

MULTILEVEL CAR PARKING DEVICE

TECHNICAL FIELD

[0001]

The present invention relates to a multilevel car parking device including a car parking space arranged in multistage.

BACKGROUND ART

[0002]

A multilevel car parking device described in Patent Document 1, for example, accommodates an automobile in each car parking space by elevating a pallet (20) mounted with an automobile (A) with a lifter (elevator 6a), and horizontally moving the pallet between the lifter and each car parking space (7), (8), (11), (12) by a moving device (30), (31), (32).

[Patent Document 1] JP 1989-219261 A

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0003]

In the above-described multilevel car parking device, problems may occur in moving a pallet if positions of the pallet and the moving device are shifted when horizontally

moving the pallet. However, since one of the pallet or the moving device is arranged on a lifter side (moving side) and the other is arranged on a structural body (fixed side), accurately aligning the positions is not easy.

[0004]

It is an object of the present invention to provide a multilevel car parking device capable of smoothly horizontally moving the pallet between the car parking space and the lifter.

MEANS FOR SOLVING THE PROBLEMS

[0005]

To solve the above-mentioned problems, the present invention provides a multilevel car parking device including a structural body in which a car parking space is arranged in multistage, a pallet accommodated in each car parking space in a retrievable manner, a lifter elevatable along the structural body, and a pallet moving device arranged on the lifter to transfer the pallet between the lifter and the car parking space; wherein the pallet moving device includes a pair of supporting arms arranged on the lifter in an oscillating manner and a friction gear rotatably arranged at a play end of each supporting arm, the pair of supporting arms being arranged symmetrically with respect to a pallet moving direction and with the play

end directed toward the car parking space side and being constantly biased in a direction of pushing the respective play ends to each other, and the friction gear being rotated with a guide plate of the pallet sandwiched with the pair of friction gears to transfer the pallet between the lifter and the car parking space.

[0006]

As described above, by arranging the pair of supporting arms for sandwiching the guide plate of the pallet in an oscillating manner, even if the position of the pallet is slightly shifted, such shift can be absorbed with the oscillation of the supporting arm, whereby the guide plate of pallet can be reliably sandwiched.

[0007]

A large load is sometimes applied on the pallet when loading or unloading the automobile to and from the multilevel car parking device. In other words, when the automobile loaded from the loading/unloading port is suddenly stopped on the pallet, a large load toward the far side (i.e., side opposite to loading/unloading port) applies on the pallet by an inertia force of the automobile. When the automobile is suddenly accelerated at the time of unloading, a large load toward the far side is applied on the pallet by the counter-reaction of the force that accelerates the automobile. When a large load is applied

on the pallet, the pallet strongly collides with another member, and noise may generate or other member may be damaged.

[0008]

The movement to the far side of the pallet arranged at the loading/unloading port is regulated by the pallet stopper, so that even if a large load toward the far side is applied on the pallet, the pallet can be fixed at a predetermined position, and strong collision of the pallet and another member can be avoided. Furthermore, if the pallet stopper and the pallet are spaced apart, noise may generate or the pallet stopper may be damaged when the pallet and the pallet stopper collide. Thus, the pallet stopper is brought into contact with the pallet arranged at the loading/unloading port from the far side or is stopped immediately before coming into contact with the pallet, so that even if the size and the position of the pallet arranged at the loading/unloading port slightly differ, the above drawbacks can be avoided since the distance between the pallet stopper and the stopper can be made substantially zero. Furthermore, when elevating the pallet, the interference of the pallet and the pallet stopper can be prevented by evacuating the pallet stopper to a position spaced apart from the pallet.

[0009]

In the multilevel car parking device, the lifter can be supported with a simple mechanism by arranging the locking lever pivotally supported in a projectable and rotatable manner to the outer side from the lifter at the lifter, arranging the stopper at the structural body configuring the car parking space, and lowering the lifter with the locking lever projected and rotated to the outer side of the lifter to engage the locking lever from the upper side of the stopper.

[0010]

In the case where a trolley horizontally movable with the pallet moving device is arranged at the lifter, the trolley needs to be fixed at a predetermined position on the lifter. The trolley fixing device includes a pair of turning frames turnably arranged on the trolley, a pair of dog clamp members, arranged on each turning frame, for clamping a dog arranged in a projecting manner on the lifter from both sides in the moving direction of the trolley, a biasing means for turning the pair of turning frames in a direction of releasing the clamping by the dog clamp member, and a solenoid for turning the pair of turning frames in a direction of clamping the dog with the dog clamp member, so that the trolley can be easily fixed with or released from the solenoid.

[0011]

An open space is sometimes provided on the front side (exterior side) of the loading/unloading port, where a turn table for changing the direction of the automobile and the like is arranged on the front open space. The space on the upper side of the front open space can be effectively utilized as a parking space by forming the car parking space in multistage on the upper side of the front open space.

EFFECTS OF THE INVENTION

[0012]

As mentioned above, according to the multilevel car parking device of the present invention, a pallet can be smoothly horizontally moved to a car parking space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a front cross-sectional view of a multilevel car parking device.

