

BUILT-IN TYPE UNDERGROUND PARKING EQUIPMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to built-in type underground parking equipment provided with a waste collecting apparatus for collecting waste in a plural-storied building.

2. Description of the Related Art

Conventionally, a waste collecting apparatus and built-in underground parking equipment are separately provided in a plural-storied building. Examples of such parking equipment installed underground for effective space utilization include horizontal circulation type parking equipment, box-shaped circulation type parking equipment and the like. (See Japanese Patent Laid-Open Publications Nos. HEI 3-96577 and HEI 3-13672, for example.) On the other hand, such a waste collecting apparatus is installed on or above the ground for easy access of waste collecting vehicles thereto.

However, when the waste collecting apparatus and the underground parking equipment are installed separately as described above, it is necessary to provide a waste collection room together with a space for access of a waste collecting vehicle to the waste collection room as well as a vehicle entrance/exit room together with a space for access of a vehicle to the room. Further, both of the rooms need to be located on the first aboveground story for access thereto by

such a waste collecting vehicle or general vehicles. Therefore, a large space on the first aboveground story is occupied.

SUMMARY OF THE INVENTION

The present invention, which has been made to solve the problem described above, intends to provide built-in type underground parking equipment incorporating a waste collecting apparatus therein for saving a dead space and allowing a space on the first aboveground story to be utilized effectively.

The built-in type underground parking equipment according to the present invention has been conceived considering that the space for access to a vehicle entrance/exit room can be utilized also as the space for access to a waste collection room. With a view to solving the foregoing problem, the present invention provides built-in type underground parking equipment comprising: vehicle circulating means provided in an underground space of a plural-storied building for circulating vehicles; vehicle lifting means for lifting and lowering a vehicle between the vehicle circulating means and a vehicle entrance/exit story above the ground; and waste collecting means, including a waste collecting apparatus disposed in the underground space, for collecting waste from the plural-storied building into the waste collecting apparatus, the vehicle lifting means being capable of carrying the waste out of the waste collecting

apparatus to the vehicle entrance/exit story.

With this construction, the waste collecting apparatus is disposed on a basement story, and the waste collected in the waste collecting apparatus can be carried to the vehicle entrance/exit story by the vehicle lifting means. Therefore, a waste collection room and a space for access of a vehicle thereto, which have conventionally been provided on or above the ground, can be saved. The space thus saved can be effectively utilized for the residents. Further, since the waste collecting apparatus is located in the underground space, it is possible to prevent the smell of waste or noises generated upon throwing of waste from leaking to the aboveground stories (residential area).

It is possible that: the vehicle circulating means includes at least one tier of rectangular circulation path for circulating pallets for carrying respective vehicles thereon in a predetermined direction, the circulation path comprising a plurality of first lateral transfer paths for transferring the pallets in their lateral direction and first longitudinal transfer paths for transferring the pallets in their longitudinal direction between ends of the first lateral transfer paths on one side thereof and between ends of the first lateral transfer paths on an opposite side thereof; the vehicle lifting means is located in an extending direction of the first lateral transfer paths so as to be capable of transferring and receiving the pallets to and from the first

longitudinal transfer paths; and the waste collecting apparatus is located adjacent to the vehicle lifting means.

With this arrangement, the waste collecting apparatus can be placed in a vacant space adjacent the lift path of the vehicle lifting means to allow the waste collected in the waste collecting apparatus to be transferred from a basement story to the vehicle entrance/exit story by the vehicle lifting means. Therefore, the underground space of the plural-storied building as well as the aboveground space can be utilized effectively. It is to be noted that parking equipment including vehicle circulating means and vehicle lifting means as described above is generally called horizontal circulation type parking equipment.

Preferably, the waste collecting apparatus includes transfer means for transferring the waste collected therein to the vehicle lifting means. This feature makes it easy to transfer the waste collected in the waste collecting apparatus to the vehicle lifting means.

The transfer means may comprise: a dust container for containing waste therein; a second longitudinal transfer path arranged so as to be capable of longitudinally transferring and receiving the dust container to and from the vehicle lifting means; and a moving device for moving the dust container between the second longitudinal transfer path and the vehicle lifting means.

This feature allows the dust container to be

directly transferred from the longitudinal transfer path to the vehicle lifting means by the transfer means and, hence, the longitudinal transfer path can be provided at an appropriate height in a space adjacent the lift path of the vehicle lifting means in accordance with the configuration (form, size and the like) of the waste collecting apparatus.

Alternatively, the transfer means may comprise: a dust container for containing waste therein; and a second lateral transfer path arranged adjacent to the circulation path and to the vehicle lifting means so as to be capable of transferring and receiving the dust container to and from the circulation path adjacent to the dust container.

