

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

OCADO GROUP PLC,
Petitioner,

v.

AUTOSTORE TECHNOLOGY AS,
Patent Owner.

IPR2021-00311
Patent 10,474,140 B2

Before MIRIAM L. QUINN, FRANCES L. IPPOLITO, and
ALYSSA A. FINAMORE, *Administrative Patent Judges*.

FINAMORE, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Ocado Group PLC (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–4 and 11–15 of U.S. Patent No. 10,474,140 B2 (“the ’140 patent”) (Ex. 1001). Pet. 1. We issued a Decision (Paper 11, “Inst. Dec.”) granting institution of an *inter partes* review.

During trial, AutoStore (“Patent Owner”) filed a Response (Paper 23, “PO Resp.”). Petitioner filed a Reply (Paper 27, “Reply”), and Patent Owner filed a Sur-reply (Paper 29, “Sur-reply”). Oral argument took place March 28, 2022, and the record includes the transcript (Paper 36, “Tr.”).

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we conclude Petitioner has not proven by a preponderance of the evidence that claims 1–4 and 11–15 are unpatentable.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself as the real party in interest. Pet. 1. Patent Owner identifies the real parties in interest as AutoStore Technology AS, AutoStore System Inc., and AutoStore AS. Paper 5, 2; Paper 22, 2.

B. *Related Matters*

The parties identify the following as related matters: *AutoStore Technology AS v. Ocado Group PLC*, No. 2:20-cv-00494 (E.D. Va. filed Oct. 1, 2020) and *In the Matter of Certain Automated Storage and Retrieval Systems, Robots, and Components Thereof*, Inv. No. 337-TA-1228 (filed Oct. 1, 2020). Pet. 1–2; Paper 5, 2.

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Petitioner identifies as a related matter the following Board proceeding between Petitioner and Patent Owner: IPR2021-00274 (challenging U.S. Patent No. 10,294,025 B2). Pet. 2. Petitioner and Patent Owner also were involved in the following Board proceedings: IPR2021-00398 (challenging U.S. Patent No. 10,093,525 B2), IPR2021-00412 (challenging U.S. Patent No. 10,494,239 B2), and PGR2021-00038 (challenging U.S. Patent No. 10,696,478 B2).

C. The '140 Patent

The '140 patent, titled “Robot for Transporting Storage Bins,” issued on November 12, 2019, from a PCT application filed January 14, 2016. Ex. 1001, codes (22), (45), (54). The '140 patent claims priority to a foreign application filed January 28, 2015. *Id.* at code (30).

The '140 patent is directed to a remotely operated vehicle, or robot, for picking up storage bins from a storage system and a system for storing bins. *Id.* at 1:6–9. The robot is configured to move in X and Y directions on supporting rails of the storage system to receive a storage bin from a storage column within a bin storing grid. *Id.* at 1:32–36, 4:38–52.

A robot is shown in Figure 3, reproduced below.

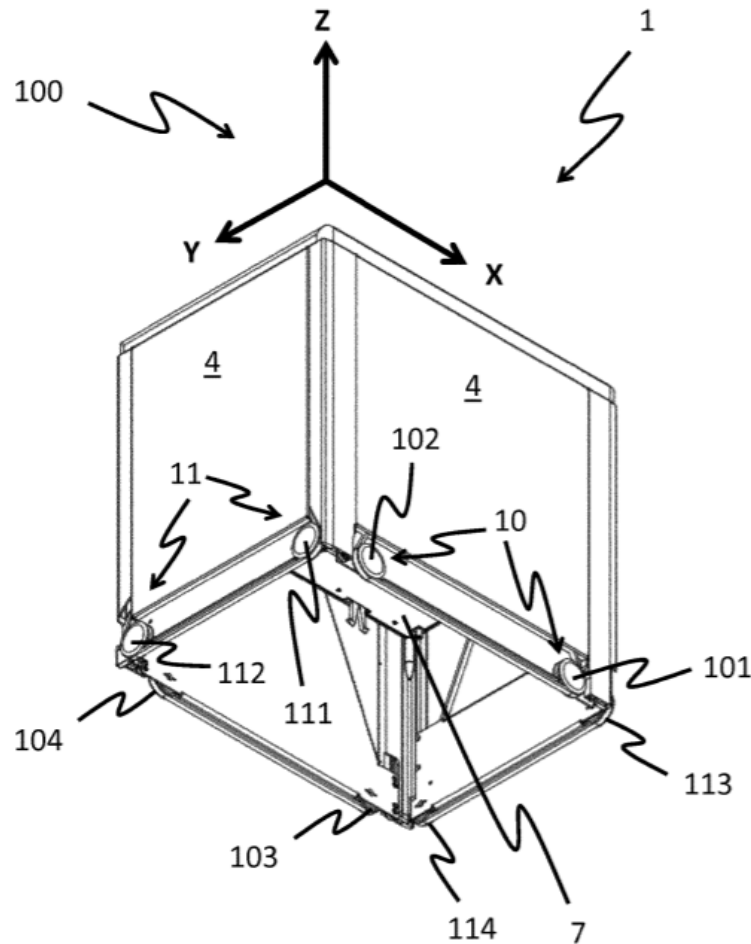


FIG. 3

Figure 3 is a perspective view of a robot seen from below. *Id.* at 4:4–5. As shown in Figure 3, robot 1 comprises body 4 that defines a cavity centrally arranged therein for receiving a storage bin. *Id.* at 4:39–41, 49–52. Lifting device 7 picks up a storage bin and retracts to the top of the cavity. *Id.* at 4:52–54. On the exterior walls of body 4, robot 1 includes first vehicle rolling means 10 and second vehicle rolling means 11. *Id.* at 4:39–49. First

vehicle rolling means 10 includes wheels 101, 102 and opposing wheels 103, 104 for movement in the X direction on supporting rails of the storage system. *Id.* at 4:41–44, Fig. 3. Second vehicle rolling means 11 includes wheels 111, 112 and opposing wheels 113, 114 for movement in the Y direction on supporting rails of the storage system. *Id.* at 4:44–47, Fig. 3. Robot 1 further includes a first driving means at or at least partly within the first vehicle rolling means, a second driving means at or at least partly within the second vehicle rolling means, and motor control electronics arranged within the volume between two of the wheels of each rolling set. *Id.* at 2:9–19.

A wheel and a rolling set are shown in Figures 8A–B and 9B, reproduced below.

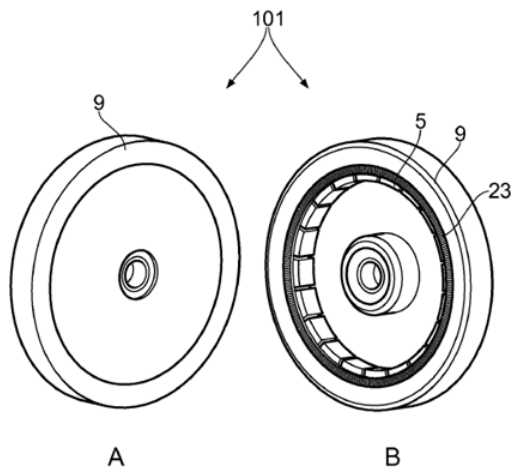


FIG. 8

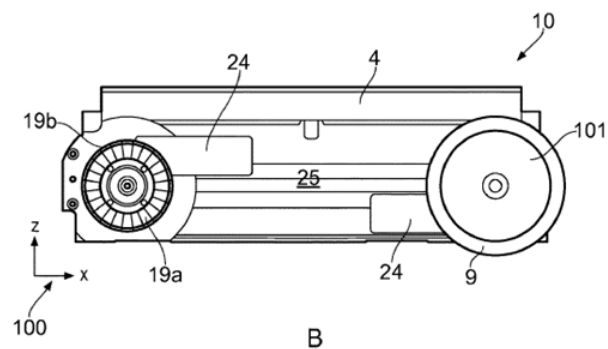


FIG. 9

Figures 8A–B are perspective views of a wheel, and Figure 9B is a cross-sectional view of a rolling set with one wheel removed. *Id.* at 4:19–25. Wheel 101 includes rotor 5 arranged inside the circumference set up by rotary encoder 23 so as to be closer to the rotational axis of

wheel 101. *Id.* at 5:16–19. Corresponding stator 19 includes electrical windings 19a wrapped around yokes 19b. *Id.* at 5:20–21. Means for measuring acceleration 24 is connected in signal communication with stator 19 of each wheel, for example by use of piezoelectric sensors. *Id.* at 5:26–29.

