

PALLET TRANSFER MECHANISM AND PALLET TRANSFER SYSTEM

BACKGROUND OF THE DISCLOSURE

5 1. Field of the Disclosure:

The present disclosure relates to transfer mechanism and systems, and more particularly, to a pallet transfer mechanism and pallet transfer system.

10 2. Description of the Related Art:

Conventionally, the most common method for accessing pallets in an automated storage and retrieval system is to connect the loading and unloading port of a stacker crane to a conveyor belt. In such approach, to meet the requirements
15 for the stacker crane to receive and deliver pallets, the number of conveyor belts installed therein is usually twice the number of stacker cranes. Also, based on the practical requirements for access efficiency, additional conveyor belts are allowed to be added and connected with the input
20 and output ports of pallets. Such method requires the user

to invest heavily in large-scale equipment during the initial stage. Further, after the completion of plans and construction of all conveyor lines, the overall structure is difficult to relocate or expand, thereby reducing the flexibility in adjustments of warehouse space and operational efficiency in the future.

SUMMARY OF THE DISCLOSURE

The present disclosure aims at resolving the issues of excessively high construction costs for transportation mechanisms and the lack of flexibility in overall spatial arrangement in conventional automated storage and retrieval systems.

For achieving the aforementioned objectives, the present disclosure provides a pallet transfer mechanism for placing a pallet and allowing different transportation devices to hand over the pallet, the pallet transfer mechanism comprises:

a placement device having a plurality of brackets arranged in a circular manner at intervals to form a handover

space, each of the brackets having a support member and a placement member, the placement member disposed on a top end of the support member and configured to place the pallet;

an obstacle sensor disposed on the support member of one of the brackets, the obstacle sensor emitting an obstacle sensing beam in a diagonal direction across the handover space toward another one of the diagonally disposed brackets, the obstacle sensing beam being used to determine whether there is an object within the handover space, and the obstacle sensor accordingly sending an obstacle-existing signal or a no-obstacle signal; and

a pallet sensor disposed on the placement member of one of the brackets, the pallet sensor emitting a pallet sensing beam in a horizontal direction toward another one of the adjacent brackets, the pallet sensing beam being used to determine whether the pallet is placed on the placement member, and the pallet sensor accordingly sending a pallet-existing signal or a no-pallet signal.

Also, the present disclosure provides a pallet transfer system for different transportation devices to hand over the

pallet, the transportation device comprising an automated guided vehicle and a stacker crane, the pallet transfer system comprising:

a pallet transfer mechanism disposed at an inbound
5 position or an outbound position, the pallet transfer mechanism comprising:

a placement device having a plurality of brackets arranged in a circular manner at intervals to form a handover space, the brackets being used to place the pallet thereon,
10 each of the brackets having a support member and a placement member, the placement member disposed on a top end of the support member and configured to place the pallet thereon;

an obstacle sensor disposed on one of the brackets,
15 the obstacle sensor emitting an obstacle sensing beam in a diagonal direction across the handover space toward another one of the diagonally disposed brackets, the obstacle sensing beam being used to determine whether there is an object within the handover space, and the obstacle sensor
20 accordingly sending an obstacle-existing signal or a no-

obstacle signal; and

a pallet sensor disposed on one of the brackets, the pallet sensor emitting a pallet sensing beam in a horizontal direction toward another one of the adjacent brackets, the
5 pallet sensing beam being used to determine whether the pallet is placed on the placement member, and the pallet sensor accordingly sending a pallet-existing signal or a no-pallet signal;

a control module coupled with the obstacle sensor and
10 the pallet sensor; when the control module is used to control the pallet transfer mechanism at the inbound position, if the control module receives the no-obstacle signal and the no-pallet signal, the control module outputs an automated guided vehicle inbound pallet placement signal; if the
15 control module receives the no-obstacle signal and the pallet-existing signal, the control module outputs a stacker crane inbound pallet pickup signal; when the control module is used to control the pallet transfer mechanism at the outbound position, if the control module receives the no-
20 obstacle signal and the no-pallet signal, the control module

outputs a stacker crane outbound pallet placement signal; if the control module receives the no-obstacle signal and the pallet-existing signal, the control module outputs an automated guided vehicle outbound pallet pickup signal;

5 and

an execution module coupled with the obstacle sensor, the pallet sensor, and the control module, the execution module configured to receive the automated guided vehicle inbound pallet placement signal, the automated guided vehicle outbound pallet pickup signal, the stacker crane inbound pallet pickup signal, and the stacker crane outbound pallet placement signal, and accordingly control operation of the automated guided vehicle and the stacker crane.

