MATERIAL HANDLING SYSTEM WITH AUTOMATIC RETRIEVAL OF SORTED ITEMS

PRIORITY CLAIM

[0001] This application claims priority under 35 U.S.C. §119 to U.S. Provisional Patent Application No. 63/152,842 filed on February 23, 2021 and U.S. Provisional Patent Application No. 63/208,956 filed on June 9, 2021. The entire disclosure of each of the foregoing applications is hereby incorporated herein by reference.

FIELD OF THE INVENTION

[0002] Embodiments of the present invention generally relate to automated material and article handling systems which can be used in warehouse, storage and/or distribution environments.

BACKGROUND

[0003] Sorting and retrieving items to fill orders can be laborious and time consuming. Many large organizations have extensive storage areas in which numerous items are stored. Sorting and retrieving items from the hundreds or 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 can be 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. Additionally, once items for an order are sorted into a bin or other container, it would be desirable to have a system for automatically removing the container with the completed order and transferring the container to a separate location.

SUMMARY

[0003a] In an aspect, the present disclosure refers to a method for delivering items to a storage assembly having a plurality of storage locations, comprising the steps of: providing a vehicle having a first drive system for driving the vehicle in a horizontal direction and a second drive system; providing a moveable track having an opening configured to receive a portion of the vehicle; actuating the first drive system to drive the vehicle along a horizontal surface to a position adjacent the moveable track; aligning the vehicle with the opening in the moveable track; driving at least a portion of the vehicle into the opening; actuating the second drive system to raise the moveable track vertically to lift the moveable track off the ground; actuating the first drive system to drive the vehicle with the moveable track in a horizontal direction toward the storage assembly; actuating the second drive system to drive the vehicle vertically up the moveable track to a position adjacent one of the storage locations; transferring an item between the vehicle and the one storage location while the vehicle is adjacent the one storage location; and actuating the second drive system to drive the vehicle downwardly toward the ground.

[0003b] In an aspect, the present disclosure refers to a method for delivering items to a storage assembly having a plurality of storage locations, comprising the steps of: driving a vehicle along a horizontal surface to a position adjacent a moveable track; operating the vehicle to lift the moveable track; driving the vehicle horizontally to carry the moveable track to a position adjacent the storage assembly; driving the vehicle vertically upwardly along the moveable track to an elevated position; transferring an item between the vehicle and a storage location in the storage assembly while the vehicle is in the elevated position; driving the vehicle vertically down the track after the step of transferring an item.

[0003c] In an aspect, the present disclosure refers to a material handling system, comprising: a storage assembly having a plurality of elevated storage locations for storing items; a vehicle configured to deliver items to the storage locations and retrieve items from the storage locations, wherein the vehicle comprises: first driving means for driving the vehicle in a horizontal direction; second driving means; and transfer means; a moveable track having an opening configured to receive a portion of the vehicle wherein the moveable track comprises

means for engaging the second driving means of the vehicle, wherein the means for engaging cooperates with the second driving means so that driving the second driving means in a first direction is operable to lift the moveable track off the ground and so that driving the second means in a second direction is operable to drive the vehicle vertically upwardly to an elevated position; wherein the vehicle is configured to drive the vehicle along a horizontal surface to a location adjacent the storage assembly; wherein the transfer means is configured to transfer an item between the vehicle and a storage location of the storage assembly while the vehicle is in the elevated position adjacent the storage location.

[0003d] In an aspect, the present disclosure refers to a material handling system cooperable with a storage assembly having a plurality of storage locations for storing a plurality of items, comprising: a vehicle for conveying items, comprising: a horizontal drive assembly configured to drive the vehicle horizontally along the ground; a vertical drive assembly configured to drive the vehicle vertically upwardly; a transfer mechanism for transferring items between the vehicle and the storage locations; a power source for powering the horizontal drive assembly and the vertical drive assembly; a moveable track, comprising: a vertical track cooperable with the vertical drive assembly of the vehicle; a support structure configured to support the vertical track in a vertical orientation; wherein the moveable track comprises an opening configured to receive at least a portion of the vehicle; wherein the vertical drive assembly and the vertical track are configured and positioned so that when the vehicle extends into the opening in the moveable track, the vertical drive assembly engages the vertical track, such that driving the vertical drive in a first direction is operable to raise the moveable track and driving the vertical drive assembly in a second direction is operable to drive the vehicle up the track to an elevated position to facilitate transfer of an item between a storage location and the vehicle; wherein the support structure is configured to support the vehicle when the vehicle is in the elevated position on the vertical track.

[0004] In view of the shortcomings of the known systems, the present disclosure provides a system for automatically retrieving groups of items that have been sorted by a sortation system.

[0005] The present disclosure also provides an apparatus and method for identifying bins in a sorting system to be shaken to settle the contents and a system for automatically shaking the identified bins to settle the contents in the bin.

[0006] The present disclosure also provides a material handling system including a storage assembly having a plurality of bins in a plurality of storage locations and a controller for identifying when one of the bins is full. The system further includes a retrieval system configured to retrieve a full bin from the storage location and transfer the bin away from the storage location. The retrieval system includes transfer means configured to transfer the bin onto the retrieval system from the storage location.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

[0008] Figure 1 A is a perspective view of a warehouse automation system;

[0009] Figure 1 B is a fragmentary perspective view of a material handling system;

[0010] Figure 2 is a plan view of the material handling system illustrated in Figure 1 B with an automated retrieval system in a first position;

[0011] Figure 3 is a plan view of the material handling system illustrated in Figure 2 with the automated retrieval system in a second position;