D. Challenged Claims

Petitioner challenges claims 1–4 and 11–15 of the '140 patent. Pet. 1. Claims 1 and 15 are independent. *Id.* at 6:25–55, 6:22–29. Independent claim 1, reproduced below with Petitioner's labels for the limitations, is illustrative of the claimed subject matter.

1. [1(preamble)] A remotely operated vehicle for picking up storage bins from an underlying storage system, comprising:
 - [1(a)] a vehicle lifting device for lifting the storage bin from the underlying storage system,
 - [1(b)] a first vehicle rolling means comprising a first rolling set and a second rolling set arranged at opposite facing side walls of a vehicle body, allowing movement of the vehicle along a first direction on the underlying storage system during use, and
 - [1(c)] a second vehicle rolling means comprising a first rolling set and a second rolling set arranged at opposite facing walls of the vehicle body, allowing movement of the vehicle along a second direction on the underlying storage system during use, the second direction being perpendicular to the first direction,
 - [1(d)] wherein each of said rolling sets comprises at least two wheels,
 - [1(e)] wherein the vehicle further comprises:
 - [1(f)] a first driving means situated at or at least partly within the first vehicle rolling means

for providing rolling set specific driving force to the vehicle in the first direction,

[1(g)] a second driving means situated at or at least partly within the second vehicle rolling means for providing rolling set specific driving force to the vehicle in the second direction and

[1(h)] motor control electronics arranged within the volume between two of the wheels of each rolling set, which motor control electronics are configured to supply electric power to the first and second vehicle rolling means.

Id. at 6:25–55. Claims 2–4 and 11–14 depend from independent claim 1.

Id. at 6:56–67, 8:1–21. Independent claim 15 recites a storage system comprising a bin storage structure and a remotely operated vehicle in accordance with independent claim 1 and, thus, incorporates all of the limitations of independent claim 1. *Id.* at 8:22–29.

E. Asserted Grounds and Evidence

Petitioner asserts that claims 1–4 and 11–15 are unpatentable on the following four grounds (Pet. 7–8):

Claims Challenged	35 U.S.C. § ¹	Reference(s)/Basis
1, 11, 15	103 ²	WO/055 ³
1, 11, 15	103	WO/055, EP/052 ⁴
1–4, 11–15	103	WO/055, EP/052, Christensen ⁵
1–4, 11–15	103	WO/055, EP/052, Farag ⁶

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended certain sections of this statute, including §§ 102 and 103, and the effective date of the relevant amendment is March 16, 2013. The earliest claimed priority date of the ’140 patent, January 28, 2015 (Ex. 1001, code (30)), is after the effective date of the AIA amendment, and there is no dispute that the ’140 patent is subject to the AIA version of the statute.

² In the Petition, Petitioner argues “WO/055 anticipates or otherwise renders obvious . . . each of claims 1, 11, and 15.” Pet. 7. Subsequently, in the Reply, with respect to limitation 1(g), Petitioner avers it “no longer asserts that WO/055 anticipates this limitation.” Reply 9, n.3. Accordingly, Petitioner has withdrawn its argument that WO/055 anticipates claims 1, 11, and 15 and limited this asserted ground to only obviousness.

³ Lindbo et al., WO 2015/019055 A1, published Feb. 12, 2015 (“WO/055”) (Ex. 1003).

⁴ Mäkinen et al., EP 2 479 052 A1, published July 25, 2012 (“EP/052”) (Ex. 1004).

⁵ Lowell Christensen, *Designing In-Hub Brushless Motors*, Machine Design (July 22, 2014), <http://machinedesign.com/motorsdrives/designing-hub-brushless-motors> [<https://web.archive.org/web/20140809193947/http://machinedesign.com/motorsdrives/designing-hub-brushless-motors>] (“Christensen”) (Ex. 1005).

⁶ Mohamed Farag, *In-Wheel Brushless DC Outer Rotor (Hub) Motor Used in Electrically Driven Vehicles* (June 19, 2013), <https://contest.techbriefs.com/2013/entries/transportation-and-automotive/3517> (“Farag”) (Ex. 1006).

To support its asserted grounds of unpatentability, Petitioner submits Declarations of Brian Pfeifer, Ph.D., P.E. (Ex. 1015; Ex. 1036). Patent Owner deposed and cross-examined Dr. Pfeifer and submits transcripts of Dr. Pfeifer's depositions (Ex. 2023; Ex. 2027).

Patent Owner relies on a Declaration of Jason Janét, Ph.D. (Ex. 2021). Petitioner deposed and cross-examined Dr. Janét and submits a transcript of Dr. Janét's deposition (Ex. 1040).

F. Asserted References

Petitioner's asserted grounds of unpatentability are based on WO/055, EP/052, Christensen, and Farag. We summarize these references in turn below.

1. WO/055

WO/055 relates to robotic devices for handling storage containers in a storage system comprising a grid of stacked units. Ex. 1003, 1:5–7. WO/055's robotic device is depicted in Figure 5, reproduced below.

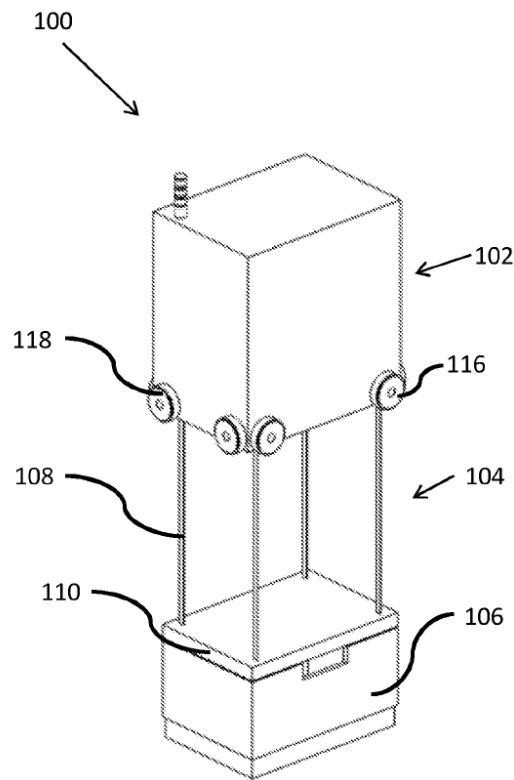


Figure 5

Figure 5 is a schematic perspective view of a load handling device. *Id.* at 10:13. Load handling device 100 comprises vehicle 102 equipped a winch or crane mechanism 104 to lift storage container or bin 106 from a stack of containers in the storage system into recess 120. *Id.* at 11:7–10, 23–24. Vehicle 102 also includes two sets of wheels 116, 118, which run on rails on the top of the frame of the storage system to enable movement of vehicle 102 in the X and Y directions, respectively, along the rails. *Id.* at 11:16–18, Fig. 2.

In one embodiment, each wheel has a motor integrated within a hub of the wheel. *Id.* at 14:27–28. This embodiment is shown in Figure 17, reproduced below.

