

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

**Exotec Product France SAS,
Exotec North America Inc., and
Exotec Product USA Inc.,
v.
OPEX Corporation**

August 27, 2025

IPR2024-00850; U.S. Patent No. 11,472,632

OPEX[®]

Outline

- A** Overview of the '632 Patent
- B Overview of the References
- C Petitioner's Grounds
- D The Disputed Issues
- E The Dependent Claims

The '632 Patent's Material Handling System

(54) MATERIAL HANDLING SYSTEM

(12) **United States Patent**
Stevens et al.

(10) **Patent No.:** US 11,472,632 B2
(45) **Date of Patent:** Oct. 18, 2022

(54) **MATERIAL HANDLING SYSTEM**

(71) **Applicant:** OPEX Corporation, Moorestown, NJ (US)

(72) **Inventors:** Alexander Stevens, Moorestown, NJ (US); Joseph Valtinsky, Moorestown, NJ (US)

(73) **Assignee:** OPEX Corporation, Moorestown, NJ (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 217 days.

(21) **Appl. No.:** 16/994,543

(22) **Filed:** Aug. 14, 2020

(65) **Prior Publication Data**
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Related U.S. Application Data

(60) Provisional application No. 62/886,602, filed on Aug. 14, 2019.

(51) **Int. Cl.**
B65G 1/137 (2006.01)
B65G 1/04 (2006.01)
B65G 1/06 (2006.01)
G06Q 10/08 (2012.01)
B65G 1/10 (2006.01)
G05D 1/00 (2006.01)
B25J 9/16 (2006.01)

(52) **U.S. Cl.**
CPC B65G 1/1375 (2013.01); B25J 9/1647 (2013.01); B65G 1/0471 (2013.01); B65G 1/0492 (2013.01); B65G 1/065 (2013.01); B65G 1/10 (2013.01); B65G 1/1371

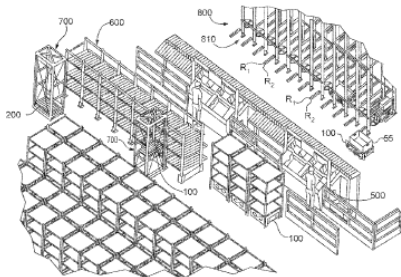
(58) **Field of Classification Search**
CPC combination set(s) only.
See application file for complete search history.

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Primary Examiner — Kyle O Logan
(74) **Attorney, Agent, or Firm** — Stephen Bland

(57) **ABSTRACT**
A system may include a vehicle for delivering items and a plurality of racks having a plurality of storage locations. The racks may be arranged to form one or more aisles. The vehicles are configured to drive horizontally along a path that may extend along a path under the racks that is parallel to the aisles. Additionally, the vehicles may be operated to turn while the vehicle is positioned under one of the racks. The vehicles may travel under the racks and cross one or more aisles to reach a particular column in one of the aisles. The vehicle climbs upwardly within the particular column to retrieve an item from a storage location in the column.

27 Claims, 11 Drawing Sheets



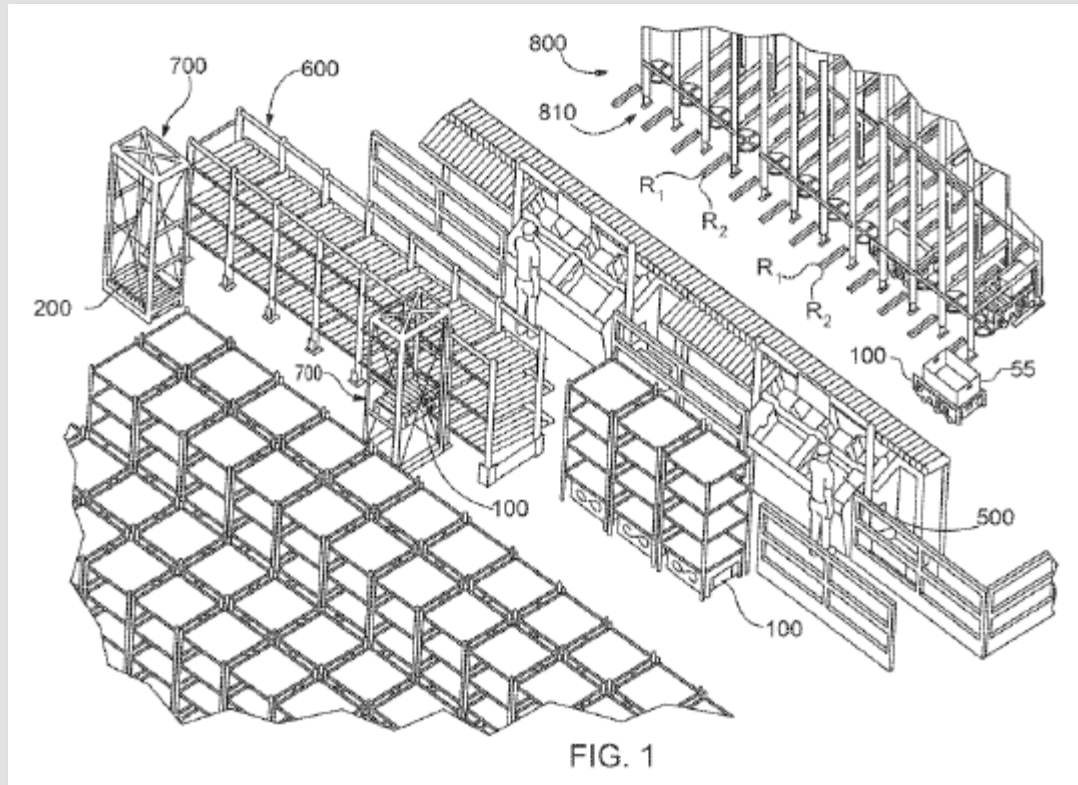
Petitioners' Exhibit 1001
Exotec v. Ope; No. IPR2024-00850
U.S. Patent No. 11,472,632; Page 1

Ex. 1001 ('632 Patent), 1

(57) ABSTRACT

A system may include a vehicle for delivering items and a plurality of racks having a plurality of storage locations. The racks may be arranged to form one or more aisles. The vehicles are configured to drive horizontally along a path that may extend along a path under the racks that is parallel to the aisles. Additionally, the vehicles may be operated to turn while the vehicle is positioned under one of the racks. The vehicles may travel under the racks and cross one or more aisles to reach a particular column in one of the aisles. The vehicle climbs upwardly within the particular column to retrieve an item from a storage location in the column.

The '632 Patent's Storage Areas

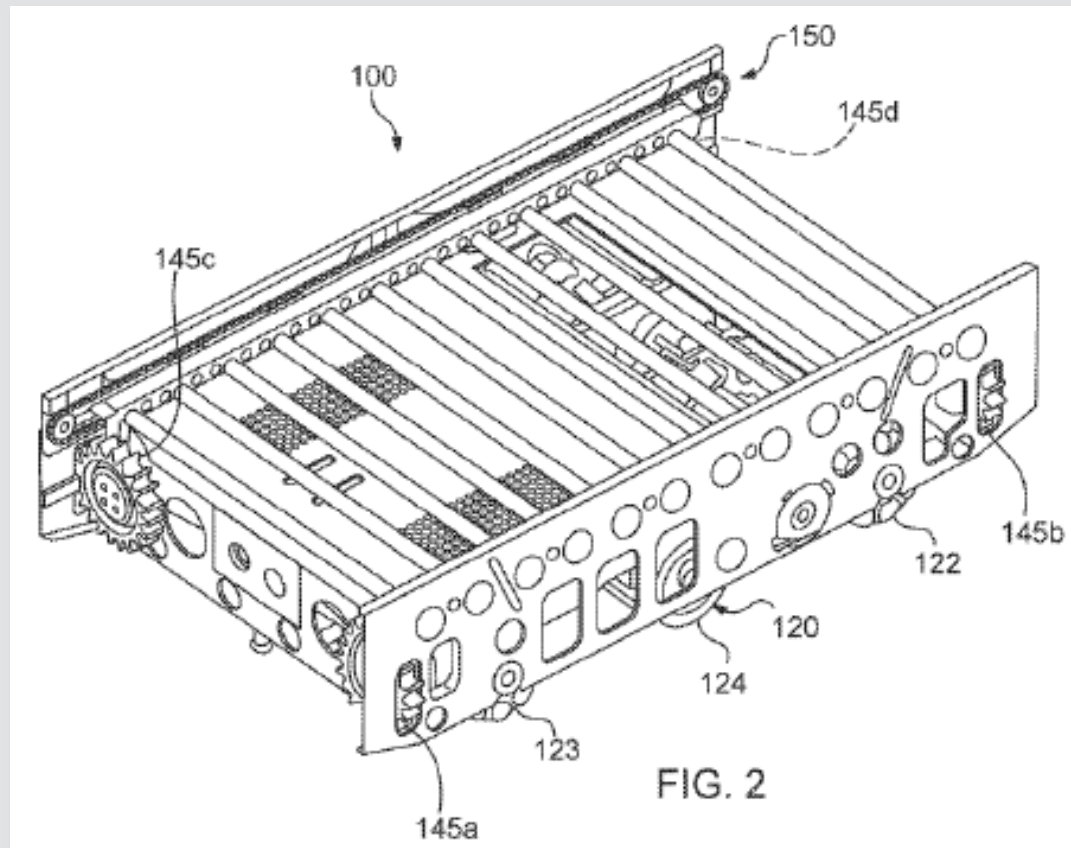


POR, 3; Ex. 1001, Fig. 1

The '632 Patent "relate[s] to automated material and article handling systems which can be used in warehouse, storage and/or distribution environments." EX1001, 1:12-15. Figure 1 of the '632 Patent, which is reproduced below, shows a material handling system that "includes one or more mechanisms for delivering items to and/or retrieving items from one of a plurality of locations, such as storage areas located in racks 800 or flow racks 600." EX1001 at 7:12-15, EX2007, ¶43.

EX1001, 1:12-15; EX1001, 7:12-15

The '632 Patent's Delivery Vehicles

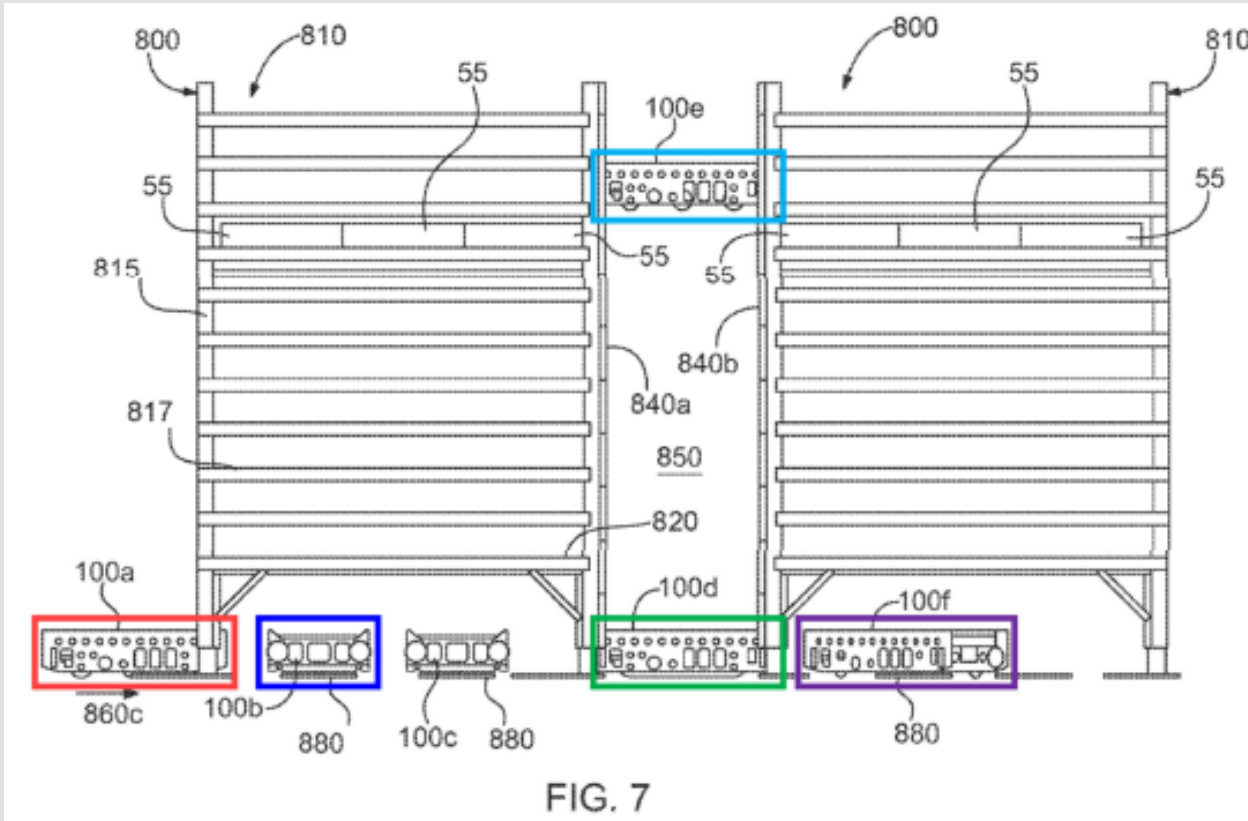


POR 5; Ex. 1001, Fig. 2

“The vehicle illustrated in FIG. 2 includes a horizontal drive assembly 120 for driving the vehicle 100 in a horizontal direction. The horizontal drive 120 may be configured to drive the vehicle along a track or along an open horizontal surface, such as a floor.” EX1001, 8:9-14. The ’632 Patent also discloses that “[i]n addition to the horizontal drive mechanism 120 the vehicle may also include a vertical drive mechanism [] for driving the vehicle 100 vertically within the rack 20.” EX1001, 9:12-14. EX2007, ¶45.

EX1001, 8:9-14; EX1001, 9:12-14

The '632 Patent Vehicle's Travel Directions

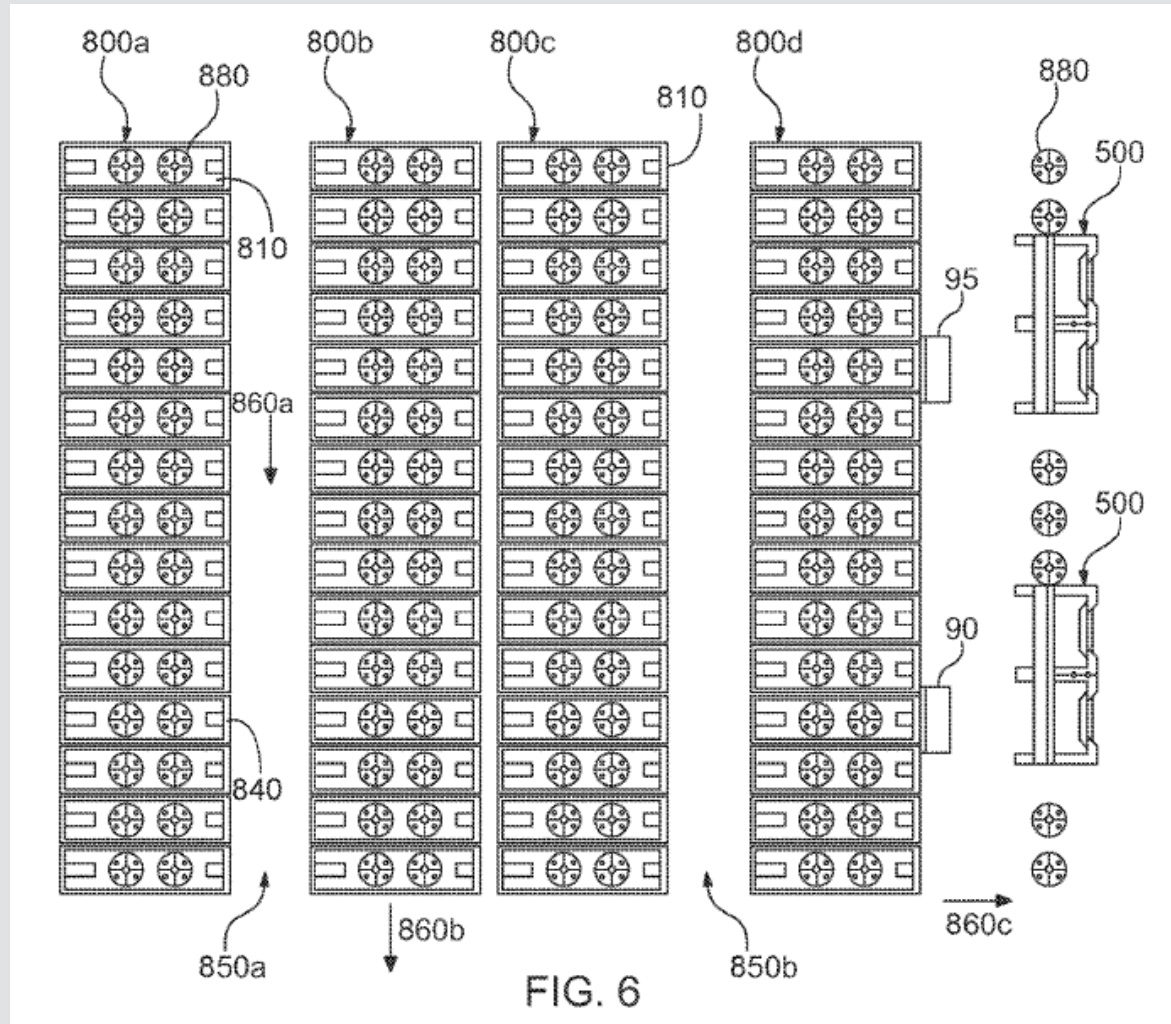


POR, 7; Ex. 1001, Fig. 7

[A] **first vehicle 100a** is oriented for horizontal movement along path 860c, transverse the length of aisle 850. A **second vehicle 100b** is oriented for horizontal movement under the rack along path 860b that is parallel to the length of the aisle 850. Additionally, a **third vehicle 100[d]** is positioned within the aisle 850 to climb vertical tracks along the racks 800 on either side of the aisle. A **fourth vehicle 100[e]** is also positioned within the aisle and has climbed up the track 840a,b to a storage location 820 in an upper portion of the column 810. Finally, a **fifth vehicle 100f** is positioned under the rack 800 and is oriented at an intermediate position between the orientation of **vehicle 100a** and the orientation of **vehicle 100b**. In particular, the racks may be configured to facilitate the vehicles turning horizontally underneath the racks. The **fifth vehicle 100f** illustrates the vehicle in the process of turning under the rack from a first path to a second path.

