

DISPATCHING SYSTEM AND METHOD FOR ITEM PICKING OF A THREE-DIMENSIONAL WAREHOUSE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present disclosure claims priority to Chinese Patent Application No. 202010722774.0, entitled “DISPATCHING SYSTEM AND METHOD FOR ITEM PICKING OF THREE-DIMENSIONAL WAREHOUSE” and filed with the China National Intellectual Property Administration on July 24, 2020, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present disclosure relates to the technical field of warehousing and logistics, and in particular, to a dispatching system and method for item picking of a three-dimensional warehouse.

BACKGROUND

Currently, with the rapid development of the logistics industry, to improve the operating efficiency of a warehouse, an automated handling device such as an automated guided vehicle (AGV) is usually used to implement the automated transportation of items. In addition, because a warehouse area is usually limited, the cost of acquiring and using a land is relatively high. To maximize the space utilization and reduce the operating cost, a dense storage method is also adopted in an existing warehouse for storing items.

In an existing technology, to simultaneously resolve two problems of improving the efficiency of the automated transportation and reducing the cost of dense storage, a four-way shuttle vehicle (referred to as a four-way vehicle below) for a dense storage warehouse and a dedicated warehouse for the operating of the four-way vehicle are designed, as shown in FIG. 1a and FIG. 1b. FIG. 1a is a cross-sectional view of a warehouse. It can be seen that each floor of the warehouse includes a plurality of adjacent storage spaces for storing items, which are interspersed with a plurality of aisles for the four-way vehicle to transport items. In addition, each rack includes a rail for the four-way vehicle to travel, a support for holding a vehicle is arranged in each storage space, and there are uprights shared by the storage spaces for support. FIG. 1b is a top view of a warehouse. It can be seen that the dense stacking of items can save a lot of space. In addition, a relatively small four-way vehicle capable of flexibly traveling

between the storage spaces transports items on a holder vehicle to the storage spaces, or transports items to a docking point of the warehouse for outbound.

However, the four-way vehicle is a high-cost handling device and needs to travel on rails, so that in a warehouse in which the four-way vehicle is used for storing or picking items, the layout of the warehouse is difficult to change flexibly due to the setting of the rails, and the construction and use cost of the warehouse is relatively high.

SUMMARY

A dispatching system, method, and apparatus for item picking of a three-dimensional warehouse provided in embodiments of the present disclosure are used for partially resolving a problem in the related art that in a dense storage warehouse applying a four-way shuttle vehicle, because rails are required to be arranged on a bottom floor, and only the four-way shuttle vehicle can perform a handling task, the operating cost of the warehouse is relatively high and the warehouse layout cannot be flexibly changed.

The following technical solutions are adopted in the embodiments of the present disclosure:

A dispatching system for a three-dimensional warehouse is provided in the present disclosure, including: one or more control centers, one or more first handling devices, one or more second handling devices, at least one three-dimensional warehouse, and at least one lifting device, where the three-dimensional warehouse is provided with a plurality of floors, the floors of the three-dimensional warehouse are communicated by the at least one lifting device, and the one or more control centers each communicate with the one or more first handling devices and the one or more second handling devices, where:

a bottom floor of the three-dimensional warehouse is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces of the bottom floor are provided with at least one of a vehicle and a vehicle support, and the vehicle support in the bottom-floor storage spaces is configured for placing a vehicle transported by the second handling devices;

higher floors of the three-dimensional warehouse other than the bottom floor are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for the first handling devices to run on, and at least some higher-floor storage spaces of the higher floors are provided with a vehicle;

the control centers are each configured to determine, according to a handling task, a first handling device, a second handling device, and a lifting device for performing the handling task, and send a handling instruction for performing the handling task to the first handling

device, the second handling device, and the lifting device separately;

the first handling device is configured to take a vehicle indicated in the handling instruction out of or put the vehicle indicated in the handling instruction into the higher-floor storage spaces according to the handling instruction sent by the control centers, and transport the vehicle indicated in the handling instruction between the higher-floor storage spaces and the higher-floor docking point;

the second handling device is configured to take the vehicle indicated in the handling instruction out of or put the vehicle indicated in the handling instruction into the bottom-floor storage spaces according to the handling instruction sent by the control centers, and transport the vehicle indicated in the handling instruction between the lifting device and the bottom-floor storage spaces and between the bottom-floor storage spaces and the bottom-floor docking point, or between the lifting device and the bottom-floor docking point; and

the lifting device is configured to ascend or descend to a specified floor according to the handling instruction sent by the control centers, and transport at least one or a combination of the vehicle indicated in the handling instruction, the first handling device, and the second handling device between the floors.

A dispatching method for at least one three-dimensional warehouse is provided in the present disclosure, where: there are at least one or more three-dimensional warehouses, floors of the three-dimensional warehouses are communicated by at least one lifting device, a bottom floor of the three-dimensional warehouses is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces are provided with a vehicle and a vehicle support, the vehicle support in the bottom-floor storage spaces is configured for placing a vehicle transported by a second handling device, higher floors other than the bottom floor of the three-dimensional warehouses are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for a first handling device to run on, at least some higher-floor storage spaces of the higher floors are provided with a vehicle, and the method includes:

determining a to-be-performed handling task;

determining, according to the handling task, a first handling device, a second handling device, and a lifting device for performing the handling task; and

sending a handling instruction to the determined first handling device, second handling device, and lifting device separately, so that the first handling device, the second handling device, and the lifting device cooperate to transport a vehicle from the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses to the bottom-

floor docking point, or transport a vehicle at the bottom-floor docking point into the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses.

At least one technical solution adopted in the embodiments of the present disclosure can achieve the following beneficial effects:

Through a combination of using first handling devices and second handling devices in a three-dimensional warehouse, a handling function of a lifting device in the three-dimensional warehouse is used, so that the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse, the layout of the warehouse can be changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the transport efficiency can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

To describe the technical solutions in the embodiments of the present disclosure more clearly, the following briefly describes the accompanying drawings required to be used in the embodiments. The accompanying drawings herein, which are incorporated in the specification as a part of the specification, show embodiments in accordance with the present disclosure, and together with the specification are used for describing the technical solutions of the present disclosure. It should be understood that, the following accompanying drawings show only some embodiments of the present disclosure, which cannot be considered as limitation on the scope. A person of ordinary skill in the art may still derive other accompanying drawings from the accompanying drawings without creative efforts.

FIG. 1a is a schematic structural diagram of a cross-sectional view of an existing warehouse;

FIG. 1b is a schematic structural diagram of a top view of an existing warehouse;

FIG. 2 is a schematic diagram of a dispatching system for item picking of a three-dimensional warehouse according to an embodiment of the present disclosure;

FIG. 3 is a schematic diagram of a top view of a three-dimensional warehouse according to an embodiment of the present disclosure;

FIG. 4a and FIG. 4b are schematic diagrams of warehouse layouts according to an embodiment of the present disclosure;

FIG. 5 is a schematic diagram of a first handling device picking and placing a vehicle from a side according to an embodiment of the present disclosure;

FIG. 6 is a schematic diagram of a distribution of a lifting device according to an embodiment of the present disclosure;

FIG. 7 is a schematic diagram of arranging a rail in a lifting device of a three-dimensional warehouse according to an embodiment of the present disclosure;

FIG. 8 is a schematic diagram of areas of a three-dimensional warehouse that are not in communication according to an embodiment of the present disclosure;

FIG. 9a and FIG. 9b are schematic diagrams of grounds of two three-dimensional warehouses that are in communication with each other according to an embodiment of the present disclosure;

FIG. 10 is a schematic diagram of a carrier in a system according to an embodiment of the present disclosure;

FIG. 11 is a schematic diagram of a specified area being a bottom-floor docking point in a system according to an embodiment of the present disclosure; and

FIG. 12 is a flowchart of a dispatching process for item picking of a three-dimensional warehouse according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

To clearly state the objectives, technical solutions, and advantages of the present disclosure, the technical solutions of the present disclosure are clearly and completely described below with reference to specific embodiments of the present disclosure and corresponding accompanying drawings. Apparently, the described embodiments are only some embodiments rather than all the embodiments of the present disclosure. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present disclosure without creative efforts shall fall within the protection scope of the present disclosure.

The technical solutions provided in the embodiments of the present disclosure are described in detail below with reference to the accompanying drawings.

FIG. 2 is a schematic diagram of a dispatching system for item picking of a three-dimensional warehouse according to an embodiment of the present disclosure, and the system includes: one or more control centers 100, one or more first handling devices 102, one or more second handling devices 104, at least one three-dimensional warehouse 106, and at least one lifting device 108, where the at least one three-dimensional warehouse 106 is provided with a plurality of floors, the floors of the three-dimensional warehouse 106 are communicated by the at least one lifting device 108, and the control centers 100 each communicate with the one or

more first handling devices 102 and the one or more second handling devices 104. The three-dimensional warehouse 106 may be divided into a bottom floor and a plurality of higher floors. Storage spaces arranged on the bottom floor are bottom-floor storage spaces, and storage spaces arranged on the higher floors are higher-floor storage spaces. For the convenience of understanding, only one control center 100 and one three-dimensional warehouse 106 are included in FIG. 2.

Because an objective of storing items in a warehouse is to store a variety of large quantities of items in a centralized manner, for example, to facilitate the selection of required items according to the needs of an order, in a system provided in the present disclosure, items in a three-dimensional warehouse are carried by a vehicle, and the vehicle needs to be transported by a first handling device 102, a second handling device 104, and a lifting device 108, a handling task in the present disclosure is also for implementing item picking, and can be determined by a control center 100 according to the order.

Specifically, when sorting items in a three-dimensional warehouse, it is necessary to first determine storage spaces of the items according to items that need to be sorted, then perform a handling task through devices, so that the items are delivered to a sorting area and sorted, and then the remaining items are stored in the warehouse after the sorting is completed, so as to implement the sorting of the items. Therefore, the handling task in the present disclosure is a task of transporting a vehicle carrying items, which is performed in order to implement the sorting of the items.

During the sorting of items, the control center 100 is configured to determine, according to a received order, storage spaces of items included in the order, then determine a path from the storage spaces to a bottom-floor docking point 110, determine, according to the path, a first handling device 102, a second handling device 104, and a lifting device 108 for performing a handling task, and send a handling instruction for performing the handling task to the first handling device 102, the second handling device 104, and the lifting device 108 separately. After the items are sorted in a sorting area, the control center 100 may then determine a path from the bottom-floor docking point 110 to the storage spaces according to the bottom-floor docking point 110 at which a vehicle is located and positions of the storage spaces in which the items need to be stored, determine, according to the path, a first handling device 102, a second handling device 104, and a lifting device 108 for performing a handling task, and send a handling instruction for performing the handling task to the first handling device 102, the second handling device 104, and the lifting device 108 separately. After a process described above, a three-dimensional warehouse completes the sorting of items.

