

-UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHARKNINJA OPERATING LLC,
SHARKNINJA MANAGEMENT LLC, AND
SHARKNINJA SALES COMPANY,
Petitioner,

v.

IROBOT CORPORATION,
Patent Owner.

IPR2021-00545
Patent 7,571,511 B2

Before BARRY L. GROSSMAN, TERRENCE W. MCMILLIN, and
JASON W. MELVIN, *Administrative Patent Judges*.

MELVIN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

SharkNinja Operating LLC, SharkNinja Management LLC, and SharkNinja Sales Company (“Petitioner”)¹ filed a Petition to institute an *inter partes* review of claims 1, 8–12, 14, 16–19, 22–25, 32–34, 36, 37, 55, 56, and 62 (the “challenged claims”) of U.S. Patent 7,571,511 B2 (Ex. 1001, the “’511 patent”) pursuant to 35 U.S.C. § 311 *et seq.* Paper 1 (“Petition” or “Pet.”). After iRobot Corporation (“Patent Owner”)² filed a Preliminary Response (Paper 6), we instituted *inter partes* review. Paper 11 (“Institution Decision” or “Inst.”).

Patent Owner filed a Response (Paper 19 (“PO Resp.”)), Petitioner filed a Reply (Paper 21 (“Pet. Reply”)), and Patent Owner filed a Sur-Reply (Paper 23 (“PO Sur-Reply”). We held oral argument on June 8, 2022, and a transcript appears in the record. Paper 30 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6(b). This is a Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, we find Petitioner has demonstrated by a preponderance of evidence that challenged claims 1, 8–12, 14, 16–19, 22, and 23 of the ’511 patent are unpatentable but has not demonstrated that any of challenged claims 24, 25, 32–34, 36, 37, 55, 56, or 62 is unpatentable.

¹ Petitioner identifies SharkNinja Operating LLC, SharkNinja Management LLC, and SharkNinja Sales Company as the real parties-in-interest. Pet. 80.

² Patent Owner identifies iRobot Corporation as the real party-in-interest. Paper 4, 2.

A. RELATED PROCEEDINGS

The parties identify the following related proceedings:

In the Matter of Certain Robotic Floor Cleaning Devices and Components Thereof, Inv. No. 337-TA-1252³ (US International Trade Commission); and

iRobot Corp. v. SharkNinja Operating LLC, Case No. 1:21-cv-10155 (Mass.). Pet. 88; Paper 4, 2.

B. THE '511 PATENT

The '511 patent is titled “Autonomous Floor Cleaning Robot” (Ex. 1001, code (54)), with an object of providing “a cleaning device that is operable without human intervention to clean designated areas” (*id.* at 1:65–67). The patent discloses “an autonomous floor-cleaning robot that comprises a self-adjustable cleaning head subsystem that includes a dual-stage brush assembly having counter-rotating, asymmetric brushes and an adjacent, but independent, vacuum assembly such that the cleaning capability and efficiency of the self-adjustable cleaning head subsystem is optimized while concomitantly minimizing the power requirements.” *Id.* at 1:23–31. Figure 2, reproduced below, is an isometric drawing of a claimed autonomous floor-cleaning robot embodiment.

³ Petitioner refers to this as 337-TA-3530, but the ITC website indicates 3530 is the docket number, not the investigation number. *See* <https://pubapps2.usitc.gov/337external/3979>.

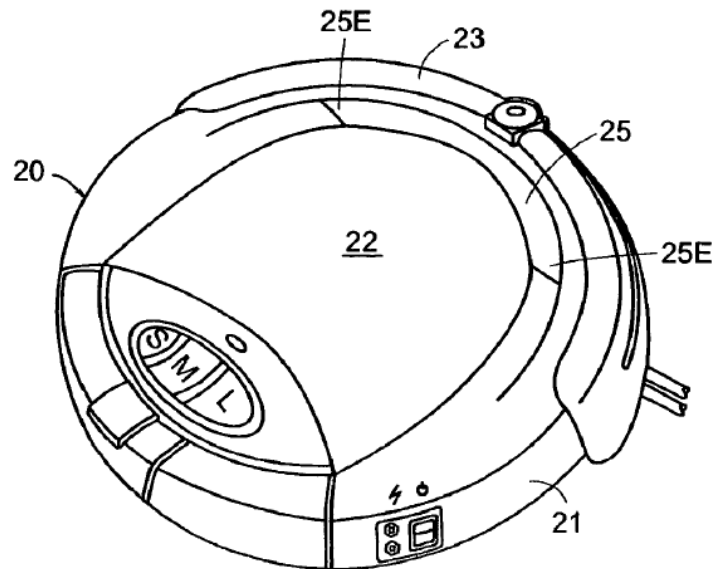


Figure 2 shows chassis 21, cover 22, displaceable bumper 23, and carrying handle 25. *Id.* at 3:33–36.

Figure 2A, reproduced below shows a “bottom plan view” of the autonomous robot.