EX1001, 17:7-25 (color added)

The '632 Patent Vehicle's Travel Paths: Along Aisles



Ex. 1001, Fig. 6

As mentioned above, structure 800 is dimensioned and arranged such that the vehicles may enter and exit from various locations beneath the storage locations, allowing for flexibility in the installation of picking and/or replenishing stations. If the system utilizes one or more vehicles and one or more racks, the racks may be configured to allow the vehicles to travel under the racks 800 as well as being able to travel across or along one or more aisles that may be incorporated into the system. For instance, referring to FIG. 6, the vehicles may follow a path that moves along one or more path segments that may be parallel or transverse to the aisle. A first such path is designated as path 860a. Path 860a is within and parallel to the length of aisle 850a. A second such path is designated path 860b, which is parallel to the length of aisle 850a, but spaced apart from the aisle. Specifically, path 860b is located under rack 800b. Rack 800b may be configured to provide clearance for movement of the vehicle under the lowermost storage location 820 so that the vehicle may travel under the rack 800b along a path 860b that is parallel to the length of the aisle. A third path is designated 860c, which is transverse 860a and 860b. As shown in FIG. 6, path 860c is parallel to the depth of the column 810.

Ex. 1001, 17:26–48

The '632 Patent Vehicle's Travel Paths: Under Columns Parallel to Aisles

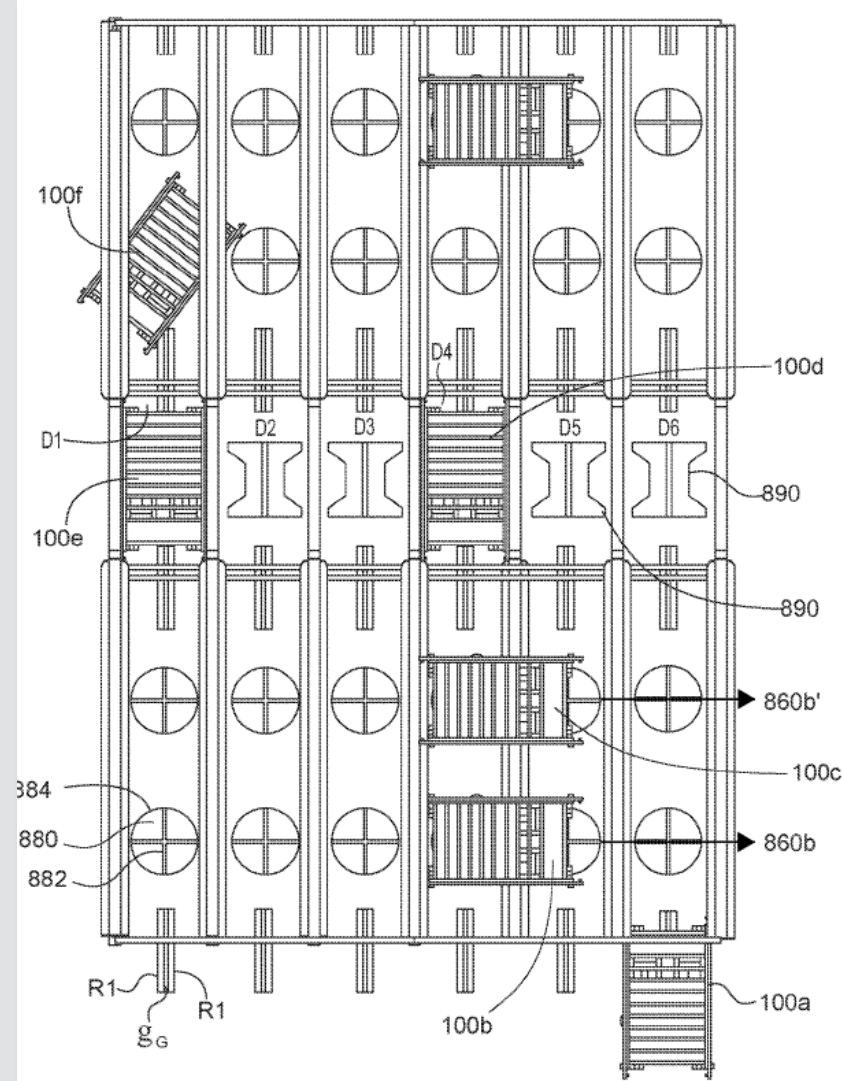


FIG. 9

Referring to FIGS. 7 and 9, the rack is optionally configured so that the columns of the rack have a depth sufficient to provide multiple paths under each column that are substantially parallel to the length of the aisle 850. Specifically, as shown in FIG. 7, the posts 815 adjacent the aisle 850 may be spaced apart from the posts 815 remote from the aisle to form an opening having a width that is greater than twice the width of the vehicle.

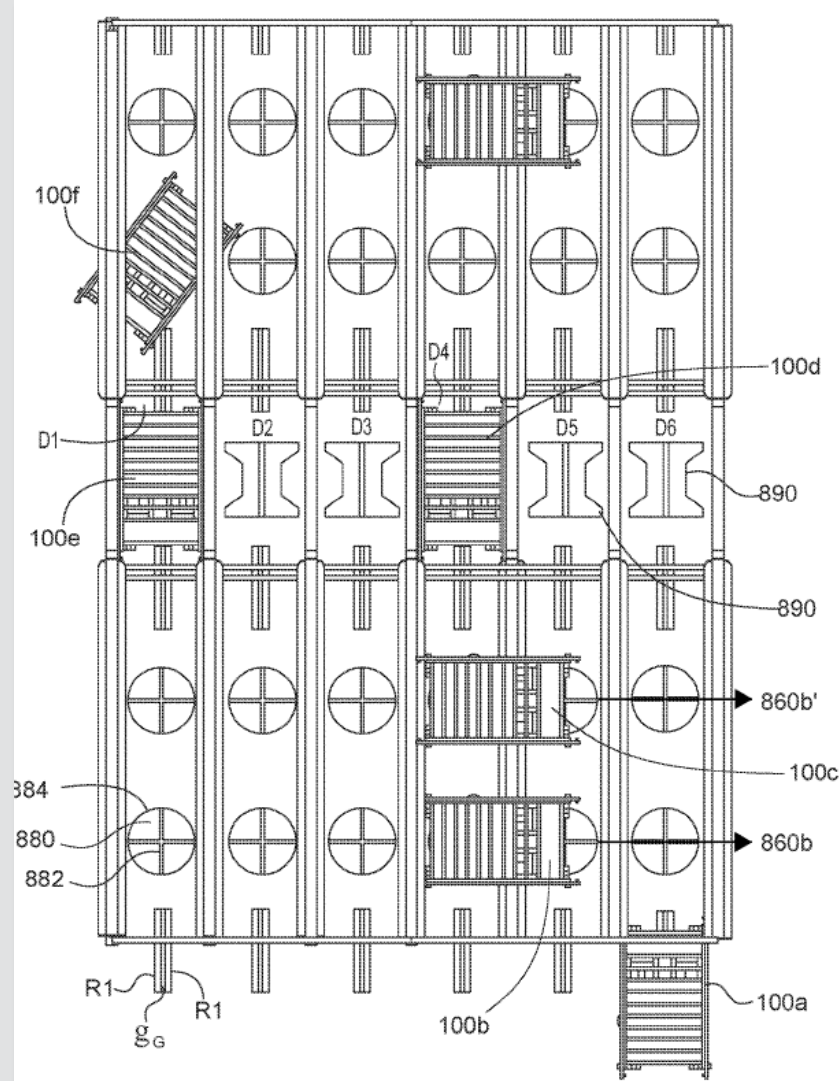
FIG. 9 illustrates vehicle 100b moving along path 860 that is parallel to the aisle and vehicle 100c moving along path 860' that is parallel to path 860. Preferably path 860' has a centerline that is spaced apart from the posts 815 adjacent the aisle that is greater than half the length "L" of the vehicle 100 (see FIG. 5). Similarly, preferably path 860 has a centerline that is spaced apart from the posts at the rearward edge of the column remote from the aisle 850 by a distance that is greater than half the length of the vehicle.

Ex. 1001, 17:48–56

Ex. 1001, Fig. 9

POR, 7, 8

The '632 Patent Vehicle's Travel Paths: Turning Under Racks



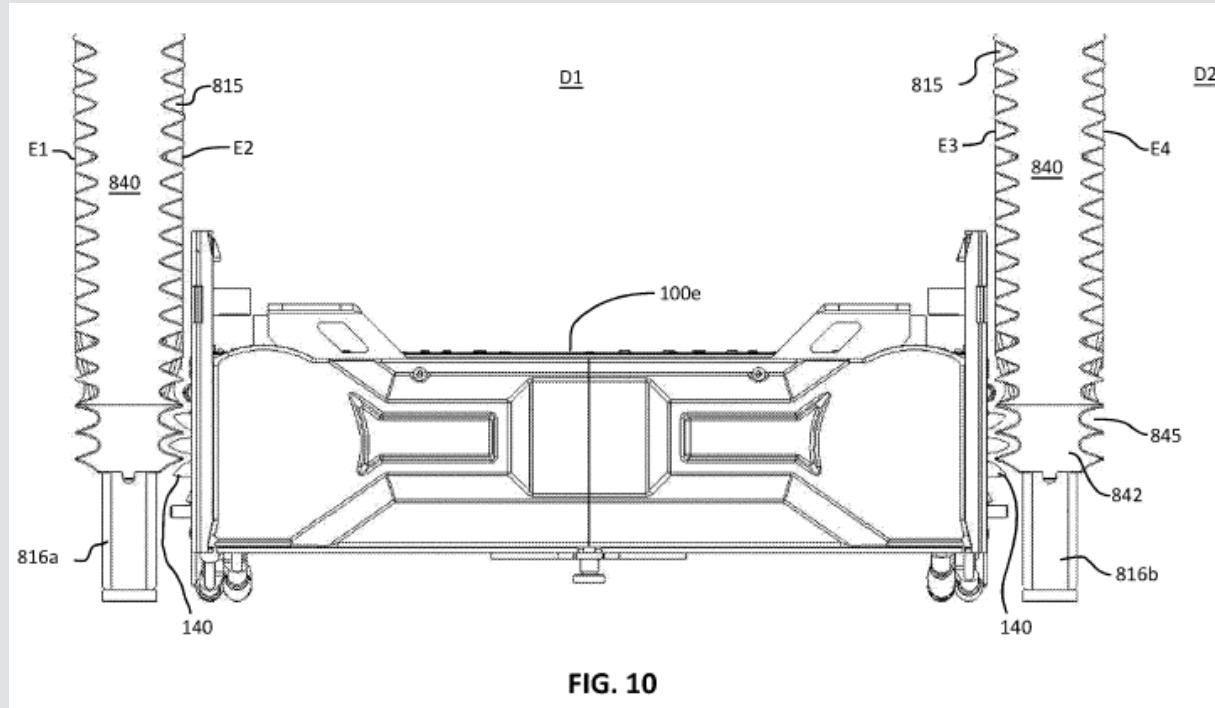
Ex. 1001, Fig. 9

Additionally, as discussed above, the vehicles may change direction by rotating about a vertical axis of rotation that passes through the vehicle. In particular, the axis of rotation may pass through the center of the vehicle. The columns **810** preferably have a depth sufficient to facilitate the vehicle rotating about the axis of rotation while the vehicle is positioned in the column under the rack. Specifically, each of path **860**, **860'** is preferably spaced apart from the posts **815** a distance greater than the distance from the axis of rotation to each of the corners of the vehicle.

When the vehicle turns under the rack **800**, the vehicle may turn in any of a variety of angles. Optionally, the vehicle may turn in increments of 90 degrees. In particular, optionally, the vehicle turns either 90 degrees or 270 degrees after exiting the aisle so that the vehicle travels parallel to the aisle under the rack after climbing the track in the aisle.

Ex. 1001, 18:7-23

The '632 Patent Vehicle's Travel Paths: Up, Down, and Through Columns



Ex. 1001, Fig. 10

Referring to FIG. 10, the track 840 and the vertical drive gear 145 may be aligned so that the vertical drive gears do not impinge upon or contact the track when the vertical gear is translated relative to the track. For instance, the spacing between the teeth of track 840 provides sufficient clearance for the teeth of the vertical drive gear 145 to pass between the gaps between the teeth of track 840 when the vertical drive gear translates horizontally along a line that is parallel to the axis of rotation of the vertical drive gear 145. More specifically, the vertical drive gear and the track may be configured and positioned so that the addendum circle of the vertical drive gear 145 overlaps with the addendum line of the teeth in the track 840. While the addendum circle of the drive gear overlaps the addendum line of the track, the teeth of the gear are configured and oriented so that the vertical drive gear passes through the gaps between teeth in the track 840.

Ex. 1001, 20:55–21:5

The '632 Patent Is Focused on Improving Efficiency

BACKGROUND

Modern material handling systems, such as those used in mail-order warehouses, supply chain distribution centers, and custom-order manufacturing facilities, face significant challenges in responding to requests for inventory articles. In their incipency, enterprises will generally invest in a level of automation that is at least adequate for current needs. As the scale of an inventory management system expands to accommodate a greater number and variety of articles, however, so too does the cost and complexity of operating it to simultaneously complete the packing, storing, replenishment, and other inventory management tasks for which it is intended.

Ex. 1001, 1:17-46

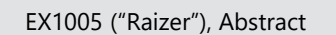
Failure to efficiently utilize resources such as space, equipment, and manpower in an inventory management facility results in lower throughput, longer response times, and a growing backlog of unfinished tasks. Greater efficiency may often be achieved, for a time, by incrementally expanding the capacity of the facility's existing automation infrastructure, particularly when that expansion follows a well-conceived plan for growth. Sooner or later, however, a point of diminishing returns is encountered. That is, the achievement of further gains in capacity and/or functionality eventually becomes cost prohibitive as compared to available alternatives, if such gains can be realized at all. When that point of diminishing returns is reached, a facility operator may be forced to abandon pre-existing material handling infrastructure and to replace that infrastructure with a completely new automation platform.

Ex. 1001, 1:17-46

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DEMONSTRATIVE EXHIBIT – NOT EVIDENCE



Raizer Focuses on Cheap Retrofitting for Small/Medium Businesses

Raizer's Background and Summary:

[0004] An automatic warehouse solution would provide an answer to many of these issues. However, there are many constraints that are preventing SMWs from implementing current solutions, including:

[0005] 1. The requirement of a large capital equipment investment.

[0006] 2. Poor modularity—Prior art automatic solutions require rigorous space and functionality design prior to initialization. For example, if a business needs to reorganize the warehouse area/facility, it requires a very large effort to relocate a crane which runs on specific rails in a specific pit inside the floor.

EX1005, [0004], [0005] [0006]

[0015] It is therefore a purpose of the present invention to provide an automatic warehouse system that is suitable for small and medium sized warehouses.

[0016] It is another purpose of the present invention to provide an automatic warehouse system that can be relatively inexpensively and easily added to existing warehouses operated by businesses.

[0023] The modular architecture of the system allows integrating with an already in-use facility with a high level of implementation flexibility and ongoing scalability.

EX1005, [0015], [0016], [0023]

Sur-Reply, 3, 8–10; POR, 1–3, 10, 26; See also EX1003, ¶178

Raizer Focuses on Cheap Retrofitting for Small/Medium Businesses

Petitioner's Expert, Dr. Spenko, Also Agrees:

[0081] Unlike existing systems, the system of the invention is designed to “plug and play” in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse. The system of the invention is capable to be part of world trend called RAAS (Robot As A Service), the rails, servers and software of the system are sold to the owner of the warehouse but some or all of the robots are leased or rented providing great flexibility to add or remove robots from the system as requirements change. Thus, the capital equipment investment for a small and medium warehouse (SMW) would be a fraction of the cost of the most modest automatic warehouse solution available today.

