

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.,
Petitioners

v.

Opex Corporation,
Patent Owner

Case No. IPR2024-00850
U.S. Patent No. 11,472,632 B2

PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §312 AND 37 C.F.R. §42.104

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LIST OF EXHIBITS

Exhibit	Short Name	Description
Ex. 1001	'632 Patent	U.S. Patent No. 11,472,632 B2
Ex. 1002	'632 File History	Prosecution History of U.S. Patent No. 11,472,632 B2
Ex. 1003	Derby Declaration	Declaration of Dr. Stephen Derby
Ex. 1004	Derby CV	Curriculum vitae of Dr. Stephen Derby
Ex. 1005	Raizer	U.S. Patent Appl. Publ. No 2017/0158430
Ex. 1006	Hangzhou	English Translation of CN Patent Publication No. CN 109987366A and Certificate of Translation
Ex. 1007		CN Patent Publication No. CN 109987366A
Ex. 1008	Goren	U.S. Patent 10,472,172 B2

Exotec Product France SAS, Exotec North America Inc., and Exotec Product USA Inc. (“Petitioners”) seek IPR under 35 U.S.C. §§311-319 and 37 C.F.R. §42 of Claims 1, 3-12, 14, 23-27 (“Challenged Claims”) of Patent No. 11,472,632 (“the ’632 Patent”). Petitioners request cancellation of the Challenged Claims.

I. STANDING UNDER 37 C.F.R. §42.104(a)

Petitioners certify the ’632 Patent is available for IPR and that Petitioners are not barred or estopped.

II. PAYMENT OF FEES

Petitioners authorize Account No. 16-0605 to be charged.

III. OVERVIEW OF CHALLENGES AND RELIEF REQUESTED

Pursuant to 42.22(a)(1) and 42.104(b)(1)-(2), Petitioners request cancellation of the Challenged Claims pursuant to the ground below. Additional support is provided in the Declaration of Dr. Derby (Ex. 1003).

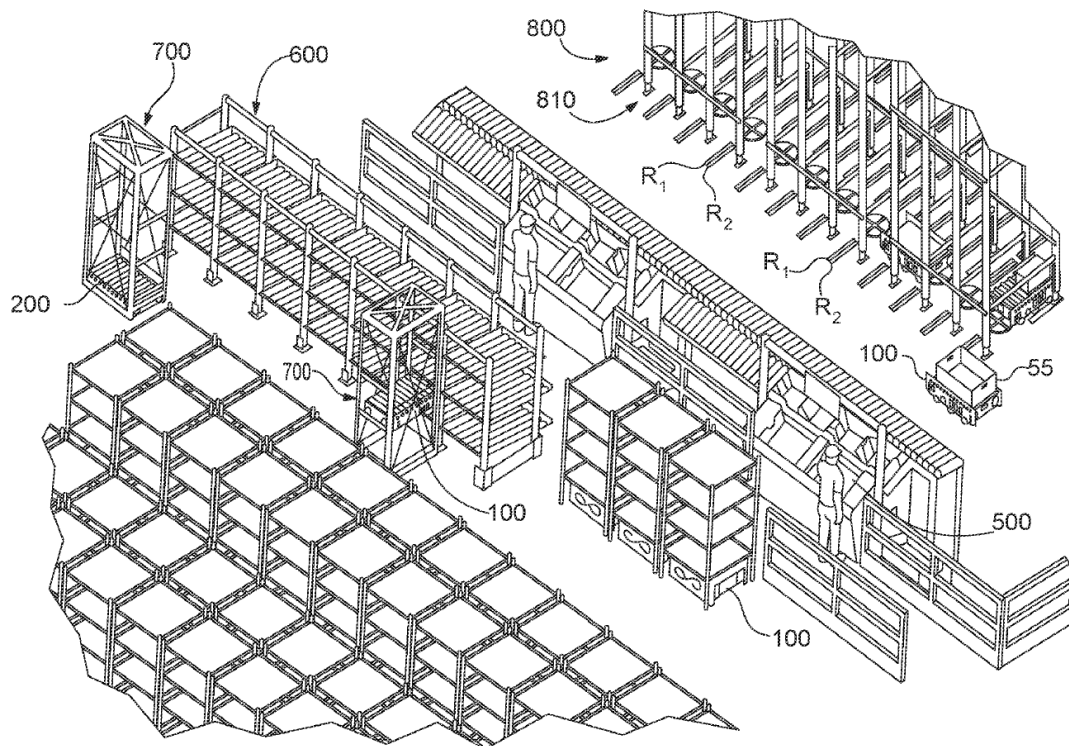
Ground 1: Claims 1, 3-12, 14, 23-27 are unpatentable under 35 U.S.C. §103 over *Raizer* and *Hangzhou*.

IV. ’632 PATENT SUMMARY

A. Specification

The ’632 Patent purports to solve alleged problems relating to material handling systems (Ex. 1001, 1:12-46, 7:41-52; Ex. 1003, ¶¶52-62).

Ex. 1001, FIG. 1

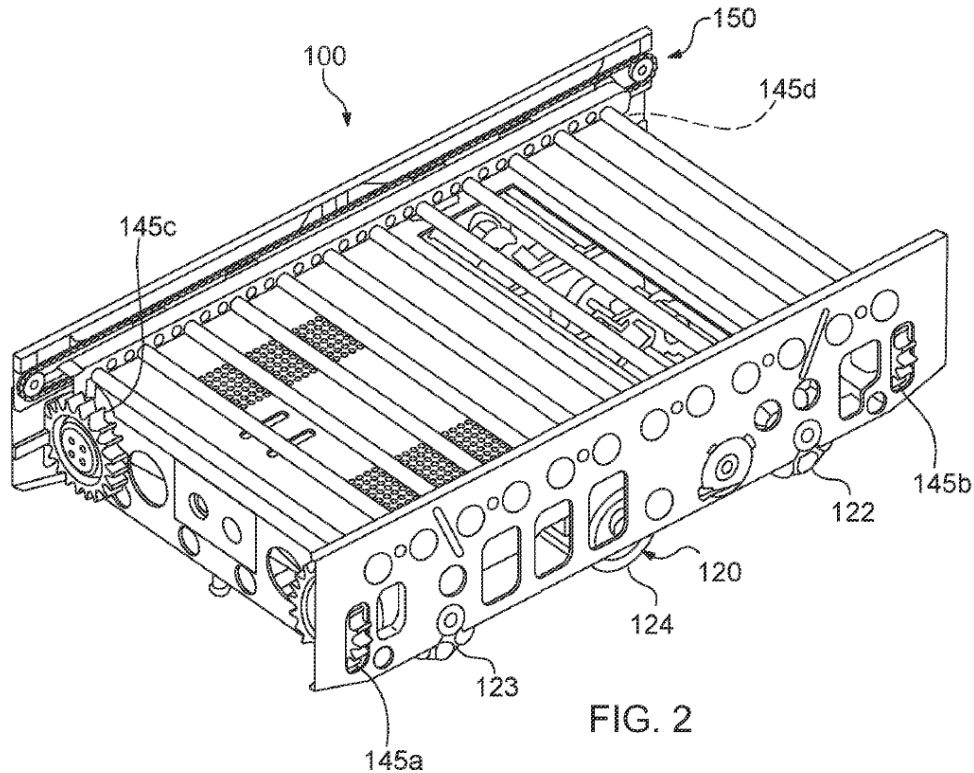


The '632 Patent discloses a “material handling system” with “storage racks,” each “includ[ing] a plurality of storage locations.” (Ex. 1001, 7:41-52; FIG. 1; Ex. 1003, ¶¶54-57).

A “delivery mechanism” may “include one or more vehicles that” “retrieve items from storage locations” and “deliver the items to a workstation 500 where an operator can retrieve the item from the vehicle.” (Ex. 1001, 7:10-22; Ex. 1003, ¶58).

The '632 Patent discloses a “vehicle” with “a horizontal drive assembly” and a “vertical drive mechanism 140¹.” (Ex. 1001, 8:9-19, 9:12-19, FIG. 2, FIG. 9; Ex. 1003, ¶¶58-60).

Ex. 1001, FIG. 2



The vehicles include a “transfer mechanism” “operative to transfer an item between a platform surface of the vehicle and one of the plurality of destination

¹ Petitioner notes that reference 140 is absent in FIGs. 2 and 3 of the '632 Patent despite being in the Specification.

areas,” and the “racks may be configured to allow the vehicles to travel under the racks” and “across or along one or more aisles.” (Ex. 1001, 10:1-23, 17:7-48; FIG. 2, FIG. 7; Ex. 1001, ¶¶61-62).

B. Prosecution History

U.S. Patent App. No. 16/994,543 was filed August 14, 2020 (Ex. 1002, 152-212). A Notice of Allowance was mailed June 27, 2022. (Ex. 1002, 76). A Certificate of Correction was issued to make corrections to claim 11. (Ex. 1002, 1-70). (Ex. 1003, ¶¶63-69).

C. Claim Construction

The claims are construed herein “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b).” 37 C.F.R. § 42.100(b) (Nov. 13, 2018). The terms should receive their respective plain and ordinary meaning as understood by a person of ordinary skill in the art under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

But for a few exceptions, neither the language of the challenged claims nor the specification of the ’632 Patent indicates that all of the steps of the method claims must be performed in the order they are written. *Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1342-43 (Fed. Cir. 2001); *Altiris, Inc. v. Symantec Corp.* 318 F.3d 1363, 1369-1371 (Fed. Cir. 2003); *Koninklijke Philips N.V. v. Zoll Med Corp.*, 656 Fed. Appx. 504, 512-514 (Fed. Cir. 2016).

V. PRIOR ART

A. Raizer (Ex. 1005)

U.S. Pub. No. 2017/0158430 A1 (“*Raizer*,” Ex. 1005), published June 8, 2017 (Ex. 1005, Cover; Ex. 1003, ¶¶72-88). *Raizer* is prior art under at least 35 U.S.C. §102(a) (AIA) (Ex. 1003, ¶73).

B. Hangzhou (Ex. 1006)

Chinese Patent Publication Patent No. CN 109987366A (“*Hangzhou*,” Ex. 1006) published July 9, 2019 (Ex. 1006, Cover; Ex. 1003, ¶¶89-98). *Hangzhou* is prior art under at least 35 U.S.C. §102(a) (AIA) (Ex. 1003, ¶90).

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention of the ’632 Patent would have been 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. (Ex. 1003, ¶¶42-43). More education can supplement practical experience and *vice versa* (Ex. 1003, ¶¶42-43).

VII. ARGUMENT

A. Ground 1: Claims 1, 3-12, 14, 23-27 Are Unpatentable Under 35 U.S.C. §103 over *Raizer* and *Hangzhou*

Raizer and *Hangzhou* render obvious claims 1, 3-12, 14, 23-27 of the '632 patent (Ex. 1003, ¶¶99-552).

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).

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).

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. (Ex. 1003, ¶¶108, 109, 110). The practice of installing shelving units with elevated lower shelves to allow robots loaded with containers to travel underneath was a known technique at the time to limit congestion and avoid bottlenecks. (Ex. 1003, ¶107).

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).

A POSITA would have noted that several *Hangzhou* embodiments, with expressly interchangeable features, disclose switching or turning travel directions between perpendicularly arranged column and row channels while under shelving

units to reduce blockages and shorten robot turnover time. (Ex. 1003, ¶¶112, 115). Such turning allows the *Raizer* robot to autonomously choose “among all possible paths” to a destination thereby reducing congestion, avoiding traffic jams, and more efficiently using space. (Ex. 1003, ¶¶113-114).

A POSITA would have considered *Hangzhou*’s multiple embodiments (Embodiments 1-4) to be interchangeable or, at a minimum, as describing features that were readily combinable at least in view of shared commonalities and *Hangzhou*’s explicit disclosure that the fourth embodiment is “a general form of the previous three embodiments.” (Ex. 1006, ¶[0076]; Ex. 1003, ¶115).

Allowing the autonomous robots of *Raizer* to travel along the various paths described in *Hangzhou* is additionally obvious because such a combination relies on known solutions to improve similar systems and methods in the same way. Here, “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have known that implementing the under-rack travel and turning routing of *Hangzhou* with *Raizer*’s autonomous robots having three-dimensional navigation and travel capabilities would have led to a predictable result of reducing congestion and preventing traffic jams as taught by both *Raizer* and *Hangzhou*. (Ex. 1003, ¶¶110, 114).

Moreover, the '632 Patent is silent as to any particular benefit, unexpected result, or criticality of a choice of a particular routing. Given the disclosures of *Raizer* and *Hangzhou* indicating the robots and trolleys can travel throughout a warehouse and can do so in ways to reduce congestion and prevent traffic jams, the choice of routing (turning, under racks, in, across, or parallel to aisles) is an obvious matter of design choice in view of the cited references. (Ex. 1003, ¶101); *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975).

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).

2. Claim 1

- i. [1.pre]: A method for delivering items to storage locations and retrieving items from storage locations, comprising the steps of:**

To the extent [1.pre] is limiting, *Raizer* discloses [1.pre]. (Ex. 1003, ¶¶117-120).

Raizer discloses "an automatic system for picking and placing boxes on shelves in a warehouse" comprised of "autonomous mobile robots," and "a

network of vertical and horizontal rails” “parallel to” “vertical support posts and horizontal shelves.” (Ex. 1005, Abstract; Ex. 1003, ¶118). *Raizer*’s robots “navigate and travel autonomously both along the floor and up the vertical rails and along the horizontal rails of [a] network of rails.” (Ex. 1005, Abstract; Ex. 1003, ¶¶119-120).

ii. [1.a1]: providing a plurality of storage racks spaced apart from one another forming a plurality of aisles,

Raizer discloses [1.a]. (Ex. 1003, ¶¶121-123).

Raizer discloses a “storage area” with “a plurality of shelving units” (storage racks) where the shelving units consist of “horizontal and vertical pieces of angle iron that support the shelves.” (Ex. 1005, ¶[0092]; FIG. 1; Ex. 1003, ¶122). “[V]ertical supports divide shelving units into bays (B1, B2, ...),” and “sides of the shelving units that face the aisles” (plurality of aisles) “between units are called faces (F1, F2, ...).” (Ex. 1005, ¶[0092]; Ex. 1003, ¶¶122-123).

Ex. 1005, FIG. 1 (annotated)

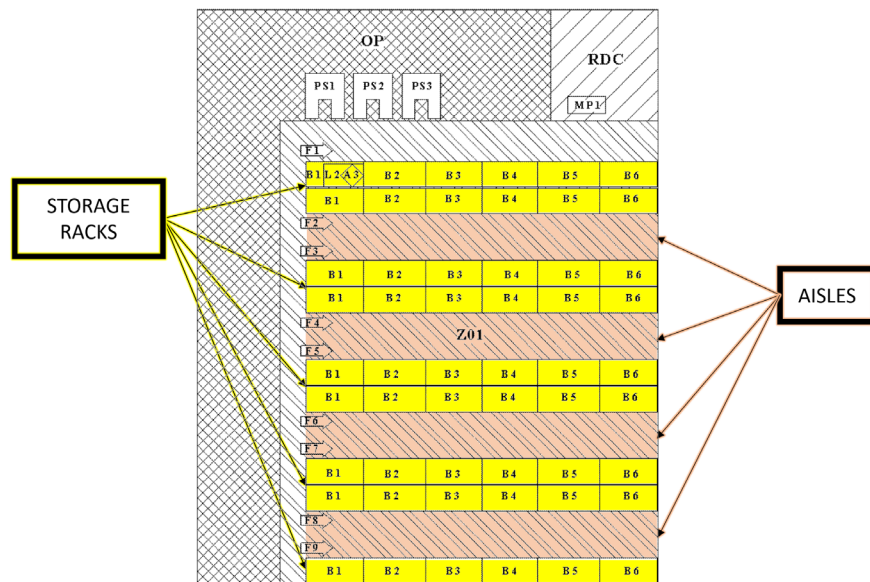


Fig. 1

- iii. *[1.a2]: wherein each storage rack comprises a plurality of columns and each column comprises a plurality of storage locations;*

Raizer discloses [1.a2]. (Ex. 1003, ¶¶124-127).

Raizer's "storage area" has "a plurality of shelving units" (storage racks) where "a given row of shelves" (storage locations) "in a bay" (columns) "can hold several boxes arranged in one or more side-by-side stacks each comprising one or more boxes stacked one upon the other." (Ex. 1005, ¶[0092], Ex. 1003, ¶¶125-126). The "exact location of a box in the warehouse is designated by an address" "representing the zone, face, bay, level, and specific location." (Ex. 1005, ¶[0092]; Ex. 1003, ¶¶125-126).

iv. [1.b1]: providing a plurality of delivery vehicles

Raizer discloses [1.b1]. (Ex. 1003, ¶¶128-130).

Raizer discloses “a set of autonomous mobile robots” (delivery vehicles). (Ex. 1005, ¶[0019]; Ex. 1003, ¶129). The robots “complete [a] mission of removing a box from (or delivering a box to) a specific location on a shelf” in a warehouse. (Ex. 1005, ¶¶[0019, 0027, 0114], Ex. 1003, ¶¶129-130).

v. [1.b2]: wherein each vehicle comprises a horizontal drive system operable to drive the vehicle along a horizontal surface,

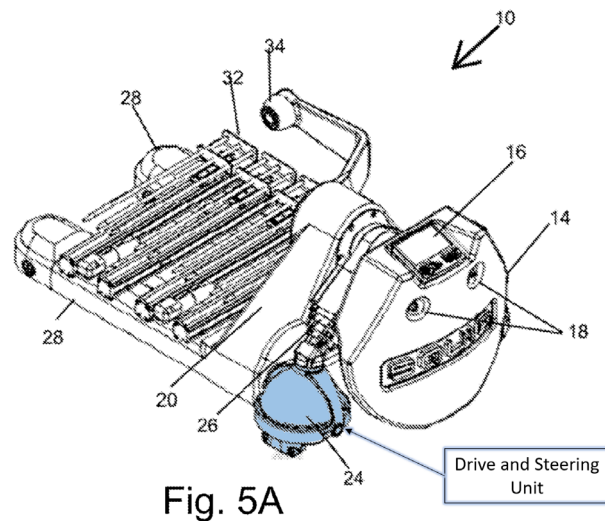
Raizer discloses [1.b2]. (Ex. 1003, ¶¶131-136).

Raizer discloses that the “robots of the system comprise” “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 an axis vertical 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, ¶[0025]; Ex. 1003, ¶132). The “robots” “navigate both along the ground,” “and up and along the shelves to the exact desired location.” (Ex. 1005, ¶[0078]; Ex. 1003, ¶133). Navigating along the ground is traveling along a horizontal surface. (Ex. 1003, ¶133).

The “[r]obot 10 moves along the ground on four wheels,” where “two rear wheels 30 could be fixed and passive so that they can only rotate about their axles

which are perpendicular to the axis of the long beams 28 of the frame and are ‘dragged along’ by the front wheels,” or “could be multi directional wheels which allow movement to any direction, about an axis vertical to the floor.” (Ex. 1005, ¶[0104]; FIGs. 5A, 5B; Ex. 1003, ¶134). “The front driving wheels 22 dictate the steering angle and differential speeds of the rear wheels,” and/or “can be independently rotated in any direction by drive and steering units 24.” (Ex. 1005, ¶[0104]; FIGs. 5A, 5B; Ex. 1003, ¶134).

Ex. 1005, FIG. 5A (annotated)



Ex. 1005, FIG. 5B (annotated)

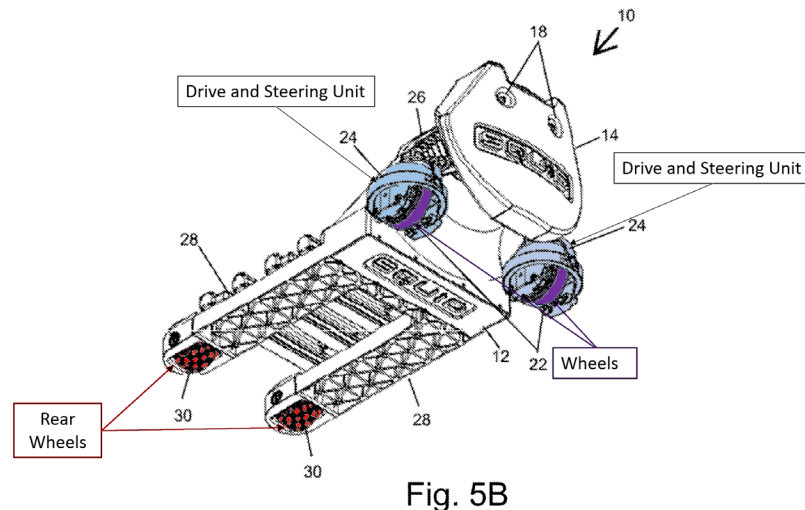


Fig. 5B

Raizer discloses a horizontal drive system comprising drive wheels 22, rear wheels 30, and drive and steering units 24 operable to drive the vehicle along a horizontal surface. (Ex. 1003, ¶¶135-136).

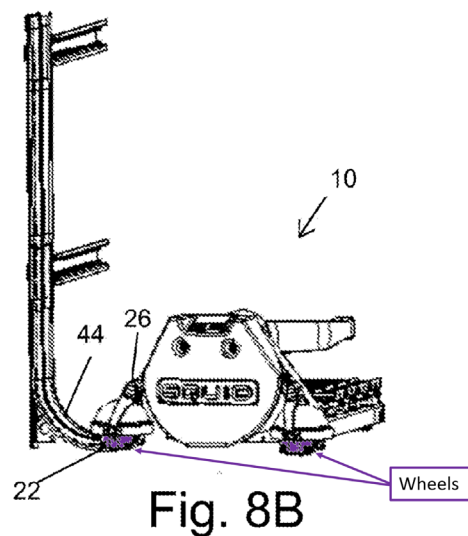
vi. [1.b3]: a vertical drive operable to drive the vehicle vertically and

Raizer discloses [1.b3] (Ex. 1003, ¶¶137-147).

Raizer discloses that the robots “navigate” “up and along the shelves to the exact desired location.” (Ex. 1005, ¶[0078]; Ex. 1003, ¶¶138-139). *Raizer* discloses a “process of the robot” “leaving the floor of the warehouse and climbing a vertical rail attached to the shelving,” where the “robot travels vertically with both front wheels in the same vertical rail.” (Ex. 1005, ¶¶[0114-0121]; FIGs. 8A-8G; Ex. 1003, ¶140).

Raizer shows “a synchronized movement” “between the driving motor of the right front wheel 22, and electric motors and actuators ... inside the right arm unit 26 that are responsible for changing the length and angle of the arm unit advancing the right wheel into the ‘U’-shaped channel 46 in terminal 44 while the robot 10 remains in position on the floor.” (Ex. 1005, ¶[0116]; FIG. 8B Ex. 1003, ¶141).

