

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

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.,
Petitioner

v.

OPEX Corporation,
Patent Owner

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

OPEX CORPORATION'S
PATENT OWNER RESPONSE

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Patent Trial and Appeal Board
U.S. Patent and Trademark Office
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PATENT OWNER'S EXHIBIT LIST

OPEX Exhibit No.	DESCRIPTION
2001	Declaration of Dr. William E. Singhose
2002	Declaration of Goutam Patnaik In Support Of Motion For Admission <i>Pro Hac Vice</i>
2003	Matthew Spenko, Ph.D. <i>Curriculum Vitae</i>
2004	Nagai et al, "Fault-Free Integrity of Urban Driverless Vehicle Navigation with Multi-Sensor Integration: A Case Study in Downtown Chicago" October 2023
2005	Annotated Figure 1 from U.S. Patent Publication No. 2017/0158430 (Raizer)
2006	Deposition Transcript of Matthew Spenko, Ph.D., dated January 23, 2025
2007	Declaration of Dr. William E. Singhose Accompanying POR
2008	Hong et al, "Semi-automated approach to indoor mapping for 3D as-built building information modeling" May 2015
2009	Whyte, "Multipath Interference in Indirect Time-of-Flight Depth Sensors" March 2021

All emphasis has been added unless noted otherwise.

I. INTRODUCTION

Exotec’s Petition challenges claims 1, 3-12, 14, and 23-27 (hereinafter “the challenged claims”) of U.S. Patent No. 11,472,632 (the ’632 Patent (“EX1001”)) as allegedly rendered obvious based on the combination of U.S. Patent Publication No. 2017/0158430 (EX1005 or “Raizer”) and Chinese Patent Publication Patent No. CN 109987366A (EX1006 or “Hangzhou”). But a POSITA would not have been motivated to combine the two disparate references, nor would there have been a reasonable expectation of success in making the proposed combination.

Exotec’s references are directed to achieving different solutions to different problems. Raizer is designed to retrofit an existing warehouse with a singular type of advanced robot that can traverse three-dimensional space. Hangzhou, on the other hand, is directed at increasing efficiency of warehouses with known floorplans using two different types of robots—a more complex stacking robot that moves storage bins vertically and a set of low-profile delivery trolleys that move around horizontally on the floor.

First, a person of ordinary skill in the art would not have combined Raizer with Hangzhou because the proposed modification would have detracted from what Raizer considered to be a primary motivation behind its invention, namely, the ability to retrofit existing warehouses. Therefore, the proposed combination undermines Raizer’s intended purpose and most of its purported benefits. Exotec’s

expert, Dr. Spenko agreed that Raizer “tout[ed] that [retrofitting] is one of the benefits of the system.” EX2006 at 70:16-24 (“Q. The terminals help Raizer with its ability to retrofit a warehouse, right, because you can add it on to an existing shelving unit? [A.] That’s not entirely clear. I think the idea is that the entire system – *I mean it’s like the entire system is there to be retrofitted onto an existing warehouse, right.*”) But, as set forth below, Petitioner’s proposed combination runs counter to this purpose, illustrating the incompatibility of Petitioner’s combination and demonstrating that a POSITA would not have looked to combine Raizer and Hangzhou. Therefore, for at least this reason, the Board should deny Exotec’s Petition.

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.

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.

II. SUMMARY OF THE '632 PATENT

A. Overview

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.

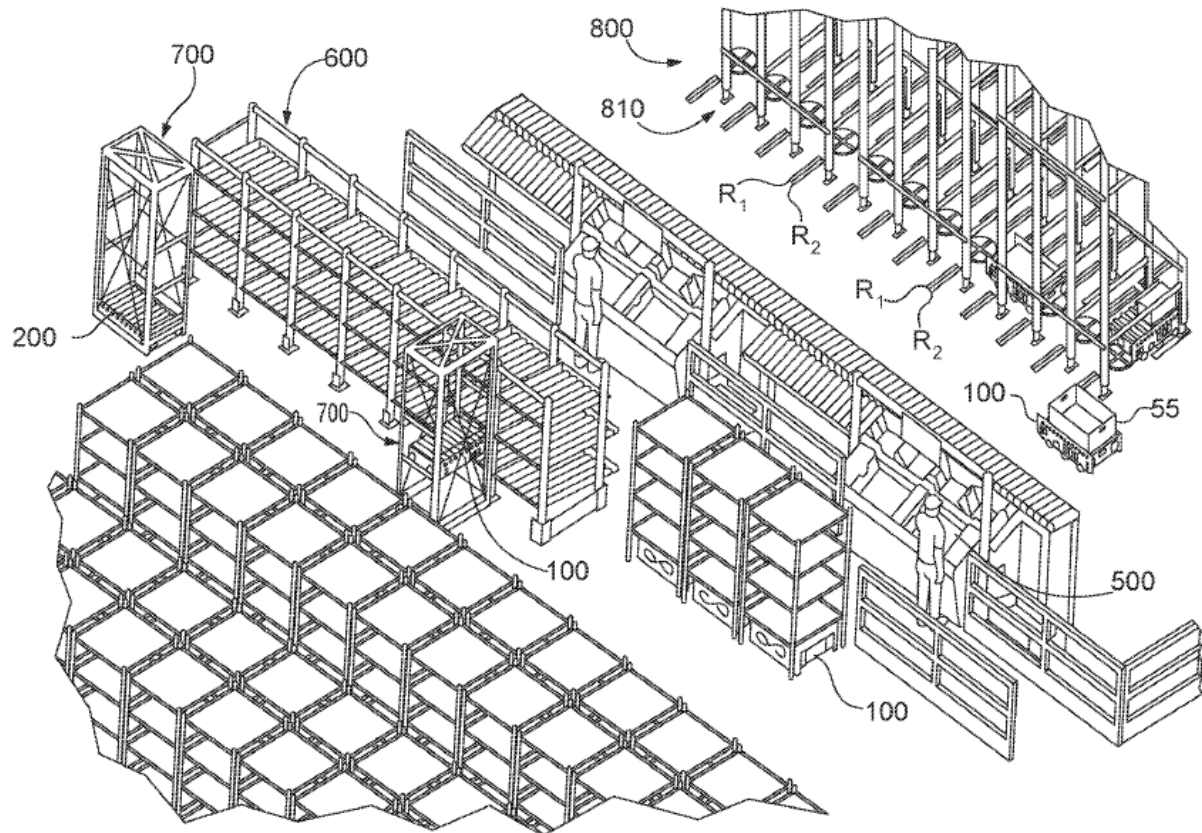


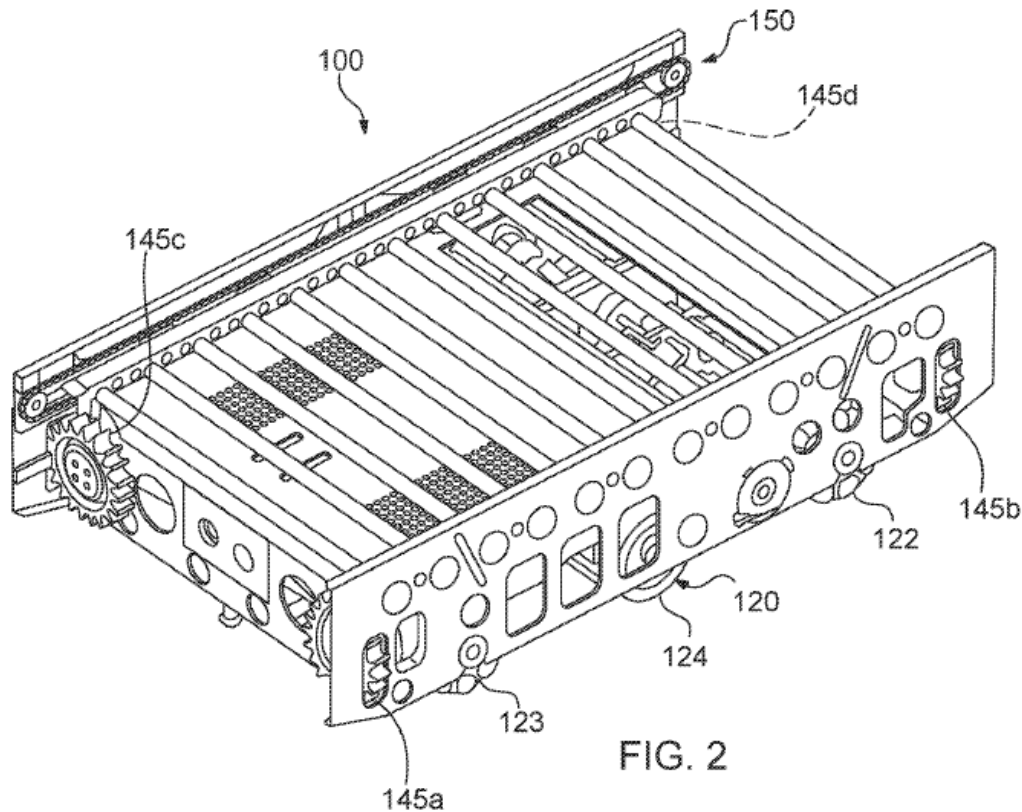
FIG. 1

EX1001, Figure 1.

According to the '632 Patent, “[t]he delivery mechanism may include one or more vehicles 100 that transport items. For instance, ...the vehicles may retrieve items from storage locations 820 in the racks 800 and deliver the items to a workstation 500 where an operator can retrieve the item from the vehicle.” EX1001, 7:15-20. EX2007, ¶43.

As the '632 Patent explains, “[t]he vehicles 100 may be autonomous systems that include an onboard power supply for driving the vehicle. The vehicles may also include a communication system for wirelessly receiving and transmitting control

signals between each vehicle and a control element...” EX1001, 8:1-5. Figure 2, which is reproduced below, “illustrates details of one of the vehicles 100 that are shown in [Figure] 1.” EX1001, 7:62-63. EX2007, ¶44.