[0086] 3. Picking Station: The picking station is a sorting work-station where a human worker is guided by the system to efficiently handle several orders concurrently. A terminal screen and indication lights assist the human worker to either pick or put away the merchandise in a very high output while keep its work very accurate in a safe, quiet, and comfortable work-space. The structural components of the picking station are generally those that were present in the warehouse prior to retrofitting the warehouse with the system of the invention but the picking station software is dedicated to interface with the new system.

EX1005, [0086]

Q. So, okay, if you take Raizer as disclosed, we know that one of its priorities we went through is to be able to be retrofitting a prior warehouse, right?

A. Right.

EX1005, [0081]; EX2006, 97:25–98:4

Sur-Reply, 3, 8–10; POR, 1–3, 10, 26; See also EX1003, ¶178

Raizer's Efficient, Low-Cost Navigation *Avoids* Congestion

[0079] Some of the features of the invention that makes the system unlike existing systems are:

[0080] The robots in the system of the invention use "anchor point navigation". That is they use less accurate sensing and motions when travelling on the floor in order to arrive at the designated destination as rapidly and efficiently as possible and employ dedicated algorithms and more precise sensing only when near anchor points, i.e. fixed specific locations in the warehouse such as terminals (locations at which the robot leaves the floor and climbs a vertical rail of the shelving system), picking stations, and battery charging stations. This feature provides significant savings in energy and load on the sensor and navigation system since the robot has to check exactly where it is only when approaching its destination.

EX1005,[0079], [0080]

[0098] Embodiments of the system comprise software that enables advanced capabilities such as realization of Internet of Things (IoT) scenarios. For example, System components will be able to identify, connect and cooperate with other IoT enabled devices like automated hauling devices, smart entry gates and doors, automatic counting & measure systems, cleaning robots and other warehouse IoT participants. the system of the invention is designated as a self-learning system where, for example, algorithm can track the movement of the robots and organize the routes of traffic in and around the warehouse to reduce congestion and prevent "traffic jams" when the robots are busy filling orders. All of these scenarios are possible without any human intervention and relying on accumulated data which collected as a routine daily basis.

EX1005, [0098]

Sur-Reply, 3, 8–10; POR, 1–3, 10; See also EX2007, ¶¶ 64, 77, 98

Overview of Hangzhou

(19) National Intellectual Property Administration of the People's Republic of China

(12) Patent Application for Invention

(10) Application Publication No. CN 109987366 A
(43) Application Publication Date July 9, 2019

(21) Application No. 201910036500.3

(22) Application Date January 15, 2019

(71) Applicant Hangzhou Dachuan Intelligent Technology Co., Ltd.

Address Working Station 014, Floor 2, Building 4, No 1, Street 8, Economic and Technological Development Zone, Hangzhou, Zhejiang Province, 310018

(72) Inventors Yuerong ZHAO, Meiyuan LIU

(74) Patent Agency Shanghai Jingsheng Intellectual Property Agency Co., Ltd. 31253

Agent Ziling FENG

(51) Int. Cl.
B65G 1/04 (January 2006)

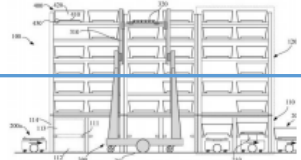
7 pages of claims, 19 pages of description, and 8 pages of drawings

(54) Title of the Invention
UNMANNED WAREHOUSING SYSTEM AND INBOUND AND OUTBOUND METHOD THEREFOR

(57) Abstract
Disclosed in the present invention are an unmanned warehousing system and an inbound and outbound method therefor, which solve the problems of complex deployment, inconvenient maintenance, and high cost of the existing system. In an embodiment of the system, a two-layer channel support frame is provided below a shelf, wherein a lower layer is used to automatically guide a trolley to pass through, an upper layer is used for the temporary cache or passage of a standardized container, and an interlayer support plate runs through along the length or width direction of the entire shelf. When an outbound process of items is implemented, a stacking vehicle automatically travels to a designated shelf and aligns with the same, and the standardized container on the shelf is picked up by means of a pickup mechanism. Then, the container is lowered onto the upper layer of the support frame to cache the container on the support plate. Subsequently, an auto-guided trolley travels through the lower layer

CN 109987366 A

Petitioners' Exhibit 1006
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(54) Title of the Invention

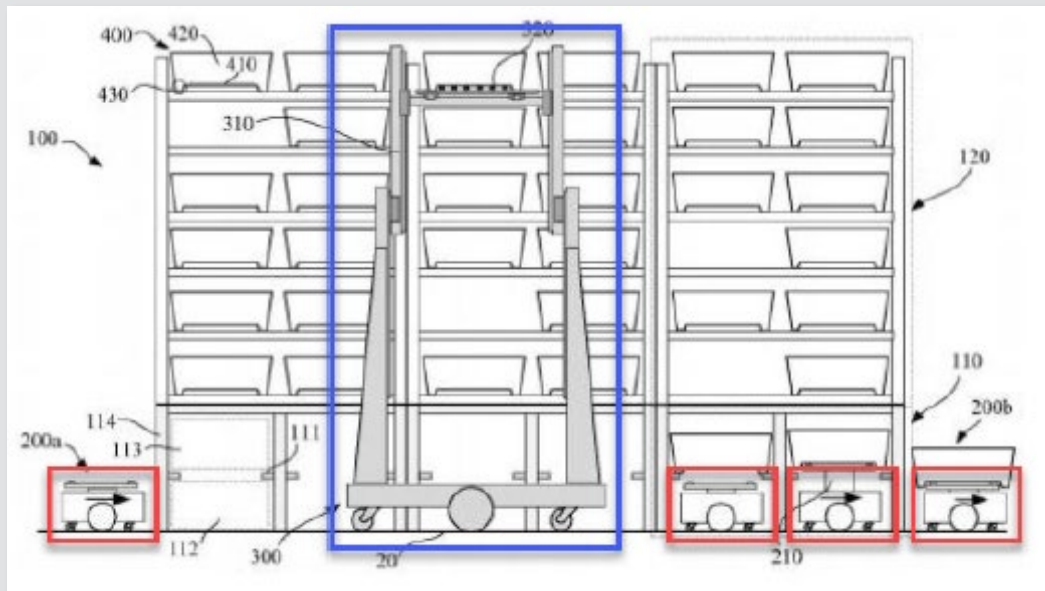
UNMANNED WAREHOUSING SYSTEM AND INBOUND AND OUTBOUND METHOD THEREFOR

(57) Abstract

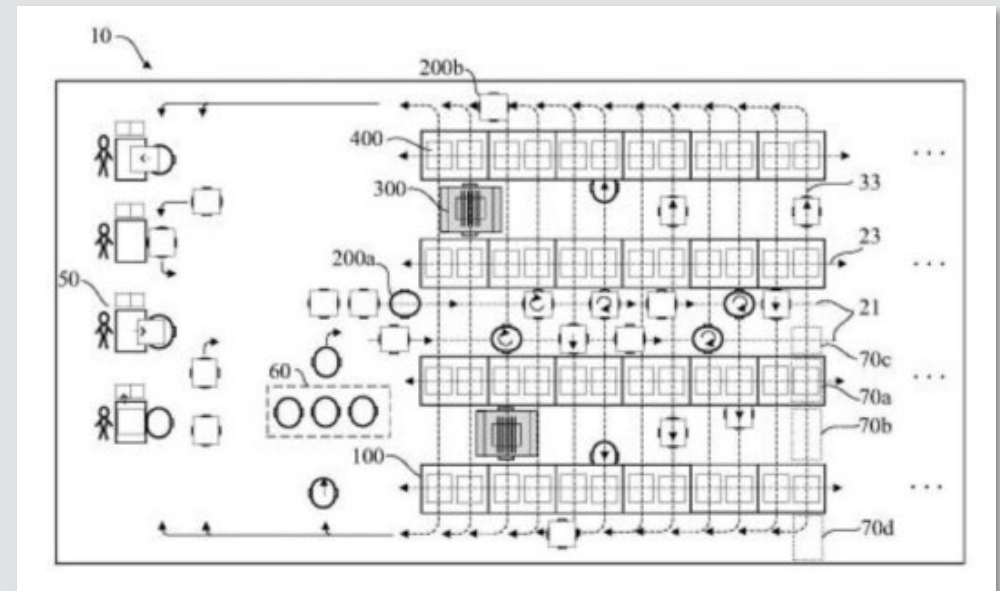
Disclosed in the present invention are an unmanned warehousing system and an inbound and outbound method therefor, which solve the problems of complex deployment, inconvenient maintenance, and high cost of the existing system. In an embodiment of the system, a two-layer channel support frame is provided below a shelf, wherein a lower layer is used to automatically guide a trolley to pass through, an upper layer is used for the temporary cache or passage of a standardized container, and an interlayer support plate runs through along the length or width direction of the entire shelf. When an outbound process of items is implemented, a stacking vehicle automatically travels to a designated shelf and aligns with the same, and the standardized container on the shelf is picked up by means of a pickup mechanism. Then, the container is lowered onto the upper layer of the support frame to cache the container on the support plate. Subsequently, an auto-guided trolley travels through the lower layer

of the support frame to a position below the container to separate the container from the support member by hoisting the container before entering a sorting site through a channel and a laneway. The steps are reversed for an inbound process. This system is easy to deploy, convenient to maintain, and low in cost. A large number of robots operate concurrently by means of a dispatching system, so that the overall efficiency is high.

Hangzhou Uses Two Robots With Different Functions



POR, 15; EX1006, Fig. 2



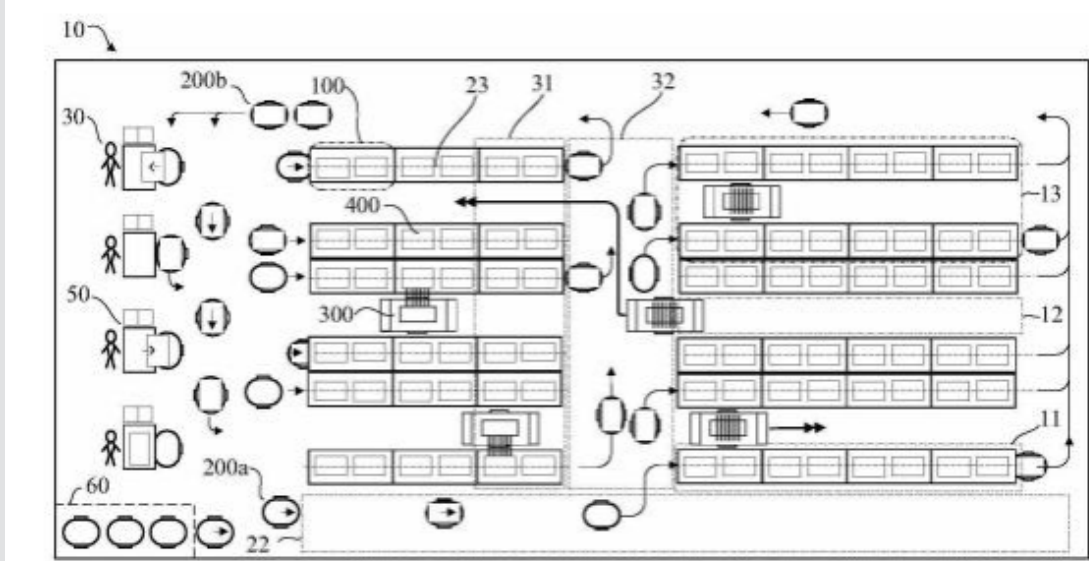
POR, 16; EX1006, Fig. 10

Hangzhou's invention is designed to provide an unmanned warehousing system using a multi-type robot approach with (1) ground-based symmetrical **trolley robots** wherein the trolley robots travel in a channel support frame to retrieve packages from the cache space above, and (2) large **stacker robots** that pick up the standardized containers from the shelf, and lowers and deposits the containers to "the upper layer of the support frame to cache the container on the support plate."

POR, 14

Sur-Reply, 3, 8-10; POR, 1, 14-16, 33, 40, 41, 44

Hangzhou's Travel Under Racks *Causes* Congestion, Collisions, and Delay



EX1006, Fig. 1; POR, 33

[0059] Potential collisions may occur since the stacking device and auto-guided trolleys carrying standardized containers need to use the cache space below shelf rows. In addition to running in a time-shared manner at the dispatch level, auto-guided trolleys 200 also run an obstacle avoidance algorithm to ensure safety and reliability. Generally speaking, stacking vehicle path planning has a higher priority. Therefore, auto-guided trolley path planning will be adjusted based on the information on stacking vehicle path planning. For instance, when an auto-guided trolley carrying standardized containers drives along the row channel below a shelf row and is about to enter the next channel support frame ahead, the auto-guided trolley confirms the absence of obstacles, such as other auto-guided trolleys or standardized containers, in the next channel support frame according to the information obtained via wireless communication and through its sensor system.

EX1006, [0059]

[0063] Below is a basic planning algorithm. Obtain the information on the stacking vehicles and space occupancy on the route ahead from the dispatch control system when an auto-guided trolley 200 has reached the edge of a stacking row laneway 12 the trolley is about to enter. Then conduct an analysis, continuing the calculation if the auto-guided trolley passage space 112 and the cache space 113 opposite to the stacking row laneway 12 allow the trolley to enter to determine whether the time for passing through the stacking row laneway 12 is intersected with the time for stacking vehicles 300 to running through this section of the row laneway. Move forward if there is no intersection. Otherwise, run the algorithm above again after waiting for some time. The algorithm requires a stacking vehicle 300 to release its path planning in the incoming few seconds to the dispatch control system in advance. The auto-guided trolley 200 has more opportunities to cross the row laneway since it takes only a few seconds to pass through the stacking row laneway 12, and the stacking vehicle 300 does not occupy and pass through the position for a relatively long time. The whole system can operate with higher efficiency.

EX1006, [0063]

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- E The Dependent Claims

Petitioner Presents One Obviousness Ground

Ground	Challenged Claims	References
I (103)	1, 3-12, 14, 23-27	Raizer and Hangzhou

The Proposed Combination

A POSITA would have understood that combining the *Raizer* autonomous robots, which move both horizontally and vertically, with *Hangzhou's* teaching of running such robots in passage spaces beneath the shelves, would achieve maximum flexibility in maneuvering the robots along the warehouse floor and eliminating bottlenecks. (Ex. 1003, ¶¶109-110). A POSITA would have also understood that the vertical travel flexibility of *Raizer's* robots eliminates the need for *Hangzhou's* stacking vehicles because *Raizer's* robots themselves can pick and place containers on upper shelves, thereby making this combination even more useful. (Ex. 1003, ¶111).

Petition, 7

The straightforward nature of the proposed combination is the epitome of reasonableness—*Raizer's* robots, which *Raizer* discloses as being able to navigate anywhere along the floor of a warehouse, with *Hangzhou's* teaching of routing such robots under the shelves of the warehouse and across aisles.

Reply, 5, 6

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The Disputed Issues

- 1 A POSITA would not have combined Raizer and Hangzhou
- 2 Petitioner fails to articulate a sufficient motivation to incorporate Hangzhou's travel underneath shelves into Raizer
- 3 Petitioner fails to articulate why a POSITA would have had a reasonable expectation of success when combining Hangzhou's travel underneath shelves with Raizer

The Disputed Issues

- 1** A POSITA would not have combined Raizer and Hangzhou
- 2 Petitioner fails to articulate a sufficient motivation to incorporate Hangzhou's travel underneath shelves into Raizer
- 3 Petitioner fails to articulate why a POSITA would have had a reasonable expectation of success when combining Hangzhou's travel underneath shelves with Raizer

Petitioner's Alleged Motivation to Combine

Petitioner Argues in Petition:

1. *Motivation to Combine*

A POSITA would have been motivated to combine *Raizer* and *Hangzhou* (Ex. 1003, ¶¶100-116).

A POSITA at the time of the assumed priority date of the '632 patent was well aware of the design need for autonomous robot warehouse systems to decrease congestion, avoid autonomous robot collisions, and maximize space utilization. (Ex. 1003, ¶¶46-53, ¶107). A POSITA would rely on a reference, such as *Raizer*, that focused on improving automated systems for warehouse management. (Ex. 1003, ¶¶102-103). *Raizer* discloses autonomous robots configured to travel along the horizontal floor of a warehouse but also along “a network of vertical and horizontal rails” that may be attached to most any type of shelving structure. (Ex. 1003, ¶¶103-104).

Pet., 6

Petitioner Repeats in Reply:

A POSITA was well aware of the design need for autonomous robot warehouse systems to decrease congestion, avoid autonomous robot collisions, and maximize space utilization. Petition, 6; Ex. 1003, ¶¶105-107. A POSITA would have relied on *Raizer* that focused on improving automated systems for warehouse management and disclosed autonomous robots configured to travel both horizontally along the floor of the warehouse and along a network of vertical and horizontal rails. Petition, 6-7; Ex. 1003, ¶¶103-104.