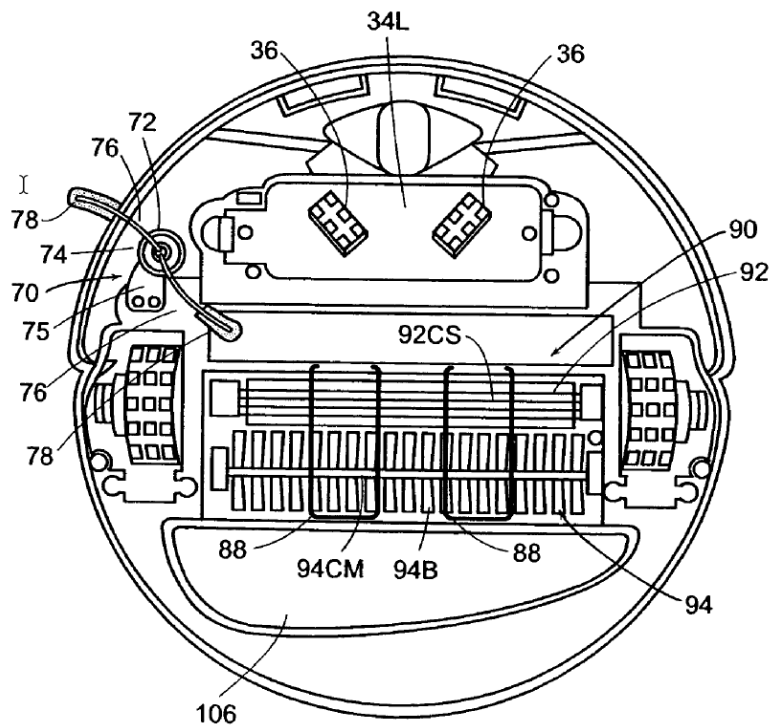


Figure 2A additionally shows “side brush assembly 70.” *Id.* at 3:36–43.

C. CHALLENGED CLAIMS

Petitioner challenges claims 1, 8–12, 14, 16–19, 22–25, 32–34, 36, 37, 55, 56, and 62 of the '511 patent. Pet. 1. Challenged claims 1, 24, and 55 are independent.⁴ Claim 1 is reproduced below.

1. A floor-cleaning robot comprising:
 - a wheeled housing defining a housing perimeter,
 - a motor drive operably connected to wheels of the housing to propel the robot across a floor surface;
 - an obstacle detector responsive to obstacles encountered by the robot;
 - a control circuit in electrical communication with both the obstacle detector and the motor drive and configured to control the motor drive to maneuver the robot to avoid detected obstacles across the floor surface during a floor-cleaning operation;
 - a powered primary brush assembly configured to rotate about an axis generally parallel to the floor surface disposed across a central region of an underside of the housing and positioned to brush the floor surface as the robot is propelled across the floor surface; and
 - a powered side brush extending beyond the housing perimeter and positioned to brush floor surface debris from beyond the housing perimeter toward a projected path of the primary brush assembly.

Ex. 1001, 16:23–43.

D. THE ASSERTED GROUNDS

Petitioner challenges claims 1, 8–12, 14, 16–19, 22–25, 32–34, 36, 37, 55, 56, and 62 of the '511 patent based on the grounds set forth in the table below.

⁴ Independent claim 39 is not challenged.

Claims Challenged	35 U.S.C. §	References
1, 8–12, 16, 18, 19, 22–25, 32–34, 37, 55, 56, 62	103	Bisset ⁵ , Toyoda ⁶
1, 8–12, 16, 18, 19, 22–25, 32–34, 37, 55, 56, 62	103	Bisset, Ye ⁷
14, 36	103	Bisset, Toyoda, Jones ⁸
14, 36	103	Bisset, Ye, Jones
16, 17	103	Bisset, Toyoda, Horst ⁹
16, 17	103	Bisset, Ye, Horst

See Pet. 3. Petitioner also relies on the Declaration of Dr. Mitchell Pryor (Ex. 1003, “Pryor Decl.”). Patent Owner relies on the Declaration of Dr. Donald A. Coates (Ex. 2008).

II. ANALYSIS

A. LEGAL STANDARDS

A patent claim is unpatentable as obvious if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103. Obviousness is resolved on the basis of underlying factual

⁵ WO 00/38026, published June 29, 2000 (Ex. 1005). Petitioner contends this reference is prior art under 35 U.S.C. § 102(b). Pet. 9.

⁶ JP 2000-353014 A, published December 19, 2000 (Ex. 1007, Certified Translation of Ex. 1006). Petitioner contends this reference is prior art under 35 U.S.C. § 102(b). Pet. 10.

⁷ CN 2389761Y, published Aug. 2, 2000 (Ex. 1026, Certified Translation of Ex. 1025). Petitioner contends this reference is prior art under 35 U.S.C. § 102(b). Pet. 12.

⁸ Joseph L. Jones, et al., “Mobile Robots: Inspiration to Implementation”, ISBN 1-56881-097-0, 1998 (Ex. 1008). Petitioner contends this reference is prior art under 35 U.S.C. § 102(b). Pet. 76.

⁹ US 3,732,590, issued May 15, 1973 (Ex. 1015). Petitioner contends this reference is prior art under 35 U.S.C. § 102(b). Pet. 82.

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 ordinary skill in the art; and (4) objective evidence of non-obviousness.¹⁰ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic*, 815 F.3d at 1363 (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

Patent Owner has waived any argument not raised in the Patent Owner Response. *See* Paper 12, 8 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”); *In re NuVasive, Inc.*, 842 F.3d 1376, 1380–81 (Fed. Cir. 2016); Consolidated Trial Practice Guide 52 (Nov. 2019), *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

B. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner submits that an ordinarily skilled artisan “would have had at least a four-year degree in mechanical or electrical engineering or a closely related field and at least one year of experience in the design and implementation of robotics and embedded systems.” Pet. 4–5 (citing Ex. 1003 ¶¶ 17–19). Patent Owner does not challenge that definition for the level of ordinary skill in the art, and we adopt it here.

¹⁰ Patent Owner has not submitted such objective evidence here.