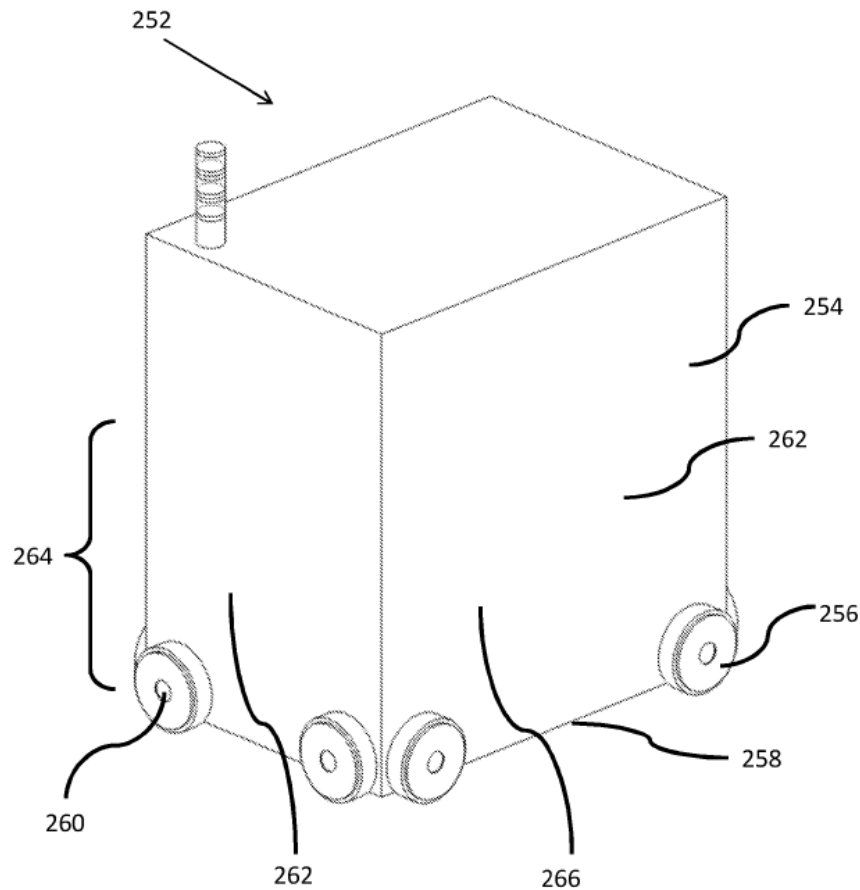


Figure 17

Figure 17 is a perspective view of a load handling device according to an embodiment of the invention. *Id.* at 11:1. In this embodiment, load handling device 252 includes a plurality of wheels 256 mounted near lower edge 258 of housing 254. *Id.* at 14:25–25. Wheels 256 are motorized hub wheels, with each wheel 256 having a motor integrated within hub 260 to drive the respective wheel directly, thereby eliminating any need for drive belts connected between the wheels and drive motors. *Id.* at 14:26–29. The motors are powered by batteries located within side walls 262 of lower part 264 of housing 254, adjacent to container-receiving space 266 of load handling device 252. *Id.* at 14:31–32. “Locating the batteries low down in

this way has the advantageous effect of lowering the centre of gravity of the device 252, thereby increasing its stability and allowing higher acceleration and deceleration.” *Id.* at 14:32–34.

2. EP/052

EP/052 relates to a working machine such as a tractor. Ex. 1004, 1:3–5, 9–10, Fig. 1. EP/052’s working machine is depicted in Figure 1, reproduced below.

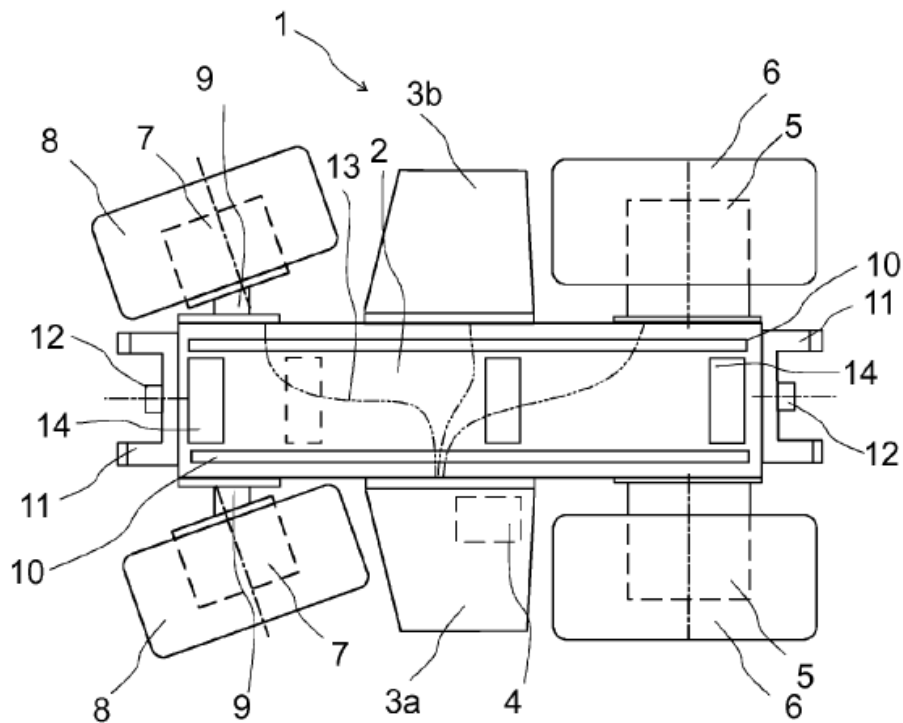


Fig.1

Figure 1 shows a working machine, as well as its parts in a top view. *Id.* at 6:21–22. As shown in Figure 1, drive unit 1 comprises frame 2 to which other modules and necessary parts can be connected. *Id.* at 6:38–40. Frame 2 includes two wheel modules connected to one of its ends, and each

of these wheel modules is made up of wheel 6 and electric hub motor 5. *Id.* at 6:41–44. Frame 2 also includes two wheel modules connected to its other, opposite end, and each of these wheel modules is made up of wheel 8 and electric hub motor 7. *Id.* at 6:53–56. At least one device that produces electric energy is placed in unit 3a between wheels 6 and 8. *Id.* at 8:53–56. Another device producing electric energy can be placed in unit 3b, which is located opposite unit 3a and between wheels 6 and 8. *Id.* at 9:3–7. Control device 4 for controlling the function of drive unit 1 and the modules can be placed in frame 2, unit 3a, or unit 3b. *Id.* at 9:52–57.

3. *Christensen*

Christensen relates to electric motors formatted to fit inside the wheel of a vehicle. Ex. 1005, 1. The in-hub motors “are direct-drive motors with no gearbox.” *Id.* In one embodiment, the motor magnets are bonded to the rotor, and the rotor sits outside the stator and rotates around it. *Id.* at 3. In this embodiment, the rotor is “formed as the tire rim and the tire will directly mount to the motor rotor.” *Id.*

4. *Farag*

Farag relates to a “full mechanical, magnetic and electrical design of an in-wheel brushless DC outer rotor (hub) motor.” Ex. 1006, 1. “As all motors, the rotary motion is developed via the magnetic interaction of the magnetic fields in the rotor (rotating part) and the stator (stationary part).” *Id.* at 2. Farag discloses that its “motor design could be used on any electric locomotive vehicle.” *Id.*

III. ANALYSIS

A. *Principles of Law*

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the claimed subject matter as a whole would have been obvious at the pertinent time to a person having ordinary skill in the art to which the claimed subject matter pertains. The question of obviousness under 35 U.S.C. § 103 is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

An obviousness analysis must include a reason, based upon rational underpinnings, why a person of ordinary skill would have been motivated to modify the prior art to achieve the claimed invention. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (“To satisfy its burden of proving obviousness, a petitioner . . . must . . . articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007))). The requirement of a reason to combine is a safeguard against hindsight bias, which is characterized by the “temptation to read into the prior art the teachings of the invention in issue.” *KSR*, 550 U.S. at 421 (quoting *Graham*, 383 U.S. at 36).

⁷ In this proceeding, neither party has presented evidence or argument directed to secondary considerations.

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). The prior art may reflect the level of ordinary skill in the art. *Id.*

Petitioner contends a person of ordinary skill in the art (“POSITA”) would have had “at least a bachelor’s degree in mechanical engineering, and at least two to three years of experience working in the field of the design of robotic vehicles for material handling systems.” Pet. 15 (quoting Ex. 1015 ¶ 71). “Patent Owner does not dispute Petitioner’s proposed level of ordinary skill in the art.” PO Resp. 3.

In this Final Written Decision, we adopt Petitioner’s definition of the level of ordinary skill in the art. We find, on the complete trial record, that this definition is consistent with the level of ordinary skill reflected in the asserted references and the ’140 patent.

C. Claim Construction

We interpret a claim “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) (2019). Under this standard, we construe the claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.* Furthermore, we expressly construe the claims to the extent necessary to determine whether Petitioner has proven that the challenged claims are unpatentable. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017)

(“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner proposes constructions for the following six claim terms of independent claim 1: “vehicle,”⁸ “rolling means,” “driving means,” “rolling set specific driving force,” “motor control electronics,” and “arranged within the volume between two of the wheels.” Pet. 16–24. Petitioner also proposes a construction for the following limitation of claim 14: “wherein the stator field windings are following the outer periphery of the wheels.” *Id.* at 24.

Patent Owner argues the claim term “vehicle” and the limitation of claim 14 reciting “wherein the stator field windings are following the outer periphery of the wheels” do not need to be expressly construed to resolve the issues in this *inter partes* review. PO Resp. 4, 10. Moreover, Patent Owner agrees with Petitioner’s constructions for the claim terms “rolling means” and “arranged within the volume between two of the wheels,” and Patent Owner does not substantively dispute Petitioner’s construction for “driving means.” *Id.* at 4–5, 10.