EX1001, Figure 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.

The vehicles disclosed in the ’632 Patent “may also include an optional transfer mechanism for transferring items between the vehicle and a destination, such as a storage location. For instance, the transfer mechanism 150 [shown in Figure 2] may be operative to transfer an item between a platform surface of the vehicle and one of the plurality of destination areas 820.” EX1001, 10:1-6. EX2007, ¶46.

The ’632 Patent discloses that “[t]he 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.” EX1001, Abstract. Additionally, “[t]he vehicles may travel under the racks and cross one or more aisles to reach a particular column in one of the aisles.” EX1001, Abstract. EX2007, ¶47.

Specifically, Figure 7, which is reproduced below, “illustrates a plurality of vehicles in different orientations relative to the racks 800 and the storage locations 820.” EX1001, 17:7-9.

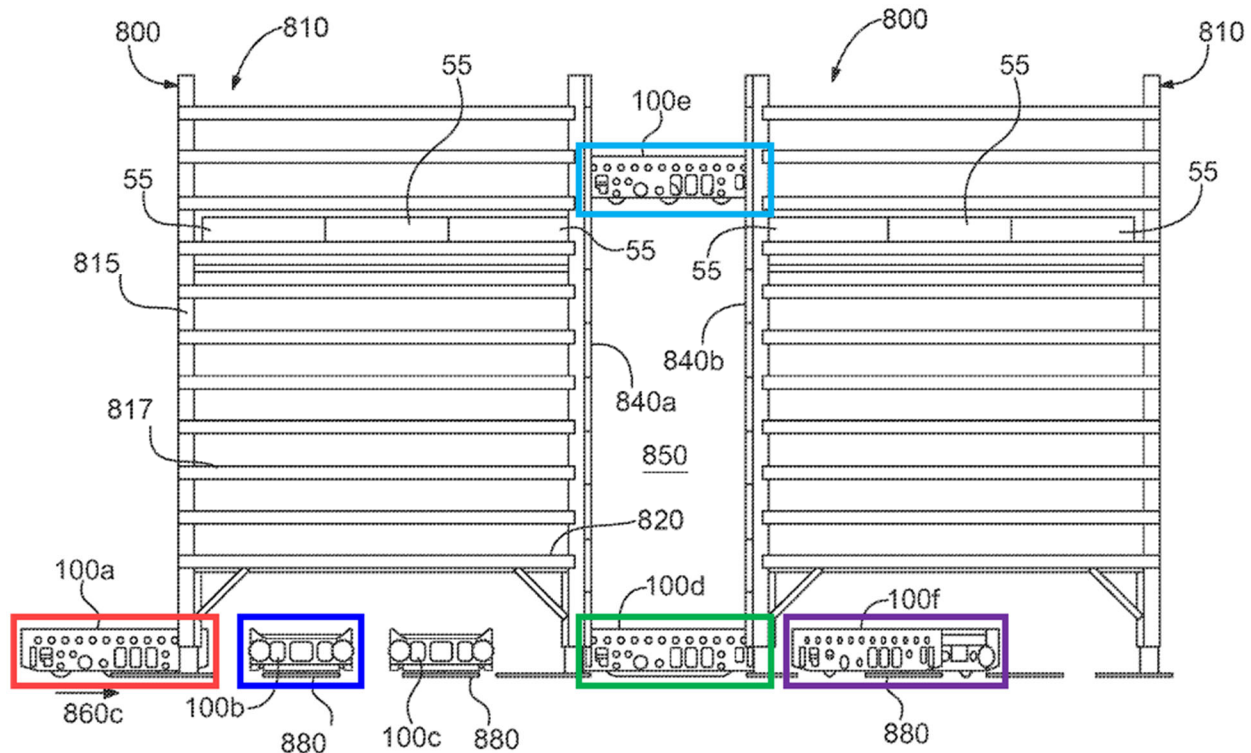


FIG. 7

EX1001, Figure 7.

As the '632 Patent explains:

[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. EX2007, 48-50.

B. Prosecution History

The '632 Patent was filed as US Patent Application No. 16/994,543 on August 14, 2020. EX1001, cover. On October 20, 2020, Applicant filed a Preliminary Amendment to remove multiple claim dependencies from various dependent claims. EX1002, 137-143. A Notice of Allowance was mailed on June 27, 2022 (EX1002, 76-77) and the '632 Patent was issued on October 18, 2022. A Certificate of Correction was issued on January 3, 2023, to make the corrections to claim 11 shown below. EX1001, 28.

In Claim 11:

	<u>READS</u>	<u>SHOULD READ</u>
Line 50	"wherein the first horizontal path under the path is spaced apart"	--wherein the first horizontal path under the first rack is spaced apart--
Line 50	"from the first horizontal path a distance greater"	--from the second horizontal path a distance greater--

EX1002, 1.

III. CLAIM CONSTRUCTION

The Board need only construe terms “that are in controversy, and only to the extent necessary to resolve the controversy.” *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Petitioner argues no terms need construction. Petition, 4. For purposes of this submission only, Patent Owner does not dispute Petitioner’s position. However, Patent Owner reserves the right to advance additional claim construction positions should the need arise.

IV. OVERVIEW OF THE REFERENCES

Petitioner relies on the combination of U.S. Patent Publication No. 2017/0158430 (EX1005 or “Raizer”) and a Chinese Patent Publication Patent No. CN 109987366A (EX1006 or “Hangzhou”). Specifically, Petitioner relies on “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 . . .” Petition, 7.

A. Raizer

Raizer is directed to “an automatic system for picking and placing boxes on shelves in a warehouse.” EX1005, ¶18. Raizer’s system includes:

- a. a set of autonomous mobile robots;

b. a network of vertical and horizontal rails that are parallel to the vertical support posts and horizontal shelves of the shelving system in the warehouse; and

c. a Real Time Traffic Management (RTTM) server, which is a central processing server configured to communicate with the robots and other processors and servers in the warehouse.

EX1005, ¶¶19-21. EX2007, ¶¶53-54.

Raizer is designed to satisfy an overarching goal described as: (1) providing “an automatic warehouse system that can be relatively inexpensive and easily added to existing warehouses operated by businesses” which is (2) “suitable for small and existing warehouses.” EX1005, ¶¶15, 16.

Raizer’s improvements towards an “automatic warehouse solution” was meant to overcome a number of shortcomings in the prior art for implementing warehouse systems in existing warehouses. EX1005, ¶4. The shortcomings in the prior art Raizer sought to overcome were:

- 1) Large capital equipment investment;
- 2) Poor modularity – required significant reorganization and/or pre-planning;
- 3) Downtime – significant downtime for implementation;
- 4) Limited Flexibility – systems were designed in a specific manner for specific conditions and products/containers and could not adjust to different products or other demands;

- 5) No gradual implementation capability – required major structural changes in the facility and/or infrastructures that would demand overhaul to an existing warehouse; and
- 6) Redundancy capability – failure in one part of the system would stop operations in the entire system.

EX1005, ¶¶4-13.

1. Raizer's Robots

Figure 5A, which is reproduced below, is a “schematic top perspective ... view[] of the robot 10 of the system of [Raizer].” EX1005, ¶103.

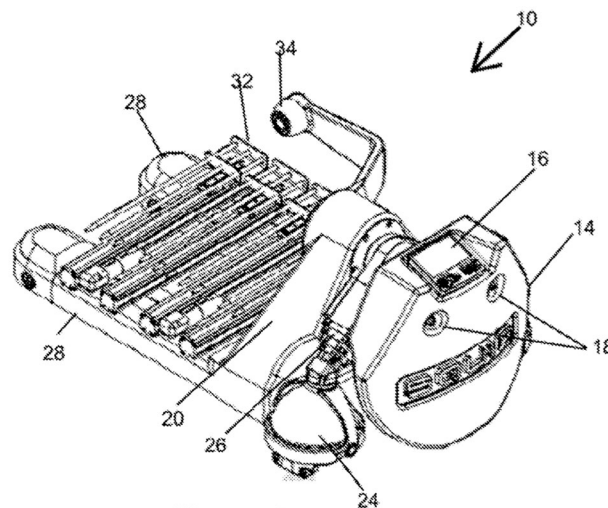
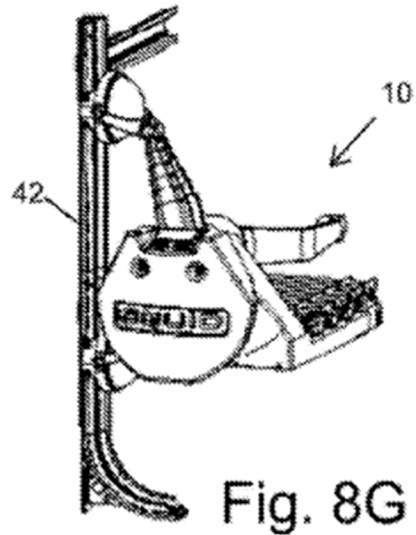
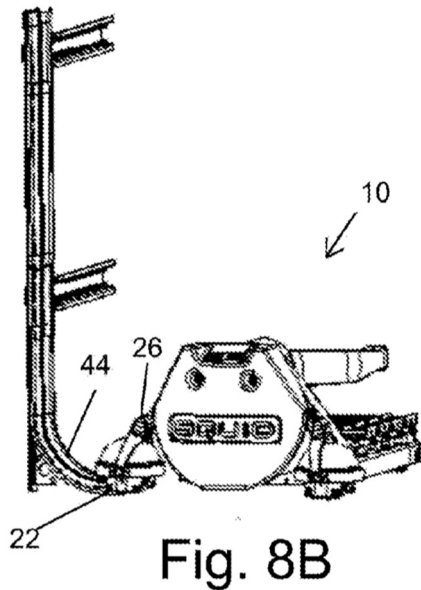


Fig. 5A

EX1005, Figure 5A. EX2007, ¶56.