Additionally, it should be further noted that, the three-dimensional warehouse and related methods for implementing item picking in the present disclosure are not only applicable to the picking of commodity items in a warehousing scenario, but also applicable to the picking of finished products, semi-finished products, or semi-processed items in a factory production scenario, and the picked items are used for implementing a specific production link or a specific production node. The application scenario of item picking is not specifically limited in the present disclosure. Therefore, in the present disclosure, a bottom floor of a three-dimensional warehouse 106 is provided with at least one bottom-floor docking point 110, at least some bottom-floor storage spaces of the bottom floor are provided with at least one of a vehicle 114 and a vehicle support 116, and the vehicle support 116 in the bottom-floor storage spaces is configured for placing a vehicle 114 to be transported by a second handling device 104. The vehicle support 116 may be mounted in the bottom-floor storage spaces or removed from the bottom-floor storage spaces as required. In a case that different bottom-floor storage spaces are selected for mounting the vehicle support 116, the vehicle support may be mounted in areas in which the vehicle 114 is placed and having different bottom strokes, a space between the areas in which the vehicle 114 is placed may be used as an aisle for the second handling device 104 carrying the vehicle 114 to pass through. The vehicle support 116 is used for the second handling device 104 to place the vehicle 114, and the second handling device 104 places the vehicle 114 including items on the vehicle support 116 in the bottom-floor storage spaces, that is, storing the items into the warehouse.

In addition, the bottom-floor docking point 110 of the three-dimensional warehouse 106 is a docking point outside the three-dimensional warehouse 106. For example, a forklift or another handling device may take out the vehicle 114 that need to be out of the warehouse from the bottom-floor docking point 110, or transport the vehicle 114 that need to be stored to the bottom-floor docking point 110, and then at least one of the first handling device 102, the second handling device 104, and the lifting device 108 transports the vehicle 114 from the bottom-floor docking point 110 into the bottom-floor storage spaces or the higher-floor storage spaces according to the handling instruction sent by the control center 100.

In the present disclosure, the vehicle 114 is configured to carry items, but the specific form of the vehicle 114 is not limited in the present disclosure. For example, the vehicle 114 may be a tray, a box, or the like, as long as it can accommodate or support items.

In addition, higher floors of the three-dimensional warehouse 106 other than the bottom floor are each provided with at least one higher-floor docking point 112, the higher floors are each provided with a rail 118 for the first handling device 102 to run on, and at least some

higher-floor storage spaces of the higher floors are provided with the vehicle 114. A structure configured for placing the vehicle 114, such as a support rod, a tray, or the like, is arranged in each of the higher-floor storage spaces of the higher floors.

Further, in the present disclosure, the vehicle 114 arranged on each floor of the three-dimensional warehouse 106 may include items stored in the warehouse or other idle vehicles 114. An occupancy rate of storage spaces of each floor, that is, a ratio of a quantity of storage spaces in which the vehicle 114 is arranged to a total quantity of storage spaces may be configured as required. Then, an occupancy rate of higher-floor storage spaces of higher floors may be set between 0 and 100%, and an occupancy rate of bottom-floor storage spaces of a bottom floor may be set between 0 and 100%.

Still further, due to structures such as reinforcing ribs and beams in the three-dimensional warehouse 106 and the vehicle 114 already stored in the storage spaces, the first handling device 102 or the second handling device 104 cannot directly travel from one storage space to another adjacent storage space when carrying the vehicle 114. Therefore, each floor of the three-dimensional warehouse 106 is provided with an aisle for the first handling device 102 or the second handling device 104 carrying the vehicle 114 to pass through.

FIG. 3 provided in the present disclosure is a schematic diagram of a top view of a three-dimensional warehouse. The left side is a schematic diagram of higher floors, and it can be seen that the higher floors include rails 118, so that the first handling device 102 can travel on the rails 118. The right side is a schematic diagram of a bottom floor, and it can be seen that the bottom floor does not include rails 118. Moreover, it can be seen from the top view that each floor of the three-dimensional warehouse 106 is provided with aisles for the first handling device 102 or the second handling device 104 to pass through.

In addition, it should be noted that in the present disclosure, layouts of aisles of different floors may not be the same, and may be set as required. In a dense storage warehouse, if it is necessary to transport items in storage spaces not adjacent to an aisle, items in storage spaces adjacent to the aisle need to be transported first, the storage spaces adjacent to the aisle is referred to as a temporary aisle, and then the items in the storage spaces not adjacent to the aisle are transported by a handling device. Therefore, usually for the consideration of transport efficiency, a stock keeping unit (SKU) of items stored in storage spaces not adjacent to an aisle is the same as an SKU of items stored in storage spaces adjacent to the aisle. In this case, an arrangement order of storage spaces and aisles in a warehouse is as follows: 1 aisle, 4 storage spaces, and 1 aisle, as shown in FIG. 4a, which can increase the storage density of items without affecting the operating efficiency of the warehouse.

However, in a case that a single SKU does not have enough items requiring two or more storage spaces for storage, a layout shown in FIG. 4a may affect the operating efficiency of the warehouse. Therefore, a layout shown in FIG. 4b may usually be used, that is, the arrangement order of storage spaces and aisles in the warehouse is: 1 aisle, 2 storage spaces, and 1 aisle.

In the present disclosure, each floor of the three-dimensional warehouse may adopt the layout shown in FIG. 4a or FIG. 4b or a combination of the two layouts, which is not limited in the present disclosure. Moreover, according to the needs of storing items, each floor may adopt different layouts. For example, bulky commodities that take up a lot of space are stored on a floor A, and a single SKU has enough items requiring two or more storage spaces for storage, then the floor A may all adopt the layout of FIG. 4a. Small commodities are stored on a floor A+1, then the floor A+1 may all adopt the layout of FIG. 4b.

In the present disclosure, the first handling device 102 may be specifically a handling device traveling on a rail, such as a four-way shuttle, and the second handling device 104 may be specifically a handling device traveling on a plane, such as an AGV. Certainly, the specific forms of the first handling device 102 and the second handling device 104 are not limited in the present disclosure, which can be set as required, as long as the first handling device 102 can travel along a rail and transport the vehicle 114 in the higher-floor storage spaces, and the second handling device 104 can travel on the bottom floor and transport the vehicle 114 in the bottom-floor storage spaces.

When a control center 100 determines a to-be-performed handling task according to an order, the control center 100 may first determine the to-be-performed handling task, determine, according to the handling task, a first handling device 102 for performing the handling task, and send a handling instruction to the first handling device 102.

Then, the first handling device 102 may take a vehicle 114 indicated in the handling instruction out of or put the vehicle 114 indicated in the handling instruction into higher-floor storage spaces according to the handling instruction sent by the control center 100, and transport the vehicle 114 indicated in the handling instruction between the higher-floor storage spaces and a higher-floor docking point 1102.

A second handling device 104 may take out the vehicle 114 indicated in the handling instruction or put the vehicle 114 indicated in the handling instruction into bottom-floor storage spaces according to the handling instruction sent by the control center 100, and transport the vehicle 114 indicated in the handling instruction between a lifting device 108 and the bottom-floor storage spaces, between the bottom-floor storage spaces and a bottom-floor docking point 110, or between the lifting device 108 and the bottom-floor docking point 110. A bottom

surface of the three-dimensional warehouse 106 is a plane on which the second handling device 104 travels. Specifically, the bottom surface may be a ground on which the three-dimensional warehouse 106 is located, or a platform provided on the bottom floor of the three-dimensional warehouse 106 for the second handling device 104 to travel on, for example, a steel platform on the bottom floor of the three-dimensional warehouse 106 for the second handling device 104 to travel on.

The lifting device 108 is configured to ascend or descend to a specified floor according to the handling instruction sent by the control center 100, and transport at least one or a combination of the vehicle indicated in the handling instruction, the first handling device, and the second handling device between floors.

The specified floor is a floor that the lifting device 108 performing the handling task needs to reach, for example, the vehicle 114 is transported from a third floor to the bottom floor. Then, the control center 100 may separately send two handling instructions to the lifting device 108, the lifting device 108 reaches the third floor according to a handling instruction received for the first time (that is, a specified floor indicated in the handling instruction received for the first time), and when the vehicle 114 has been transported into the lifting device 108, the lifting device 108 may reach the bottom floor according to the received handling instruction (that is, a specified floor indicated in the received handling instruction for the second time). Certainly, the foregoing is only an example. In the example described above, the control center 100 may alternatively send only one handling instruction. Then, the specified floor is separately the third floor and the bottom floor in order, so that the lifting device 108 reaches the third floor and the bottom floor in sequence according to the handling instruction, and transports a vehicle 114 of the third floor to the bottom floor.

In addition, in the present disclosure, at least some higher-floor storage spaces of the higher floors are further provided with a vehicle support 114 configured for placing the vehicle. The vehicle support 114 is the same as the vehicle support 114 arranged in the bottom-floor storage spaces described above, the specific arrangement has been described, and details are not described herein again.

In addition, in the present disclosure, a distance between the vehicle support 116 arranged in the higher-floor storage spaces or a structure for placing the vehicle 114 arranged in the higher-floor storage spaces and a rail 118 is greater than a height of the first handling device 102 not carrying the vehicle 114, so that the first handling device 102 can travel to below the higher-floor storage spaces, and transport the vehicle 114 from below the higher-floor storage spaces in a piggyback manner and leave the higher-floor storage spaces.

In an embodiment provided in the present disclosure, taking a process of transporting the vehicle 114 from any one of the higher-floor storage spaces to the bottom-floor docking point 110 for item outbound as an example, a process in which a dispatching system for a three-dimensional warehouse performs a handling task is described.

A control center 100 of the dispatching system for the three-dimensional warehouse first determines, according to a to-be-performed handling task after determining that items located in higher-floor storage spaces need to be transported to a bottom-floor docking point 110 for outbound, first handling devices 102 of floors on which the higher-floor storage spaces are located; and

then determines a first handling device 102 for performing the handling task from the determined first handling devices 102, and sends a handling instruction. The control center 100 may determine, according to whether the first handling devices 102 are idle or a quantity of to-be-executed handling instructions, the first handling device 102 for performing the handling task from the first handling devices 102.

Certainly, the policy adopted to select the first handling device 102 is not limited in the present disclosure, which can be set as required. For example, the control center 100 may simply select any one of the idle first handling devices 102 as the first handling device 102 for performing the handling task; or further, determine a first handling device 102 closest to the higher-floor storage spaces in which the items of the handling task are located from the idle first handling devices 102 as the first handling device 102 for performing the handling task.

In addition, when sending a handling instruction to the first handling device 102, the control center 100 may also send a handling instruction to a lifting device 108 asynchronously, so that the lifting device 108 ascends or descends to a floor on which the higher-floor storage spaces are located (that is, the specified floor), that is, a floor on which a vehicle 114 of the handling task is located. Then, the lifting device 108 may move to the floor according to the handling instruction, wait for the first handling device 102 to transport the vehicle 114 to a higher-floor docking point 112, and receive the vehicle 114 through the higher-floor docking point 112. It should be noted that, in the present disclosure, handling instructions sent by the control center 100 to different handling devices are not the same.