Ex. 1005, FIG. 8B (annotated)



As “right wheel 22 enters the terminal it is geometrically locked to the rail,” and “[t]he synchronized movement between the driving motor of the right front wheel 22 and right arm unit 26 continues to extend the right arm unit as right wheel 22 moves further up terminal 44.” (Ex. 1005, ¶¶[0116-0117]; FIG. 8C; Ex. 1003, ¶141). “[T]he right front wheel 22 and right arm unit 26 continue to extend the right arm unit as right wheel 22 moves further up terminal 44.” (Ex. 1005, ¶[0118]; FIG. 8D; Ex. 1003, ¶142).

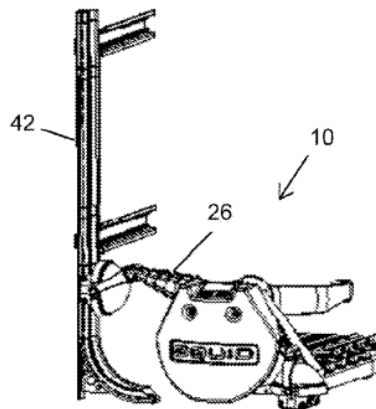
Ex. 1005, FIG. 8D

Fig. 8D

After “the right wheel has advanced further up vertical rail 42 and starts to pull the robot 10 slightly off the ground,” the “left front wheel 22 moves into the ‘U’-shaped channel 46 in terminal 44 and is locked to the rail.” (Ex. 1005, ¶¶[0119-0121]; FIG. 8F; Ex. 1003, ¶143).

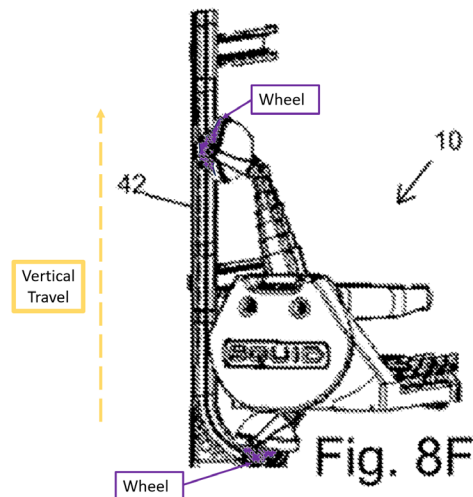
Ex. 1005, FIG. 8F (annotated)

Fig. 8F

Raizer shows “a bottom view of the shell 38 of drive and steering unit 24,” noting that in the figure “[t]he wheel 22 and all other components of the drive and

steering unit have been removed to show the small wheels 36 that lock the robot to the rails.” (Ex. 1005, ¶[0122]; FIG. 9A; Ex. 1003, ¶144). “[O]n each side of the shell 38 there is a group of five small wheels 36,” where “[e]ach group comprises two wheels mounted with their axles parallel to the sides of the shell and three wheels mounted with the axles [sic] perpendicular to the sides of the shell.” (Ex. 1005, ¶[0122]; FIG. 9A; Ex. 1003, ¶144).

Ex. 1005, FIG. 9A (annotated)

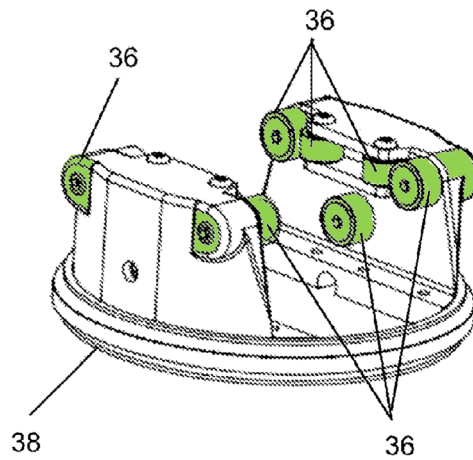
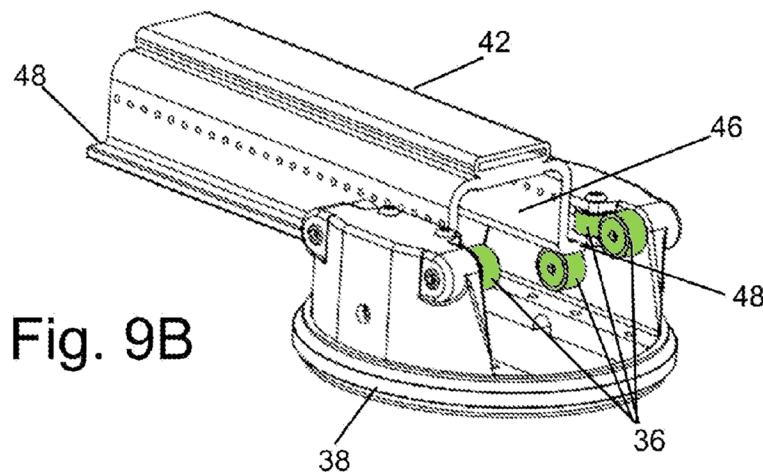


Fig. 9A

“[W]hen the drive wheel 22 enters the U shaped channel 46 in rail 42 the small wheels 36 lock the drive wheel on the rail.” (Ex. 1005, ¶[0122]; FIG. 9B; Ex. 1003, ¶145).

Ex. 1005, FIG. 9B (annotated)



Raizer discloses a vertical drive system comprising drive wheels 22, small wheels 36, and drive and steering units 24 operable to drive the vehicle vertically. (Ex. 1003, ¶146).

vii. [1.b4]: a transfer mechanism operable to transfer an item between the vehicle and one of the storage racks;

Raizer discloses [1.b4]. (Ex. 1003, ¶¶148-152).

Raizer's robots comprise a "gripper mechanism attached to the top side of the [robot] frame that is configured to pick up and place boxes," and allows "the robot to handle different sized boxes." (Ex. 1005, ¶¶[0027, 0031]; Ex. 1003, ¶149). The "robot" can "grab and lift [a] carton" "to place the cartons on the shelves or to pick them up." (Ex. 1005, ¶[0101]; Ex. 1003, ¶149).

Raizer discloses that "[t]he combination of the capability of independently changing the lengths and angles of the two arm units 26 and the capability of activating the two drive and steering units 24 independently allows the robot" "to

place a box on a shelf or remove it from any height or any orientation on the shelf.” (Ex. 1005, ¶¶0133]; Ex. 1003, ¶150).

Raizer discloses a robot positioning a box on a shelf. (Ex. 1005, ¶¶0138]; FIG. 14A; Ex. 1003, ¶151). *Raizer* discloses a gripper mechanism (transfer mechanism) operable to transfer an item between the vehicle and one of the storage racks. (Ex. 1003, ¶152).

Ex. 1005, FIG. 14A

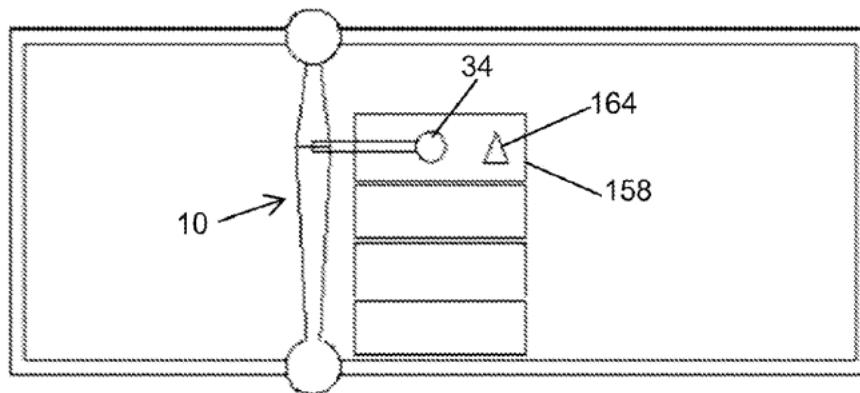


Fig. 14A

viii. [1.c]: driving a first one of the vehicles to drive the first vehicle to the storage racks;

Raizer discloses [1.c]. (Ex. 1003, ¶¶153-157).

Raizer discloses that “the robots comprise a set of on-board sensors, a processor, software, and other electronics configured to provide them with three-dimensional navigation and travel capabilities” “to navigate and travel autonomously both along the floor and up the vertical rails and along the horizontal

rails of the network of rails to reach an exact location on the floor or shelving system.” (Ex. 1005, Abstract, ¶¶[0022, 0034, 0080]; Ex. 1003, ¶¶154-156).

Raizer discloses driving a first one of the robots (vehicles) to an exact location (the storage rack. (Ex. 1003, ¶157).

ix. [1.d1]: driving the first vehicle along a first path under a first one of the racks

Raizer and *Hangzhou* render obvious [1.d1]. (Ex. 1003, ¶¶158-165).

Raizer discloses a plurality of storage racks and driving the first vehicle to various locations. (*see* [1.a], [1.c] *supra*; Ex. 1003, ¶158).

Raizer’s system is “plug and play in any warehouse, integrating with an already in-use facility, shelving system and infrastructure resources of a conventional warehouse,” and deploys “a self-learning system where, for example, algorithm [sic] 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.” (Ex. 1005, ¶¶[0079, 0098]; Ex. 1003, ¶159).

Should *Raizer* be determined to not disclose driving a vehicle along a path under one of the racks, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶160).

Hangzhou discloses “an unmanned warehousing system” where a “lower layer” of a “channel support frame” “is used to automatically guide a trolley to pass through,” such that an “auto-guided trolley travels through the lower layer of the

support frame to a position below the containers.” (Ex. 1006, Abstract; Ex. 1003, ¶161). The “auto-guided trolley 200 is a small mobile robot with auto-navigation ability” and “preferentially travels in column laneways 32 and auto-guided trolley passage spaces 112.” (Ex. 1006, ¶[0048]; Ex. 1003, ¶161).

Ex. 1006, Figure 2 (annotated)

Figure 2

A POSITA would have been motivated to combine driving of trolleys under a rack of *Hangzhou* with the capabilities of *Raizer*'s robots. (Ex. 1003, ¶164; *see also* Motivation to Combine *supra*). *Raizer* and *Hangzhou* render obvious driving the first vehicle along a first path under a first rack. (Ex. 1003, ¶165).

x. [1.d2]: wherein the first rack is adjacent a first one of the aisles and

Raizer and *Hangzhou* render obvious [1.d2]. (Ex. 1003, ¶¶166-170). *Raizer* discloses a plurality of storage racks spaced apart from one another forming a plurality of aisles where a row of racks is adjacent an aisle. (*see* [1.a] *supra*; Ex. 1003, ¶167).

Should *Raizer* be determined to not disclose a first rack, under which the vehicle travels, that is adjacent a first aisle, a POSITA would have looked to *Hangzhou*. (Ex. 1006, ¶¶[0035-0037]; Figure 1; Ex. 1003, ¶¶167-168).

Ex. 1006, Figure 1 (annotated)

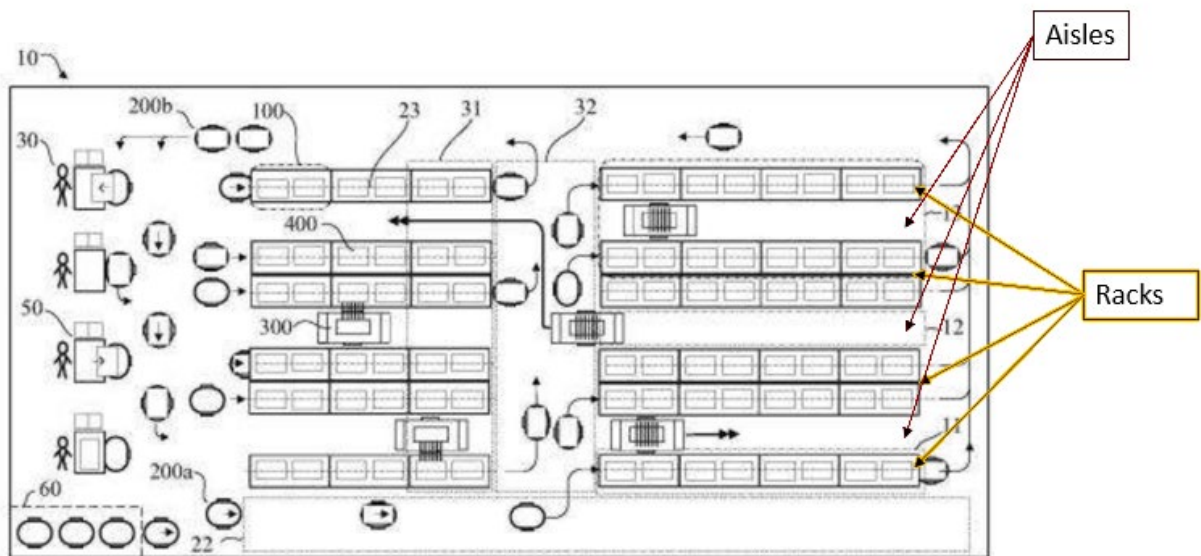


Figure 1

A POSITA would have been motivated to combine the driving of trolleys along a path under a rack where the path is adjacent an aisle of *Hangzhou* with the capabilities of *Raizer's* robots. (Ex. 1003, ¶169; *see also* Motivation to Combine *supra*). *Raizer* and *Hangzhou* render obvious the first rack is adjacent a first one of the aisles. (Ex. 1003, ¶170).

- xi.* ***[1.d3]: wherein the first path extends in a direction parallel to the first aisle and spaced apart from the first aisle;***

Raizer and *Hangzhou* render obvious [1.d3]. (Ex. 1003, ¶¶171-176). *Raizer* discloses a plurality of storage racks spaced apart from one another forming a plurality of aisles adjacent to the row of racks under which the robot may travel in a

first path spaced apart from and parallel to a first aisle. (*see* [1.a], [1.d2] *supra*; Ex. 1003, ¶172).

To the extent *Raizer* does not disclose that the first path is under a rack, a POSITA would have turned to *Hangzhou*. (Ex. 1003, ¶172).

Figure 10²³ of *Hangzhou* discloses that a “dotted line displayed on the center line of each shelf row is used to indicate the row channel 23 for auto-guided trolleys 200 under the shelf, which is a path parallel to the stacking row laneway 12.” (Ex. 1006, ¶[0040]; Ex. 1003, ¶173). *Hangzhou* discloses the first path extends in a direction parallel to the first aisle and spaced apart from the first aisle. (Ex. 1006, Figure 10; Ex. 1003, ¶174, 176).

² Figure 10 depicts Embodiment 4 of *Hangzhou*, which is expressly disclosed as having all of the features of Embodiments 1, 2, and 3 disclosed in connection with Figures 1-6, 7-8, and 9. (Ex. 1006, ¶[0076]; Ex. 1003, ¶¶97-98, 115, 173, 183, 193).

³ Figure 10 of *Hangzhou* also discloses a first path extending in a direction parallel to the first aisle and spaced apart from the first aisle. (Ex. 1006, ¶[0072]; Figure 10; Ex. 1003, n3).

Ex. 1006, Figure 10 (annotated)

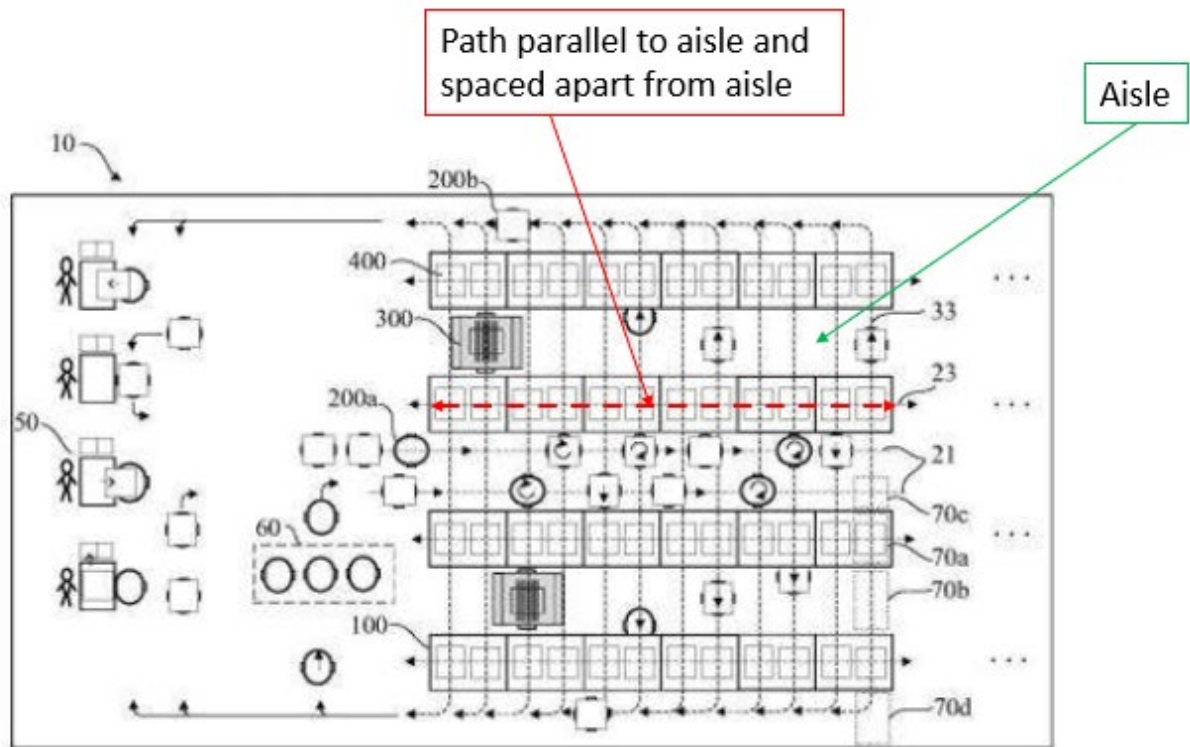


Figure 10

A POSITA would have been motivated to combine driving of trolleys under racks in a direction parallel to an aisle of *Hangzhou* with the capabilities of *Raizer*. (Ex. 1003, ¶175; *see also* Motivation to Combine *supra*).

xii. [1.e] turning the first vehicle while the first vehicle is under the first rack;

Raizer and *Hangzhou* render obvious claim element [1.e]. (Ex. 1003, ¶¶177-187). *Raizer* discloses that the vehicles can travel in any direction and to various locations. (*see* [1.b1-b4], and [1.c] *supra*; Ex. 1003, ¶¶177-180). Should *Raizer* be

determined to not disclose turning the vehicle while the vehicle is under the rack, a POSITA would have turned to *Hangzhou*. (Ex. 1003, ¶181).

Hangzhou discloses driving the vehicle under the rack and that the “trolleys are generally designed” “to turn in place,” even 90° (*see* [1.d1] *supra*; Ex. 1006, ¶¶[0048, 73], Figure 2; Ex. 1003, ¶¶182,184-185).

Hangzhou discloses that “an auto-guided trolley 200 may switch between the row direction and the column direction,” and that “[s]witching the driving direction does not bring a problem to auto-guided trolleys because auto-guided trolleys 200 can be small enough to turn in the auto-guided trolley passage space 112.” (Ex. 1006, ¶[0072]; Figure 10⁴; Ex. 1003, ¶183).

⁴ *see n2 supra*.

Ex. 1006, Figure 10

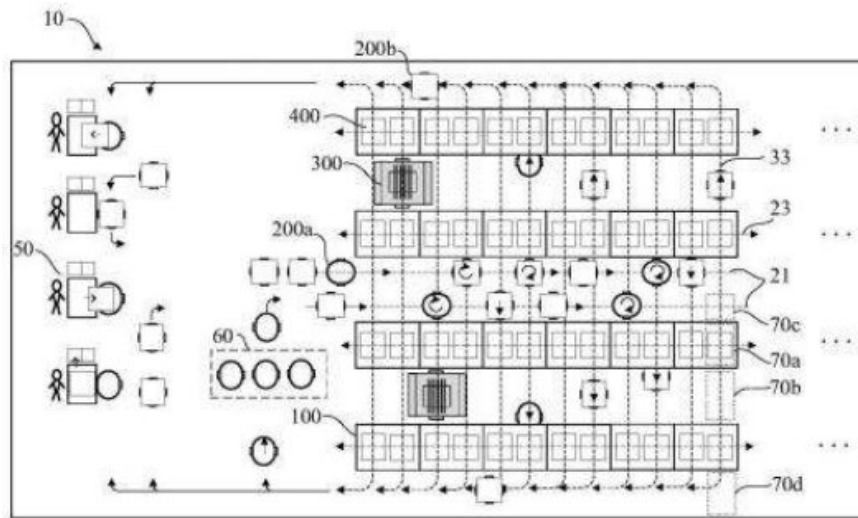


Figure 10

It would have been obvious to a POSITA that *Raizer's* robot could turn while under a shelf, given *Raizer's* disclosure of three-dimensional movement capabilities and ability to turn “360 degrees about an axis vertical to the floor.” (Ex. 1003, ¶186). A POSITA would have also, or alternatively, been motivated to combine the ability of *Hangzhou's* trolley to rotate in place 90° under shelves with *Raizer's* travel capabilities. (Ex. 1006, ¶¶[0072, 0076]; Ex. 1003, ¶186; *see also* Motivation to Combine *supra*). *Raizer* and *Hangzhou* render obvious turning the first vehicle while the first vehicle is under the first rack. (Ex. 1003, ¶187).

xiii. [1.f]: driving the vehicle into the first aisle;

Raizer and *Hangzhou* render obvious claim element [1.f]. (Ex. 1003, ¶¶188-195). *Raizer* discloses that the vehicles can travel in any direction and to various

locations. (*see* [1.b1-b4], [1.c], and [1.e] *supra*; Ex. 1003, ¶¶188-191). Should *Raizer* be determined to not disclose driving the vehicle into the aisle from under the rack, the POSITA would have turned to *Hangzhou*. (Ex. 1003, ¶191).

Hangzhou discloses driving the vehicle under the rack. (*see* [1.d1] *supra*; Ex. 1006, ¶[0048]; Ex. 1003, ¶192). *Hangzhou* discloses that the trolley can turn to travel from under a rack and across aisles. (Ex. 1006, ¶[0072] (“auto-guided trolleys 200 can be small enough to turn in the auto-guided trolley passage space 112”); Figure 10⁵; Ex. 1003, ¶192). Figure 10 of *Hangzhou* depicts a vehicle driving into an aisle. (Ex. 1003, ¶192).

⁵ *see n2 supra*.

