

Petition ¹	Declaration ²
IV. INVALIDITY GROUNDS A. Ground 1A: Claims 1-2 Are Unpatentable over Durvasula and Fu-007. 1. Durvasula Durvasula (EX1014) is U.S. Patent Application Publication No. US20140015959A1 of Patent Owner's '918 Application that was published on January 16, 2014. Durvasula is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1) and pre-AIA 35 U.S.C. §102(b). <i>See</i> §III.C; Janét, ¶97. Durvasula discloses a pool cleaning system and contains technical features that are identical or similar to those of the '191 Patent and is analogous art with respect to Claims 1-3 of the '191 Patent. Janét, ¶98. 2. Fu-007	VII. INVALIDITY GROUNDS A. Ground 1A: Claims 1-2 Are Unpatentable under AIA 35 U.S.C. §103 over Durvasula with Fu-007. 1. Durvasula 97. Durvasula (EX1014) is U.S. Patent Application Publication No. US20140015959A1 of Patent Owner's '918 Application that was published on January 16, 2014. Durvasula is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1) because it was published more than one year before its effective filing date which is no earlier than July 11, 2016. <i>See</i> §VI.C, <i>supra</i>. Additionally, Durvasula is also prior art under pre-AIA 35 U.S.C. §102(b). 98. Durvasula discloses a pool cleaning system and contains technical features that, in my opinion, are identical or similar to those of the '191 Patent and is analogous art with respect to Claims 1-3 of the '191 Patent. 2. Fu-007 99. Fu-007 (EX1007) is Chinese Patent Application Publication No. CN101139007A published on March 12, 2008 and is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1). In

¹ The background section on the Patent and the Priority date are also identical but they are not included in this exhibit, only the substantive arguments are.

² Additions/differences in the Declaration are highlighted, as all the content in the petition can be found in the declaration. All differences are minimal and non-substantive, usually nothing more than additional parentheticals or citations.

Fu-007 (EX1007) discloses an underwater cleaning robot for swimming pools using camera-based control. Fu-007, Abstract, pp.8-10, 14-16, Claims 1, 4. Fu-007 is analogue art with respect to the subject matter of Claims 1-3 of the '191 Patent. Janét, ¶¶99-100. Fu-007's robot includes a control system with a central processing unit (controller) housed in control system enclosure 8. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1-2 (annotated below). [omitted image] Control system enclosure 8 is housed within a sealed drive control enclosure, which is "installed on and fixed to the interior of the robot main shell 19...to sealingly enclose the control system components" and has "waterproof properties." Fu-007, pp.8-9, 12-14, Claim 4, FIG. 4 (annotated below). [omitted image] Fu-007's robot also includes monitoring camera 2 "installed on two front panels of the robot main shell 19" and connected to the central processing unit via image acquisition card. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1, 4, 6 (annotated). [omitted images]	addition, Fu-007 is also prior art under pre-AIA 35 U.S.C. §102(b). 100. Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. Fu-007, Abstract, pp.8-103, 14-16, Claims 1, 4. In my opinion, Fu-007 is analogue art with respect to the subject matter of Claims 1-3 of the '191 Patent. 101. Fu-007's robot includes a control system with a central processing unit (controller) housed in control system enclosure 8. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1-2 (annotated below). [omitted image] 102. Control system enclosure 8 is housed within a sealed drive control enclosure, which is "installed on and fixed to the interior of the robot main shell 19...to sealingly enclose the control system components" and has "waterproof properties." Fu-007, pp.8-9, 12-14, Claim 4, FIG. 4 (annotated below). [omitted image] 103. Fu-007's robot also includes monitoring camera 2 "installed on two front panels of the robot main shell 19" and connected to the central processing unit via image acquisition card. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1, 4, 6 (annotated). [omitted images] 104. Fu-007's control system enclosure 8 is "provided with both a power input interface and a rechargeable battery box, allowing the robot to be powered either externally or by the battery box." Fu-007, pp.8-9, 12-14, Claim 4. During autonomous cleaning,
--	---

Fu-007's central processing unit generates control signals based on images from monitoring camera 2—the robot “determines a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold, and plans a cleaning movement...to complete the cleaning task.” Fu-007, p.10, 14-16, Claim 7. Fu-007's robot may operate “powered by the battery box,” enabling untethered operation. Fu-007, pp.8-10, 12-14, Claims 4-5.

3. Motivation to Combine

Both Durvasula and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve systems.