Then, the first handling device 102 travels through, according to the received handling instruction, an aisle of the located floor to below the higher-floor storage spaces in which the vehicle 114 of the handling task is located, transports the vehicle 114 in the higher-floor storage spaces in a piggyback manner, travels through the aisle of the floor again to the higher-floor docking point 112 of the located floor, and places the vehicle 114 into the lifting device 108

through the higher-floor docking point 112; and after placing, sends information that the handling instruction is executed to the control center 100.

It should be noted that, the handling instruction sent to the first handling device 102 includes identifiers of the higher-floor storage spaces requiring transport, an identifier of the higher-floor docking point 112, and a path from the higher-floor storage spaces to the higher-floor docking point 112. In a case that the three-dimensional warehouse 106 includes a plurality of higher-floor docking points 112, the control center 100 may determine identifiers and paths of the higher-floor docking points 112 through path optimization as information included in a first handling instruction, and send the information to the first handling device 102, so that the first handling device 102 transports the vehicle 114 to the higher-floor docking point 112 according to the optimized path.

The control center 100 determines, according to the information that the handling instruction is executed sent by the first handling device 102, that the lifting device 108 has obtained the vehicle 114 through the higher-floor docking point 112, and sends a handling instruction to the lifting device 108 according to the handling task corresponding to the currently transported vehicle 114. The handling instruction includes a specified floor to be reached by the lifting device 108 next, and in this example, the specified floor is a bottom floor.

Then, the lifting device 108 may determine, according to a handling instruction sent again by the control center 100, to transport the currently transported vehicle 114 to the bottom floor of the three-dimensional warehouse 106, and send information that the handling instruction is executed to the control center 100.

The control center 100 determines, according to the information that the handling instruction is executed sent by the lifting device 108, that the vehicle 114 has been transported to the bottom floor; and then may determine a second handling device 104 for performing the handling task from second handling devices 104, and send a handling instruction to the determined second handling device 104. The logic for determining the second handling device 104 for performing the handling task from the second handling devices 104 may be the same as the logic for determining the first handling device 102 for performing the handling task from the first handling devices 102, and details are not described herein again in the present disclosure.

The second handling device 104 travels through an aisle of the bottom floor to the lifting device 108 according to the handling instruction sent by the control center 100, and transports the vehicle 114 transported by the lifting device 108; and then travels through the aisle of the bottom floor again to the bottom-floor docking point 110, places the vehicle at the bottom-floor

docking point 110, and sends information that the handling instruction is executed to the control center 100.

Finally, the control center 100 may determine that the handling task is performed according to completed information sent by the second handling device 104.

A vehicle support 116 may also be arranged at the bottom-floor docking point 110. The vehicle support 116 may be a conveyor and may be connected to a conveyor line, so that items transported by the second handling device 104 to the bottom-floor docking point 110 can be transported to a specified area (for example, a picking area or a packing area.) along the conveyor line.

Finally, after receiving information that a third handling instruction is executed, the control center 100 determines that the items are correctly transported to the bottom-floor docking point 110, and the handling task is performed.

In another embodiment of the present disclosure, in a case that items that need to be delivered are located in bottom-floor storage spaces, the control center 100 may determine a second handling device 104 for performing the handling task from the second handling devices 104, and send a handling instruction to the determined second handling device 104.

The second handling device 104 travels through the aisle of the bottom floor to the bottom-floor storage spaces according to the received handling instruction, and transports a vehicle 114 stored in the bottom-floor storage spaces.

Then, the second handling device 104 travels through the aisle of the bottom floor again to the bottom-floor docking point 110, places the vehicle at the bottom-floor docking point 110, and sends information that the handling instruction is executed to the control center 100.

Finally, after receiving the information that the handling instruction is executed sent by the second handling device 104, the control center 100 determines that the vehicle 114 is correctly transported to the bottom-floor docking point 110, and the handling task is performed.

In an embodiment provided in the present disclosure, taking a process of transporting a vehicle 114 from a bottom-floor docking point 110 into any one of higher-floor storage spaces for inventory as an example, a process in which a dispatching system for item picking of a three-dimensional warehouse performs a handling task is described.

First, according to the to-be-performed handling task, and when determining that a vehicle 114 that has been transported to the bottom-floor docking point 110 needs to be transported to the higher-floor storage spaces for inventory, a control center 100 of the system may first determine a second handling device 104 for performing the handling task from second handling devices 104, and send a handling instruction to the determined second handling device 104.

Certainly, for the logic for determining the second handling device 104 for performing the handling task, details are not described in the present disclosure.

Then, the second handling device 104 travels through, according to the received handling instruction, an aisle of a bottom floor to the bottom-floor docking point 110 to transport the vehicle 114, then travels through the aisle of the bottom floor again to a lifting device 108, and places the vehicle on the lifting device 108; and after placing, sends information that the handling instruction is executed to the control center 100.

In addition, when sending the handling instruction to the second handling device 104, the control center 100 may also send a handling instruction to the lifting device 108 asynchronously, so that the lifting device 108 moves to the bottom floor (that is, a specified floor), that is, a floor on which the bottom-floor docking point 110 is located. Then, the lifting device 108 may move to the bottom floor according to the handling instruction, and wait for the second handling device 104 to transport the vehicle 114 to the lifting device 108.

After receiving information that the handling instruction is executed sent by the second handling device 104, the control center 100 may continue to send a handling instruction to the lifting device 108 according to the information that the handling instruction is performed and a floor on which higher-floor storage spaces for storing the items are located included in the handling task, and the specified floor corresponding to the handling instruction is the floor on which the higher-floor storage spaces for storing the items are located.

The lifting device 108 transports, according to the received handling instruction sent by the control center 100 again, the vehicle 114 to the floor on which the higher-floor storage spaces are located, and sends information that the handling instruction is executed to the control center 100. In addition, when the lifting device 108 reaches the specified floor, the vehicle 114 may further be transported out of the lifting device 108 through the higher-floor docking point 112.

The control center 100 determines, according to the information that the handling instruction is executed sent by the lifting device 108, a first handling device 102 for performing the handling task from first handling devices 102 on the floor on which the higher-floor storage spaces are located, and sends a handling instruction to the determined first handling device 102.

The first handling device 102 travels to the higher-floor docking point 112 through an aisle of the located floor according to the received handling instruction, transports the vehicle 114 lifted from the bottom floor by the lifting device 108, then travels through the aisle of the located floor again to below the higher-floor storage spaces, and places the vehicle 114 into the higher-floor storage spaces.

Finally, after placing the vehicle 114, the first handling device 102 may send information that the handling instruction is executed to the control center 100, after receiving the information that the handling instruction is executed sent by the first handling device 102, the control center 100 determines that the vehicle 114 is correctly transported to the higher-floor storage spaces, and the handling task is performed.

Further, in the present disclosure, the first handling device 102 may use various methods for transporting the vehicle 114 out of or storing the vehicle 114 into the higher-floor storage spaces.

Specifically, the control center 100 determines, according to the handling task, the higher-floor storage spaces corresponding to the handling task. For example, higher-floor storage spaces for storing the vehicle 114 may be considered as the higher-floor storage spaces corresponding to the handling task, or higher-floor storage spaces determined when the vehicle 114 is stored for inventory may also be considered as the higher-floor storage spaces corresponding to the handling task.

Then, the control center 100 may send a handling instruction to the determined first handling device 102 according to positions of the higher-floor storage spaces and positions of aisles adjacent to the higher-floor storage spaces.

Then, the first handling device 102 may, at a rail position adjacent to the higher-floor storage spaces, take out the vehicle 114 from a side of the higher-floor storage spaces according to the handling instruction sent by the control center 100 to the first handling device 102, or put the transported vehicle 114 in the first handling device 102 into the higher-floor storage spaces from the side of the higher-floor storage spaces. As shown in FIG. 5, FIG. 5 is a schematic diagram of a first handling device picking and placing a vehicle from a side provided in the present disclosure. The first handling device 102 is located at an aisle position adjacent to a higher-floor storage space, and picks and places items from the side of the higher-floor storage space.

Alternatively, after determining the higher-floor storage spaces corresponding to the handling task, the control center 100 sends a handling instruction to the determined first handling device 102 according to positions of the higher-floor storage spaces and positions of other storage spaces above the higher-floor storage spaces.

Then, the first handling device 102 may take out the vehicle 114 from above the higher-floor storage spaces into the first handling device 102 according to the handling instruction sent by the control center 100, or put the vehicle 114 in the first handling device 102 into the higher-floor storage spaces from above the higher-floor storage spaces.

Still further, in the present disclosure, the second handling device 104 may also use various methods for transporting the vehicle 114 out of or storing the vehicle 114 into the bottom-floor storage spaces.

Specifically, the control center 100 determines, according to the handling task, the bottom-floor storage spaces corresponding to the handling task. For example, bottom-floor storage spaces for storing the vehicle 114 may be considered as the bottom-floor storage spaces corresponding to the handling task, or bottom-floor storage spaces determined when the vehicle 114 is stored for inventory may also be considered as the bottom-floor storage spaces corresponding to the handling task.

Then, the control center 100 may send a handling instruction to the determined second handling device 104 according to positions of the bottom-floor storage spaces and positions of aisles adjacent to the bottom-floor storage spaces.

Then, the second handling device 104 may, at an aisle position adjacent to the bottom-floor storage spaces, take out the vehicle 114 from a side of the bottom-floor storage spaces according to the handling instruction sent by the control center 100 to the second handling device 104, or put the transported vehicle 114 in the second handling device 104 into the bottom-floor storage spaces from the side of the bottom-floor storage spaces.

Alternatively, after determining the bottom-floor storage spaces corresponding to the handling task, the control center 100 sends a handling instruction to the determined second handling device 104 according to the positions of the bottom-floor storage spaces.

Then, the second handling device 104 may, at an aisle position adjacent to the bottom-floor storage spaces, enter to below the bottom-floor storage spaces according to the handling instruction sent by the control center 100, and take out the vehicle 114 from below the bottom-floor storage spaces to the second handling device 104, or place the vehicle 114 indicated in the handling instruction in the second handling device 104 into the bottom-floor storage spaces.

In addition, in the present disclosure, because for each three-dimensional warehouse 106, at least one lifting device 108 may be arranged in the three-dimensional warehouse 106, to allow the vehicle 114 to be placed on any floor of the three-dimensional warehouse 106, in a case that the three-dimensional warehouse 106 includes a plurality of lifting devices 108, at least an overlap exists between specified floors reachable by the plurality of lifting devices 108.