In this arrangement, the dust container is placed on the second lateral transfer path. The dust container is then transferred to the vehicle lifting means through the circulation path adjacent thereto. That is, the circulation path for transferring vehicles is utilized to transfer the dust container. This arrangement allows the waste collecting apparatus to be simplified, which leads to a cost reduction.

A possible arrangement is such that: the vehicle circulating means includes plural tiers of third lateral transfer paths for transferring pallets for carrying respective vehicles thereon in their lateral direction; the vehicle lifting means is located adjacent to an end of the third lateral transfer paths so as to be capable of transferring and receiving the pallets to and from the third

lateral transfer paths; and the waste collecting apparatus is located adjacent the vehicle lifting means on a side opposite away from the third lateral transfer paths across the vehicle lifting means.

In this arrangement, since the waste collecting apparatus is located adjacent the vehicle lifting means on the side opposite away from the third lateral transfer paths across the vehicle lifting means, the vehicle lifting means can transfer the waste collected in the waste collecting apparatus from a basement story to the vehicle entrance/exit story easily. Further, in this case, a space is defined above or below the waste collecting apparatus, which may be utilized to place auxiliary parking pallets therein thereby increasing the parking capacity for vehicles. It is to be noted that such parking equipment including vehicle circulating means and vehicle lifting means as described above is generally called box-shaped circulation type parking equipment.

The waste collecting apparatus may include transfer means for transferring the waste collected therein to the vehicle lifting means. This feature makes it easy to transfer the waste collected in the waste collecting apparatus to the vehicle lifting means.

The transfer means may comprise a dust container for containing waste therein, and a fourth lateral transfer path arranged so as to be capable of transferring and receiving the dust container to and from the vehicle lifting means located

adjacent to the dust container.

In this arrangement, the dust container is placed on the fourth lateral transfer path. The dust container is then transferred to the vehicle lifting means located adjacent thereto. This arrangement allows the waste collecting apparatus to be simplified, which leads to a cost reduction.

The dust container may comprise a truck movably placed on the longitudinal transfer path or the lateral transfer path, and a plurality of transferable containers removably placed on the truck. This feature enables the operator of a waste collecting vehicle to handle the container transferred to an aboveground story easily. The containers may be fixed to and formed integrally with the truck.

The waste collecting means may include a dust chute for discharging waste from each story of the plural-storied building into the dust container. This feature makes it possible to collect waste discharged from each story of the plural-storied building into the dust container through the dust chute efficiently.

The dust chute may be provided with a shutter for blocking the discharging of waste, the shutter being pivotally attached to an outlet portion of the dust chute. This feature enables the outlet portion of the dust chute to be closed with the shutter to block the discharging of waste from the dust chute when the dust container is carried out.

The dust chute may be further provided with

detection means for determining whether or not the waste contained in the dust container has exceeded a predetermined amount, the detection means being attached to the outlet portion of the dust chute. This feature makes it possible to prevent the waste contained in the dust container from overflowing and dropping into the basement space.

Preferably, the detection means is a photoelectric sensor. In such a case, waste bulging out of the dust container in indeterminate form can be detected easily.

The dust chute may be provided with turning means for turning the outlet portion thereof about the axis of the dust chute to face a waste inlet portion of the dust container. This feature allows waste put into the dust container through the dust chute to be uniformly accumulated in the dust container.

The above and further objects and features of the invention will be more fully appreciated from the following detailed description with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a layout in a plural-storied building to which built-in type underground parking equipment according to a first embodiment of the present invention is applied;

Fig. 2 is a fragmentary plan view of horizontal circulation type parking equipment;

Fig. 3 is a fragmentary sectional view of the horizontal circulation type parking equipment as viewed in the direction indicated by arrows III-III of Fig. 2;

Fig. 4 is a fragmentary enlarged side view of the horizontal circulation type parking equipment as viewed in the direction indicated by arrows IV-IV of Fig. 2;

Fig. 5 is a fragmentary sectional view of the horizontal circulation type parking equipment as viewed in the direction indicated by arrows V-V of Fig. 2;

Fig. 6 is a fragmentary plan view illustrating an arrangement in a state where a dust container is loaded on the lift; and

Fig. 7 illustrates a layout in a plural-storied building to which built-in type underground parking equipment according to a second embodiment of the present invention is applied.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

Fig. 1 illustrates a layout in a plural-storied building to which built-in type underground parking equipment according to a first embodiment of the present invention is applied.

