

## SPECIFICATION

### CARGO STORAGE DEVICE

#### 5 TECHNICAL FIELD

The present invention relates to a unit for housing a cargo such as vehicles including passenger cars and trucks as well as freight carriers such as forklifts and handcarts, and particularly relates to a parking tower.

#### 10 BACKGROUND TECHNOLOGY

In recent years, in order to save the occupied areas of parking lots, multistory parking spaces have been installed, and a parking tower is one of them.

The mainstream parking towers have been constituted of a housing  
15 capable of housing a number of vehicles, and a base stand movable up and down. They transport a vehicle received in the base stand at an entrance on the ground to a housing rack of the housing so as to house it therein, and discharge the vehicle to the exit on the ground from the housing rack in the reverse steps as necessary.

20 However, such a type of parking tower has to transfer a vehicle to a predetermined housing rack from the entrance when housing the vehicle, and has to transfer a vehicle to the exit from the housing rack when discharging it, and therefore, it takes time. In addition, since the orientation of the vehicle is the same when the vehicle is received and when it is discharged, the vehicle  
25 has to be reversed either when received or when discharged, and therefore, there is the disadvantage that the operation takes too much time and labor.

In order to overcome such a disadvantage, the present inventor has previously proposed a cargo housing unit for vertically holding a plurality of cargo housing bodies at columns which are vertically provided, characterized  
30 by including reversing means which laterally rotates a cargo housing body arbitrarily taken out from a row of a plurality of vertically housed housing bodies to reverse their orientations, endless drive means which is disposed in the vertical direction along the above-described columns, provided with housing body holding parts for holding the above-described reversed cargo

housing body at predetermined spaces, and causes the cargo housing body to fall by the tare weight in a state holding the cargo housing body, and braking means which converts a rotational force of the above-described endless drive means into accumulation energy and applies a braking force to the endless drive means (JP3276695B).

Figure 8 is a front view of this unit, Figure 9 is a perspective view of a main part of this unit, and Figure 10 is a cross-sectional view of the cargo housing body holding part of this unit.

The unit vertically houses a plurality of vehicles C,... and includes a pair of columns 101,101' provided side by side on the ground to be opposed to each other, a plurality of vehicle mounting bases 102,...,102',... as cargo housing bodies rising and lowering along the columns 101,101', a raising drive mechanism 103 which raises the vehicle mounting bases 102,102',..., a chain 104 as endless drive means, a braking mechanism 105 as braking means which converts the rotational force of the chain 104 into accumulation energy and applies a braking force to the chain 104, and a frame 106 provided with an exit and an entrance of the vehicle at the same side.

A pair of columns 101,101' are vertically provided at a distance longer than the width of each of the vehicle mounting bases 102,102' from each other, and the respective columns 101,101' are formed by cylindrical outer columns 107,107', and cylindrical inner columns 108,108' which are located at the inner sides of the outer columns 107,107', and are vertically provided with respective base portions buried under the ground.

When the vehicle C is received into the predetermined vehicle mounting base 102 from the entrance of the cargo housing unit, and subsequently, the operation part switch is turned on, a power motor 109 of the raising drive mechanism is driven, a chain 112 wound on a chain wheel 111 starts to run via a rotary shaft 110, and the vehicle mounting base 102 is pushed upward along a lifting vertical groove 114 of the column 101 by the action of a lift plate 113, as a result of which, a stopper 115 is pushed to open.

Subsequently, when the vehicle mounting base 102 reaches an upper floor and the raising drive mechanism is stopped by the operation switch, a bearing 116 of the vehicle mounting base 102 becomes engaged with a

stopper 115 at a communication part 117a of an inclined groove 117 of that floor. At this time, since the holding mechanism works to inhibit rotation of the vehicle mounting base 102, the vehicle C stops at this floor and is housed.

Next, in order to discharge the thus housed vehicle C, a power supply is  
5 connected to a cell motor (not shown) of the holding mechanism mounted to a predetermined vehicle mounting base 102 by the operation switch to rotate the cell motor. Thereby, an arm (not shown) moves to the cell motor side, the holding mechanism is released, the bearing 116 of the vehicle mounting base 102 rolls down on a tip end surface 115b of the inclined stopper 115 by  
10 the tare weight of the vehicle C and the vehicle mounting base 102, and is received in the inclined groove 117. Namely, the bearing 116 rolls down along the inclined groove 117, and is received in a vertical groove for falling which is located on a substantial back side of the lifting vertical groove. Thereby, the vehicle mounting base 102 on which the vehicle C is mounted  
15 rotates by substantially 180° along the periphery of the column 101, and therefore, the vehicle C is disposed to be oriented with its front facing the exit.