With such configuration, the pallet transfer mechanism of the present disclosure does not have a physical connection with the aforementioned transportation devices, allowing for positional adjustments according to practical needs and the available space of the automated storage and retrieval system, providing greater flexibility in warehouse space adjustment and utilization, thereby improving the

overall efficiency of cargo transportation.

Furthermore, the modules of the pallet transfer system in the present disclosure work in a stable and precise collaboration to control the movement and operation of various transportation devices, ensuring a higher level of transportation and transfer accuracy of the pallet.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the pallet transfer mechanism in accordance with an embodiment of the present disclosure.

Fig. 2 is a schematic view of the operation status of the pallet transfer mechanism in accordance with an embodiment of the present disclosure, illustrating the path of the sensing beam.

Fig. 3 is a schematic view of the operation status of the pallet transfer mechanism in accordance with an embodiment of the present disclosure, illustrating the position of the positioning point.

Fig. 4 is a perspective view of the pallet transfer

mechanism in accordance with another embodiment of the present disclosure.

Fig. 5 is a schematic view of the operation status of the pallet transfer mechanism in accordance with another embodiment of the present disclosure.

Fig. 6 is a schematic view of the connection relationship of the pallet transfer system in accordance with an embodiment of the present disclosure.

10 **DETAILED DESCRIPTION OF THE DISCLOSURE**

The aforementioned and further advantages and features of the present disclosure will be understood by reference to the description of the preferred embodiment in conjunction with the accompanying drawings where the components are illustrated based on a proportion for explanation but not subject to the actual component proportion.

Referring to **Fig. 1** to **Fig. 6**, the present disclosure provides a pallet transfer mechanism **100** for placing a pallet **1** thereon and allowing different transportation devices to hand over the pallet **1**. The pallet transfer mechanism **100**

comprises a placement device **10**, an obstacle sensor **20**, and
a pallet sensor **30**. Therein, the transportation devices
include an automated guided vehicle (AGV), a stacker crane
(machine for transporting cargos in an automated storage
5 and retrieval system(ASRS)), and a forklift. The pallet
transfer mechanism **100** is allowed to be disposed at an
inbound position or an outbound position of the storage
space of the ASRS for the automated guided vehicle and the
stacker crane to hand over the pallet **1** (for the inbound
10 operation which puts the pallet **1** into the ASRS or for the
outbound operation which takes out the pallet **1** from the
ASRS) or disposed at a shipping position out of the storage
space of the ASRS for the automated guided vehicle and the
stacker crane to hand over the pallet **1** (for the shipping
15 operation which transports the pallet **1** to a target location
out of the ASRS).

The placement device **10** comprises a plurality of
brackets **11** arranged in a circular manner at intervals to
form a handover space **12**. Each of the brackets **11** has a
20 support member **111** and a placement member **112**. The

placement member **112** disposed on a top end of the support member **111** and configured to place the pallet **1** thereon. Therein, in the embodiment, four brackets **11** are included and disposed in a square shape arrangement, so that the four
5 brackets **11** are able to support the four corners of the pallet **1**, stabilizing the placement of the pallet **1**.

Referring to **Fig. 1** and **Fig. 2**, in the embodiment, the placement device **10** comprises a plurality of guidance members **13** and a block member **14**. Each guidance member
10 **13** is vertically disposed on each corresponding placement member **112**. The guidance members **13** are used to restrict the pallet **1** at a handover position **P**. The block member **14** is vertically disposed on one side of the periphery of the placement member **112**, so as to restrict the pallet **1** at the
15 handover position **P**. Therefore, the guidance members **13** and the block member **14** enable the pallet **1** to be stably placed at the handover position **P**, facilitating the transportation performance of the pallet **1** by the transportation devices.

