

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;

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

wherein one 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 second connector is releasably connectable with the first 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 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.

2. The apparatus 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 apparatus 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 apparatus 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 apparatus 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 apparatus 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 apparatus 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 apparatus of any of claims 1-7 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.

9. The apparatus of claim 8 wherein when one of the vehicles is aligned with the first container, the first container separates the second vehicle from the vehicle.
10. The apparatus of any of claims 1-9 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.
11. The apparatus of any of claims 1-10 wherein the vehicles comprise a generally planar platform for receiving the containers.
12. The apparatus of any of claims 1-11 wherein the plurality of storage locations comprise a first rack of storage locations spaced apart from a second rack of storage locations so that an aisle is formed between the first rack and the second rack.
13. The apparatus of claim 12 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.
14. The apparatus of claim 12 or 13 wherein the vehicles are displaceable within the aisle.
15. The apparatus of claim 14 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.
16. The apparatus of any of claims 1-15 wherein the containers contain one or more engagement elements configured to engage the transfer mechanism of the vehicles.
17. 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.
18. The apparatus of claim 17 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.

19. The apparatus of claim 17 or 18 wherein the connection of the first and second connectors impedes horizontal displacement of the first container relative to the second container.
20. The apparatus of claim 19 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.
21. The apparatus of claim 19 or 20 wherein the connection of the first and second connectors permits vertical displacement of the first container relative to the second container.
22. The apparatus of any of claims 19-21 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.
23. The apparatus of any of claims 17-22 wherein the first connector comprises a tongue and the second connector comprises a groove configured to receive the tongue.
24. The apparatus of any of claims 17-23 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.
25. The apparatus of claim 24 wherein when one of the vehicles is aligned with the first container, the first container separates the second vehicle from the vehicle.
26. The apparatus of any of claims 17-25 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.

27. The apparatus of any of claims 17-26 wherein the vehicles comprise a generally planar platform for receiving the containers.
28. The apparatus of any of claims 17-27 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.
29. The apparatus of claim 18 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.
30. The apparatus of any of claims 17-29 wherein the containers contain one or more engagement elements configured to engage the transfer mechanism of the vehicles.