The plural-storied building 100 includes basement stories 101 and 102 for accommodating vehicles thereon, and

aboveground stories 103, 104 ... provided with residences. The basement stories 101 and 102 are provided with horizontal circulation type parking equipment 1. The horizontal circulation type parking equipment 1 includes a plurality of pallets 5, and two first lateral transfer paths 3 and 4 extending parallel on the same floor surface for transferring the pallets 5 in their lateral direction (X direction in Fig. 1). Between ends of the first lateral transfer paths 3 and 4 situated on one side and between ends of the first lateral transfer paths 3 and 4 situated on the other side are provided first longitudinal transfer paths 11, respectively, for transferring the pallets 5 in their longitudinal direction (Y direction in Fig. 1), which will be described later. The first lateral transfer paths 3 and 4 and the first longitudinal transfer paths 11 constitute a generally rectangular circulation path for circulating the pallets 5. The horizontal circulation type parking equipment 1 further includes a lift 2 located adjacent to the circulation path (on the right-hand side in Fig. 1) for lifting or lowering pallet 5 transferred from the circulation path.

In this construction, pallet 5 carrying a vehicle to exit from the horizontal circulation type parking equipment 1 is circulated on the circulation path including first lateral transfer path 4 and first longitudinal transfer path 11 until it is transferred to the first longitudinal transfer path 11 located adjacent to the lift 2. The pallet 5 is then

transferred from that first longitudinal transfer path 11 onto the lift 2. Thereafter, the lift 2 is raised to transfer the pallet 5 to the aboveground story 103. In this way, the vehicle is caused to exit from the parking equipment 1. It is to be noted that the above-described construction of the horizontal circulation type parking equipment 1 is merely an example.

The second basement story 101 is provided with a dust container 6 for containing waste 105 therein. The dust container 6 is disposed adjacent to the above-described circulation path and to the lift 2 so as to be capable of being loaded on or unloaded from the lift 2. A dust chute 7 is provided above the dust container 6 for dropping waste 105 therethrough from each of the stories of the plural-storied building 100 into the dust container 6. The dust chute 7 extends vertically (in the Z direction in Fig. 1) through the basement stories 101 and 102 and the aboveground stories 103 and 104. The dust chute 7 is provided with a waste inlet 7a on each story for allowing waste discharged from the residences of each of the aboveground stories 103 and 104 to be thrown therein. The dust chute 7 has an outlet portion 7b which defines an outlet so that its axis is eccentric with respect to the axis of the dust chute 7. The outlet portion 7b has a base end (on the side opposite from the outlet) provided with a turning device 7c for turning the outlet portion 7c about the axis of the dust chute 7. This structure

allows waste 105 to be put in the dust container 6 generally uniformly without imbalance.

The first aboveground story 103 is provided with a vehicle entrance/exit room 8 for allowing vehicles to enter or exit the parking equipment 1. The floors of the vehicle entrance/exit room 8 and first basement story 102 are formed with openings 8a, respectively, which extend vertically through the respective floors for allowing the lift 2 to move upward and downward between the second basement story 101 and the vehicle entrance/exit room 8. The openings 8a constitute part of a lift path of the lift 2. When the lift 2 is located in the vehicle entrance/exit room 8, the upper surface of the lift 2 (vehicle carrying surface) is flush with the floor surface (vehicle transfer surface) of the vehicle entrance/exit room 8. The vehicle entrance/exit room 8 is provided with a vehicle entrance/exit 8b through which vehicles 8 enter or exit the parking equipment 1.

Although the dust container 6 is placed on the second basement story 101 in this embodiment, the dust container 6 may be placed at an appropriate position along the vertical direction of the basement stories 101 and 102 depending on the configuration (form, size and the like) of the dust container 6 determined in accordance with the amount of waste 5 to be collected. This is possible because the dust container 6 can be directly loaded on or unloaded from the lift 2 and because the lift 2 can be stopped at a

predetermined position.

It is to be noted that the first lateral transfer paths 3 and 4 and the first longitudinal transfer paths 11 constitute the vehicle circulating means, while the lift 2 constitutes the vehicle lifting means.

The above-described construction has the following advantages. When waste 105 is thrown into the dust chute 7 through waste inlet 7a on the second aboveground story 104 for example, the waste 105 drops vertically within the dust chute 7 (in the arrow Z2 direction indicated by broken line in Fig. 1) and is discharged from the outlet portion 7b of the dust chute 7 into the dust container 6. When a predetermined amount of waste 105 is contained in the dust container 6, the dust container 6 is transferred longitudinally (in the arrow Y direction indicated by broken line in Fig. 1) for loading on the lift 2. The transfer means will be described later. Thereafter, the lift 2 is raised vertically (in the arrow Z1 direction indicated by broken line in Fig. 1) to transfer the dust container 6 to the first aboveground story 103. Then, the waste 105 in the dust container 6 is collected into a waste collecting vehicle 9. The dust container 6 thus emptied is lowered to the second basement story 101 by the lift 2 and returned to its original position.