Ex. 1006, Figure 10 (annotated)

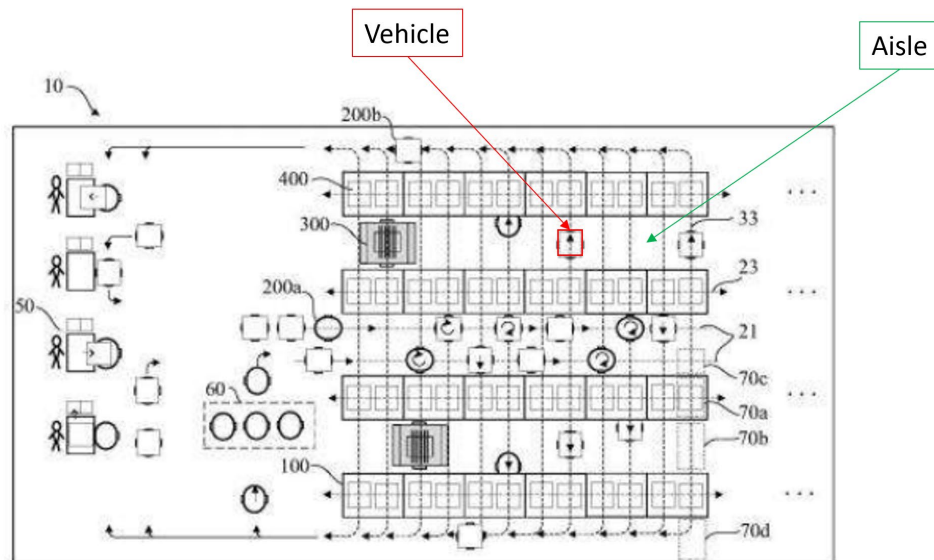


Figure 10

A POSITA would have understood the additional pathways illustrated in Figure 10 allow travel under the shelves and across aisles. (Ex. 1003, ¶193).

It would have been obvious to a POSITA that *Raizer's* robot would have the ability to turn while under a rack and then travel across an aisle as in *Hangzhou*, given *Raizer's* disclosure of three-dimensional movement capabilities and ability to turn 360 degrees, as such capability would allow the robot to “choose among all possible paths.” (Ex. 1003, ¶194; *see also* Motivation to Combine *supra*).

- xiv. ***[1.g]: driving the first vehicle upwardly in the aisle to a first of the storage locations;***

Raizer discloses [1.g]. (Ex. 1003, ¶¶196-202).

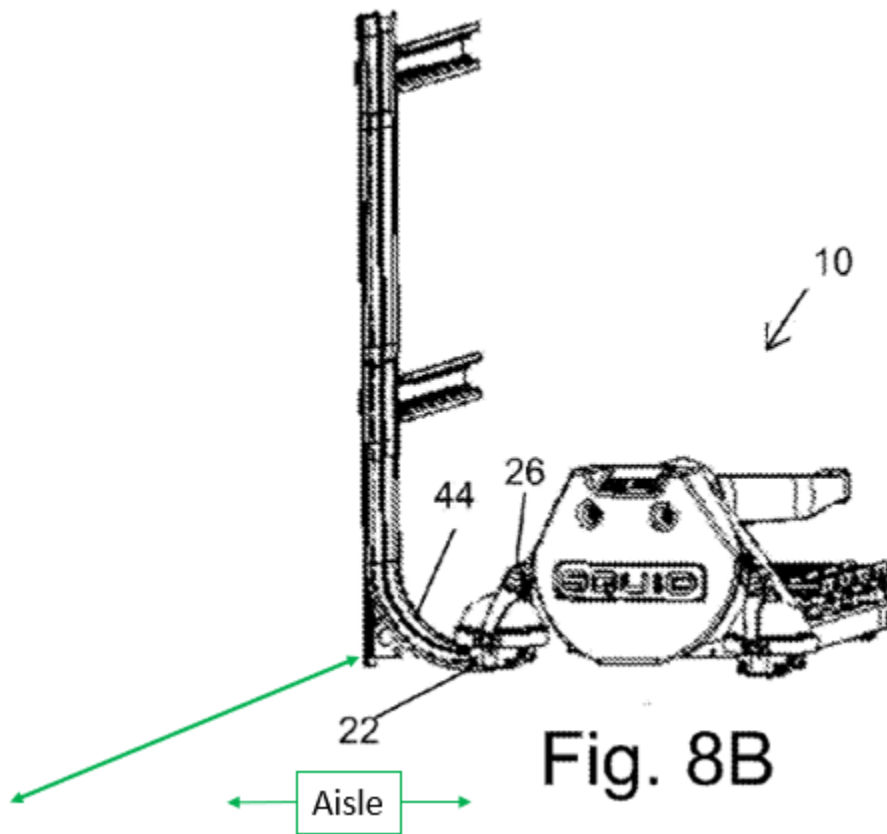
Raizer discloses that the “robot [can] engage a vertical rail, to raise itself off the floor, and to move up and along the network of vertical and horizontal rails.” (Ex. 1005, ¶¶0056, 0078]; Ex. 1003, ¶199). Rails “allow for the vertical and horizontal movement capabilities of the robots along the shelving,” and “are mounted on or parallel to the vertical supports and shelves of the warehouse.” (Ex. 1005, ¶¶0056, 0078]; Ex. 1003, ¶199).

A “curved piece of rail called a terminal 44 is attached to the bottom of the vertical rails where they reach the ground” which is “where robots 10 can connect or disconnect from the rails 42 in order to climb or descend from the shelves.” (Ex. 1005, ¶0111]; Ex. 1003, ¶198).

Raizer discloses that a robot “travels vertically with both front wheels in the same vertical rail and travels horizontally with one of its front wheels in a horizontal rail that is attached to the shelf on which the box is located and the other front wheel in a horizontal rail that is attached to the shelf above the first shelf” “[i]n order to complete its mission of removing a box from (or delivering a box to) a specific location on a shelf the robot.” (Ex. 1005, ¶0114]; Ex. 1003, ¶197).

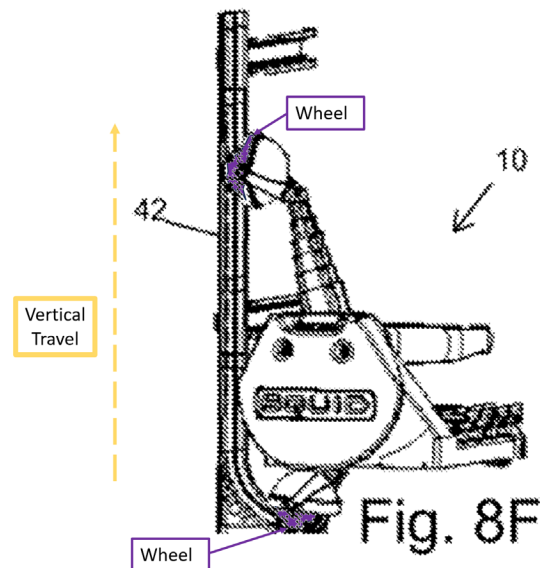
Raizer discloses a robot “leaving the floor of the warehouse and climbing a vertical rail attached to the shelving,” and that a “robot travels vertically with both front wheels in the same vertical rail.” (Ex. 1005, ¶¶0114-0121]; FIGs. 8A-8G; Ex. 1003, ¶200).

Ex. 1005, FIG. 8B (annotated)



After “the right wheel has advanced further up vertical rail 42 and starts to pull the robot 10 slightly off the ground,” the “left front wheel 22 moves into the ‘U’-shaped channel 46 in terminal 44 and is locked to the rail.” (Ex. 1005, ¶¶[0119-0121]; FIG. 8F; Ex. 1003, ¶[201]).

Ex. 1005, FIG. 8F (annotated)



Raizer discloses driving the first vehicle upwardly in the aisle to a first of the storage locations. (Ex. 1003, ¶202).

xv. [1.h]: transferring an item between the first vehicle and the first storage location;

Raizer discloses [1.h]. (Ex. 1003, ¶¶203-207).

Raizer discloses robots with a gripper mechanism (transfer mechanism). (see [1.b4] *supra*; Ex. 1005, ¶¶[0027, 0031, 0101, 0133]; Ex. 1003, ¶148-152, 204-5).

Raizer depicts a robot positioning a box on a shelf in the storage area. (Ex. 1005, ¶[0138]; FIG. 14A; Ex. 1003, ¶206). That is, *Raizer* discloses positioning (transferring) a box (an item) between the robot (first vehicle) and the shelf in the storage area (first storage location). (Ex. 1003, ¶207).

Ex. 1005, FIG. 14A

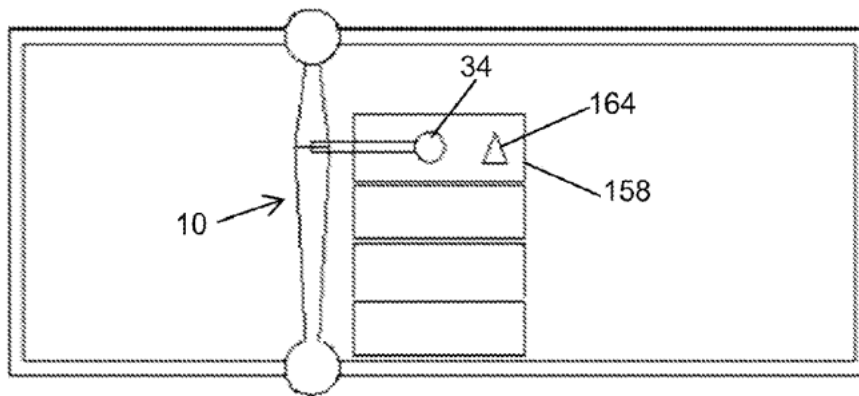


Fig. 14A

- xvi. [1.i]: driving the first vehicle downwardly in the aisle until the vehicle is on the horizontal surface;**

Raizer discloses [1.i]. (Ex. 1003, ¶¶208-211). *Raizer* discloses driving the vehicle upwardly in the aisle. (see [1.g] *supra*).

Raizer discloses a robot with “three-dimensional navigation and travel capabilities” that enable the robot “to navigate and travel autonomously both along the floor and up and down” (driving the vehicle downwardly) “the vertical rails and along the horizontal rails of the network of rails to reach an exact location on the floor or shelving system of the warehouse.” (Ex. 1005, ¶¶[0056, 0078], Claims 1, 4, 18; Ex. 1003, ¶¶209-210). *Raizer* discloses driving the vehicle downwardly in the aisle until the vehicle is on the horizontal surface. (Ex. 1003, ¶211).

- xvii. [1.j]: driving the first vehicle across the first aisle after the step of driving the first vehicle downwardly; and**

Raizer and *Hangzhou* render obvious [1.j]. (Ex. 1003, ¶¶212-217).

Raizer discloses driving the vehicle downwardly. (see [1.i] *supra*; Ex. 1003, ¶¶213-214).

Should *Raizer* be determined to not disclose driving the vehicle across the first aisle after the step of driving the first vehicle downwardly, such a feature would have been obvious to a POSITA. (Ex. 1003, ¶215). Given *Raizer*'s disclosure of a robot that can "navigate and travel autonomously both along the floor and up and down the vertical rails and along the horizontal rails of the network of rails to reach an exact location on the floor or shelving system of the warehouse," a POSITA would have understood that a robot could also be driven across an aisle after having been driven downwardly to a horizontal surface. (Ex. 1003, ¶215).

A POSITA may also turn to *Hangzhou*, which discloses trolleys "carrying standardized containers" "in row and column directions" underneath the shelving units and across multiple aisles along the column channels. (Ex. 1006, ¶[0050]; see [1.d1], [1.d2], [1.d3], and [1.f] *supra*; Ex. 1003, ¶216). Given *Hangzhou*'s disclosure, it would have been obvious to a POSITA to incorporate *Hangzhou*'s movement capabilities underneath the shelves and across multiple aisles into *Raizer*'s system to allow *Raizer*'s robots to more efficiently move retrieved items to picking stations. (Ex. 1003, ¶216; see also Motivation to Combine *supra*).

xviii. *[1.k]: driving the vehicle out from under the storage racks after the step of driving the first vehicle across the first aisle.*

Raizer and Hangzhou render obvious [1.k]. (Ex. 1003, ¶¶218-223).

Raizer and Hangzhou disclose driving the vehicle into or across an aisle, (see [1.f], [1.j] *supra*; Ex. 1003, ¶219), and that a vehicle could be driven out from under the storage racks after having been driven across an aisle. (see [1.d1], [1.f], [1.j] *supra*; Ex. 1003, ¶¶220-221).

Ex. 1006, Figure 10⁶ (annotated)

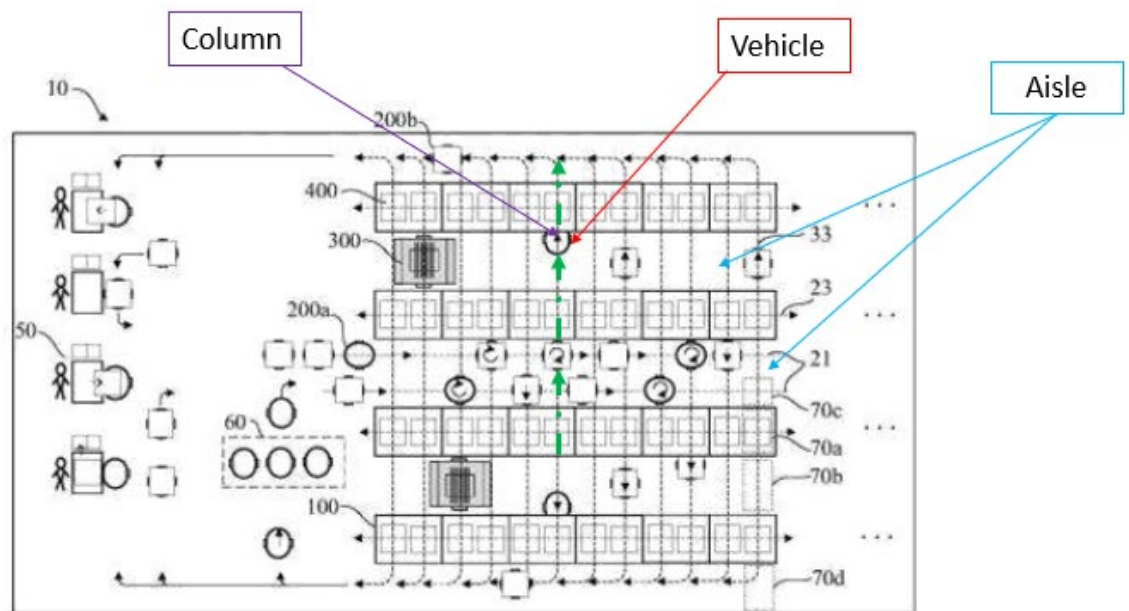


Figure 10

⁶ see n2 *supra*.

Given *Hangzhou*'s disclosure of trolleys "carrying standardized containers" "in row and column directions" (Ex. 1006, ¶[0050]), under the shelving units and across multiple aisles, it would have been obvious to a POSITA to combine *Hangzhou*'s movement under the shelves and across multiple aisles with *Raizer*'s system to allow *Raizer*'s robots to move more directly to and from picking stations. (Ex. 1003, ¶222; *see also* Motivation to Combine *supra*). *Raizer* and *Hangzhou* render obvious driving the vehicle out from under the storage racks after the step of driving the first vehicle across the first aisle. (Ex. 1003, ¶223).

3. Claim 3

i. [3.pre-3.a]: The method of claim 1 wherein a plurality of vertical tracks segments are attached to vertical posts of the first column and

Raizer and *Hangzhou* render obvious [3.pre] and [3.a]. (*see* [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶224-230).

Raizer discloses a "plurality of shelving units" that consist of "of horizontal and vertical pieces of angle iron that support the shelves." (Ex. 1005, Abstract, ¶[0092]; Ex. 1003, ¶¶225-226). "[A] network of vertical and horizontal rails" "are parallel to the vertical support posts and horizontal shelves" "in [a] warehouse." (Ex. 1005, ¶[0040]; Ex. 1003, ¶¶226-227).

Raizer depicts a plurality of vertical track segments attached to vertical posts of the first column. (Ex. 1005, FIG. 8E; Ex. 1003, ¶228).

Ex. 1005, Figure 8E (annotated)

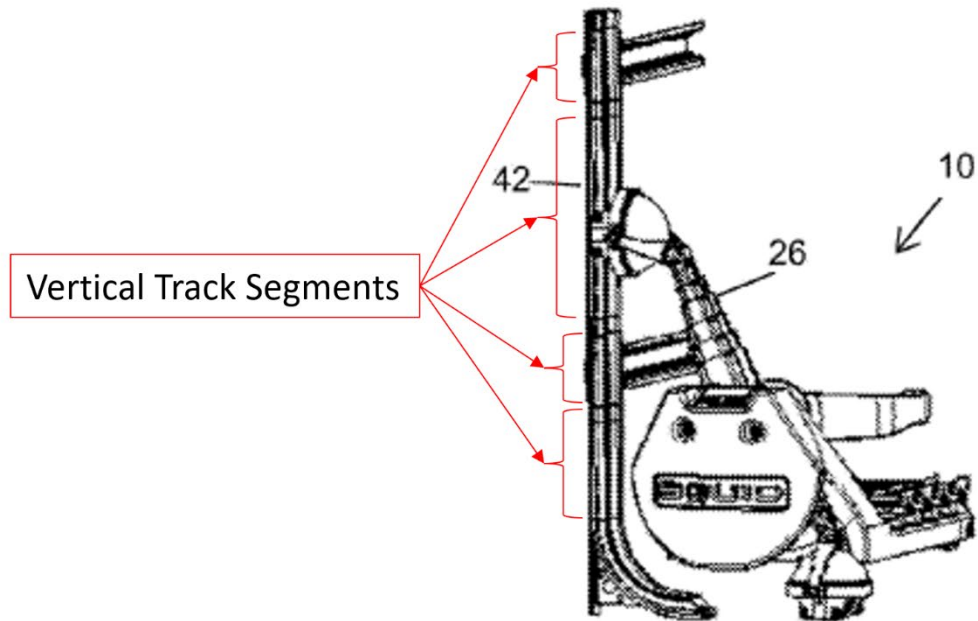


Fig. 8E

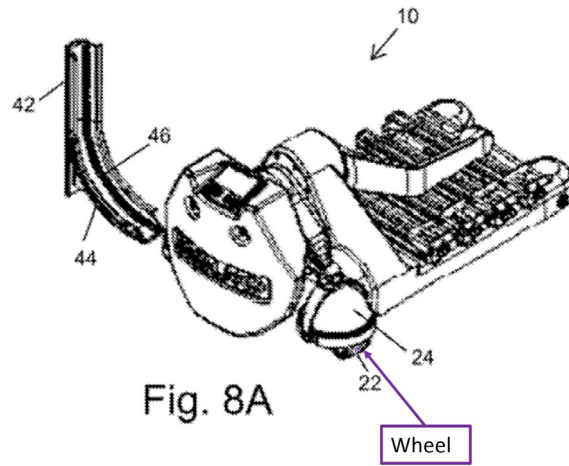
Should *Raizer* be determined to not disclose vertical track segments attached to multiple vertical posts of the first column, such a feature would have been obvious to a POSITA given *Raizer's* disclosure of attaching vertical rails to the vertical supports of the shelving. (Ex. 1005, ¶¶0078]; Ex. 1003, ¶229). A POSITA would also have been motivated to attach vertical rails to multiple service supports of a column to reduce collisions and congestion along the vertical rails of *Raizer*. (Ex. 1003, ¶¶229-230).

ii. [3.b]: wherein the step of driving the first vehicle into the first aisle comprises aligning the vertical drive of the first vehicle with the vertical track segments.

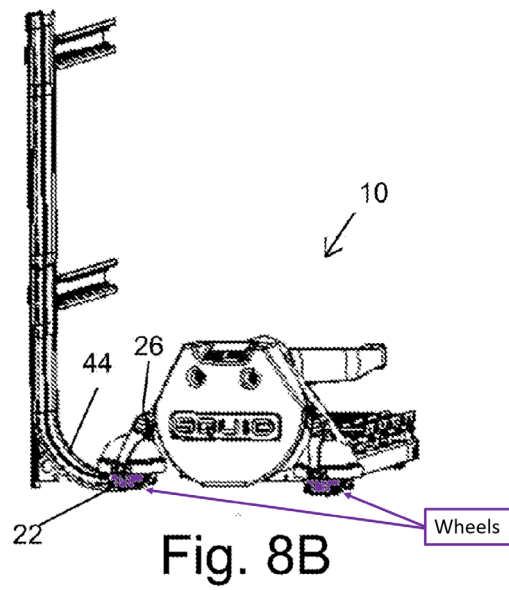
Raizer discloses [3.b]. (Ex. 1003, ¶¶231-237). *Raizer* discloses that the vehicles can travel in any direction and to various locations including into the aisles. (see [1.b1-b4], [1.c], [1.e], and [1.f] *supra*; Ex. 1003, ¶¶231-233).

Raizer discloses that, as a robot approaches an intended terminal, a sensor “stops the robot at an exact position relative to the terminal.” (Ex. 1005, ¶¶[0114-0121]; FIGs. 8A-8G; Ex. 1003, ¶¶234-235). After stopping, “[t]he 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 in the terminal 44.” (Ex 1005, ¶¶[0115-0116]; FIG. 8A; Ex. 1003, ¶¶235). The drive and steering units 24 are activated to turn both front wheels 22 of the vertical drive of *Raizer’s* robot 10 to align with the terminal 44 and the vertical track segments embodied by vertical rail 42. (Ex. 1003, ¶¶235-237).

Ex. 1005, FIG. 8A (annotated)



Ex. 1005, FIG. 8B (annotated)



4. Claim 4

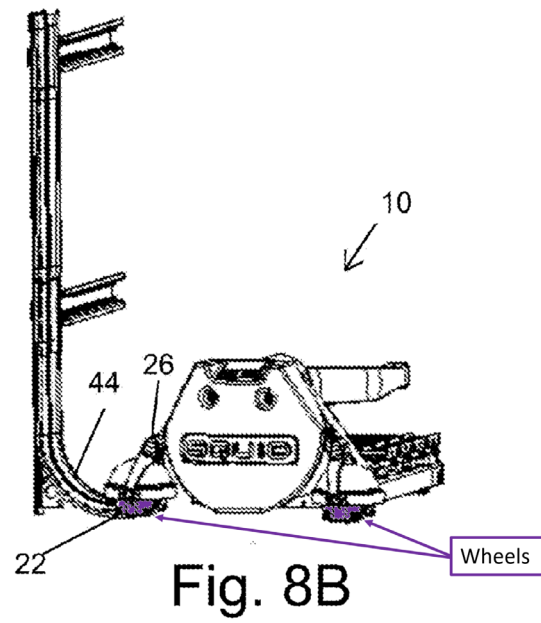
- i. ***[4.pre-4.a]: The method of claim 3, wherein the step of driving the first vehicle into the aisle comprises driving a first portion of the vertical drive through the vertical track segment and***

Raizer and *Hangzhou* render obvious [4.pre] and [4.a]. (see [3.pre]-[3.b] *supra*; Ex. 1003, ¶¶238-247).

