positioned in the first storage location is spaced from the aisle by the first container; wherein the first storage container comprises a first connector at a first end and the second storage container comprises a second connector at a second end, wherein the second connector is releasably connectable with the first connector to releasably connect the first and second storage containers at the first storage location; wherein each vehicle comprises a transfer mechanism for transferring the first and second storage containers between the vehicle and the first storage location wherein the releasable connection between the first and second containers is operable to displace the second storage container when the transfer mechanism displaces the first storage container; and a central controller for controlling operation of the vehicles, wherein the central controller is configured to control a first of the vehicles by directing the first vehicle to the first storage location, transferring the first storage container onto the first vehicle to displace the second storage container toward the aisle, directing the first vehicle to a second one of the storage locations and transferring the first container to the second storage location before returning to the first storage location to retrieve the second storage container from the first storage location.

[005b] According to another aspect, the present disclosure refers to a material handling system for storing or retrieving a plurality of items, comprising: a plurality of vehicles for delivering and retrieving items, wherein each vehicle comprises an on-board motor for driving the vehicle; a first rack of storage locations; a second rack of storage locations spaced apart from the first rack with an aisle between the first and second racks, wherein the vehicles are displaceable vertically and horizontally within the aisle; a plurality of storage containers wherein each storage location is configured to receive a plurality of the storage containers; wherein a first of the storage containers comprises a first connector at a first end and a second of the storage containers comprises a second connector at a second end, wherein the first connector is releasably connectable with the second connector to releasably connect the first and second storage containers at one of the storage locations; wherein each vehicle comprises a transfer mechanism for transferring the first and second storage containers between the vehicle and the one storage locations wherein the releasable connection between the first and second

CLAIMS

What is claimed is:

1. An automated storage and retrieval system defining a plurality of storage locations for receiving items, comprising:

a plurality of independently operable vehicles for delivering and retrieving items, wherein each vehicle comprises an on-board motor for driving the vehicle;

a track for guiding the vehicles;

a plurality of storage locations disposed along the track so that the track is configured to guide the vehicles to the storage locations, wherein a plurality of the storage locations are vertically spaced apart from one another forming a first vertical column and a plurality of the storage locations are vertically spaced apart from one another forming a second vertical column and the first vertical column is separated from the second vertical column to form an aisle between the first vertical column and the second vertical column and wherein the vehicles are vertically displaceable in the aisle along the track;

a plurality of storage containers wherein each storage location is configured to receive a plurality of the storage containers so that a first container positioned in a first storage location is adjacent the aisle and a second container positioned in the first storage location is spaced from the aisle by the first container;

wherein the first storage container comprises a first connector at a first end and the second storage container comprises a second connector at a second end, wherein the second connector is releasably connectable with the first connector to releasably connect the first and second storage containers at the first storage location;

wherein each vehicle comprises a transfer mechanism for transferring the first and second storage containers between the vehicle and the first storage location wherein the releasable connection between the first and second containers is operable to displace the second storage container when the transfer mechanism displaces the first storage container; and

a central controller for controlling operation of the vehicles, wherein the central controller is configured to control a first of the vehicles by directing the first vehicle to the first storage location, transferring the first storage container onto the first vehicle to displace the second storage container toward the aisle, directing the first vehicle to a second one of the storage locations and transferring the first container to the second storage location before returning to the first storage location to retrieve the second storage container from the first storage location.

2. The system of claim 1 wherein the track comprises:

a plurality of horizontal track sections spaced apart from one another and extending in a generally horizontal direction;

a plurality of vertical track sections spaced apart from one another and extending in a generally vertical direction, wherein the vertical track sections intersect the horizontal track sections to form a loop; and

an intersection where one of the horizontal track sections intersects one of the vertical track sections, wherein the intersection provides a first path in a generally horizontal direction and a second path in a generally vertical direction.

3. The system of claim 1 wherein the connection of the first and second connectors impedes horizontal displacement of the first container relative to the second container.

4. The system of claim 3 wherein the connection of the first and second connectors is sufficient to support the weight of the second container during horizontal displacement such that displacing the first container horizontally displaces the second container horizontally when the first and second connectors are connected.

5. The system of claim 3 or 4 wherein the connection of the first and second connectors permits vertical displacement of the first container relative to the second container.

6. The system of any of claims 3-5 wherein the first and second connectors are configured such that displacement of the first connector vertically relative to the second connector disconnects the first connector from the second connector.

7. The system of any of claims 1-6 wherein the first connector comprises a tongue and the second connector comprises a groove configured to receive the tongue.