Fig. 2 is a side cross-sectional view of the multilevel car parking device.

Fig. 3 is a plan cross-sectional view at a first stage of the multilevel car parking device.

Fig. 4 is a plan cross-sectional view at second or higher stages of the multilevel car parking device.

Fig. 5 is a plan view of an elevating body.

Fig. 6 is a plan view of a trolley.

Fig. 7 is a side view of the trolley.

Fig. 8 is a plan view of a pallet moving device.

Fig. 9 is a side view of a pallet stopper.

Fig. 10 is a plan view of the pallet stopper.

Fig. 11 is a plan view of a detection device of the pallet stopper.

Fig. 12 is a side cross-sectional view of a lifter supporting device.

Fig. 13 is a bottom view of a trolley fixing device.

Fig. 14 is a longitudinal cross-sectional view of the trolley fixing device.

Fig. 15 is a schematic view showing the trolley fixing device (at the time of traveling).

Fig. 16 is a schematic view showing the trolley fixing device (front of fixed position).

Fig. 17 is a schematic view showing the trolley fixing device (fixed position).

BEST MODE FOR CARRYING OUT THE INVENTION

[0014]

Hereinafter, an embodiment of the present invention will be described with reference to the drawings. In the description below, a long side direction of a rectangular

car parking space 2 (i.e., front and back direction of an automobile A accommodated in the car parking space 2) is the front and back direction, and a short side direction (width direction of the automobile A) is the width direction in a horizontal plane, for the sake of convenience of explanation.

[0015]

Figs. 1 to 4 show a multilevel car parking device according to one embodiment of the present invention. The multilevel car parking device includes a structural body 1 and a car parking space 2 arranged in multistage on the interior of the structural body 1. In the illustrated example, two rows of main garage rows 3a, 3a in which the car parking space 2 is arranged in multistage are lined in the width direction, and two rows of sub-garage rows 3b, 3b in which the car parking space 2 is arranged in multistage are arranged facing each of the main garage rows 3a, 3a in the front and back direction. Each car parking space 2 is arranged with fixed rails 4, 4 extending in the width direction spaced apart in the front and back direction. A front open space 5 is formed on a front side of a loading/unloading port 6 of the multilevel car parking device, and the sub-garage rows 3b, 3b are arranged on the upper side of the front open space 5. A turn table 7 is arranged on the front open space 5, so that the automobile

A can change the direction on the turn table 7 when loading or unloading the automobile A.

[0016]

Each car parking space 2 of the multilevel car parking device is arranged with a pallet 8 for mounting the automobile on the upper surface. A plurality of casters 9 is attached at both ends in the front and back direction of the pallet 8 (see Fig. 7). A band plate-shaped guide plate 8a extending in the width direction is arranged at the lower surface of the pallet 8. The pallet 8 is slidable in the width direction with respect to the structural body 1 by mounting the casters 9 of the pallet 8 on the fixed rail 4 of the car parking space 2 so as to be rollable.

[0017]

The multilevel car parking device is arranged with a lifter 10 for elevating or lowering the pallet 8. The lifter 10 is configured by an elevating body 11 arranged so as to be elevated or lowered along the main garage rows 3a, 3a between the main garage rows 3a, 3a, and a trolley 12 arranged on the upper surface of the elevating body 11.

[0018]

The elevating body 11 is held by being suspended by a suspending member (not shown) such as a chain or a wire rope, and is elevated or lowered by an appropriate driving mechanism. As shown in Fig. 5, the elevating body 11

includes a long square-shaped frame body 13 in which frame members are combined. First guide rails 14, 14 are arranged along the front and back direction at an upper surface of a long side portion of the frame body 13. A pair of guide rollers 15, 15 is rotatably arranged at one short side portion of the frame body 13. The elevating body 11 can be elevated in the horizontal state along the main garage rows 3a, 3a between the main garage rows 3a, 3a by rollably contacting the guide rollers 15, 15 to a guide frame (not shown) extending in the up and down direction arranged on the structural body 1.

[0019]

The trolley 12 is slidable in the front and back direction with respect to the elevating body 11, so that the pallet 8 can be moved between the main garage rows 3a, 3a and between the sub-garage rows 3b, 3b. As shown in Figs. 6 and 7, the trolley 12 includes a long square-shaped frame body 16 in which frame members are combined. Attachment rods 17a, 17b having a substantially square cross-section are arranged at the short side portion of the frame body 16. Second guide rails 19, 19 are arranged along the inner side surface at the short side portion of the frame body 16. A caster 18 is rotatably arranged at both ends in the width direction of the attachment rods 17a, 17b. A plurality of guide plates 20 is arranged on the

upper surface of one attachment rod 17b. Motors 21, 21 for rotatably driving the caster 18 attached to the attachment rod 17b are arranged on the attachment rod 17b.