That is, through the overlapping floors, the lifting devices 108 can communicate floors of the three-dimensional warehouse 106. As shown in FIG. 6, the three-dimensional warehouse 106 includes a total of four floors, and three lifting devices 108 respectively communicating a bottom floor and a first floor, the first floor and a second floor, and the second floor and a third

floor. Certainly, the lifting device 108 may be located at different positions of the three-dimensional warehouse 106.

A control center 100 may transport a vehicle to any floor of the three-dimensional warehouse 106 through one or more lifting devices 108. For example, in FIG. 6 described above, in a case that items on the third floor need to be transported to the bottom floor, the control center may dispatch first handling devices 102 and corresponding lifting devices 108 of the first to third floors respectively, so that the lifting devices 108 and the first handling devices 102 on the floors transport the items from the third floor to the bottom floor in a relay manner.

In the present disclosure, rails 118 may be arranged in the lifting devices 108, so that the rails 118 in the lifting devices 108 can be connected to rails 118 arranged in higher floors of the three-dimensional warehouse 106. Then, when moving along the rails on the higher floors, the first handling devices 102 may travel into the lifting devices 108, and directly place the vehicle 114 into the lifting devices 108, or the first handling devices 102 may be transported by the lifting devices 108 to other floors, as shown in FIG. 7.

Still further, in the present disclosure, in a case that rails 118 are also arranged in the lifting devices 108, the control center 100 may also dispatch the first handling devices 102 between different floors through the lifting devices 108.

Specifically, in the present disclosure, the control center 100 may determine, according to a to-be-performed handling task corresponding to some or all of the higher floors, a quantity of first handling devices 102 required by the higher floors. The control center 100 may determine a floor on which higher-floor storage spaces involved in the handling task are located as a higher floor corresponding to the handling task. For example, in a case that in a handling task A, a vehicle 114 needs to be transported from the third floor, then the third floor is a higher floor corresponding to the handling task A, or in a case that in a handling task B, a vehicle 114 needs to be transported to a specific higher-floor storage space of the third floor, then the third floor is a higher floor corresponding to the handling task B. In addition, the control center 100 may determine, according to a quantity of to-be-performed handling tasks corresponding to the higher floors, the quantity of first handling devices 102 required by the higher floors. In a case that there are more to-be-performed handling tasks corresponding to the higher floors, the quantity of first handling devices 102 required by the higher floors is more. Certainly, due to a limited space of each floor in the warehouse, an excessive quantity of first handling devices 102 may result in a reduction in travel paths for devices or congestion in paths. Therefore, in the present disclosure, the control center 100 may also determine, according to a preset

maximum quantity of first handling devices 102 of each higher floor, the quantity of first handling devices 102 required by the higher floors. The maximum quantity of first handling devices 102 may vary according to the layout of each floor. In a case that a quantity of vehicles 114 arranged in the higher floors is less, it means that a quantity of areas through which the first handling devices 102 can pass is greater.

Then, the control center 100 may determine, according to the quantity of first handling devices 102 required by the each of the higher floors and a current quantity of first handling devices 102 of the each of the higher floors, first handling devices 102 that need to be dispatched to the each of the higher floors, and send a dispatching instruction to the first handling devices 102 that need to be dispatched.

Then, the first handling devices 102 are further configured to travel into the lifting devices 108 along the rails 118 according to the received dispatching instruction sent by the control center 100, and reach a higher floor specified in the dispatching instruction through the lifting devices 108.

In addition, in the description of the structure of the three-dimensional warehouse 106 described above in the present disclosure, higher-floor docking points 112 respectively set on the higher floors are independent of the lifting devices 108. This is because if the first handling devices 102 cannot reach the lifting devices 108, a vehicle 114 needs to be transported to the lifting devices 108 through the higher-floor docking points 112, and then the lifting devices 108 transport the vehicle 114 to a specified floor.

However, if rails 118 are also arranged in the lifting devices 108 and the first handling devices 102 can travel into the lifting devices 108, the higher-floor docking points 112 may alternatively be set in the lifting devices 108 in the present disclosure.

Then, the first handling devices 102 are further configured to travel to the higher-floor docking points 112 in the lifting devices 108 according to a handling instruction sent by the control center 100, and place the vehicle 114 at the higher-floor docking points 112, or take out the vehicle 114 from the higher-floor docking points 112.

Further, in the present disclosure, because the construction of a warehouse may be affected by various aspects, the layout of floors may be different. In a case that there is a floor where not all areas are communicated by rails among the higher floors of the three-dimensional warehouse 106, as shown in FIG. 8, if a first handling device 102 needs to be dispatched between two areas, the control center 100 may be configured to:

for the floor where not all areas are communicated by rails 118, in a case that a first handling device 102 needs to be dispatched between different areas of the floor, determine an

area from which the first handling device 102 is to be dispatched as a departure area, and determine an area into which the first handling device 102 is to be dispatched as a destination area, and determine another floor closest to the floor where all areas are communicated by rails as a transit floor.

The control center 100 sends a dispatching instruction to the first handling device 102 in the departure area, sends a handling instruction to a lifting device 108 communicating the transit floor and the departure area, and sends a handling instruction to a lifting device 108 communicating the transit floor and the destination area, so that the first handling device 102 reaches the destination area from the departure area through the two lifting devices 108 and a rail 116 of the transit floor.

Still further, in the system provided in the present disclosure, in a case that there are two or more three-dimensional warehouses 106, bottom surfaces of the three-dimensional warehouses 106 are in communication with each other. As shown in FIG. 9a and FIG. 9b, FIG. 9a is a simple schematic diagram corresponding to FIG. 8 in which the bottom surfaces of the two three-dimensional warehouses are in communication with each other, indicating that because only the bottom floors of the two three-dimensional warehouses are in communication, the two three-dimensional warehouses can be considered as a whole. FIG. 9b is a detailed schematic diagram, it can be seen that the two three-dimensional warehouses are independently arranged on the bottom surfaces.

In addition, the control center 100 may determine, according to at least some to-be-performed handling tasks corresponding to the three-dimensional warehouses 106, a quantity of first handling devices 102 required by each of the three-dimensional warehouses 106; and

determine, according to the quantity of first handling devices 102 required by the each of the three-dimensional warehouses 106 and a current quantity of first handling devices 102 of the each of the three-dimensional warehouses 106, first handling devices 102 that need to be dispatched to the each of the three-dimensional warehouses 106; and

determine a three-dimensional warehouse 106 from which first handling devices 102 are to be dispatched as a departure warehouse, and determine a three-dimensional warehouse 106 into which the first handling devices 106 are to be dispatched as a destination warehouse, send a dispatching instruction to the first handling devices 102 in the departure warehouse, and send a handling instruction to second handling devices 104, a lifting device 108 of the departure warehouse, and a lifting device 108 of the destination warehouse, so that the first handling devices 102 are dispatched from the departure warehouse to the destination warehouse through the two lifting devices 108 and the second handling devices 104.

The second handling devices 104 are configured to transport the first handling devices 102 from a bottom floor of the departure warehouse to a bottom floor of the destination warehouse according to the dispatching instruction.

It should be noted that, because the first handling devices 102 can travel into the lifting devices 108 through rails, the second handling devices 104 may consider the first handling devices 102 in the lifting devices 108 as the vehicle 114 in the lifting devices 108, and transport the first handling devices 102 out of the lifting devices 108 in the same manner as the vehicle 114. Moreover, because the bottom floors of the three-dimensional warehouses 106 are in communication, the second handling devices 104 can reach another three-dimensional warehouse 106 from one three-dimensional warehouse 106 through the bottom floors, so as to dispatch the first handling devices 102 between different three-dimensional warehouses 106.

In addition, in the present disclosure, an unpowered carrier 120 or a powered carrier 120 is arranged in the lifting device 108, and the higher-floor docking point 112 is provided with at least the carrier 120 located in the lifting device. The powered carrier 120, such as a roller line, a transport line, a two-way telescopic fork, or the like, may actively move a vehicle 114 placed on the carrier 120, and the specific form is not limited, while the unpowered carrier 120 may include at least a vehicle support 116 for placing a vehicle 114 thereon.

The first handling device 102 is further configured to travel to the carrier 120 used as a higher-floor docking point 112 in the lifting device 108, and place the vehicle 114 on the carrier 120, or take out the vehicle 114 from the carrier 120 used as the higher-floor docking point 112.

Further, in the present disclosure, the unpowered carrier 120 or the powered carrier 120 is arranged outside at least some positions at which the lifting devices 108 are docked with the higher floors on the higher floors of the three-dimensional warehouse 106. Then, the higher-floor docking point in the present disclosure is at least further provided with the carrier located outside the lifting device, as shown in FIG. 10.

In a case that the lifting device 108 is located at a higher floor, the carrier 120 located outside the lifting device 108 is docked with the carrier 120 located in the lifting device 108, so that the vehicle 114 is transported from the carrier 120 in the lifting device 108 to the carrier 120 outside the lifting device 108, or the vehicle 114 is transported from the carrier 120 outside the lifting device 108 to the carrier 120 in the lifting device 108.

It should be noted that, in the present disclosure, in a case that the carriers 120 inside and outside the lifting devices 108 are all unpowered carriers 120, the first handling devices 102 may take out or store the vehicle 114 from the side, and push the vehicle 114 onto the carrier 120. In a case that any one of the carriers 120 inside and outside the lifting devices 108 is a

powered carrier 120, the vehicle 114 may be pushed by the powered carrier 120.

In addition, in the present disclosure, a specified area of the bottom floor of the three-dimensional warehouse 106 is provided with at least one bottom-floor docking point 110, that is, the bottom-floor docking point 110 may also be a specified area of the bottom floor.

Then, the second handling device 104 is configured to take the vehicle 114 out of the bottom-floor storage spaces or the lifting devices 108, transport the vehicle 114 to the bottom-floor docking point 110, and place the vehicle 114 in the specified area; or take out the vehicle 114 from the bottom-floor docking point 110 in the specified area, and transport the vehicle 114 into the bottom-floor storage spaces or the lifting devices 108.

Because the bottom-floor storage spaces may be provided with a vehicle support 116 for placing the vehicle 114, and a minimum distance between the vehicle support 116 and the bottom floor may be greater than a height of the second handling device 104, there is usually a height difference between the vehicle support of the bottom-floor storage spaces 116 and the bottom floor. Similarly, because the lifting device 108 needs to obtain items from the higher-floor docking point 112, and a height of the higher-floor docking point 112 is adapted to the first handling devices 102, there is usually a height difference between the lifting device 108 and the bottom floor.

Then, in a case that the bottom-floor docking point 110 is located in a specified area on the bottom floor, an apparatus for lifting the vehicle 114 and placing the vehicle 114 needs to be arranged in the second handling device 104, such as a fork that can be lifted or lowered, so that the second handling device 104 transport the vehicle 114 from the specified area on the bottom floor into the bottom-floor storage spaces or the lifting devices 108 at different heights.

