Material Handling Apparatus having Input/Output Station and Method of Use

Related Applications

[001] This application claims priority to U.S. Provisional Patent Application No. 63/410,211 filed on September 26, 2022. The entire disclosure of the foregoing application is hereby incorporated herein by reference.

Field of the Invention

[002] The present invention relates to a material handling system for storing or retrieving items. More specifically, the present invention relates to a material handling system incorporating a plurality of destination areas and a plurality of vehicles for carrying items to and/or from the destination areas and to and/or from one or more workstations.

Background of the Invention

[003] Storing and retrieving items to fill a customer order can be laborious and time consuming, especially in a system that stores thousands of items. Storing and retrieving items from thousands of storage areas requires significant labor to perform manually. In many fields, automated picking has developed to reduce labor cost and improve customer service by reducing the time it takes to fill a customer order. However, the known systems of automatically handling the materials are either very expensive or have limitations that hamper their effectiveness. Accordingly, there is a need in a variety of material handling applications for automatically storing and/or retrieving items.

Summary

[004] The present invention provides a number of inventive aspects that relate to material handling and/or storage and retrieval processes.

[004a] According to an aspect, the present disclosure refers to a material handling system, comprising:

a plurality of storage locations vertically spaced apart from one another;

a track positioned adjacent the storage locations;

a plurality of containers positioned in the storage locations;

a plurality of vehicles configured to convey the containers, wherein each vehicle is operable to retrieve one of the plurality of containers from one of the storage locations or to store one of the plurality of container into one of the storage locations, wherein each vehicle comprises:

a drive system configured to drive the vehicle along the track to a first of the storage locations to position the vehicle to retrieve a first of the containers from the first storage location; and

a power source for providing power to the drive system;

a first horizontal conveyor configured to receive the containers and convey the containers along a first horizontal path to a workstation where an operator can retrieve one or more items from the containers wherein the first horizontal path is in a first direction;

a transfer station configured to receive containers from the vehicles and convey the containers toward the first horizontal conveyor wherein the transfer station comprises:

a second horizontal conveyor configured to displace the containers along a second horizontal path toward the first horizontal conveyor, wherein the second horizontal path is transverse the first horizontal path; and

a guide configured to guide the vehicles from the horizontal surface to a first transfer location positioned along the second horizontal conveyor, wherein the system is operable to transfer the first container from the first vehicle onto the second horizontal conveyor at the transfer location.

[004b] According to another aspect, the present disclosure refers to a method for storing or retrieving a plurality of containers in a plurality of storage locations in one or more storage racks, comprising the steps of:

controlling a plurality of independently operable vehicles to deliver containers to the storage locations or retrieve containers from the storage locations, wherein the step of controlling comprises the steps of;

driving a first of the vehicles along a horizontal surface toward one of the storage racks;

displacing the first vehicle upwardly from the horizontal surface to one of the storage locations to align the first vehicle with a first of the containers;

driving the first vehicle with the first container along the horizontal surface between the storage rack and a transfer station;

displacing the first vehicle vertically between the horizontal surface and a transfer location at the transfer station;

transferring the first container between the first vehicle and a first conveyor of the transfer station;

controlling the first conveyor to convey the first container away from the transfer location toward a workstation or from the workstation and toward the transfer location;

retrieving one or more items from the first container at the workstation or storing one or more items into the first container at the workstation.

[004c] According to another aspect, the present disclosure refers to a transfer station for material handling system configured to store a plurality of containers comprising:

a plurality of vehicles wherein each vehicle comprises a horizontal drive mechanism for driving the vehicle along a horizontal surface and a vertical drive mechanism for driving each vehicle vertically;

a first conveyor having a loading station wherein the first conveyor is operable in a first direction to displace items away from the loading station;

a first track positioned adjacent the loading station and cooperable with the vertical drive of the delivery vehicles to displace a front edge of the delivery vehicles;

a second track spaced apart from the first track and cooperable with the vertical drive of the delivery vehicles to displace a rear edge of the delivery vehicles.

[005] According to one example, a material handling system is provided, which includes a storage assembly housing a plurality of containers, a plurality of delivery vehicles, a transfer station and a first conveyor for conveying containers away from the transfer station.

[0029] The transfer mechanism may be configured to displace the first container in a direction that is transverse the second horizontal path as the first vehicle displaces the container toward the second horizontal conveyor.

[0030] Optionally, the first horizontal conveyor includes a plurality of vertically spaced apart overlapping conveyors forming multiple conveyor levels.

[0031] Optionally, the second horizontal conveyor comprises a plurality of vertically spaced apart overlapping conveyors. If the first and second conveyors each include a plurality of overlapping conveyor level, then each level of the second conveyor may intersect one of the conveyor levels of the first horizontal conveyor.

[0032] According to yet another example, a method for storing or retrieving a plurality of containers is provided. The method uses a plurality of vehicles that move between storage locations where the containers are stored and a transfer station. The containers are transferred to the transfer station. From the transfer station, the containers are conveyed to a workstation. At the workstation an operator retrieves one or more items from the containers or stores one or more items into the containers.

[0033] Optionally, the method includes the step of controlling the plurality of vehicles by driving a first vehicle along a horizontal surface toward one of the storage racks. The first vehicle is then displaced upwardly from the horizontal surface to one of the storage locations to align the first vehicle with a first container.

[0034] The step of transferring the containers to the transfer station may include the step of driving the first vehicle with the first container along the horizontal surface between the storage rack and a transfer station.

[0035] Optionally, the first vehicle is displaced vertically between the horizontal surface and a transfer location at the transfer station.

[0036] The step of displacing the first vehicle vertically between the horizontal surface and a transfer location may include driving the first vehicle vertically up a guide adjacent the transfer location.

[0037] The step of transferring the first container may include the step of transferring the first container between the first vehicle and a first conveyor of the transfer station.