Reply, 2-3

Sur-Reply, 1-3, 12, 13; POR, 2, 21-26

The Problems OPEX Solved

BACKGROUND

Modern material handling systems, such as those used in mail-order warehouses, supply chain distribution centers, and custom-order manufacturing facilities, face significant challenges in responding to requests for inventory articles. In their incipency, enterprises will generally invest in a level of automation that is at least adequate for current needs. As the scale of an inventory management system expands to accommodate a greater number and variety of articles, however, so too does the cost and complexity of operating it to simultaneously complete the packing, storing, replenishment, and other inventory management tasks for which it is intended.

Ex. 1001, 1:17-46

Failure to efficiently utilize resources such as space, equipment, and manpower in an inventory management facility results in lower throughput, longer response times, and a growing backlog of unfinished tasks. Greater efficiency may often be achieved, for a time, by incrementally expanding the capacity of the facility's existing automation infrastructure, particularly when that expansion follows a well-conceived plan for growth. Sooner or later, however, a point of diminishing returns is encountered. That is, the achievement of further gains in capacity and/or functionality eventually becomes cost prohibitive as compared to available alternatives, if such gains can be realized at all. When that point of diminishing returns is reached, a facility operator may be forced to abandon pre-existing material handling infrastructure and to replace that infrastructure with a completely new automation platform.

Ex. 1001, 1:17-46

Traveling Under Racks *Increases* Congestion, Collisions, and Delay, Contrary To Petitioner's Purported Motivation

Raizer Already Avoids Congestion, Traffic Jams, and Collisions

S.-Tek Sys., LLC v. Engineered Corrosion Sols., LLC, 748 Fed. Appx. 1003, 1007 (Fed. Cir. 2018)



South-Tek only argued that a person of ordinary skill would have been motivated to use Wood's drain to allow water to drain from Viking's system. Viking's system already includes a drum drip drain that serves this purpose. Given the *redundant functions* of Viking's drum drip and Wood's condensate drain, the Board found a person of ordinary skill would not have been motivated to add a condensate drain to Viking in addition to the system's drum drip drain.

[0098] Embodiments of the system comprise software that enables advanced capabilities such as realization of Internet of Things (IoT) scenarios. For example, System components will be able to identify, connect and cooperate with other IoT enabled devices like automated hauling devices, smart entry gates and doors, automatic counting & measure systems, cleaning robots and other warehouse IoT participants. the system of the invention is designated as a self-learning system where, for example, algorithm can track the movement of the robots and organize the routes of traffic in and around the warehouse to reduce congestion and prevent “traffic jams” when the robots are busy filling orders. All of these scenarios are possible without any human intervention and relying on accumulated data which collected as a routine daily basis.

EX1005, [0098]

Sur-Reply, 3, 12–13; POR, 1–3, 32

Raizer *Already Uses* Space Efficiently

PO pointed out:

Second, the Petition fails to detail the motivation to combine or any reasonable expectation of success in combining Raizer and Hangzhou. Petitioner points to the generalized automated warehouse goals to “reduce congestion, avoid traffic jams, [and] make more efficient use of space, and to allow Raizer’s robots to ‘choose among all possible paths,’” despite other priorities highlighted in the relied upon references. Petition, 9. This is insufficient to establish that a POSITA would have had a motivation to combine Raizer and Hangzhou.

Raizer describes:

[0031] In embodiments of the system of the invention the gripper mechanism comprises an array of micro-pallet lifters, wherein each micro-pallet lifter in the array can be operated independently of the others thereby allowing the robot to handle different sized boxes and maximizing the efficient use of shelf space.

[0105] FIG. 5E is a schematic top view of robot 10 showing the micro-pallet lifters 32. The embodiment of robot 10 shown in the figures has four micro-pallet lifters 32 each comprising three tines 162. Each micro-pallet lifter can be operated independently of the others thereby allowing the robot to handle different sized boxes and maximizing the efficient use of shelf space since the boxes can be stacked on the shelves in stacks that are very close to each other. There is no need to leave space between the stacks to introduce the arm like appendages employed on conventional robots to grab the boxes on either side in order to lift and insert or remove them from the shelf.

Petitioner's Alleged Motivation Is Constructed From Hindsight Bias

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007)



A factfinder should be aware, of course, of the *distortion* caused by *hindsight bias* and must be cautious of arguments reliant upon *ex post* reasoning.

Petitioner Argues in Reply:

The Petition set forth a goal shared by both *Raizer* and *Hangzhou*—creating an efficient automated warehouse system capable of reducing congestion and avoiding traffic jams. See Ex. 1005, ¶[0098]; Ex. 1006, ¶[0076]; Petition, 6-8, 20, 47; Ex. 1003, ¶102.

Reply, 13

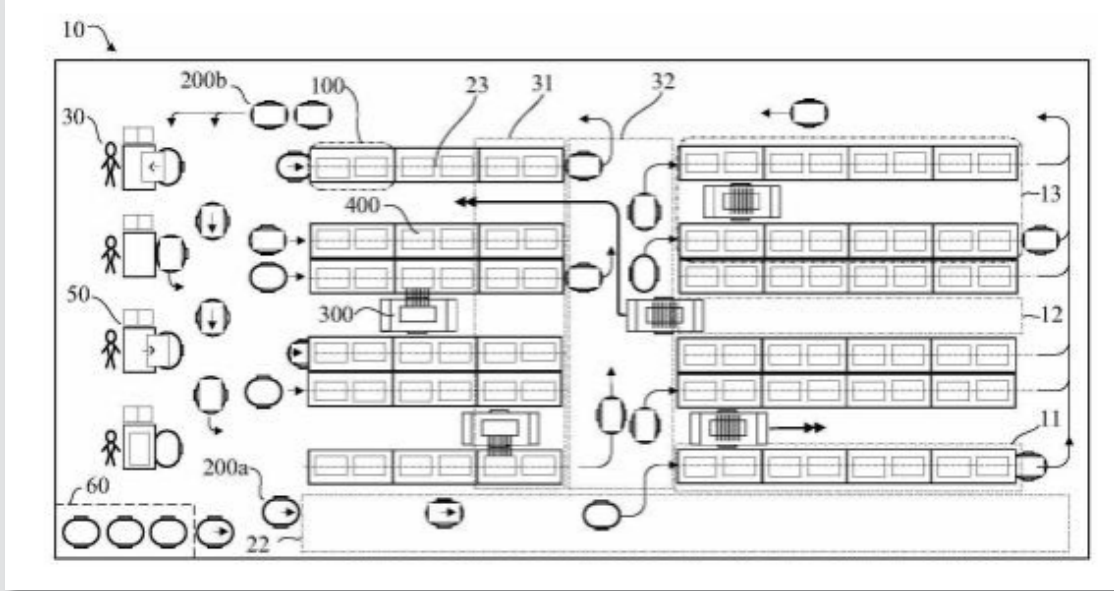
Dr. Derby (Petitioner's expert) claims:

108. *Hangzhou* both identifies and provides a solution to the problem to be solved by the '632 patent (e.g., improved efficient utilization of resources such as space, equipment, and manpower and collision avoidance) by providing “an unmanned warehousing system” based on “mobile robots” and “caching spaces” “involving a storage sorting system,” where “a two-layer channel support frame is provided below a shelf,” such that “[the] lower layer is used to automatically guide a trolley to pass through.” (Ex. 1006, Abstract, ¶[0035]). *Hangzhou* discloses that “an auto-guided trolley 200 preferentially travels in column laneways 32 and in auto-guided trolley passage spaces 112,” i.e., under the shelf. (Ex. 1006, ¶[0048]). *Hangzhou* discloses that, to avoid collisions, “auto-guided trolleys carrying standardized containers” “use the cache space below shelf rows,” and “run obstacle avoidance algorithms.” (Ex. 1006, ¶[0059]).

Ex. 1003, ¶108

Sur-Reply, 7, 8; POR, 23-26

Hangzhou's Travel Under Racks Causes Congestion, Collisions, and Delay



EX1006, Fig. 1; POR, 33

[0059] Potential collisions may occur since the stacking device and auto-guided trolleys carrying standardized containers need to use the cache space below shelf rows. In addition to running in a time-shared manner at the dispatch level, auto-guided trolleys 200 also run an obstacle avoidance algorithm to ensure safety and reliability. Generally speaking, stacking vehicle path planning has a higher priority. Therefore, auto-guided trolley path planning will be adjusted based on the information on stacking vehicle path planning. For instance, when an auto-guided trolley carrying standardized containers drives along the row channel below a shelf row and is about to enter the next channel support frame ahead, the auto-guided trolley confirms the absence of obstacles, such as other auto-guided trolleys or standardized containers, in the next channel support frame according to the information obtained via wireless communication and through its sensor system.

EX1006, [0059]

[0063] Below is a basic planning algorithm. Obtain the information on the stacking vehicles and space occupancy on the route ahead from the dispatch control system when an auto-guided trolley 200 has reached the edge of a stacking row laneway 12 the trolley is about to enter. Then conduct an analysis, continuing the calculation if the auto-guided trolley passage space 112 and the cache space 113 opposite to the stacking row laneway 12 allow the trolley to enter to determine whether the time for passing through the stacking row laneway 12 is intersected with the time for stacking vehicles 300 to running through this section of the row laneway. Move forward if there is no intersection. Otherwise, run the algorithm above again after waiting for some time. The algorithm requires a stacking vehicle 300 to release its path planning in the incoming few seconds to the dispatch control system in advance. The auto-guided trolley 200 has more opportunities to cross the row laneway since it takes only a few seconds to pass through the stacking row laneway 12, and the stacking vehicle 300 does not occupy and pass through the position for a relatively long time. The whole system can operate with higher efficiency.

EX1006, [0063]

Traveling Under Racks *Increases* Cost, *Contrary* to Raizer's Goal Of Being Low Cost

Raizer's Goal Is to Minimize Cost

[0002] The world of logistics is a never ending challenge of improving efficiency and **reducing cost**. The largest **costs** are associated with human labor and storage capacity. In the early 1980s automation based solutions began to be implemented in the logistics arena. Since then these solutions have greatly improved, **dramatically reducing operational costs** and improving productivity. The caveat is that these automatic solutions come at a great expense in facility and equipment, making these types of solutions available only to companies who can **afford the cost** and sustain the ROI.

EX1005, [0002]

[0004] An automatic warehouse solution would provide an answer to many of these issues. However, there are many constraints that are preventing SMWs from implementing current solutions, including:

[0005] 1. The requirement of a **large capital equipment investment**.

EX1005, [0004], [0005]

[0016] It is another purpose of the present invention to provide an automatic warehouse system that can be relatively **inexpensively** and easily added to existing warehouses operated by businesses.

EX1005, [0016]

[0081] Unlike existing systems, the system of the invention is designed to “plug and play” in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse. The system of the invention is capable to be part of world trend called RAAS (Robot As A Service), the rails, servers and software of the system are sold to the owner of the warehouse but some or all of the robots are leased or rented providing great flexibility to add or remove robots from the system as requirements change. **Thus, the capital equipment investment for a small and medium warehouse (SMW) would be a fraction of the cost of the most modest automatic warehouse solution available today.**

EX1005, [0081]

Sur-Reply, 3, 8–10; POR, 1–3, 10, 26; See also EX1003, 178

Raizer Requires Anchor Point Navigation, Which Minimizes Cost

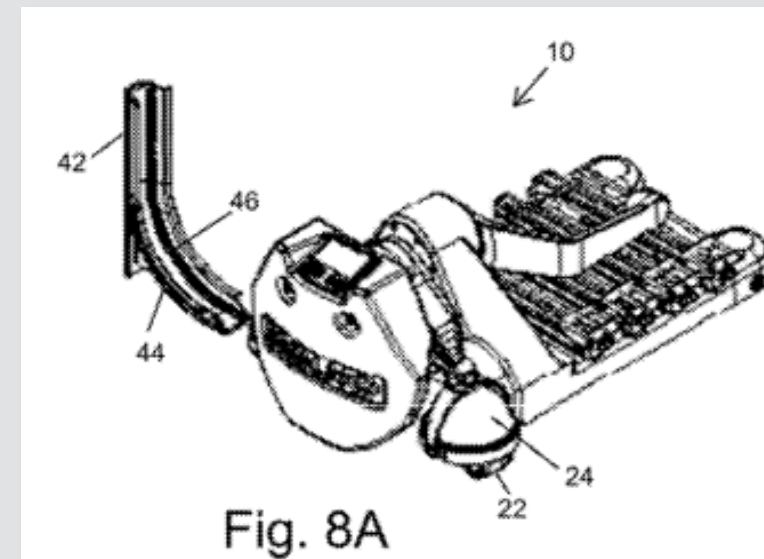
[0079] Some of the features of the invention that makes the system unlike existing systems are:

[0080] The robots in the system of the invention use “anchor point navigation”. That is they use less accurate sensing and motions when travelling on the floor in order to arrive at the designated destination as rapidly and efficiently as possible and employ dedicated algorithms and more precise sensing only when near anchor points, i.e. fixed specific locations in the warehouse such as terminals (locations at which the robot leaves the floor and climbs a vertical rail of the shelving system), picking stations, and battery charging stations. This feature provides significant savings in energy and load on the sensor and navigation system since the robot has to check exactly where it is only when approaching its destination.

EX1005, [0079], [0080]

[0115] In FIG. 8A the robot 10 has used the set of on-board sensors to travel using anchor point navigation to the designated vertical rail 42 that it has been instructed to ascend to reach one of the shelves in the warehouse. A sensor, e.g. a RFID sensor, that is activated as robot 10 approaches the designated terminal 44 stops the robot at an exact position relative to terminal 44. The electric steering motors in the drive and steering units 24 are activated to turn both front wheels 22 by ninety degrees so that they are exactly facing the “U”-shaped channel 46 in terminal 44.

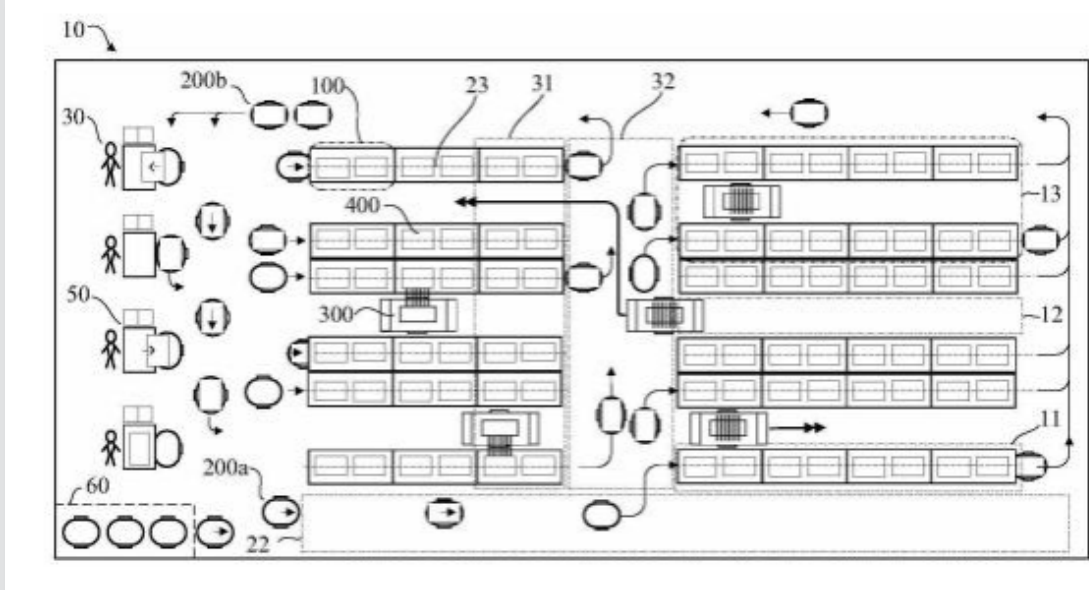
EX1005, [0115]



EX1005, Fig. 8A

POR, 13, 52-54

Traveling Beneath Shelves Requires More Accurate, *Expensive* Sensing



EX1006, Fig. 1; POR, 33

[0059] Potential collisions may occur since the stacking device and auto-guided trolleys carrying standardized containers need to use the cache space below shelf rows. In addition to running in a time-shared manner at the dispatch level, auto-guided trolleys 200 also run an obstacle avoidance algorithm to ensure safety and reliability. Generally speaking, stacking vehicle path planning has a higher priority. Therefore, auto-guided trolley path planning will be adjusted based on the information on stacking vehicle path planning. For instance, when an auto-guided trolley carrying standardized containers drives along the row channel below a shelf row and is about to enter the next channel support frame ahead, the auto-guided trolley confirms the absence of obstacles, such as other auto-guided trolleys or standardized containers, in the next channel support frame according to the information obtained via wireless communication and through its sensor system.