Further, in the present disclosure, when the lifting device 108 include a built-in carrier 120, the bottom floor of the three-dimensional warehouse 106 may also be provided with a powered carrier 120, so that when the lifting device 108 is located at the bottom floor, the carrier 120 on the bottom floor is docked with the carrier 120 located in the lifting device 108, to transport the vehicle 114 from the carrier 120 in the lifting device 108 to the carrier 120 on the bottom floor, so that the second handling device 104 can take out the vehicle 114 from the carrier 120 on the bottom floor, or when the second handling device 104 places the vehicle 114 on the carrier 120 on the bottom floor, the carrier 120 on the bottom floor can transport the vehicle 114 from the carrier 120 on the bottom floor to the carrier 120 in the lifting device 108.

Therefore, the second handling device 104 in the present disclosure is further configured to take out the vehicle 114 from the carrier 120 on the bottom floor, transport the vehicle to the bottom-floor docking point 112, and place the vehicle 114 in the specified area; or the second

handling device 104 may take out the vehicle 114 from the bottom-floor docking point 112 in the specified area, and transport the vehicle 114 to the carrier 120 on the bottom floor. As shown in FIG. 11, a dashed line indicates a movement path of the vehicle 114.

Further, in another implementation of the present disclosure, the control center 100 may send a handling instruction for transporting to a specified area outside the three-dimensional warehouse 106 as required to a second handling device 104, and the second handling device 104 may transport the vehicle 114 to the specified area according to the handling instruction. That is, in the present disclosure, the second handling device 104 is not limited to only operating in the three-dimensional warehouse 106. Because the second handling device 104 operates on a platform of the bottom floor, the second handling device is not limited by a rail, and can be more flexibly connected to a device outside the system or outside the three-dimensional warehouse 106, so as to transport the vehicle 114 out or transport the vehicle 114 in. The device outside may be a forklift controlled by a worker, a roller line for conveying the vehicle 114, a production line, an area where workers sort items, or the like, which is not limited in the present disclosure.

Still further, the system may further include: at least one external temporary storage area, where the external temporary storage area is in a form of at least one of three-dimensional storage or planar storage, which is not limited in the present disclosure. In a case that the external temporary storage area is in the form of three-dimensional storage, a lifting device 108 may also be arranged in the external temporary storage area for communicating floors of the external temporary storage area. Certainly, if the external temporary storage area is not provided with a lifting device 108, a vehicle 114 of middle and higher floors of the external temporary storage area may also be transported by a three-dimensional handling device, such as a forklift, and a layout structure of the external temporary storage area may also be in the form shown in FIG. 2 to FIG. 4b.

In the present disclosure, the external temporary storage area and the three-dimensional warehouse 106 may share second handling devices 104, and the second handling devices 104 transport the vehicle 114 between the external temporary storage area and at least one three-dimensional warehouse 106, or are docked with the vehicle 114. For example, when items in the three-dimensional warehouse 106 need to be transported to the external temporary storage area, the control center 100 may send a handling instruction to the second handling devices, and the second handling devices 104 may transport the vehicle 114 to the external temporary storage area for temporary storage.

Certainly, in a case that the external temporary storage area is in the form of planar storage,

the external temporary storage area may also be a temporary storage area including a vehicle support 116 arranged on a ground. The external temporary storage area may be used for storing items with a relatively high inbound and outbound frequency, reducing the inbound and outbound frequency of the three-dimensional warehouse 106 by using the vehicle 114, and reducing the time occupying the handling devices during transporting the items with a relatively high inbound frequency. Generally, the storage capacity of the external temporary storage area is less than that of the three-dimensional warehouse 106, and the structure is simpler, as long as items can be temporarily stored. Therefore, the external temporary storage area may only include a vehicle support 116 arranged on a ground as described above.

Based on a dispatching system for item picking of a three-dimensional warehouse shown in FIG. 2 and the description of the process of performing the handling task described above, it can be seen that in the system provided in the present disclosure, through a combination of using first handling devices and second handling devices in a three-dimensional warehouse, a handling function of a lifting device in the three-dimensional warehouse is used, so that the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse, the layout of the warehouse can be changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the handling efficiency can be improved.

In addition, in the present disclosure, to increase the flexibility of the path selection of a second handling device 104 not transporting the vehicle 114, a height of the vehicle support 116 in at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse 106 is greater than a height of the second handling device 104 not carrying the vehicle 114.

The second handling device 104 not carrying the vehicle 114 is further configured to selectively travel below the at least some bottom-floor storage spaces, or transport the vehicle 114 from below the at least some bottom-floor storage spaces in a piggyback manner.

Further, an interval between uprights in the at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse 106 is greater than a width of the second handling device 104, and a height of a lowest point of a connector between two adjacent uprights of at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse 106 is higher than the height of the second handling device 104 not carrying the vehicle 114. The second handling device 104 not carrying the vehicle 114 is further configured to selectively travel between two adjacent uprights of the at least some bottom-floor

storage spaces of the bottom floor.

Based on the system shown in FIG. 2, the present disclosure also provides a dispatching method for a three-dimensional warehouse, as shown in FIG. 12.

FIG. 12 is a flowchart of a dispatching process for a three-dimensional warehouse provided in the present disclosure. There are at least one or more three-dimensional warehouses, floors of the three-dimensional warehouses are communicated by at least one lifting device, a bottom floor of the three-dimensional warehouses is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces are provided with a vehicle and a vehicle support, the vehicle support in the bottom-floor storage spaces is configured for placing a vehicle transported by a second handling device, higher floors other than the bottom floor of the three-dimensional warehouses are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for a first handling device to run on, at least some higher-floor storage spaces of the higher floors are provided with a vehicle, and the handling process may specifically include the following steps:

S200: Determine a to-be-performed handling task.

It should be noted that, the handling task is used for a three-dimensional warehouse to implement the sorting of items, so that a task of a handling device transporting a vehicle can be determined according to a received order.

S202: Determine, according to the handling task, a first handling device, a second handling device, and a lifting device for performing the handling task.

S204: Send a handling instruction to the determined first handling device, second handling device, and lifting device separately, so that the first handling device, the second handling device, and the lifting device cooperate to transport the vehicle from the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses to the bottom-floor docking point, or transport the vehicle at the bottom-floor docking point into the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses.

The handling method provided in the present disclosure may be specifically performed by a control center. The control center may be one or more devices, such as a distributed server including a plurality of servers, which is not limited in the present disclosure. Certainly, because there can be one or more three-dimensional warehouses, a control center may be set to determine handling tasks of the plurality of three-dimensional warehouses, and dispatch devices for performing the handling tasks, or a plurality of control centers may respectively determine different handling tasks and dispatch devices for performing the handling tasks. In a case that there are a plurality of control centers, the control centers may share determined

handling tasks, to allow the plurality of control centers to cooperate to perform the plurality of handling tasks.

In addition, for the detailed process of performing the method, reference may be made to the description of the process of performing the handling task in the dispatching system for item picking of a three-dimensional warehouse described above, and details are not described herein again in the present disclosure.

Further, in the present disclosure, an example in which the control center executes the dispatching process is used for description. Because the first handling device can transport the vehicle from above or from the side of the higher-floor storage spaces, when a handling instruction is sent to the determined first handling device, to enable the first handling device to perform the handling task, the control center may determine, according to the handling task, a higher-floor storage space corresponding to the handling task, and send a handling instruction to the determined first handling device according to a position of the higher-floor storage space and an aisle position adjacent to the higher-floor storage space, so that the first handling device, at the aisle position, takes out a vehicle indicated in the handling instruction from a side of the higher-floor storage space to the first handling device according to the handling instruction, or the first handling device places the vehicle indicated in the handling instruction in the first handling device into the higher-floor storage space from the side according to the handling instruction.

The aisle position adjacent to the higher-floor storage spaces is an aisle position where there is no warehouse structure such as a three-dimensional warehouse reinforcement structure (such as reinforcing ribs) or partitions between higher-floor storage spaces. Because an aisle is a passage for the first handling device to travel through when transporting the vehicle, and the first handling device needs to transport the vehicle from the higher-floor storage spaces and travel along the aisle, an unblocked passage between each of the higher-floor storage spaces and an adjacent aisle exists necessarily. Certainly, in the system described above, there may be various plane layouts of the three-dimensional warehouse. Then, at least by transporting other vehicles, any one of the higher-floor storage spaces can also be in communication with the aisle.

Alternatively, the control center may determine, according to a handling task, a higher-floor storage space corresponding to the handling task, and send the handling instruction to the determined first handling device according to a position of the higher-floor storage space and positions of other storage spaces above the higher-floor storage space, so that the first handling device takes out a vehicle indicated in the handling instruction from the positions of other higher-floor storage spaces above the higher-floor storage space according to the handling

instruction to the first handling device, or the first handling device lowers the vehicle indicated in the handling instruction in the first handling device to the higher-floor storage space according to the handling instruction.

In addition, in the present disclosure, the second handling device may also take items out of the bottom-floor storage spaces in different manners, such as transporting the vehicle from below or from the side of the bottom-floor storage spaces. Therefore, when sending a handling instruction to the determined second handling device to enable the second handling device to perform the handling task, the control center may determine, according to a handling task, a bottom-floor storage space corresponding to the handling task, and send the handling instruction to the second handling device according to a position of the bottom-floor storage space and an aisle position adjacent to the bottom-floor storage space, so that the second handling device, at the aisle position adjacent to the bottom-floor storage space, takes out a vehicle indicated in the handling instruction from a side of the bottom-floor storage space to the second handling device, or places the vehicle indicated in the handling instruction in the second handling device into the bottom-floor storage space from the side.

Further, the control center may further determine, according to a handling task, a bottom-floor storage space corresponding to the handling task, and send the handling instruction to the second handling device according to a position of the bottom-floor storage space, so that the second handling device, at an aisle position adjacent to the bottom-floor storage space, enters to below the bottom-floor storage space, and takes out a vehicle indicated in the handling instruction from below the bottom-floor storage space to the second handling device, or places the vehicle indicated in the handling instruction in the second handling device into the bottom-floor storage space.

In addition, in a case, a rail is arranged in the lifting device, and is configured to be connected to the rail arranged in each of the higher floors, to allow the first handling device to travel into the lifting device.

The control center may further be configured to determine, at least in part according to a to-be-performed handling task of each of the higher floors, a quantity of first handling devices required by the each of the higher floors, and determine, according to the quantity of first handling devices required by the each of the higher floors and a current quantity of first handling devices of the each of the higher floors, first handling devices that need to be dispatched to the each of the higher floors; and then send a dispatching instruction to the determined first handling devices that need to be dispatched, so that the first handling devices are further configured to travel into the lifting devices according to the received dispatching

instruction, and reach a higher floor specified in the dispatching instruction through the lifting devices.

Further, if the higher-floor docking point is set to be located in the lifting device, when sending a handling instruction to the first handling device, the control center may determine, according to a handling task, a higher-floor docking point in the lifting device corresponding to the handling task, and send the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device, so that the first handling device travels to the higher-floor docking point in the lifting device, and places a vehicle at the higher-floor docking point, or takes out a vehicle from the position of the higher-floor docking point.