Patent Owner, however, disputes Petitioner’s constructions for the claim terms “rolling set specific driving force” and “motor control electronics.” *Id.* at 6–10. Patent Owner argues that Petitioner’s construction of “rolling set specific driving force” contradicts the ITC’s construction of this term in a related proceeding (*id.* at 7–9) and that Petitioner’s construction of “motor control electronics” differs from the construction to

⁸ The parties refer to this claim term as the “single-spaced robot limitation.” Pet. 16; PO Resp. 3.

which Petitioner agreed in the related ITC proceeding (*id.* at 9–10). Patent Owner further argues that the Board should adopt the constructions of these claims terms from the related ITC proceeding. *Id.*

In its Reply, Petitioner acknowledges Patent Owner’s proposed constructions for the claim terms “rolling set specific driving force” and “motor control electronics” are the constructions the parties assumed in the related ITC proceeding. Reply 1. Petitioner agrees to adopt to Patent Owner’s constructions for these claim terms. *Id.*

In view of the issues in this *inter partes* review and the parties’ acquiesces to certain constructions, the parties acknowledge there are no claim construction issues. *See* Tr. 8:25–9:1 (Petitioner contending “[t]here are, I believe, no additional or remaining claim construction issues”), 34:6–8 (Patent Owner asserting “[a]s acknowledged by the Petitioner, there are no claim construction issues which need to be resolved by this Panel”). We similarly determine that no claim term requires an express construction for us to ascertain whether Petitioner has shown the challenged claims to be unpatentable.

D. Obviousness Based on WO/055⁹

In its Petition, Petitioner challenges claims 1, 11, and 15 under 35 U.S.C. § 103, contending the claimed subject matter would have been obvious over WO/055. Pet. 25–41; Reply 2–12. Patent Owner argues WO/055 does not render obvious the claimed subject matter. PO Resp. 11–31; Sur-reply 1–11. For the reasons below, we determine that

⁹ *See supra* n.2.

Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 1, 11, and 15, which includes motor control electronics arranged within the volume between two of the wheels of each rolling set as recited in limitation 1(g), would have been obvious over WO/055.

1. Independent Claim 1

Independent claim 1 recites, in pertinent part, “motor control electronics arranged within the volume between two of the wheels of each rolling set, which motor control electronics are configured to supply electric power to the first and second vehicle rolling means,” i.e., limitation 1(g). Ex. 1001, 6:51–55 (emphasis added). The parties agree that the claim term “motor control electronics” recited in limitation 1(g) means “electronics that control a motor.” PO Resp. 9; Reply 1. The parties also agree that the claim term “arranged within the volume between two of the wheels” recited in limitation 1(g) requires the motor control electronics to be arranged entirely within the space defined by the height and depth of the wheels with a length extending from the inner edge of one wheel to the inner edge of another. Pet. 23; PO Resp. 10.

For the motor control electronics recited in limitation 1(g), Petitioner contends that WO/055 renders obvious the subject matter of this limitation.¹⁰ Pet. 36–37; Reply 9–12. Petitioner points to WO/055’s disclosure that the wheel hub embodiment shown in Figure 17 includes the batteries within side

¹⁰ In the Petition, Petitioner contends WO/055 anticipates or otherwise renders obvious the motor control electronics recited in limitation 1(g). Pet. 36–37. Subsequently, in the Reply, Petitioner avers it “no longer asserts that WO/055 anticipates this limitation.” Reply 9, n.3. Accordingly, Petitioner has withdrawn its argument that WO/055 discloses this limitation and relies on only obviousness.

walls 262 of lower part 264 of housing 254 to yield “the advantageous effect of lowering the centre of gravity of the device 252, thereby increasing its stability and allowing higher acceleration and deceleration” and argues “[a] POSITA would be motivated by this disclosure to place the motor control electronics entirely in the volume between two wheels, knowing that it would reduce the size of the robot and lower its center of gravity.” Pet. 36 (citing Ex. 1003, 14:31–34; Ex. 1015 ¶ 122).

Petitioner also argues that placing the motor control electronics within the volume between two of the wheels would have been an obvious design choice because “[t]here are only a limited number of choices—within the volume between the wheels, outside that volume on the side of the robot, or in the plane above the cavity.” *Id.* (citing Ex. 1015 ¶ 123). According to Petitioner, “[e]ach [choice] is obvious to try.” *Id.* Petitioner further argues “the claimed location is the most likely to be chosen because it would necessarily reduce the size of the robot and reduce the amount of cabling required to connect motor control electronics to the hub motors.” *Id.* at 37. In support of this argument, Petitioner points to Patent Owner’s statement, with respect to the European counterpart to the ’140 patent, that choosing the volume between the wheels would result in a shorter length of cabling and a more compact design of the vehicle. *Id.* (citing Ex. 1014, 6, 8; Ex. 1015 ¶¶ 122–123).

In its Response, Patent Owner contends Petitioner’s obviousness arguments fail for several reasons. PO Resp. 24–31. In particular, Patent Owner argues that “nothing in WO/055 would have motivated a POSITA to place the motor control electronics *entirely* within the volume between two

of the wheels of each rolling set.” *Id.* at 27 (citing Ex. 2021 ¶ 81). Patent Owner’s declarant, Dr. Janét, testifies that

[I]f the batteries extended beyond the volume between the wheels, the center of gravity would not necessarily change. The size of the robot would not change if the motor control electronics were partially outside of the volume between the wheels. Nor would the length of the cable required to connect the motor control electronics be larger if the electronics were outside of the volume between the wheels. WO/055 does not teach a POSITA the importance of locating components between the wheels.

Ex. 2021 ¶ 82. Patent Owner further argues “there is no logic to Petitioner’s argument that WO/055’s disclosure of batteries located *entirely outside* of the volume between the wheels would somehow motivate ‘a POSITA to place the motor control electronics *entirely within* the volume between the wheels.’” PO Resp. 28 (quoting Ex. 1015 ¶ 123). Patent Owner maintains that WO/055’s wheel hub embodiment does not have any components placed between the wheels. *Id.*

Patent Owner also argues that “Petitioner’s obvious-to-try argument fails because the specific location recited in limitation [1(g)] was not a known and predictable choice for locating motor control electronics.” *Id.* at 30 (citation omitted). Rather than a small and finite number of options, Patent Owner argues that there are a large number of possible locations for the motor control electronics. *Id.* at 30–31. According to Patent Owner, Dr. Pfeifer admits that the motor control electronics could have been placed anywhere in the vehicle body or outside the vehicle body (*id.* (citing Ex. 2023, 136:2–10)), and Dr. Janét testifies that the motor control electronics would have been placed inside the cavity, depending on the design of the cavity and the bins (*id.* at 30 (citing Ex. 2021 ¶ 83)).

In its Reply, Petitioner responds that “WO/055 specifically discloses that the [motor control electronics] should be located in close proximity to the batteries and the drive motor, and a POSITA would understand that these components should remain together in WO/055’s other embodiments.”

Reply 9 (citing Ex. 1036 ¶ 27; Ex. 2023, 98:12–100:11). Petitioner further argues “[g]iven a POSITA’s understanding that [motor control electronics] should be located near the drive motors and batteries (EX1036, ¶28), placing the [motor control electronics] in the volume between the wheels of each rolling set in the in-wheel motor embodiment would have least been obvious to try.” *Id.* at 10. According to Petitioner:

There are only three logical locations near the batteries and in-wheel motors, and only the last would work: (1) within the cavity, which would obstruct the lifting device; (2) within the side walls, which would not work because the batteries are already located there; or (3) on the outside of the side walls of the robot. . . .

A POSITA also would understand that there are only three choices for placing the [motor control electronics] circuit board on the outside of the side walls: (1) above the volume between the wheels; (2) partly within and partly outside the volume between the wheels; or (3) entirely within the volume between the wheels (as in claim 1 of the ’140 Patent).

Id. at 10–11 (citing Ex. 1015 ¶¶ 122–123; Ex. 1036 ¶¶ 29–31). Petitioner goes on to argue that “a POSITA would understand that the natural location is fully within the volume between the wheels” because that location requires the least amount of cabling and minimizes concerns about electrical interference, protects the motor control electronics from collisions, and is otherwise unused such that locating the motor control electronics there would not increase the robot’s footprint. *Id.* (citing Ex. 1036 ¶ 32; Ex. 1040, 58:7–14, 62:15–63:4).