Raizer discloses that the robots can travel in any direction and have vertical drive systems configured to engage with the vertical rails and move the robots vertically. (see [1.b1-b4], [1.c], [1.e], [1.f], [1.g] *supra*; Ex. 1003, ¶¶239-242).

Raizer discloses “a synchronized movement tak[ing] place between the driving motor of the right front wheel 22, and electric motors and actuators ... inside the right arm unit 26 ... advancing the right wheel into the ‘U’-shaped channel 46 in terminal 44 while the robot 10 remains in position on the floor,” where “right wheel 22 enters the terminal [and] is geometrically locked to the rail.” (Ex. 1005, ¶[0116]; FIGs. 8A-8G; Ex. 1003, ¶243). The “synchronized movement between the driving motor of the right front wheel 22 and right arm unit 26 continues to extend the right arm unit as right wheel 22 moves further up terminal 44.” (Ex. 1005, ¶[0117]; FIGs. 8B, 8C, 8E; Ex. 1003, ¶¶243-244).

Ex. 1005, FIG. 8B (annotated)



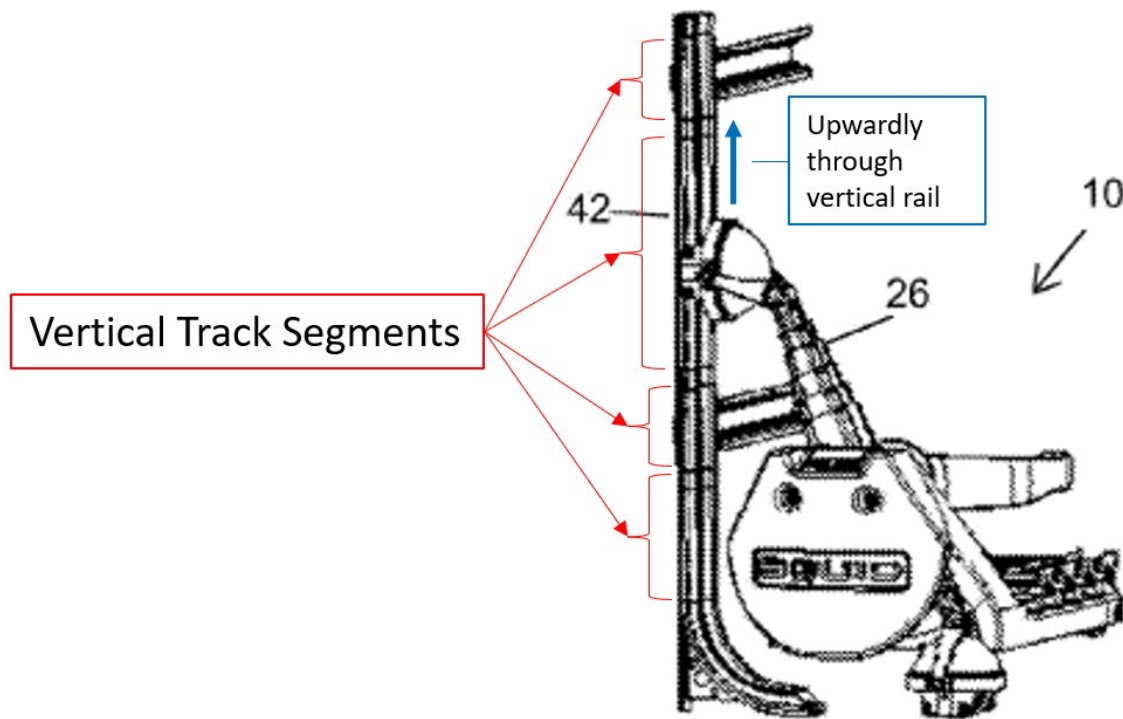


Fig. 8E

Raizer discloses that the "right front wheel 22" is driven through the terminal 44 to move upwardly and through the vertical rail 42 track segment. (Ex. 1003, ¶¶245-247).

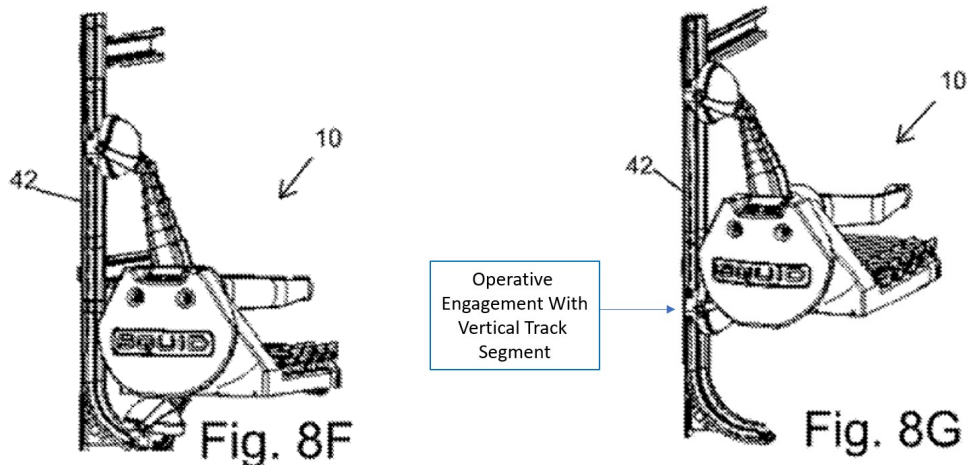
ii. [4.b]: driving a second part of the vertical drive into operative engagement with the vertical track segment.

Raizer discloses [4.b]. (Ex. 1003, ¶¶248-251).

Raizer discloses that its left front wheel 22 (a second part of its vertical drive) moves into the "U"-shaped channel 46 in terminal 44 and is locked into the vertical

rail 42,” and the second part of the vertical drive becomes operatively engaged with the lower-most vertical track segment. (Ex. 1005, ¶[0120-0121]; FIGS. 8F-8G; Ex. 1003, ¶¶249-250).

Ex. 1005, FIGs. 8F, 8G (annotated)



That is, *Raizer* illustrates movement of a second part of its vertical drive into and through terminal 44 to operatively engage the lower-most vertical track segment of the vertical rail 42. (Ex. 1003, ¶¶250-251).

5. Claim 5

- i. [5.pre-5.a]: The method of claim 1 wherein the first storage rack is formed of a plurality of vertical posts and**

Raizer and *Hangzhou* render obvious [5.pre] and [5.a]. (see [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶252-253).

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

Raizer discloses [5.b]. (Ex. 1003, ¶¶254-256).

Raizer depicts a top view of a robot in FIG. 5D. (Ex. 1005, ¶[0103]; FIG. 5D; Ex. 1003, ¶255). The robot (vehicle) has a length and a width, and the length is greater than the width. (Ex. 1003, ¶¶255-256).

Ex. 1005, FIG. 5D (annotated)

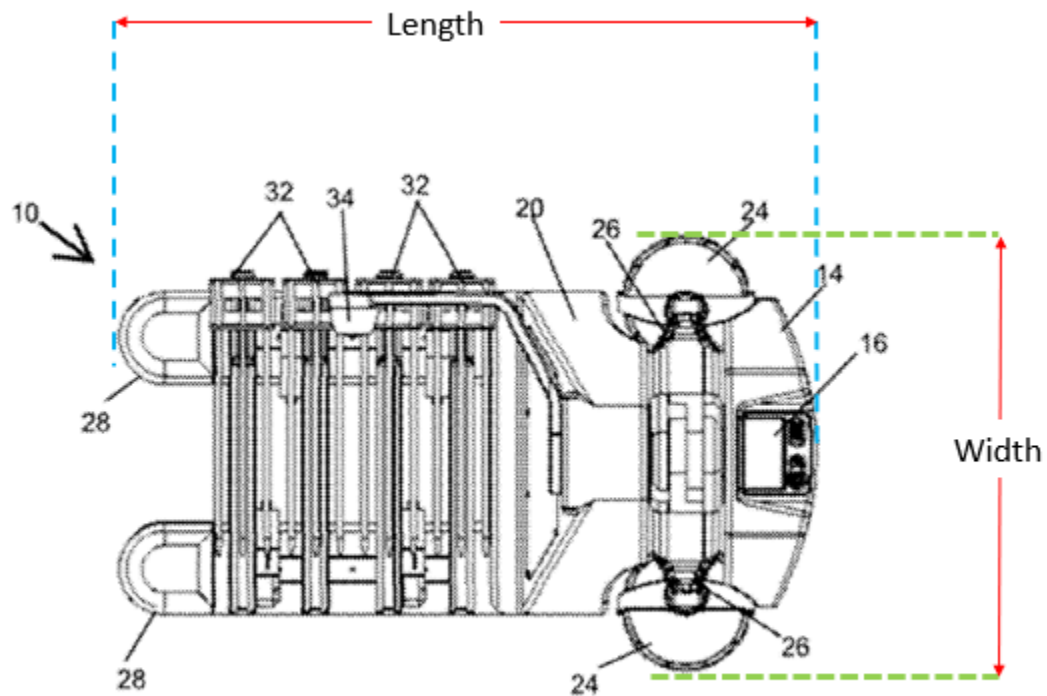


Fig. 5D

- 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 the⁷ half the length of the vehicle.***

Raizer and *Hangzhou* render obvious [5.c]. (Ex. 1003, ¶¶257-264). *Raizer* and *Hangzhou* disclose driving the first vehicle along a first path under the storage racks. (see [1.a], [1.c], [1.d1] *supra*; Ex. 1003, ¶257).

Should *Raizer* be determined to not disclose driving the vehicle along a path spaced apart from the vertical posts by a distance greater than half the length of the vehicle, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶258).

Hangzhou discloses “support members 111 divid[ing] the space inside channel support frames 110 into an auto-guided trolley passage space 112 and a cache space 113 for docking standardized containers.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶259). *Hangzhou* discloses a “horizontal gap” “between support members 111” that makes “auto-guided trolley passage space 112 connect cache spaces 113 in the row direction of shelf to form a row channel” which “allow auto-guided trolleys 200 carrying customized containers 400 to travel.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶259).

⁷ The claim language of the '632 Patent recites “by a distance greater the half the length of the vehicle.” (Ex. 1001, 25:62-63). Notwithstanding any lack of clarity, claim 5 is rendered obvious by *Raizer* and *Hangzhou* nonetheless. (Ex. 1003, 107n4).

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*).

6. Claim 6

- i. [6.pre-6.a]: the step of driving the first vehicle to a workstation to present an item to an operator after the step of driving the first vehicle out from under the storage racks.***

Raizer and *Hangzhou* render obvious [6.pre] and [6.a]. (*see* [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶265-273). *Raizer* and *Hangzhou* render obvious driving the vehicle out from under the storage racks. (*see* [1.d1] *supra*; Ex. 1003, ¶266).

Raizer discloses a warehouse floor plan including an operations area where “[h]uman workers man the picking stations” “to receive boxes containing items” “the robots have retrieved from the storage area.” Once a robot retrieves an item it “navigates to [a] picking station and unloads [the item].” (Ex. 1005, ¶¶[0092], [0096]; Ex. 1003, ¶¶267-268).

Should *Raizer* be determined to not disclose driving the first vehicle to a workstation to present an item to an operator after the step of driving the vehicle out from under the storage racks, a POSITA would have looked to *Hangzhou*, which discloses trolleys performing actions like positioning, lifting, dropping, and carrying to transfer standardized containers 400 between cache spaces 113 and sorting workstations 50 where workers remove the items. (Ex. 1006, ¶¶[0036, 0047]; Ex. 1003, ¶272). A POSITA would have understood that a vehicle could be driven to a workstation to present an item to an operator after having been driven out from under the storage racks. (*see* [1.d1], [1.f], [1.j], and [1.k] *supra*; Ex. 1003, ¶¶269-272; *see also* Motivation to Combine *supra*).

7. Claim 7

- i. [7.pre-7.a]: The method of claim 1, wherein the step of driving the first vehicle across the aisle comprises driving the first vehicle under a second of the storage racks***

Raizer and *Hangzhou* render obvious [7.pre] and [7.a] (*see* [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶274-277).

Should *Raizer* be determined to not disclose driving the vehicle across the first aisle and under a second storage rack, a POSITA would have understood that, given *Raizer*'s disclosure of the robot's ability "to navigate and travel autonomously both along the floor and up and down the vertical rails and along the horizontal rails of the network of rails to reach an exact location on the floor or shelving system of the warehouse," a robot could be driven across an aisle and underneath storage racks to minimize congestion and optimize the number of pathways traveled by the robots to allow more robots to maneuver along the warehouse floor. (Ex. 1003, ¶278).

A POSITA would also have looked to *Hangzhou*. (see [1.d1] *supra*; Ex. 1003, ¶¶279-280).

Hangzhou discloses that the "auto-guided trolleys" can "switch between trolley-special laneways 21 and column channels 33 and between column channels 33 and row channels 23." (Ex. 1006, ¶[0072]; Figure. 10⁸; Ex. 1003, ¶280). The trolley can move underneath the shelving units in a path parallel to the row channels 23 (aisles), and then turn to travel from underneath the shelving unit and across row laneways 21 (aisles) along the column channels 33. (Ex. 1006, ¶¶[0063], [0072], Figure 10; Ex. 1003, ¶¶280-282).

⁸ see n2 *supra*.

Ex. 1006, Figure 10

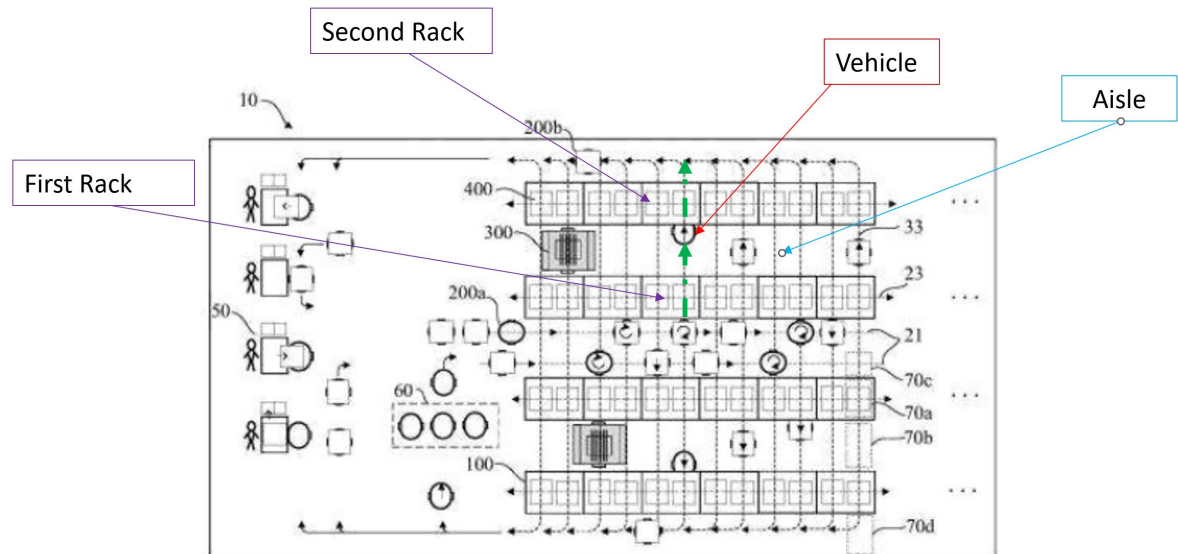


Figure 10

A POSITA would have been motivated to combine driving trolleys into an aisle and under a second storage rack of *Hangzhou* with the travel capabilities of *Raizer*. (Ex. 1003, ¶283; *see also* Motivation to Combine *supra*).

8. Claim 8

- i. **[8.pre-8.a]: 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.**

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*).

9. Claim 9

i. [9.pre-9.a]: The method of claim 8 wherein the vertical axis extends through the first path.

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).

⁹ All emphasis added herein unless indicated otherwise.

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*).

10. Claim 10

- i. [10.pre-10.a]: The method of claim 1 comprising the step of driving a second of the vehicles under the first rack along a second path parallel to the first path so that the second vehicle passes the first vehicle as the first vehicle travels along the first path.***

Raizer and *Hangzhou* render obvious [10.pre] and [10.a]. (see [1.pre]-[1.k] *supra*; Ex. 1003, ¶¶298-308). *Raizer* and *Hangzhou* render obvious vehicles

¹⁰ see n2 *supra*.

traveling in any direction, including along a first path under the storage shelves. (*see* [1.b1b2], and [1.d1] *supra*; Ex. 1003, ¶300).

Should *Raizer* be determined to not disclose driving a second vehicle under the first rack along a second path parallel to the first path so that the second vehicle passes the first vehicle, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶301).

The '632 patent describes a “rack” “includ[ing] a plurality of columns” “populated within [sic] a number of containers or totes.” (Ex. 1001, 18:22-26; Ex. 1003, ¶302).

Hangzhou discloses modular shelves “placed in rows and columns to improve the plot ratio,” where “[t]wo shelf rows” are “placed face to face to share a stacking row laneway 12 in the middle,” such that the “combination of the stacking row laneway 12 and all the shelf rows 11 facing the row laneway is defined as a shelf-laneway combination 13.” (Ex. 1006, ¶[0037]; Ex. 1003, ¶¶303-304).

Hangzhou discloses a first vehicle and a second vehicle travelling under a rack and parallel to each other such that one of the vehicles could pass the other. (Ex. 1006, Figure 1¹¹; Ex. 1003, ¶¶304-305).

¹¹ *see* n2 *supra*.

Ex. 1006, Figure 1 (annotated)

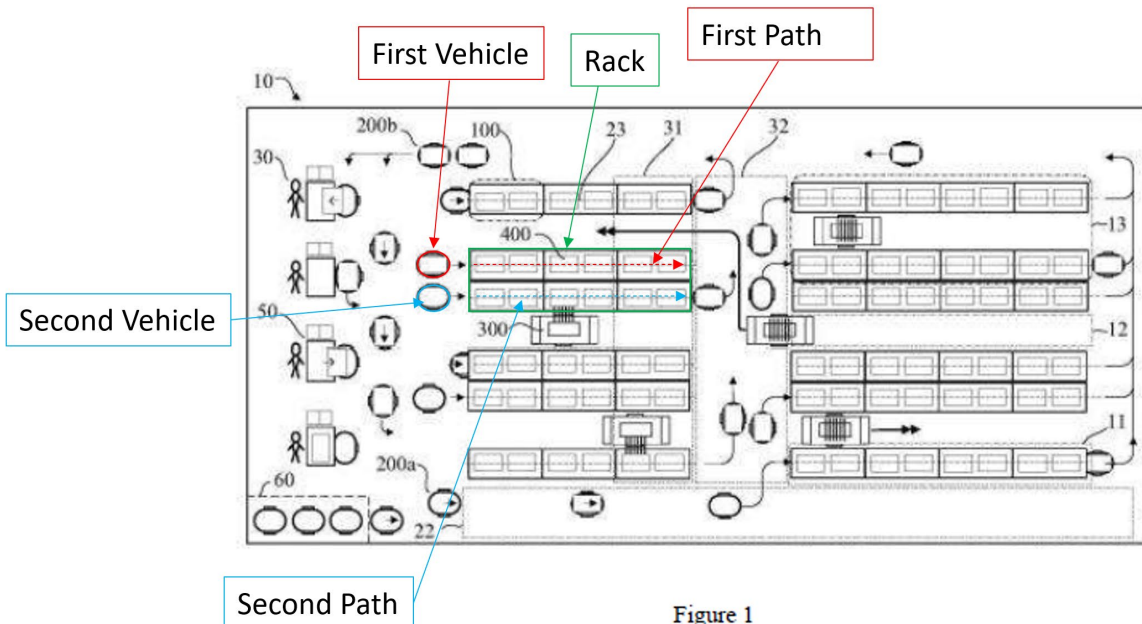


Figure 1

To the extent *Hangzhou*'s parallel shelf rows were determined not to expressly disclose racks, it would have been obvious to a POSITA that two shelf rows could be combined to define a single wider shelf to allow for multiple rows of boxes and to enable two trolleys to travel along parallel paths underneath such a single wider shelf. (Ex. 1003, ¶306). A POSITA would have been motivated to combine the teachings of *Hangzhou* with those of *Raizer* to allow for more efficient use of shelving space by increasing the amount of shelving space relative to unused space in the aisles between the shelves. (Ex. 1003, ¶307; *see also* Motivation to Combine *supra*).

11. Claim 11

- i. [11.pre]: A material handling system for delivering items to storage locations and retrieving items from storage locations, comprising:**

To the extent element [11.pre] is limiting, *Raizer* discloses [11.pre]. (see [1.pre] *supra*; Ex. 1003, ¶¶309-312).

- ii. [11.a1]: a first storage rack having a plurality of columns each of which comprises a plurality of storage locations**

Raizer discloses [11.a1]. (see [1.a1-a2] *supra*; Ex. 1003, ¶¶313-316).

- iii. [11.a2]: wherein the first storage rack is longitudinally elongated;**

Raizer discloses [11.a2]. (Ex. 1003, ¶¶317-319).

Raizer discloses a “floor plan of a typical warehouse” having a “storage area” with “a plurality of shelving units” (Ex. 1005, ¶[0092]; Ex. 1003, ¶318). The “vertical supports divide shelving units into sections call [sic] bays (B1, B2, ...),” and “[t]he sides of the shelving units that face the aisles between units are called faces (F1, F2, ...).” (Ex. 1005, ¶[0092]; Ex. 1003, ¶318).

Ex. 1005, FIG. 1 (annotated)

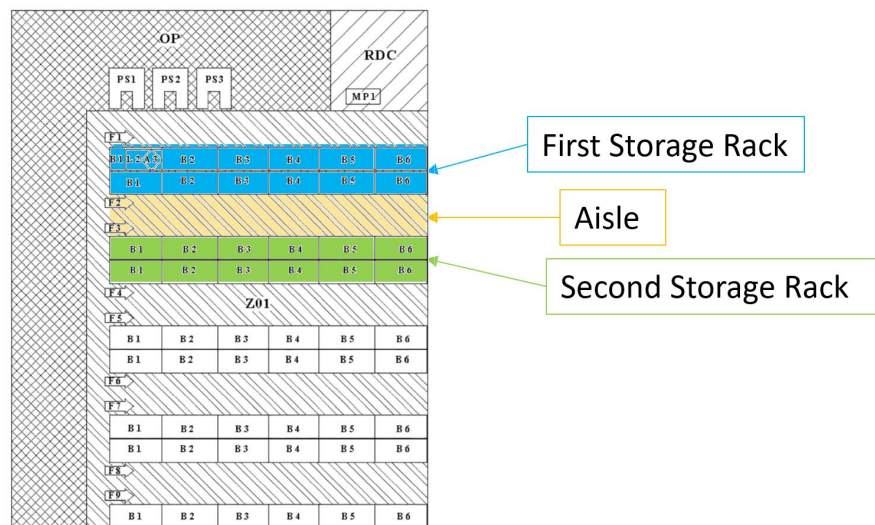


Fig. 1

-
- iv. ***[11.b1]: a second storage rack having a plurality of columns each of which comprises a plurality of storage locations***

Raizer discloses [11.b1]. (see [1.a1-a2], [11.a1-a2] *supra*; Ex. 1003, ¶¶320-323).