[0020]

The trolley 12 is arranged on the first guide rails 14, 14 in the front and back direction arranged on the elevating body 11 with each caster 18 rollably mounted. In this state, when the caster 18 arranged on one attachment rod 17b is rotatably driven by driving the motor arranged on the attachment rod 17b, the trolley 12 moves in the front and back direction along the first guide rails 14, 14 of the elevating body 11. A pair of supporting rails 22, 22 is arranged on an extended line of the first guide rails 14, 14 arranged on the elevating body 11 between the sub-garage rows 3b, 3b (see Fig. 4). The trolley 12 can be transferred from the lifer 10 to the sub-garage rows 3b, 3b by moving the trolley 12 in the front and back direction and mounting the same on the supporting rails 22, 22.

[0021]

As shown in Fig. 6, the trolley 12 is arranged with pallet moving devices 23a, 23b for moving the pallet 8 in the width direction. The pallet moving devices 23a, 23b are symmetrically arranged on both sides in the width direction of an attachment plate 24 arranged at one end side in the front and back direction of the trolley 12.

The pallet 8 can be transferred between each car parking space 2 and the lifter 10 by the pallet moving devices 23a, 23b. One pallet moving device 23a will be described below, but since the other pallet moving device 23b has a similar configuration, the description thereof will not be given.

[0022]

As shown in Fig. 8, the pallet moving device 23a includes a pair of guide rails 25, 25' being arranged on the attachment plate 24 and extending in the width direction, a moving board 26 arranged to be movable along the guide rails 25, 25', guide members 26a, 26a' with a plurality of casters 27, 27' arranged to be rollable along the guide rails 25, 25', and a box 26b attached to the guide member 26a, 26a'.

[0023]

A pair of first pivot shafts 28, 28' passing in the up and down direction and being fixed in a standing manner is arranged at symmetric positions in the front and back direction in the box 26b. The upper parts of the first pivot shafts 28, 28' project to the upper side from the box 26b, and a pair of supporting arms 29, 29' rotatably and pivotally supported through a plurality of bearings is arranged at the projecting portion. The supporting arms 29, 29' are held in parallel and horizontally toward the outer side in the width direction. The supporting arms 29, 29'

have a flat rectangular solid shape with a space formed inside, where the opposing inner side surfaces and the center side end face in the width direction are opened.

[0024]

Second pivot shafts 31, 31' passing and being fixed in the up and down direction are arranged at the distal ends (ends on the side opposite to the first pivot shafts 28, 28') of the supporting arms 29, 29'. The pivot shafts 31, 31' are arranged with friction gears 30, 30' rotatably journaled in the supporting arms 29, 29' through the bearing. The friction gears 30, 30' have the inner side portions facing each other projecting out from the opened opposing inner side surfaces of the supporting arms 29, 29' so as to be contactable to each other.

[0025]

An attachment bar 32 is arranged at the distal ends of the supporting arms 29, 29' to couple the distal ends. The attachment bar 32 is arranged by being horizontally passed through the lower corners of the distal ends of the supporting arms 29, 29', where both ends project out from the supporting arms 29, 29'. The supporting arms 29, 29' are slidable with respect to the attachment bar 32.

[0026]

Both ends of the attachment bar 32 are arranged with a nut 34, 34' screw coupled to a screw groove formed at

both ends of the attachment bar 32, an annular plate 33, 33' fitted to the inner side of the nut 34, 34', and a compression spring 35, 35' arranged between the annular plates 33, 33' and the supporting arms 29, 29'. The supporting arms 29, 29' are constantly biased in the direction in which the distal ends close by the elastic force of the compression springs 35, 35', thereby configuring a parallel link mechanism.

[0027]

The friction gears 30, 30' are rotatably driven by a first driving mechanism 36. The first driving mechanism 36 includes a drive motor 37 arranged at one end of the moving board 26, a driving shaft 38 projecting upward from the drive motor 37, and a drive gear 39 fixed to the driving shaft 38.

[0028]

Transmission gears 40, 40' are rotatably arranged through the bearing at the first pivot shafts 28, 28' arranged at the supporting arms 29, 29'. The transmission gears 40, 40' are fixed to the inner surfaces of the supporting arms 29, 29'. The transmission gears 40, 40' have the peripheral edges projecting out from the opened opposing inner side surfaces and the opened center side end face in the width direction of the supporting arms 29, 29' so as to gear with each other. One of the transmission

gears 40 gears with the drive gear 39.

[0029]

The transmission gears 40, 40' and the friction gears 30, 30' are arranged with chain wheels 41, 41' and 42, 42', respectively. The chain wheels 41 and 42 are wound with an endless chain 43, and the chain wheels 41' and 42' are wound with an endless chain 43'. Tension wheels 44, 44' are arranged at the supporting arms 29, 29'. The endless chains 43, 43' are geared to the tension wheels 44, 44', respectively, where the tensile force of the endless chains 43, 43' can be adjusted by appropriately adjusting the position in the width direction.