Raizer explains that the robots “have 3 dimensional movement capabilities. Utilizing at least one pair of motorized arms, the robots navigate both along the ground and up and along the shelves to the exact desired location.” EX1005, ¶78.

EX2007, ¶5. The vertical motion capability of the Raizer robots is illustrated in Figures 8B through 8G:



EX 1005, Figures 8B and 8G.

As shown in Figures 8B through 8G, the shelves of Raizer have a curved rail to the floor that allows the robot to attach and climb onto the vertical rail of rack. Raizer refers to this structure as “terminal 44.” EX1005, ¶111 (“A curved piece of rail called a terminal 44 is attached to the bottoms of the vertical rails where they reach the ground.”). And as Raizer explains, the vertical rail of the rack “is the only place where robots 10 can connect or disconnect from the rails 42 in order to climb to or descend from the shelves.” EX1005, ¶111; *see also, id.*, ¶85 (“The robots engage the rails **only** at a designated ‘terminal’ located on the floor and use these rails to maneuver vertically and horizontally.”). EX2007, ¶¶59-60.

2. Raizer's Navigation Control System

Raizer's navigation system uses automated mapping to set up possible paths (and none go under the racks) and it relies on anchor point navigation to save money. EX1005, ¶¶80, 84; EX2006, 58:3-11. This navigation system enables the robots to travel along the ground and up and along the shelves. EX1005, ¶78 (“Utilizing at least one pair of motorized arms, the robots navigate both [1] along the ground and [2] up and along the shelves to the exact desired location.”).

Raizer's navigation along the ground uses what Raizer calls “anchor point navigation.” “That is [the robots] 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, ¶80. EX2007, ¶62.

As the robots prepare to travel up and along the shelves, the robots switch over to a more expensive, complex, and accurate navigation control system. *See* EX1005, ¶80 (“[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.”). “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, ¶80. EX2007, ¶¶63-64.

Indeed, Raizer discloses that its navigation system that employs “anchor point navigation” is what distinguishes Raizer’s system from other existing systems. EX1005, ¶¶79-80 (“Some of the features of the invention that makes the system *unlike existing systems* are: The robots in the system of the invention use ‘*anchor point navigation*.’”). EX2007, ¶65.

B. Hangzhou

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.” EX1006, Abstract, ¶¶4-6, 48-49. The different robots used in Hangzhou are identified below:

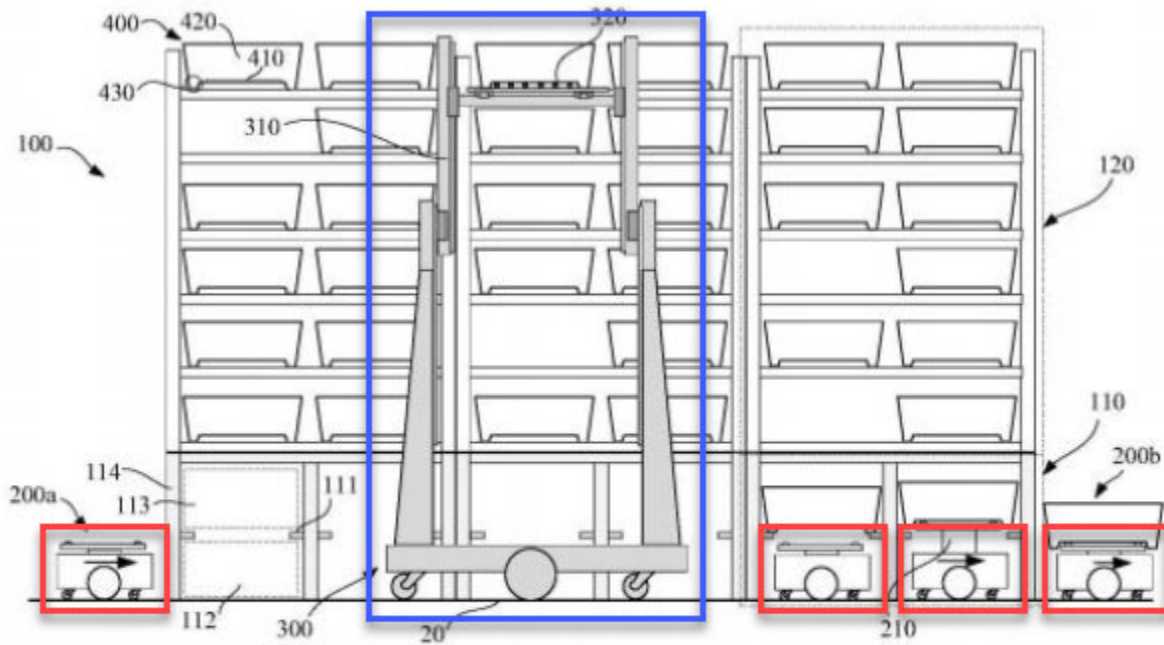


FIG. 2

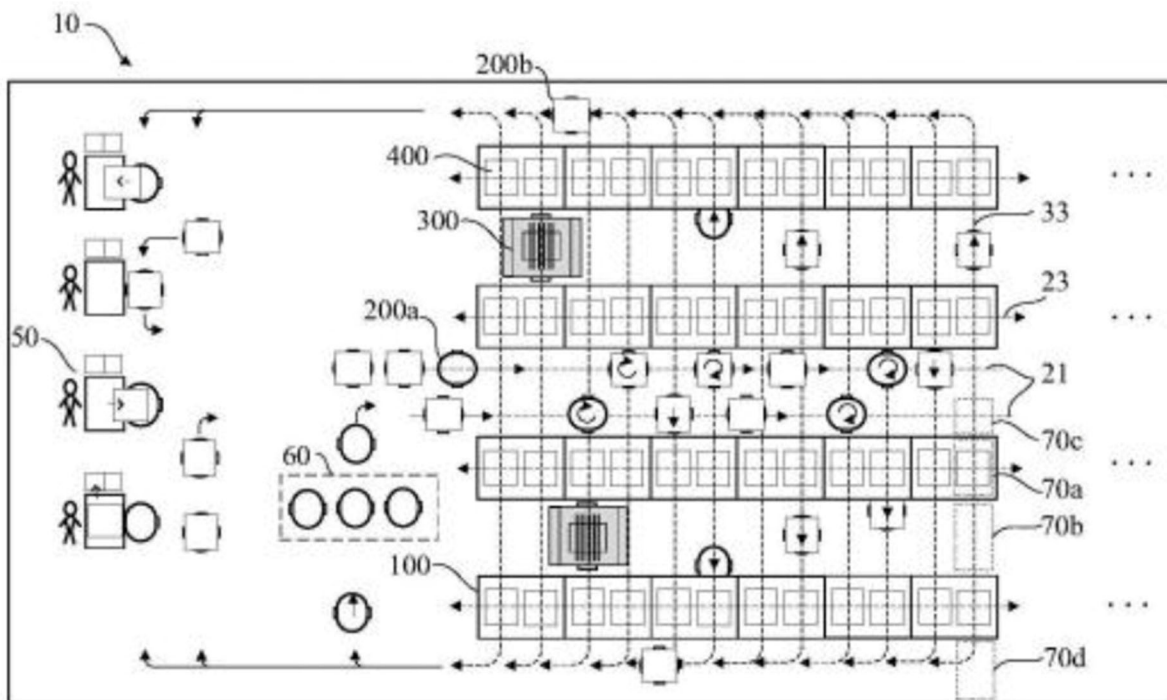
EX1006, Figure 2.

Hangzhou teaches away from single-type robot systems, noting that “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.” EX1006, ¶4. Instead, Hangzhou specifically employs a multi-type robot system, because it “can take advantage of different robots’ strengths” despite the fact that it can “lead[] to a higher deployment cost.” EX1006, ¶5.

Hangzhou specifies the types of actions needed by its trolleys in order for them to move and perform their functions. For instance, when turning under a shelf,

the trolley drops a container on the support member portion under the shelves, turns 90° in place, and hoists the container. EX1006, ¶73.

Figure 10 of Hangzhou shows various possible paths, including under the shelves 100, that its trolleys can take. EX2007, ¶¶65-67.



EX1006, Figure 10.

This increased degree of freedom in movement on the floor, however, comes with a cost. Hangzhou's trolleys must be equipped with an extensive sensor network and complex navigation control systems in order for this navigation system to work properly without collisions. See EX1006, ¶59 ("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.”).

Specifically, when Hangzhou’s trolleys are under the racks, they are either guided by specialized channel support frames, or are utilizing complex sensor networks to avoid obstacles. *See* EX1006, ¶59 (“[W]hen 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.***”). EX2007, ¶¶69-70.

Importantly, unlike Raizer’s robots that can climb up the shelves, Hangzhou’s trolleys cannot leave the floor. Rather, Hangzhou utilizes two separate robot types that move in coordination with each other: (1) ground-based trolleys and (2) vertical stacking vehicles, as shown in annotated Figures 3 of Hangzhou below. In addition to the complex on-the-ground navigation algorithms associated with the trolleys, Hangzhou’s system must additionally coordinate the motions of the two different

robots so that they can work together to store and retrieve items from the storage shelves, while leveraging their respective comparative advantages. EX2007, ¶71; *see also* EX1006, ¶5.

For example, when the trolleys are under the shelves, they must transfer or receive items from the stacking vehicle which moves the items vertically up the storage racks. More specifically, as shown in Figure 3 below, Hangzhou's trolleys dock the containers they carry onto cache space 113, so that the stacking vehicle can lift it and place it on the shelves. EX1006, ¶46 ("A lifting platform 310 with a large lifting range is mounted above a stacking vehicle 300 and has a grabbing component 320 that can grab standardized containers 400 on different layers of a shelf 100."). In a similar manner, trolleys can retrieve containers from cache space 113 after the containers have been placed in cache space 113 by the stacking vehicle. EX1006, ¶46 ("At the lowest position of the lifting platform 310, grabbing components can place standardized containers 400 into cache spaces 113 on both sides."). EX2007, ¶¶74-76.