In its Sur-reply, Patent Owner argues that, contrary to Petitioner's argument, WO/055 does not disclose the motor control electronics should be placed close to the batteries and the drive motor. Sur-reply 8–9 (citing Reply 9–12; Ex. 2027, 20:6–24:2). Patent Owner also argues that Petitioner falsely assumes a POSITA would understand that within the cavity, within the side walls, and on the outside of the side walls would have been the only three locations for locating the motor control electronics in the wheel hub embodiment because WO/055 discloses placing the control components in the upper part of the vehicle. *Id.* at 9 (citing Ex. 1003, 6:11–14, 11:31–34; Ex. 2021 ¶ 76). Patent Owner further argues that Dr. Pfeifer admits it would be possible to put the motor control electronics in the side walls with the batteries, and that a POSITA would have placed the motor control electronics in the side walls, which is a safe space inside the robot and close to the batteries. *Id.* at 10 (citing Ex. 2027, 24:14–25:22). Patent Owner additionally argues that a POSITA would not have placed the motor control electronics in the volume between the wheels because WO/055 discloses that the motor control electronics are bulky. *Id.* at 10–11 (citing Ex. 1003, 6:11–14, 11:31–34; Ex. 2021 ¶¶ 76, 84, 93).

We begin with our analysis of Petitioner's evidence and arguments concerning limitation 1(g). Petitioner relies on obviousness and, more particularly, on an obviousness argument premised entirely on Dr. Pfeifer's reasoning.

Dr. Pfeifer opines:

WO/055, in one embodiment, describes the location of batteries powering the wheel motors as “located within side walls 262 of a lower part 264 of the housing 254,” *which includes the volume between the wheels of the rolling sets.* (EX1003,

14:31-32.) . . . According to the specification, placing the battery in this location “has the advantageous effect of lowering the centre of gravity of the device 252, thereby increasing its stability and allowing higher acceleration and deceleration.” (*Id.* 14:33-34.) A POSITA would be motivated by this disclosure to place the motor control electronics entirely in the volume between two wheels of the robot, knowing that it would reduce the size of the robot and lower its center of gravity. (*See id.*)

Ex. 1015 ¶ 122 (emphasis added). As we explained in the Decision at institution, however, the location of the battery, i.e., within side walls 262 of lower part 264 of housing 254, does not include the volume between the wheels, as Dr. Pfeifer testifies, because, as shown in Figure 17, wheels 256 are outside of side walls 262. Dec. 26–27. Thus, WO/055’s disclosure of placing the battery within the side walls of the lower part of the housing to reduce the size of the robot and lower the center gravity does not persuasively explain why a POSITA would have placed the motor control electronics within the volume between the wheels.

Dr. Pfeifer also opines that there is only a limited number of choices for locating the motor control electronics on the robot and that each choice would have been obvious to try. Ex. 1015 ¶ 122; Ex. 1036 ¶¶ 27–32. The Supreme Court set forth the standard for when a combination may be obvious to try: “When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *KSR*, 550 U.S. at 421 (emphasis added). Furthermore, under our rules, “[e]xpert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.” 37 C.F.R. § 42.65(a). For the reasons that follow, Dr. Pfeifer’s obvious-to-try testimony is unpersuasive and lacking factual support.

Dr. Pfeifer testifies that WO/055 specifically discloses the power components, control components, and drive components should be located in proximity to one another. Ex. 1036 ¶ 27 (citing Ex. 1003, 6:12–14, 20–29, 11:31–34, 12:16–18). Dr. Pfeifer also testifies that, in the in-wheel motor embodiment shown in Figure 17, WO/055 discloses batteries, i.e., power components, located within side walls 262 of lower part 264 of the housing next to the motors. *Id.* ¶ 28 (Ex. 1003, 14:31–38). According to Dr. Pfeifer, “given WO/055’s teaching that [motor control electronics] should be located near the drive motors and batteries, . . . placing the [motor control electronics] entirely in the volume between the wheels of each rolling set—in close proximity to the in-wheel drive motors and batteries—would have been obvious to try.” *Id.*

Dr. Pfeifer further testifies a POSITA would have understood that, in placing the motor control electronics close to the drive components and the power components, there are only three locations for the motor control electronics, but only one location would have worked. Specifically, Dr. Pfeifer testifies that “[t]he [motor control electronics] could be: (1) placed within the cavity, which would not work because it would obstruct the lifting device; (2) within the side walls, which would not work because the batteries are already located there; or (3) on the outer side of the side walls of the robot.” *Id.* ¶ 29. Dr. Pfeifer continues:

A POSITA would also understand that there are three logical choices for placing the [motor control electronics] circuit board on the outside of the side walls: (1) outside the volume between the wheels; (2) partly within and partly outside the volume between the wheels; or (3) entirely within the volume between the wheels (as in claim 1 of the ’140 Patent). . . . Because the number of choices is both finite and small, and the choices

themselves are readily visualized, each option, in my opinion, is obvious to try.

Id. ¶ 30. Dr. Pfeifer then opines that of the three choices for locating the motor control electronics, a POSITA would have selected the volume between the wheels. According to Dr. Pfeifer:

Of these three choices, a POSITA would understand that placing the [motor control electronics] entirely in the volume between the wheels would be the natural location for several reasons. *First*, that space is otherwise unused, as Dr. Janét admitted. (EX1040, 62:15-63:4.) Placing the [motor control electronics] in the volume between the wheels would not increase the footprint of the robot. *Second*, the [motor control electronics] placed in that location would be protected from collisions. The wheels act as a buffer, protecting the [motor control electronics] from damage. *Third*, locating the [motor control electronics] there would require the least amount of cabling between the control unit and the wheels, minimizing concerns about electrical interference.

Ex. 1036 ¶ 32.

At the outset, we agree with Patent Owner that, contrary to Dr. Pfeifer’s testimony, WO/055 does not specifically disclose that the motor control electronics should be placed close to the batteries and the drive motor. Rather, WO/055 discloses that certain embodiments of the load handling device have the bulky components, namely the battery, controllers, and motors for driving the wheels, located in upper part 112 of vehicle 102. Ex. 1003, 11:31–34, 12:12–18. Furthermore, we find that WO/055 does not disclose locating the components near each other advantageously reduces the robot’s footprint and improves efficiency of the storage system, as Dr. Pfeifer testifies. Instead, WO/055 attributes the reduced footprint to locating the bulky components above the container-receiving space. *Id.* at 6:20–23 (“By arranging the bulky components of the load handling device above the

container-receiving space, the footprint of the load handling device is reduced compared to the cantilever designs . . . in which the bulky components are housed in a vehicle module disposed to one side of the container-receiving space.”).

Even if we were to agree that WO/055 discloses locating the motor control electronics close to the batteries and the drive motor, Dr. Pfeifer provides no credible support for his testimony that a POSITA would have considered there to be three options for locating the motor control electronics close the batteries and the drive motor, namely, within the cavity, within the side walls, and on the outer side of the side walls of the robot. There is also no credible support for Dr. Pfeifer’s testimony that a POSITA would have understood the options for placing the motor control electronics on the outside of the side walls to be: outside the volume between the wheels, partly within and partly outside the volume between the wheels, and entirely within the volume between the wheels. Put simply, there is no factual support or other credible evidence for Dr. Pfeifer’s testimony directed to certain locations being *known* options for locating motor control electronics such that there is a limited number of those *known* options. *See also* Ex. 2021 ¶ 83 (Dr. Janét testifying that “nothing in the prior art suggests that placing motor control electronics in the volume between two wheels was an identified and predictable solution”).

Not only does Dr. Pfeifer’s testimony regarding the volume between the wheels being one of a small number of known options for locating the motor control electronics lack corroboration, Dr. Pfeifer’s three reasons for selecting the volume between the wheels are unpersuasive because they are unsupported by the references and are, instead, premised on hindsight.

Indeed, whatever benefit Petitioner has advanced for a POSITA to recognize these options finds no support in the referenced and has been disputed by Dr. Janét, who we credit in this regard. Ex. 2021 ¶ 82.

Beginning with protection from collisions, there is no support for Dr. Pfeifer's testimony that a POSITA would have located the motor control electronics within the volume between the wheels to protect the motor control electronics from collisions. Turning to the volume between the wheels being unused, Figure 17 of WO/055 shows the volume between the wheels as unused. Figure 17, however, also shows the volume above and to the sides of the wheels as unused. Thus, the volume between the wheels being unused does not persuasively explain why a POSITA would have located the motor control electronics there.

Regarding reduced cabling, the only support for Dr. Pfeifer's testimony that a POSITA would have located the motor control electronics within the volume between the wheels to reduce cabling is Patent Owner's statement regarding the European counterpart to the '140 patent. Patent Owner stated that the invention described in the European counterpart requires less cabling due to the motor control electronics being located in the volume between the wheels. Ex. 1014, 6, 8. As Patent Owner's statement regards the invention set forth in the European counterpart to the '140 patent, not the prior art, Dr. Pfeifer's testimony that a POSITA would have located the motor control electronics within the volume between the wheels to reduce cabling is premised on hindsight. *See W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983) ("To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall

victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.”).