Next, with the raising and lowering plate of the vehicle mounting base 102 engaged with and held by a hook part 118 of the chain 112, the vehicle mounting base 102 with the vehicle C mounted thereon falls by the tare  
20 weight, and reaches the lowest floor. On this occasion, the falling state is detected stepwise by a sensor 119, and the vehicle mounting base 102 is braked stepwise by an electromagnetic clutch linked to the sensor 119, and quietly gets down on the ground enabling the vehicle C to be discharged with its front facing forward.

25 The cargo housing unit has the advantages of being capable of housing a vehicle in a short time and discharging the vehicle in a short time, and having no need to carrying in and out a vehicle by reversing it, but rotation of the vehicle and the vehicle mounting base has to be performed by only one arm. Therefore, the total mass of the vehicle mounting base and the vehicle  
30 mounted thereon is exerted on the arm base part, which causes the risk of breakage, and the rotation is performed by rolling into the inclined groove, which brings about the disadvantage to readily cause breaking.

## DISCLOSURE OF THE INVENTION

The present invention has been completed under such circumstances and has an object to provide a cargo housing unit which is improved to reduce the load between cargo-mounting horizontal base stands and supporting members, so as to be freed from the troubles due to failure.

As a result of the repeated studies on enhancement of the function of the cargo housing unit, the present inventor has found out that a support column of a cargo-mounting horizontal base stand is constructed of a combination of a stationary part and a rotary part, and mounting of the horizontal base stand to the support column is performed with a cylindrical unit fixed via a mounting member having an arc-wise cross section, thereby strengthening a mounting portion of the horizontal base stand, and mounting can be made by horizontal translation to reduce the burden of the mass, whereby the above-described object can be achieved, and the inventor has completed the present invention based on this knowledge.

Namely, the present invention provides a cargo housing unit characterized in that, in a cargo housing unit comprising, within an upright housing, a lift part for raising having a plurality of cargo-mounting horizontal base stands disposed at approximately uniform distances, a lift part for lowering adjacent thereto keeping parallelism therewith and upright columnar supporting members which support the aforementioned horizontal base stands in a horizontally rotatable fashion between the two parts, the aforementioned supporting members are formed of a mobile part consisting of a plurality of cylindrical units stacked each independently from the others in a rotatable fashion by 180 degrees within a horizontal plane and a stationary part consisting of a supporting axial body which supports each of the cylindrical units and serves as the axis of rotation when the same is under rotation within a horizontal plane, the aforementioned horizontal base stand being connected to the aforementioned mobile part with intervention of a connection member having a curved surface.

## BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a front view of a parking tower of one example of the present invention.

Figure 2 is a plan view of the ground floor of the parking tower in Figure 1.

Figure 3 is a vertical sectional view of an upright supporting column in the parking tower in Figure 1.

5 Figure 4 is a cross-sectional view of a cylindrical unit in the parking tower in Figure 1.

Figure 5 is a vertical cross sectional view of a cylindrical unit in the parking tower in Figure 1.

10 Figure 6 is a plan view of a flange-formed plate in the parking tower in Figure 1.

Figure 7 is an explanatory illustration of the mechanism performing the horizontal rotating movement by a single motor in the parking tower in Figure 1.

Figure 8 is a front view of a conventional cargo housing unit.

15 Figure 9 is a perspective view of a main part of the cargo housing unit in Figure 8.

Figure 10 is a cross-sectional view of a cargo housing body holding part of the cargo housing unit in Figure 8.

## 20 BEST MODE FOR CARRYING OUT THE INVENTION

Next, with reference to the attached drawings, the best mode for carrying out the present invention will be described for a parking tower having a vehicle as a cargo as an example.

25 Figure 1 is a front view with the front surface cut off to show an internal structure of a parking tower, and Figure 2 is a plan view of the ground floor of the same parking tower.

As shown in Figures 1 and 2, the parking tower consists of an above-ground part A and an underground part B. The above-ground part A has a housing 1 constituting an entire superstructure, and the front face of the ground floor of this housing 1 is opened to form entrances 2,2' and an exit 3.

30 The above-ground part A is divided into two lift parts 4,4' for raising, and one lift part 5 for lowering, and the lift parts 4,4' for raising are provided with a plurality of vehicle mounting bases or, namely, cargo-mounting horizontal base stands 6,...6',... disposed at approximately uniform distances in the

vertical direction for housing a vehicle C, and two upright columns or, namely, upright columnar supporting members 7,7' for supporting them.