The construction of the built-in type underground parking equipment according to the first embodiment of the present invention will be described in more detail with

reference to Figs. 2 to 6. Fig. 2 is a fragmentary plan view of the horizontal circulation type parking equipment 1. Fig. 3 is a fragmentary sectional view as viewed in the direction indicated by arrows III-III of Fig. 2. Fig. 4 is a fragmentary enlarged side view as viewed in the direction indicated by arrows IV-IV of Fig. 2. Fig. 5 is a fragmentary sectional view as viewed in the direction indicated by arrows V-V of Fig. 2. Fig. 6 is a fragmentary plan view illustrating an arrangement in a state where the dust container is loaded on the lift.

As shown in Fig. 2, the first lateral transfer paths 3 and 4 on each of the aforementioned stories are each provided with a pair of first lateral transfer rails 10 for carrying the pallets 5 thereon, and a lateral transfer device (not shown) for transferring the pallets 5 in their lateral direction (in the arrow X direction in Fig. 2). The plurality of pallets 5 for carrying respective vehicles thereon are aligned on the lateral transfer rails 10, and each of the pallets 5 comprises a substantially rectangular base plate 5a and four lateral transfer wheels 5b attached to the underside of the base plate 5a. Adjacent pallets 5 are coupled to each other via couplers 5c provided at both edges of each pallet which are opposite in the lateral transfer direction (in the arrow X direction in Fig. 2). The couplers 5c engage each other in the lateral transfer direction (in the arrow X direction in Fig. 2) thereby to prevent relevant adjacent

pallets 5 from moving relative to each other in their lateral direction. Further, the couplers 5c are configured to be capable of separating away from each other in the longitudinal transfer direction (in the arrow Y direction in Fig. 2) and in the vertical direction (perpendicularly to the sheet surface of Fig. 2), thereby detaching relevant adjacent pallets 5 from each other.

The first longitudinal transfer paths 11 extend between ends of the first lateral transfer paths 3 and 4 on one side and between other ends of the first lateral transfer paths 3 and 4 on the opposite side, respectively. The first longitudinal transfer paths 11 each include plural pairs of first longitudinal transfer rails 11a for carrying the pallets 5 thereon, and a first longitudinal transfer device for transferring the first longitudinal transfer rails 11a in the longitudinal transfer direction (in the arrow Y direction in Fig. 2). The first longitudinal transfer paths 11 are arranged so as to be capable of transferring or receiving vehicles to and from the first lateral transfer paths 3 and 4. Here, only one first longitudinal transfer path 11 extending between ends of the first lateral transfer paths 3 and 4 on one side is illustrated. The spacing between a pair of first longitudinal transfer rails 11a is set generally equal to that between a pair of first lateral transfer rails 10 of each of the first lateral transfer path 3 and 4.

The first longitudinal transfer device is provided

with a driver 10b for driving the device, two driving sprockets 11c attached to the driving shaft of the driver 10b with predetermined spacing therebetween, and two driven sprockets 11d arranged generally in parallel with the driving sprockets 11c as spaced a predetermined distance from the driving sprockets 11c in the longitudinal transfer direction (in the arrow Y direction in Fig. 2). The two driven sprockets 11d are coupled to each other via a shaft for rotation together. Two chains 11e are trained around the driving sprockets 11c and the driven sprockets 11d to form loops bridging therebetween. Thus, when the driver 11b drives the driving sprockets 11c, the chains 11e revolve in the longitudinal transfer direction (in the arrow Y direction in Fig. 2). The plural pairs of first longitudinal transfer rails 11a are so mounted as to cross the two chains 11e. With such a structure, the first longitudinal transfer device can stop the first longitudinal transfer rails 11a at a position where a vehicle can be transferred to and from each of the first lateral transfer paths 3 and 4.

The lift 2 is located adjacent to the first longitudinal transfer path 11 so as to be capable of transferring or receiving the pallets 5 in the lateral transfer direction (in the arrow X direction in Fig. 2) to and from the lift 2. The lift 2 comprises a carrying portion 12 for carrying a vehicle or the dust container 5 thereon, a guide portion 13 for guiding the carrying portion 12 in the

ascending or descending direction, and an elevating portion 14 for lifting or lowering the carrying portion 12.

The carrying portion 12 is provided with a pair of lateral transfer rails 12b for carrying thereon a vehicle laterally transferred (in the arrow X direction in Fig. 2) from the first longitudinal transfer path 11, and a pair of longitudinal transfer rails 12c for carrying thereon the dust container 6 longitudinally transferred (in the arrow Y direction in Fig. 2) from a second longitudinal transfer path 16, which will be described later. The pair of rails 12b and the pair of rails 12c are arranged to intersect each other perpendicularly on a rectangular frame 12a.

