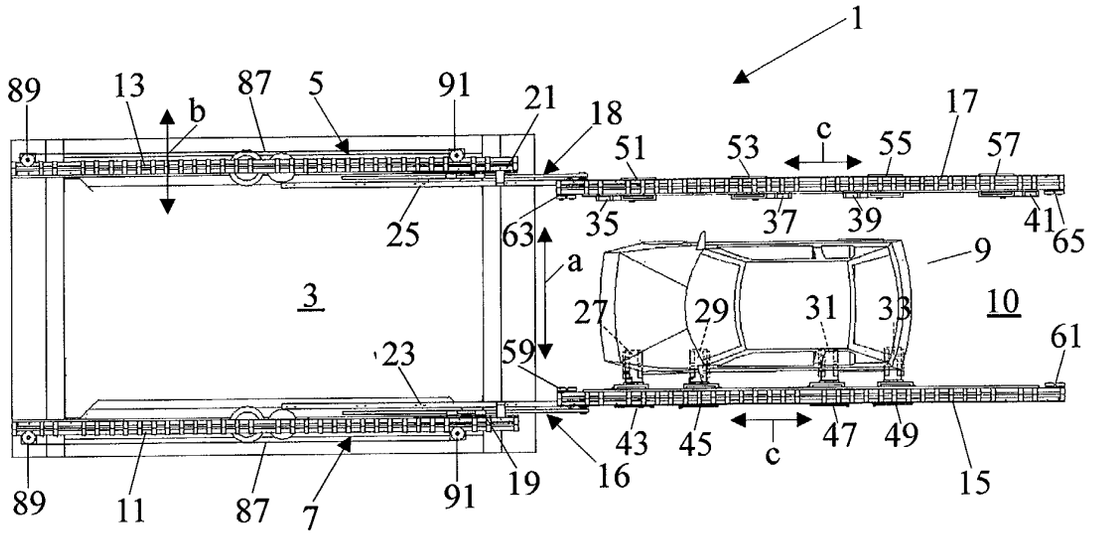
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FIG. 1

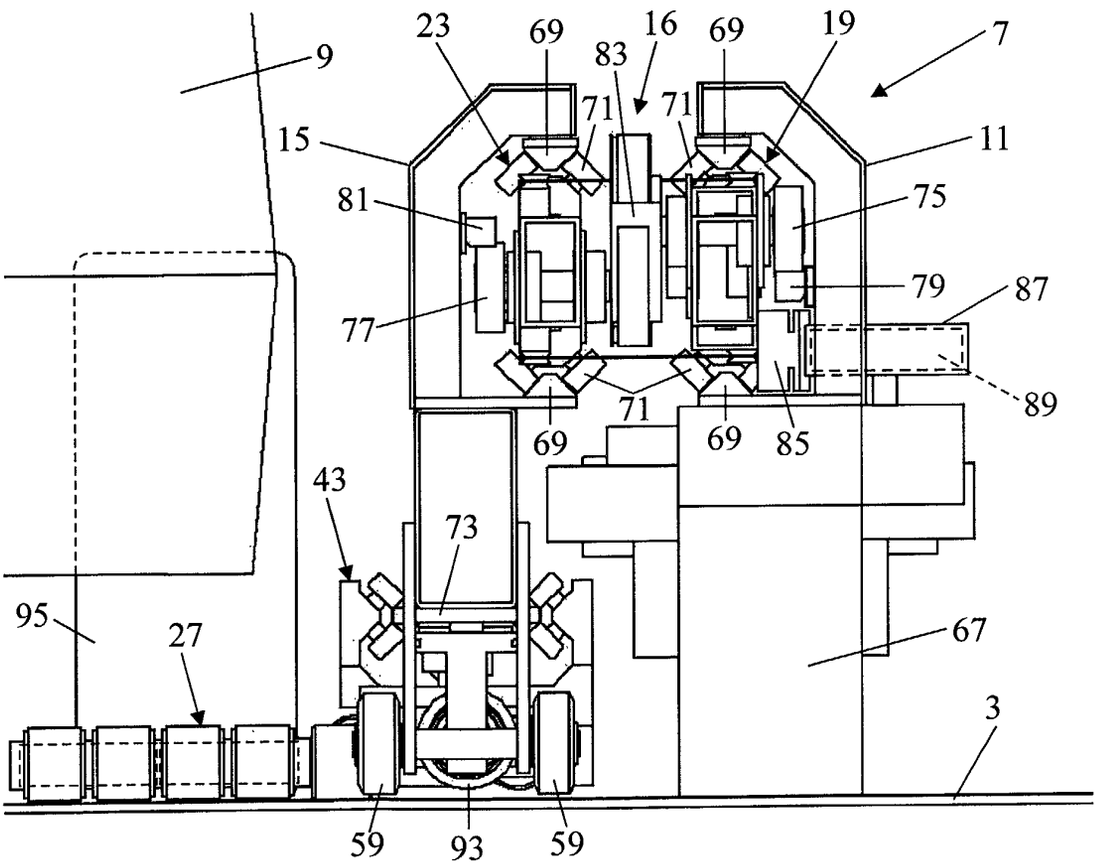
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FIG. 2