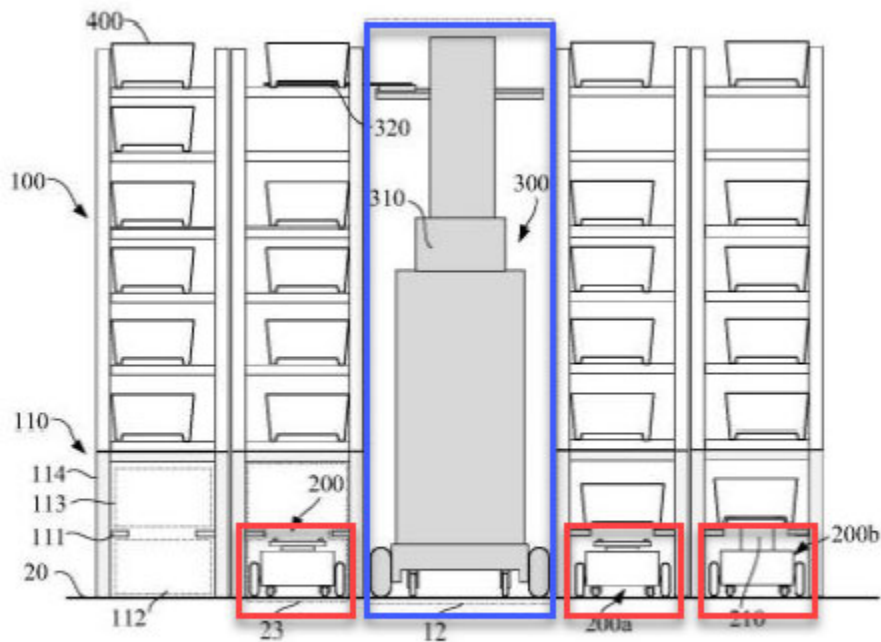


FIG. 3

EX1006, Figure 3.

In Hangzhou, **stacking vehicles** have priority over **trolleys**. EX1006, ¶59. (“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.”). Accordingly, during path planning, trolleys can end up waiting for a clear path before they reach a location to retrieve an item:

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.***

EX1006, ¶63. Thus, the movement of the trolleys on the ground are often slowed down in order to avoid collisions and to effectuate proper delivery and retrieval of items to the stacking vehicle. See EX1006, ¶63; EX1006, ¶55 (“If there is not any standardized container 400 to be outbound at the right end, the trolley 200 waits or continues to move forward to other shelves that needs to be outbound.”). EX2007, ¶76.

V. STANDARD FOR OBVIOUSNESS

Exotec alleges that Raizer in combination with Hangzhou renders obvious the Challenged Claims of the ’632 Patent. Specifically, Exotex argues that 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.” Petition, 7.

It is well established law that “[a] proposed modification [is] inappropriate for an obviousness inquiry when the modification render[s] the prior art reference

inoperable for its intended purpose.” *In re Fritch*, 972 F.2d 1260, 1265 n.12 (Fed. Cir. 1992); *see also In re Ratti*, 270 F.2d 810, 813 (C.C.P.A. 1959) (holding that a combination of references under 103 is improper when it requires “a change in the basic principles under which [that reference’s] were designed to operate.”) The proper question to ask is whether a POSITA “would have seen a benefit to” combining the references. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 424 (2007). A combination must also “have been obvious from a fair reading of the prior art reference as a whole to turn the prior art apparatus upside down.” *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). When a combination with a second reference would frustrate a first reference’s “principle of operation” it “is unlikely to motivate a person of ordinary skill to pursue a combination with that reference.” *Plas-Pak Indus., Inc. v. Sulzer Mixpac AG*, 600 F. App’x 755, 759 (Fed. Cir. 2015). Such a combination therefore cannot render a claimed invention obvious. *Id.*

Additionally, Petitioner provides no motivation for its combination beyond general attributes of warehouse technology. *See* Petition, 7. Petitioner fails to address the conflicts in the goals and the manner of achieving those goals between Raizer and Hangzhou. Dr. Spenko similarly only alleges that a POSITA would be motivated to combine these two references because both references are “generally directed to the field of automated handling of materials in a warehouse.” EX1003, ¶102. Dr. Spenko ignores that this is a broad field with a myriad of approaches and

needs, which a POSITA would not necessarily combine into one system. EX2007, ¶¶93-94.

Similarly, Exotec and Dr. Spenko do not provide any details on how the alleged combined system would operate. Petitioner and its expert merely state that Hangzhou's method of driving under shelves could be implemented in Raizer, without any substantive discussion or showing of a reasonable expectation of success to create such a combination. Petition, 9; EX1003, ¶101.

These conclusory statements regarding the motivation to combine Raizer and Hangzhou, and the system this combination would create, are insufficient. *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019). Combining Raizer and Hangzhou as Petitioner proposes would undermine the goals articulated in Raizer. Similarly, if Petitioner followed through on a hypothetical combination of these systems, it would have been evident that they are incompatible, and indeed do not have a reasonable expectation of success. Thus, the references relied upon by Petitioner cannot be properly combined to render the '632 Patent obvious.

VI. INDEPENDENT CLAIMS 1, 11, AND 23 ARE PATENTABLE

Petitioner challenges the patentability of claims 1, 3-12, 14, and 23-27 of the '632 Patent, based on the combination of Raizer and Hangzhou.

Claims 1, 11, and 23 are independent. EX1001, 24:1-36, 26:15-52, 28:20-46.

Claims 3-10, 12, 14, and 24-27 depend directly from one or another of independent claims 1, 11, and 23. *Id.*, 25:47-26:14, 26:53-58, 27:3-6, 28:47-60.

A. Petitioner Offers Only Conclusory Statements To Declare A Motivation To Combine, Ignoring Explicit Teaching Away In The Specifications

It is well established that to sufficiently demonstrate motivation to combine, a Petitioner must show more than the mere existence of two references in the same field. *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.”). Similarly, “a conclusory assertion with no explanation is inadequate to support a finding that there would have been a motivation to combine” because “[t]his type of finding, without more, tracks the ex post reasoning *KSR* warned of and fails to identify any actual reason why a skilled artisan would have combined the elements in the manner claimed.” *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019) (quoting *In re Van Os*, 844 F.3d 1359, 1361–62 (Fed. Cir. 2017)).

Petitioner makes this error, failing to provide sufficient evidentiary support regarding a motivation to combine the references. Petitioner repeatedly states that a

“POSITA would have been motivated to combine specific teachings of Hangzhou with those of Raizer,” but without further justification, these statements are merely conclusory. Such statements are the *ex-post* reasoning cautioned against by *KSR*.

Petitioner points to generalized and overarching issues common to warehousing, namely to “reduce congestion, avoid traffic jams, [and] make more efficient use of space.” Petition, 9. These issues, though, are vague, applicable to all automated warehouse systems, and do not actually articulate why a POSITA would look to specifically combine Raizer with Hangzhou’s ability to go under the racks. Petitioner is required to show that a POSITA *would* have combined the references, not just that they *could* have. *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (rejecting expert analysis as it “primarily consisted of conclusory references to her belief that one of ordinary skill in the art could combine these references, not that they would have been motivated to do so”).

Petitioner fails to describe why a POSITA *would* have modified Raizer and Hangzhou in combination because the references’ respective specifications pursue different goals and are incompatible. Raizer advocates for the benefits of an approach attaching rails to existing shelves to ascend and descend the shelves, flexible containers, and a one-robot system comprising complex robots with arms. EX1005, ¶¶115, 132, 133. In contrast, Hangzhou discloses use of specific shelving patterns, standardized containers, and a two-robot system where robots are

specialized to planes of motion and particular tasks—specifically teaching against a one-robot system. EX1006, ¶¶4-5.

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.

Petitioner completely ignores that Hangzhou actually teaches away from using a robotic arm, such as that utilized in Raizer's robots. EX1006, ¶6 (“Or, although the on-site modification is not required, a large number of costly heavy-load mobile trolleys or robotic arms need to be configured. Complex deployment, inconvenient maintenance, and high costs all limit promotion.”).

Tellingly, Petitioner acknowledges that the Raizer and Hangzhou systems have different goals directed to implementation of different types of warehouse systems and approaches. Petitioner, citing the specification, describes Raizer as “plug and play in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse.” Petition, 20. In contrast, Hangzhou requires “a ‘lower layer’ of a ‘channel support frame’ [that] ‘is used to automatically guide a trolley to pass through’” (Petition, 20-21), and

Hangzhou, itself, specifies that its application is “especially suitable for temporary warehouses.” EX1006, ¶9.

B. Petitioner’s Modified System Contradicts Raizer’s Goals And Principle Of Operation And Is Thus Incompatible With Raizer

Raizer’s invention is designed to satisfy an overarching goal described as: (1) providing “an automatic warehouse system that can be relatively inexpensive and easily added to existing warehouses operated by businesses” which is (2) “suitable for small and medium sized warehouses.” EX1005, ¶¶15, 16. Petitioner fails to address how a combination of Raizer and Hangzhou would satisfy these characteristics.

Petitioner’s proposed combination would destroy each of Raizer’s purposes. Thus, Petitioner’s proposed combination cannot render the ’632 Patent obvious. *See Medtronic, Inc. v. Teleflex Innovations SA RL*, 69 F.4th 1341, 1349–50 (Fed. Cir. 2023) (explaining that it would have been an “error for the Board to ignore evidence that a proposed modification would interfere with a reference’s stated purpose” and affirming Board finding that challenged patent was non-obvious in part because “the destruction of [a prior art reference’s] ‘entire premise’ ‘counsel[ed] strongly against’ obviousness.”)