[0030]

The moving board 26 is moved in parallel in the width direction by a second driving mechanism 45. The second driving mechanism 45 includes a drive motor 46 arranged at a predetermined area of the attachment plate 24 of the trolley 12, a rack jack 47 coupled to the drive motor 46, and a rack 48 that gears with the rack jack 47 and that is slidable in the width direction. The end of the rack 48 is coupled to the end face of the box 26b of the moving board 26 through a pressing member 49 and a joint 50. When the drive motor 46 is rotatably driven, the rotational movement is converted to the linear movement through the rack jack 47 and the rack 48, so that the moving board 26 is moved in

parallel in the width direction along the guide rails 25, 25'. The other end of the rack 48 of the rack jack 47 is coupled to the moving board of the other pallet moving device 23b, where the moving boards of the pallet moving devices 23a and 23b simultaneously move in parallel by rotatably driving the drive motor 46.

[0031]

The pallet moving device 23a is arranged with a first position detection mechanism 51 for detecting the position of the moving board 26 moved in parallel by the second driving mechanism 45. Here, the movement of the moving board 26 to the side projecting to the outer side in the width direction is the forward movement and the movement to the opposite side is the backward movement. The first position detection mechanism 51 includes an attachment bracket 52 arranged in parallel to the guide rail 25 at the side of the guide rail 25, first to fourth proximity switches 53a to 53d arranged at a predetermined interval on the attachment bracket 52, and an operation rod 54 fixed to the moving board 26 and extended in the width direction. When the moving board 26 moves in parallel and approaches the first to fourth proximity switches 53a to 53d, each of the switches 25a to 25d is operated and the position of the moving board 26 (friction gear 30) is detected. In this case, when the first proximity switch 53a and the second

proximity switch 53b operate, the moving board 26 of one pallet moving device 23a is at the forward movement end position (shown with a virtual line at the left end of Fig. 8), and the friction gear of the other pallet moving device 23b is at the backward movement end position (not shown). When the second proximity switch 53b and the third proximity switch 53c operate, the friction gears of the pallet moving devices 23a and 23b are both at intermediate positions (shown with solid line in Fig. 8). When the third proximity switch 53c and the fourth proximity switch 53d operate, the friction gear 30 of the pallet moving device 23a is at the backward movement end position (not shown), and the friction gear of the pallet moving device 23b is at the forward movement end position (shown with a virtual line at the right end of Fig. 8).

[0032]

The accommodation and the retrieval of the automobile A in the multilevel car parking device of the above-described configuration will now be described. In the initial state, assume that the automobile A is not accommodated in each car parking space 2 of the main garage rows 3a, 3a and the sub-garage rows 3b, 3b of the structural body 1, the lifter 10 is stopped at the lowermost end position, that is, the loading/unloading port, and the pallet 8 is not mounted on the lifter 10.

[0033]

When accommodating the automobile A in the car parking space 2 of the main garage row 3a, the lifter 10 is first raised to the height of the desired car parking space 2 with an appropriate driving mechanism. In this state, the fixed rail 4 of the car parking space 2 of the main garage row 3a and the second guide rails 19, 19 of the trolley 12 are positioned on the same line in the width direction, and the supporting rails 22, 22 between the sub-garage row 3b and the first guide rails 14, 14 of the elevating body 11 are positioned on the same line in the front and back direction. When accommodating the automobile A in the car parking space 2 of the sub-garage row 3b, a trolley moving drive motor 21 is further operated from the above state to horizontally move the trolley 12 along the first guide rails 14, 14 of the elevating body 11, and arrange the trolley 12 on the supporting rails 22, 22 between the sub-garage rows 3b, 3b. In this case, the fixed rails 4, 4 of the car parking space 2 of the sub-garage rows 3b, 3b and the second guide rails 19, 19 of the trolley 12 are positioned on the same line in the width direction.

[0034]

Thereafter, the drive motor of the second driving mechanism 45 arranged on the pallet moving device 23a is

operated to project the rack 48 in the width direction. The moving board 26 then moves forward (moves toward the outer side in the width direction) along the guide rails 25, 25'. When the operation rod 54 approaches the first proximity switch 53a and the second proximity switch 53b, the forward movement end position of the moving board 26 is detected. The second driving mechanism 45 of the pallet moving device 23a is then stopped, and the pair of friction gears 30, 30' are held in a state projecting out to the outer side in the width direction from the trolley 12. The guide plate 8a at the lower surface of the pallet 8 accommodated in the car parking space 2 is sandwiched by the friction gears 30, 30' constantly biased in the direction of pressure contacting each other with the elastic force of the compression springs 35, 35'. In this case, the supporting arms 29, 29' oscillate with the first pivot shafts 28, 28' as the center by the action of the parallel link mechanism, and thus the guide plate 8a can be reliably sandwiched by the friction gears 30, 30' even if an error occurs in the attachment position of the guide plate 8a at the lower surface of the pallet 8, as the guide plate 8a hits one of the friction gears 30, 30' and the supporting arms 29, 29' oscillate.