C. CLAIM CONSTRUCTION

Patent Owner submits that no claim requires construction. PO Resp. 9. Petitioner submits that Patent Owner relies on a narrow construction of “disposed within” to argue against the challenge to claims 24 and 55. Pet. Reply 1, 18–19. Those claims recite a “primary brush assembly” and “cleaning head,” respectively, that must be “disposed within the round housing perimeter.” Ex. 1001, 17:50–63, 20:5–25. Patent Owner contends that “within . . . means entirely within as described in the specification.” Tr. 59:1–9. According to Petitioner, “[t]he claims do not require that the entirety of the primary brush/cleaning head lie within the housing perimeter.” Pet. Reply 17.

There is no dispute that the specification discloses embodiments with a primary brush entirely within the housing perimeter. *See* Ex. 1001, Figs. 2A, 3B. But Patent Owner does not identify disclosures expressly *requiring* that configuration. Thus, we do not view the specification as resolving the issue.

Patent Owner additionally relies on several dictionary definitions for “within” to support its view. PO Resp. 56 (citing Ex. 2019). Petitioner challenges those definitions as not requiring complete enclosure or relating to a different sense of the word. *See* Pet. Reply 18–19. We do not find the dictionary definitions helpful in this instance. As explained below, the claim language sufficiently informs our interpretation.

Patent Owner points to claim 55’s “round housing perimeter,” which must “allow the robot to freely turn when proximate to the obstacles encountered on the floor surface during a floor-cleaning operation.” PO Resp. 58 (quoting Ex. 1001, 20:13–16). Although, as Petitioner points out, that aspect of the round perimeter is not recited in claim 24, its presence

in claim 55 give context to the round perimeter and why a structure “within” the perimeter could not extend beyond the perimeter. Only if “within” requires a structure to be completely within the housing perimeter would the round perimeter allow the robot to freely turn when near obstacles.

Petitioner points to claim 56, which depends from claim 55 and further recites “the cleaning head comprises a powered primary brush assembly disposed within the housing perimeter and positioned to engage the floor surface.” *Id.* at 18 (quoting Ex. 1001, 20:30–33). Petitioner reasons that claim 56’s “disposed within” language would be superfluous if claim 55 already requires the entirety of the cleaning head to be within the perimeter. *Id.* Regardless of the “within” phrase, however, claim 56 would still include additional limitations beyond claim 55, and Patent Owner’s construction therefore does not render the entire claim superfluous. We read the repetition of “disposed within the housing perimeter,” although potentially superfluous, as reinforcing the location of claim 56’s primary brush assembly in contrast to the rotating side brush, which claim 55 requires “extending beyond the round housing perimeter.” *See* Ex. 1001, 20:17–33.

We determine that the claims are best understood to require that the primary brush assembly (claim 24) and cleaning head (claim 55) must be entirely within the round housing perimeter. We reach that construction because the claims use “within” to establish a relationship with the round perimeter, which identifies a boundary structure. The claims contrast other structures that extend beyond the perimeter, suggesting that structures “within” the perimeter cannot extend beyond the perimeter. And the specification’s embodiments are consistent with that understanding of “within” (albeit without expressly requiring it). Finally, claim 55’s recitation

of the purpose for the round housing perimeter (allowing free rotation near obstacles) supports our construction for “within.”

We determine additionally that no other claim term requires construction to resolve the parties’ disputes. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

D. OBVIOUSNESS OVER BISSET AND TOYODA

Petitioner relies on Bisset for most aspects of claim 1, relying on Toyoda for the claimed powered side brush. Pet. 22–35.

Bisset, entitled “Sensors Arrangement” (Ex. 1005, code (54)), “relates to an arrangement of sensors for an autonomous vehicle, particularly but not exclusively for an autonomous vacuum cleaner” (*id.* at 1:3–4). Bisset describes that autonomous vehicles generally have a plurality of sensors for detecting obstacles in the path of the vehicle to prevent collision or accidents. *Id.* at 1:6–7. Figure 1 of Bisset shows a perspective view of an automated vacuum cleaner and is reproduced below.

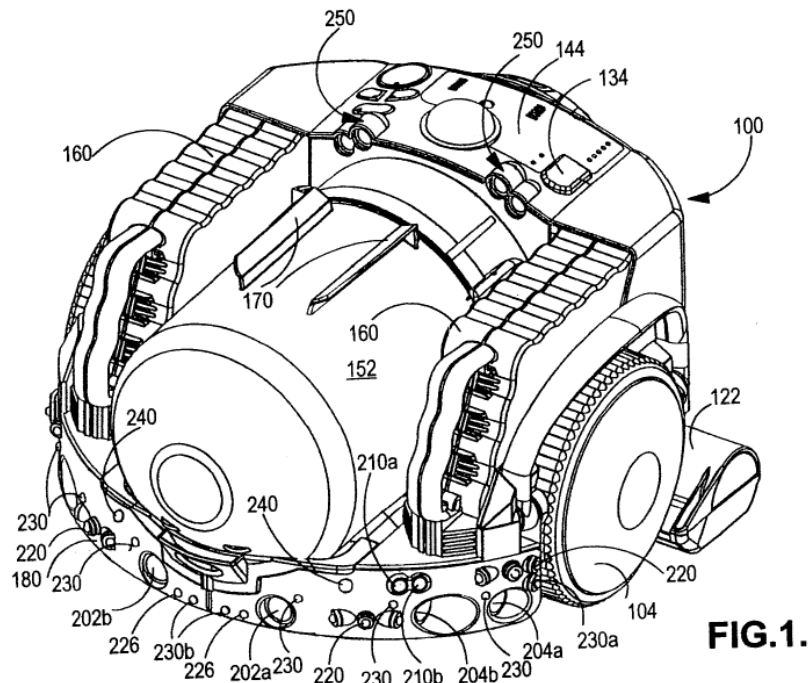


Figure 1 shows Bisset's vacuum cleaner 100, including cleaner head 122, cyclonic separator 152 for separating dirt and dust from the air drawn into the cleaner 100, battery packs 160, wheels 104, sensors 202a/b, 204a/b, and 210a/b. Ex. 1005 at 5:4–6:22.