Given Dr. Pfeifer’s unpersuasive and uncorroborated reasoning as to why motor control electronics arranged within the volume between two of the wheels of each rolling set, as recited in limitation 1(g), Petitioner has not persuaded us that the claimed subject matter, including the motor control electronics of limitation 1(g), would have been obvious. Petitioner has not shown by a preponderance of the evidence, that the subject matter of independent claim 1 would have been obvious over WO/055.

2. *Claim 11 and Independent Claim 15*

Our analysis for independent claim 1 in section III.D.2 applies to claim 11, which depends from independent claim 1, and independent claim 15, which recites a storage system comprising a bin storage structure and a remotely operated vehicle in accordance with independent claim 1. For the reasons above in section III.D.2, Petitioner has not shown by a preponderance of the evidence that the subject matter of claim 11 and independent claim 15 would have been obvious over WO/055.

E. *Obviousness Based on WO/055 and EP/052*

Petitioner challenges claims 1, 11, and 15 under 35 U.S.C. § 103, contending the claimed subject matter would have been obvious over WO/055 and EP/052. Pet. 41–47; Reply 12–20. Patent Owner argues WO/055 and EP/052 do not render obvious the claimed subject matter. PO Resp. 31–43; Sur-reply 11–17. For the reasons below, Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 1, 11, and 15, which includes motor control electronics arranged

within the volume between two of the wheels of each rolling set as recited in limitation 1(g), would have been obvious over WO/055 and EP/052.

1. Independent Claim 1

For limitation 1(g), which recites motor control electronics arranged within the volume between two of the wheels of each rolling set, Petitioner argues units 3a and 3b both include components that supply electricity to the motors and transmit control signals to control them. Pet. 44–45 (citing Ex. 1004, 3:32–35, 3:49–4:10, 8:53–9:4, 9:14–18, 53–57; Ex. 1015 ¶ 149). Petitioner also argues units 3a and 3b are placed on the side of frame 2 between wheels 6 and 8 such that units 3a and 3b are within the volume between two of the wheels of each rolling set. *Id.* at 45–47 (citing Ex. 1004, 8:54–56, claim 3, Figs. 1–3; Ex. 1015 ¶¶ 150–153).

Petitioner argues a person of ordinary skill in the art would have combined the teachings of WO/055 and EP/052 with a reasonable expectation of success. *Id.* at 43 (citing Ex. 1015 ¶ 143). Petitioner maintains that both WO/055 and EP/052 relate to robotic vehicles and have the goal of reducing the size of the vehicle. *Id.* (citing Ex. 1003, 5:26–29; Ex. 1004, 1:47–49, 2:16; Ex. 1015 ¶ 143). According to Petitioner, WO/055 reduces the vehicle size by using in-hub motors to eliminate the need for a power transmission chain, and EP/052 similarly uses in-hub motors to reduce vehicle size by eliminating the mechanical power transmission system. *Id.* (citing Ex. 1003, 14:26–29; Ex. 1004, 1:47–49, 2:16). Petitioner also argues that “[f]urther size reduction is achieved in EP/052 by putting bulky electrical storage and control units required by the in-hub motors within the volume between the wheels,” and that “[s]uccess in applying this disclosure from EP/052 to the wheel hub motors of WO/055 was likely,

because the space is otherwise unused.” *Id.* (citing Ex. 1004, 9:52–57, Figs. 1–2; Ex. 1015 ¶ 144). Petitioner further argues that EP/052 teaches placing units 3a and 3b between wheels 6 and 8 to attain a low structure and to reduce any attendant cabling. *Id.* at 45 (citing Ex. 1004, 3:10–16, 8:54–56, Figs. 1–3; Ex. 1015 ¶ 150).

Patent Owner argues that a POSITA would not have been motivated to combine the teachings of WO/055 and EP/052. PO Resp. 31–36. In particular, Patent Owner argues that EP/052 is not related to a robotic vehicle but instead is directed to a working machine, such as a tractor and other heavy machinery (*id.* at 31 (citing Ex. 1004 ¶ 8; Ex. 2021 ¶ 86)), and that EP/052 is not concerned with optimizing space to provide a smaller footprint (*id.* at 32).

Patent Owner also argues that EP/052’s motor control electronics are not entirely within the volume between two wheels, as recited in limitation 1(g). *Id.* at 37–40. In support of its argument, Patent Owner provides Dr. Janét’s annotated version of EP/052’s Figure 1, reproduced below. *Id.* at 38 (citing Ex. 2021 ¶ 100).

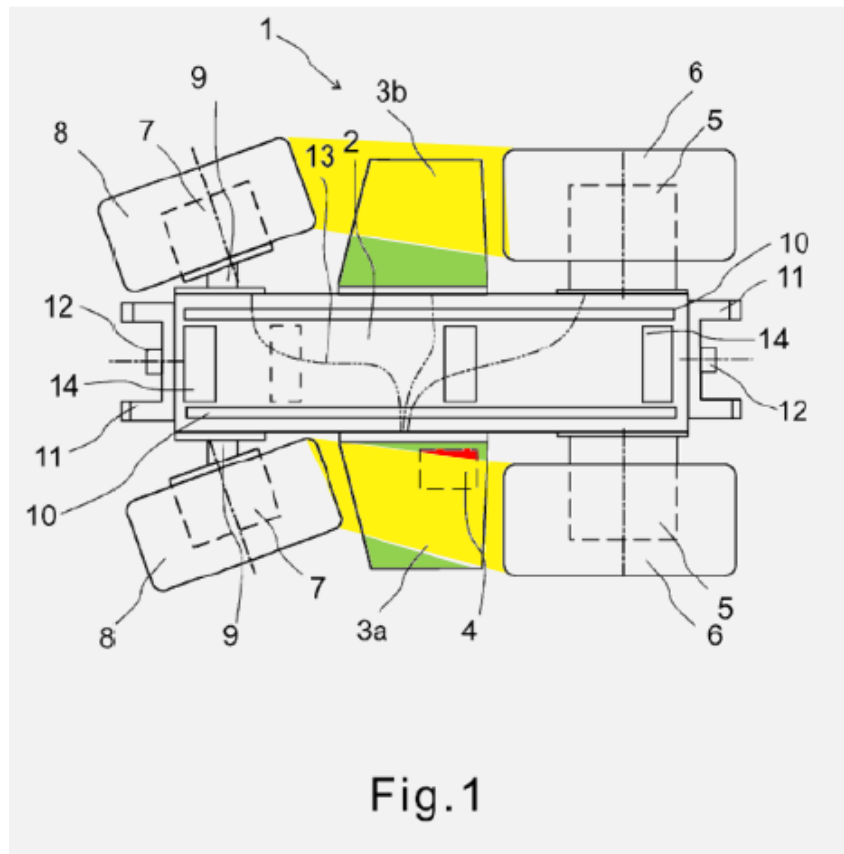


Figure 1 is a top view of a working machine. Ex. 1004 ¶ 26. Dr. Janét annotated Figure 1 to show in yellow the volume between the two wheels on each side of the working machine, the volume including the area formed by the depth of the wheels, the length extending between the inner edges of the wheels, and the length extending between the outer edges of the wheels. PO Resp. 38 (citing Ex. 2021 ¶ 100). Dr. Janét further annotated Figure 1 to show in red the portion of control device 4 that is outside the volume between the wheels shown in yellow. *Id.* (citing Ex. 2021 ¶ 100). Dr. Janét similarly annotated Figure 1 to show in green the portion of each of unit 3a and 3b that is outside the volume between the wheels shown in yellow. *Id.* (citing Ex. 2021 ¶ 100).