[0035]

When the guide plate 8a is sandwiched with the

friction gears 30, 30' in such a manner, the drive motor 37 of the first driving mechanism 36 and the drive motor 46 of the second driving mechanism 45 are operated at substantially the same time therewith to rotatably drive the drive gear 39 and enter or exit the rack 48. The rotational driving force of the drive gear 39 is transmitted to the friction gears 30, 30' through the transmission gears 40, 40' and the endless chains 43, 43' as well as the chain wheels 41, 41', 42, 42'. The entering and exiting of the rack 48 causes the moving board 26 to move backward (accommodate to the inner side in the width direction). In other words, as the friction gears 30, 30' move backward while rotating, the guide plate 8a of the pallet 8 sandwiched between the friction gears 30, 30' is sent to the trolley 12 side by the friction force with the friction gears 30, 30'. As a result, the casters 9 of the pallet 8 transfers onto the second guide rails 19, 19 of the trolley 12 from the fixed rails 4, 4 of the car parking space 2, and the pallet 8 moves onto the lifer 10. Thereafter, when the operation rod 54 moves backward with the backward movement of the moving board 26, and the second proximity switch 53b and the third proximity switch 53c operate, the first driving mechanism 36 and the second driving mechanism 45 stop. In this case, the pallet 8 is positioned and held in place on the trolley 12 by

sandwiching both ends in the width direction of the guide plate 8a of the pallet 8 with each friction gear of the pallet moving devices 23a and 23b.

[0036]

When the empty pallet 8 is moved to the lifter 10 in such a manner, the lifter 10 is lowered and stopped at the loading/unloading port 6 (in the present embodiment, lowermost position between main garage rows 3a, 3a). In this state, the automobile A on the turn table 7 of the front open space 5 of the structural body 1 is advanced into the structural body 1 from the loading/unloading port 6, and stopped on the pallet 8. In this case, if the automobile A is loaded without being sufficiently decelerated and then suddenly stopped on the pallet, a large load toward the far side (advancing direction of automobile A) applies on the pallet 8. In order to regulate the movement of the pallet 8 by the load, a pallet stopper 200 having the configuration below is arranged in the multilevel car parking device according to the present embodiment. In the description of the pallet stopper 200, the direction the distal end (roller 201) of the pallet stopper 200 projects toward the pallet 8 side is the front side (right side of Figs. 9 to 11), and the direction the distal end of the pallet stopper 200 separates from the pallet 8 and moves backward is the back side (left side of

Figs. 9 to 11).

[0037]

The pallet stopper 200 is arranged on the far side (side opposite to the side the automobile A enters and exists) of the pallet 8 arranged at the loading/unloading port 6. As shown in Figs. 9 and 10, the pallet stopper 200 includes a roller 201 having a rotation axis in the width direction, a supporting tool 202 for supporting the roller 201, a rack arm 203 extending to the back side from the supporting tool 202, a pinion 204 that gears with the rack arm 203, and a motor 205 for rotatably driving the pinion 204. The roller 201 can be moved in the front and back direction by rotatably driving the motor 205. The pallet stopper 200 is arranged with a first sensor 220 for detecting the backward movement stop position of the roller 201, and a second sensor 230 for detecting an advance limit position of the roller 201. The supporting tool 202 of the roller 201 is fixed with an operation rod 206 bent to a hook shape.

[0038]

The pallet stopper 200 is arranged with a detection device 210 for determining the stop position of the roller 201. The detection device 210 advances and retreats with the roller 201. As shown in Fig. 11, the detection device 210 is fixed at the supporting tool 202, and includes an

attachment tool 211 having a substantially C-shape in top view, a supporting bar 212 passing through the attachment tool 211 in the front and back direction, and a third sensor 213 for detecting the position of the backward end 212a (left end of Fig. 11) of the supporting bar. A spring 214 is attached on the outer periphery of the supporting bar 212. The spring 214 is sandwiched by the attachment tool 211 and a locking portion 215 arranged at the supporting bar 212, and is held in a compressed state. The supporting bar 212 is biased in a direction of projecting toward the front side. In this case, the distal end of the supporting bar 212 is arranged slightly projecting out than the distal end of the roller 201. A freely rotatable ball 216 is arranged at the distal end of the supporting bar 212.

[0039]

The operation of the pallet stopper 200 will now be described. When the pallet 8 is arranged at the loading/unloading port, the motor 205 is driven to project the roller 201 to the front side (pallet 8 side). The ball 216 arranged at the distal end of the supporting bar 212 of the detection device 210 comes into contact with a stopper receiving plate 8b arranged at the end of the pallet 8 prior to the roller 201. The supporting bar 212 is thereby relatively pushed to the back side with respect to the attachment tool 211, and the backward end 212a of the

supporting bar 212 is detected by the third sensor 213. At the same time as the detection, the motor 205 is stopped, and the roller 201 is stopped. In this case, the dimension and the position of each member are set so that the roller 201 comes into contact with the stopper receiving plate 8b of the pallet 8 or stops immediately before coming into contact. In this case, if the roller 201 is strongly pressed against the stopper receiving plate 8b, the load applied on the pallet 8 directly applies on the motor 205 and the motor 205 may be damaged, and thus they are preferably brought into contact lightly. As a target, the roller 201 is rotatable in the contacted state. If the motor 205 is not stopped by the detection device 210 for some kind of drawback, the motor 205 is stopped when the operation rod 206 fixed on the supporting tool 202 of the roller 201 is detected by the second sensor 230 (see virtual line of Fig. 10).