Toyoda discloses a self-propelled cleaning robot, “with left and right side brushes for sweeping dirt in from a floor surface, and with a main brush on its main body center portion for taking swept-in dirt into a dust box.” Ex. 1007, code (54), ¶¶ 1, 5.

1. Modifying Bisset

Petitioner asserts that skilled artisans had reason to modify Bisset’s robot by adding side brushes “to improve the reach and cleaning ability of Bisset’s robot.” Pet. 14. Petitioner reasons that it “it was well known that side brushes improved the functionality of floor cleaners, including robotic vacuums.” Pet. 14 (citing Ex. 1003 ¶ 48). To that end, Petitioner identifies additional evidence that side brushes were understood “to enter corners and

crevices that cannot be reached by [the primary] brush . . . , and throw the dirt forward and inward so that it may be taken up when reached by [the primary] brush.” *Id.* (quoting Ex. 1010, 2:4–14); accord *id.* (citing Ex. 1032, 6, Fig. 2). Petitioner identifies further disclosures in the prior art that side brushes were used “to improve cleaning power close to walls or at room corners.” *Id.* (quoting Ex. 1012 ¶ 3). Petitioner identifies Toyoda as teaching powered side brushes that extend beyond the robot’s periphery. *Id.* at 15 (citing Ex. 1007, Figs. 7, 8; Ex. 1003 ¶ 50). Petitioner asserts that adding Toyoda’s side brushes “improves the corner and crevice-cleaning ability of Bisset’s robot” by extending outside the path of Bisset’s brush bar to provide added cleaning reach. *Id.* at 17 (citing Ex. 1003 ¶ 53).

Patent Owner asserts that Toyoda’s side brushes, when added to Bisset’s robot, would block Bisset’s downward-looking wheel sensors and render Bisset inoperable for its intended purpose. PO Resp. 11–29. According to Patent Owner, Bisset’s “downward facing sensors 274, 276, 278 and 280” are “required in order for Bisset to navigate properly” but would be blocked by the proposed side brushes. *Id.* at 13–14.

Bisset discloses that its downward-looking wheel sensors 274 and 276 are “provided in the chassis 102 immediately in front of each of the driven wheels 104.” Ex. 1005, 11:29–30. Each of Bisset’s claims includes the sensors. *Id.* at 17:5–6, 18:25, 19:6–7, 19:19–20; *see* PO Resp. 15. And Bisset uses independent circuits for the wheel sensors so that a failure of one circuit or sensor does not prevent operation of the remaining sensors. Ex. 1005, 12:9–12. Thus, we recognize that Bisset includes the wheel sensors as a significant aspect. *See* Inst. 19. Bisset discloses benefits from its approach—namely, that using wheel sensors “allows more flexibility in

controlling movement of the cleaning device” because it may continue to move even though the downward-looking sensor at the robot’s leading edge does not detect a surface. *Id.* at 2:1–4; *accord id.* at 1:19–23. That said, we do not agree with Patent Owner that eliminating Bisset’s wheel sensors would render Bisset inoperable.

Bisset discloses that prior-known robotic cleaning devices used downward-looking sensors to monitor the presence of a surface on which to travel. *Id.* at 1:10–12. It recognizes the known arrangement of a single such sensor at the forward edge of the device (*id.* at 1:14–17) and describes that the addition of downward-looking wheel sensors allows greater flexibility in maneuvering (*id.* at 1:19–2:4). Because prior cleaning robots used a single downward-looking sensor, we do not agree that limiting Bisset’s robot to its single downward-looking sensor 272 would render the robot inoperable. It is true that Bisset would lose the additional benefit provided by the downward-looking wheel sensors, but that benefit is one of improved flexibility, not the fundamental operation of a cleaning robot.

Bisset discloses that the forward sensor, like the wheel sensors, “is capable of detecting the presence or absence of the surface across which the cleaner 100 travels.” *Id.* at 12:3–5. As Petitioner points out, Bisset discloses an embodiment that “does not have a side downlooking sensor” and “senses edge 516 at the top of the staircase using its leading edge sensor.” *Id.* at 15:1–7, Figs. 14, 15. Thus, Bisset expressly contemplates a robot that avoids traveling past a drop off using just the single leading-edge sensor.

Further, Patent Owner points out that Bisset “relates to an arrangement of sensors for an autonomous vehicle.” PO Resp. 14 (quoting Ex. 1005, 1:3–4). Indeed, Bisset discloses using “a plurality of sensors

which are designed and arranged to detect obstacles in the path of the cleaner 100 and its proximity to, for example, a wall or other boundary such as a piece of furniture.” *Id.* at 5:10–12. A substantial portion of Bisset’s disclosures relate to a range of sensor types and positions such that the robot may detect obstacles. *Id.* at 6:30–11:24. As modified with side brushes in the manner Petitioner asserts, Bisset’s robot would retain the benefits of its broad sensor network.

Further, Bisset discloses a variety of downward-looking sensors as possible, including one mounted on an arm extending from the robot’s side. *Id.* 14:25–28; *see* Pet. Reply 11. Bisset’s disclosure of alternative downward-looking sensor configurations supports Dr. Prior’s statement that Bisset’s sensors could be repositioned to accommodate the addition of powered side brushes. *See* Ex. 1003 ¶ 88; Pet. Reply 10–11. Thus, Petitioner’s combination would not undermine Bisset’s ability to sense its surroundings, including the surface on which it travels. We find that the proposed combination would have remained operable for its intended purpose.