EX1006, [0059]

[0063] Below is a basic planning algorithm. Obtain the information on the stacking vehicles and space occupancy on the route ahead from the dispatch control system when an auto-guided trolley 200 has reached the edge of a stacking row laneway 12 the trolley is about to enter. Then conduct an analysis, continuing the calculation if the auto-guided trolley passage space 112 and the cache space 113 opposite to the stacking row laneway 12 allow the trolley to enter to determine whether the time for passing through the stacking row laneway 12 is intersected with the time for stacking vehicles 300 to running through this section of the row laneway. Move forward if there is no intersection. Otherwise, run the algorithm above again after waiting for some time. The algorithm requires a stacking vehicle 300 to release its path planning in the incoming few seconds to the dispatch control system in advance. The auto-guided trolley 200 has more opportunities to cross the row laneway since it takes only a few seconds to pass through the stacking row laneway 12, and the stacking vehicle 300 does not occupy and pass through the position for a relatively long time. The whole system can operate with higher efficiency.

EX1006, [0063]

POR, 16–17, 52–55

The Combination Destroys Raizer's Anchor Point Navigation

Dr. Singhose (PO's Expert) Explained:

62. During the first stage of Raizer's navigation, when the robots drive horizontally on the ground, Raizer's robots use "anchor point navigation." Because Raizer's robots use "anchor point navigation," they "use *less accurate sensing and motions when travelling on the floor* in order to arrive at the designated destination as rapidly and efficiently as possible..." [EX1005, RAIZER ¶80.]

63. During the second stage of Raizer's navigation, when the robots climb up vertically along the rails and travel horizontally along the shelves, the robots switch over to a more expensive, complex, and accurate navigation control system. Specifically, Raizer's robots "employ dedicated algorithms and more precise sensing only when near anchor points, i.e. fixed specific locations in the warehouse such as terminals (locations at which the robot leaves the floor and climbs a vertical rail of the shelving system), picking stations, and battery charging stations." [EX1005, RAIZER ¶80.]

EX2007, ¶¶62, 63

98. Finally, a POSITA would also expect failure from collisions occurring as the Raizer robots attempt to go under and come out from under the storage racks. Raizer's anchor point navigation is simply not designed to avoid collisions going under and coming out of the storage racks. To avoid this failure mode, a POSITA would know that a more complex and expensive navigation system would have to be developed. This required alteration would destroy one of the main functions and inventive aspects of Raizer.

EX2007, ¶98

POR, 13, 20, 52-54

More Precise Navigation Interferes With Raizer's Stated Purpose

**Medtronic, Inc. v. Teleflex Innovations SARL,
69 F.4th 1341, 1349–50 (Fed. Cir. 2023)**



Indeed, we have held it was *error* for the Board to ignore evidence that a proposed modification would *interfere* with a reference's *stated purpose*.

**A POSA Would Not Have Been Motivated to
Add The Option to Travel Under Racks to
Raizer Because Doing So Would Add Cost and
Complexity Contrary to Raizer's Goals, and
Raizer Already Provides Extra Travel Paths as
The Warehouse Expands**

Raizer Focuses on Cheap Retrofitting for Small/Medium Businesses

Raizer's Background and Summary:

[0004] An automatic warehouse solution would provide an answer to many of these issues. However, there are many constraints that are preventing SMWs from implementing current solutions, including:

[0005] 1. The requirement of a large capital equipment investment.

[0006] 2. Poor modularity—Prior art automatic solutions require rigorous space and functionality design prior to initialization. For example, if a business needs to reorganize the warehouse area/facility, it requires a very large effort to relocate a crane which runs on specific rails in a specific pit inside the floor.

EX1005, [0004], [0005] [0006]

[0015] It is therefore a purpose of the present invention to provide an automatic warehouse system that is suitable for small and medium sized warehouses.

[0016] It is another purpose of the present invention to provide an automatic warehouse system that can be relatively inexpensively and easily added to existing warehouses operated by businesses.

[0023] The modular architecture of the system allows integrating with an already in-use facility with a high level of implementation flexibility and ongoing scalability.

EX1005, [0015], [0016], [0023]

Sur-Reply, 3, 8–10; POR, 1–3, 10, 26; See also EX1003, ¶78

Raizer Focuses on Cheap Retrofitting for Small/Medium Businesses

Dr. Spenko (Petitioner's Expert) Also Agrees:

[0081] Unlike existing systems, the system of the invention is designed to “plug and play” in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse. The system of the invention is capable to be part of world trend called RAAS (Robot As A Service), the rails, servers and software of the system are sold to the owner of the warehouse but some or all of the robots are leased or rented providing great flexibility to add or remove robots from the system as requirements change. Thus, the capital equipment investment for a small and medium warehouse (SMW) would be a fraction of the cost of the most modest automatic warehouse solution available today.

Q. So, okay, if you take Raizer as disclosed, we know that one of its priorities we went through is to be able to be retrofitting a prior warehouse, right?

A. Right.

EX1005, [0081]; EX2006, 97:25–98:4

[0086] 3. Picking Station: The picking station is a sorting work-station where a human worker is guided by the system to efficiently handle several orders concurrently. A terminal screen and indication lights assist the human worker to either pick or put away the merchandise in a very high output while keep its work very accurate in a safe, quiet, and comfortable work-space. The structural components of the picking station are generally those that were present in the warehouse prior to retrofitting the warehouse with the system of the invention but the picking station software is dedicated to interface with the new system.

EX1005, [0086]

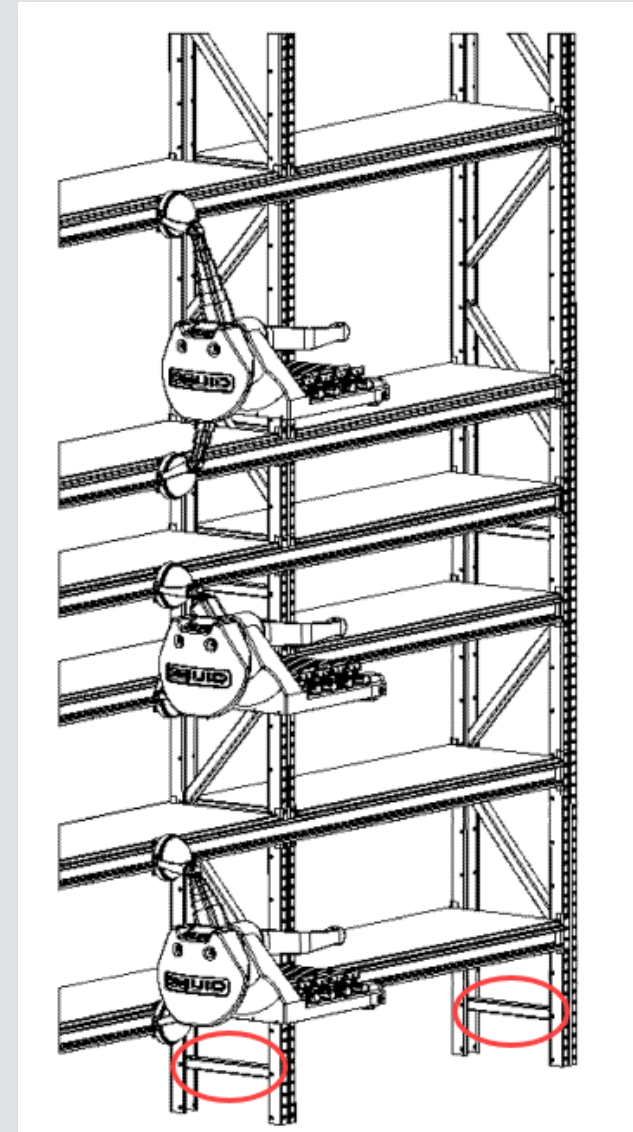
Sur-Reply, 3, 8–10; POR, 1–3, 10, 26; See also EX1003, ¶78

A POSA Knew Travel Under Racks Was *Not* Compatible With All Retrofits

Dr. Singhose (PO's Expert) Explained:

106. Petitioner's proposed modification to allow for travel underneath shelves, such as along a "path ... parallel to the aisle" would require modifications of Raizer that are unacceptable to a POSITA reading Raizer. Petitioner's only proposed modification to satisfying a "path ... parallel to the aisle" is to modify Raizer's storage racks by "installing shelving units with elevated lower shelves to allow robots loaded with containers to travel underneath." [Petition, 7.] Installing new shelving units is incompatible with the teachings of Raizer and, therefore, a POSITA would not make this modification in view of Raizer.

EX2007, T106



EX1005, Fig. 12A POR 31-33

Modifying Shelf Height *Requires* Downtime And Large Capital Expense

Petitioner Argues in Reply:

Reply, 9

Opex provides no explanation as to why modifying *Raizer* with shelving units with elevated lower shelves leads to poor modularity or runs counter to *Raizer*'s goals of adaptability. POR, 31-32. To the contrary, elevating the lower shelves would allow more robots to travel vertically to increase warehouse efficiency. Opex also overlooks clear disclosure in *Raizer* that "the system can obviously be installed in new structures" and is not limited to "retrofit existing warehouses." Ex. 1005, ¶112; see also Ex. 2006, 71:8-21. Indeed, Dr. Singhose confirmed that a POSITA would "have a lot of freedom" in setting shelf height and would clearly set a shelf height in a warehouse based on a combined height of a robot and the item that it carries. Ex. 1009, 49:19-52:3; see also Ex. 2007, ¶94.

Dr. Singhose (PO's Expert) Explained: EX2007. ¶116

Modifying shelf structure would create switching costs for existing warehouses requiring massive capital equipment investment, something *Raizer* explicitly cautions against. [See EX1005, *RAIZER* ¶ 5.] Modifying the shelf structure of a warehouse to have Hangzhou's undershelf travel lanes and guiding channel support frame would also create unacceptable periods of downtime and inflexibility in the system, a problem *Raizer* specifically seeks to solve. [EX1005,

EX1005, [0004]–[0005]; [0007]–[0011]

[0004] An automatic warehouse solution would provide an answer to many of these issues. However, there are many constraints that are preventing SMWs from implementing current solutions, including:

[0005] 1. The requirement of a large capital equipment investment.

[0007] 3. Downtime—Prior art automatic solutions for warehouse management require 3-12 months of "sterile environment" with no disruptions in order to be implemented. That means a business needs to add the cost of either:

[0008] Moving its operation to a temporary facility while implementing; or

[0009] In case of relocation, moving the operation to new location only after implementation; or

[0010] Shutting down the business for the time of implementation.

[0011] 4. Limited flexibility—Most of the prior art systems are designed to a specific output rate in pre-set conditions and products/containers. Thus the systems cannot cope when it is desired to take on a new customer with different size/shape/weight of products/containers. Most prior art systems are not designed to change their output rate dramatically, thus these systems cannot cope with peak times where a business needs to temporary increase its output.

Sur–Reply, 9; POR, 31, 32

Traveling Under Shelves Interferes With Raizer's Stated Purpose

Medtronic, Inc. v. Teleflex Innovations SARL, 69 F.4th 1341, 1349–50 (Fed. Cir. 2023)

Indeed, we have held it was *error* for the Board to ignore evidence that a proposed modification would *interfere* with a reference's *stated purpose*.



Sur-Reply, 8-10; POR, 26

Raizer Does Not Need Additional Horizontal Travel Paths Under the Racks

Petitioner Argues Raizer Needs Additional Travel Paths As It Expands

Petitioner Claims in Petition:

A POSITA would have understood that the vertical travel flexibility of *Raizer's* autonomous robots allows for robust increases in available storage space as shelving units grow taller to take advantage of the full height of a warehouse. (Ex. 1003, ¶111). More autonomous robots would be needed to pick and place packages on these taller shelving units creating a need for new travel ways for the robots to avoid collisions and to reduce congestion. (Ex. 1003, ¶¶105-106).

Pet., 6

Petitioner Reiterates in Reply:

A POSITA would have turned to *Hangzhou* and its teaching of routing autonomous robots in passage spaces beneath the shelves to provide added travel pathways. Petition, 7-9; Ex. 1003, ¶¶108-110. These additional travel pathways are needed as more autonomous robots are added to take advantage of taller shelving units due to increased available storage space. Petition, 6-7; Ex. 1003, ¶106. Indeed, elevating shelves for under-shelf robot travel was known. Petition, 6-7; Ex. 1003,

Reply, 3

Dr. Derby (Petitioner's Expert) Cites One Paragraph in Raizer:

105. A person of ordinary skill in the art at the time of the assumed priority date of the '632 patent was well aware of the design need to increase the number of travel ways that are available to autonomous robot vehicles in a warehouse environment such as that disclosed by the *Raizer* in order to decrease congestion and prevent traffic jams. To the extent that *Raizer* were construed as failing to disclose movement of its autonomous robots under its rows of shelves, a person of ordinary skill in the art would have been motivated to consider taking advantage of the mobility of the autonomous robots by considering different travel ways to avoid congestion. *Raizer* also discloses that the autonomous robots and rail system can be implemented in warehouses having a variety of shelving designs as the system is not dependent on the specific shelf structure. (Ex. 1005, ¶[0081]).

106. Considering congestion from a mathematical perspective, given a fixed number of autonomous robot vehicles, increasing the number of travel ways available implies reducing the probability that multiple autonomous robot vehicles use the same travel way, thereby reducing the probability that two autonomous robot vehicles block one another. Thus, increasing the number of travel ways is a logical approach that the skilled person would readily consider.

EX1003, ¶¶105, 106; Sur-Reply, 2, 3; POR, 32-34

Petitioner's Only Cite To Raizer Says Nothing About Adding Paths

[0081] Unlike existing systems, the system of the invention is designed to “plug and play” in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse. The system of the invention is capable to be part of world trend called RAAS (Robot As A Service), the rails, servers and software of the system are sold to the owner of the warehouse but some or all of the robots are leased or rented providing great flexibility to add or remove robots from the system as requirements change. Thus, the capital equipment investment for a small and medium warehouse (SMW) would be a fraction of the cost of the most modest automatic warehouse solution available today.

EX1005, [0081]

Sur-Reply, 3; POR, 32–34

Raizer Already Adds Additional Travel Paths As It Expands

Raizer Claims

each robot comprises: components configured to engage and mechanically secure the two front driving wheels to the vertical and horizontal rails allowing the robot to travel on the network of rails;

EX1005, [0142]

Dr. Singhose (PO's Expert) Explained

120. Raizer, in contrast to Hangzhou's method of spacing out multi-type robots across the floor, avoids collisions by using only one type of robot and distributes them vertically on shelves to reduce floor congestion and avoid collisions. This strategy also reduces mapping issues by eliminating the need to go under shelves. As shown below in Figure 12A, Raizer's robots travel on the face of the shelves and can travel above and below each other to avoid colliding. This operational strategy exploits the three-dimensional nature of automated warehouses and greatly reduces floor congestion.

EX2007, [0120]

Raizer Depicts

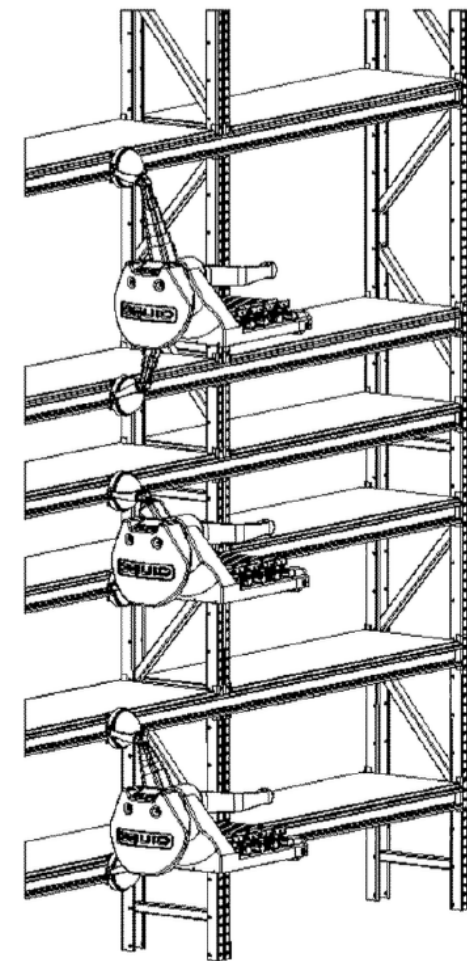


Fig. 12A

EX1005, Fig. 12A

POR, 34

Hangzhou *Disparages* Single-Robot-Type
Systems Like Raizer, and Every Reference
Petitioner Points to That Travels Under The
Racks Does So Using Multiple-Robot-Types

Petitioner Combines Hangzhou's Travel Path With Raizer's Single Robot

¶¶109-111. A “POSITA would have also understood that the vertical travel flexibility of *Raizer's* robots eliminates the need for *Hangzhou's* stacking vehicles because *Raizer's* robots themselves can pick and place containers on upper shelves, thereby making this combination even more useful.” *Id.*

Reply, 2

Sur-Reply, 10–12; POR 15

Prior Art Lacks Single-Type Robots Moving Horizontally, Vertically, and Below Racks

Petitioner overlooks or does not appreciate the difficulty in implementing the '632 Patent's use of a single robot to move horizontally and vertically, as well as under the shelves. Indeed, as acknowledged by Dr. Spenko, even the "state of the art" presented by Petitioner (EX1008) utilizes a two-robot system, similar to Hangzhou, one for horizontal movement, and a different one for vertical movement. *See* EX2006, 79:6-80:22.