Similarly, it is well established that when a proposed combination is inconsistent with references’ stated objectives it cannot establish obviousness of a challenged patent. *See ASUSTeK Computer, Inc. et al v. LiTL LLC*, IPR2024-00532,

Paper 20 at 21, 23 (denying institution by finding that “Petitioners’ modified computer incapable of fulfilling Lane’s objectives” and that “the proposed modification would render Lane’s computer unsuitable for its intended purpose”); *see also Shimano, Inc. v. Globeride, Inc.*, IPR2015-00273 Paper 40, 12 (Final Written Decision) (PTAB Jun 16, 2016) (citing *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984) as standing for the proposition that a case of obviousness is undermined if modifying the prior art would render that prior art inoperable for its intended purpose); *see also Trivasular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (affirming the Board’s finding that a POSITA would not have had motivation to replace barbs in a primary reference with gripping protuberances from a secondary reference because the modification “would ***destroy the basic objective*** of the barbs, which is to penetrate surrounding tissue”); *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984) (reversing the Board’s determination of obviousness where the modification to the primary reference that turned it upside down as needed to meet the claim would have ***rendered the primary reference “inoperable for its intended purpose”***); *Plas-Pak Industries, Inc., v. Sulzer Mixpac AG*, 600 F.App’x 755, 758 (Fed. Cir. 2015) (affirming Board’s finding of obviousness where proposed alteration to prior art would not achieve “backflow prevention” comparable to that disclosed in a prior art reference where that reference was “rife with statements defining ‘the invention’ as adding stop valves to prevent backflow,” explaining that

“[s]uch a change in a reference’s ‘principle of operation’ is unlikely to motivate a person of ordinary skill to pursue a combination with that reference”).

Attempting to implement the robot described in Raizer to operate as Petitioner proposes raises several engineering issues that would both discourage a POSITA from combining the references and indicate that a POSITA would not anticipate success in attempting the combination.

Raizer robot’s design is not compatible with Hangzhou’s loading techniques, which enable Hangzhou’s operation under the shelves. Hangzhou requires use of a specialized lower loading rack that constrains the trolley’s movement when carrying a specialized container; as such, Hangzhou teaches that when turning under a storage rack, a trolley should unload its payload, turn 90 degrees, reload the payload, and proceed perpendicularly. EX 1006, ¶73; EX 2007, ¶97. Further, the Raizer robot’s profile is incompatible with travel beneath storage racks, as evidenced by Hangzhou’s symmetrical, low-profile trolley design. EX 2007, ¶95.

Most significantly, Raizer’s navigation system is not designed to properly navigate underneath storage racks. EX 2007, ¶97. Razier’s efficient path finding system is one of its core inventive aspects, as it is designed to operate on low position information to increase efficiency. EX 1005, ¶80. Traveling under racks would require much higher positional accuracy than on an open floor, decreasing efficiency and removing a core inventive aspect from Razier’s robot. EX 2007, ¶97. Hangzhou

itself acknowledges design difficulties that arise when creating a single-robot automated warehousing system, as it explicitly considered and rejected a single-type mobile robot solution. EX 1006, ¶4.

C. Petitioner Fails To Provide Sufficient Details Regarding Its Proposed Modified System

In its Petition, Petitioner does not detail the system of its proposed combination or provide support as to whether a POSITA would have a reasonable expectation of success in combining these references. Despite expressly relying on Raizer’s robots for horizontal and vertical travel and Hangzhou’s running of robots in passage spaces beneath the shelves (Petition, 7), Petitioner improperly picks and chooses elements from Raizer and Hangzhou, element by element, to attack the patent.

To evaluate an obviousness combination the references in the combination “must be read together, not in isolation.” *Palo Alto Networks, Inc. v. Centripetal Networks, LLC*, 122 F.4th 1378, 1386 (Fed. Cir. 2024). Similarly, it is not sufficient for these references individually to disclose all of the claim limitations. Instead, the proposed combination must meet the claim limitations. *Id.*

Exotec fails to meet these standards of disclosure as they do not provide any details on how the proposed modified system would operate. Instead, Petitioner merely states that for the combination of Raizer and Hangzhou “[a] POSITA would have been motivated to combine and would have had a reasonable expectation of

success in combining Raizer and Hangzhou.” Petition, 9. This unsupported “reasonable expectation of success” is far from predictable, given the lack of information Exotec provides. Numerous material implementation details are left unaddressed, such as whether the robots would travel on rails or if there would be the cache space and channel support frame to guide the delivery robots. The all-important navigation system is left unaddressed as well - Raizer discloses a “survey mode” that generates required navigation maps, while Hangzhou does not disclose any such mode. EX1005, ¶84; EX2007, ¶89.

These ambiguities improperly leave the Board and the Patent Owner to guess as to how Exotec’s proposed combination would operate. *Netflix, Inc. v. DivX, LLC*, 84 F.4th 1371, 1377 (Fed. Cir. 2023) (finding “the Board should also not have to decode a petition to locate additional arguments beyond the ones clearly made”); *see also 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.’”) (citing to 35 U.S.C. § 312(a)(3)).

Because of Petitioner’s failure to clarify the operation of the proposed system or even attempt to reconcile some of their incompatibilities, Petitioner has not demonstrated a reasonable expectation of success in combining Raizer and

Hangzhou. *Samsung Elecs. Co., Ltd. v. Elm 3DS Innovations, LLC*, 925 F.3d 1373, 1381 (Fed. Cir. 2019) (finding that Petitioner’s failure to explain how a proposed combination would account for constraining factors in a material fabrication method claim was fatal to an obviousness challenge).

1. Petitioner’s Proposed Modification Contradicts Raizer’s Goals And Would Require Unacceptable Capital Equipment Investment, Reorganization, and Downtime

Raizer discloses that it aims to solve specific shortcomings associated with the implementation of prior art systems. These shortcomings of implementing prior art systems include “the requirement of a large capital equipment investment,” “poor modularity” including required reorganization, and required “downtime.” EX1005, ¶¶5-7. Petitioner’s proposed system comprised of Raizer’s robots and Hangzhou’s ability to go under the shelves exacerbates these shortcomings. Therefore, a POSITA would not have been motivated to look to Hangzhou to modify Raizer.

For example, Petitioner’s proposed modification to allow for travel underneath shelves, such as along a “path ... parallel to the aisle” would have required unacceptable modifications of 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. However, this proposed modification requires large capital equipment investment (new shelving

structures), leads to poor modularity, and requires reorganization and downtime.

These are exactly the shortcomings that Raizer aims to avoid. *See* EX1005, ¶¶4-16.

2. Petitioner Ignores Raizer’s Inventive Aspects And Propose A Modified System Which Frustrates Raizer’s Principle Of Operation And Introduces Additional Issues

Petitioner improperly only focuses on “reducing congestion” and creating more travel paths while ignoring the solutions presented by Raizer, the massive switching costs that modification would create, and various other issues created by their proposed system—such as aisle traffic and collisions. These ignored issues show the flaws of the Petition and “counsel strongly against obviousness.” *Medtronic, Inc. v. Teleflex Innovations SA RL*, 69 F.4th 1341, 1349–50 (Fed. Cir. 2023).

First, Petitioner focuses only on the fact that increasing the number of travel paths could hypothetically ease congestion. Petition, 6. This, however, is a non-existent problem. Raizer teaches that its invention already reduces congestion. EX1005, ¶98 (“...algorithm can track the movement of the robots and organize the routes of traffic in an around the warehouse to reduce congestion and prevent ‘traffic jams’ when the robots are busy filling orders.”). Thus, in spite of Raizer’s explicit teaching that its method reduces congestion, Petitioner concludes that “[a] POSITA would have turned to Hangzhou and its teaching of running autonomous robots in passage spaces beneath the shelves to provide such added travel ways.” Petition, 7.

Dr. Spenko echoes this phantom problem and speculates regarding the hypothetical benefits of creating additional travel paths:

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, ¶106.

Both Exotec and Dr. Spenko ignore the downsides of creating travel lanes under shelves, and in turn ignore that other significant traffic issues are created by introducing Hangzhou's travel under the shelves into Raizer. A key aspect of Hangzhou is its use of a multi-type robot instead of single-type robot approach. EX1006, ¶¶4-6. As explained by Hangzhou, the "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, ¶48.

Thus, the trolleys of Hangzhou avoid congestion and collisions with the stacking vehicles by traveling in the column laneways and in trolley passage space (located under the shelves and shown as red lines). EX1006, ¶48; EX2007, ¶68.

The trolleys preferably do not enter the stacking row laneway aisles reserved for the stacking vehicles. *Id.* By preferably restricting the trolleys to traveling under the shelves instead of in the aisles, as well as giving stacking vehicles priority over the trolleys, the system of Hangzhou is able to efficiently deliver goods and avoid collisions. EX1006, ¶¶48, 59; EX2007, ¶68.

In contrast to Hangzhou's method of spacing out multi-type robots across the floor, Raizer avoids collisions by using only one type of robot and spacing them out vertically on shelves, precluding the need to go under the shelves. EX2007, ¶119. For example, as shown below in Figure 12A, Raizer's robots travel on the face of the shelves but can be above and below each other on different shelves to avoid colliding. EX2007, ¶119. This structure effectively adds numerous travel paths in the vertical direction, thereby reducing the need for numerous travel paths on the ground surface.