8. The system of any of claims 1-7 wherein the first storage location is configured to house the first and second containers in horizontal alignment wherein the first container is positioned in front of the second container.

9 The system of any of claims 1-8 wherein the first storage location has a depth and the first and second container each have a length, wherein the depth of the first storage location is at least as long as the combined length of the first and second containers.

10. The system of any of claims 1-9 wherein the vehicles comprise a generally planar platform for receiving the containers.

11. The system of claim 10 wherein a pick station is disposed at an end of the aisle, wherein the vehicles deliver containers to the pick station so that operators can retrieve items from the containers at the pick station.

12. The system of claim 10 or 11 wherein the vehicles are displaceable within the aisle.

13. The system of claim 12 wherein the vehicles comprise drive wheels that engage the track and wherein the racks are positioned relative to the track so that the containers project horizontally into the aisle beyond the track.

14. The system of any of claims 1-13 wherein the containers contain one or more engagement elements configured to engage the transfer mechanism of the vehicles.

15. A material handling system for storing or retrieving a plurality of items, comprising:

a plurality of vehicles for delivering and retrieving items, wherein each vehicle comprises an on-board motor for driving the vehicle;

a first rack of storage locations;

a second rack of storage locations spaced apart from the first rack with an aisle between the first and second racks, wherein the vehicles are displaceable vertically and horizontally within the aisle;

a plurality of storage containers wherein each storage location is configured to receive a plurality of the storage containers;

wherein a first of the storage containers comprises a first connector at a first end and a second of the storage containers comprises a second connector at a second end, wherein the first connector is releasably connectable with the second connector to releasably connect the first and second storage containers at one of the storage locations;

wherein each vehicle comprises a transfer mechanism for transferring the first and second storage containers between the vehicle and the one storage locations wherein the releasable connection between the first and second containers is operable to displace the second storage container when the transfer mechanism displaces the first storage container; and

a central controller for controlling operation of the vehicles, wherein the central controller is configured to control a first of the vehicles by directing the first

vehicle to the one storage location, transferring the first storage container onto the first vehicle to displace the second storage container toward the aisle, directing the first vehicle to a second one of the storage locations and transferring the first container to the second storage location before returning to the first storage location to retrieve the second storage container from the first storage location.

16. The system of claim 15 comprising a track for guiding the vehicles, wherein the track comprises:

a plurality of horizontal track sections spaced apart from one another and extending in a generally horizontal direction;

a plurality of vertical track sections spaced apart from one another and extending in a generally vertical direction, wherein the vertical track sections intersect the horizontal track sections to form a loop; and

an intersection where one of the horizontal track sections intersects one of the vertical track sections, wherein the intersection provides a first path in a generally horizontal direction and a second path in a generally vertical direction.

17. The system of claim 15 or 16 wherein the connection of the first and second connectors impedes horizontal displacement of the first container relative to the second container.

18. The system of claim 17 wherein the connection of the first and second connectors is sufficient to support the weight of the second container during horizontal displacement such that displacing the first container horizontally displaces the second container horizontally when the first and second connectors are connected.

19. The system of claim 17 or 18 wherein the connection of the first and second connectors permits vertical displacement of the first container relative to the second container.

20. The system of any of claims 17-19 wherein the first and second connectors are configured such that displacement of the first connector vertically relative to the second connector disconnects the first connector from the second connector.

21. The system of any of claims 15-20 wherein the first connector comprises a tongue and the second connector comprises a groove configured to receive the tongue.

22. The system of any of claims 15-21 wherein the storage location in which the first and second containers are located is configured to house the first and second containers in horizontal alignment wherein the first container is positioned in front of the second container.

23. The system of claim 22 wherein when one of the vehicles is aligned with the first container, the first container separates the second container from the vehicle.

24. The system of any of claims 15-23 wherein the one of the storage locations has a depth and the first and second container each have a length, wherein the depth of the one storage location is at least as long as the combined length of the first and second containers.

25. The system of any of claims 15-24 wherein the vehicles comprise a generally planar platform for receiving the containers.

26. The system of any of claims 15-25 wherein a pick station is disposed at an end of the aisle, wherein the vehicles deliver containers to the pick station so that operators can retrieve items from the containers at the pick station.

27. The system of claim 16 wherein the vehicles comprise drive wheels that engage the track and wherein the racks are positioned relative to the track so that the containers project horizontally into the aisle beyond the track.

28. The system of any of claims 15-27 wherein the containers contain one or more engagement elements configured to engage the transfer mechanism of the vehicles.