Still further, an unpowered carrier or a powered carrier is arranged in the lifting device, and the higher-floor docking point is provided with at least the carrier located in the lifting device. Then, the control center may determine, according to a handling task, a higher-floor docking point in a lifting device corresponding to the handling task; and send the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device, so that the first handling device travels to a carrier that is used as the higher-floor docking point in the lifting device, and places a vehicle on the carrier, or takes out a vehicle from the carrier that is used as the higher-floor docking point.

In addition, if an unpowered carrier or a powered carrier is further arranged outside the lifting device, and the higher-floor docking point is further provided with at least the carrier outside the lifting device, the control center may further determine, according to a handling task, a higher-floor docking point corresponding to the handling task, and send the handling instruction to the lifting device according to a floor on which the higher-floor docking point is arranged, so that the lifting device, on the floor on which the higher-floor docking point is arranged, is docked with the carrier located in the lifting device through the carrier located outside the lifting device, and transports the vehicle from the carrier located in the lifting device to the carrier that is located outside the lifting device and used as the higher-floor docking point, or transports the vehicle on the carrier that is located outside the lifting device and used as the higher-floor docking point to the carrier in the lifting device.

In addition, in the present disclosure, the bottom-floor docking point of the bottom floor of the three-dimensional warehouse is an area of the three-dimensional warehouse for the docking with a vehicle outside, and if there is a device such as a forklift outside the three-dimensional warehouse that can fork and pick a vehicle from the bottom floor, at least one bottom-floor docking point can be arranged in a specified area on the bottom floor of the three-

dimensional warehouse. When sending the handling instruction to the determined second handling device, the control center may also determine, according to a handling task, a bottom-floor docking point arranged in a specified area corresponding to the handling task, and send a handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area, so that the second handling device takes a vehicle indicated in the handling instruction out of the bottom-floor storage spaces or the lifting devices, transports the vehicle to the bottom-floor docking point, and places the vehicle in the specified area, or takes out a vehicle indicated in the handling instruction from the bottom-floor docking point in the specified area, and transports the vehicle into the bottom-floor storage spaces or the lifting devices.

Further, a powered carrier may further be arranged in the lifting device, and correspondingly, the bottom floor of the three-dimensional warehouse is provided with a powered carrier. When controlling the lifting device to transport the vehicle, the control center may determine, according to a handling task, a bottom-floor docking point corresponding to the handling task, and send the handling instruction to the lifting device to instruct the lifting device to move to the bottom floor, so that the lifting device moves to the bottom floor, and the carrier on the bottom floor is docked with the carrier located in the lifting device, to transport the vehicle from the carrier in the lifting device to the carrier on the bottom floor, or transport the vehicle on the carrier on the bottom floor to the carrier in the lifting device.

In a case described above, the vehicle on the bottom floor is transported from the lifting device to the carrier on the bottom floor. Then, the control center may determine, according to a handling task, a bottom-floor docking point arranged in a specified area corresponding to the handling task, and send a handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area, so that the second handling device takes out a vehicle from the carrier on the bottom floor, transports the vehicle to the bottom-floor docking point, and places the vehicle in the specified area, or when the second handling device is to transport the vehicle to the lifting device, and the vehicle can be lifted to other floors by the lifting device, the second handling device may take out a vehicle indicated in the handling instruction from the bottom-floor docking point in the specified area according to the received handling instruction, and transport the vehicle to the carrier on the bottom ground.

In addition, in a case that the higher floors of the three-dimensional warehouse include a higher floor where not all areas are communicated by rails, for the higher floor where not all areas are communicated by rails, in a case that the control center determines that a first handling device needs to be dispatched between different areas of the higher floor, for example, the first

handling device needs to be dispatched according to the need to perform the handling task as described in the foregoing system, then the control center may determine an area from which the first handling device is to be dispatched as a departure area, determine an area into which the first handling device is to be dispatched as a destination area, and determine another higher floor which is closest to the higher floor and in which all areas are communicated by rails as a transit floor; and send a dispatching instruction to the first handling device in the departure area, send a handling instruction to a lifting device communicating the transit floor and the departure area, and send a handling instruction to a lifting device communicating the transit floor and the destination area, so that the first handling device reaches the destination area from the departure area through the two lifting devices and the transit floor.

Still further, in a case that there are two or more three-dimensional warehouses, in the present disclosure, the bottom surfaces of the three-dimensional warehouses are in communication with each other, and when determining that the first handling device needs to be dispatched between different three-dimensional warehouses, the control center may determine a three-dimensional warehouse from which the first handling device is to be dispatched as a departure warehouse, and determine a three-dimensional warehouse into which the first handling device is to be dispatched as a destination warehouse; and

send a dispatching instruction to the first handling device in the departure warehouse, and send a handling instruction to a second handling device, a lifting device of the departure warehouse, and a lifting device of the destination warehouse, so that the first handling device is dispatched from the departure warehouse to the destination warehouse through the two lifting devices and the second handling device.

In addition, in another embodiment provided in the present disclosure, one or more external temporary storage areas are arranged outside the three-dimensional warehouses, where the external temporary storage areas are in a form of three-dimensional storage or planar storage. The external temporary storage areas and the three-dimensional warehouses share at least some of the second handling devices, or the second handling devices transport and/or are docked with the vehicle between the external temporary storage areas and at least one of the three-dimensional warehouses.

Then, when determining a to-be-performed handling task, the control center may determine the to-be-performed handling task according to item inventory information and order information stored in the external temporary storage areas and the three-dimensional warehouses. That is, items stored in the external temporary storage areas and the item storage capacity of the external temporary storage areas need to be taken into consideration.

Based on the method shown in FIG. 12, through a combination of using first handling devices and second handling devices in a three-dimensional warehouse, a handling function of a lifting device in the three-dimensional warehouse is used, so that the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse, the layout of the warehouse can be changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the transport efficiency can be improved.

In the 1990s, improvements of a technology can be clearly distinguished between hardware improvements (for example, improvements to a circuit structure such as a diode, a transistor, or a switch) and software improvements (improvements to a method procedure). However, with the development of technology, improvements of many method procedures can be considered as direct improvements of hardware circuit structures. Designers almost all program an improved method procedure to a hardware circuit, to obtain a corresponding hardware circuit structure. Therefore, it does not mean that the improvement of a method procedure cannot be implemented by using a hardware entity module. For example, a programmable logic device (PLD) (for example, a field programmable gate array (FPGA)) is a type of an integrated circuit whose logic function is determined by a user by programming the device. The designers perform voluntary programming to "integrate" a digital system into a single PLD without requiring a chip manufacturer to design and prepare a dedicated integrated circuit chip. Moreover, nowadays, instead of manually making integrated circuit chips, this programming is mostly implemented by using "logic compiler" software, which is similar to the software compiler used in program development and writing. The original code is written in a specific programming language before compiling, and this language is referred to as a hardware description language (HDL). There are various kinds of HDLs, for example, advanced Boolean expression language (ABEL), altera hardware description language (AHDL), Confluence, Cornell university programming language (CUPL), HDCal, Java hardware description language (JHDL), Lava, Lola, MyHDL, PALASM, Ruby hardware description language (RHDL), and the like. Currently, the most commonly used HDLs are very-high-speed integrated circuit hardware description language (VHDL) and Verilog. A person skilled in the art should also understand that provided that a method procedure is logically programmed and then programmed to an integrated circuit by using the foregoing hardware description languages, a hardware circuit that implements the logical method procedure can be easily obtained.

The controller can be implemented in any appropriate manner. For example, the controller

can take the form of, for example, a microprocessor or processor and a computer-readable medium storing computer-readable program code (for example, software or firmware) executable by the (micro)processor, a logic gate, a switch, an application-specific integrated circuit (ASIC), a programmable logic controller, and an embedded microcontroller. Examples of the controller include, but are not limited to, the following microcontrollers: ARC 625D, Atmel AT91SAM, Microchip PIC18F26K20, and Silicone Labs C8051F320. The memory controller can also be implemented as a part of the memory control logic. A person skilled in the art also appreciates that, in addition to implementing the controller in the form of pure computer-readable program code, it is also possible to implement, by logically programming the method steps, the controller in the form of a logic gate, switch, ASIC, programmable logic controller, and embedded microcontroller and other forms to achieve the same function. Such a controller can thus be considered as a hardware component, and apparatuses included therein for implementing various functions can also be considered as structures inside the hardware component. Alternatively, apparatuses configured to implement various functions can be considered as both software modules implementing the method and structures inside the hardware component.

The system, the apparatus, the module or the unit described in the foregoing embodiments may be implemented by a computer chip or an entity, or implemented by a product having a certain function. A typical implementation device is a computer. Specifically, the computer may be, for example, a personal computer, a laptop computer, a cellular phone, a camera phone, a smartphone, a personal digital assistant, a media player, a navigation device, an email device, a game console, a tablet computer, a wearable device, or a combination of any of these devices.

For ease of description, when the apparatus is described, the apparatus is divided into units according to functions, which are separately described. Certainly, during implementation of the present disclosure, the functions of the units may be implemented in the same piece of or a plurality of pieces of software and/or hardware.

A person skilled in the art can understand that the embodiments of the present disclosure may be provided as a method, a system, or a computer program product. Therefore, the present disclosure may use a form of hardware-only embodiments, software-only embodiments, or embodiments combining software and hardware. In addition, the present disclosure may use a form of a computer program product that is implemented on one or more computer-usable storage media (including but not limited to a disk memory, a CD-ROM, an optical memory, and the like) that include computer-usable program code.

The present disclosure is described with reference to flowcharts and/or block diagrams of

the method, device (system), and computer program product in the embodiments of the present disclosure. It should be understood that computer program instructions can implement each procedure and/or block in the flowcharts and/or block diagrams and a combination of procedures and/or blocks in the flowcharts and/or block diagrams. These computer program instructions may be provided to a general-purpose computer, a dedicated computer, an embedded processor, or a processor of another programmable data processing device to generate a machine, so that an apparatus configured to implement functions specified in one or more procedures in the flowcharts and/or one or more blocks in the block diagrams is generated by using instructions executed by the general-purpose computer or the processor of another programmable data processing device.

These computer program instructions may also be stored in a computer readable memory that can instruct a computer or any other programmable data processing device to work in a specific manner, so that the instructions stored in the computer readable memory generate an artifact that includes an instruction apparatus. The instruction apparatus implements a specific function in one or more processes in the flowcharts and/or in one or more blocks in the block diagrams.

These computer program instructions may also be loaded into a computer or another programmable data processing device, so that a series of operation steps are performed on the computer or another programmable data processing device to generate processing implemented by a computer, and instructions executed on the computer or another programmable data processing device provide steps for implementing functions specified in one or more procedures in the flowcharts and/or one or more blocks in the block diagrams.