Durvasula describes vehicle 30 as “an automated powered device” that autonomously cleans pool surfaces. Durvasula, [0014]. Fu-007 similarly describes an underwater cleaning robot that can “help and even replace humans to autonomously complete underwater cleaning work.” Fu-007, p.11. A POSITA would have been motivated to combine the complementary teachings of Durvasula and Fu-007 to achieve improved systems. Janét, ¶105.

A POSITA would have recognized that the teachings in Durvasula and Fu-007 are directed to the same pool cleaning technical field and provide similar technical solutions to address similar technical issues. Janét, ¶106.

Specifically, both use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body within the swimming pool. *Compare* Durvasula, [0020], [0022]-[0023], *with* Fu-007, pp.10, 14-16, Claims 4, 7. Accordingly, a POSITA would have investigated the technical

Fu-007's central processing unit generates control signals based on images from monitoring camera 2—the robot “determines a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold, and plans a cleaning movement...to complete the cleaning task.” Fu-007, p.10, 14-16, Claim 7. Fu-007's robot may operate “powered by the battery box,” enabling untethered operation. Fu-007, pp.8-10, 12-14, Claims 4-5.

3. Reasons for Combining Durvasula and Fu-007

105. Both Durvasula and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve **autonomous pool cleaning operations**.

Durvasula describes vehicle 30 as “an automated powered device” that autonomously cleans pool surfaces. Durvasula, [0014]. Fu-007 similarly describes an underwater cleaning robot that can “help and even replace humans to autonomously complete underwater cleaning work.” Fu-007, p.11. A POSITA would have been motivated to combine the complementary teachings of Durvasula and Fu-007 to achieve improved **autonomous pool cleaning operations**.

106. A POSITA would have recognized that the teachings in Durvasula and Fu-007 are directed to the same pool cleaning technical field, **are based on recognition of the same or similar technical issues in pool cleaning**, and provide similar technical **solutions to address those** issues. Specifically, both references use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body within the swimming pool. *Compare* Durvasula, [0020], [0022]-[0023], *with* Fu-007, pp.10, 14–16, Claims 4, 7. Accordingly, a POSITA would have investigated the technical teachings in both

teachings in both to seek guidance when designing a pool cleaning system. Janét, ¶106.

Durvasula teaches placing the controller outside the pool in a tethered configuration, or a remote server or portable electronic device (PED) in a wireless configuration (Durvasula, [0013]-[0039], [0045]-[0046], FIGS. 1-5, 9, Claims 2-4, 10). Fu-007 teaches placing its controller within the cleaning vehicle in a sealed drive control enclosure. Fu-007, pp.8-9, 12-14, Claim 4. A POSITA would have been motivated to modify Durvasula by substituting Durvasula's external controller with Fu-007's onboard controller structure for the following reasons.

First, a POSITA would have been guided by Durvasula and Fu-007 to make such combination to advance Durvasula's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Janét, ¶108. Durvasula's reliance on an external controller and tether constrains autonomy by limiting range and often requiring human intervention to manage cable entanglements. *Id.* Fu-007 teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller, the modified system would have enhanced autonomous operations—generating control signals onboard to plan paths and complete cleaning tasks without requiring human supervision or corresponding data transmission

Durvasula and Fu-007 to seek guidance when designing a pool cleaning system **for specific pool cleaning considerations and applications.**

107. Durvasula teaches placing the controller in a dry station outside the pool in a tethered configuration, or a remote server or portable electronic device (PED) in a wireless configuration (Durvasula, [0013]-[0039], [0045]-[0046], FIGS. 1-5, 9, Claims 2-4, 10). Fu-007 teaches placing its controller within the cleaning **and moving platform as part of a** sealed drive control enclosure **suitable for underwater operation.** Fu-007, pp.8-9, 12-14, Claim 4. A POSITA would have been motivated to modify Durvasula by substituting Durvasula's external controller with Fu-007's onboard controller structure for at least two reasons.

108. First, a POSITA would have been guided by Durvasula and Fu-007 to make such a combination to advance Durvasula's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Durvasula's reliance on an external controller and tether constrains autonomy by limiting range and often requiring human intervention to manage cable entanglements. Fu-007 explicitly teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller, the modified system would have enhanced autonomous operations—generating control signals onboard to plan paths and complete cleaning tasks without requiring human supervision or corresponding transmission of data **(e.g., images, control signals)** between the underwater cleaner and an external controller located outside the water **(in a dry station, a remote server, or a portable electronic device (Durvasula, [0013]-**

between the underwater cleaner and an external controller. Cui, pp.5-6; Janét, ¶108.