Hangzhou Claims a Two-Robot Solution Is Superior

Hangzhou

[0003] An automated warehousing solution using mobile robots makes less site modification than those with the integrated shelves and shuttle vehicles, making it easier to deploy and realize high-concurrency operations, which results in its popularity in some situations. Such a solution can be classified into a single-type mobile robot solution and a multi-type robot collaboration solution including at least one mobile robot, depending on the type of mobile robots used.

[0004] The solution adopting single-type mobile robots is advantaged by easy modularization and standardization, so that a faulty device unit can be replaced quickly. Amazon's Kiva robot system is a typical example. Patent US7826919 introduces using a submersible auto-navigation trolley to move unitized shelves, realizing "goods to people." However, in the solution, the whole shelf is handled, requiring each mobile trolley to be provided with a high load capacity, which greatly increases the device cost. In addition, the shelf should not be too high or it will easily tip over during movement, which restricts the improvement of warehousing capacity. The solution in Patent JP2004277062 owned by Panasonic in Japan is to use single-type mobile robots with lifting platforms and fork means to connect with shelves. However, the number of shelf layers generally does not exceed three to ensure robot movement stability, which limits the storage capacity of warehouses together with the high cost of a single mobile robot.

[0005] The multi-type robot collaboration solution including at least one mobile robot can take advantage of different robots' strengths. The solution in Patent US10138060 owned by Amazon

Sur-Reply, 7; EX1006, [0003]–[0005]

Sur-Reply, 10–12; POR 15, 25, 40

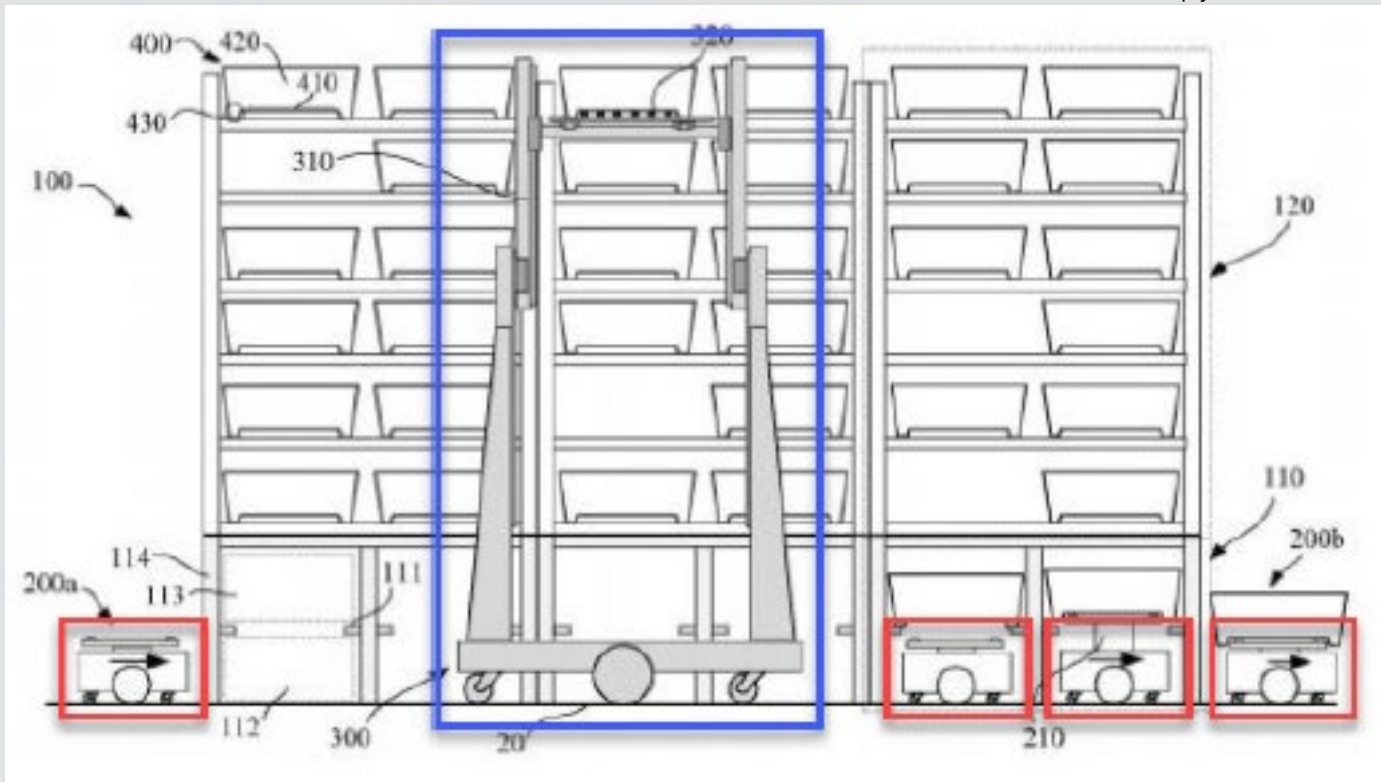
Hangzhou Teaches a Two Robot Solution: One Travels Horizontal and One Vertical

Sur-Reply

system. More importantly, *Hangzhou* implements a multi-robot system approach after explicitly categorizing the solutions available in the art as “a single type mobile solution and a multiple type robot collaboration solution”; therefore, *Hangzhou* expresses a preference for and teaches towards a multi-robot solution over a single-type solution. EX1006, ¶3.³

Sur-Reply, 12

Hangzhou's Robots



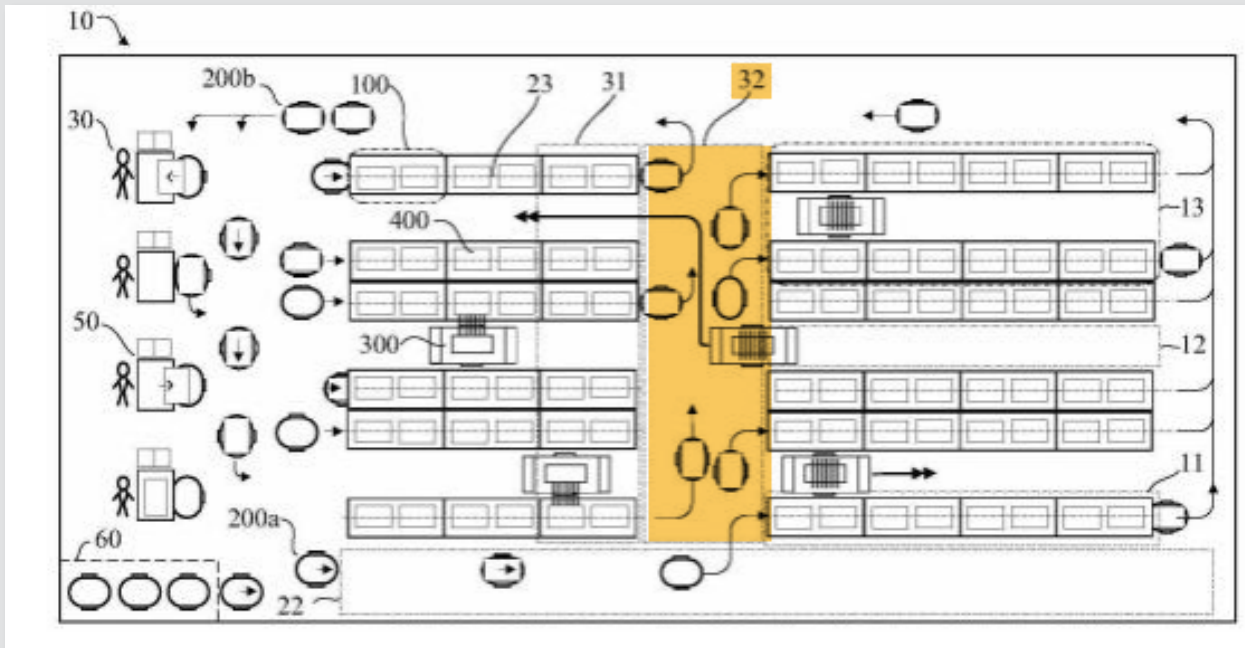
POR, 15; EX1006, Fig. 2

Sur-Reply, 10-12; POR 14-16

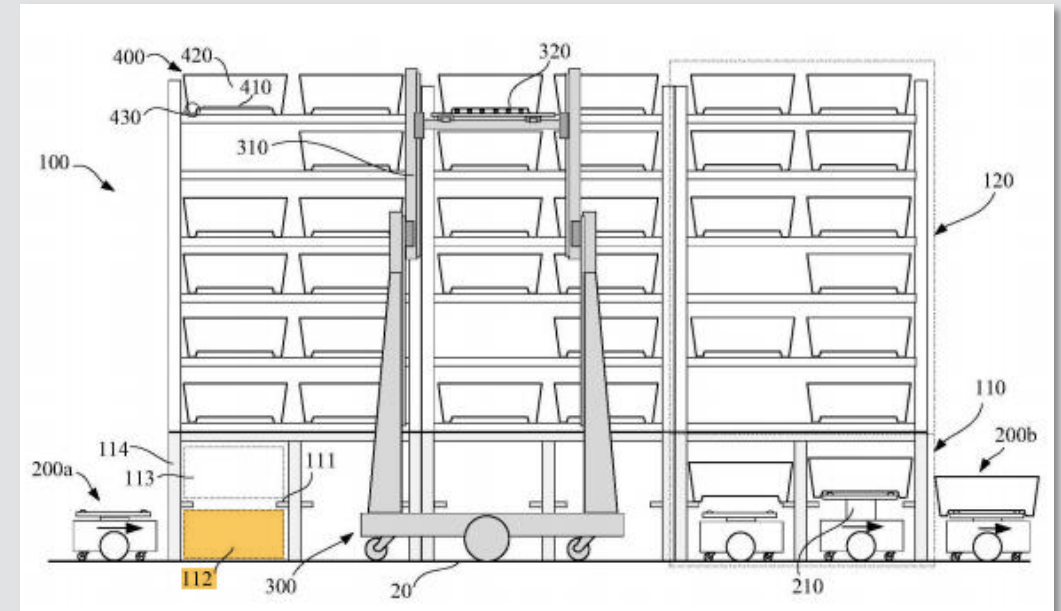
Hangzhou's Trolley Robots Travel Under Shelves to Avoid Stacking Robots

[0048] An auto-guided trolley 200 is a small mobile robot with auto-navigation ability, usually driven by a differential gear train, and equipped with four universal wheels. Such a trolley is characterized by a small size and a low cost. In addition, trolleys are generally designed in symmetrical so that they can turn in place. However, the specific driving form is not limited thereto, and may also be an omnidirectional drive wheel train and others. As shown in FIG. 1, in this embodiment, an auto-guided trolley 200 preferentially travels in column laneways 32 and auto-guided trolley passage spaces 112, never entering stacking row laneways 12 to avoid path conflicts with stacking vehicles 300.

EX1006, [0048]



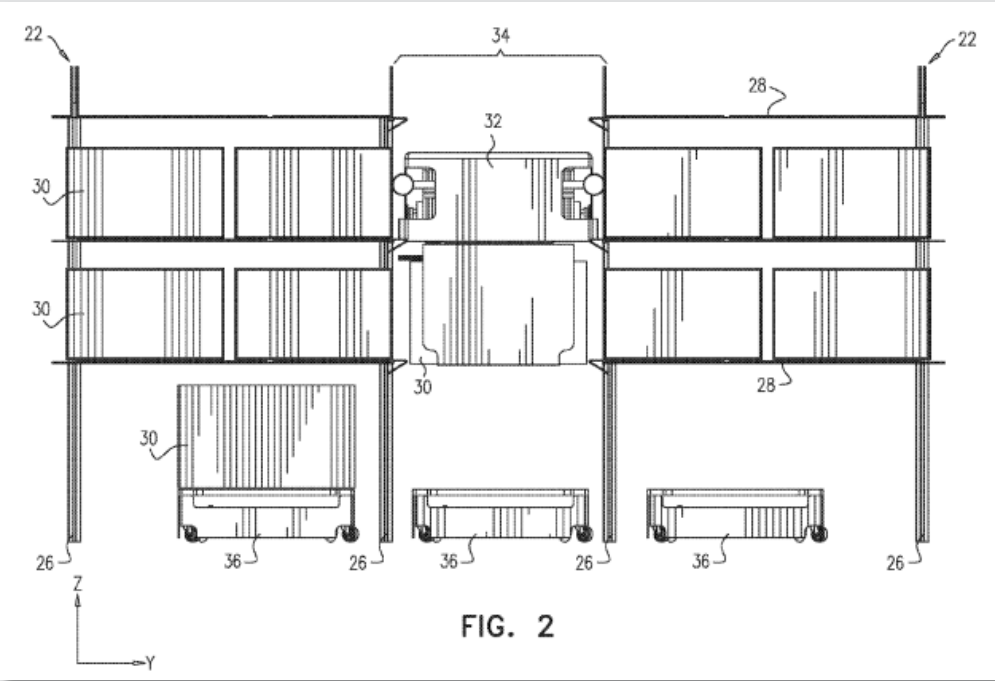
EX1006, Fig. 1



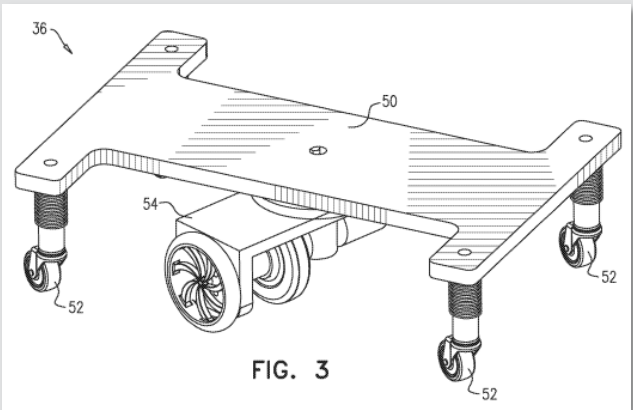
EX1006, Fig. 2

POR 16, 17, 33, 34

Goren Teaches a Two Robot Solution: One Travels Horizontal and One Vertical



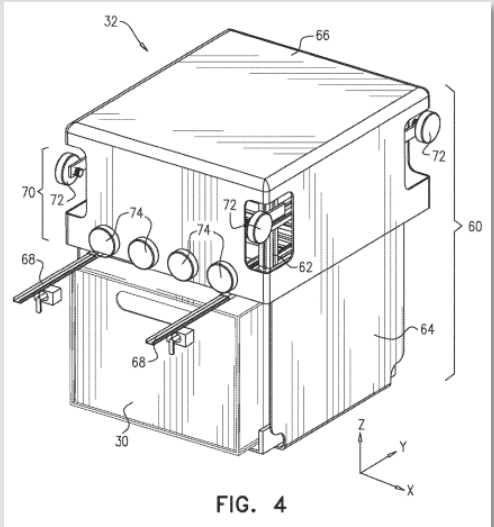
EX1008, Fig. 2



EX1008, Fig. 3

Floor robots **36** travel among shelving units **22** along horizontal paths on floor **24**, moving independently of but in coordination with lift robots **32**. Lift robots **32** transfer containers **30** that they have removed from shelves **28** to floor robots **36**, which then convey the containers from shelving units **22** to a specified destination. In the pictured embodiments, legs **26** of shelving units **22** are high enough so that floor robots **36** can travel beneath shelves **28** in order to deliver containers **30** to their destinations. In distribution center **20**, for example, floor robots convey containers **30** to a packing station **38**, where a picker **42** moves items **40** from the containers to cartons **44** for delivery to customers. Similarly, floor robots **36** convey containers **30** to lift robots **32** for placement on shelves **28**.

EX1008, Fig. 8:45-58



EX1008, Fig. 4

A POSA Would *Not* Have Been Able To Access
and Change Raizer's Proprietary Mapping
Software in Order to Make the Proposed
Combination

A POSA Would Need Access to Razier's Proprietary Software to Make Combination

Sur-Reply

EX1009, 65:5–11, 68:9–11. Additionally, OPEX is not advocating that “prior art descriptions of software *considered by its owner* as proprietary” ought to be exempt from obviousness determinations, as Petitioner asserts. Reply, 17. Rather, because of *Razier's* explicit (and unique) disclosure in its specification that the functions of initial mapping and subsequent “Fine Positioning” is performed via proprietary software, a POSITA would be unable to modify that software to direct the robot to map under shelves or engage in “Fine Positioning,” as Petitioner’s combined system would require since it is using *Razier's* robots. EX1005, ¶84; EX2007, ¶¶142–143.

Sur-Reply, 15

142. Second, Petitioner’s proposed combination leverages proprietary components, such as those of Raizer, and therefore, a POSITA cannot have a reasonable expectation of success creating this combination.

EX2007, ¶142

Razier's Proprietary Software

[0084] 1. Robots: A set of autonomous centrally controlled mobile robots that bring desired boxes to and from the picking station. The robots have 3 dimensional travel capabilities enabling them to travel along the ground and up and along the shelves. The robots are pre-loaded with **proprietary software** which includes the warehouse layout, routes, intersections, and designated areas (this mapping survey is recorded by a “Survey Mode” of the robot’s software). Each robot utilizes dedicated maneuvering algorithms and a **proprietary “Fine Positioning” procedure** to enable precise, quick and efficient loading.