[0040]

The automobile A is placed on the upper surface of the pallet 8 in this state. In this case, the movement to the far side of the pallet 8 is regulated by the pallet stopper 200, so that the pallet can be fixed at a predetermined position even if the automobile A is suddenly stopped and the load toward the far side (left direction in the figure) is applied on the pallet 8, and thus the

collision of the pallet and other members (e.g., structural body 1) can be avoided. As the gap between the stopper receiver 8b of the pallet 8 and the roller 201 is substantially zero, the noise and impact of when the pallet 8 and the roller 201 collide can be suppressed.

Furthermore, as the pallet stopper 200 is brought into contact with the stopper receiver 8b with the roller 201 or the ball 216, even if the pallet 8 slightly lowers when the automobile rides on the pallet 8, the roller 201 and the ball 216 can rotate to absorb such displacement, and thus the load will not be applied on the rack arm 203 and the supporting bar 212.

[0041]

When the automobile A is mounted on the pallet 8, the motor 205 is rotatably driven in the opposite direction to move the roller 201 backward. When the detection plate 206 fixed at the supporting tool 202 of the roller 201 is detected by the first sensor 220, the position of the motor 205 is stopped. Thereafter, the pallet 8 mounted with the automobile A is elevated. Accordingly, an event in which the pallet 8 and the roller 201 interfere when the pallet 8 ascends (or descends) can be reliably avoided by moving the roller 201 backward. Even when unloading the automobile A on the pallet 8, the pallet 8 can be fixed in place even if the automobile A is suddenly accelerated at the time of

unloading by regulating the movement toward the far side of the pallet 8 with the pallet stopper 200, similar to above.
[0042]

The pallet 8 mounted with the automobile A is then elevated to the height of the car parking space 2 where the pallet 8 is originally accommodated, and the fixed rails 4, 4 of the car parking space 2 and the second guide rails 19, 19 of the trolley 12 are arranged on the same line in the width direction.

[0043]

Thereafter, the drive motor 37 of the first driving mechanism 36 and the drive motor 46 of the second driving mechanism 45 arranged in the pallet moving device 23a are driven to rotatably drive the drive gear 39 and project the rack 48 to the outer side in the width direction. The friction gears 30, 30' move forward while rotating in the direction of conveying the pallet 8 out to the car parking space 2 side, so that the guide plate 8a of the pallet 8 sandwiched between the friction gears 30, 30' is conveyed out to the car parking space 2 side by the friction force of the friction gears 30, 30'. As a result, the casters 9 of the pallet 8 transfers onto the fixed rails 4, 4 of the car parking space 2 from the second guide rails 19, 19 of the trolley 12, and the pallet 8 moves to the car parking space 2. When the operation rod 54 approaches the first

proximity switch 53a and the second proximity switch 53b with the forward movement of the moving board 26, the operation of the first driving mechanism 36 and the second driving mechanism 45 of the pallet moving device 23a stops, and the pallet 8 is positioned and held at the home position of the car parking space 2.

[0044]

When the automobile A is accommodated in the desired car parking space 2 in such a manner, the drive motor 46 of the second driving mechanism 45 of the pallet moving device 23a is operated to enter or exit the rack 48. The friction gears 30, 30' thereby detach from the guide plate 8a of the pallet 8 and move backward. When the operation rod 54 approaches the second proximity switch 53b and the third proximity switch 53c, the second driving mechanism 45 is stopped and the friction gears 30, 30' are held at the original home position.

[0045]

The multilevel car parking device may be arranged with a lifter supporting device 56 (see Fig. 12) for temporarily supporting the lifter 10 when the lifter 10 is stopped at the height of each car parking space 2 of the structural body 1. The lifter supporting device 56 includes a solid rectangular shaped supporting case 57, which is fixed to the elevating body 11, is interiorly

formed with a space, and has the outer side surface opened; a pivot shaft 58 bridged across side plates 57a, 57a of the supporting case 57, and a locking lever 59 having a boss 59a rotatably fitted and inserted to the pivot shaft 58. The locking lever 59 is constantly biased in the inner side direction of the supporting case 57 by a return spring 60. The locking lever 59 is arranged with a locking nail 59b at the distal end and is arranged with a projecting piece 61 at the boss 59a. A rotation regulating member 62 for regulating the rotation of the locking lever 59 by coming into contact with the back end face of the locking lever 59 is arranged at a predetermined position in the supporting case 57. A round bar shaped stopper 63 is fixed at the upper surface of the fixed frame (not shown) configuring the structural body 1 at the pallet loading/unloading side of each garage row. The stopper 63 is arranged at a position the locking nail 59b of the locking lever 59 can engage from the upper side. When the locking lever 59 is engaged with the stopper 63, the positions of the locking lever 59 and the stopper 63 are adjusted such that the fixed rails 4, 4 in the width direction of the car parking space 2 and the second guide rails 19, 19 in the width direction of the trolley 12 are arranged on the same line in the same plane. A locking lever operation actuator is arranged at a predetermined position in the supporting case

57. The actuator is configured by a solenoid 64, a plunger 64a that projects in or out by the solenoid 64, and a coupling link 65 for coupling the distal end of the plunger 64a to the projecting piece 61 of the locking lever 59.