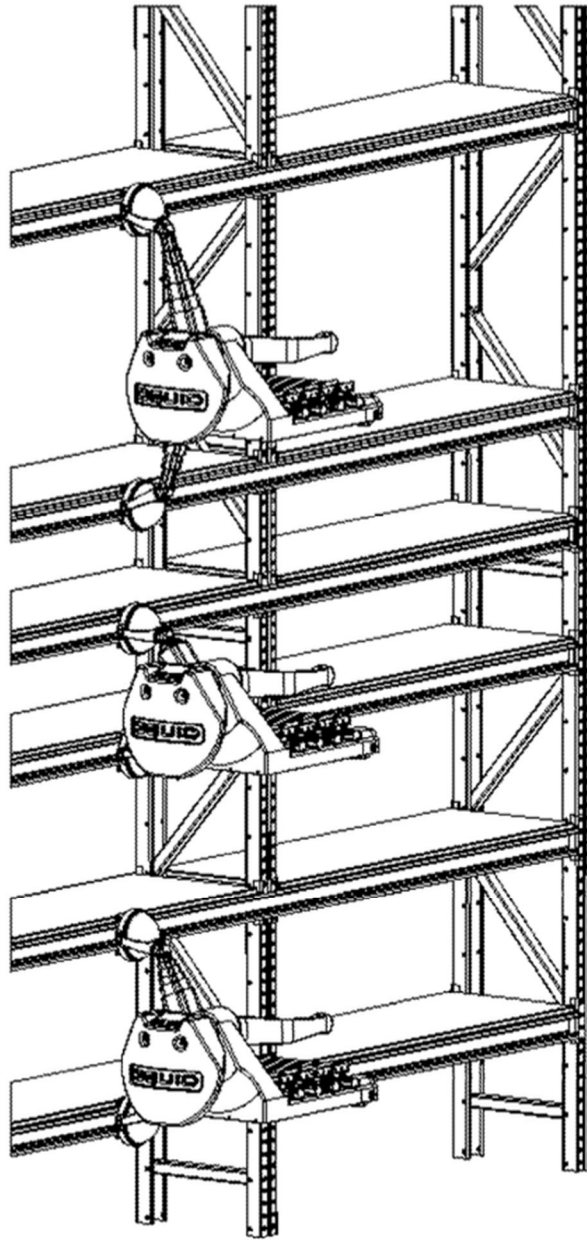
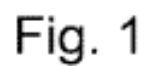


Fig. 12A

EX1005, Figure 12A.

During his deposition, Dr. Spenko walked through various possible ways that the delivery robots in Petitioner's proposed system would operate in a warehouse. He stated how a robot in the modified system, which uses Raizer's robots, would



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In his proposed modified system, the delivery robot could travel along a **path** (shown in yellow) until it reached a desired **terminal** (shown in red), wherein it would climb the shelves vertically until it reached the desired **bay** (underlined in grey).

For the first scenario, leaving from F1, Dr. Spenko walked through Raizer's unmodified system. EX2006, 95:23-107:9. In the second through fourth scenarios, Dr. Spenko walked through Petitioner's modified system, using Hangzhou's ability to go under the shelves with Raizer, to go from starting points at or near F3, F6, and F8, respectively.

Tellingly, in every example which Dr. Spenko acknowledged were reasonable representations of how a robot could travel in Petitioner's combined system, the robot was required to travel out from under the shelves and out into the aisle. This inefficient path structure was required to engage the terminals to access the rails so that the robot could travel vertically to ascend the shelves. *See, e.g.*, EX2006, 111:3-112:2; EX2007, ¶126; EX1005, ¶111. Traveling out into the aisles is required as the terminals of Raizer are on the front of the shelf units and curve out into the aisles. *See* EX1005, ¶111; EX2006, 70:3-15. These terminals are the "only place where robots 10 can connect or disconnect from the rails 42 in order to climb to or descend from the shelves." EX1005, ¶111; EX2006, 69:4-14. Raizer's robot must swing

into the aisle to connect with the terminals as Raizer's robot engages the rails with arms in the front of the robot. EX1005, Figures 8B-8G.

Therefore, while the robots in Raizer could avoid collisions with each other by spacing vertically, when using Hangzhou's under the shelves capability, Raizer's robots would be more apt to collide given the increased need to enter the aisle based on the design and implementation of Raizer's terminals, undercutting Petitioner's supposed benefits of increased pathways. EX2007, ¶¶127-128.

This is not surprising. Hangzhou's stacking robots fill the aisles. EX1006 Figure 3. The stacking vehicles are configured so they can simultaneously service the shelves on either side of an aisle. EX1006, ¶¶16, 46, Figure 3. As explained in Hangzhou:

The width of a stacking vehicle 300 is slightly narrower than that of a stacking row laneway 12, and its grabbing components 320 can grab standardized containers 400 and items on shelves 100 on both sides of a stacking row laneway 12.

EX1006, ¶46.

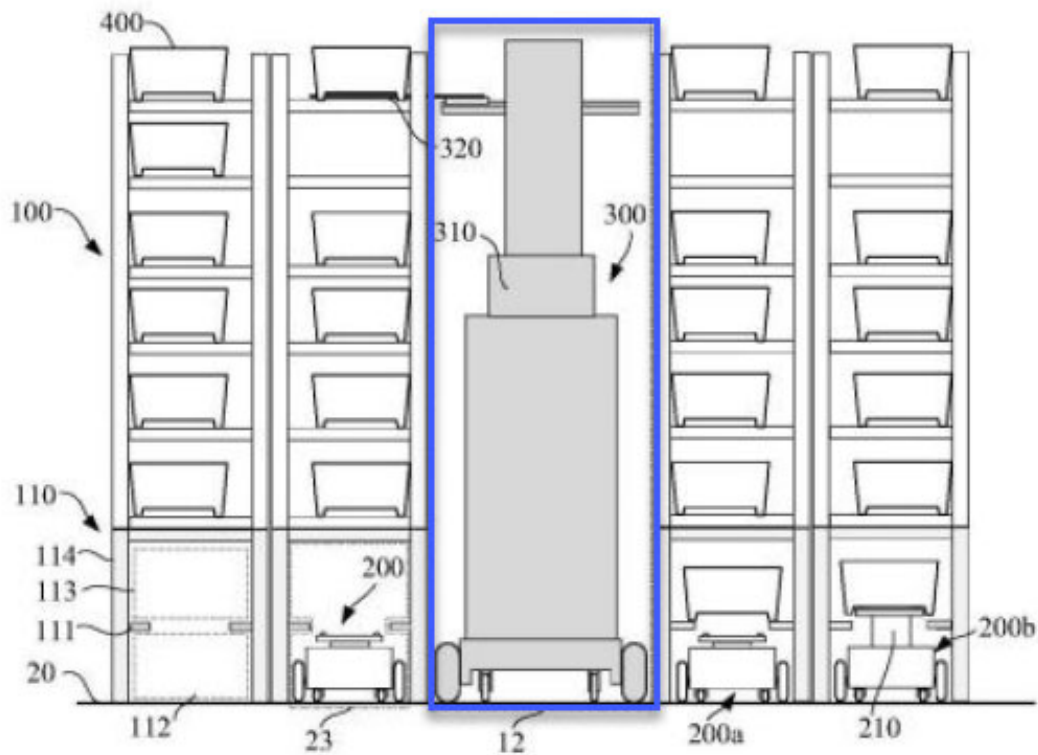


FIG. 3

Comparing the possible paths outlined in Exhibit 2005 to Figure 3 of Hangzhou, it is apparent that implementation of Petitioner's proposed system is not as straight forward as Petitioner suggests. Raizer's robots are wide enough to support the containers they carry. EX2007, ¶129; EX1005, ¶102. This differs from Hangzhou, in which the trolleys drop off the containers onto support members below the shelves in order to turn 90⁰ before picking them up again, in order to avoid having to turn the containers as well. EX1006, ¶73; EX2006, 77:10-17.

D. Hangzhou's Teachings And Petitioner's Modified System

Hangzhou's invention is designed to provide an unmanned warehousing system using (1) a multi-type robot approach where one type of robot used is a low-profile symmetrical trolley robot which (2) travels in a channel support frame to retrieve packages from the cache space above. EX1006, ¶¶4-6, 48-49. Petitioner's proposed modification fails to account for these characteristics.

1. Petitioner's Proposed Modification Contradicts Hangzhou's Teachings

Hangzhou explicitly teaches using a system using multi-type robots instead of single-type robot approach wherein the "trolley is characterized by a small size and a low cost." EX1006, ¶48. Petitioner directly contradicts these teachings by proposing a system using Raizer's robots which are complex, expensive robots designed to be a single-type robot approach utilizing extending arms and the use of terminals to facilitate traveling vertically up the shelves. *See* EX2007, ¶96.

In discussing the background of the art, Hangzhou specifically teaches away from a single-type, noting that a single-type robot system is not desirable because "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." EX1006, ¶4. Moreover, in single-type systems, "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."

EX1006, ¶4. A multi-type robot system, in contrast, “can take advantage of different robots’ strengths” but may “lead[] to a higher deployment cost.” EX1006, ¶5. Hangzhou specifically chose to utilize the two separate robot types that include (1) trolleys and (2) a stacking vehicle and move in tandem with each other to avoid the drawbacks associated with the single-type robot system.

In contrast to Hangzhou’s teachings, Petitioner’s proposed modification utilizes Raizer’s robots which service the whole shelf and are designed to be used in a single-type robot system. EX1006, ¶4, EX2007, ¶66; *see* POPR Section IV.A. Raizer’s robots also utilize robotic arms (*see, e.g.,* EX1003, Figure 12A), which Hangzhou again teaches away from. EX1006, ¶6. Hangzhou explains, regarding the prior art systems:

To sum up, ***most of the existing solutions need complex deployment, requiring on-site modification and the installation of a large number of auxiliary electromechanical devices.*** The devices cannot continue to operate in the case of failures, and it is inconvenient to maintain them. ***Or, although the on-site modification is not required, a large number of costly heavy-load mobile trolleys or robotic arms need to be configured.*** Complex deployment, inconvenient maintenance, and high costs all limit promotion.

EX1006, ¶6 (*emphasis added*).

Further, regarding its system design, Hangzhou also teaches symmetric robots used in conjunction with standardized containers. EX1006, ¶¶48-49. In contrast,

Raizer's robots can be asymmetrical (EX1005, Figure 5D) and are designed to "handle different sized boxes." EX1005, ¶105.

Of note, the dates of the references further undercut Petitioner's purported motivation to combine these references. Hangzhou was filed January 15, 2019, after Raizer was published June 8, 2017. EX1005 at Cover, EX1006 at Cover. Per Dr. Spenko, a POSITA "who did his homework" would have been aware of Raizer's robots at the time Hangzhou was drafted. EX2006, 92:9-93:9. Yet, Hangzhou nonetheless chose to utilize a two-robot system to travel below the shelves and move vertically, further demonstrating that Petitioner is oversimplifying their proposed combination without supporting that it could actually be accomplished.