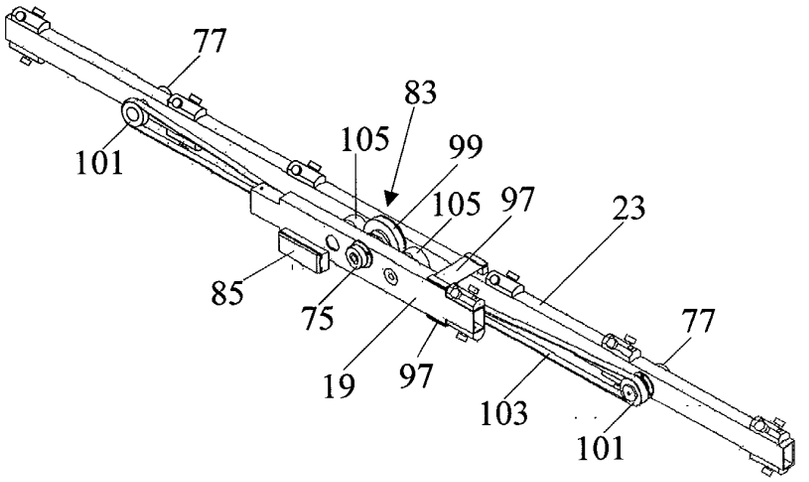


FIG. 3

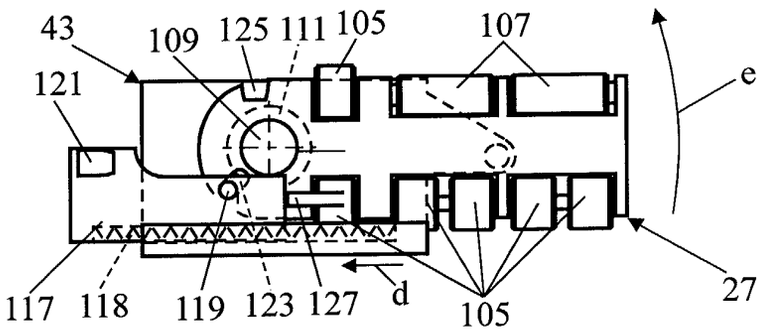


FIG. 4

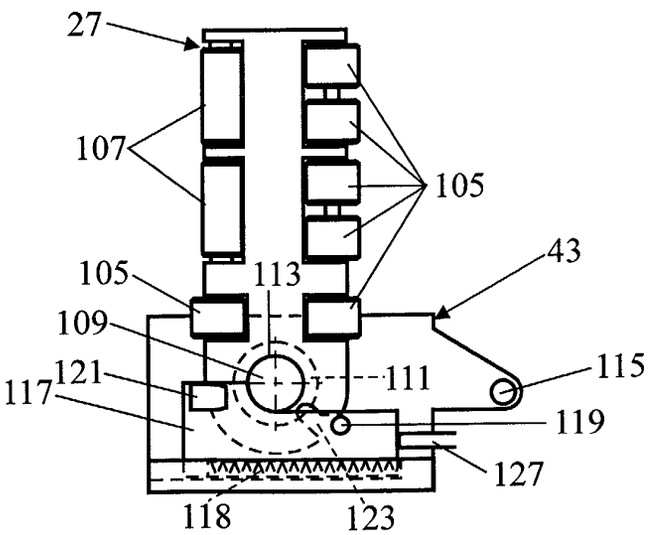


FIG. 5

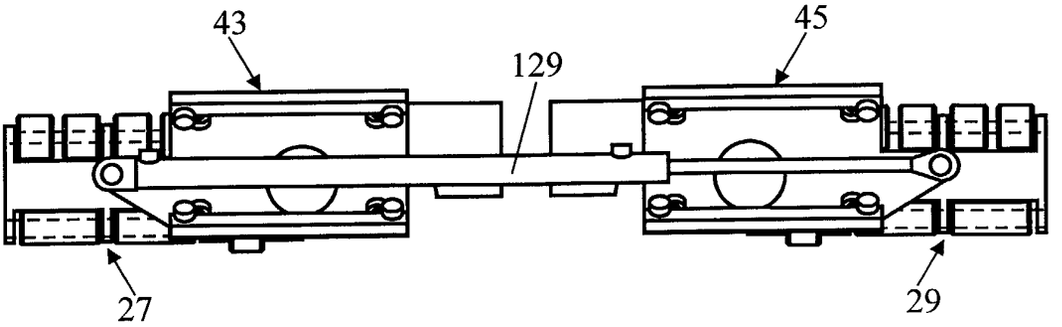


FIG. 6

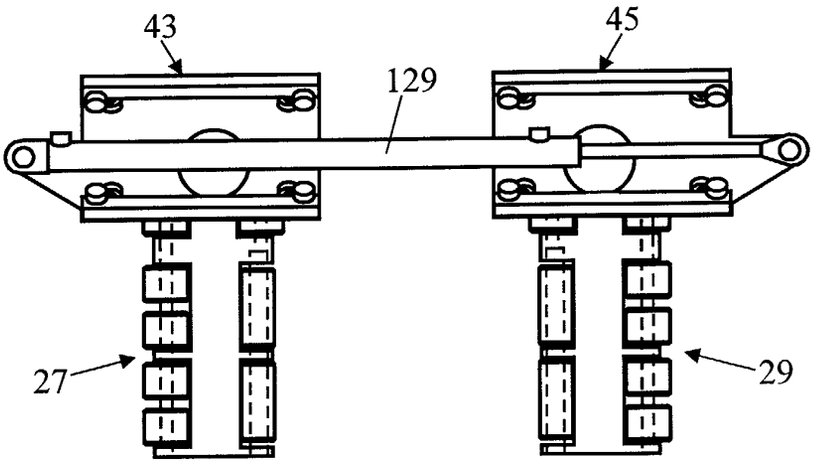