20 The obstacle sensor **20** is disposed on the support

member **111** of one of the brackets **11**. The obstacle sensor emits an obstacle sensing beam **L1** in a diagonal direction across the handover space **12** toward another one of the diagonally disposed brackets **11**. The obstacle sensing beam

5 **L1** is used to determine whether there is an object within the handover space **12**, and the obstacle sensor **20** accordingly sends an obstacle-existing signal or a no-obstacle signal. Therein, if the obstacle sensing beam **L1** detects an object in the handover space **12** (i.e., the light

10 beam is blocked by the object and unable to reach the other bracket **11**), the obstacle sensor **20** sends the obstacle-existing signal; if no object is detected, the obstacle sensor **20** sends the no-obstacle signal.

Referring to **Fig. 1** and **Fig. 2**, in the embodiment, two

15 obstacle sensors **20** are included and disposed on the support member **111** of two adjacent brackets **11**. The two obstacle sensing light beams **L1** are emitted in a crossed pattern, so that when one of the obstacle sensing light beams **L1** detects an object in the handover space **12**, the corresponding

20 obstacle sensor **20** sends the obstacle-existing signal.

Through the crossed emission of the obstacle sensing light beams **L1**, the presence of an object in the handover space **12** is detected more accurately.

The pallet sensor **30** is disposed on the placement member **112** of one of the brackets **11**. The pallet sensor **30** emits a pallet sensing beam **L2** in a horizontal direction toward another one of the adjacent brackets **11**. The pallet sensing beam **L2** is used to determine whether the pallet **1** is placed on the placement member **112**, and the pallet sensor **30** accordingly sends a pallet-existing signal or a no-pallet signal. Therein, if the pallet sensing beam **L2** detects the pallet **1** on the placement member **112** (i.e., the light beam is blocked by a corner pillar of the pallet **1** on the placement member **112**), the pallet sensor **30** sends the pallet-existing signal; if no pallet **1** is detected, the pallet sensor **30** sends the no-pallet signal.

Referring to **Fig. 4** and **Fig. 5**, in another embodiment, the pallet transfer mechanism **100** comprises a barcode reader **40** vertically disposed on one side of the periphery of the placement member **112**. The barcode reader **40** is used

to read a barcode **1a** on the pallet **1**, such that the barcode reader **40** senses the barcode **1a** to confirm if the cargo information on the pallet **1** is correct, ensuring that the transfer process of the pallet **1** is smoother and reducing the possibility of errors during the transfer operation.

Referring to **Fig. 4** and **Fig. 5**, in another embodiment, the pallet transfer mechanism **100** comprises a forklift sensor **50** disposed on the bottom face of the placement member **112**. The forklift sensor **50** detects if there is a forklift on one side of the placement device **10** along the horizontal direction, and accordingly sends a forklift-existing signal or a no-forklift signal. Therein, if the forklift sensor **50** detects the forklift, the forklift sensor **50** sends the forklift-existing signal; if no forklift is detected, the forklift sensor **50** sends the no-forklift signal. Since the forklift is typically used for the shipping process of the pallet **1**, the forklift sensor **50** is usually disposed on the pallet transfer mechanism **100** at the shipping position.

Referring to **Fig. 6**, in the embodiment, the present disclosure provides a pallet transfer system **200**, which

controls the operation of the aforementioned transportation devices based on the sensing conditions of the pallet transfer mechanism **100**. The pallet transfer system **200** comprises the pallet transfer mechanism **100**, a control
5 module **210**, and an execution module **220**.

The control module **210** is coupled with the obstacle sensor **20** and the pallet sensor **30**. When the control module **210** is used to control the pallet transfer mechanism **100** at the inbound position, if the control module **210** receives the
10 no-obstacle signal and the no-pallet signal, the control module **210** outputs an automated guided vehicle inbound pallet placement signal; if the control module **210** receives the no-obstacle signal and the pallet-existing signal, the control module **210** outputs a stacker crane inbound pallet
15 pickup signal. When the control module **210** is used to control the pallet transfer mechanism **100** at the outbound position, if the control module **210** receives the no-obstacle signal and the no-pallet signal, the control module **210** outputs a stacker crane outbound pallet placement signal; if
20 the control module **210** receives the no-obstacle signal and

the pallet-existing signal, the control module **210** outputs an automated guided vehicle outbound pallet pickup signal.