- v. ***[11.b2]: wherein the second storage rack is longitudinally elongated,***

Raizer discloses [11.b2]. (see [11.b1], [11.a1-a2] *supra*; Ex. 1003, ¶¶324-326).

- vi. ***[11.b3]: wherein the second storage rack is spaced apart from the first storage rack to provide an aisle between the first and second storage racks;***

Raizer discloses [11.b3]. (see [11.a2], [11.b1-b2] *supra*; Ex. 1003, ¶¶327-329).

vii. [11.c1]: a plurality of delivery vehicles

Raizer discloses [11.c1]. (see [1.b1] *supra*; Ex. 1003, ¶¶330-332).

viii. [11.c2]: wherein each vehicle has a length and a width and

Raizer discloses [11.c2]. (Ex. 1003, ¶¶333-335).

Raizer depicts a top view of a robot in FIG. 5D. (Ex. 1005, ¶[0103]; FIG. 5D; Ex. 1003, ¶334). Shown below, the robot (vehicle) has a length and a width. (Ex. 1003, ¶¶335).

Ex. 1005, FIG. 5D (annotated)

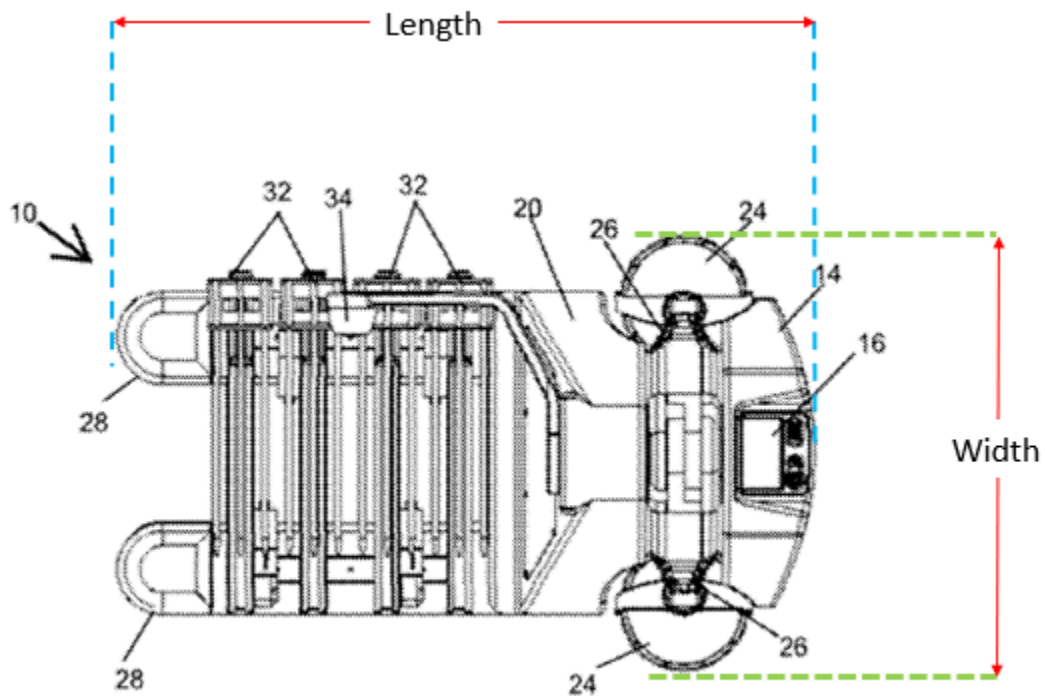


Fig. 5D

- ix. [11.c3]: each vehicle comprises: a horizontal drive system operable to drive the vehicle along a horizontal surface;**

Raizer discloses [11.c3]. (see [1.b2] *supra*; Ex. 1003, ¶¶336-341).

- x. [11.c4]: a vertical drive operable to drive the vehicle vertically;**

Raizer discloses [11.c4]. (see [1.b3] *supra*; Ex. 1003, ¶¶342-352).

- xi. [11.c5]: and a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations;**

Raizer discloses [11.c5]. (see [1.b4] *supra*; Ex. 1003, ¶¶353-357).

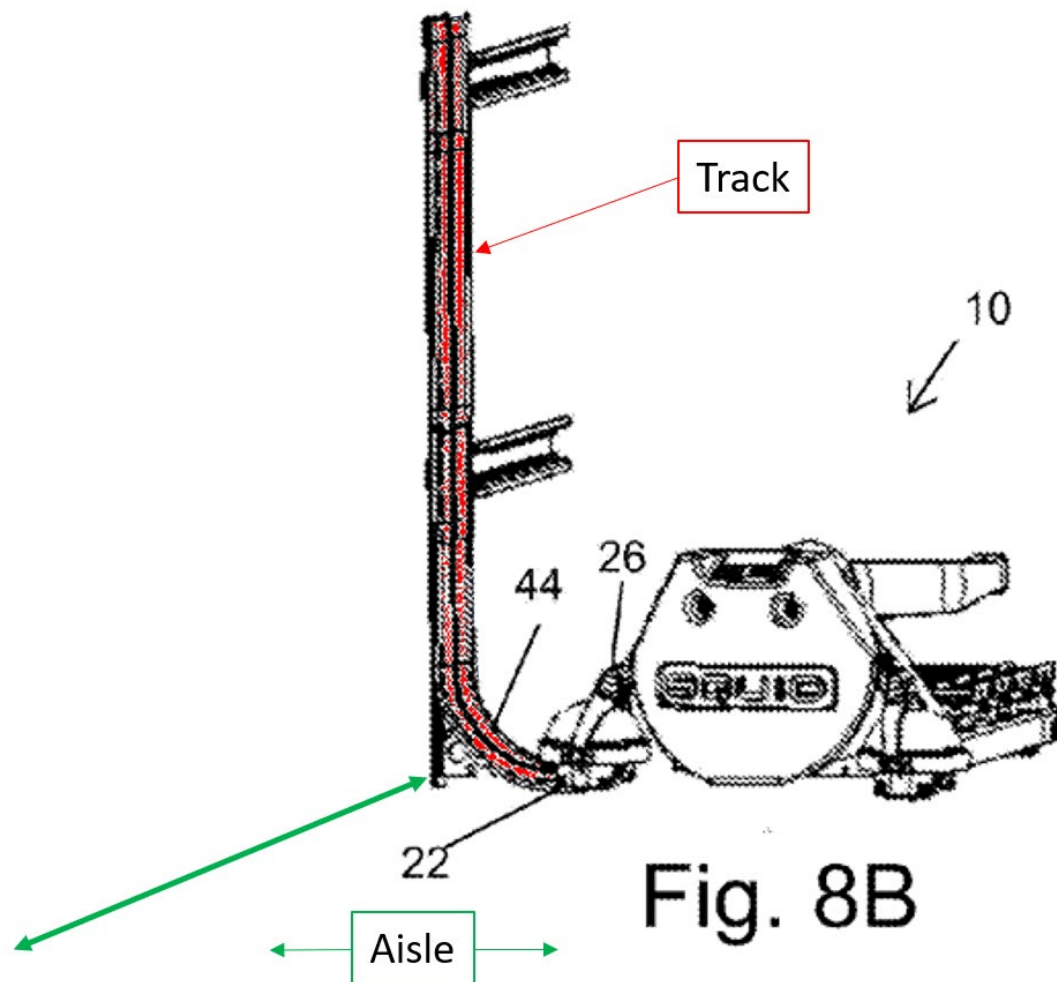
- xii. [11.d]: a track positioned in the aisle wherein the vertical drive is configured to cooperate with the track to drive the vehicle vertically upwardly;**

Raizer discloses [11.d]. (Ex. 1003, ¶¶358-365). *Raizer* discloses a vertical drive. (see [11.c4] *supra*).

Raizer discloses 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.” (Ex. 1005, ¶[0020]; Ex. 1003, ¶¶359-361). *Raizer* discloses “[a] curved piece of rail called a terminal 44 is attached to the bottoms of the vertical rails where they reach the ground,” and that “[t]his 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.” (Ex. 1005, ¶[0111]; Ex. 1003, ¶361). From this description and in the context of FIG. 1, a POSITA would have understood that terminal 44 and vertical rails 42 represent

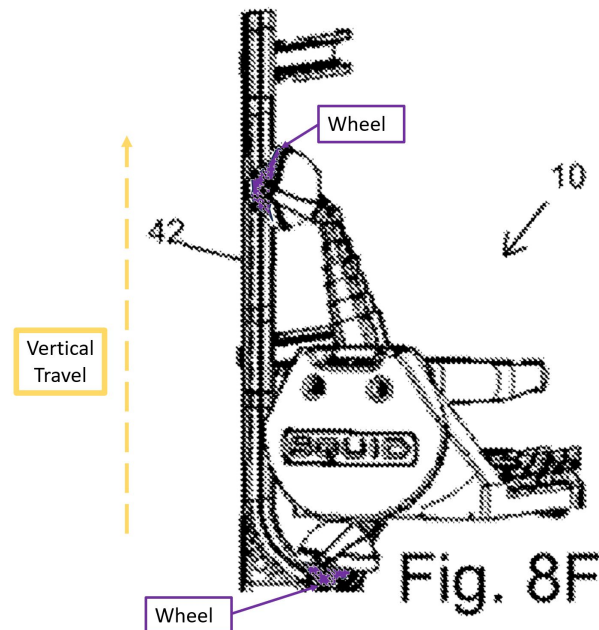
a track positioned in an aisle extending upward and attaching to vertical support posts of the shelving units. (Ex. 1003, ¶361).

Raizer discloses “a synchronized movement tak[ing] place between the driving motor of the right front wheel 22, and electric motors and actuators ... inside the right arm unit 26 that are responsible for changing the length and angle of the arm unit advancing the right wheel into the ‘U’-shaped channel 46 in terminal 44 while the robot 10 remains in position on the floor.” (Ex. 1005, ¶[0116]; FIGs. 8A-8G; Ex. 1003, ¶¶362-363). As “right wheel 22 enters the terminal it is geometrically locked to the rail.” (Ex. 1005, ¶[0116]; Ex. 1003, ¶363). “The synchronized movement between the driving motor of the right front wheel 22 and right arm unit 26 continues to extend the right arm unit as right wheel 22 moves further up terminal 44.” (Ex. 1005, ¶[0117]; FIG. 8C; Ex. 1003, ¶363).



After “the right wheel has advanced further up vertical rail 42 and starts to pull the robot 10 slightly off the ground,” the “left front wheel 22 moves into the ‘U’-shaped channel 46 in terminal 44 and [being] locked to the rail.” (Ex. 1005, ¶¶[0119-0121]; FIG. 8F; Ex. 1003, ¶364).

Ex. 1005, FIG. 8F (annotated)



Raizer discloses a track, terminal 44 and/or vertical rails 42, positioned in the aisle where the vertical drive is configured to cooperate with the track to drive the vehicle upwardly. (Ex. 1003, ¶365).

xiii. [11.e]: a first horizontal path that extends under the first rack in a direction parallel to the aisle;

Raizer and *Hangzhou* render obvious [11.e]. (Ex. 1003, ¶¶366-373). *Raizer* discloses a plurality of storage racks spaced apart from one another forming a plurality of aisles where the row of racks is adjacent the aisle. (see [11.b3] *supra*; Ex. 1003, ¶366).

Should *Raizer* be determined to not disclose a first horizontal path that extends under the first rack in a direction parallel to the aisle, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶367).

Hangzhou discloses “auto-guided trolleys 100” travel “under the shelf,” as indicated by the dotted line, and that the path is “parallel to the stacking row laneway 12” or aisle. (Ex. 1006, Abstract, ¶¶[0040, 0044-45, 0048]; Figure 1; Ex. 1003, ¶¶368-371).

Ex. 1006, Figure 1 (annotated)

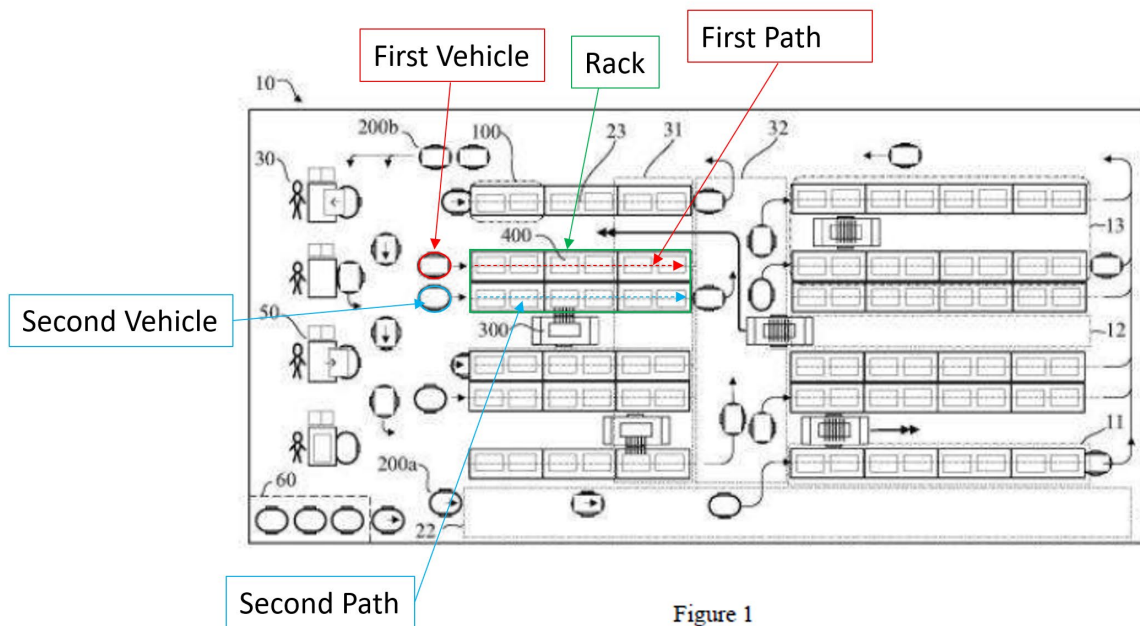


Figure 1

A POSITA would have been motivated to combine the teachings of *Hangzhou* with those of *Raizer* to allow for increased travel paths for robots to reduce congestion, avoid traffic jams, and increase efficient use of space. (Ex. 1003, ¶372; *see also* Motivation to Combine *supra*).

- xiv. **[11.f]: a second horizontal path that extends under the first rack in a direction parallel to the aisle;**

Raizer and *Hangzhou* render obvious [11.f]. (*see* [11.e], [1.d2-d3], [1.e], [10.a] *supra*; Ex. 1003, ¶¶374-381).

xv. ***[11.g]: wherein the horizontal drive is configured to turn the vehicle under the first rack by rotating the vehicle about a vertical axis that extends through the vehicle;***

Raizer and *Hangzhou* render obvious [11.g]. (see [1.b2], [1.e], [8.a] *supra*; Ex. 1003, ¶¶382-392).

Raizer discloses that the “robots of the system comprise” “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* 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, ¶383). *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, ¶¶383-385).

To the extent *Raizer* does not disclose rotating the first vehicle about a vertical axis that extends through the first vehicle while underneath a rack, a POSITA would turn to the teachings of *Hangzhou* as set forth above with respect to [1.e]. (Ex. 1003, ¶¶387-390).

A POSITA would have been motivated to combine *Raizer* and *Hangzhou* for the reasons set forth herein. (Ex. 1003, ¶391; *see also* Motivation to Combine *supra*).

xvi. [11.h1]: wherein the storage rack comprises a plurality of vertical posts and

Raizer discloses [11.h1]. (see [1.a1-a2], [3.a], [11.a1], [11.b1] *supra*; Ex. 1003, ¶¶393-394). *Raizer* discloses a “plurality of shelving units” with “a network of vertical and horizontal rails” that are “parallel to” “vertical support posts and horizontal shelves.” (Ex. 1003, ¶¶393-394).

xvii. [11.h2]: the first and second horizontal paths are each spaced apart from the vertical posts a distance greater the one half the length of the vehicles;

Raizer and *Hangzhou* render obvious [11.h2]. (Ex. 1003, ¶¶395-402). *Raizer* and *Hangzhou* render obvious a first and second horizontal paths extending under the shelves. (see [1.e], [11.f], [5.c] *supra*; Ex. 1003, ¶395).

Should *Raizer* be determined to not disclose the first and second horizontal paths spaced apart a distance greater the one half the length of the vehicles, the POSITA would have turned to *Hangzhou*. (see [5.c] *supra*; Ex. 1003, ¶396).

Hangzhou discloses “[s]upport members 111 divid[ing] the space inside channel support frames 110 into an auto-guided trolley passage space 112 and a cache space 113 for docking standardized containers.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶397). *Hangzhou* discloses a “horizontal gap” “between support members 111” that makes “auto-guided trolley passage space 112 connect cache space 113 in the row direction of the shelf to form a row channel 23” which “allows auto-guided trolleys

200 carrying customized containers 400 to travel.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶397).

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, ¶¶398-399).

A POSITA would have understood that the first and second horizontal paths the trolleys travel along, in *Hangzhou* and given the teachings of *Hangzhou*, would be spaced apart from the vertical posts by a distance greater than half the length of the vehicle in order to allow the trolleys to turn without colliding with the support pieces or each other and to allow the robots of *Raizer* to engage with the vertical rails once in the aisle between the shelves. (Ex. 1003, ¶¶400-401; *see also* Motivation to Combine *supra*).

xviii. [11.i]: where the first horizontal path under the first rack is spaced apart from the second horizontal path a distance greater than the width of the vehicles.

Raizer and *Hangzhou* render obvious claim element [11.i]. (Ex. 1003, ¶¶403-412). *Raizer* and *Hangzhou* render obvious first and second horizontal paths under

a rack spaced apart by an aisle. (see [10.a-b], [11.e], [11.f] *supra*; Ex. 1003, ¶403). Should *Raizer* be determined to not disclose the first and second horizontal paths spaced apart a distance greater than the width of the vehicles, a POSITA would have turned to *Hangzhou*. (Ex. 1003, ¶404).

Hangzhou discloses “[s]upport members 111 divid[ing] the space inside channel support frames 110 into an auto-guided trolley passage space 112 and a cache space 113 for docking standardized containers.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶405). *Hangzhou* discloses a “horizontal gap” “between support members 111” that makes “auto-guided trolley passage space 112 connect cache spaces 113 in the row direction of the shelf rows to form a row channel 23” which “allow auto-guided trolleys 200 carrying customized containers to travel.” (Ex. 1006, ¶[0045]; Ex. 1003, ¶405).

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,” by “turning 90° in place,” and that *Hangzhou* discloses 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]; Figure 1; Ex. 1003, ¶¶406-409).

Hangzhou discloses that a “dotted line displayed on the center line of each shelf row is used to indicate the row channel 23 for auto-guided trolleys 200 under the shelf, which is a path parallel to the stacking row laneway 12.” (Ex. 1006, ¶[0040]; Ex. 1003, ¶[406]). *Hangzhou* depicts at least two robots entering shelf columns simultaneously and traveling along parallel paths. (Ex. 1003, ¶[406]).

Ex. 1006, Figure 1 (annotated)

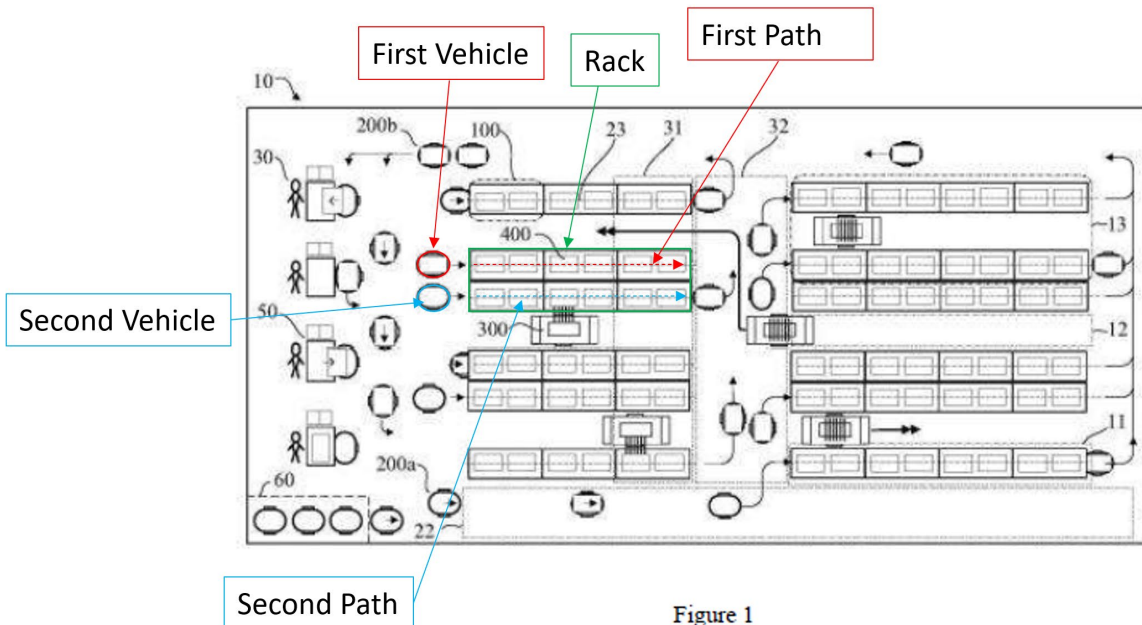


Figure 1

Equipped with *Hangzhou*’s disclosure of multiple trolleys moving in column and row channels beneath shelves, trolleys rotating in place underneath the shelves, and desire to solve blockages and congestion, a POSITA would have understood that the first and second horizontal paths would be spaced apart a distance greater than the width of the vehicles to avoid collisions between two vehicles traveling beneath the shelves. (Ex. 1003, ¶¶410-411; *see also* Motivation to Combine *supra*).