Patent Owner argues next that Petitioner fails to sufficiently justify modifying Bisset with either Toyoda or Ye. PO Resp. 30–41. According to Patent Owner, side brushes are unnecessary because “Bisset’s asymmetric brush roll is specifically designed to clean against the walls and in the corners of a room.” *Id.* at 30; *accord id.* at 34–36. We do not agree.

As the Petition demonstrates, the hard casing protruding from the robot’s body “would limit the reach of Bisset’s brush bar.” Pet. 18 (citing Ex. 1003 ¶¶ 57–58). Additionally, using an asymmetric brush to reach corners limits the navigation paths, as the robot has only one side that can

clean to a boundary. *Id.* at 18–19 (citing Ex. 1003 ¶ 57). Thus, we agree with Petitioner that adding Toyoda’s side brushes to Bisset’s robot would allow it to “effectively clean corners and edges on both sides of the robot” and would provide “a larger overall cleaning span, allowing the robot to collect more debris with each pass.” Pet. 19 (citing Ex. 1003 ¶ 58).

Although Patent Owner argues that similar benefits would have come from other approaches to modifying Bisset’s robot—extending Bisset’s main brush farther and having the brush extend out both sides of Bisset’s robot—(see PO Resp. 37), that does not persuade us the combination lacks sufficient motivation. As Petitioner points out, an alternative design does not undermine a reason to modify, because obviousness “does not require that the motivation be the best option, only that it be a suitable option from which the prior art did not teach away.” *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197–98 (emphasis omitted) (Fed. Cir. 2014) (citing *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)). We find that skilled artisans would have had reason to combine Toyoda’s powered side brushes with Bisset’s robot as Petitioner asserts.

Patent Owner argues that the Petition is deficient for lacking details about how to incorporate the accompanying structures that allow Toyoda’s side brushes to operate. PO Resp. 30–34. We do not agree that such detail was required. As Petitioner’s expert testified, side brushes were a conventional, known element. Ex. 1003 ¶ 59. It belies the notion of a skilled artisan to imagine that such a trained engineer would use Toyoda’s brushes without also using the structures and details required for them to operate. See PO Resp. 30–31. We conclude that skilled artisans would have understood

which of Toyoda's disclosed systems were required in order to implement Toyoda's powered brushes in Bisset's robot.

Patent Owner submits that implementing the proposed combination would have posed a challenge of high complexity, particularly in light of limited space available in Bisset's robot. PO Resp. 41–48. We do not agree. Patent Owner even admits that “a complete redesign” could allow the combination (*id.* at 47), and we see no reason that a complete redesign would be beyond the capabilities of skilled artisans. Moreover, we agree with Petitioner that Patent Owner's arguments overstate the challenge, by too heavily relying on Bisset's illustrations and imposing size constraints that Bisset does not. *See* Pet. Reply 3–4. Based on the foregoing, we conclude that skilled artisans would have had a reasonable expectation of success with the proposed modification.

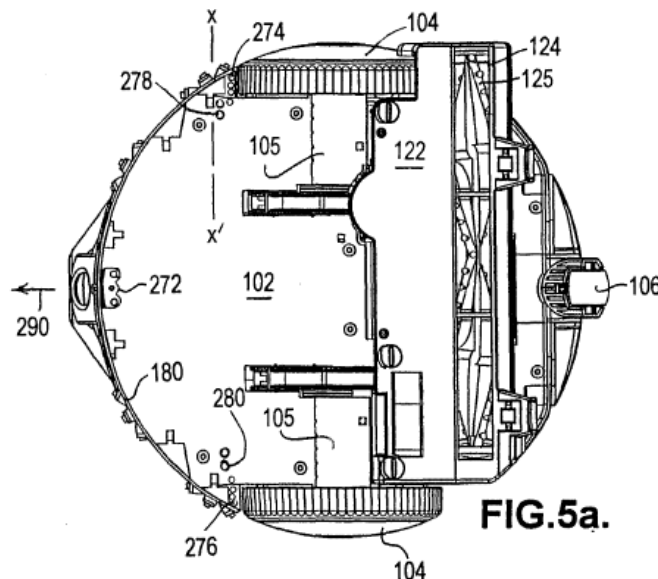
2. Claim 1

Petitioner provides contentions showing where each of claim 1's limitations is taught by Bisset or Toyoda. Pet. 22–35. Other than as discussed above, Patent Owner does not contest Petitioner's showing. *See* PO Resp. 9–48. We have reviewed the parties' contentions and the evidence presented and conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 1 would have been obvious over Bisset and Toyoda.

3. Claim 19

Claim 19 depends from claim 1, which recites “a wheeled housing defining a housing perimeter,” and further requires “the housing perimeter is round.” Petitioner submits that Bisset's robot satisfies the claim language because Bisset describes its chassis 102 or housing as “generally circular in

shape and is supported on two driven wheels 104 and a castor wheel 106.”
Pet. 22–23 (quoting Ex. 1005, 3:15–18, Figs. 5a), 51. Bisset’s Figure 5a is reproduced below.



Ex. 1005, 26. Figure 5a depicts an underneath view of Bisset’s robot, including chassis 102 and driven wheels 104, which “are arranged at either end of a diameter of the chassis 102, the diameter lying perpendicular to the longitudinal axis of the cleaner 100.” *Id.* at 2:25–26, 3:15–23.