Meanwhile, in the underground part B, the drive mechanism for raising the vehicle mounting bases 6,...6',... of the above-described lift parts 4,4' for raising, for example, hydraulic cylinders 8,8' and a control mechanism 10 which converts kinetic energy into electric energy and accumulates the electric energy, and applies a buffering force for braking at the time of lowering predetermined vehicle mounting bases 6,6' via a chain 9 provided at the lift part 5 for lowering are housed.

Figure 3 is a vertical sectional view showing one example of the structure of the above-described upright supporting column 7 which is constructed by a stationary part constituted of a stationary axial body 11 and a mobile part constituted of a plurality of cylindrical units 12,... which are mounted around it to be risible and horizontally rotatable by 180°. Flange-formed plates 13,... for temporarily supporting the adjacent cylindrical units 12 directly over them, and stoppers 14,... are fixedly provided at the stationary axial body 11, and the respective cylindrical units 12,... are provided with drive motors 15,... for rotating for performing the horizontal rotational movement, and gears 15',... for rotating which are meshed with drive shaft gears thereof.

Next, Figure 4 is a cross-sectional view showing an internal structure of the individual cylindrical unit 12, and Figure 5 is a vertical sectional view. The cylindrical unit 12 is constructed of an outer cylinder 16, two pairs of channels with C-shaped sections (hereinafter, abbreviated as C-shaped channels) 17 and 18, and 17' and 18' which are fixed to the outer cylinder 16, and an outer cylinder receiving plate 19 which is fitted into one pair of them, and mounted in an upwardly movable fashion with stability.

The above-described outer cylinder receiving plate 19 is a semi-cylindrical curved plate, has the vehicle mounting base 6 integrally fixed to its lower portion, is inserted into openings 17a and 18a of the C-shaped channels 17 and 18, and is kept in a stable and risible state by four pairs of parallel double rollers 20,... and eight vertical rollers 21,... mounted to the outer cylinder receiving plate 19.

A stopper pushing-up member 22 which is provided at the outer cylinder 16, when the outer cylinder receiving plate 19 rises, pushes from below the stopper 14, which is always biased with a spring so that its upper portion opens outward with a support point 14a as a center, to recess its upper end portion, which is protruded outward, to inside, so that it does not interfere with rising of the outer cylinder receiving plate 19.

Figure 6 is a plan view of the flange-formed plate 13 fixedly provided at the stationary supporting column 11 for supporting the cylindrical unit 12. The flange-formed plate 13 is provided with notch portions 13a,13a' and 13b,13b' corresponding to the C-shaped channels 17,18 and 17',18' and 13b,13b' are notched deeper than 13a,13a' by the amount required for giving a space for allowing it to pass the upper end portion of the stopper 14 which is recessed inward by the stopper pushing-up member 22.

When a vehicle is housed in the parking tower constructed as above, the vehicle is mounted on the vehicle mounting base 6 on the ground floor in Figure 1 by causing the vehicle to proceed in the direction as it faces, namely, toward the back of the housing space, and thereafter, the lift part 4 for raising is started to operate by pressing a switch on a control panel (not shown) provided in the vicinity of the entrance of the parking tower. By this operation, the pushing-up member 22 slides upward by the hydraulic cylinder 8, and the stopper 14 is pulled into the stopper passing notch portions 13b,13b' of the flange-formed plate 13 against the spring by which it is biased, and the outer cylinder receiving plates 19,... rise with the vehicle mounting bases 6 without an obstacle. Rising of the outer cylinder receiving plates 19,... continues in sequence to the position where the vehicle mounting base is not present because it moves to the lift for lowering from the lift for raising, for example, the position of the fourth floor in Figure 1, and when it reaches the position, it automatically stops to finish the housing operation.

Next, when the vehicle housed in the parking tower is discharged, a command is sent to the floor in which the vehicle to be discharged is housed by pressing the switch of the above-described control panel, the drive motor 15 for rotating of that floor is actuated to start horizontal rotation of the cylindrical unit 12 in which the predetermined vehicle mounting base 6 is fixedly provided via the gear 15' for rotation.

The horizontal rotation of the cylindrical unit 12 is performed in the state in which it is supported on the flange-formed plate 13 with only the inner roller, in contact with the flange-formed plate 13, of the parallel double roller 20, and the outer roller is not supported, and therefore, when it rotates by 180 degrees and reaches the position of the lift part 5 for lowering, the outer cylinder receiving plate 19 is outside the support range of the stopper 14, whereby the support is released, and it falls by the tare weight along the C-shaped channel for lowering while causing the chain 9 engaged with it to perform circulatory rotation. The falling state is detected by a sensor (not shown) with time, and stepwise braking is performed for the falling by an electromagnetic clutch actuating in response to the detection signal of the sensor, braking is performed by a load occurring to a generator 23 for rotation of the chain 9, and the falling gradually stops by a buffering action.