The execution module **220** is coupled with the obstacle sensor **20**, the pallet sensor **30**, and the control module **210**.

5 The execution module **220** is configured to receive the automated guided vehicle inbound pallet placement signal, the automated guided vehicle outbound pallet pickup signal, the stacker crane inbound pallet pickup signal, and the stacker crane outbound pallet placement signal, and
10 accordingly control operation of the automated guided vehicle and the stacker crane. With such configuration, the control module **210** and the execution module **220**, based on the signal sent by the obstacle sensor **20** and the pallet sensor **30**, confirms if the automated guided vehicle and the
15 stacker crane are allowed to enter the pallet transfer mechanism **100** for placing or picking up the pallet **1**, and accordingly controls the operation of the automated guided vehicle and the stacker crane.

More specifically, taking the pallet transfer mechanism
20 **100** disposed at the inbound position as an example, if the

control module **210** receives the aforementioned no-obstacle signal and the no-pallet signal, the control module **210** outputs the automated guided vehicle inbound pallet placement signal to the execution module **220**, and the
5 execution module **220** controls the automated guided vehicle to place the pallet **1** at the handover position **P**. When the automated guided vehicle finishes the placement of the pallet **1** and leaves the handover space **12** (The obstacle sensor **20** first changes from sending the no-obstacle signal
10 to sending the obstacle-existing signal, and then changes from sending the obstacle-existing signal back to sending the no-obstacle signal, while the pallet sensor **30** changes from sending the no-pallet signal to sending the pallet-existing signal), the control module **210** receives the no-
15 obstacle signal and the pallet-existing signal, and accordingly outputs the stacker crane inbound pallet pickup signal to the execution module **220**, such that the execution module **220** controls the stacker crane to take the pallet **1** at the handover position **P** and place the pallet **1** at the vacancy
20 in the ASRS.

Referring to **Fig. 6**, in the embodiment, the control module **210** stores an abnormal warning time. If the duration of the obstacle-existing signal or pallet-existing signal remains for a time longer than the abnormal warning time,
5 the control module **210** sends an abnormal signal to notify the user for troubleshooting.

Referring to **Fig. 3** and **Fig. 6**, in the embodiment, the pallet transfer system **200** comprises a positioning point **230**, which is arranged on one side of the placement device **10**
10 and within the handover space **12**. The positioning point **230** is used for the automated guide vehicle to perform a positioning operation, allowing the automated guide vehicle to move to the correct position. Therein, when the automated guide vehicle is positioned at the positioning
15 point **230** on the side of the placement device **10**, the automated guide vehicle sends an inquiry signal to the control module **210** to reconfirm whether there is still an obstacle or pallet **1** in the handover space **12**, so as to further ensure the transportation and transfer accuracy of the pallet
20 **1**, thereby improving the overall pallet transportation

efficiency.

Referring to **Fig. 4** to **Fig. 6**, in another embodiment of the present disclosure, when the control module **210** is used to control the pallet transfer mechanism **100** at the shipping position, if the control module **210** receives the no-obstacle signal and the no-pallet signal, the control module **210** outputs an automated guided vehicle warehouse exit pallet placement signal; if the control module **210** receives the no-obstacle signal and the pallet-existing signal, the control module **210** outputs a forklift warehouse exit pallet pickup signal. The execution module **220** receives the automated guided vehicle warehouse exit pallet placement signal and the forklift warehouse exit pallet pickup signal, and accordingly controls the operation of the automated guided vehicle and the forklift. With such configuration, when the pallet transfer mechanism **100** is used for shipping goods, the pallet transfer system **200** is able to control the operation of the automated guided vehicle and the forklift based on the aforementioned conditions, ensuring the transportation and transfer accuracy of the pallet **1**.