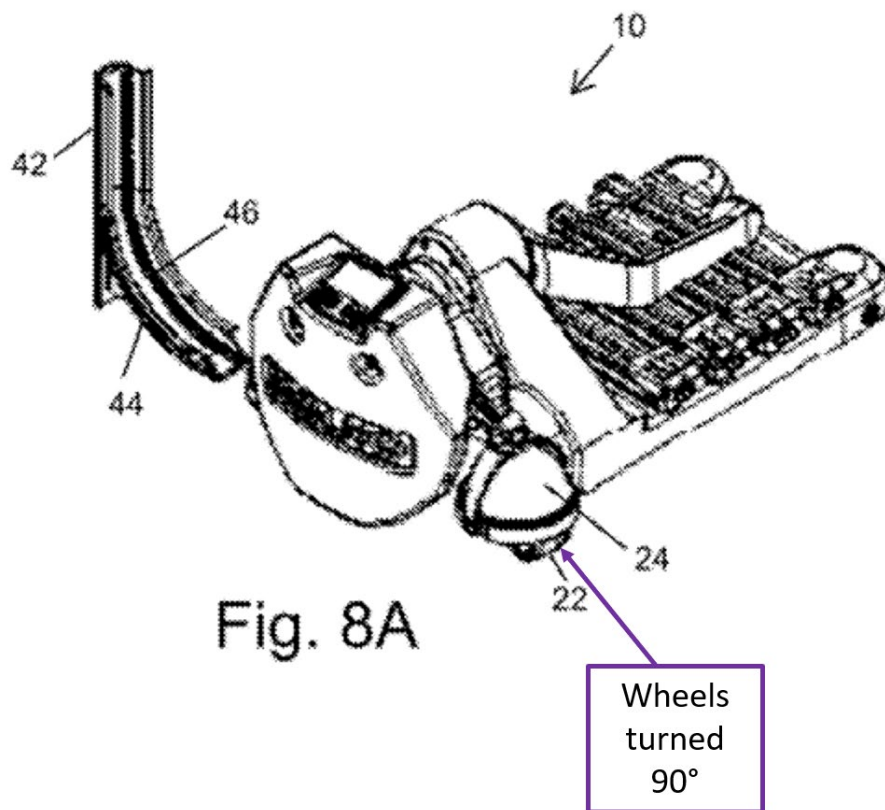
12. Claim 12

- i. [12.pre-12.a]: The system of claim 11 wherein the vertical drive comprises a plurality of rotatable elements that each rotate about a horizontal axis and***

Raizer and *Hangzhou* render obvious [12.pre] and [12.a]. (see [11.pre-11.i] *supra*, Ex. 1003, ¶¶413-419).

Raizer discloses robots with “two drive and steering units,” each comprising “one front wheel and components configured to rotated [sic] the front wheel at least 360 degrees about an axis vertical 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, ¶¶414-417).

Ex. 1005, FIG. 8A (annotated)



Raizer discloses “[t]he 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.” (Ex. 1005, ¶¶[0114-0121]; FIGs. 8A-8G; Ex. 1003, ¶418). *Raizer* discloses the vertical drive comprises wheels 22 (a plurality of rotatable elements) that each rotate about a horizontal axis. (Ex. 1003, ¶419).

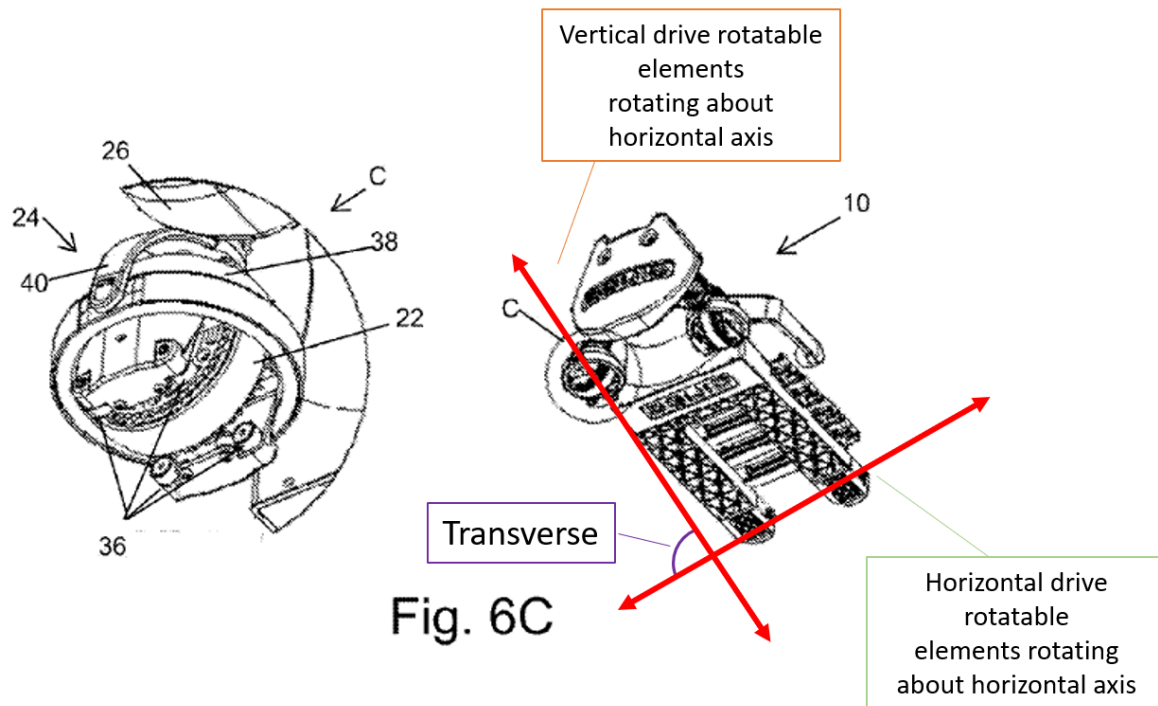
- ii. *[12.b]: wherein the horizontal drive comprises a plurality of rotatable elements that each rotate about a horizontal axis transverse the axes of rotation of the vertical drive elements.*

Raizer discloses [12.b]. (Ex 1003, ¶¶420-424).

Raizer discloses that the robots comprise “two drive and steering units,” each comprising “one front wheel and components configured to rotated [sic] the front wheel at least 360 degrees about an axis vertical 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, ¶¶421-422).

Raizer discloses that the “[r]obot 10 moves along the ground on four wheels,” where “two rear wheels 30 could be fixed and passive so that they can only rotate about their axles which are perpendicular to the axis of the long beams 28 of the frame and are ‘dragged along’ by the front wheels,” or “could be multi directional wheels which allow movement to any direction, about an axis vertical to the floor.” (Ex. 1005, ¶[0104]; Ex. 1003, ¶423). “The front driving wheels 22 dictate the steering angle and differential speeds of the rear wheels,” and/or “can be independently rotated in any direction by drive and steering units 24.” (Ex. 1005, ¶[0104]; Ex. 1003, ¶423). The rear wheels, which form part of the horizontal drive, rotate along a horizontal axis that is transverse the horizontal axes about which wheels 22 of the vertical drive system rotate. (Ex. 1003, ¶¶423-424).

Ex. 1005, FIG. 6C (annotated)



When front wheels 22 are rotated and positioned to engage the vertical rails and raising the robot, rotatable elements of the horizontal drive (rear wheels 30) rotate about a horizontal axis that is transverse to the horizontal axes about which the wheels 22 (vertical drive elements) are rotating. (Ex. 1003, ¶424).

13. Claim 14

- i. ***[14.pre-14.a]: The system of claim 11 wherein the track comprises drive elements configured to cooperate with the vertical drive so that rotating the vertical drive about a horizontal axis operates to drive the vehicle upwardly along the track.***

Raizer and Hangzhou render obvious [14.pre] and [14.a]. (see [11.pre]-[11.i] *supra*; Ex. 1003, ¶¶425-434).

Raizer discloses vertical and horizontal rails “made from ‘U’-shaped profiles” “with a channel 46 in which the front wheels 22 of robot 10 travel and two flanges” (drive elements) “48 on either side of channel 46.” (Ex. 1005, ¶[0111]; FIG. 7A; Ex. 1003, ¶427).

Ex. 1005, FIG. 7A

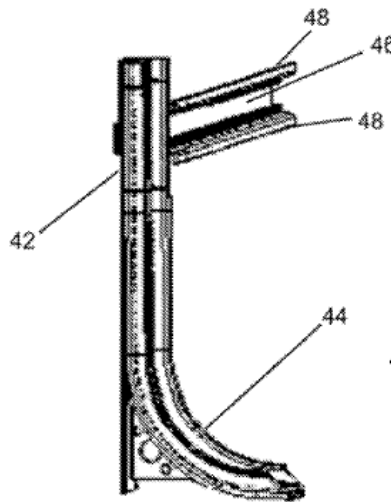


Fig. 7A

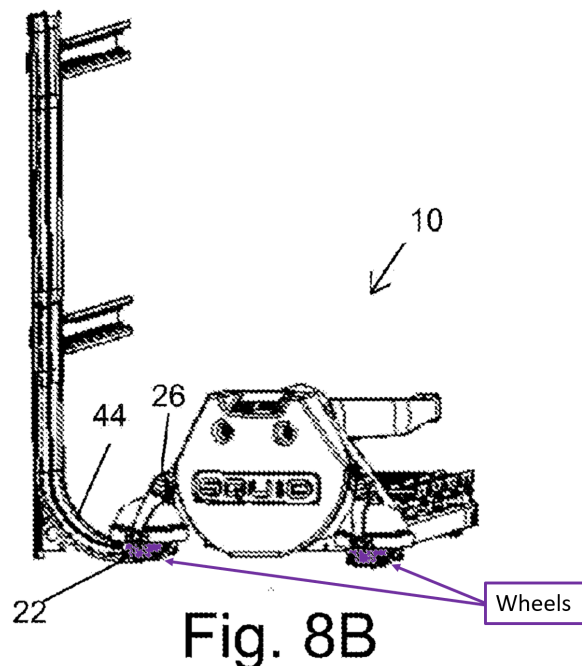
A “curved piece of rail called a terminal 44 is attached to the bottoms of the vertical rails where they reach the ground,” “where robots 10 can connect or disconnect from the rails 42” “to climb to or descend from the shelves.” (Ex. 1005, ¶¶[0030, 0056, 0078, 0111]; Ex. 1003, ¶¶428-430). *Raizer* discloses that a “robot travels vertically with both front wheels in the same vertical rail.” (Ex. 1005, ¶[0114]; Ex. 1003, ¶431).

Raizer discloses “a synchronized movement tak[ing] place between the driving motor of the right front wheel 22, and electric motors and actuators ... inside

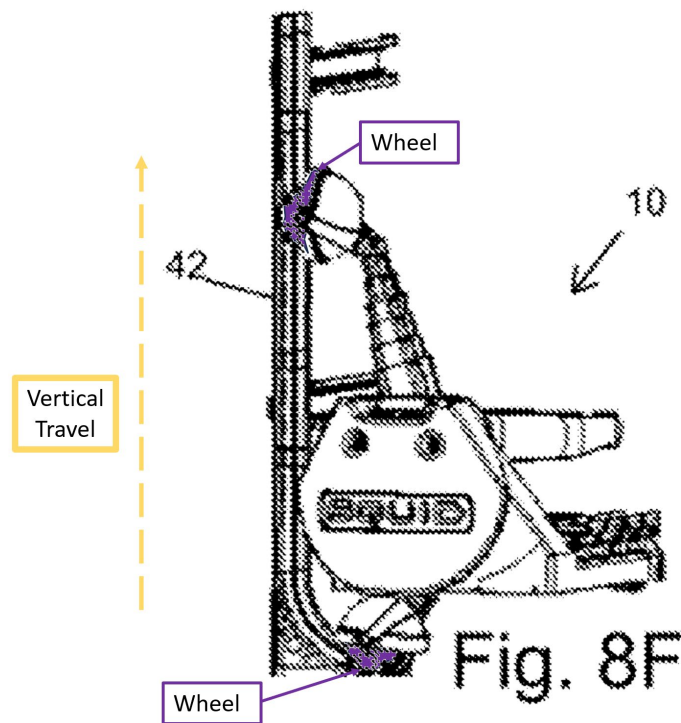
the right arm unit 26 that are responsible for changing the length and angle of the arm unit advancing the right wheel into the ‘U’-shaped channel 46 in terminal 44 while the robot 10 remains in position on the floor.” (Ex. 1005, ¶¶[0114-0121]; FIGa. 8A-8G; Ex. 1003, ¶¶431-432). As “right wheel 22 enters the terminal it is geometrically locked to the rail.” (Ex. 1005, ¶¶[0116-0117]; FIG. 8B, 8C, 8F; Ex. 1003, ¶¶433-434).

“The synchronized movement between the driving motor of the right front wheel 22 and right arm unit 26 continues to extend the right arm unit as right wheel 22 moves further up terminal 44.” (Ex. 1005, ¶[0117]; FIG. 8C; Ex. 1003, ¶432).

Ex. 1005, FIG. 8B (annotated)



Ex. 1005, FIG. 8F (annotated)



Raizer's 'U'-shaped rails have drive elements configured to cooperate with the wheels 22 of the vertical drive, which allow the robot to climb vertically while locked into the rail (by wheels 36) so that rotating wheels 22 of the vertical drive about a horizontal axis drives the robot vertically upward along the rail. (Ex. 1003, ¶434).

14. Claim 23

- i. [23.pre]: A method for delivering items to storage locations and retrieving items from storage locations, comprising the steps of:*

To the extent element [23.pre] is limiting, *Raizer* discloses [23.pre]. (see [1.pre] *supra*; Ex. 1003, ¶¶435-438).

- ii. *[23.a1]: providing a plurality of storage racks spaced apart from one another forming a plurality of aisles,*

Raizer discloses [23.a1]. (see [1.a1] supra; Ex. 1003, ¶¶439-441).

Ex. 1005, FIG. 1 (annotated)

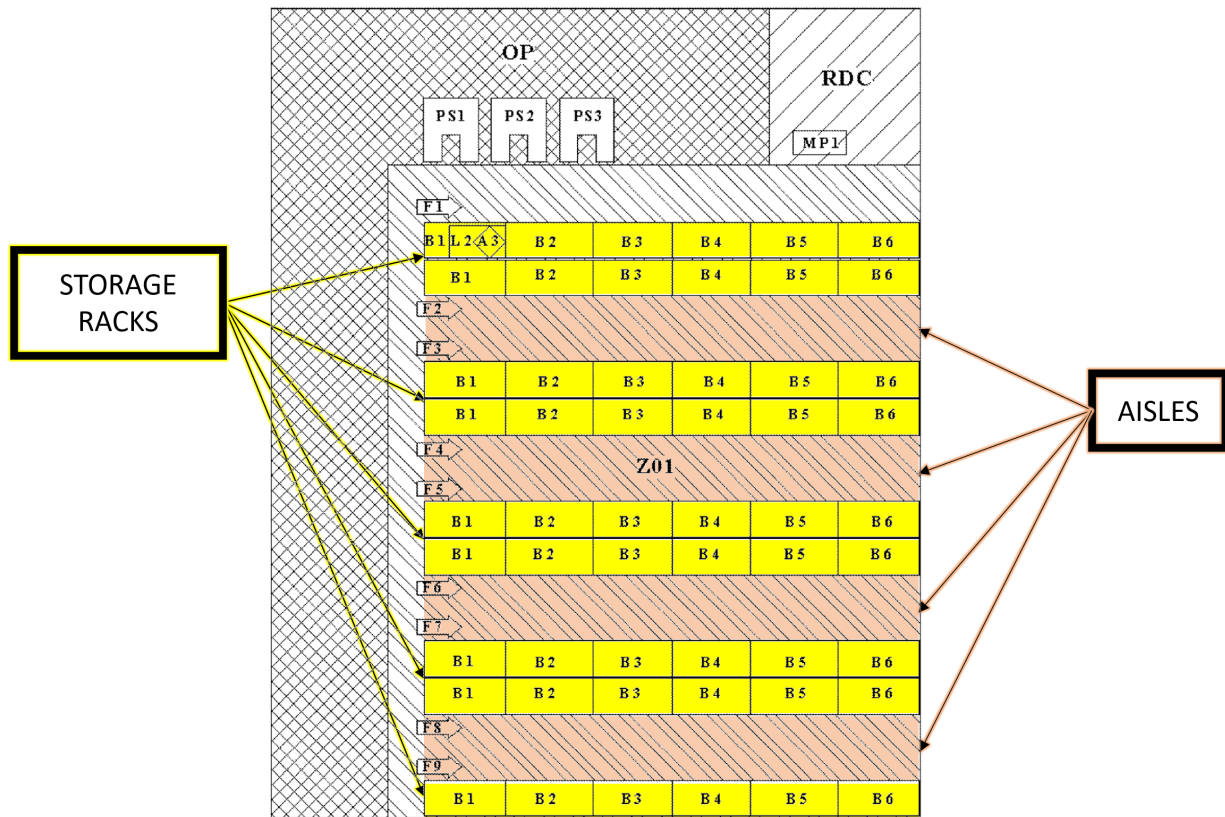


Fig. 1

- iii. *[23.a2]: wherein each storage rack comprises a plurality of columns and each column comprises a plurality of storage locations;*

Raizer discloses [23.a2]. (see [1.a2] supra; Ex. 1003, ¶¶442-445).

Raizer's "storage area" has "a plurality of shelving units" (storage racks) where "a given row of shelves" (storage locations) "in a bay" (columns) "can hold

several boxes arranged in one or more side-by-side stacks each comprising one or more boxes stacked one upon the other.” (Ex. 1005, ¶¶[0092], Ex. 1003, ¶¶443-445).

iv. [23.b1]: providing a plurality of delivery vehicles

Raizer discloses [23.b1]. (see [1.b1] *supra*; Ex. 1003, ¶¶446-448).

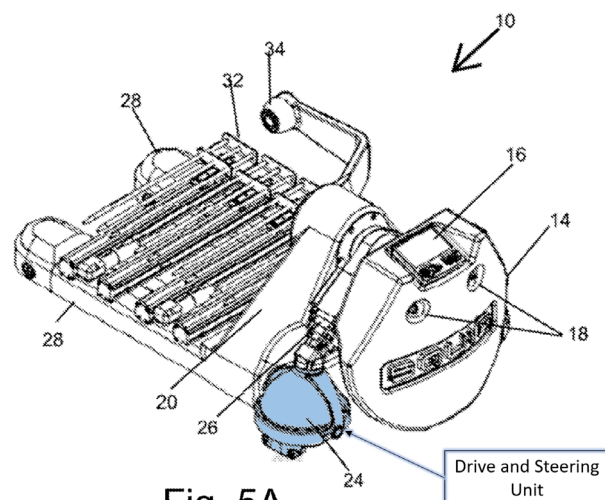
Raizer discloses “an automatic system for picking and placing boxes on shelves in a warehouse,” the system comprising “a set of autonomous mobile robots.” (Ex. 1005, ¶¶[0018-0019]; Ex. 1003, ¶447-448).

v. [23.b2]: wherein each vehicle comprises a horizontal drive system operable to drive the vehicle along a horizontal surface,

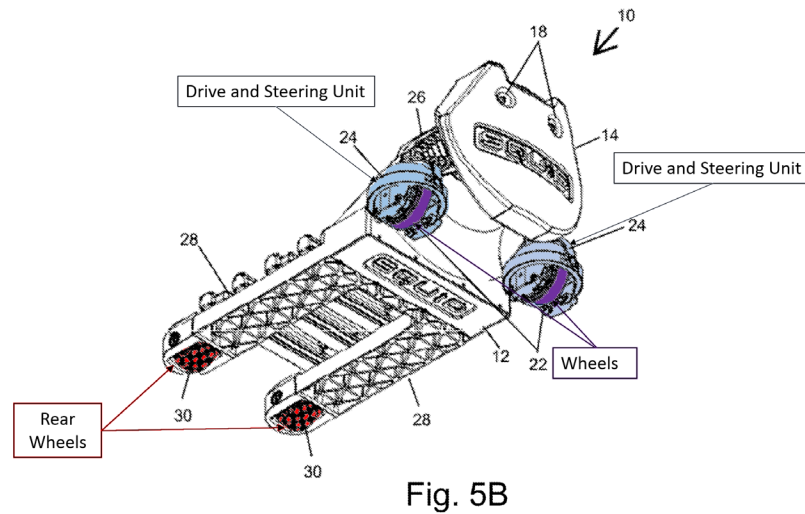
Raizer discloses [23.b2]. (see [1.b2] *supra*; Ex. 1003, ¶¶449-454).

Raizer discloses a horizontal drive system comprising drive wheels 22, rear wheels 30, and drive and steering units 24 operable to drive the vehicle along a horizontal surface. (Ex. 1003, ¶¶450-454).

Ex. 1005, FIG. 5A (annotated)



Ex. 1005, FIG. 5B (annotated)

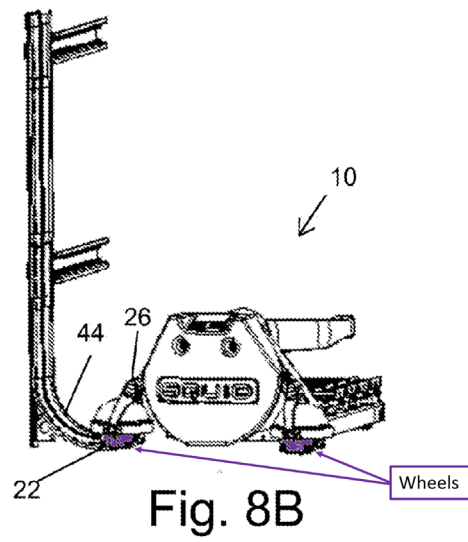


vi. [23.b3]: a vertical drive operable to drive the vehicle vertically and

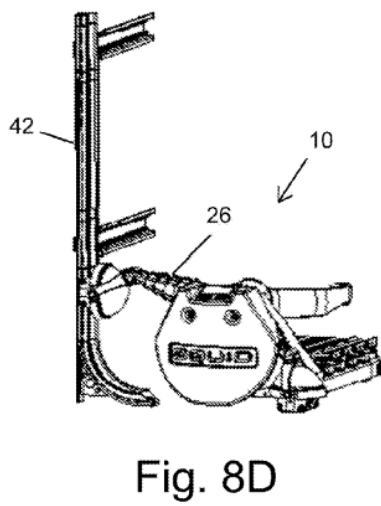
Raizer discloses [23.b3]. (see [1.b3] *supra*; Ex. 1003, ¶¶455-465).

Raizer discloses a vertical drive system comprising drive wheels 22, small wheels 36, and drive and steering units 24 operable to drive the vehicle vertically. (Ex. 1003, ¶¶455-465).

