transferred to and/or from the applicable location.

[005] In some material handling systems, a conveyor may form part of a movable vehicle used to transport objects to, or retrieve the objects from, the location where a transfer operation is performed. In material systems of this type, failure to rapidly and accurately determine that an object has been transferred from or to the conveyor may delay (or prevent) the vehicle from advancing to the next location.

SUMMARY

[006] The Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[007] The disclosure provides a number of aspects that may form part of a material handling system. The system may include one or more of a number of aspects of the invention as further described below.

[007a] According to an aspect, the present disclosure refers to an apparatus for sorting a plurality of items, comprising: a plurality of sort destinations; a plurality of delivery vehicles for delivering items to the sort destinations, wherein each vehicle comprises an on-board motor for driving the vehicle; an input station comprising a qualification station for analyzing items to detect a first characteristic of the item indicative of the sort destination to which the item is to be sorted and a second characteristic indicative of a physical characteristic of the item; a conveyor for conveying items from the qualification station to a loading station wherein items are loaded onto the vehicle at the loading station; a track for guiding the delivery vehicles to the sort

destinations, wherein the track is adjacent the sort destinations and comprises a plurality of generally vertical rail sections forming a row of columns and a plurality of generally horizontal rail sections interconnecting the columns forming a vertical loop; a recirculation conveyor extending transverse the loop and toward the input station wherein the recirculation conveyor is configured to convey items away from the track toward the input station; a controller for providing signals for controlling operation of the vehicles, wherein in response to signals received from a scanning station for an item that is loaded onto one of the vehicles, the controller selectively provides one or more signals to direct the vehicle to an entrance to the recirculation conveyor and to discharge the item onto the recirculation conveyor wherein the recirculation conveyor is operable to convey the item back toward the input station for re-processing at the qualification station.

[007b] According to an example, the present disclosure refers to an apparatus for sorting a plurality of items, comprising: a first group of sort destinations positioned along a first track; a second group of sort destinations positioned along a second track, wherein the second track is spaced apart from the first track to form an aisle between the first and second track; a plurality of delivery vehicles vertically and horizontally displaceable within the aisle for delivering items to the sort destinations; an input station comprising a qualification station configured to analyze an item to detect a first characteristic of the item indicative of the sort destination to which the item is to be sorted and a second characteristic of the item; a conveyor for conveying items from the qualification station to a loading station where items are loaded onto the delivery vehicles; a recirculation path providing a path along which the item can be transported back toward the input station, wherein the recirculation path has a first end positioned vertically higher than at least a portion of the conveyor; a reject area positioned adjacent the loading station; a controller for controlling operation of the vehicles, wherein the controller is configured to selectively direct items to one of the three locations in response to a combination of the first and second characteristics, wherein the three locations comprise the reject bin, the recirculation path and one of the sort destinations.

[007c] According to an example, the present disclosure refers to a method for

sorting a plurality of items to a plurality of sort locations, comprising the steps of: conveying items to from an input area to a loading area; scanning the items between the input area and the loading area to detect a first characteristic of the items; scanning the items between the input area and the loading area to detect a second characteristic of the items; loading each item on an independently operable vehicle that moves along vertical loop of track in an aisle between a first set of sort locations and a second set of sort locations; selectively operating the vehicles to direct items to a reject area in response to the step of scanning the items to detect a first characteristic or the step of scanning the items to detect a second characteristic; selectively operating one of the vehicles to raise an item above the height of the input area in response to the step of scanning the item to detect a first characteristic; selectively operating the one vehicle to convey the item to a recirculation path after the step of selectively operating the vehicles to raise the item, wherein the step of selectively operating the vehicles to convey the item to a recirculation path in in response to failing to detect a second characteristic for the item; selectively operating the vehicle to convey the item to one of the sort destinations in response to detecting the first characteristic and the second characteristic; and conveying the item along the recirculation path toward the input area if the item is conveyed to the recirculation path.

[008]According to one example, the disclosure may provide an apparatus for sorting a plurality of items is provided. The apparatus includes a plurality of sort destinations and a plurality of a plurality of delivery vehicles for delivering items to the sort destinations. A controller is provided for providing signals for controlling operation of the vehicles. A database for storing a plurality of vehicle movement profiles is also provided. In response to a characteristic determined for an item, the central controller retrieves a vehicle movement profile and the central controller controls the movement of the vehicle in response to the retrieved vehicle movement profile. The vehicle movement profile may comprise one or more of the following: acceleration, deceleration and cornering speed.

[009]According to another example, the disclosure may comprise a track system for guiding the delivery vehicles to the sort destinations.

CLAIMS

1. An apparatus for sorting a plurality of items, comprising:

a plurality of sort destinations;

a plurality of delivery vehicles for delivering items to the sort destinations, wherein each vehicle comprises an on-board motor for driving the vehicle;

an input station comprising a qualification station for analyzing items to detect a first characteristic of the item indicative of the sort destination to which the item is to be sorted and a second characteristic indicative of a physical characteristic of the item;

a conveyor for conveying items from the qualification station to a loading station wherein items are loaded onto the vehicle at the loading station;

a track for guiding the delivery vehicles to the sort destinations, wherein the track is adjacent the sort destinations and comprises a plurality of generally vertical rail sections forming a row of columns and a plurality of generally horizontal rail sections interconnecting the columns forming a vertical loop;

a recirculation conveyor extending transverse the loop and toward the input station wherein the recirculation conveyor is configured to convey items away from the track toward the input station;

a controller for providing signals for controlling operation of the vehicles, wherein in response to signals received from a scanning station for an item that is loaded onto one of the vehicles, the controller selectively provides one or more signals to direct the vehicle to an entrance to the recirculation conveyor and to discharge the item onto the recirculation conveyor wherein the recirculation conveyor is operable to convey the item back toward the input station for re-processing at the qualification station.

2. The apparatus of claim 1 wherein the controller is configured so that in response to signals from the qualification station the controller controls the vehicle to direct the vehicle to the one of the sort destinations.

3. The apparatus of claim 1 or 2 wherein the recirculation conveyor comprises a roller bed, chute or conveyor belt.

4. The apparatus of any of claims 1-3 wherein a first group of the sort destinations is disposed on a first side of the track and a second group of the sort destinations is disposed on a second side of the track so that an aisle is formed between the first and second groups of sort destinations, wherein an output station is positioned at an end of the aisle.

5. The apparatus of any of claims 1-4 wherein in response to detecting that an item has the second characteristic, the controller is configured to control one of the vehicles to deliver the item to either the recirculation conveyor or one of the sort destinations and wherein in response to detecting that the item does not have the second characteristic the controller is configured to control the one vehicle to deliver the item to a reject bin.

6. The apparatus of claim 5 wherein the reject bin is positioned adjacent the loading station so that the item can be delivered into the reject bin without moving the vehicle from the loading station.