Patent Owner argues that although the Petition maps Bisset’s chassis 102 to the claimed housing, Petitioner’s expert, Dr. Pryor, testified that a skilled artisan would identify the claimed “housing” as Bisset’s housing 142. PO Resp. 52–54 (citing Ex. 2020, 94:5–15, 96:4–19). Petitioner contests that interpretation of the testimony, arguing that Dr. Pryor was asked about the scope of “housing 142” within Bisset. Pet. Reply 16–17. We view the squabble about terminology as beside the point. The Petition unambiguously identifies Bisset’s chassis 102 with driven wheels 104 and a castor wheel 106 as the claimed wheeled housing. Pet. 51.

Patent Owner argues also that Bisset's chassis does not define a round housing perimeter. PO Resp. 55–61. According to Patent Owner, Petitioner cannot rely on the shape of Bisset's driven wheels as part of the structure defining the claimed "wheeled housing defining a [round] housing perimeter." We, however, agree with Petitioner that the mapping is appropriate, given that the claim language recites a *wheeled* housing. *See* Pet. Reply 16. Indeed, another limitation of claim 1 refers to "wheels of the housing," supporting that the wheels are properly considered part of the wheeled housing. Further, we agree with Petitioner that the claim language reads on Bisset's identified structures. *See* Pet. 23 (showing an annotated version of Bisset's Figure 5a indicating the round perimeter of the identified wheeled housing).

We have reviewed the parties' contentions and the evidence presented and conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 19 would have been obvious over Bisset and Toyoda.

4. Claims 24 and 55

Independent claim 24 recites "a housing defining a round housing perimeter" and "a powered primary brush assembly disposed within the round housing perimeter." Independent claim 55 similarly requires a housing defining a round housing perimeter and a "cleaning head disposed within the round housing perimeter."

Patent Owner argues that Bisset discloses neither a round housing nor a primary brush or cleaning head within a round housing perimeter. PO Resp. 52–60. Although, as discussed above regarding claim 19, we

conclude that Bisset discloses the claimed housing, we agree that its primary brush (or cleaning head) is not within the housing perimeter.

As discussed above, we construe “within” as requiring the primary brush or cleaning head not extend beyond the perimeter. *See supra* at § II.C, pp. 8–10. Under our construction for a structure “disposed within the round housing perimeter,” the disputed limitations do not read on Bisset’s brush bar.

Petitioner argues further that “[i]t would have thus been obvious to shorten the brush bar (and related components) to symmetrically position it within the housing perimeter.” Pet. 32, 57. Petitioner reasons that “Bisset’s brush bar configuration and position is simply a design choice, and the primary brush could also be located at the longitudinal center of the fore-aft axis, positioned generally between the wheels.” *Id.* at 32. Petitioner submits also that, in the asserted combination “Bisset’s protruding brush bar is unnecessary in view of the side brushes.” *Id.*

We conclude that Petitioner’s reasoning falls short. Bisset does not locate its brush bar as one of many possible choices with little functional significance—rather, it specifically discloses a brush bar that extends beyond the housing perimeter to permit an expanded cleaning reach. Ex. 1005, 5:4–8. Petitioner has not articulated a reason that skilled artisans would have changed that design. Even upon incorporating side brushes, a skilled artisan would need some reason to change the brush bar; it is not enough to simply state that the protruding brush bar is “unnecessary.”

Accordingly, we conclude that Petitioner has not shown by a preponderance of the evidence that claim 24 or claim 55 is unpatentable over Bisset and Toyoda. Because claims 25, 32–34, 37, 56, and 62 depend from

either claim 24 or claim 55, Petitioner also has not proven unpatentability of those claims.

5. Remaining claims

For claims 8–12, 16, 18, 22, and 23, Petitioner provides contentions showing how those claims’ limitations are taught by Bisset or Toyoda. Pet. 36–54. Other than as discussed, Patent Owner does not challenge those contentions. We have reviewed the parties’ contentions and the evidence presented and conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 8–12, 16, 18, 22, and 23 would have been obvious over Bisset and Toyoda.

E. OBVIOUSNESS OVER BISSET AND YE

Petitioner relies on Ye as an alternative disclosure for side brushes that skilled artisans would have had reason to use with Bisset’s robot. Ye, titled “Fully Automatic Cleaning Robot,” provides “a fully automatic cleaning robot that is under smart control by a computer; is capable of realizing timed start-up, cleaning, and vacuuming automatically; provides reminders and allows message-leaving; and can alternatively be controlled manually with an infrared remote control.” Ex. 1026, code (54), 3.¹¹ The robot comprises a vacuum cleaner, a walking apparatus configured to drive the movement of the vacuum cleaner, and an electric control portion. *Id.* at 1.

¹¹ Our citations to Ye use the branded page numbers at the bottom of the exhibit, which totals 15 pages.

Ye discloses “a left cleaning wheel 7, and a right cleaning wheel 9” (*id.* at 4), alternatively referred to as “left and right cleaning plates (7 and 9 in FIG. 4)” (*id.* at 5). Ye’s Figures 3 and 4 are reproduced below:

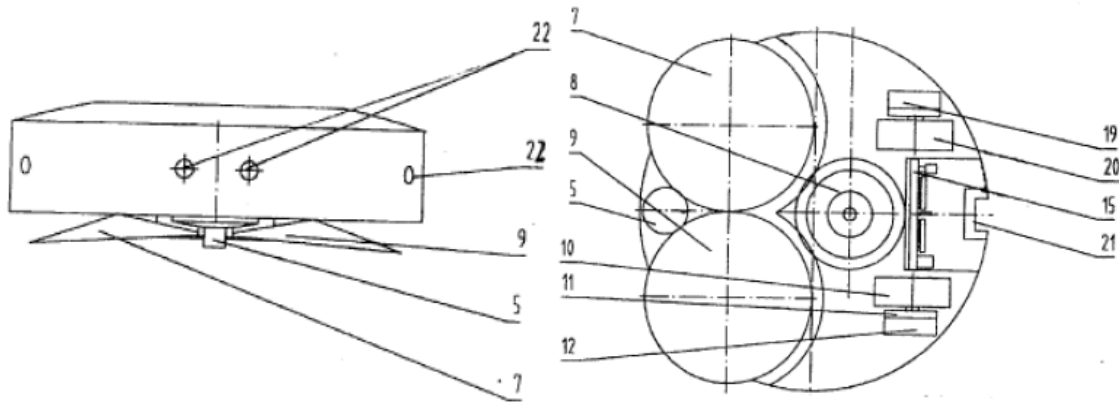


FIG. 3

FIG. 4

Id. at 11. Figure 3 depicts a side view of Ye’s robot and Figure 4 depicts a top cutaway view of the robot, both including left cleaning wheel 7 and right cleaning wheel 9. *Id.* at 4.

Patent Owner argues that Ye does not disclose the claimed “side brushes” because Ye’s cleaning plates are not brushes. PO Resp. 49. We agree that “plates” or “wheels” as disclosed by Ye are not necessarily brushes as claimed. Petitioner contends that its expert, Dr. Pryor, testified that skilled artisans would understand Ye’s “plates” or “wheels” to be side brushes. Pet. Reply 13. But Dr. Pryor testified in his deposition that Ye’s plates/wheels “can be construed as being side brushes for serving the purposes of the side brushes in the Ye patent” and that those labels “clearly refer to the items here that carry out the work of cleaning by rotating in the directions that push debris into the central region where the vacuum cleaner component would pick it up.” Ex. 2020, 238:11–239:13; *accord id.* at 240:22–241:2 (“these words that it uses are reasonable surrogates for what

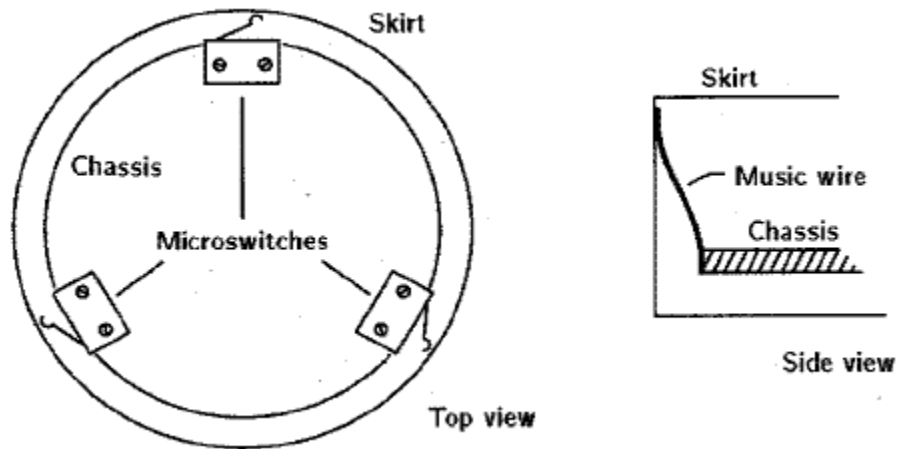
is obviously doing the work of cleaning as a brush”). That testimony confirms that Ye’s wheels perform the function of a brush, but does not support that the wheels are in fact brushes. We conclude that Petitioner has not established that Ye’s wheels are brushes. Accordingly, Petition has not shown by a preponderance of the evidence that the challenged claims are unpatentable over Bisset and Ye.

F. OBVIOUSNESS OVER BISSET, TOYODA, AND JONES

Petitioner asserts that the additional elements claims 14 and 36 were taught by Jones and that skilled artisan had reason to incorporate Jones’s teachings to the above combination of Bisset and Toyoda to arrive at the claims. Pet. 76–82. As claim 36 depends from claim 24, for which we have concluded Petitioner fails to prove unpatentability, we consider only claim 14 for the challenge including Jones.

Jones is a textbook about the “design and construction of mobile robots.” Ex. 1008, 8.¹² Jones discloses building systems, including a microprocessor and software to manage a large number of sensors. *Id.* at 2. Jones discloses that “[f]orce sensors can be used to determine when the robot is in contact with another object and where that object is in relation to the robot” and that “[s]uch information allows the robot to maneuver away from collisions.” Ex. 1008, 80. An excerpt from Jones’s Figure 5.21 is reproduced below.

¹² Our citations to Jones use the branded page numbers at the bottom of the exhibit, which totals 242 pages.



Id. Figure 5.21 depicts one approach to implementing a full-coverage, force-detecting bumper on a cylindrical robot, using three microswitches on the robot's perimeter to contact a movable skirt around the robot. *Id.*

Petitioner submits that skilled artisans had reason to modify Bisset's robot to include a force-detecting bumper and related sensor in light of Jones's statement that "force sensors have proven the most reliable, exhibit the lowest noise, and produce the most easily interpreted signal of all sensors." Pet. 77–78 (quoting Ex. 1008, 79–80 (emphasis omitted)). Petitioner reasons that, although Bisset's robot already included obstacle sensors, adding "a force-detecting bumper would provide a 'fail safe' for Bisset's obstacle sensors," which "could occasionally miss an obstacle or malfunction." Pet. 78 (citing Ex. 1008, 174 ("[I]t is helpful to use the bumper as a fail safe"), 192 ("[Mobile robots'] sensors are often in error:"); Ex. 1014, 4:19–22 ("When obstructions exist in the dead angles of the sensors 4A and 4C due to an orientation of the robot, the touch sensors 5 will sense them only if the bumpers 31-34 lightly touch them."); Ex. 1003 ¶ 143).