The guide portion 13 is located on a side opposite away from the first longitudinal transfer path 11 across the carrying portion 12 (on the right-hand side in Fig. 2). The guide portion 13 includes two guide rails 13b. As shown in Fig. 3, the guide rails 13b are spaced from each other and stand vertically from the floor surface of the second basement story 101 to the underside of the floor of the first aboveground story 103. On the side of the frame 12a of the carrying portion 12 opposite away from the first longitudinal transfer path 11 (on the right-hand side in Fig. 2), an elevation guided portion 12d extends for guiding the upward and downward movement of the carrying portion 12 relative to the guide portion 13. The elevation guided portion 12d is provided, on the guide portion 13 side, with guide rollers 13a

which can roll along the guide rails 13b. The carrying portion 12 has a lower portion to which reinforcing supports 12e are attached for preventing downward displacement of the carrying portion 12. The reinforcing supports 12e extend obliquely downward from the lower portion of the carrying portion 12 on the side closer to the first longitudinal transfer path 11 to the respective guide rail 13b and has respective tip ends to which the guide rollers 13a which can roll along the guide rails 13b are attached. This arrangement allows the guide portion 13 to guide the carrying portion 12 upward and downward.

The elevating portion 14 includes a driver 14a set on the floor surface of the basement story 101, a driving sprocket 14b coupled to the driving shaft of the driver 14a, and a driven sprocket 14c fitted to the underside of the floor of the aboveground story 103. Each of the sprockets 14b and 14c comprises two sprockets coupled to each other via a shaft for rotation together. Two chains 14d are trained around the driving sprocket 14b and the driven sprocket 14c to form loops bridging therebetween. Thus, when the driver 14a drives the driving sprocket 14b, the chains 14d revolve vertically (in the arrow Z1 direction in Fig. 3). The chain 14d on the side opposite away from the carrying portion 12 (on the right-hand side in Fig. 3) is provided, at an intermediate portion thereof, with a counterbalance 14e in weight equilibrium with the carrying portion 12 for decreasing the output of the

driver 14a. On the other hand, the chain 14d on the side adjacent the carrying portion 12 is attached, at an intermediate portion thereof, with the elevation guided portion 12d of the carrying portion 12. This arrangement allows the elevating portion 14 to lift or lower the carrying portion 12.

The following description is directed to the second longitudinal transfer path 16 for placing the dust container 6 thereon. As shown in Fig. 2, the second longitudinal transfer path 16 is provided on the floor surface of the second basement story 101 at a location adjacent to the first longitudinal transfer path 11 and to the lift 2. The second longitudinal transfer path 16 is arranged so as to be capable of transferring and receiving the dust container 6 to and from the lift 2. Specifically, the second longitudinal transfer path 16 includes a pair of second longitudinal transfer rails 16a for carrying the dust container 6 thereon, and a moving device for moving the dust container 6 between the second longitudinal transfer path 16 and the lift 2. The spacing between the pair of second longitudinal transfer rails 16a is set generally equal to the spacing between the pair of longitudinal transfer rails 12c of the lift 2.

The moving device includes a driver 16b disposed on the side of the second longitudinal transfer rails 16a opposite away from the lift 2 (on the upper side in Fig. 2), two driving sprockets 16c attached to the driving shaft of the

driver 16b with predetermined spacing therebetween, and two driven sprockets 16d disposed on the side of the second longitudinal transfer rails 16a closer to the lift 2 as spaced from each other by a distance equal to the spacing between the driving sprockets 16c. The two driven sprockets 16d are coupled to each other via a shaft for rotation together. Two chains 16e are trained around the driving sprockets 16c and the driven sprockets 16d to form loops bridging therebetween. Thus, when the driver 16b drives the driving sprockets 16c, the chains 16e revolve in the longitudinal transfer direction (in the arrow Y direction in Fig. 2). The second longitudinal transfer rails 16a are so mounted as to cross the two chains 16e. This arrangement allows the moving device to move the dust container 6 between the second longitudinal transfer path 16 and the lift 2.

As shown in Fig. 4, the dust container 6 is held in engagement with the chains 16e so as to be transferred on the second longitudinal transfer rails 16a by the revolution of the chains 16e. More specifically, the dust container 6 has a lower surface provided with an L-shaped male coupler 6e at the end thereof closer to the driving sprockets 16c. The chains 16e are provided, at an intermediate portion thereof, with a U-shaped female coupler 16f for engagement with the male coupler 6e. The male coupler 6e is configured to disengage from the female coupler 16f when the dust container 6 is lifted toward the dust chute 7 (in the arrow Z1 direction in

Fig. 3) or engage the female engagement member 16f when the dust container 6 is carried on the second longitudinal transfer rails 16a.