[0046]

The operation of the lifter supporting device 56 will now be described.

[0047]

First, the lifter 10 is elevated and arranged at a position of the height of the desired car parking space 2. The lifter 10 stops when the locking lever 59 arranged on the lifter 10 passes the stopper 63 of the car parking space 2 and is positioned on the upper side of the stopper 63 by a predetermined dimension (e.g., 5 to 10 cm). At the same time as the stopping of the lifter 10, the solenoid 64 is excited to enter or exit the plunger 64a, and the locking lever 59 is rotated with the pivot shaft 58 as the center against the elastic force of the return spring 60. The locking lever 59 then projects out from the supporting case 57, and the locking nail 59b faces the stopper 63. The locking lever 59 engages the stopper 63 when the lifter 10 is lowered in this state. Thus, the lifter 10 is temporarily supported by the structural body 1, and the fixed rails 4, 4 of the car parking space 2 and the second guide rails 19, 19 of the trolley 12 are arranged on the

same line. After the stopper 63 and the locking lever 59 are engaged, the locking lever 59 does not return even if the solenoid 64 is demagnetized as the distal end of the locking lever 59 and the stopper 63 are engaged in the rotating direction of the locking lever 59, whereby the temporary supporting state is maintained.

[0048]

After the pallet 8 is transferred, the lifter 10 is slightly elevated. The engagement of the locking lever 59 and the stopper 63 is then released, and the locking lever 59 rotates by the elastic force of the return spring 60 and retreats into the supporting case 57. The lifter 10 is thus in an elevatable state.

[0049]

The multilevel car parking device can be arranged with a trolley fixing device 100 for stopping and fixing the trolley 12 at the home position of the elevating body 11. The trolley fixing device 100 is attached to the trolley 12 and holds the trolley in place by clamping a dog arranged in a projecting manner on the elevating body 11. For example, as shown in Figs. 13 and 14, the trolley fixing device 100 includes a base plate 101 fixed to the trolley, fulcrum shafts 102a, 102b, and turning frames 103a, 103b. The fulcrum shafts 102a, 102b are lined along the moving direction (left and right direction in the figure)

of the trolley at the central part of the base plate 101, and the turning frames 103a, 103b are attached in a freely turning manner to the fulcrum shafts 102a, 102b. The fulcrum shafts 102a, 102b are arranged on the path of the dog 116 of the elevating body 11 (see Figs. 15 to 17). The turning frames 103a, 103b are symmetrically arranged. The play end (end on the side opposite to the fulcrum shafts 102a, 102b) of each of the turning frames 103a, 103b is respectively arranged with inclination levers 104a, 104b inclined by a predetermined angle from the lower part of the play end. The inner ends (fulcrum shafts 102a, 102b side end) of the inclination levers 104a, 104b are respectively arranged with dog clamp members 105a, 105b so as to face each other.

[0050]

Solenoids 106a, 106b are symmetrically arranged at both ends of the base plate 101. The distal ends of the plungers 106a', 106b' of the solenoids 106a, 106b are pivotally attached to pivotal attachment members 108a, 108b arranged in a projecting manner at the basal end of the turning frames 103a, 103b by way of coupling links 107a, 107b. When the solenoids 106a, 106b are excited to take in the plungers 106a', 106b', the turning frames 103a, 103b turn with the fulcrum shafts 102a, 102b as the supporting points by way of the coupling links 107a, 107b and the

pivotal attachment members 108a, 108b (see arrow X of Fig. 13).

[0051]

The base plate 101 is arranged with first stoppers 109a, 109b for regulating the turn (turn in the X direction of Fig. 13) in the direction the play end of each of the turning frames 103a, 103b rises at a predetermined position. The turn of each of the turning frames 103a, 103b is regulated when stopper receiving members 110a, 110b of the turning frames 103a, 103b come into contact with the first stoppers 109a, 109b, respectively (see virtual line of Fig. 13).

[0052]

The base plate 101 is arranged with return springs 111a, 111b at symmetrical positions. One ends of the return springs 111a, 111b are fixed to spring locking members 112a, 112b arranged on the base plate 101, and the other ends are fixed to spring locking members 113a, 113b arranged in a projecting manner at the basal ends of the turning frames 103a, 103b. The turning frames 103a, 103b are constantly biased in the direction of lowering the play end (see arrow Y of Fig. 13) by the tensile force of the return springs 111a, 111b.

[0053]

The base plate 101 is arranged with second stoppers

114a, 114b for regulating the turn (turn in the Y direction of Fig. 13) in the direction the play end of each of the turning frames 103a, 103b lowers at a predetermined position. The turn of each of the turning frames 103a, 103b is regulated when stopper receiving members 115a, 115b of the turning frames 103a, 103b come into contact with the second stoppers 114a, 114b, respectively.