Patent Owner challenges Petitioner's contention, arguing that skilled artisans "would not have implemented the bumper-based sensor of Jones in Bisset as doing so would have fundamentally altered Bisset's principle of operation, namely using its large suite of contact-less sensors to make sure it 'has a good understanding of its environment.'" PO Resp. 62 (quoting Ex. 2020, 168:11–14). We do not agree. Petitioner provides a rational explanation of why skilled artisans would add a redundant system to Bisset's sensor array. Although Bisset uses redundancy among its infrared and ultrasonic sensors (Ex. 1005, 6:30–12:19; *see* PO Resp. 63–64), the mechanical nature of Jones's bumper sensor proposed by Petitioner would potentially detect conditions that may not trigger Bisset's native sensors. *See* Pet. Reply 22–23. Thus, we agree that Petitioner's proposed combination was supported by an adequate reason.

Patent Owner does not otherwise dispute Petitioner's showing regarding obviousness of claim 14 over Bisset, Toyoda, and Jones. We have reviewed the parties' contentions and the evidence presented and conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 14 would have been obvious over Bisset, Toyoda, and Jones.

G. OBVIOUSNESS OVER BISSET, TOYODA, AND HORST

Claim 16 depends from claim 1 and further recites "the side brush assembly comprises bristles extending from a driven hub." Claim 17 depends from claim 16 and further recites "the hub has laterally extending brush arms from which the bristles extend."

Petitioner asserts that the additional elements of claims 16 and 17 were taught by Horst and that skilled artisans had reason to incorporate

Horst's teachings to the above combination of Bisset and Toyoda to arrive at the claims. *Id.* at 82–87.

Horst “relates to rotary sweepers and is particularly suitable for use in poultry sheds.” Ex. 1015, 1:2–3. Horst discloses “a rotary sweeper including a central web member, a plurality of arms extending radially from said member, bristles on each said arm arranged along the longitudinal axis of the latter; and means for imparting rotary drive to said web member.” *Id.* at 1:12–17.

Patent Owner does not challenge Petitioner's contentions as to claim 16 but argues as to claim 17 that skilled artisans would not have looked to Horst because it is not analogous art. PO Resp. 64–65. Patent Owner submits that “Horst is directed to [a] large, manual industrial sweeper designed to clean animal droppings from poultry sheds and is in no way analogous or even relevant to robotic vacuum cleaners.” *Id.* at 64 (citing Ex. 1015, code (57), 1:1–10).

Petitioner responds that Horst “is generally directed to sweeping, debris collection, and improving the same with rotary brushes,” which is sufficient to establish analogous art. Pet. Reply 23 (quoting Pet. 82). Petitioner points out that the '511 patent lists sweeper references under its References Cited, and Ye's robot cites an industrial sweeper as prior art. Pet. Reply 24 (citing Ex. 1001, code (56) (listing Ex. 1038); Ex. 1026, 3 (listing Ex. 1032)). Petitioner also submits that “a rotary brush performs the same function (e.g., sweeping debris or refuse) in the same manner (rotating a brush), irrespective of whether it is robotic or what happens to the debris after it is swept.” Pet. Reply 24.

We agree with Petitioner that references describing sweepers and debris collection beyond the scope of robot vacuum cleaners are nonetheless reasonably pertinent to the problem facing the inventors of the '511 patent. Horst's sweeper discloses an approach to collecting debris from a large area with a rotating brush. That approach to the function of debris collection logically would have commended itself to artisan considering how to expand the reach of a robotic vacuum.

While we agree with Patent Owner that directly using Horst's "industrial-type brushes in a residential setting" may not be appropriate, we conclude that a skilled artisan considering the intended application would "adapt Horst's bristle arms and bristles, or more modern versions, for Bisset's modified robot." Ex. 1003 ¶ 154; *see KSR*, 550 U.S. at 421 ("A person of ordinary skill is also a person of ordinary creativity, not an automaton."); *In re ICON Health and Fitness, Inc.*, 496 F.3d 1374, 1382 (Fed. Cir. 2007) ("[W]e do not ignore the modifications that one skilled in the art would make to a device borrowed from the prior art.").

Patent Owner does not otherwise dispute Petitioner's showing regarding obviousness of claims 16 and 17 over Bisset, Toyoda, and Horst. We have reviewed the parties' contentions and the evidence presented and conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 16 and 17 would have been obvious over Bisset, Toyoda, and Horst.

III. CONCLUSION¹³

For the reasons discussed, we conclude:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 8–12, 16, 18, 19, 22–25, 32– 34, 37, 55, 56, 62	103	Bisset, Toyoda	1, 8–12, 16, 18, 19, 22, 23	24, 25, 32–34, 37, 55, 56, 62
1, 8–12, 16, 18, 19, 22–25, 32– 34, 37, 55, 56, 62	103	Bisset, Ye		1, 8–12, 16, 18, 19, 22–25, 32–34, 37, 55, 56, 62
14, 36	103	Bisset, Toyoda, Jones	14	36
14, 36	103	Bisset, Ye, Jones		14, 36
16, 17	103	Bisset, Toyoda, Horst	16, 17	
16, 17	103	Bisset, Ye, Horst		16, 17
Overall Outcome			1, 8–12, 14, 16–19, 22, 23	24, 25, 32–34, 36, 37, 55, 56, 62

¹³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Accordingly, it is

ORDERED that Petitioner has proven that claims 1, 8–12, 14, 16–19, 22 and 23 of the '511 patent are unpatentable;

FURTHER ORDERED that Petitioner has not proven that any of claims 24, 25, 32–34, 36, 37, 55, 56, or 62 of the '511 patent is unpatentable; and

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

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