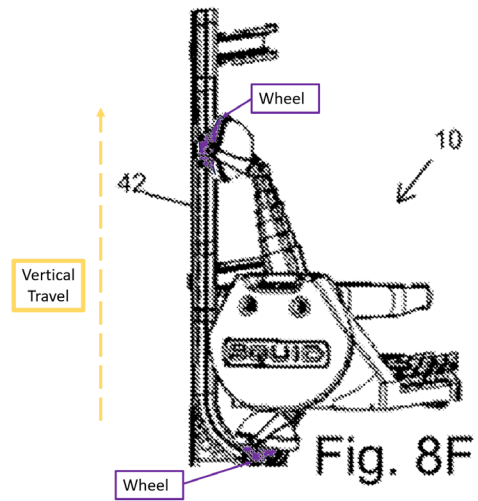
Ex. 1005, FIG. 8B (annotated)



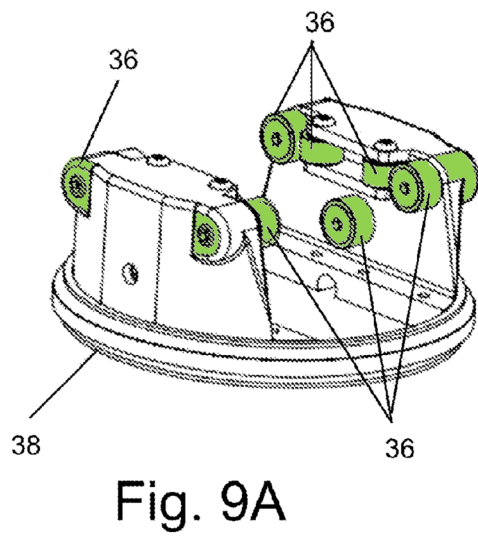
Ex. 1005, FIG. 8D



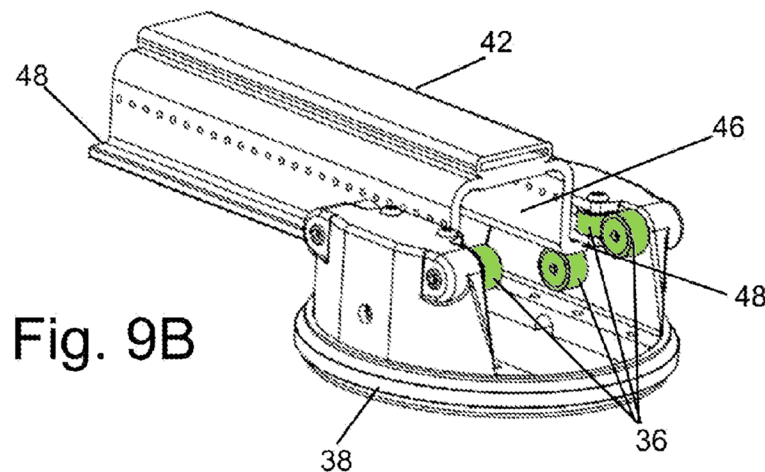
Ex. 1005, FIG. 8F (annotated)



Ex. 1005, FIG. 9A (annotated)



Ex. 1005, FIG. 9B (annotated)



-
- vii. *[23.b4]: a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations;*

Raizer discloses [23.b4]. (see [1.b4] *supra*; Ex. 1003, ¶¶466-470).

Raizer discloses that the robots comprise a “gripper mechanism” attached to the top side of its robot that is configured to pick up and place boxes of differing sizes. (see [1.b4], [1.h] *supra*; Ex. 1005, ¶¶[0027, 0031]; Ex. 1003, ¶467).

Raizer also discloses that “[t]he combination of the capability of independently changing the lengths and angles of the two arm units 26 and the capability of activating the two drive and steering units 24 independently allows the robot, with the assistance of fine positioning sensor 34, to place a box on a shelf or remove it from any height or any orientation on the shelf.” (Ex. 1005, ¶[0133]; Ex. 1003, ¶468).

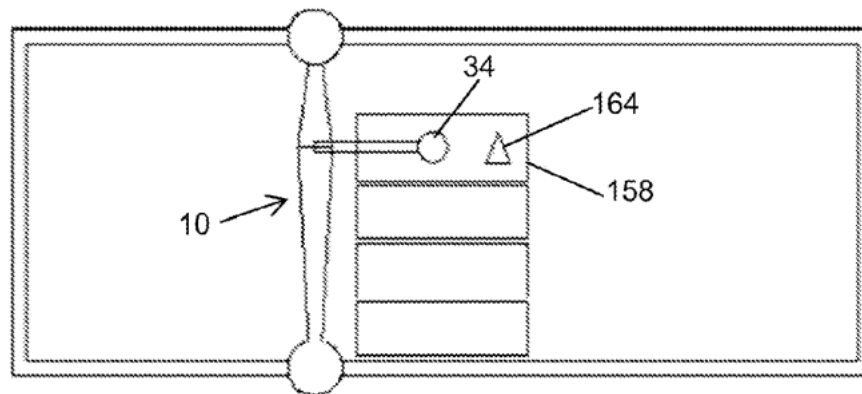


Fig. 14A

- viii. [23.c1]: driving a first of the vehicles under one or more of the storage racks along a path that crosses one or more aisle,

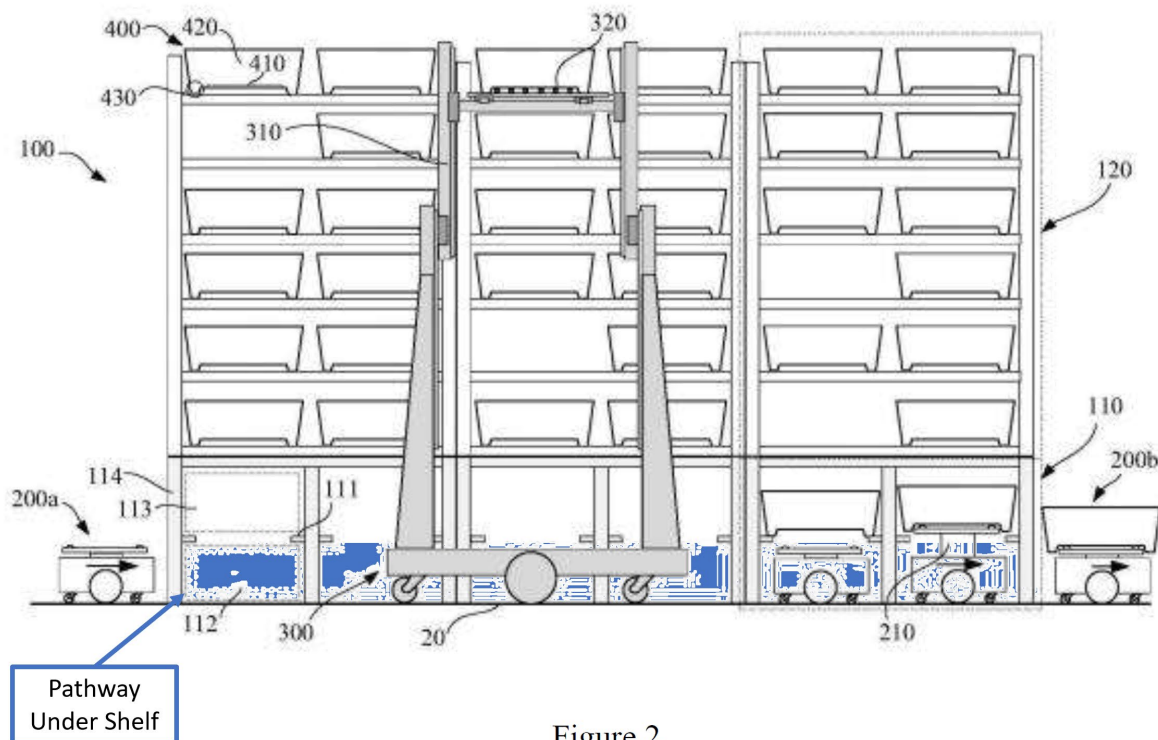
Raizer and *Hangzhou* render obvious [23.b4]. (see [1.d1], [1.j], [7.a] *supra*; Ex. 1003, ¶¶471-480). *Raizer* discloses that the vehicles can travel in any direction and to various locations. (see [23.b1-b4] *supra*; Ex. 1003, ¶472).

Should *Raizer* be determined to not disclose driving a first of the vehicle under one or more of the storage racks along a path that crosses one or more aisle, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶473).

Hangzhou discloses “an unmanned warehousing system” where “a lower layer is used to automatically guide a trolley to pass through.” (Ex. 1006, Abstract; Ex. 1003, ¶474). The “auto-guided trolley” has “auto-navigation ability” and “preferentially travels in column laneways 32” and “in auto-guided trolley passage spaces 112.” (Ex. 1006, ¶[0048]; Ex. 1003, ¶474).

Hangzhou discloses “modular channel support frames may be mounted below a shelf 100” to raise the shelf to a height “slightly higher than the trolley.” (Ex. 1006, ¶[0044]; Ex. 1003, ¶¶475-476).

Ex. 1006, Figure 2 (annotated)



Hangzhou discloses a shelf (a first rack), with a lower layer set up under the shelf, and that the automatically guided trolley (first vehicle) passes through the lower layer (is driven via a path that extends under at least one of the storage racks). (Ex. 1003, ¶476).

Hangzhou discloses that the “auto-guided trolleys” can “switch between trolley-special laneways 21 and column channels 33 and between column channels

33 and row channels 23.” (Ex. 1006, ¶¶[0062, 0072, 0076]; Figure 10¹²; Ex. 1003, ¶477). Shown in Figure 10, the trolley can move underneath the shelving units in a path parallel to the row channels 23 (aisles), and then turn to travel from underneath the shelving unit and across row laneways 21 (aisles) along the column channels 33. (Ex. 1006, ¶¶[0062-0064]; Ex. 1003, ¶¶477-478).

Ex. 1006, Figure 10

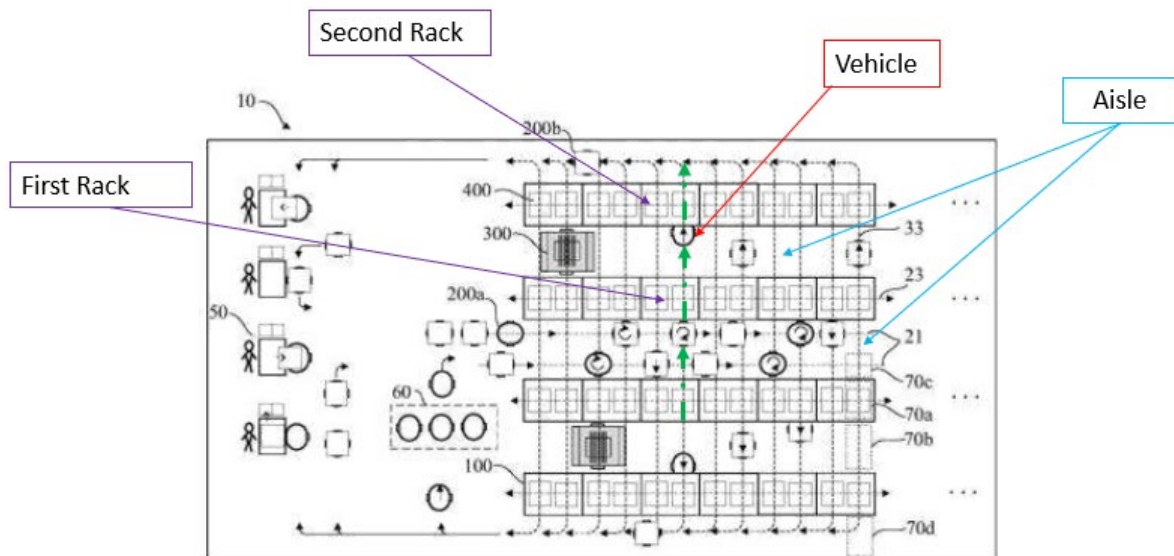


Figure 10

A POSITA would have been motivated to combine the teachings of *Hangzhou* with those of *Raizer* to reduce congestion, avoid traffic jams, and improve efficient use of space. (Ex. 1003, ¶479; *see also* Motivation to Combine *supra*).

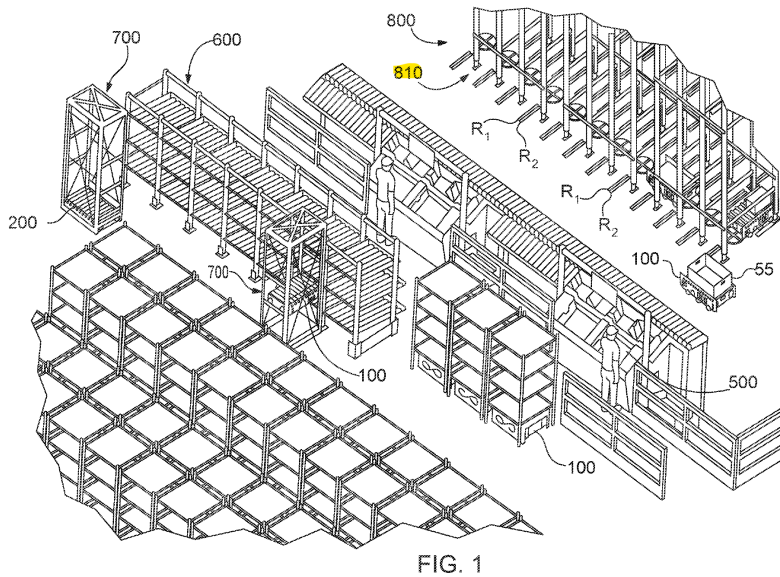
¹² *see n2 supra*.

ix. ***[23.c2]: wherein the step of driving the first vehicle includes driving the first vehicle into a first of the columns in a first of the aisles;***

Raizer and *Hangzhou* render obvious [23.c2]. (Ex. 1003, ¶¶481-487). *Raizer* discloses a plurality of storage shelves spaced apart forming a plurality of aisles and wherein each storage rack comprises a plurality of columns. (*see* [23.a1-a2] *supra*; Ex. 1003, ¶481).

The '632 patent describes a “vertical column[] 810,” and a vehicle may be driven into a column before the vehicle is driven vertically upward along the column while protruding into the aisle. (Ex. 1001, 7:45; Ex. 1003, ¶482).

Ex. 1001, FIG. 1 (annotated)



Hangzhou discloses that “auto-guided trolleys 200” can “switch between trolley-special row laneways 21 and column channels 33.” (Ex. 1006, ¶[0072]; Ex. 1003, ¶483). The trolleys can move under the shelving units in a path parallel to the

row channels 23 (aisles), then turn to travel from under the shelving unit and across row laneways 21 (aisles) along the column channels 33. (Ex. 1003, ¶483). *Hangzhou*, in Figure 10¹³ (annotated below), depicts driving a first vehicle into a first of the columns in a first of the aisles. (Ex. 1003, ¶¶483, 487).

Ex. 1006, Figure 10 (annotated)

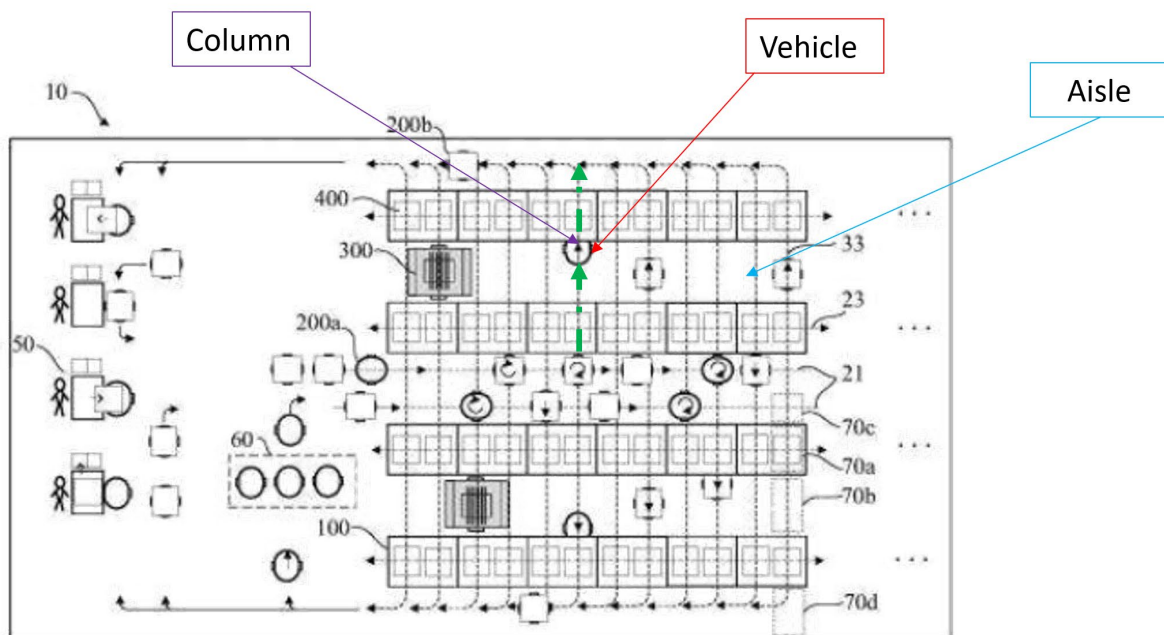


Figure 10

Given the embodiment illustrated in Figure 10 is “a general form of the previous three embodiments,” and provides additional pathways that may be

¹³ see n2 *supra*.

traveled along the warehouse floor, a POSITA would have understood that the additional pathways shown in Figure 10 allow for travel under the shelves and across aisles. (Ex. 1003, ¶484).

It would have been obvious to a POSITA to combine *Hangzhou*'s movement capabilities under racks and across multiple aisles with *Raizer*'s system to allow *Raizer*'s robots to move more directly to and from picking stations while also reducing congestion and making more efficient use of space. (Ex. 1003, ¶¶483, 485-486; *see also* Motivation to Combine *supra*).

Moreover, given *Raizer*'s three-dimensional movement capabilities and ability to turn "360 degrees about an axis vertical to the floor," it would have been obvious to a POSITA that *Raizer*'s robot would have the ability to turn under a storage shelf and then travel across an aisle as disclosed in *Hangzhou*, because, [a]s taught by *Hangzhou*, such functionality would allow the *Raizer* robot to "choose among all possible paths" thereby further reducing congestion, avoiding traffic jams, and making more efficient use of space. (Ex. 1006, ¶[0076]; Ex. 1003, ¶486; *see also* Motivation to Combine *supra*).

- x. ***[23.d]: driving the first vehicle vertically upwardly within the first aisle until the first vehicle is adjacent a first of the storage locations;***

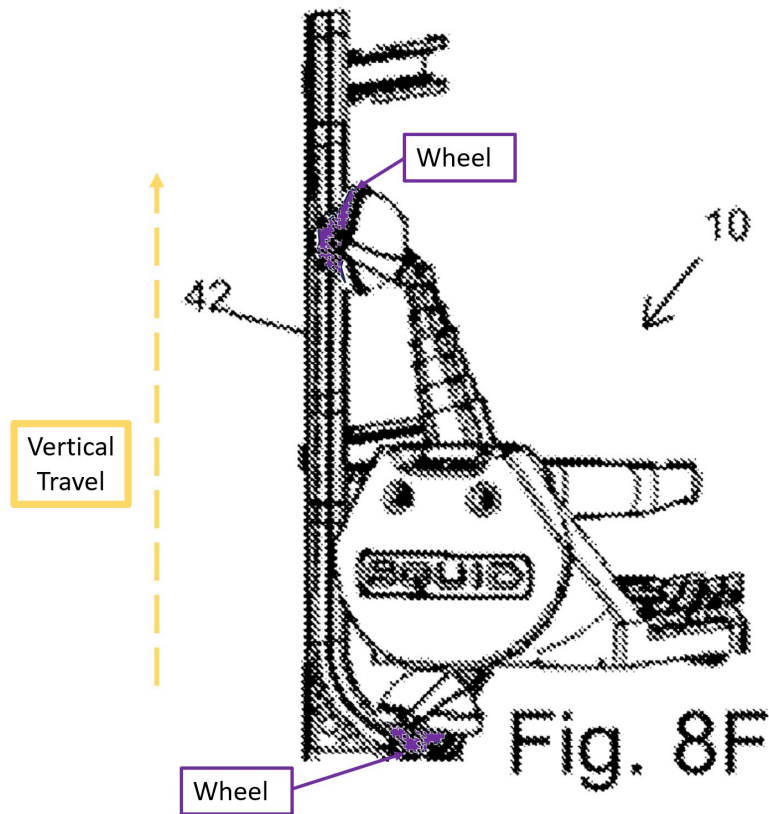
Raizer discloses [23.d]. (*see* [1.g] *supra*; Ex. 1003, ¶¶488-495).

Raizer discloses that, “[i]n order to complete its mission of removing a box from (or delivering a box to) a specific location on a shelf the robot travels vertically with both front wheels in the same vertical rail and travels horizontally with one of its front wheels in a horizontal rail that is attached to the shelf on which the box is located and the other front wheel in a horizontal rail that is attached to the shelf above the first shelf.” (Ex. 1005, ¶[0114]; Ex. 1003, ¶¶489-491).

Raizer discloses that the “robot [can] engage a vertical rail, to raise itself off the floor, and to move up and along the network of vertical and horizontal rails.” (Ex. 1005, ¶[0056]; Ex. 1003, ¶491). *Raizer* discloses that the robots can “navigate both along the ground and up and along the shelves,” (or vertically), “to the exact desired location.” (Ex. 1005, ¶[0078]; Ex. 1003, ¶491). Rails “allow for the vertical and horizontal movement capabilities of the robots along the shelving,” and “are mounted on or parallel to the vertical supports and shelves of the warehouse.” (Ex. 1005, ¶[0078]; Ex. 1003, ¶491). These vertical rails are engaged by the robots in the aisles between the shelves. (Ex. 1003, ¶491).

Raizer depicts a robot “leaving the floor of the warehouse and climbing a vertical rail attached to the shelving.” (Ex. 1005, ¶¶[0114-0121]; FIGs. 8A-8G; Ex. 1003, ¶493). *Raizer* discloses that a “robot travels vertically with both front wheels in the same vertical rail” while in the aisle (Ex. 1005, ¶[0114]; Ex. 1003, ¶¶492-493).

Ex. 1005, FIG. 8F (annotated)



Raizer discloses “the robot 10 is shown travelling along two adjacent horizontal rails towards its target location on the shelf.” (Ex. 1005, ¶[0129]; FIG. 11E; Ex. 1003, 494).