[0054]

The dog 116 is arranged in a projecting manner at the stop position of the trolley 12, and is formed to a length of being clamped between the dog clamp members 105a, 105b arranged facing each other.

[0055]

The operation of the trolley fixing device 110 will be described below.

[0056]

First, when traveling the trolley 12, the solenoids 106a, 106b are excited to turn the turning frames 103a, 103b and brought into contact with the first stoppers 109a, 109b. According to such turn, the inclination levers 104a, 104b arranged on the turning frames 103a, 103b are evacuated from the position the dog 116 passes to obtain the unlock state (see Fig. 15). If the trolley 12 is traveled in such a state, the dog arranged on the trolley 12 does not come into contact with the inclination levers

104a, 104b at all, and thus the trolley 12 can travel smoothly.

[0057]

When stopping and fixing the trolley 12 at the home position of the elevating body 11, the solenoids 106a, 106b are demagnetized before the dog 116 reaches the home position, and the turning frames 103a, 103b are turned until coming into contact with the second stoppers 114a, 114b by the elastic force of the return springs 111a, 111b. According to such turn, the inclination levers 104a, 104b are returned to the position the dog 116 passes to obtain the lock state. If the trolley is traveled in such a state, one inclination lever 104a comes into contact with the dog 116 arranged on the trolley 12 immediately before the trolley reaches the home position. Accordingly, one turning frame 103a attached with the inclination lever 104a turns against the return spring 111a, and the inclination lever 104a passes while being pushed and spread by the dog 116 (see Fig. 16).

[0058]

When the inclination lever 104a passes the dog 116, the dog clamp member 105b attached to the other inclination lever 104b comes into contact with one end face of the dog 116 and the trolley 12 is stopped. At the same time, one inclination lever 104b detaches from the dog 116, and the

turning frame 103a turns until coming into contact with the second stopper 114a by the return spring 111a. The inclination lever 104a then returns to the lock state, the dog 116 is clamped between the dog clamp members 105a and 105b, and the trolley 12 is fixed (see Fig. 17).

[0059]

Thereafter, when releasing the fixation and traveling the trolley 12, the solenoids 106a, 106b are excited to turn the turning frames 103a, 103b to the unlock position, so that the dog clamp members 105a, 105b of the inclination levers 104a, 104b are evacuated from the position the dog 116 passes to obtain the unlock state.

DESCRIPTION OF THE REFERENCE SYMBOLS

[0060]

A	Automobile
1	Structural body
2	Car parking space
5	Front open space
6	Loading/unloading port
7	Turn table
8	Pallet
8a	Guide plate
8b	Stopper receiving plate
9	Caster

10 Lifter
11 Elevating body
12 Trolley
23a, 23b Pallet moving device
29 Supporting arm
30 Friction gear
56 Lifter supporting device
100 Trolley fixing device
200 Pallet stopper

CLAIMS

1. A multilevel car parking device comprising a structural body in which a car parking space is arranged in multistage, a pallet accommodated in each car parking space in a retrievable manner, a lifter elevatable along the structural body, and a pallet moving device arranged on the lifter to transfer the pallet between the lifter and the car parking space; wherein

the pallet moving device includes a pair of supporting arms arranged on the lifter in an oscillating manner and a friction gear rotatably arranged at a play end of each supporting arm, the pair of supporting arms being arranged symmetrically with respect to a pallet moving direction and with the play end directed toward the car parking space side and being constantly biased in a direction of pushing the respective play ends to each other, and the friction gear being rotated with a guide plate of the pallet sandwiched with the pair of friction gears to transfer the pallet between the lifter and the car parking space.

2. The multilevel car parking device according to claim 1, wherein a horizontally movable pallet stopper is arranged at a far part of a loading/unloading port, the

pallet stopper regulating movement of the pallet to the far side by being brought into contact with the pallet arranged at the loading/unloading port from the far side or being stopped immediately before coming into contact with the pallet from the far side.

3. The multilevel car parking device according to claim 1, wherein the lifter is arranged with a locking lever pivotally supported so as to be projectable and rotatable toward an outer side from the lifter and the structural body configuring the car parking space is arranged with a stopper, the lifter lowered with the locking lever projected and rotated to the outer side of the lifter to engage the locking lever from an upper side of the stopper.

4. The multilevel car parking device according to claim 1, wherein

the lifter includes an elevatable elevating body, a trolley arranged on the elevating body and horizontally movable with the pallet moving device, and a trolley fixing device for fixing the trolley at a predetermined position on the elevating body; and

the trolley fixing device includes a pair of turning frames turnably arranged on the trolley, a pair of dog

clamp members, arranged on each turning frame, for clamping a dog arranged in a projecting manner on the elevating body from both sides in a moving direction of the trolley, a biasing means for turning the pair of turning frames in a direction of releasing the clamp by the dog clamp member, and a solenoid for turning the pair of turning frames in a direction of clamping the dog with the dog clamp members.

. 5. The multilevel car parking device according to claim 1, wherein the car parking space is formed in multistage on an upper side of a front open space of the loading/unloading port.