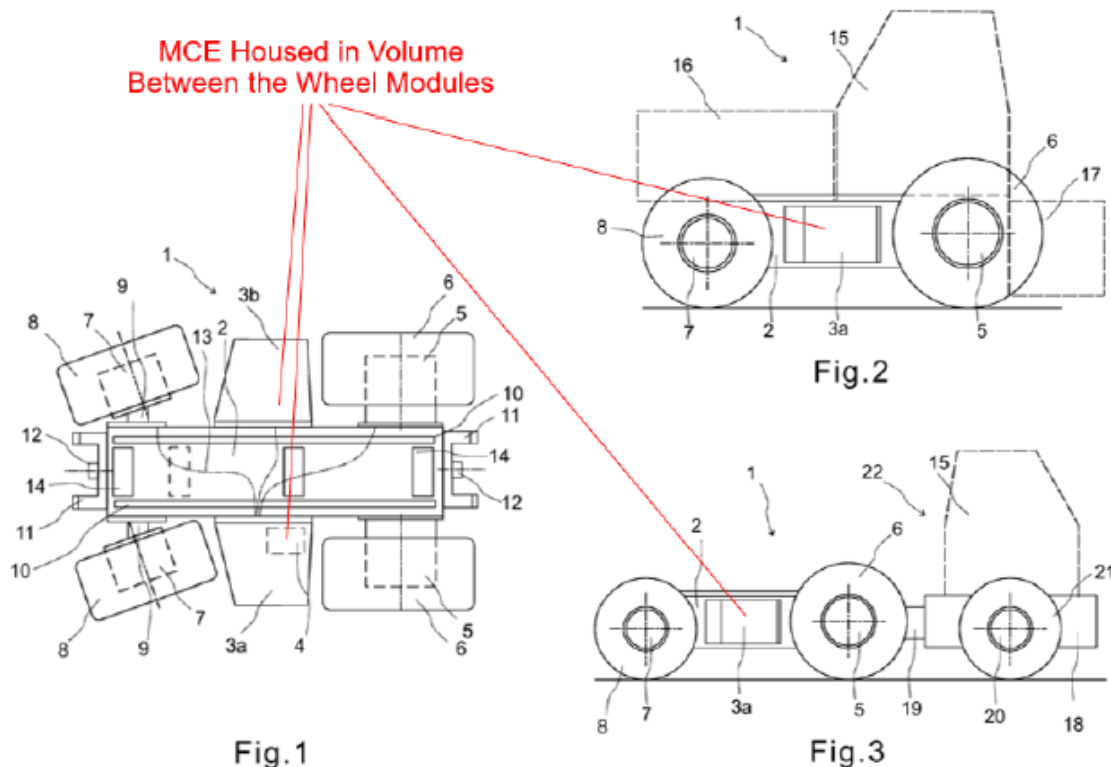
Patent Owner argues EP/052's motor control electronics are not arranged within the volume between two of the wheels of each rolling set, as

also recited in limitation (1g). *Id.* at 40–43. According to Patent Owner, EP/052 discloses only a single location for control device 4 for controlling the functions of the drive unit. *Id.* at 40 (citing Ex. 1004 ¶¶ 13, 41, Fig. 4; Ex. 2021 ¶ 97). Specifically, Patent Owner argues: “EP/052 explains that control device 4 can be placed in the frame of the working machine, in the unit 3a, *or* in the unit 3b. But EP/052 does not teach or suggest putting control units in *both* units 3a and 3b.” *Id.* (citing Ex. 1004 ¶ 41; Ex. 2021 ¶ 97).

In its Reply, Petitioner maintains that a POSITA would have been motivated to combine the teachings of WO/055 and EP/052. Reply 12–17. In particular, Petitioner argues EP/052 is reasonably pertinent to WO/055 because WO/055 and EP/052 teach the use of in-wheel motors to solve the same problem in the same way—to make the robot smaller and lighter. *Id.* at 14 (citing Ex. 1003, 5:15–39, 11:36–40, 12:6–10, 14:28–29; Ex. 1004, Abstract, 1:47–50, 2:15–16, 3:46–48, 8:53–56, claim 1; Ex. 1036 ¶¶ 36–38).

Petitioner also maintains that EP/052 discloses motor control electronics within the volume between two wheels. *Id.* at 17–19. According to Petitioner, Dr. Janét’s annotated version of EP/052’s Figure 1 “does not properly depict the ‘volume’ in EP/052 that corresponds to the ‘volume between the wheels’ in WO/055, as a POSITA would understand it.” *Id.* at 17 (citing Ex. 1036 ¶¶ 43–46). Petitioner argues that the wheels shown in WO/055’s Figure 17 are each an assembly comprising a hub motor and a tire surrounding the motor and that the volume between the wheels in WO/055 extends from the vehicle body to the outer side of each of the wheel/hub motor assembly. *Id.* at 17–18 (citing Ex. 1003, 7:7–8, 14:26–28; Ex. 1036 ¶ 44). Petitioner also argues EP/052’s wheel modules correspond to

WO/055's wheels. *Id.* at 18 (citing Ex. 1004, 6:38–52; Ex. 1036 ¶¶ 38, 46). Petitioner further argues EP/052 discloses control device 4, unit 3a, and unit 3b are located entirely within the volume between two wheels modules. *Id.* (citing Ex. 1036 ¶ 47; Ex. 2023, 201:4–202:14). In support of this argument, Petitioner provides annotated versions of EP/052's Figures 1–3, reproduced below. *Id.* at 19.



Figures 1–2 are top and side views, respectively of a working machine, and Figure 3 is a side view of another embodiment of a working machine. Ex. 1004 ¶ 26. Petitioner annotated these figures to include red lines pointing to control device 4, unit 3a, and unit 3b, and Petitioner labeled the red lines “[Motor Control Electronics] Housed in Volume Between the Wheel Modules.”

Petitioner additionally maintains that EP/052 discloses motor control electronics within the volume between two of the wheels of each rolling set. Reply 19–20. According to Petitioner, “EP/052 expressly contemplates having multiple control units and placing them on both sides of the robot. As EP/052 explains, its depiction of a single control device 4 is only ‘illustrative,’ and ‘[i]t is possible to control the function of the drive unit 1, the modules and the units by means of *one or several electric control units*.’” *Id.* at 19–20 (citing Ex. 1004, 9:52–57).

In its Sur-reply, Patent Owner argues EP/052 is not reasonably pertinent to the problem the inventor sought to solve. Sur-reply 11. In particular, Patent Owner argues Petitioner’s argument that WO/055 and EP/052 solve the same problem in the same way, namely, using in-wheel motors to make the robot smaller and lighter, is incorrect and irrelevant. *Id.*

Patent Owner also argues that Petitioner has not shown EP/052 discloses motor control electronics arranged within the volume between two of the wheels because Petitioner’s argument ignores the claim language. *Id.* at 15. Specifically, Patent Owner argues “Petitioner’s attempt to expand the ‘volume between the wheels of each rolling set’ to include the in-wheel motors is contrary to the claim language, which specifically recites that the motor control electronics are located in the volume between the *wheels*, not the volume between *the wheels and the motor that drives them*.” *Id.* (citing PO Resp. 37–40; Ex. 1001, claim 1).

With respect to motor control electronics arranged within the volume between two of the wheels of each rolling set, Patent Owner argues EP/052 discloses motor control electronics in either unit 3a or unit 3b, but not both units 3a and 3b. *Id.* at 16. According to Patent Owner, “although EP/052

mentions that the control device 4 itself might comprise ‘several’ units, it never suggests that these components would be located in different areas of the robot, let alone one between each set of wheels.” *Id.* (citing PO Resp. 40–43).

We begin with whether EP/052 is analogous art to the claimed invention. “A reference qualifies as prior art for an obviousness determination only when it is analogous to the claimed invention.” *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019) (citing *In re Klein*, 647 F.3d 1343, 1348 (Fed. Cir. 2011)). A reference is analogous art if it is from the same field of endeavor or if it is reasonably pertinent to the particular problem with which the inventor is involved. *Id.* (citing *In re Bigio*, 381 F.3d 1320, 1324 (Fed. Cir. 2004)). “[A] reference outside an inventor’s field of endeavor is ‘reasonably pertinent’ only if its subject matter ‘logically would have commended itself to an inventor’s attention in considering his problem.’” *Id.* at 1382 (quoting *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992)).

The claimed invention in the ’140 patent relates to a robot for picking up storage bins from a storage system and a storage system for storing bins. Ex. 1001, 1:6–9. EP/052 relates to working machine, such as a tractor. Ex. 1004, 1:3–5, 9–10, Fig. 1. The claimed invention in the ’140 patent and EP/052 are from different fields of endeavor, and Petitioner does not argue otherwise.

Petitioner relies on EP/052 being reasonably pertinent to the particular problem with which the inventor is involved. According to the ’140 patent:

[W]ith [the] known system each vehicle is covering a cross section of the underlying storage system that corresponds to two

storage columns, thereby limiting maximum number of simultaneously operating vehicles.

One or more embodiments of the present invention may provide a vehicle and a storage system that allows a significant increase in the number of simultaneously operating vehicles during successful handling of storage bins.