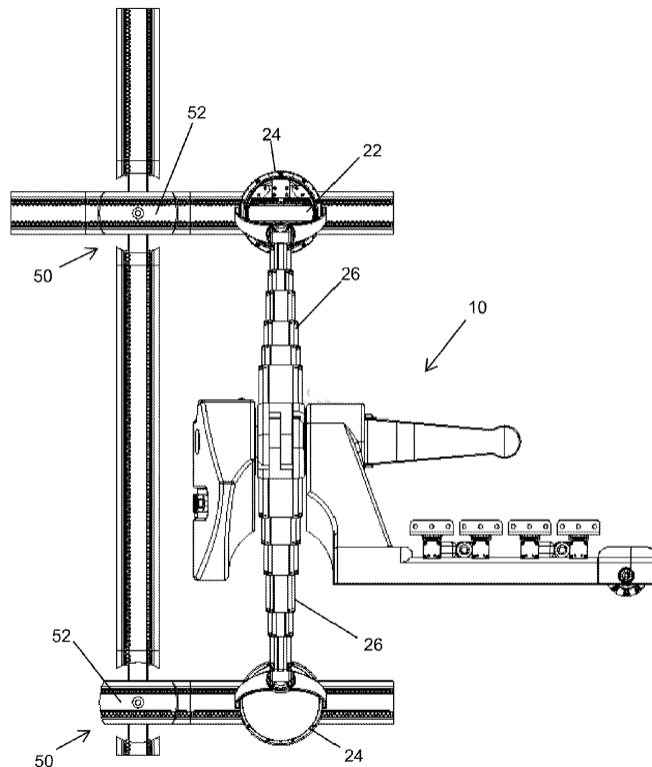
Ex. 1005, FIG. 11E

Fig. 11E

Raizer discloses driving the first vehicle vertically upwardly within the first aisle until the first vehicle is adjacent a first of the storage locations. (Ex. 1003, ¶495).

xi. [23.e]: transferring an item from the first storage location to the first vehicle;

Raizer discloses [23.e]. (see [1.h] *supra*; Ex. 1003, ¶¶496-500).

Raizer discloses that the robots comprise a “gripper mechanism” attached to the top side of its robot that is configured to pick up and place boxes of differing sizes. (see [1.b4], [1.h] *supra*; Ex. 1005, ¶¶[0027, 0031, 0101]; Ex. 1003, ¶497).

Raizer discloses that a combination of “independently changing the lengths and

angles of the two arm units 26 and the capability of activating the two drive and steering units 24 independently allows the robot, with the assistance of fine positioning sensor 34, to place a box on a shelf or remove it from any height or any orientation on the shelf.” (Ex. 1005, ¶[0133]; Ex. 1003, ¶¶498-499).

Ex. 1005, FIG. 14G

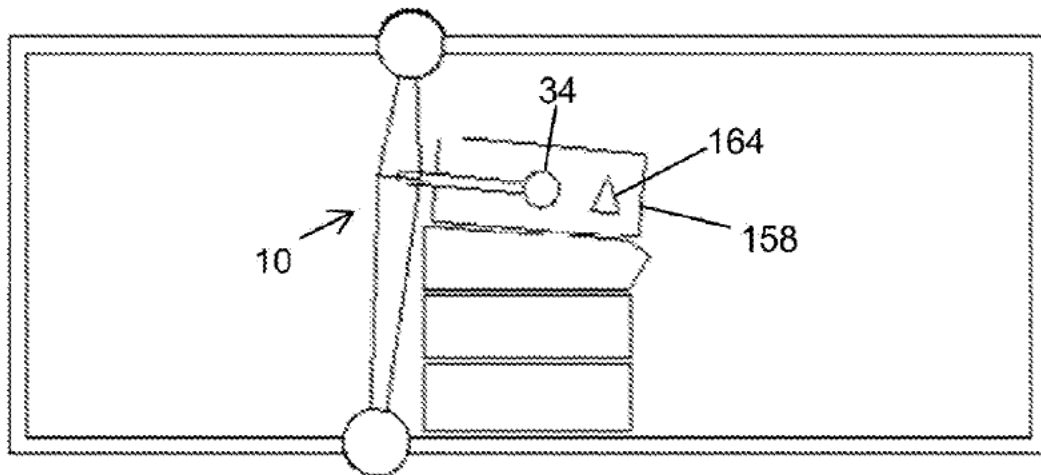


Fig. 14G

Raizer discloses transferring an item from the first storage location to the first vehicle. (Ex. 1003, ¶500).

xii. [23.f]: driving the first vehicle downwardly within the first aisle;

Raizer discloses [23.f]. (see [1.i] *supra*; Ex. 1003, ¶¶501-504).

Raizer discloses that the “robot [can] engage a vertical rail, to raise itself off the floor, and to move up and along the network of vertical and horizontal rails.” (Ex. 1005, ¶[0056]; Ex. 1003, ¶502).

Raizer discloses driving the first vehicle downwardly within the first aisle. (Ex. 1003, ¶¶503-504).

xiii. [23.g]: driving the vehicle out of the first aisle via a path that extends under at least one of the storage racks.

Raizer and *Hangzhou* render obvious [23.g]. (see [1.d1-d3] *supra*; Ex. 1003, ¶¶505-512).

Raizer discloses that the vehicles can travel in any direction and to various locations. (Ex. 1003, ¶¶505-508). Should *Raizer* be determined to not disclose driving the vehicle out of the first aisle via a path that extends under at least one of the storage racks, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶509).

Hangzhou discloses that an “auto-guided trolley 200 preferentially travels along column laneways 33 and in auto-guided trolley passage spaces 112.” (Ex. 1006, ¶[0048]; Ex. 1003, ¶510). *Hangzhou* depicts a trolley (which has been designated “vehicle” in the annotated Figure 10¹⁴), that had driven into a column, and then proceeds along a path that extends under another storage rack. (Ex. 1003, ¶510).

¹⁴ see n2 *supra*.

Ex. 1006, Figure 10 (annotated)

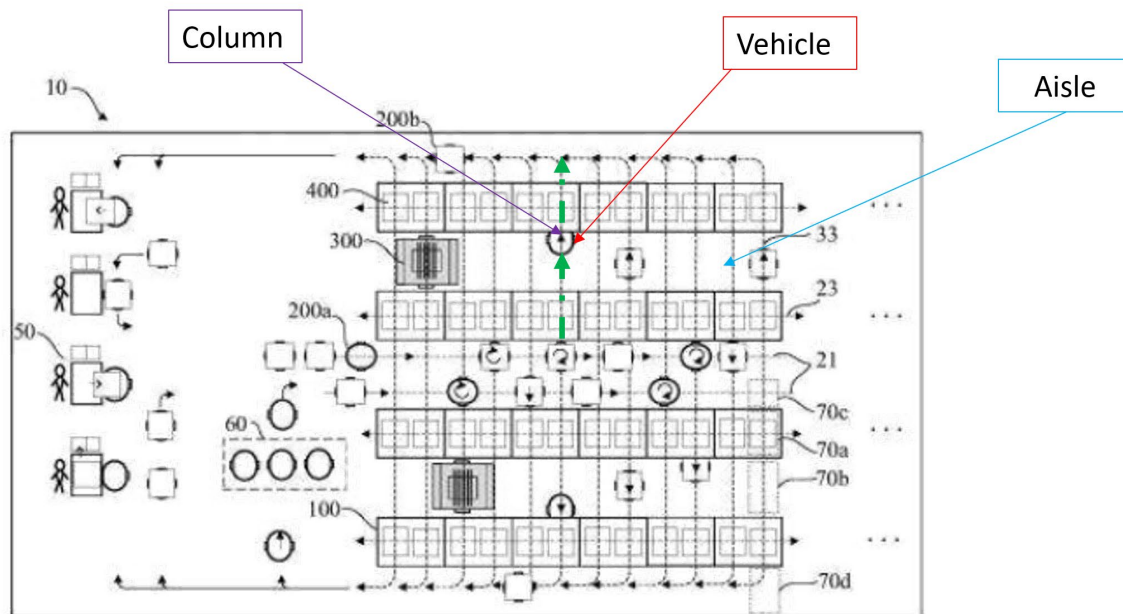


Figure 10

Given *Hangzhou's* disclosure of trolleys “carrying standardized containers” “in row and column directions” underneath the shelving units and across multiple aisles (Ex. 1006, ¶[0050]; Figure 10), it would have been obvious to a POSITA to combine *Hangzhou's* movement capabilities underneath the shelves and across multiple aisles with *Raizer's* system to allow *Raizer's* robots to move more directly to and from picking stations while also reducing congestion and more efficiently using warehouse space. (Ex. 1003, ¶511; *see also* Motivation to Combine *supra*).

15. Claim 24

- i. [24.pre-24.a]: The method of claim 23 wherein the path includes a portion passing under one of the racks and extending parallel to one of the aisles.**

Raizer and Hangzhou render obvious [24.pre] and [24.a]. (see [23.a-23.g], [1.d1-d3], [10.pre-10.a] *supra*; Ex. 1003, ¶¶513-521).

16. Claim 25

- i. [25.pre-25.a]: The method of claim 24 comprising the step of driving a second of the vehicles past the first vehicle under the one rack as the first vehicle is driven along the portion of the path under the one of the racks.**

Raizer and Hangzhou render obvious [25.pre] and [25.a]. (see [24.pre-a]), [10.a] *supra*; Ex. 1003, ¶¶522-528).

17. Claim 26

- i. [26.pre-26.a]: comprising the step of turning the vehicle while the vehicle is under one of the racks,**

Raizer and Hangzhou render obvious [26.pre] and [26.a]. (see [23.a-g], [1.e] *supra*; Ex. 1003, ¶¶529-541).

- ii. [26.b]: wherein the step of turning comprises turning the vehicle to align the vehicle with a path perpendicular to the first aisle.**

Raizer and Hangzhou render obvious [26.b]. (Ex. 1003, ¶¶542-547). *Raizer* discloses turning a vehicle. (Ex. 1003, ¶542).

Should *Raizer* be determined to not disclose turning the vehicle to align the vehicle with a path perpendicular to the first aisle, a POSITA would have looked to *Hangzhou*. (Ex. 1003, ¶543).

Hangzhou discloses “an auto-guided trolley 200” that may switch between the row direction and the column direction,” where “[s]witching the driving direction does not bring a problem to auto-guided trolleys because auto-guided trolleys 200 can be small enough to turn in the auto-guided trolley passage space 112.” (Ex. 1006, ¶[0072]; Ex. 1003, ¶544).

Hangzhou discloses “where the dotted lines intersect, an auto-guided trolley 200 may switch between the row direction and the column direction,” or turn. (Ex. 1006, ¶¶[0068-0072], Figure 10¹⁵; Ex. 1003, ¶545).

¹⁵ *see n2 supra*.

Ex. 1006, Figure 10 (annotated)

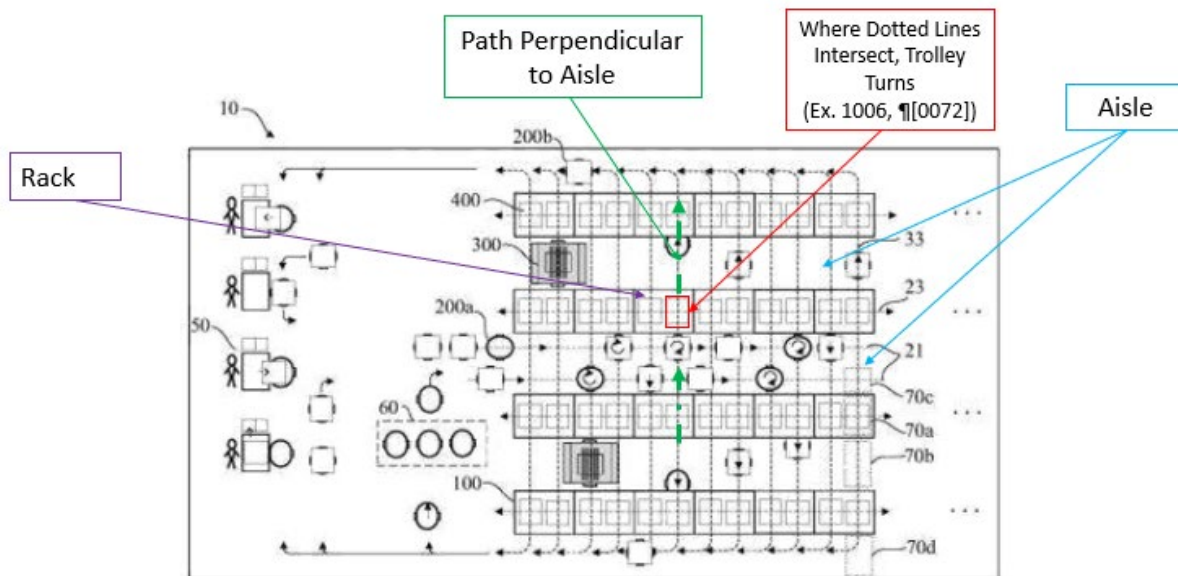


Figure 10

Hangzhou discloses that an “auto-guided trolley 200 carrying standardized containers 400 switches between the row and column directions along the traveling direction by” “turning 90° in place.” (Ex. 1006, ¶[0073]; Ex. 1003, ¶[546]). *Hangzhou* teaches turning the trolley to align the trolley with a path perpendicular to the aisle. (Ex. 1003, ¶[546]).

A POSITA would have been motivated to combine the teachings of *Hangzhou* with those of *Raizer*. (Ex. 1003, ¶[546]; *see also* Motivation to Combine *supra*).

18. Claim 27

- i. [27.pre-27.a]: The method of claim 26 wherein the step of turning the vehicle comprises rotating the vehicle about a vertical axis passing through the vehicle.**

Raizer and Hangzhou render obvious [27.pre] and [27.a]. (see [26.pre]-[26.a], [8.a] *supra*; Ex. 1003, ¶¶548-552).

VIII. PRIOR ART NOT PREVIOUSLY PRESENTED TO THE OFFICE

The Board should not deny institution under §325(d). *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 7 (PTAB Feb. 13, 2020) (precedential).

The Board has held that the first prong of *Advanced Bionics* is not met where “neither [the combination references] nor similar prior art was before the examiner... the prosecution history does not include any overlapping arguments directed to this prior art.” *Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.* No. IPR2021-00050, Paper 24 (P.T.A.B. May 7, 2021), at 19–21. And in such a case, the Board “need not address part two of the analysis.” *Id.* at 21.

Neither *Raizer* nor *Hangzhou* was cited during prosecution and is not cumulative of the art considered by the Examiner during prosecution.

IX. CONCLUSION

Petitioners request cancellation of the Challenged Claims.

X. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest Under 37 C.F.R. §42.8(b)(1)

The real parties-in-interest are Petitioners Exotec Product France SAS, Exotec North America Inc., and Exotec Product USA Inc.

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

Petitioners are not aware of any related matters.

C. Designation of Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioners provide the following designation of counsel.

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	Vantage South End 1120 South Tryon Street, Suite 300 Charlotte, NC 28203-6818 Phone: 704.444.1000 Fax: 704.444.1111 Email: Christopher.Douglas@alston.com
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Pursuant to 37 C.F.R §42.10(b), a Power of Attorney is being submitted with this Petition.

D. Service Information

Please address all correspondence and service to the address listed above.
Petitioners consent to electronic service directed to Exotec-632IPR@alston.com.

Date: May 2, 2024

By: /John D. Haynes/
John D. Haynes
Reg. No. 44,754

CLAIMS APPENDIX

<u>Claim</u>	<u>Recitation</u>
1.pre	A method for delivering items to storage locations and retrieving items from storage locations, comprising the steps of:
1.a1	providing a plurality of storage racks spaced apart from one another forming a plurality of aisles,
1.a2	wherein each storage rack comprises a plurality of columns and each column comprises a plurality of storage locations;
1.b1	providing a plurality of delivery vehicles
1.b2	wherein each vehicle comprises a horizontal drive system operable to drive the vehicle along a horizontal surface,
1.b3	a vertical drive operable to drive the vehicle vertically and
1.b4	a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations;
1.c	driving a first one of the vehicles to drive the first vehicle to the storage racks;
1.d1	driving the first vehicle along a first path under a first one of the racks
1.d2	wherein the first rack is adjacent a first one of the aisles and
1.d3	wherein the first path extends in a direction parallel to the first aisle and spaced apart from the first aisle;
1.e	turning the first vehicle while the first vehicle is under the first rack;
1.f	driving the vehicle into the first aisle;
1.g	driving the first vehicle upwardly in the aisle to a first of the storage locations;

<u>Claim</u>	<u>Recitation</u>
1.h	transferring an item between the first vehicle and the first storage location;
1.i	driving the first vehicle downwardly in the aisle until the vehicle is on a horizontal surface;
1.j	driving the first vehicle across the first aisle after the step of driving the first vehicle downwardly; and
1.k	driving the vehicle out from under the storage racks after the step of driving the first vehicle across the first aisle.
3.pre	The method of claim 1,
3.a	wherein a plurality of vertical tracks segments are attached to vertical posts of the first column and
3.b	wherein the step of driving the first vehicle into the first aisle comprises aligning the vertical drive of the first vehicle with the vertical track segments.
4.pre	The method of claim 3,
4.a	wherein the step of driving the first vehicle into the aisle comprises driving a first portion of the vertical drive through the vertical track segment and
4.b	driving a second part of the vertical drive into operative engagement with the vertical track segment.
5.pre	The method of claim 1
5.a	wherein the first storage rack is formed of a plurality of vertical posts and
5.b	the first vehicle has a length and a width and the length is greater than the width and
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 the half the length of the vehicle.

<u>Claim</u>	<u>Recitation</u>
6.pre	The method of claim 1 comprising
6.a	the step of driving the first vehicle to a workstation to present an item to an operator after the step of driving the first vehicle out from under the storage racks.
7.pre	The method of claim 1,
7.a	wherein the step of driving the first vehicle across the aisle comprises driving the first vehicle under a second of the storage racks.
8.pre	The method of claim 1,
8.a	wherein the step of turning comprises rotating the first vehicle about a vertical axis that extends through the first vehicle.
9.pre	The method of claim 8
9.a	wherein the vertical axis extends through the first path.
10.pre	The method of claim 1 comprising
10.a	the step of driving a second of the vehicles under the first rack along a second path parallel to the first path so that the second vehicle passes the first vehicle as the first vehicle travels along the first path.
11.pre	A material handling system for delivering items to storage locations and retrieving items from storage locations, comprising:
11.a1	a first storage rack having a plurality of columns each of which comprises a plurality of storage locations
11.a2	wherein the first storage rack is longitudinally elongated;
11.b1	a second storage rack having a plurality of columns each of which comprises a plurality of storage locations
11.b2	wherein the second storage rack is longitudinally elongated,

<u>Claim</u>	<u>Recitation</u>
11.b3	wherein the second storage rack is spaced apart from the first storage rack to provide an aisle between the first and second storage racks;
11.c1	a plurality of delivery vehicles
11.c2	wherein each vehicle has a length and a width and
11.c3	each vehicle comprises: a horizontal drive system operable to drive the vehicle along a horizontal surface;
11.c4	a vertical drive operable to drive the vehicle vertically;
11.c5	and a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations;
11.d	a track positioned in the aisle wherein the vertical drive is configured to cooperate with the track to drive the vehicle vertically upwardly;
11.e	a first horizontal path that extends under the first rack in a direction parallel to the aisle;
11.f	a second horizontal path that extends under the first rack in a direction parallel to the aisle;
11.g	wherein the horizontal drive is configured to turn the vehicle under the first rack by rotating the vehicle about a vertical axis that extends through the vehicle;
11.h1	wherein the storage rack comprises a plurality of vertical posts and
11.h2	the first and second horizontal paths are each spaced apart from the vertical posts a distance greater than one half the length of the vehicles;
11.i	wherein the first horizontal path under the first rack is spaced apart from the second horizontal path a distance greater than the width of the vehicles.
12.pre	The system of claim 11
12.a	wherein the vertical drive comprises a plurality of rotatable elements that each rotate about a horizontal axis and

<u>Claim</u>	<u>Recitation</u>
12.b	wherein the horizontal drive comprises a plurality of rotatable elements that each rotate about a horizontal axis transverse the axes of rotation of the vertical drive elements.
14.pre	The system of claim 11
14.a	wherein the track comprises drive elements configured to cooperate with the vertical drive so that rotating the vertical drive about a horizontal axis operates to drive the vehicle upwardly along the track.
23.pre	A method for delivering items to storage locations and retrieving items from storage locations, comprising the steps of:
23.a1	providing a plurality of storage racks spaced apart from one another forming a plurality of aisles,
23.a2	wherein each storage rack comprises a plurality of columns and each column comprises a plurality of storage locations;
23.b1	providing a plurality of delivery vehicles
23.b2	wherein each vehicle comprises a horizontal drive system operable to drive the vehicle along a horizontal surface,
23.b3	a vertical drive operable to drive the vehicle vertically and
23.b4	a transfer mechanism operable to transfer an item between the vehicle and one of the storage locations;
23.c1	driving a first of the vehicles under one or more of the storage racks along a path that crosses one or more aisle,
23.c2	wherein the step of driving the first vehicle includes driving the first vehicle into a first of the columns in a first of the aisles;
23.d	driving the first vehicle vertically upwardly within the first aisle until the first vehicle is adjacent a first of the storage locations;
23.e	transferring an item from the first storage location to the first vehicle;
23.f	driving the first vehicle downwardly within the first aisle;

<u>Claim</u>	<u>Recitation</u>
23.g	driving the vehicle out of the first aisle via a path that extends under at least one of the storage racks.
24.pre	The method of claim 23
24.a	wherein the path includes a portion passing under one of the racks and extending parallel to one of the aisles.
25.pre	The method of claim 24 comprising
25.a	the step of driving a second of the vehicles past the first vehicle under the one rack as the first vehicle is driven along the portion of the path under the one of the racks.
26.pre	The method of claim 23
26.a	comprising the step of turning the vehicle while the vehicle is under one of the racks,
26.b	wherein the step of turning comprises turning the vehicle to align the vehicle with a path perpendicular to the first aisle.
27.pre	The method of claim 26
27.a	wherein the step of turning the vehicle comprises rotating the vehicle about a vertical axis passing through the vehicle.

CERTIFICATION UNDER 37 C.F.R. §42.24

Under the provisions of 37 CFR §42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *inter partes* review totals 13,610 words (Sections I-IX), which is less than the 14,000 allowed under 37 CFR §42.24(a)(i).

Date: May 2, 2024

By: /John D. Haynes/
John D. Haynes

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e), 42.105, the undersigned hereby certifies that true and correct copies of the above-captioned PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 11,472,632, all associated exhibits, and Petitioners' Powers of Attorney were served in their entirety on May 2, 2024, upon the following parties via UPS Next Day Air®:

156121 - Opex Corporation
305 Commerce Dr
Moorestown, NJ 08057
UNITED STATES

Service copies are also being sent via email and FTP to:

Brian Dinicola (Reg. No. 36,122)
bdinicola@opex.com

Stephen Eland (Reg. No. 41,010)
seland@opex.com

Opex Corporation
info@opex.com

Petitioners believe these to be additional addresses likely to effect service under 37 C.F.R. § 42.105.

Date: May 2, 2024

By: /John D. Haynes/
John D. Haynes