EX1005, [0084]

Raizer's Proprietary Software Would Have Dissuaded Combination

Sur-Reply

1. Proprietary Software Would Have Dissuaded Combination

Petitioner's rebuttal to OPEX's arguments as to proprietary components are unavailing. First, OPEX does not contend that basic movement code would have been beyond the capacity of a POSITA at the time. Rather, essential functions in *Raizer* that Petitioner relies upon to meet the '632 Patent's claim limitations (*e.g.*, driving or picking up boxes), are contingent upon successful execution of *complex* behavior (*e.g.*, mapping or the specified anchor point navigation), which explicitly requires proprietary software. EX1005, ¶¶32, 77, 84, 89, 137. Dr. Singhose noted that recreating such software would be beyond the skill of a POSITA. EX1009,

Sur-Reply, 14–15

Dr. Singhose (PO's Expert) Deposition

Q So -- so what does proprietary software entail to you?

A Well, proprietary software would be software that a company develops essentially in secret and puts in some useful or unusual operations that nobody else has, and so they can -- normally in this industry it's so you can sell it for money because you've done something that nobody else has done.

Q Is the use of proprietary components such as software typical in the automated warehouse industry?

A Yes. The use of some proprietary elements would be occurring from time to time.

Sur-Reply, 14–15; EX1009, 65:3–16

An Obviousness Combination Cannot Be Based On Secret Information

N. Telecom, Inc. v. Datapoint Corp.
908 F.2d 931, 936 (Fed. Cir. 1990)



A document, to serve as a “printed publication”, must be generally available.

The district court was unable to find that anyone could have had access to the documents by the exercise of reasonable diligence.

Raytheon Techs. Corp. v. Gen. Elec. Co.,
993 F.3d 1374, 1377 (Fed. Cir. 2021)



We have also previously expounded the principle that if an obviousness case is based on a ***non-self-enabled reference***, and no other prior art reference or evidence would have enabled a skilled artisan to make the claimed invention, then the invention cannot be said to have been obvious.

**A POSA Would Have Realized That Mapping
Under The Racks With Raizer's Survey Mode
Would Have Been Greatly Complicated By
Multipath Effects**

Raizer's Only Disclosed Warehouse Mapping Method is Survey Mode

Raizer's Mapping:

[0033] In embodiments of the system of the invention the processor of each robot is pre-loaded with dedicated software which includes the warehouse layout, routes, intersections, and designated areas.

EX1005, [0033]

[0084] 1. Robots: A set of autonomous centrally controlled mobile robots that bring desired boxes to and from the picking station. The robots have 3 dimensional travel capabilities enabling them to travel along the ground and up and along the shelves. The robots are pre-loaded with proprietary software which includes the warehouse layout, routes, intersections, and designated areas (this mapping survey is recorded by a "Survey Mode" of the robot's software). Each robot utilizes dedicated maneuvering algorithms and a proprietary "Fine Positioning" procedure to enable precise, quick and efficient loading.

EX1005, [0084]

Dr. Spenko (Petitioner's Expert) Agrees

Q. And I'm looking at the second part of Paragraph 84. "The robots are preloaded with proprietary software which includes the warehouse layout, routes, intersections, and designated areas (this mapping survey is recorded by a survey mode of the robot's software). Each robot utilizes dedicated maneuvering algorithms and a proprietary fine positioning procedure to enable precise, quick and efficient loading."

Do you see that?

And maybe -- my question is like when I see that description, especially with respect to survey mode, it sounds like to me Raizer is using the robots to go out and kind of map the area.

A. That's a fair assessment.

EX2006, 60:21-61:10

Sur-Reply, 19-23; POR, 30, 49-52

Multipath Effects Create Problems When Mapping Under Racks With Survey Mode

Dr. Singhose (PO's Expert) Explained

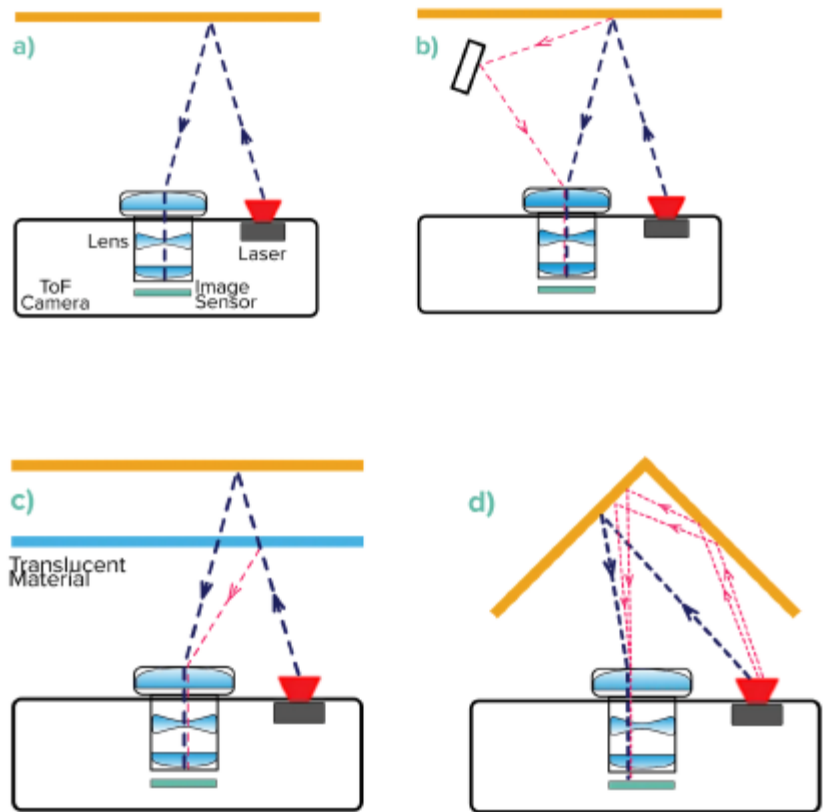
signal emitting-and-detecting measurements. For example, LiDAR sensors emit laser pulses and measure reflected signals. While this can, and often does, work well in open spaces, such a system being used under shelves would be subject to an array of noisy reflected signals that bounce off of the overhead shelves, the support legs, and more distant objects beyond the shelves. These conditions lead to the well-known multipath reflection problems that significantly degrade emitting-and-detecting sensors in such closed spaces. The reprogramming of such sensors to achieve reliable operation in under-the-shelf conditions is too complex of a modification for a POSITA to achieve, especially in conjunction with proprietary software.

EX2007,1151

Sur-Reply, 17, 19-23; POR, 30, 49-52

Multipath Effects Create Problems When Mapping Under Racks With Survey Mode

Dr. Singhose (PO's Expert) Declaration



EX2009, Multipath Reflection Diagrams

Dr. Singhose (PO's Expert) Deposition

Q Isn't it true that several of the physical circumstances shown in Cases A through F are not relevant to or could easily be excluded from a secured warehouse environment?

A I wouldn't say several; I would say a couple. For example, F is being used to indicate fog and rain and snow, in my opinion. That could show up in a warehouse if you have smoke or dust or something like that, but I would say for the most part that's not going to happen that often.

A But the other ones, B and D are going to be happening a fair amount of time.

EX1009, 100:10–102:3

Sur-Reply, 24; POR, 50–52

Multipath Effects Persist if Operating With An Emitter Detector Sensor

Dr. Singhose (PO's Expert) Identified:

Q So in operating -- after we have the map, when the robot is in operating mode, is the -- are multipath effects a problem?

A No. The multipath effect I'm talking about is the multipath effect during mapping. So their question is I'm done with mapping; is there multipath effects? Not the ones I'm talking about.

There are -- if you used an emitted detector sensor to operate during the obstacle detection, you would get -- you would have those kind of multipath effects still, but that would be for the application of detecting obstacles, not for the application of mapping.

EX1009, 91:20-92:11

Sur-Reply, 17-19

Raizer's Vehicles Cannot Turn Under Every Rack

Hangzhou's Trolleys Can Turn Under Racks Because They Are Symmetrical

Hangzhou Teaches:

Disclosed in the present invention are an unmanned warehousing system and an inbound and outbound method therefor, which solve the problems of complex deployment, inconvenient maintenance, and high cost of the existing system. In an embodiment of the system, a two-layer channel support frame is provided below a shelf, wherein a lower layer is used to automatically guide a trolley to pass through, an upper layer is used for the temporary cache or passage of a standardized container, and an interlayer support plate runs through along the length or width direction of the entire shelf. When an outbound process of items is implemented, a stacking vehicle automatically travels to a designated shelf and aligns with the same, and the standardized container on the shelf is picked up by means of a pickup mechanism. Then, the container is lowered onto the upper layer of the support frame to cache the container on the support plate. Subsequently, an auto-guided trolley travels through the lower layer of the support frame to a position below the container to separate the container from the support member by hoisting the container before entering a sorting site through a channel and a laneway. The steps are reversed for an inbound process. This system is easy to deploy, convenient to maintain, and low in cost. A large number of robots operate concurrently by means of a dispatching system, so that the overall efficiency is high.

EX1006, Abstract

[0048] An auto-guided trolley 200 is a small mobile robot with auto-navigation ability, usually driven by a differential gear train, and equipped with four universal wheels. Such a trolley is characterized by a small size and a low cost. In addition, trolleys are generally designed in symmetrical so that they can turn in place. However, the specific driving form is not limited thereto, and may also be an omnidirectional drive wheel train and others. As shown in FIG. 1, in this embodiment, an auto-guided trolley 200 preferentially travels in column laneways 32 and auto-guided trolley passage spaces 112, never entering stacking row laneways 12 to avoid path conflicts with stacking vehicles 300.

EX1006, [0048]

[0073] For example, an auto-guided trolley 200 is driven by the differential gear train. The equivalent diameter of the trolley 200 is less than the short side of the channel support frame 110. When the trolley 200 travels to the center of the channel support frame 110, the trolley 200 may turn in place without movement interference. The auto-guided trolley 200 carrying standardized containers 400 switches between the row and column directions along the traveling direction by performing a series of actions, including dropping and docking the standardized containers on the support members, the trolley turning 90° in place, and hoisting the standardized containers.

EX1006, [0073]

Sur-Reply, 9; POR, 28–39

Petitioner Incorporates Hangzhou Vehicle's Turning but Not its Profile

Dr. Spenko (Petitioner's Expert) Confirmed:

Q. Is the modified system that you envision where you combine these two references, you're using Raizer's robots, true?

A. Yes.

Q. And that's because Hangzhou's robots don't show climbing vertically in part, right?

MR. DOUGLAS: Object to form.

THE WITNESS: I don't know how to put it other than you look at Raizer's robots, and then in view of Hangzhou's ability to run them under shelves, and I don't know, that's how I'm looking at this, at this combination of the two patents.

EX2006, 89:10-21

Sur-Reply, 26, 27; POR, 58

The Disputed Issues

- 1 A POSITA would not have combined Raizer and Hangzhou
- 2 Petitioner fails to articulate a sufficient motivation to incorporate Hangzhou's travel underneath shelves into Raizer
- 3 Petitioner fails to articulate why a POSITA would have had a reasonable expectation of success when combining Hangzhou's travel underneath shelves with Raizer

Petitioner Bears the Burden to Show Obviousness



Eli Lilly & Co. v. Teva Pharm. Int'l GmbH,
8 F.4th 1331, 1348 (Fed. Cir. 2021)

[I]n considering what constitutes a reasonable expectation of success, we must also consider that the law places the burden of proof on the petitioner to prove a proposition of unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). Thus, in this case, it was, at all times, Lilly's ***burden*** to show that the claims would have been obvious, ***including*** that a skilled artisan would have had a ***reasonable expectation*** of success in achieving the claimed invention.

Petitioner's Purported Motivation Is Inappropriately Conclusory

Petitioner Repeats Conclusory Statements of Generalized Objectives

Petitioner Argues in Petition:

1. Motivation to Combine

A POSITA would have been motivated to combine *Raizer* and *Hangzhou* (Ex. 1003, ¶¶100-116).

A POSITA at the time of the assumed priority date of the '632 patent was well aware of the design need for autonomous robot warehouse systems to decrease congestion, avoid autonomous robot collisions, and maximize space utilization. (Ex. 1003, ¶¶46-53, ¶107). A POSITA would rely on a reference, such as *Raizer*, that focused on improving automated systems for warehouse management. (Ex. 1003, ¶¶102-103). *Raizer* discloses autonomous robots configured to travel along the horizontal floor of a warehouse but also along “a network of vertical and horizontal rails” that may be attached to most any type of shelving structure. (Ex. 1003, ¶¶103-104).

Pet., 6

Petitioner Repeats in Reply:

A POSITA was well aware of the design need for autonomous robot warehouse systems to decrease congestion, avoid autonomous robot collisions, and maximize space utilization. Petition, 6; Ex. 1003, ¶¶105-107. A POSITA would have relied on *Raizer* that focused on improving automated systems for warehouse management and disclosed autonomous robots configured to travel both horizontally along the floor of the warehouse and along a network of vertical and horizontal rails. Petition, 6-7; Ex. 1003, ¶¶103-104.

Reply, 2–3

Sur-Reply, 7, 8; POR, 2, 21–26

Conclusory Statements Cannot Establish A Motivation to Combine



TQ Delta, LLC v. CISCO Sys., Inc.,
942 F.3d 1352, 1359 (Fed. Cir. 2019).

Rejections on obviousness grounds in particular, *cannot be sustained by mere conclusory statements*; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

POR at 22

Microsoft Corp. v. Enfish, LLC,
662 Fed. Appx. 981, 990 (Fed. Cir. 2016)

Microsoft gave no reason for the motivation of a person of ordinary skill to combine Visual Basic and Salton except that *the references were directed to the same art or same techniques* The Board did not err in finding those assertions inadequate to show persuasively that a relevant skilled artisan would have been motivated to combine the references.

Nor did the Board err in finding insufficient the declarations of Microsoft's relevant expert, Dr. Hosking. He asserted that a person of ordinary skill would have been motivated to combine Visual Basic's and Salton's indexing systems because they “*address[ed] the same technical issues* and disclose[d] closely related subject matters.”

POR at 23

Petitioner's Purported Motivation Is
Inappropriately Based on What a POSITA
"Could" Have Done, Not What a POSITA
"Would" Have Done

Showing a POSITA “Could” Have Made Proposed Combination Is Insufficient

Petitioner Argues in Reply:

11 (“Decision”), 27; Petition, 6-9. These rationales included at least the following: “it is a known and recognized practice to provide pathways (e.g., auto-guided trolley passage spaces 112) underneath shelving units for movement of automated trolleys or robots” (Ex. 1006 ¶[0048], Petition 7, Ex. 1003, ¶109); “[i]t was well known to elevate the shelving units above the floor so that robots loaded with containers can travel underneath thereby allowing for more flexible route planning and the elimination of bottlenecks” (Ex. 1003 ¶107; *see also id* at Section VI, ¶¶45–53); running “robots in passage spaces beneath the shelves, would achieve maximum flexibility in maneuvering the robots along the warehouse floor and eliminating bottlenecks” (Petition, 7; Ex. 1003, ¶¶109-110); “the vertical travel flexibility of Raizer’s robots eliminates the need for Hangzhou’s stacking vehicles because Raizer’s robots themselves can pick and place containers on upper shelves, thereby making this combination even more useful” (Petition, 7; Ex. 1003, ¶111).

Reply, 1, 2

In short, Petitioner argues:

1. POSITA allegedly **could** provide pathways under shelves.
2. Elevating shelves allegedly **could** increase flexibility in route planning.
3. Elevating shelves allegedly **could** eliminate bottlenecks.
4. Raizer’s vertical travel allegedly **could** eliminate need for stacking vehicles.

Adidas AG v. Nike, Inc.,
963 F.3d 1355, 1359 (Fed. Cir. 2020)



The obviousness inquiry does not merely ask whether a skilled artisan **could** combine the references, but instead asks whether ‘they **would** have been motivated to do so.’

Sur-Reply, 2

Sur-Reply, 1, 2

Petitioner's "Obvious To Try" Argument Is Unsupported

“Obvious to Try” Arguments Are Unsupported

Petitioner Argues in Reply:

Illumina Cambridge, Ltd., 821 F.3d 1359, 1369 (Fed. Cir. 2016)). However, a “conclusion of obviousness requires a reasonable expectation of success,” and that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, *predictable* solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *Id.* (citing *KSR Int’l Co.*, 550, U.S. 398 (2007)) (emphasis in original). “*If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.*” *Id.*

There was a design need or market pressure to solve a problem—reducing congestion, avoiding traffic jams, and more efficiently using space, including in circumstances where storage space is vertically increased by taller shelving units, in automated warehouses employing autonomous robots. Petition, 6-9; Ex. 1003,

Reply, 7, 8

Design Choice Inapplicable When Combined System is Not Obvious

In re Kuhle,
526 F.2d 553, 188 USPQ 7 (CCPA 1975)



We also agree that the particular placement of the contact provides no novel or unexpected result. The manner in which electrical contact is made for Smith's battery would be an obvious matter of design choice within the skill of the art.... As the board pointed out, use of a spring-loaded contact in the manner claimed is *well known* with the common flashlight.