In a typical configuration, a computing device includes one or more processors (CPUs), an input/output (I/O) interface, a network interface, and an internal memory.

The internal memory may include a form such as a volatile memory, a random-access memory (RAM) and/or a non-volatile memory such as a read-only memory (ROM) or a flash RAM in a computer-readable medium. The internal memory is an example of the computer-readable medium.

The computer-readable medium includes a non-volatile medium and a volatile medium, a removable medium and a non-removable medium, which may implement storage of information by using any method or technology. Information may be a computer-readable instruction, a data structure, a program module, or other data. Examples of computer storage media include but are not limited to a phase change memory (PRAM), a static random access memory (SRAM), a dynamic random access memory (DRAM), another type of RAM, a ROM,

an electrically erasable programmable read-only memory (EEPROM), a flash memory or another memory technology, a CD-ROM, a digital versatile disc (DVD) or another optical storage, a cassette magnetic tape, tape and disk storage or another magnetic storage device or any other non-transmission media that may be configured to store information that a computing device can access. Based on the definition in the present disclosure, the computer-readable medium does not include transitory computer readable media (transitory media), such as a modulated data signal and a carrier.

It should be further noted that the terms "include", "comprise", or any variants thereof are intended to cover a non-exclusive inclusion. Therefore, a process, method, article, or device that includes a series of elements not only includes such elements, but also includes other elements not specified expressly, or may include inherent elements of the process, method, article, or device. Unless otherwise specified, an element limited by "include a/an..." does not exclude other same elements existing in the process, the method, the article, or the device that includes the element.

A person skilled in the art should understand that the embodiments of the present disclosure may be provided as a method, a system, or a computer program product. Therefore, the present disclosure may use a form of hardware only embodiments, software only embodiments, or embodiments with a combination of software and hardware. Moreover, the present disclosure may use a form of a computer program product that is implemented on one or more computer-usable storage media (including but not limited to a disk memory, a CD-ROM, an optical memory, and the like) that include computer-usable program code.

The present disclosure can be described in the general context of computer-executable instructions executed by a computer, for example, program modules. Generally, the program module includes a routine, a program, an object, a component, a data structure, and the like for executing a particular task or implementing a particular abstract data type. The present disclosure may also be implemented in a distributed computing environment in which tasks are performed by remote processing devices connected by using a communication network. In a distributed computing environment, the program module may be located in both local and remote computer storage media including storage devices.

The embodiments of the present disclosure are all described in a progressive manner, for same or similar parts in the embodiments, refer to these embodiments, and descriptions of each embodiment focus on a difference from other embodiments. Especially, a system embodiment is basically similar to a method embodiment, and therefore is described briefly; for related parts, reference may be made to partial descriptions in the method embodiment.

The descriptions are merely embodiments of the present disclosure, and are not intended to limit the present disclosure. For a person skilled in the art, various modifications and changes may be made to the present disclosure. Any modification, equivalent replacement, and improvement made within the spirit and principle of the present disclosure shall fall within the scope of the claims of the present disclosure.

CLAIMS

1. A dispatching system for item picking of a three-dimensional warehouse, comprising: one or more control centers, one or more first handling devices, one or more second handling devices, at least one three-dimensional warehouse, and at least one lifting device, wherein the three-dimensional warehouse is provided with a plurality of floors, the plurality of floors of the three-dimensional warehouse are communicated by the at least one lifting device, and the one or more control centers each communicate with the one or more first handling devices and the one or more second handling devices, wherein:

a bottom floor of the three-dimensional warehouse is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces of the bottom floor are provided with at least one of a vehicle and a vehicle support, and the vehicle support in the bottom-floor storage space is configured for placing a vehicle transported by the second handling device;

higher floors of the three-dimensional warehouse other than the bottom floor are each provided with at least one higher-floor docking point and a rail for the first handling device to run thereon, and at least some higher-floor storage spaces of the higher floor are provided with a vehicle;

the control center is configured to determine, according to a handling task, a first handling device, a second handling device, and a lifting device for performing the handling task, and send a handling instruction for performing the handling task to the first handling device, the second handling device, and the lifting device separately;

the first handling device is configured to take a vehicle indicated in the handling instruction out of or put the vehicle indicated in the handling instruction into the higher-floor storage space according to the handling instruction sent by the control center, and transport the vehicle indicated in the handling instruction between the higher-floor storage space and the higher-floor docking point;

the second handling device is configured to take a vehicle indicated in the handling instruction out of or put the vehicle indicated in the handling instruction into the bottom-floor storage space according to the handling instruction sent by the control center, and transport the vehicle indicated in the handling instruction between the lifting device and the bottom-floor storage space, between the bottom-floor storage space and the bottom-floor docking point, or between the lifting device and the bottom-floor docking point; and

the lifting device is configured to ascend or descend to a specified floor according to the handling instruction sent by the control center, and transport at least one of the vehicle indicated

in the handling instruction, the first handling device, and the second handling device between the floors.

2. The system according to claim 1, wherein at least some higher-floor storage spaces in the higher floor are further provided with a vehicle support configured for placing the vehicle, and a distance between the vehicle support and the rail is greater than a height of the first handling device not carrying the vehicle; and

the first handling device is further configured to travel to below the higher-floor storage space, and transport the vehicle from below the higher-floor storage space in a piggyback manner and leave the higher-floor storage space.

3. The system according to claim 1, wherein the first handling device is further configured to, at a rail position adjacent to the higher-floor storage space, take out the vehicle from a side of the higher-floor storage space to the first handling device, or place the vehicle from the first handling device into the higher-floor storage space from the side of the higher-floor storage space.

4. The system according to claim 1, wherein the first handling device is further configured to take out the vehicle from above the higher-floor storage space to the first handling device, or put the vehicle from the first handling device into the higher-floor storage space from above the higher-floor storage space.

5. The system according to claim 1, wherein the three-dimensional warehouse comprises a plurality of lifting devices, and at least an overlap exists between specified floors reachable by the plurality of lifting devices.

6. The system according to claim 1, wherein a rail is arranged in the lifting device, and is configured to connect with the rail arranged in the higher floor, to enable the first handling device to travel into the lifting device.

7. The system according to claim 6, wherein the control center is further configured to determine, at least in part according to a to-be-performed handling task of each of the higher floors, a quantity of first handling devices required by the each of the higher floors, determine, according to the quantity of first handling devices required by the each of the higher floors and a current quantity of first handling devices of the each of the higher floors, first handling devices that need to be dispatched by the each of the higher floors, and send a dispatching instruction to the first handling devices that need to be dispatched; and

the first handling device is further configured to travel into the lifting device according to the received dispatching instruction, and reach a higher floor specified in the dispatching instruction through the lifting device.

8. The system according to claim 6, wherein the higher-floor docking point is arranged in the lifting device; and

the first handling device is further configured to travel to the higher-floor docking point in the lifting device, and place the vehicle at the higher-floor docking point, or take out the vehicle from the higher-floor docking point.

9. The system according to claim 7, wherein the higher floors of the three-dimensional warehouse comprise a higher floor where not all areas are communicated by the rail;

for the higher floor where not all areas are communicated by the rail, in a case that the first handling device needs to be dispatched between different areas of the higher floor, the control center is configured to determine an area from which the first handling device is to be dispatched as a departure area, and determine an area into which the first handling device is to be dispatched as a destination area, and determine another higher floor which is closest to the higher floor and in which all areas are communicated by the rail as a transit floor; and send a dispatching instruction to the first handling device in the departure area, send a handling instruction to a lifting device communicating the transit floor and the departure area, and send a handling instruction to a lifting device communicating the transit floor and the destination area, so that the first handling device reaches the destination area from the departure area through the two lifting devices and the transit floor.

10. The system according to claim 7, comprising at least two three-dimensional warehouses, wherein bottom surfaces of the three-dimensional warehouses are in communication with each other;

in a case that the first handling device needs to be dispatched between different three-dimensional warehouses, the control center is configured to determine a three-dimensional warehouse from which the first handling device is to be dispatched as a departure warehouse, and determine a three-dimensional warehouse into which the first handling device is to be dispatched as a destination warehouse, send a dispatching instruction to the first handling device in the departure warehouse, and send a handling instruction to a second handling device, a lifting device of the departure warehouse, and a lifting device of the destination warehouse, so that the first handling device is dispatched from the departure warehouse to the destination warehouse through the two lifting devices and the second handling device; and

the second handling device is configured to transport the first handling device from the bottom floor of the departure warehouse to the bottom floor of the destination warehouse according to the dispatching instruction.

11. The system according to claim 1, wherein an unpowered or powered carrier is arranged

in the lifting device, and the higher-floor docking point is provided with at least the carrier located in the lifting device; and

the first handling device is further configured to travel to the carrier, and place the vehicle on the carrier, or take out the vehicle from the carrier.

12. The system according to claim 11, wherein an unpowered or powered carrier is arranged outside the lifting device, the higher-floor docking point is further provided with at least the carrier located outside the lifting device, and in a case that the lifting device is located at a higher floor, the carrier located outside the lifting device is docked with the carrier located in the lifting device, so that the vehicle is transported from the carrier located in the lifting device to the carrier located outside the lifting device, or the vehicle is transported from the carrier located outside the lifting device to the carrier located in the lifting device.

13. The system according to claim 11 or 12, wherein the unpowered carrier at least comprises a vehicle support configured for placing the vehicle, and the powered carrier at least comprises a conveyor and/or a two-way telescopic fork.

14. The system according to claim 1, wherein a height of the vehicle support in the at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse is higher than a height of the second handling device not carrying the vehicle; and the second handling device is further configured to, when not carrying the vehicle, selectively travel below the at least some bottom-floor storage spaces, or transport the vehicle from below the at least some bottom-floor storage spaces in a piggyback manner and leave the bottom-floor storage spaces.

15. The system according to claim 14, wherein an interval between uprights in at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse is greater than a width of the second handling device, and a height of a lowest point of a connector between two adjacent uprights of at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse is higher than the height of the second handling device not carrying the vehicle; and the second handling device is further configured to, when not carrying the vehicle, selectively travel between the two adjacent uprights of the at least some bottom-floor storage spaces of the bottom floor.

16. The system according to claim 1, wherein the second handling device is configured to, at an aisle position adjacent to the bottom-floor storage space, take out the vehicle from a side of the bottom-floor storage space to the second handling device, or place the vehicle from the second handling device into the bottom-floor storage space from the side of the bottom-floor storage space.

17. The system according to claim 1, wherein the second handling device is configured to, at an aisle position adjacent to the bottom-floor storage space, enter to below the bottom-floor storage space, and take out the vehicle from below the bottom-floor storage space to the second handling device, or place the vehicle indicated in the handling instruction from the second handling device into the bottom-floor storage space.

18. The system according to claim 1, wherein a specified area of the bottom floor of the three-dimensional warehouse is provided with at least one bottom-floor docking point; and

the second handling device is configured to take the vehicle out of the bottom-floor storage space or the lifting device, transport the vehicle to the bottom-floor docking point, and place the vehicle in the specified area; or take out the vehicle from the bottom-floor docking point in the specified area, and transport the vehicle to the bottom-floor storage space or the lifting device.