Furthermore, the control module **210** is coupled with the forklift sensor **50**. When the automated guided vehicle is about to enter the handover space **12**, if, upon the no-obstacle signal and the no-pallet, the control module **210**
5 simultaneously receives the no-forklift signal, the control module **210** outputs the automated guided vehicle warehouse exit pallet placement signal, such that the automated guided vehicle enters the handover space **12**. If the control module **210** receives the forklift-existing signal, and the duration of
10 it exceeds the aforementioned abnormal warning time, the control module **210** sends the abnormal signal to notify the user for troubleshooting.

Referring to **Fig. 4** to **Fig. 6**, in another embodiment, the pallet transfer system **200** comprises a display device
15 **240** coupled with the control module **210** and the execution module **220**. The display device **240** is configured to display a pallet information of the pallet **1**. Therein, the pallet information is allowed to include the cargo information identified by the barcode reader **40**, and the information of
20 whether the pallet **1** is positioned at the handover position

P.

With the foregoing configuration, advantages of the present disclosure will be illustrated below.

The pallet transfer mechanism **100** of the present
5 disclosure does not have a physical connection with the
aforementioned transportation devices, allowing for
positional adjustments according to practical needs and the
available space of the automated storage and retrieval
system, providing greater flexibility in warehouse space
10 adjustment and utilization, thereby improving the overall
efficiency of cargo transportation.

Each sensors of the pallet transfer mechanism **100** is
able to accurately monitor the moving status and the
placement status of the object in the mechanism, so that the
15 present disclosure further ensures the transportation and
transfer accuracy of the pallet **1**.

Furthermore, the modules and devices of the pallet
transfer system **200** in the present disclosure work in a
stable and precise collaboration to control the movement
20 and operation of various transportation devices, ensuring a

transportation and transfer accuracy of the pallet 1.

Although particular embodiments of the disclosure have
been described in detail for purposes of illustration, various
modifications and enhancements may be made without
5 departing from the scope of the disclosure. Accordingly, the
disclosure is not to be limited except as by the appended
claims.

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What is claimed is:

1. A pallet transfer mechanism for placing a pallet thereon and allowing different transportation devices to hand over the pallet 1, the pallet transfer mechanism
5 comprises:

a placement device having a plurality of brackets arranged in a circular manner at intervals to form a handover space, each of the brackets having a support member and a placement member, the placement member disposed on a top
10 end of the support member and configured to place the pallet thereon;

an obstacle sensor disposed on the support member of one of the brackets, the obstacle sensor emitting an obstacle sensing beam in a diagonal direction across the handover
15 space toward another one of the diagonally disposed brackets, the obstacle sensing beam being used to determine whether there is an object within the handover space, and the obstacle sensor accordingly sending an obstacle-existing signal or a no-obstacle signal; and

20 a pallet sensor disposed on the placement member of

one of the brackets, the pallet sensor emitting a pallet sensing beam in a horizontal direction toward another one of the adjacent brackets, the pallet sensing beam being used to determine whether the pallet is placed on the placement member, and the pallet sensor accordingly sending a pallet-existing signal or a no-pallet signal.

2. The pallet transfer mechanism of claim 1, wherein the placement device comprises a plurality of guidance members and a block member; each of the guidance members is vertically disposed on the corresponding placement member; the guidance members are used to restrict the pallet at a handover position; the block member is vertically disposed on one side of a periphery of the placement member, so as to restrict the pallet at the handover position.

3. The pallet transfer mechanism of claim 1, wherein two obstacle sensors are included and disposed on the support member of two of the adjacent brackets; the two obstacle sensing light beams are emitted in a crossed pattern.

4. The pallet transfer mechanism of claim 1, wherein the pallet transfer mechanism comprises a barcode reader

and a forklift sensor; the barcode reader is vertically disposed on one side of a periphery of the placement member, and configured to read a barcode of the pallet; the transportation devices include a forklift, and the forklift
5 sensor is disposed on a bottom face of the placement member; the forklift sensor is configured to detect if there is a forklift on one side of the placement device along a horizontal direction, and accordingly send a forklift-existing signal or a no-forklift signal.