Sur-Reply, 5

The Disputed Issues

- 1 A POSITA would not have combined Raizer and Hangzhou
- 2 Petitioner fails to articulate a sufficient motivation to incorporate Hangzhou's travel underneath shelves into Raizer
- 3 Petitioner fails to articulate why a POSITA would have had a reasonable expectation of success when combining Hangzhou's travel underneath shelves with Raizer

Reasonable Expectation of Success Remains Petitioner's Burden

***Eli Lilly & Co. v. Teva Pharms. Int'l GmbH*,
8 F.4th 1331, 1348 (Fed. Cir. 2021)**



[I]n considering what constitutes a reasonable expectation of success, we must also consider that the law places the burden of proof on the petitioner to prove a proposition of unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). Thus, in this case, it was, at all times, Lilly's burden to show that the claims would have been obvious, including that a skilled artisan would have had a reasonable expectation of success in achieving the claimed invention.

Reasonable Expectation Of Success Is Different Than Motivation to Combine

Eli Lilly & Co. v. Teva Pharms. Int'l GmbH, 8 F.4th 1331, 1344 (Fed. Cir. 2021)



Before addressing Lilly's specific arguments, however, we must first emphasize the clear distinction in our case law between a patent challenger's burden to prove that a skilled artisan would have been motivated to combine prior art references and the ***additional requirement*** that the patent challenger ***also*** prove that the skilled artisan would have had a reasonable expectation of successfully achieving the claimed invention from the combination

A finding by the Board that a patent challenger has demonstrated a motivation to combine references ***does not*** necessarily imply that the challenger has also met its burden of showing a reasonable expectation of success

Petitioner Did Not Argue, Much Less Show, a Reasonable Expectation of Success

Petitioner Did Not Argue a Reasonable Expectation of Success

Petitioner Makes Conclusory Statements:

A POSITA would have been motivated to combine specific teachings of *Hangzhou* with those of *Raizer* to reduce congestion, avoid traffic jams, make more efficient use of space and to allow *Raizer's* robots to “choose among all possible paths.” (Ex. 1003, ¶¶113-114). A POSITA would have been motivated to combine and would have had a reasonable expectation of success in combining *Raizer* and *Hangzhou*. (Ex. 1003, ¶¶101, 116).

Petition, 1

Dr. Derby (Petitioner's Expert) Repeats the Conclusory Statements:

101. A person of ordinary skill in the art would have had a reasonable expectation of success in the combination of *Raizer* and *Hangzhou* based on the explicit teachings of the references and the knowledge of the person of ordinary skill in the art. Moreover, in view of the disclosures of *Raizer* and *Hangzhou* indicating the robots and trolleys can travel throughout a warehouse, the choice of routing (e.g., turning, under racks, in, across, or parallel to aisles) is an obvious matter of design choice.

EX1003, ¶¶101,

POR, 42-45

Petitioner Did Not Prove A Reasonable Expectation Of Success

PO's Response:

And third, Petitioner does not set forth any substantive support for a reasonable expectation of success in combining the references. Exotec merely mentions that “[a] POSITA would have been motivated to combine and would have had a reasonable expectation of success in combining Raizer and Hangzhou.” Petition, 9. These omissions demonstrate that Petitioner has not met its burden and that the Board should find the claims patentable.

POR, 2, 3; Sur-Reply, 5

Petitioner Replies With More Conclusory Statements:

Opex’s unsupported and contrived complexities cannot help it escape the simple fact that *Raizer* and *Hangzhou* are readily combinable with a clear expectation of success. The proposed and straightforward combination of *Raizer* and *Hangzhou* is amply set forth in the Petition. Petition, 6-9; Ex. 1003, ¶¶110-111.

Reply, 5

There was a need to solve a problem—reducing congestion, avoiding traffic jams as robot numbers increase, and more efficiently using space in automated warehouses employing autonomous robots and shelving units that are built taller and taller to take advantage of the full height of the warehouse. Petition, 6-9; Ex. 1003, ¶¶101-115. There were predictable solutions—increasing the number of available travel ways by running autonomous robots in passage spaces beneath shelves and across and parallel to aisles. *Id.* A POSITA had reason to pursue the known options such that it would lead to the anticipated success—reducing congestion, avoiding traffic jams, and more efficiently using space in automated warehouses employing autonomous robots. *Id.* Thus, a POSITA had a reasonable expectation of success in combining *Raizer* and *Hangzhou*.

Reply, 14, 15

Petitioner Inappropriately Failed to Describe the Combined System

Petitioner Did Not Describe The Combined System

Petitioner Argues in Reply:

The straightforward nature of the proposed combination is the epitome of reasonableness—*Raizer's* robots, which *Raizer* discloses as being able to navigate anywhere along the floor of a warehouse, with *Hangzhou's* teaching of routing such robots under the shelves of the warehouse and across aisles.

Reply, 5–6

Hangzhou Describes its Routing Method:

[0059] Potential collisions may occur since the stacking device and auto-guided trolleys carrying standardized containers need to use the cache space below shelf rows. In addition to running in a time-shared manner at the dispatch level, auto-guided trolleys 200 also run an obstacle avoidance algorithm to ensure safety and reliability. Generally speaking, stacking vehicle path planning has a higher priority. Therefore, auto-guided trolley path planning will be adjusted based on the information on stacking vehicle path planning. For instance, when an auto-guided trolley carrying standardized containers drives along the row channel below a shelf row and is about to enter the next channel support frame ahead, the auto-guided trolley confirms the absence of obstacles, such as other auto-guided trolleys or standardized containers, in the next channel support frame according to the information obtained via wireless communication and through its sensor system.

EX1006, [0059]

While Raizer Describes:

[0084] 1. Robots: A set of autonomous centrally controlled mobile robots that bring desired boxes to and from the picking station. The robots have 3 dimensional travel capabilities enabling them to travel along the ground and up and along the shelves. The robots are pre-loaded with proprietary software which includes the warehouse layout, routes, intersections, and designated areas (this mapping survey is recorded by a "Survey Mode" of the robot's software). Each robot utilizes dedicated maneuvering algorithms and a proprietary "Fine Positioning" procedure to enable precise, quick and efficient loading.

EX1005, [0084]

POR, 29–32

Outline

- A Overview of the '632 Patent
- B Overview of the References
- C Petitioner's Grounds
- D The Disputed Issues
- E The Dependent Claims**

Petitioner Did Not Show The Combination Practices All Elements of Claim 5

Claim 5

5. The method of claim 1 wherein the first storage rack is formed of a plurality of vertical posts and the first vehicle has a length and a width and the length is greater than the width and wherein the step of driving the first vehicle along the first path comprises driving the vehicle along a path spaced apart from the vertical posts by a distance greater than half the length of the vehicle.

EX1001, 25:57-63

Sur-Reply, 26-27; POR, 56-59

Petitioner Actually Proves Raizer's Vehicle Does Not Practice Element 5(b)

Claim 5(b) Requires

[5.b]: the first vehicle has a length and a width and the length is greater than the width and

Petition, 43

Petitioner Argues In Reply:

A. Claim 5.

Regarding 5b, Opex argues that *Raizer's* drawings do not explicitly indicate a scale, stating that “*Raizer* teaches against a robot where its ‘length is greater than its width.’” POR, 56-57. Opex ignores the disclosure in *Raizer* that the “main components of robot 10 which are shown in [FIGS. 5A-5D] are mounted on a frame comprised of *two long beams 28 that are rigidly connected together at one end by a shorter beam 12.*” Ex. 1005, ¶[0103] (emphasis added); Petition, 5, 43; Ex. 1003, ¶¶85, 255. *Raizer's* robot has a first dimension dictated by the shorter beam (e.g., a width) and a second dimension dictated by the long beams (e.g., a length), and given the relative language, the “length is greater than the width.” *Id.*

Reply, 26, 27

Petitioner and Its Experts Allege:

Ex. 1005, FIG. 5B (annotated)

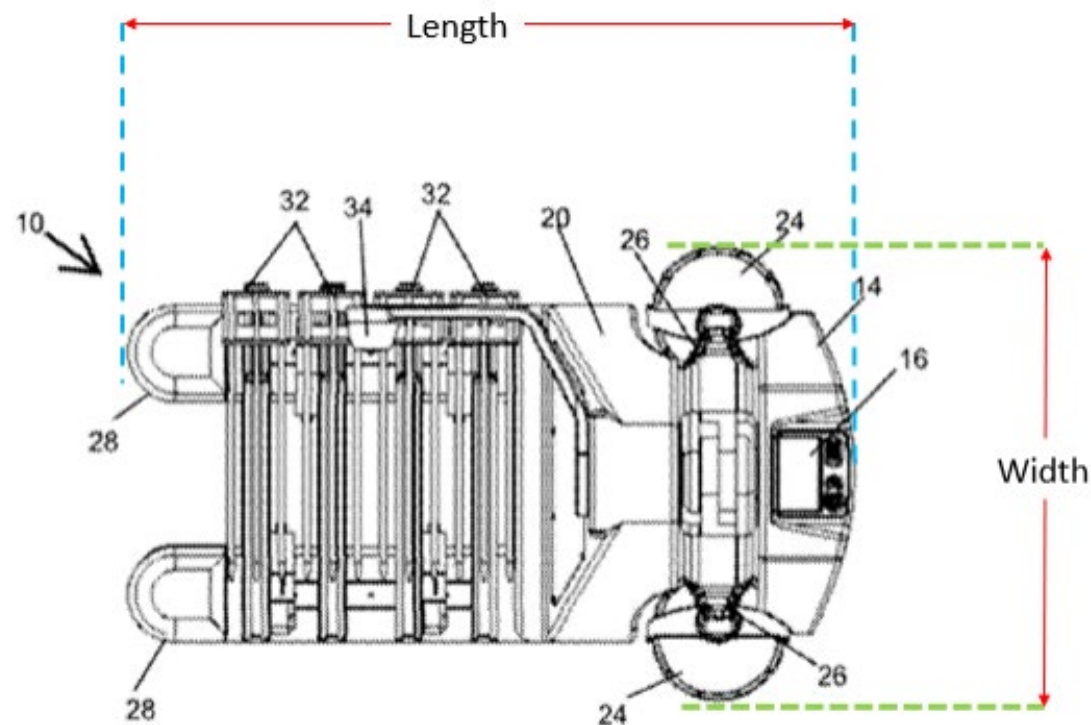


Fig. 5D

Petition, 44

Sur-Reply, 26-27; POR, 56-59

Petitioner Cannot Rely on Undisclosed Measurements For Claim 5(b)

**Nystrom v. TREX Co., Inc.,
424 F.3d 1136 (Fed. Cir. 2005)**



Absent any written description in the specification of quantitative values, arguments based on measurement of a drawing are of little value.

Petitioner Wrongly Mixes and Matches Hangzhou and Raizer For Claim 5(c)

Claim 5(c) Requires:

- iii. *[5.c]: wherein the step of driving the first vehicle along the first path comprises driving the vehicle along a path spaced apart from the vertical posts by a distance greater than half the length of the vehicle.*

Petition, 45

Petitioner Argues Hangzhou Meets This Element:

Hangzhou discloses that the trolleys may “switch between trolley-special row laneways 21 and column channels 33 and between column channels 33 and row channels 23,” that the trolleys “turn[] 90° in place” and that the “diameter of the trolley 200 is less than the short side of the channel support frame 110,” such that “[w]hen the trolley 200 travels to the center of the channel support frame 110, the trolley 200 may turn in place without movement interference.” (Ex. 1006, ¶¶0072-0073); Ex. 1003, ¶¶260-261).

Given *Hangzhou*’s disclosure of trolleys moving in column and row channels beneath shelves and being small enough to rotate in place 90° to switch traveling directions, a POSITA would have understood that the path would be spaced from the vertical posts by a distance greater than half the length of the vehicle to allow the vehicles to turn without colliding with support members and to allow the robots of *Raizer* to engage with the vertical rails once in the aisle between the shelves. (Ex. 1003, ¶¶262-264; see also Motivation to Combine *supra*).

Petition, 45, 46; see also Ex. 1003, ¶¶ 258-264

Hangzhou’s Turning Requires Hangzhou’s Symmetrical Trolleys:

[0048] An auto-guided trolley 200 is a small mobile robot with auto-navigation ability, usually driven by a differential gear train, and equipped with four universal wheels. Such a trolley is characterized by a small size and a low cost. In addition, trolleys are generally designed in symmetrical so that they can turn in place. However, the specific driving form is not limited thereto, and may also be an omnidirectional drive wheel train and others. As shown in FIG. 1, in this embodiment, an auto-guided trolley 200 preferentially travels in column laneways 32 and auto-guided trolley passage spaces 112, never entering stacking row laneways 12 to avoid path conflicts with stacking vehicles 300.

EX1006, [0048]

Petitioner’s Combination Requires Raizer’s Allegedly Asymmetric Vehicles:

The straightforward nature of the proposed combination is the epitome of reasonableness—*Raizer*’s robots, which *Raizer* discloses as being able to navigate anywhere along the floor of a warehouse, with *Hangzhou*’s teaching of routing such robots under the shelves of the warehouse and across aisles.

Reply, 5, 6

Sur-Reply, 27; POR, 58

Petitioner Did Not Show The Combination Practices All Elements of Claims 8 and 9

Claims 8 and 9

8. The method of claim 1 wherein the step of turning comprises rotating the first vehicle about a vertical axis that extends through the first vehicle.

9. The method of claim 8 wherein the vertical axis extends through the first path.

EX1001, 26:4-8

Sur-Reply, 27; POR, 59

Petitioner Relies on Hangzhou's Trolley For the Dependencies of Claims 8 and 9

Raizer and *Hangzhou* render obvious [8.pre] and [8.a]. (See [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶285-290).

Raizer discloses robots comprising “two drive and steering units, “where “each unit compris[es] one front wheel and components configured to rotated [sic] the front wheel at least 360 degrees *about a vertical axis*⁹ to the floor in order to steer the robot” and “to rotate the front wheel about a horizontal axis in order to cause the robot to move in the direction that the front wheel is pointing.” (Ex. 1005, ¶[0056]; Ex. 1003, ¶¶286-287). *Raizer* discloses that “[t]he front wheels 22 of robot 10 can be independently rotated 360 degrees about *an axis vertical to the floor* by their respective drive and steering units 24.” (Ex. 1005, ¶[0107]; Ex. 1003, ¶287). Should *Raizer* be determined to not disclose rotating the vehicle about a vertical axis that extends through the vehicle while under a rack, a POSITA would have turned to *Hangzhou*. (see [1.e] *supra*; Ex. 1003, ¶288). A POSITA would have been motivated to combine the teachings of *Hangzhou* and *Raizer*. (Ex. 1003, ¶288; see also Motivation to Combine *supra*).

Petition, 49, 50

Raizer and *Hangzhou* render obvious [9.pre] and [9.a]. (see [8.pre]-[8.a] *supra*; Ex. 1003, ¶¶291-297). *Raizer* and *Hangzhou* render obvious a vehicle capable of rotating 360 degrees about a vertical axis that extends through the vehicle's body while the vehicle is under a storage rack. (see [1.e], [8.a] *supra*; Ex. 1003, ¶292).

Should *Raizer* be determined to not disclose turning where the vertical axis extends through the first path, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶293).

Hangzhou discloses driving the vehicle under the rack in a “row direction and column direction” and “switching the driving direction” “at the position where the dotted lines intersect” by “turn[ing] in the auto-guided trolley passage space 112,” such that the trolley rotates about an axis extending through the first path when it “switch[es] between the row direction and column direction” by “turning 90° in place.” (Ex. 1006, ¶[0073]; Figures 1, 10¹⁰; Ex. 1003, ¶¶294-295).

A POSITA would have been motivated to combine the teachings of *Hangzhou* into those of *Raizer*. (see [1.e], [8] *supra*; Ex. 1003, ¶296; see also Motivation to Combine *supra*).

Petition, 50, 51

Petitioner's Combination Relies on Raizer's Vehicle, Not Hangzhou's

The straightforward nature of the proposed combination is the epitome of reasonableness—*Raizer's* robots, which *Raizer* discloses as being able to navigate anywhere along the floor of a warehouse, with *Hangzhou's* teaching of routing such robots under the shelves of the warehouse and across aisles.

Reply, 5, 6

THANK YOU

Petitioner's Reply Cannot Fill Gaps in Petition



Intelligent Bio-Systems, Inc. v. Illumina Cambridge, Ltd., 821 F.3d 1359, 1369 (Fed. Cir. 2016)

It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify “with particularity” the “evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3). “All arguments for the relief requested in a motion must be made in the motion. A reply may only respond to arguments raised in the corresponding opposition or patent owner response.” 37 C.F.R. § 42.23(b).

POR, 30



37 CFR § 42.23 - Oppositions, replies, and sur-replies

(b) All arguments for the relief requested in a motion must be made in the motion. A reply may only respond to arguments raised in the corresponding opposition, patent owner preliminary response, patent owner response, or decision on institution. A sur-reply may only respond to arguments raised in the corresponding reply and may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.

37 CFR 42.23(b)

POR, 30; Sur-Reply, 14