Further, as shown in Figs. 2 and 4, the dust container 6 is divided into two parts in the longitudinal transfer direction (in the arrow Y direction in Fig. 2) by a partition plate 6a. Hereinafter, the two parts will be respectively referred to as a front container 6b and a rear container 6c. Each of the front container 6b and the rear container 6c has a bottom surface provided with two wheels 6d, which are carried on the respective second longitudinal transfer rails 16a for travel thereon. Each of the front container 6b and the rear container 6c has a top formed with an opening allowing waste 105 to be put into the container therethrough. Further, each of the front container 6b and the rear container 6c has a side face provided with a door 107 allowing waste 105 contained therein to be removed laterally therefrom. Although the wheels 6d are directly attached to the dust container 6 in the illustrated embodiment, a truck (not shown) for carrying the dust container 6 thereon may be separately provided. For example, the dust container 6 may comprise a plurality of transferable containers removably carried on the truck. Specifically, use may be made of a known resin container provided with casters, for example. The truck has a lower surface provided with four wheels and is transferably carried on the longitudinal transfer rails 16a.

The dust container 6, the second longitudinal transfer path 16 and the moving device constitute transfer means for the waste collecting apparatus.

Referring now to Figs. 5 and 6, description is made of the dust chute 7 for guiding waste 105 from each story of the plural-storied building 100 to the dust container 6. The dust chute 7 and the waste collecting apparatus constitute waste collecting means.

As shown in Fig. 5, the outlet portion 7b of the dust chute 7 is so positioned as to face the top opening of the dust container 6. As described earlier, the axis of the outlet of the outlet portion 7b is eccentric with respect to the axis of the dust chute 7. The above-described turning device 7c is fitted to the base end of the outlet portion 7b. As shown in Fig. 6, the turning device 7c is connected to a driver 7f via a chain 7e for turning the outlet of the outlet portion 7b about its axis, as indicated by an arrow R in Fig. 5. Therefore, waste 105 from the dust chute 7 can be distributed to the front container 6b and the rear container 6c substantially evenly. Although the outlet portion 7b of the dust chute 7 is turnable about the axis of the dust chute 7 in this embodiment, the present invention is not limited thereto. For example, if the dust container 6 comprises one piece without the partition plate 6a, the outlet portion 7b of the dust chute 7 may be fixed in a predetermined position relative to the top opening of the dust container 6.

The outlet of the outlet portion 7b of the dust chute 7 is provided with a plate-shaped lid (shutter) 7d which is slidable horizontally for opening and closing the outlet. Thus, the discharging of waste 105 from the dust chute 7 to the dust container 6 can be controlled. A photoelectric sensor (detection means) 7e is provided at the end of the outlet portion 7b on the side closer to the dust container 6. Thus, it is possible to determine whether or not a predetermined amount of waste 105 has been collected in the dust container 6 by means of the sensor 7e. Specifically, the photoelectric sensor 7e comprises a light emitting portion and a light receiving portion. The light emitting portion emits light rays 7f for horizontally illuminating a wide region directly above the top opening of the dust container 6, while the light receiving portion receives the light rays 7f. Whether or not a predetermined amount of waste 105 has been collected in the dust container 6 can be determined by detection of whether or not the light rays 7f have been blocked by the waste 105. Although the method is described which utilizes the photoelectric sensor 7e for determining whether or not a predetermined amount of waste 105 has been collected, a non-contact sensor such as an ultrasonic sensor may be used. It is preferable that the photoelectric sensor 7e is designed to be responsive only when the light rays 7f have been continuously blocked for a predetermined period of time (for about two seconds) so as not to be responsive to

waste 105 being discharged from the dust chute 7 into the dust container 6.

As shown in Fig. 6, an operation control panel 108 for controlling these operations is provided adjacent the vehicle entrance/exit 8b of the plural-storied building 100. Though not illustrated, the operation control panel 108 comprises a central processing unit, a storage unit and an input/output device connected to the central processing unit, and the like. The storage unit prestores therein a program related to the carrying in and out of vehicles 106 and the dust container 6 so that the carrying in and out of the vehicles 106 and the dust container 6 do not interfere with each other. The arrangement described above has the following advantages.

As shown in Fig. 5, the dust container 6 is initially placed on the longitudinal transfer path 16 on the second basement story 101. In this state, the lid 7d of the dust chute 7 slides horizontally to open the outlet of the outlet portion 7b. Waste 105 thrown into the dust chute 7 through waste inlet 7a drops naturally through the dust chute 7 and collects into the front container 6b. When the photoelectric sensor 7e determines that the amount of the waste 105 in the front container 6b has exceeded a predetermined amount, the lid 7d of the dust chute 7 slides horizontally to close the outlet of the outlet portion 7b. Thereafter, the outlet portion 7b is turned by the turning