E. Petitioner Fails to Establish a Reasonable Expectation of Success

Regardless of whether Petitioner has established a motivation to combine Raizer with Hangzhou—which they have not—Petitioner has failed to establish a reasonable expectation of success for doing so. Petitioner fails on three fronts: (1) Petitioner fails to address a reasonable expectation of success in their Petition; (2) Petitioner fails to describe their proposed combination with sufficient specificity as to determine whether there would be a reasonable expectation of success; and (3) even if Petitioner's system is deemed sufficiently described, the system would not have operated successfully as described.

1. Petitioner’s Failure To Address A Reasonable Expectation Of Success In Their Petition Is Fatal

Assuming *arguendo* that Exotec has demonstrated a motivation to combine Raizer and Hangzhou, Exotec still must show a reasonable expectation of success. The Federal Circuit has found that “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 ...” *Eli Lilly & Co. v. Teva Pharms. Int’l GmbH*, 8 F.4th 1331, 1344 (Fed. Cir. 2021). Exotec fails to meet this burden.

Exotec’s only mention of any “expectation of success” of their proposed combination is 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. This conclusory assessment clearly falls well short of the requirement to *show* a reasonable expectation of success, and not to merely state that there was one.

Further, Exotec’s blanket conclusion is not saved by their reliance on Petitioner’s Expert Declaration. Petition, 9. Similar to Exotec, Dr. Spenko only relies on conclusory assessments and not the references’ actual disclosures. For example, from Petitioner’s expert declaration:

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. Dr. Spenko does not provide any examples of the “explicit teachings” or what knowledge of a POSITA indicate a reasonable expectation of success, instead dismissing the central navigation issues as an “obvious matter of design choice.” *Id.* As set forth above, Raizer and Hangzhou’s disclosures explicitly teach against a combination, let alone a successful one.

Dr. Spenko does not provide any support for his statement that the routing for Petitioner’s combined system is “an obvious matter of design choice.” EX1003, ¶101. Raizer and Hangzhou take different approaches to warehouse item retrieval. Raizer uses a singular-type of complex robot which travels only through aisles due to its design and functionality to climb rails vertically to retrieve containers (via terminals which stick out into the aisles), while Hangzhou uses a multi-type robot system where the trolley robots cannot climb but travel under the shelves through the use of a channel support frame to automatically guide a trolley and avoid the stacking robots. Dr. Spenko’s conclusory statement that the choice of routing is “an

obvious matter of design choice” is unfounded and overlooks (or ignores) these fundamental differences in the references and their implications.

Thus, as neither Exotec nor Dr. Spenko provide any meaningful arguments or evidence pertaining to a reasonable expectation of success, the Board should reject the Petition.

2. Petitioner Fails To Describe Their Proposed Combination With Sufficient Specificity As To Determine The Reasonable Expectation Of Success

Exotec and Dr. Spenko failed to provide adequate disclosure of their proposed modified system. Petitioner improperly identified only singular elements from each of the references, instead of describing an actual proposed system. *See Palo Alto Networks, Inc. v. Centripetal Networks, LLC*, 122 F.4th 1378, 1386 (Fed. Cir. 2024).

For example, Dr. Spenko fails to describe with any particularity how his proposed system would operate. He was even ambiguous as to whether the stacking robots in Hangzhou would continue to be used in the combined system, a key functionality of Hangzhou which allows for the inexpensive and efficient stocking and retrieval of packages on the shelves. EX2006, 89:10-90:25. Stacking robots, however, are incompatible with Raizer’s robots.

As Petitioner fails to actually describe how Raizer and Hangzhou would be modified in view of each other, they have failed to demonstrate a reasonable expectation of success for this hypothetical system.

3. Petitioner’s Proposed Combination, Even If Described Sufficiently To Be Created, Would Not Have Operated Successfully

Petitioner’s modified system likely would not have operated successfully and therefore cannot be said to have the requisite reasonable expectation of success. *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013) (finding no reasonable expectation of success where expert testimony suggested Patent Challenger’s proposed combination would not have worked for its intended purpose).

As set forth above, Petitioner’s proposed system is incompatible with the goals and teachings of Raizer and Hangzhou. Further, Petitioner’s proposed combination requires the use of proprietary components, such as those of Raizer, and therefore a POSITA cannot have a reasonable expectation of success creating this combination. For example, Raizer describes its automated storage-and-retrieval invention as using proprietary components to perform critical functions:

- 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). EX1005, ¶84.

- Each robot utilizes dedicated maneuvering algorithms and a **proprietary “Fine Positioning” procedure** to enable precise, quick and efficient loading. EX1005, ¶84.

Given their expressly proprietary nature, these components cannot be combined with technology from a secondary source by a POSITA, because a POSITA would not have access to the proprietary components. *N. Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 936 (Fed. Cir. 1990) (holding that sensitive documents housed in a corporate library restricted to authorized persons were not “generally available” and therefore did not qualify as “printed publications”). A POSITA would not know how to modify the proprietary component to achieve the proposed combination. EX2007, ¶¶144-146.

The proprietary components used in Raizer perform critical features *vis-à-vis* the '632 Patent claims. Example uses of the proprietary components in the claimed features include:

- “*driving a first one of the vehicles to drive the first vehicle to the storage racks.*” '632 Patent Claim [1.c].¹ This limitation cannot be practiced without the proprietary software that includes the warehouse layout, routes, intersections, and designated areas.

¹ Patent Owner adopts the claim numbering convention from Petitioners’ petition for ease of reference.

There is no way to drive vehicles to the storage racks without the layout, routes, and intersections provided by the proprietary software.

- “*driving the first vehicle along a first path under a first one of the racks.*” ’632 Patent Claim [1.d1]. This limitation cannot be practiced without the proprietary software that includes the warehouse layout, routes, intersections, and designated areas. There is no way to drive vehicles under the storage racks without the layout, routes, and intersections provided by the proprietary software.
- “*a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations.*” ’632 Patent Claim [11.c5]. This limitation cannot be practiced without the **proprietary “FinePositioning” procedure** to enable precise, quick and efficient loading.
- “*transferring an item between the first vehicle and the first storage location.*” ’632 Patent Claim [23.e]. This limitation is practiced using the **proprietary “FinePositioning” procedure** to enable precise, quick and efficient loading.

In this proceeding, a POSITA is “a person with a working knowledge of mechanical design and automation. That person would have had a Bachelor of Science degree in an academic discipline emphasizing the design of mechanical, automation, and robotics technologies, in combination with training or at least one

to two years of related work experience. Alternatively, that person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline. More education can supplement practical experience and vice versa.” Petition, 5; Institution Decision, 9-10.

Importantly, a POSITA is not a person that developed Raizer’s proprietary components. Nor is a POSITA a person working at a company that makes systems using Raizer’s proprietary components. Therefore, a POSITA would not know how to modify Raizer’s proprietary components or have any expectation of success in performing any such modification.

Raizer uses its proprietary software, including a “Survey Mode,” (EX1005, ¶84) to establish the routes and intersections that its robots use to navigate. Because Raizer’s invention does not travel or turn its robots under the shelves, its proprietary software does not establish routes and intersections under the shelves. Therefore, the proposed combination requires that Raizer’s proprietary software be changed so that it can establish the required new routes and intersections. Such modifications would be nonobvious, and not have a reasonable expectation of success.

Even assuming that a POSITA would get access to Raizer’s proprietary software, the POSITA would need to alter the process such that the robots could drive and turn under the shelves during the “Survey Mode” portion of the proprietary

software execution. Mapping under shelves, however, is very challenging and beyond the skill of a POSITA. EX2007, ¶152. To be clear, Hangzhou’s two-robot system specifically avoids such requirements to map the paths under the shelves because of the channel support frames guiding the trolleys. EX1006, ¶59. However, in order for Raizer’s robots to be able to drive and turn under the shelves, additional mapping of the space below the shelves using sensors that perform “Survey Mode” must be carried out. EX2007, ¶151.

Raizer’s sensors that perform Raizer’s “Survey Mode” mapping would operate drastically different when driving under a shelf than when driving in the open area of the warehouse. *Id.* Sensors used in such mapping activities generally use beam emitting-and-detecting measurements. *Id.* For example, LiDAR sensors emit laser pulses and measure reflected signals. *Id.* While this can work well in open spaces, such a system being used under shelves would be subject to an array of noisy reflected signals (multipath effects) that bounce off of the overhead shelves and the support legs of the shelves, or distant walls beyond the shelves. *Id.* The reflection patterns in such closed spaces are too complex for a POSITA to work with, especially in conjunction with proprietary software. *Id.*

These reflected signals cause issues with both proprietary and non-proprietary aspects of Raizer’s robots traveling under shelves and highlight significant issues with Petitioner’s proposed combination.

Petitioner has offered no evidence that Raizer's robots would operate successfully underneath these shelves in light of the multipath effects. Raizer uses sensors to navigate the aisles of a warehouse while Hangzhou uses a channel support frame to help guide its trolleys. EX1005, ¶22; EX1006, ¶8. Attempting to use Raizer's robot and its sensors to navigate under shelves would create serious navigation issues due to these multipath effects. EX2007, ¶154. A POSITA at the time of invention of the '632 patent would not have had a reasonable expectation of success for solving these navigation issues, especially in a manner that would have been acceptable in the warehouse settings described in Raizer or Hangzhou. *Id.* Thus, there is not a reasonable expectation of success for Petitioner's proposed combination, and Petitioner's conclusory statements do not show otherwise.

In fact, such sensor challenges are even beyond the abilities of large robotics companies staffed with numerous research Ph.Ds. As Dr. Singhose explains, he conducted numerous tests on the automapping features offered in autonomous robots around the time of the priority date of the '632 Patent (2021). EX2007, ¶155. Although large robotics companies, such as iRobot and SharkNinja, offered features that could "automatically" map a home and detect carpets and furniture, the mapping systems worked poorly and often needed to be manually overridden with adjusted maps. *Id.* In particular, the robots could not reliably map under low-hanging obstacles such as beds. *Id.* Overhead structures create reflection patterns that are

too complicated for the sensor algorithms to correctly interpret real object locations.