Ex. 1001, 1:42–49. Accordingly, the inventor for the claimed invention in the '140 patent is involved with reducing the footprint of the robot to increase the number of robots that operate simultaneously.

Petitioner analogizes EP/052 to WO/055 and ostensibly argues in-wheel motors make a robot smaller and lighter. Reply 14 (“Both WO/055 and EP/052 teach the use of in-wheel motors to solve the same problem in the same way—to make the robot smaller and lighter.” (citing Ex. 1003, 11:36–40, 12:6–10; Ex. 1004, Abstract, 3:46–48)). Yet, neither EP/052 nor WO/055 discloses using in-wheel motors to reduce a robot’s footprint, which is the problem with which the inventor of the claimed invention is involved. EP/052’s working machine addresses the problem of suboptimal weight and weight distribution, not a reduced footprint. Ex. 1004, 1:43–2:7. WO/055’s load handling device addresses the problem of reducing the footprint to a single grid space (5:27–29, 6:1–9), but WO/055 does not attribute the reduced footprint to the use of in-wheel motors. To the contrary, WO/055 discloses an embodiment of a load handling device that takes up a single grid space and has the bulky components, including the motors for driving the wheels, located in upper part 112 of vehicle 102. Ex. 1003, 11:31–40.

For these reasons, Petitioner has not explained persuasively how EP/052 logically would have commended itself to the attention of the inventor of the '140 patent, who was considering the problem of reducing

the footprint of a robot, and we are not persuaded EP/052 is reasonably pertinent to the particular problem with which the inventor is involved. Petitioner has not persuaded us that EP/052 is analogous art to the claimed invention.

Even if we were to agree with Petitioner that EP/052 is analogous art to the claimed invention, we remain unpersuaded that the claimed subject matter would have been obvious over WO/055 and EP/052. Specifically, Petitioner has not persuaded us that the claimed subject matter, which includes motor control electronics arranged within the volume between two of the wheels of each rolling set as recited in limitation 1(g), would have been obvious.

Petitioner relies on EP/052 to disclose motor control electronics arranged within the volume between two of the wheels, as recited in limitation 1(g). *See, e.g.*, Reply 17 (“EP/052 Discloses Placing [Motor Control Electronics] in the Volume Between the Wheels.” (emphasis omitted)). Specifically, Petitioner’s position is that EP/052’s control device 4, unit 3a, and unit 3b are located entirely within volume between two wheel modules, each of which includes a wheel and a hub motor. *Id.* at 18 (citing Ex. 1004, 6:38–52; Ex. 1036 ¶¶ 38, 46–47; Ex. 2023, 201:4–202:14). Petitioner’s argument that EP/052 discloses motor control electronics arranged within the volume between two of the wheels is premised on the volume between the wheels extending from the vehicle body to the other side of the wheel/hub motor assembly. *Id.* (“The volume between the ‘wheels’ in WO/055 extends from the vehicle body to the outer side of the wheel/hub motor assembly.” (citing Ex. 1036 ¶ 44)). We agree with Patent Owner that Petitioner’s argument is contrary to the claim

language, which recites “the volume between two of the wheels,” not the volume between two of the wheel/hub motor assemblies. Ex. 1001, 6:51–52. Petitioner’s argument also ignores the parties’ agreed-upon construction of the claim term “arranged within the volume between two of the wheels,” which according to the parties, requires the motor control electronics to be arranged entirely within the space defined by the height and depth of the wheels with a length extending from the inner edge of one wheel to the inner edge of another. Pet. 23; PO Resp. 10.

Petitioner also relies on EP/052 to disclose motor control electronics arranged within the volume between two of the wheels of each rolling set, as recited in limitation 1(g). *See, e.g.*, Reply 19 (“EP/052 Discloses Placing [Motor Control Electronics] in the Volume Between *Each* Rolling Set.” (emphasis omitted)). In support of its argument that EP/052 discloses motor control electronics arranged within the volume between two of the wheels of each rolling set, Petitioner points to only EP/052’s disclosure that the drive unit includes one or more electric control units. *Id.* at 20 (citing Ex. 1004, 9:52–57). Specifically, the relied-upon portion of EP/052 discloses “[i]t is possible to control the function of the drive unit 1, the modules and the units by means of one or several electric control units or control devices, which are illustrated by means of a control device 4, which can be placed for example in the frame 2 or in the unit 3a or 3b.” Ex. 1004, 9:52–57.

Petitioner argues this portion of EP/052 discloses multiple control devices located at different locations, including on frame 2, in unit 3a, and in unit 3b, whereas Patent Owner argues the portion discloses locating multiple control devices at one location, which may be on frame 2, in unit 3a, and in unit 3b. EP/052 better supports Patent Owner’s argument. The relied-upon portion

itself discloses that control device 4 represents multiple control devices, and Figure 1 shows control device 4 located in one location, namely in unit 3a.

For these reasons, Petitioner has not shown sufficiently that EP/052 discloses motor control electronics arranged within the volume between two of the wheels of each rolling set, as recited in limitation 1(g). Petitioner has not proven by a preponderance of the evidence that the subject matter of independent claim 1 would have been obvious over WO/055 and EP/052.

2. Claim 11 and Independent Claim 15

Our analysis for independent claim 1 in section III.E.2 applies to claim 11, which depends from independent claim 1, and independent claim 15, which recites a storage system comprising a bin storage structure and a remotely operated vehicle in accordance with independent claim 1. For the reasons above in section III.E.2, Petitioner has not shown by a preponderance of the evidence that the subject matter of claim 11 and independent claim 15 would have been obvious over WO/055 and EP/052.

F. Obviousness Based on WO/055, EP/052, and Christensen

Petitioner challenges claims 1–4 and 11–15 under 35 U.S.C. § 103, contending the claimed subject matter would have been obvious over WO/055, EP/052, and Christensen. Pet. 47–61; Reply 20–25. Patent Owner argues WO/055, EP/052, and Christensen do not render obvious the claimed subject matter. PO Resp. 43–53; Sur-reply 17–21.

Petitioner argues “Christensen discloses the specific use of a ‘brushless permanent-magnet (BLPM) configuration’ to drive the wheels of a robotic vehicle, the same type of electric motor that is specifically discussed in the specification of the ’140 Patent in connection with Claim

Limitations 1(e) and 1(f) of claim 1.” Pet. 50 (citing Ex. 1001, 2:22–24; Ex. 1005, 2; Ex. 1015 ¶ 161). Petitioner does not rely on Christensen with respect to limitation 1(g). Consequently, for the reasons discussed above in section III.E.1, Petitioner has not persuaded us that subject matter of claims 1–4 and 11–15 would have been obvious over WO/055, EP/052, and Christensen.

G. Obviousness Based on WO/055, EP/052, and Farag

Petitioner challenges claims 1–4 and 11–15 under 35 U.S.C. § 103, contending the claimed subject matter would have been obvious over WO/055, EP/052, and Farag. Pet. 62–70; Reply 26–29. Patent Owner argues WO/055, EP/052, and Farag do not render obvious the claimed subject matter. PO Resp. 53–59; Sur-reply 21–23.

Petitioner argues “Farag discloses the specific use of an ‘an in-wheel brushless DC outer rotor (hub) motor’ with ‘high flux magnetic inserts’ (which are permanent magnets) for use in a driving means, the same type of electric motor that is specifically discussed in the specification of the ’140 Patent in connection with Claim Limitations 1(e) and 1(f) of claim 1.” Pet. 64 (citing Ex. 1001, 2:22–24; Ex. 1006). Petitioner does not rely on Farag with respect to limitation 1(g). Consequently, for the reasons discussed above in section III.E.1, Petitioner has not persuaded us that subject matter of claims 1–4 and 11–15 would have been obvious over WO/055, EP/052, and Farag.

IV. CONCLUSION

For the reasons above, Petitioner has not proven, by a preponderance of the evidence, the unpatentability of claims 1–4 and 11–15 of the '140 patent.

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 11, 15	103	WO/055		1, 11, 15
1, 11, 15	103	WO/055, EP/052		1, 11, 15
1–4, 11–15	103	WO/055, EP/052, Christensen		1–4, 11–15
1–4, 11–15	103	WO/055, EP/052, Farag		1–4, 11–15
Overall Outcome				1–4, 11–15

V. ORDER

In consideration of the foregoing, it is:

ORDERED that claims 1–4 and 11–15 of the '140 patent have not been shown to be unpatentable; and

FURTHER ORDERED that, as this is a Final Written Decision, a party seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2021-00311
Patent 10,474,140 B2

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