device 7c so that the outlet thereof faces the opening of the rear container 6c. Then, the lid 7d of the dust chute 7 slides horizontally to open the outlet of the outlet portion 7b. Subsequently, waste 105 thrown into the dust chute 7 through waste inlet 7a of the dust chute 7 is collected into the rear container 6c. In the same manner as described above, when the photoelectric sensor 7e determines that the amount of the waste 105 in the rear container 6c has exceeded a predetermined amount, the lid 7d of the dust chute 7 slides horizontally to close the outlet of the outlet portion 7b. Thereafter, as shown in Fig. 6, the dust container 6 is longitudinally transferred from the second longitudinal transfer rails 16a to the longitudinal transfer rails 12c of the lift 2. Then, as shown in Fig. 3, the lift 2 raises the dust container 6 to the vehicle entrance/exit room 8. Subsequently, the door 107 of the dust container 6 is opened to allow the waste 105 to be collected into the waste collecting vehicle 9. After the waste 105 has been emptied from the dust container 6, the dust container 6 is returned to its original position following the steps reverse of the above.

Next, a variation of built-in type underground parking equipment according to the first embodiment of the present invention will be described. The parking equipment in this variation is provided with a second lateral transfer path (not shown) instead of the second longitudinal transfer path 16 at that location.

Specifically, the second lateral transfer path, which includes a pair of second lateral transfer rails (not shown) for carrying the dust container 6 thereon, is located adjacent to the first longitudinal transfer path 11. The second lateral transfer path is arranged so as to be capable of transferring and receiving the dust container 6 to and from the first longitudinal transfer path 11. Thus, the dust container 6 can be transferred laterally to the first longitudinal transfer path 11. The dust container 6 is then longitudinally transferred from the first longitudinal transfer path adjacent to the second lateral transfer path to the first longitudinal transfer path 11 adjacent to the lift 2. Subsequently, the dust container 6 is transferred from the first longitudinal transfer path 11 to the lift 2. This construction does not need the driving sprockets 16c, driven sprockets 16d, chains 16e and the driver 16b, which are necessary in the first embodiment. Therefore, the arrangement of the longitudinal transfer path 16 can be simplified.

Next, with reference to Fig. 7, built-in type underground parking equipment according to a second embodiment of the present invention will be described. Unlike the underground parking equipment according to the first embodiment which is applicable to the horizontal circulation type parking system, the underground parking equipment according to the second embodiment is applicable to the box-shaped circulation type parking system. It is to be noted

that the parts which are common to those of the first embodiment are designated by like reference characters, and detailed description thereof will be omitted.

The box-shaped circulation type parking equipment 1a is provided through basement stories 101 and 102. The floor surface of each of the basement stories 101 and 102 is provided with a third lateral transfer path 3. Pallets 5 for carrying respective vehicles 106 thereon are placed on each of the third lateral transfer paths 3 for lateral transfer. On opposite end sides of the third lateral transfer paths 3 are formed lift paths for allowing respective lifts 2 to ascend and descend. One of the two lifts 2 communicates with a vehicle entrance/exit room 8 on the first aboveground story 103 for carrying vehicles 106 in or out. The two third lateral transfer paths 3 and the two lifts 2 form a generally rectangular circulation path.

On the first basement story 102, a fourth lateral transfer path 16 for placing the dust container 6 thereon is provided adjacent to the lift 2 adapted to carry vehicle 106 out on the side opposite from the third lateral transfer path 3 across the lift 2. A dust chute 7 is installed above the dust container 6 so that waste 105 thrown into the dust chute 7 through a waste inlet 7a can be put into the dust container 6 through outlet portion 7b of the dust chute 7. Further, a third lateral transfer path 3 for placing an auxiliary parking pallet thereon is provided on the second basement story 101 at

a location directly below the fourth lateral transfer path 16 and adjacent to the lift 2 adapted to carry vehicle 106 out. Although the fourth lateral transfer path 16 is located on the first basement story 102 in this embodiment, there is no particular limitation thereto. For example, the fourth lateral transfer path may be located on the second basement story 101. Moreover, since stop positions of the lift 2 in the vertical direction can be established appropriately, the third lateral transfer path 3 and the fourth lateral transfer path 16 can be located appropriately depending on the configurations (size, form and the like) of the dust container 6 and the vehicles 106.

In the construction described above, the dust container 6 is laterally transferred onto the lift 2. Then, the lift 2 is raised to carry the dust container 6 to the vehicle entrance/exit room 8. Subsequently, the waste 105 in the dust container 6 is collected into a waste collecting vehicle (not shown). The dust container 6 thus emptied is returned to the lateral transfer path 16 by using the lift 2 again. In this way, the dust container 6 can be carried out using the lift 2 of the box-shaped circulation type parking equipment 1a. Therefore, as compared with the conventional equipment in which a dust container 6 is installed on the ground, the installation space can be reduced. Further, since the device for laterally transferring the dust container 6 can be eliminated, the arrangement associated with the dust

container 6 can be simplified. Moreover, since the auxiliary parking pallet can be placed above or below the fourth lateral transfer path 16, the parking space can be increased. Furthermore, since the lateral transfer path 3 for the auxiliary parking pallet can be located appropriately as described above, the parking equipment can park vehicles having increased heights.