FIG. 7

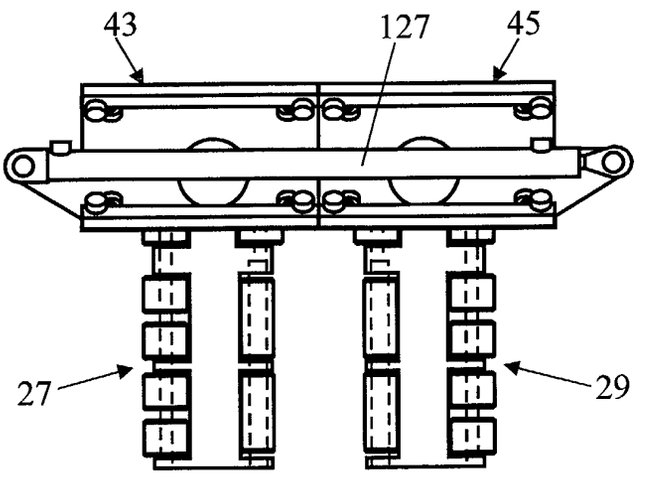


FIG. 8

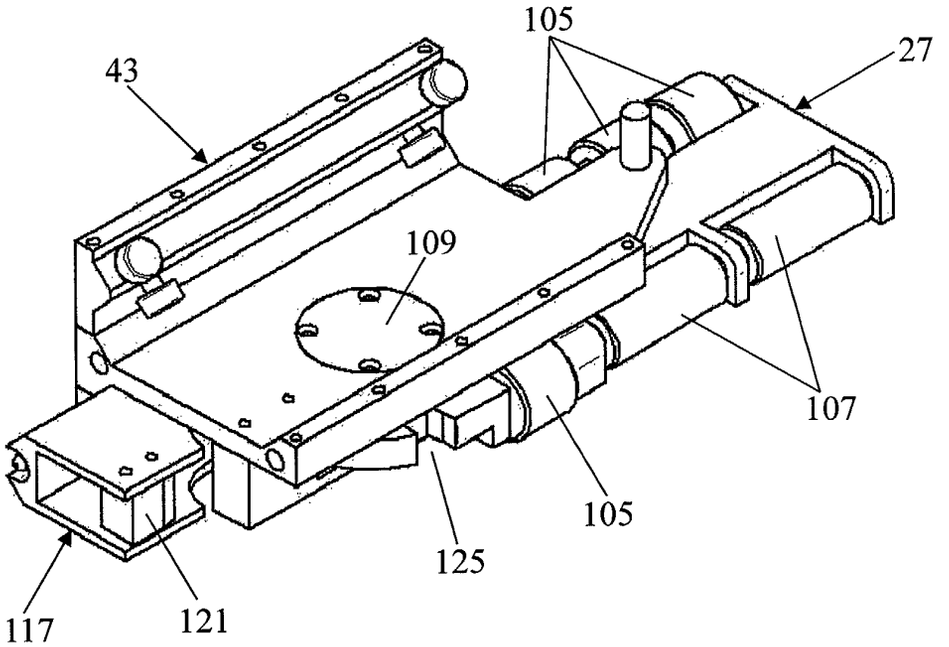
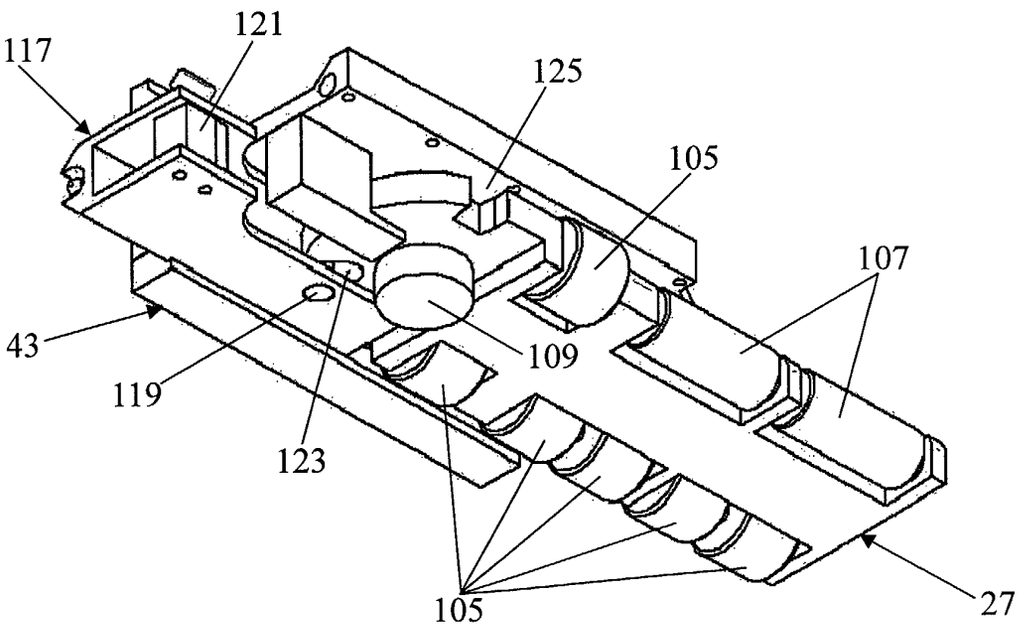

105
27
43
109
107
105
125
117
121

FIG. 9


121
117
125
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123
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27

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 January 2003	Delzor, F

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