Id.

Therefore, the sensors available at the time of the '632 Patent would not have been able to accurately map the spaces under the shelves in Raizer's "Survey Mode" to allow a modified system that would have operated as proposed by Petitioner. Whether the relevant software is proprietary or not, the proposed modification needed for Petitioner's proposed combination is still nonobvious and beyond the abilities of a POSITA.

F. Petitioner's Proposed Modification Detracts from Raizer's Inventive Principles and Objectives

As an initial matter, Petitioner ignores how the Hangzhou system's trolley robots travel through passage spaces beneath shelves. These trolley robots travel via a "two-layer channel support frame" where the "lower layer is used to automatically guide a trolley to pass through." EX1006, Abstract.

Further, Raizer and Hangzhou describe two different systems. Specifically, Raizer's robots use "anchor point navigation," which allows Raizer's robots to "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.” EX1005, ¶80; EX2007, ¶63.

Raizer’s use of “anchor point navigation” is an essential feature of Raizer’s system. EX1005, ¶¶79-80 (“Some of the features of the invention *that makes the system unlike existing systems* are: The robots in the system of the invention use “anchor point navigation”). Moreover, Raizer explains that “anchor point navigation” is beneficial, because “[t]his 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, ¶80. EX2007, ¶64.

Hangzhou requires a much more complex navigation planning system in order to ensure safe and reliable operation. EX1006, ¶59 (“*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.*”); *id.*, (“[T]he 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.*”). For example, Hangzhou’s navigation system needs to evaluate four different path planning methods. EX1006, ¶80. As a result, Hangzhou’s planning algorithm intentionally introduces delays and wait times when the trolleys are

travelling on the ground to plan a path to a destination that avoids collisions and proper transfer of items between the trolleys and the stacking vehicles. EX1006, ¶63. EX2007, ¶76.

In other words, introducing all of the required sensors and navigational system complexity required by Hangzhou to ensure safe and reliable operation into and underneath the storage shelves would mean it would have detracted from what Raizer considers to be the distinguishing features of Raizer’s purported invention: “us[ing] *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, ¶80. EX2007, ¶97. In short, altering Raizer’s robots to run beneath shelves like Hangzhou’s trolleys would have required modifications that would have obviated Raizer’s innovation.

As a final note, Petitioner’s expert declaration repeats the same conclusory statements proffered in the Petition and should be given little to no weight. “To satisfy its burden of proving obviousness, *a petitioner cannot employ mere conclusory statements.* The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016); *see also, Xerox Corp. v. Bytemark, Inc.*, IPR202200624, Paper 12 at 5 (PTAB Feb. 10, 2023) (Director Review) (precedential) (determining that “the Board was correct in giving

little weight to Petitioner’s expert because the expert declaration merely offered conclusory assertion without underlying factual support and repeated, verbatim, Petitioner’s conclusory arguments”); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (“In an [inter partes review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.”) (citing 35 U.S.C. § 312(a)(3)).

G. Dr. Spenko Misunderstands Or Fails To Fully Appreciate Essential Aspects Of The Technology At Issue

Dr. Spenko’s oversimplistic view of the issues involved with automation systems, in particular warehouse automation, shows his opinions should be given little to no weight.

For example, Dr. Spenko testified that for “everything that we’ve ever done with Lidar on cars we’ve never had to deal with multipath errors.” EX2006, 41:2-3. This demonstrates that Dr. Spenko either does not understand the sensor systems at issue or does not appreciate the complexities of what is at issue to make the Petitioner’s proposed combination actually work.

It is well established that Lidar suffers from multipath effects. EX2007, ¶157. Lidar sends out laser signals and measures the reflections to determine the distance to objects and/or targets. EX2007, ¶¶157-159. Robots navigating in cluttered environments suffer much more from multipath effects than robots navigating in an open space. EX2007, ¶161.

Dr. Spenko also testified that “a person of ordinary skill in the art wouldn’t really care that much like if [mapping is] disclosed or not” because “getting around the warehouse is not a hard -- is not hard.” EX2006, 86:20-24. Dr. Spenko goes on to testify that mapping is not that important because “a person of ordinary skill in the art see [Hangzhou] and is like all right, well, create a map. Like, done. Not an issue.” EX2006, 87:12-15. Not so. Mapping is critical for autonomous robots and is one of the largest hurdles to overcome. EX2007, ¶161. Mapping becomes an even bigger issue when the robots are inside a cluttered environment. *Id.*

Because Dr. Spenko does not appear to have fully considered what is actually involved with Petitioner’s proposed combination of Raizer and Hangzhou, he cannot support a reasonable expectation of success.

VII. DEPENDENT CLAIMS 3-10, 12, 14, AND 24-27 ARE PATENTABLE

A. Petitioner Fails To Establish That Claim 5 Is Unpatentable

1. Petitioner Fails To Establish That Raizer/Hangzhou Render Obvious Limitation 5b

Limitation 5b recites “the first vehicle has a length and a width and the length is greater than the width.” Petitioner relies on Raizer’s Figure 5D as allegedly disclosing that Raizer’s “length is greater than the width.” Petition, 44. But Petitioner’s reliance on Figure 5D is incorrect as a matter of law.

To read proportions from drawings in a patent, they must indicate explicitly that they are made to scale. *Nystrom v. TREX Co., Inc.*, 424 F.3d 1136, 1149 (Fed.

Cir. 2005) (“Absent any written description in the specification of quantitative values, arguments based on measurement of a drawing are of little value.”). The only description that Raizer provides regarding Figure 5D is that it “is a top view[] of a robot of the system of the invention.” EX1005, ¶¶65, 103. While at first blush it appears the length of the robot in the figure is longer than the width, this is insufficient. As the drawings in Raizer do not explicitly indicate a scale, Petitioner cannot rely on them to make conclusions as to geometric dimensions.

Further it makes sense in Raizer that the width of its robots may be greater than the length. The robots of Raizer must be able to “handle different sized boxes” and therefore may have “an array of micro-pallet lifters.” EX1005, ¶31. The length of the micro-pallet lifters establishes the width of the robot. *See* EX1005, ¶102, Figure 5D. To handle the described “different sized boxes,” the robots of Raizer must be sufficiently wide for the required micro-pallet lifters. EX2007, ¶130. Thus, not only is Petitioner’s cited figure insufficient to establish Claim 5b as obvious, but Raizer teaches against a robot where its “length is greater than the width.”

Thus, Petitioner fails to establish Claim 5b as obvious.

2. Petitioner Fails To Establish That Raizer/Hangzhou Render Obvious Limitation 5c

Limitation 5c recites “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 the half the length of the vehicle.” Petitioner cites

Hangzhou's robots' characteristics and abilities as supporting their position for this claim limitation. *See* Petition, 46 (“that the trolleys ‘turn[] 90⁰ in place’ and that the ‘diameter of the trolley 200 is less than the short side of the channel support frame 110, the trolley 200 may turn in place without movement interference.”; “Given Hangzhou's disclosure of trolleys . . . being small enough to rotate in place . . .”).

Petitioner's reliance on *Hangzhou's* robots' characteristics is fatal to their argument, as Petitioner's proposed combination relies on Raizer's robots, not Hangzhou's. Petition, 7 (“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, . . .”). Dr. Spenko admitted that Petitioner's proposed combination uses *Raizer's* robots—not Hangzhou's robots. EX2006, 89:10-13. Thus, Petitioner's discussion of Hangzhou's robots' ability to turn 90⁰ in place because of its symmetrical shape is irrelevant to Raizer's robots. Indeed, Dr. Spenko argued that Raizer's robots are not symmetrical in shape. EX2006, 89:10-13; EX1003, ¶255 (for limitation 5b, Dr. Spenko relied on Raizer's robot's apparent asymmetry as allegedly disclosing that limitation); *see also* Petition, 43-44.

Petitioner and Dr. Spenko undercut their own arguments and the Petitioner's proposed combination by interjecting Hangzhou's robots when needed. Petitioner shouldn't be able to have it both ways.

B. Petitioner Similarly Fails To Establish That Claims 8 and 9 Are Unpatentable

Claim 8 recites “wherein the step of turning comprises rotating the first vehicle about a vertical axis that extends through the first vehicle.” Claim 9, which depends from claim 8, recites “wherein the vertical axis extends through the first path.”

Petitioner points to the robots of Raizer and, as backup, the disclosures of Hangzhou. *See, e.g.,* Petition, 51 (“Hangzhou discloses driving . . . 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 90⁰ in place.”) Again, it is improper for Petitioner to rely on the characteristics of Hangzhou’s robots after explicitly pointing to Raizer’s robots for their proposed combination. *See* Petition, 7.

C. Petitioner Fails To Establish That Claims 3-10, 12, 14, And 24-27 Are Unpatentable

Finally, for all the same reasons as articulated in Section VI, such as Petitioner’s failure to substantiate the purported motivation to combine or substantively support a reasonable expectation of success in implementing the proposed combination of Raiser with Hangzhou’s pathways under the shelves, Petitioner also fails to establish that dependent claims 3-10, 12, 14, and 24-27 are unpatentable.

VIII. CONCLUSION

For the reasons set forth above, the Board should find the challenged claims 1, 3-12, 14, and 23-27 patentable.

Dated: February 7, 2025

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

CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

I hereby certify that this Patent Owner's Response, excluding the portions exempted under 37 C.F.R. § 42.24(a), has 11,292 words as counted by the word-processing system used to prepare this document, in compliance with 37 C.F.R. §42.24(d).

Dated: February 7, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that a complete copy of the following materials:

- Patent Owner's Response;
- Exhibit List;
- Exhibit 2003-2009; and
- Certification Under 37 C.F.R. § 42.24(d).

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