Further, the chain 9 moves from above to below with the tare weight falling of the vehicle mounting base 6 and this movement rotates a chain wheel (not shown) connected to gears 24,25 to actuate the generator 23 directly connected to the chain wheel, whereby kinetic energy of falling is converted into electric energy which can be accumulated in an capacitor 26. The thus accumulated electric energy is fed back as the power for the drive motors 15,... for horizontal rotation and the others.

In this manner, the vehicle on the vehicle mounting base 6 which reaches the ground floor is oriented to face forward with respect to the exit, and therefore, it can go out by causing it to proceed as it faces. Accordingly, it is not necessary to reverse the vehicle carefully with one's nerves overstrained as in the case of the conventional tower parking, along with saving of time.

The vehicle mounting base 6 on the ground floor after the vehicle left it rotates around the supporting column in the reverse direction from the direction on the other floors by the drive motor and the reverse gear, and moves to the first floor of the lift part for raising. When, for example, the third floor of the lift part for raising is vacant, and the vehicle mounting base in the vacant space on the ground floor is pushed up to the second floor by the hydraulic cylinder 8, the vehicle mounting base on the second floor is

pushed up to the third floor in a linkage motion with this, and the vacant space is automatically filled.

In the above parking tower, the horizontal rotating movement of the vehicle mounting base 6 of each of the cylindrical units is performed by the drive motor 15 for horizontal rotation individually provided at each of the units, but it can be performed by using a single drive motor in common.

Figure 7 is an explanatory view showing one example of the mechanism which allows the respective cylindrical units to perform the horizontal rotating movement by using such a single drive motor wherein codirectional rotary gear pairs 27,... are placed on each of the cylindrical units 12,... instead of drive motors, an input gear 27a of each of the gear pairs is connected to a drive shaft 29 of a drive motor 28 by each of magnet connectors 30,... and, by meshing it with the output gear 27b on the cylindrical unit on the required floor, the cylindrical unit is caused to perform the horizontal rotating movement.

In the case of using this mechanism, only horizontal rotation on the ground floor is preferably performed in the reverse direction from the horizontal rotation on the other floors via the reverse gear.

In the cargo housing unit of the present invention, electric energy generated in the other generating mechanism can be used as the energy necessary for buffering lowering speed of the lift part for lowering.

The present invention is described thus far with the example of the parking tower in the case where cargoes are vehicles, but the present invention can be used for housing a wide variety of cargoes such as furniture, machines, instruments, foodstuffs and the like.

## INDUSTRIAL APPLICABILITY

According to the present invention, in the case of being used as, for example, a parking tower, a discharging operation can be performed by utilizing falling by the tare weight of the horizontal base stand with a vehicle mounted thereon, and therefore, it can be performed in a short time. Even if the vehicle to be carried in is housed in the proceeding direction as such, it is reversed in the direction facing the exit when it is discharged, and therefore, time for carrying in and out can be shortened. In addition, the rotational

energy of the chain at the time of falling is converted into electric energy, and can be utilized as a power source of the motor, and therefore, there is provided the advantage of being capable of saving energy cost. Accordingly, the present invention is useful as the unit for efficiently housing various kinds  
5 of cargoes in a small site, especially, a parking tower.

## CLAIMS

1. A cargo housing unit characterized in that, in a cargo housing unit comprising, within an upright housing, a lift part for raising having a plurality  
5 of cargo-mounting horizontal base stands disposed at approximately uniform distances, a lift part for lowering adjacent thereto keeping parallelism therewith and upright columnar supporting members which support the aforementioned horizontal base stands in a horizontally rotatable fashion between the said two parts, the aforementioned supporting members are formed of a mobile part  
10 consisting of a plurality of cylindrical units stacked each independently from the others in a rotatable fashion by 180 degrees within a horizontal plane and a stationary part consisting of a supporting axial body which supports each of the cylindrical units and serves as the axis of rotation when the same is under rotation within a horizontal plane, the aforementioned horizontal base stand being  
15 connected to the said mobile part with intervention of a connection member having a curved surface.
2. The cargo housing unit described in Claim 1 wherein the mobile part is supported by a stopper and a flange-formed plate fixed to the supporting axial  
20 body of the stationary part.
3. The cargo housing unit described in Claim 1 or 2 which is provided with the mechanism for causing falling of the cargo-mounting horizontal base stand from the lift part for lowering by the tare weight and with the mechanism for buffering  
25 the falling velocity thereof by utilizing the kinetic energy of falling thereof.
4. The cargo housing unit described in any of Claims 1 to 3 which is a parking tower of automobiles.