19. The system according to claim 18, wherein a powered carrier is arranged in the lifting device, the bottom floor of the three-dimensional warehouse is provided with a powered carrier, and in a case that the lifting device is located at the bottom floor, the carrier of the bottom floor is docked with the carrier located in the lifting device, so as to transport the vehicle from the carrier in the lifting device to the carrier of the bottom floor, or transport the vehicle from the carrier of the bottom floor to the carrier in the lifting device; and

the second handling device is further configured to take out the vehicle from the carrier of the bottom floor, transport the vehicle to the bottom-floor docking point, and place the vehicle in the specified area; or take out the vehicle from the bottom-floor docking point in the specified area, and transport the vehicle to the carrier of the bottom floor.

20. The system according to claim 1, further comprising one or more external temporary storage areas, wherein the external temporary storage area is in a form of at least one of three-dimensional storage or planar storage;

the external temporary storage area and the at least one three-dimensional warehouse share at least some of the second handling devices, or the second handling device transports and/or is docked with the vehicle between the external temporary storage area and the at least one three-dimensional warehouse; and

the control center is further configured to store inventory information of items in the external temporary storage area and the at least one three-dimensional warehouse.

21. A dispatching method for item picking of at least one three-dimensional warehouse, wherein floors of the three-dimensional warehouse are communicated by at least one lifting device, a bottom floor of the three-dimensional warehouse is provided with at least one bottom-

floor docking point, at least some bottom-floor storage spaces of the bottom floor are provided with a vehicle and a vehicle support, the vehicle support in the bottom-floor storage space is configured for placing a vehicle transported by a second handling device, higher floors other than the bottom floor of the three-dimensional warehouse are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for a first handling device to run thereon, and at least some higher-floor storage spaces of the higher floors are provided with a vehicle, and the method comprises:

- determining a to-be-performed handling task;

- determining, according to the handling task, a first handling device, a second handling device and a lifting device for performing the handling task; and

- sending a handling instruction to the determined first handling device, second handling device and lifting device separately, so that the first handling device, the second handling device and the lifting device cooperate to transport a vehicle from the higher-floor storage space or the bottom-floor storage space of the three-dimensional warehouse to the bottom-floor docking point, or transport a vehicle from the bottom-floor docking point to the higher-floor storage space or the bottom-floor storage space of the three-dimensional warehouse.

22. The method according to claim 21, wherein the sending the handling instruction to the determined first handling device comprises:

- determining, according to the handling task, a higher-floor storage space corresponding to the handling task; and

- sending the handling instruction to the determined first handling device according to a position of the higher-floor storage space and an aisle position adjacent to the higher-floor storage space, so that the first handling device, at the aisle position, takes out a vehicle indicated in the handling instruction from a side of the higher-floor storage space to the first handling device, or places the vehicle indicated in the handling instruction from the first handling device into the higher-floor storage space from the side of the higher-floor storage space, according to the handling instruction.

23. The method according to claim 21, wherein the sending the handling instruction to the determined first handling device comprises:

- determining, according to the handling task, a higher-floor storage space corresponding to the handling task; and

- sending the handling instruction to the determined first handling device according to a position of the higher-floor storage space and a position of another storage space above the higher-floor storage space, so that the first handling device, according to the handling

instruction, takes out a vehicle indicated in the handling instruction from the position of the another higher-floor storage space above the higher-floor storage space to the first handling device, or lowers the vehicle indicated in the handling instruction from the first handling device to the higher-floor storage space.

24. The method according to claim 21, wherein a rail is arranged in the lifting device, and is configured to connect with the rail arranged in the higher floor, to enable the first handling device to travel into the lifting device.

25. The method according to claim 24, further comprising:

determining, at least in part according to a to-be-performed handling task of each of the higher floors, a quantity of first handling devices required by the each of the higher floors;

determining, according to the quantity of first handling devices required by the each of the higher floors and a current quantity of first handling devices of the each of the higher floors, first handling devices that need to be dispatched by the each of the higher floors; and

sending a dispatching instruction to the determined first handling devices that need to be dispatched, so that the first handling devices travel into the lifting device according to the received dispatching instruction, and reach a higher floor specified in the dispatching instruction through the lifting device.

26. The method according to claim 24, wherein the higher-floor docking point is arranged in the lifting device; and

the sending the handling instruction to the determined first handling device comprises:

determining, according to the handling task, a higher-floor docking point in the lifting device corresponding to the handling task; and

sending the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device, so that the first handling device travels to the higher-floor docking point in the lifting device, and places a vehicle at the higher-floor docking point, or takes out a vehicle from the position of the higher-floor docking point.

27. The method according to claim 25, wherein the higher floors of the three-dimensional warehouse comprise a higher floor where not all areas are connected by the rail, and the method further comprises:

for the higher floor where not all areas are communicated by the rail, determining to dispatch the first handling device between different areas of the higher floor;

determining an area from which the first handling device is to be dispatched as a departure area, and determining an area into which the first handling device is to be dispatched as a destination area, and determining another higher floor which is closest to the higher floor and

in which all areas are communicated by the rail as a transit floor; and

sending a dispatching instruction to the first handling device in the departure area, sending a handling instruction to a lifting device communicating the transit floor and the departure area, and sending a handling instruction to a lifting device communicating the transit floor and the destination area, so that the first handling device reaches the destination area from the departure area through the two lifting devices and the transit floor.

28. The method according to claim 25, wherein there are at least two three-dimensional warehouses, bottom surfaces of the three-dimensional warehouses are in communication with each other, and the method further comprises:

determining to dispatch the first handling device between different three-dimensional warehouses;

determining a three-dimensional warehouse from which the first handling device is to be dispatched as a departure warehouse, and determining a three-dimensional warehouse into which the first handling device is to be dispatched as a destination warehouse; and

sending a dispatching instruction to the first handling device in the departure warehouse, and sending a handling instruction to a second handling device, a lifting device of the departure warehouse, and a lifting device of the destination warehouse, so that the first handling device is dispatched from the departure warehouse to the destination warehouse through the two lifting devices and the second handling device.

29. The method according to claim 21, wherein an unpowered or powered carrier is arranged in the lifting device, and the higher-floor docking point is provided with at least the carrier located in the lifting device; and

the sending the handling instruction to the determined first handling device comprises:

determining, according to the handling task, a higher-floor docking point in the lifting device corresponding to the handling task; and

sending the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device, so that the first handling device travels to the carrier that is used as the higher-floor docking point in the lifting device, and places a vehicle on the carrier, or takes out a vehicle from the carrier that is used as the higher-floor docking point.

30. The method according to claim 29, wherein an unpowered or powered carrier is arranged outside the lifting device, and the higher-floor docking point is further provided with at least the carrier located outside the lifting device; and

the sending the handling instruction to the determined lifting device comprises:

determining, according to the handling task, a higher-floor docking point corresponding to the handling task; and

sending the handling instruction to the lifting device according to a floor at which the higher-floor docking point is located, so that the lifting device moves to the floor at which the higher-floor docking point is arranged, the carrier located in the lifting device is docked with the carrier located outside the lifting device, and the vehicle is transported from the carrier located in the lifting device to the carrier that is located outside the lifting device and used as the higher-floor docking point, or the vehicle on the carrier that is located outside the lifting device and used as the higher-floor docking point is transported to the carrier in the lifting device.

31. The method according to claim 21, wherein the sending the handling instruction to the determined second handling device comprises:

determining, according to the handling task, a bottom-floor storage space corresponding to the handling task; and

sending the handling instruction to the second handling device according to a position of the bottom-floor storage space and an aisle position adjacent to the bottom-floor storage space, so that the second handling device, at the aisle position adjacent to the bottom-floor storage space, takes out a vehicle indicated in the handling instruction from a side of the bottom-floor storage space to the second handling device, or places the vehicle indicated in the handling instruction from the second handling device into the bottom-floor storage space from the side of the bottom-floor storage space.

32. The method according to claim 21, wherein the sending the handling instruction to the determined second handling device comprises:

determining, according to the handling task, a bottom-floor storage space corresponding to the handling task; and

sending the handling instruction to the second handling device according to a position of the bottom-floor storage space, so that the second handling device, at an aisle position adjacent to the bottom-floor storage space, enters to below the bottom-floor storage space, and takes out a vehicle indicated in the handling instruction from below the bottom-floor storage space to the second handling device, or places the vehicle indicated in the handling instruction from the second handling device into the bottom-floor storage space.

33. The method according to claim 21, wherein a specified area of the bottom floor of the three-dimensional warehouse is provided with at least one bottom-floor docking point; and

the sending the handling instruction to the determined second handling device comprises:

determining, according to the handling task, a bottom-floor docking point arranged in the specified area corresponding to the handling task; and

sending the handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area, so that the second handling device takes a vehicle indicated in the handling instruction out of the bottom-floor storage space or the lifting device, transports the vehicle to the bottom-floor docking point, and places the vehicle in the specified area; or takes out the vehicle indicated in the handling instruction from the bottom-floor docking point in the specified area, and transports the vehicle to the bottom-floor storage space or the lifting device.

34. The method according to claim 33, wherein a powered carrier is arranged in the lifting device, and a bottom floor of the three-dimensional warehouse is provided with a powered carrier;

the sending the handling instruction to the determined lifting device comprises:

determining, according to the handling task, a bottom-floor docking point corresponding to the handling task; and

sending the handling instruction to the lifting device to instruct the lifting device to move to the bottom floor, so that the lifting device moves to the bottom floor, and the carrier on the bottom floor is docked with the carrier located in the lifting device, to transport the vehicle from the carrier in the lifting device to the carrier on the bottom floor, or transport the vehicle from the carrier on the bottom floor to the carrier in the lifting device.

35. The method according to claim 34, wherein the sending the handling instruction to the determined second handling device comprises:

determining, according to the handling task, a bottom-floor docking point arranged in the specified area corresponding to the handling task; and

sending the handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area, so that the second handling device takes out the vehicle from the carrier on the bottom floor, transports the vehicle to the bottom-floor docking point, and places the vehicle in the specified area; or takes out the vehicle indicated in the handling instruction from the bottom-floor docking point in the specified area, and transports the vehicle to the carrier on the bottom floor.

36. The method according to claim 21, further comprising: arranging one or more external temporary storage areas outside the three-dimensional warehouse, wherein the external temporary storage area is in a form of three-dimensional storage or planar storage; the external temporary storage area and the three-dimensional warehouse share at least some of the second

handling devices, or the second handling device transport and/or is docked with the vehicle between the external temporary storage area and the at least one three-dimensional warehouse; and

the determining the to-be-performed handling task comprises:

determining the to-be-performed handling task according to stored inventory information of items in the external temporary storage area and the three-dimensional warehouse and order information.