10 5. A pallet transfer system for different transportation devices to hand over a pallet, the transportation device comprising an automated guided vehicle and a stacker crane, the pallet transfer system comprising:

 a pallet transfer mechanism disposed at an inbound
15 position or an outbound position, the pallet transfer mechanism comprising:

 a placement device having a plurality of brackets arranged in a circular manner at intervals to form a handover space, the brackets being used to place the pallet thereon,
20 each of the brackets having a support member and a

placement member, the placement member disposed on a top end of the support member and configured to place the pallet thereon;

an obstacle sensor disposed on one of the brackets, the
5 obstacle sensor emitting an obstacle sensing beam in a diagonal direction across the handover space toward another one of the diagonally disposed brackets, the obstacle sensing beam being used to determine whether there is an object within the handover space, and the obstacle sensor
10 accordingly sending an obstacle-existing signal or a no-obstacle signal; and

a pallet sensor disposed on one of the brackets, the pallet sensor emitting a pallet sensing beam in a horizontal direction toward another one of the adjacent brackets, the
15 pallet sensing beam being used to determine whether the pallet is placed on the placement member, and the pallet sensor accordingly sending a pallet-existing signal or a no-pallet signal;

a control module coupled with the obstacle sensor and
20 the pallet sensor; when the control module is used to control

the pallet transfer mechanism at the inbound position, if the control module receives the no-obstacle signal and the no-pallet signal, the control module outputs an automated guided vehicle inbound pallet placement signal; if the control module receives the no-obstacle signal and the pallet-existing signal, the control module outputs a stacker crane inbound pallet pickup signal; when the control module is used to control the pallet transfer mechanism at the outbound position, if the control module receives the no-obstacle signal and the no-pallet signal, the control module outputs a stacker crane outbound pallet placement signal; if the control module receives the no-obstacle signal and the pallet-existing signal, the control module outputs an automated guided vehicle outbound pallet pickup signal; and

an execution module coupled with the obstacle sensor, the pallet sensor, and the control module, the execution module configured to receive the automated guided vehicle inbound pallet placement signal, the automated guided vehicle outbound pallet pickup signal, the stacker crane

inbound pallet pickup signal, and the stacker crane outbound pallet placement signal, and accordingly control operation of the automated guided vehicle and the stacker crane.

6. The pallet transfer system of claim 5, wherein the
5 placement device comprises a plurality of guidance members and a block member; each of the guidance members is vertically disposed on the corresponding placement member; the guidance members are used to restrict the pallet at a handover position; the block member is vertically
10 disposed on one side of a periphery of the placement member, so as to restrict the pallet at the handover position.

7. The pallet transfer system of claim 5, wherein two obstacle sensors are included and disposed on the support member of two of the adjacent brackets; the two obstacle
15 sensing light beams are emitted in a crossed pattern.

8. The pallet transfer system of claim 5, wherein the control module stores an abnormal warning time; if a duration of the obstacle-existing signal or the pallet-existing signal remains for a time longer than the abnormal
20 warning time, the control module sends an abnormal signal.

9. The pallet transfer system of claim 5, wherein the transportation devices comprises a forklift, and the pallet transfer mechanism is allowed to be disposed at a shipping position; when the control module is used to control the pallet transfer mechanism at the shipping position, if the control module receives the no-obstacle signal and the no-pallet signal, the control module outputs an automated guided vehicle warehouse exit pallet placement signal; if the control module receives the no-obstacle signal and the pallet-existing signal, the control module outputs a forklift warehouse exit pallet pickup signal; the execution module receives the automated guided vehicle warehouse exit pallet placement signal and the forklift warehouse exit pallet pickup signal, and accordingly controls the operation of the automated guided vehicle and an operation of the forklift.

10. The pallet transfer system of claim 9, wherein the pallet transfer mechanism comprises a barcode reader and a forklift sensor; the barcode reader is vertically disposed on one side of a periphery of the placement member; the barcode reader is configured to read a barcode

of the pallet; the forklift sensor is disposed on a bottom face
of the placement member; the forklift sensor is configured
to detect if there is a forklift on one side of the placement
device along a horizontal direction, and accordingly send a
5 forklift-existing signal or a no-forklift signal; the pallet
transfer system comprises a display device coupled with the
control module and the execution module; the display device
is configured to display a pallet information of the pallet.

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