According to the present invention having been described above, horizontal or box-shaped circulation type parking equipment and waste collecting apparatus are installed underground, so that dead space in the horizontal or box-shaped circulation type parking equipment can be saved while a space on the first aboveground story can be utilized effectively.

As this invention may be embodied in several forms without departing from the spirit of essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalent of such metes and bounds thereof are therefore intended to be embraced by the claims.

What is claimed is:

1. Built-in type underground parking equipment comprising:

vehicle circulating means provided in an underground space of a plural-storied building for circulating vehicles;

vehicle lifting means for lifting and lowering a vehicle between the vehicle circulating means and a vehicle entrance/exit story above the ground; and

waste collecting means, including a waste collecting apparatus disposed in the underground space, for collecting waste from the plural-storied building into the waste collecting apparatus,

the vehicle lifting means being capable of carrying the waste out of the waste collecting apparatus to the vehicle entrance/exit story.

2. The built-in type underground parking equipment in accordance with claim 1, wherein:

the vehicle circulating means includes at least one tier of rectangular circulation path for circulating pallets for carrying respective vehicles thereon in a predetermined direction, the circulation path comprising a plurality of first lateral transfer paths for transferring the pallets in their lateral direction and first longitudinal transfer paths for transferring the pallets in their longitudinal direction between ends of the first lateral transfer paths on one side

thereof and between ends of the first lateral transfer paths on an opposite side thereof;

the vehicle lifting means is located in an extending direction of the first lateral transfer paths so as to be capable of transferring and receiving the pallets to and from the first longitudinal transfer paths; and

the waste collecting apparatus is located adjacent to the vehicle lifting means.

3. The built-in type underground parking equipment in accordance with claim 1 or 2, wherein the waste collecting apparatus includes transfer means for transferring the waste collected therein to the vehicle lifting means.

4. The built-in type underground parking equipment in accordance with claim 3, wherein the transfer means comprises:

a dust container for containing waste therein;

a second longitudinal transfer path arranged so as to be capable of longitudinally transferring and receiving the dust container to and from the vehicle lifting means; and

a moving device for moving the dust container between the second longitudinal transfer path and the vehicle lifting means.

5. The built-in type underground parking equipment

in accordance with claim 3, wherein the transfer means comprises:

a dust container for containing waste therein; and
a second lateral transfer path arranged adjacent to the circulation path and to the vehicle lifting means so as to be capable of transferring and receiving the dust container to and from the circulation path adjacent to the dust container.

6. The built-in type underground parking equipment in accordance with claim 1, wherein:

the vehicle circulating means includes plural tiers of third lateral transfer paths for transferring pallets for carrying respective vehicles thereon in their lateral direction;

the vehicle lifting means is located adjacent to an end of the third lateral transfer paths so as to be capable of transferring and receiving the pallets to and from the third lateral transfer paths; and

the waste collecting apparatus is located adjacent to the vehicle lifting means on a side opposite away from the third lateral transfer paths across the vehicle lifting means.

7. The built-in type underground parking equipment in accordance with claim 6, wherein the waste collecting apparatus includes transfer means for transferring the waste collected therein to the vehicle lifting means.

8. The built-in type underground parking equipment in accordance with claim 7, wherein the transfer means comprises:

a dust container for containing waste therein; and
a fourth lateral transfer path arranged so as to be capable of transferring and receiving the dust container to and from the vehicle lifting means located adjacent to the dust container.

9. The built-in type underground parking equipment in accordance with claim 4 or 8, wherein the dust container comprises:

a truck movably placed on the longitudinal transfer path or the lateral transfer path; and

a plurality of transferable containers removably placed on the truck.

10. The built-in type underground parking equipment in accordance with any one of claims 4, 5, 8 and 9, wherein the waste collecting means includes a dust chute for discharging waste from each story of the plural-storied building into the dust container.

11. The built-in type underground parking equipment in accordance with claim 10, wherein the dust chute is

provided with a shutter for blocking the discharging of waste, the shutter being pivotally attached to an outlet portion of the dust chute.

12. The built-in type underground parking equipment in accordance with claim 10 or 11, wherein the dust chute is further provided with detection means for determining whether or not the waste contained in the dust container has exceeded a predetermined amount, the detection means being attached to the outlet portion of the dust chute.

13. The built-in type underground parking equipment in accordance with claim 12, wherein the detection means is a photoelectric sensor.

14. The built-in type underground parking equipment in accordance with any one of claims 10 to 13, wherein the dust chute is provided with turning means for turning the outlet portion thereof about the axis of the dust chute to face a waste inlet portion of the dust container.