Material Handling Apparatus having Separate Workstation and Method of Use

Priority Claim

[001] This application claims priority to U.S. Provisional Patent Application No. 63/065,524 filed on August 14, 2020 and U.S. Patent Application No. 17/403,814 filed on August 16, 2021. The entire disclosure of each of the foregoing applications 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 method for delivering items from a storage system to a pick station, comprising the steps of:

driving a vehicle having a container to a pick station; driving the vehicle upwardly at the pick station to an upper position to displace the container at an elevated position to present the container to the operator; releasably retaining the container in the elevated position; driving the vehicle downwardly away from the upper position while the container is retained in the elevated position, whereby driving the vehicle downwardly while the container is retained in the elevated position operates to detach the vehicle from the container; driving one or more subsequent vehicles to the pick station to deliver items to be placed in the container while the container is retained in the elevated position.

[004b] According to an aspect, the present disclosure refers to a material handling system workstation operable in connection with a first delivery vehicle operable to convey a first container and a second delivery vehicle operable to convey the first container, wherein the first delivery vehicle and the second delivery vehicle each comprise a vertical drive element, and wherein the workstation comprises: a frame; a track connected with the frame, wherein the track is configured to cooperate with the vertical drive element of the first and second vehicles to facilitate vertical displacement of the first and second vehicles to a raised position so that items may be transferred into or retrieved from the first container; a retainer operable between a first and second position wherein in the first position the retainer retains the first container in an upper position when the first vehicle is lowered from the raised position and wherein in the second position the retainer releases the first container from the upper position; a controller configured to selectively actuate the retainer from the second position to the first position after the first vehicle is displaced into the raised position; wherein the controller is configured to selectively actuate the retainer from the first position to the second position after a second vehicle is displaced into the raised position so that the container is released onto the second vehicle to allow the second vehicle to transfer the container away from the workstation.

[005] According to one example, a pick station for a material handling system having a plurality of independently operable vehicles delivering items is provided. The pick station optionally includes a housing. The housing may have an opening configured to

facilitate the vehicle entering the pick station. Additionally, the pick station includes a track having a fixed track positioned within the housing so that vehicles driving through the opening in the housing drive into operative engagement with the fixed track. The fixed track may be configured to guide vehicles vertically upwardly. Additionally, the track may include a lower section having a curved profile to tilt the vehicle to a predetermined angle relative to the horizon. The track may also include an upper section having a substantially straight profile to raise the vehicle at the tilted angle for a predetermined distance.

[006] According to a further example, a pick station may include a monitor for identifying the items to be removed from the container delivered to the pick station by a vehicle.

[007] According to another example, a pick station may include a track that includes a plurality of vertical tracks.

[008] According to a further example, a pick station may include a track that includes a plurality of teeth.

[009] According to a yet another example, a pick station may include a track having a first track element having a lower section having a first tooth pitch and an upper section having a first tooth pitch. Optionally, the track may have a second track element opposing the first track element and having the first tooth pitch along substantially the entire length of the second track element.

[0010] According to a further example, a method may be provided for charging a material handling vehicle configured to drive along a first pathway in a horizontal direction and a second pathway in a vertical direction. Each vehicle may include a power storage element. The method may include the step of driving a vehicle having an item to a pick station having a charging element that includes a conductive element configured to provide a charging current to the vehicle to charge the power storage element of the vehicle. The method may also include the step of displacing an electrical contact of the vehicle into engagement with the charging element. Optionally, the vehicle may be raised at the pick station while the electrical contact maintains electrical engagement with the charging element. Additionally, the charging element may be displaced while the vehicle is raised upwardly at the pick station.

[0011] According to another example, a method is provided for charging a material handling vehicle that includes the step of driving the vehicle upwardly at a pick station.

[0012] According to a further example, a method is provided for charging a material handling vehicle having a step of driving the vehicle upwardly by actuating a drive assembly of the vehicle.

[0013] According to yet another example, a method is provided for charging a material handling vehicle that includes the step of displacing the charging element and the step of displacing includes the step of vertically displacing the charging element to maintain the charging element in operative engagement with the charging contact of the vehicle as the vehicle is raised upwardly.

[0014] According to a further example, a method for charging a material handling vehicle includes the step of biasing the charging element in a vertical direction relative to the charging contact of the vehicle. Optionally the method may additionally or alternatively include the step of biasing the charging element in a horizontal direction relative to the charging contact of the vehicle.

[0015] According to another example, a method for charging a material handling vehicle may include the step of driving a vehicle with a container to the pick station. Optionally, the method may include the step of driving the vehicle upwardly to an upper position so that the container is positioned at an elevated position to present the container to an operator at the pick station.

[0016] In an example, the present disclosure also provides a method for delivering items from a storage system to a pick station. The method for delivering items includes the step of driving a vehicle having a container to a pick station. The vehicle drives upwardly at the pick station to an upper position to displace the container to an elevated position to present the container to the operator. The container may be releasably retained in the elevated position. Optionally, the vehicle may be driven downwardly away from the upper position while the container is retained in the elevated position. Driving the vehicle downwardly while the container is retained in the elevated position may operate to separate the vehicle from the container. The method may also include the step of driving one or more subsequent vehicles to the pick station to deliver items to be placed in the container while the container is retained in the elevated position.

[0017] According to another example, a method for delivering items from a storage system to a pick station may include the steps of driving a retrieval vehicle upwardly at the pick station to the upper position into operative engagement with the container while the container is retained in the elevated position. Additionally, the method may include the step of releasing the container. Optionally, the method may include the step of driving the retrieval vehicle downwardly with the released container. Additionally, the method may include the optional step of driving the retrieval vehicle horizontally away from the pick station after the step of driving the vehicle downwardly.

[0018] According to another example, the present disclosure may provide a workstation for presenting items carried by vehicles having a horizontal drive system for driving the vehicles horizontally along the ground and a vertical drive system for driving the vehicle vertically. The workstation may include a track system that includes a rear track having a plurality of drive teeth, a front track having a plurality of drive teeth, and a carriage. The carriage optionally includes a first transfer mechanism cooperable with the rear track to drive the carriage upwardly and a second transfer mechanism cooperable with the front track to drive the carriage upwardly. The first and second transfer mechanisms may be configured to engage the vertical drive system of the vehicle so that power from the vertical drive system is transferred through the first and second transfer mechanisms to drive the carriage up the track system to present an item on the vehicle to an operator at the pick station.

[0019] According to another example, the present disclosure may provide a workstation having first and second transfer mechanisms and one of the transfer mechanisms optionally includes a first gear having a first tooth pitch and a second gear element having a second tooth pitch. Optionally, the workstation may include a front track having a first segment having a tooth pitch corresponding with the first tooth pitch and a second segment having a tooth pitch corresponding to the second tooth pitch. Optionally, the first segment includes a curved profile configured to tilt the vehicles to a predetermined angle and the second segment is generally straight.