Additionally, removing the external tether would allow the vehicle to navigate freely without cable constraints. *Id.*

Second, a POSITA would have been motivated to adopt this modification to further improve the safety of Durvasula's system. Janét, ¶109. Durvasula discloses a tethered configuration that transmits both control signals and power to the vehicle through an external cable. Durvasula, [0045], FIG.9; *see also id.*, [0025] ("dry station 46 further provides electrical power to vehicle 30 in a wired fashion"), [0029] ("dry station 246 further provides part of vehicle 30 across a wired cable or wired connection"). A POSITA would have recognized that tethered systems introduce safety risks by requiring a physical electrical connection between shore-side components and the submerged cleaner, creating potential pathways for electrical leakage. Janét, ¶109.

A POSITA would have further recognized that this risk is exacerbated in swimming pool environments, where dissolved chemicals increase water conductivity and thus the potential for electrical current to reach pool users. Janét, ¶109.

[0039], [0045]-[0046], FIGS. 1-5, 9, Claims 2-4, 10)).

Additionally, removing the external tether would allow the vehicle to navigate freely without cable management constraints. Durvasula's cable can become tangled with pool features such as ladders, drains, and return fittings during cleaning operations, potentially interrupting the cleaning cycle and requiring user intervention. Fu-007's tetherless design avoids these complications, allowing the robot to navigate complex pool geometries without obstruction. Fu-007, pp.9-10, 14. Even if a power tether were retained, relocating the controller onboard would eliminate or reduce the need for signal transmission through the tether, reducing its diameter and mass and resulting in less hydrodynamic drag and impedance to movement.

109. Second, a POSITA would have been motivated to adopt this modification to further improve the safety of Durvasula's system. Durvasula discloses a tethered configuration that transmits both control signals and power to the vehicle through an external cable. Durvasula, [0045], FIG.9. *See also id.*, [0025] ("dry station 46 further provides electrical power to vehicle 30 in a wired fashion"), [0029] ("dry station 246 further provides part of vehicle 30 across a wired cable or wired connection"). A POSITA would have recognized that tethered systems introduce safety risks by requiring a physical electrical connection between shoreside components and the submerged cleaner, creating potential pathways for electrical leakage into the swimming pool environment if cable insulation wears down or connections become compromised. A POSITA would have further recognized that this risk is exacerbated in swimming pool environments, where dissolved chemicals (e.g., chlorine, calcium, pH balancers, algaecides) increase water conductivity and thus the potential for electrical current to reach pool users.

Fu-007 teaches a safer architecture that eliminates the external tether, including the power cable. Fu-007 discloses a “sealed drive control enclosure” with “waterproof properties” that houses the controller entirely inside the robot, and a “rechargeable battery box” that allows the robot to operate “without using the signal relay and cable manager 28 and the signal and power cable 33.” Fu-007, pp.8-9, 12-14, Claim 4. A POSITA would have been motivated to replace Durvasula’s tethered controller configuration with Fu-007’s onboard, sealed, battery-powered architecture, because this modification would have eliminated the need for external cables entering the water—including power cables—thereby removing the primary pathway for electrical leakage and enhancing the overall safety. Janét, ¶110.

A POSITA would have had a reasonable expectation of success in making this combination, because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots. *See, e.g.*, Fu-007, pp.8-10. *See also* Knoll, [0007], [0027]-[0028], FIG.1 (showing control unit 11 inside the vehicle, as explained in §§IV.E.1-IV.E.2); Renaud (EX1015), [0008]-[0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner, as explained in §§IV.F.1-IV.F.2); Janét, ¶111.

Additionally, Fu-007’s onboard controller is already configured to execute image-based cleaning tasks similar to Durvasula’s—

110. Fu-007 teaches a safer architecture that eliminates the external tether, including the power cable. Fu-007 discloses a “sealed drive control enclosure” with “waterproof properties” that houses the controller entirely inside the robot, and a “rechargeable battery box” that allows the robot to operate “without using the signal relay and cable manager 28 and the signal and power cable 33.” Fu-007, pp.8–9, 12–14, Claim 4. A POSITA would have been motivated to replace Durvasula’s tethered controller configuration with Fu-007’s onboard, sealed, battery-powered architecture, because this modification would have eliminated the need for external cables entering the water—including power cables—thereby removing the primary pathway for electrical leakage and enhancing the overall safety **profile of the device for pool users.**

111. A POSITA would have had a reasonable expectation of success in making this combination because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots, as shown by the teachings in Fu-007. *See, e.g.*, Fu-007, pp.8–10. *See also* Knoll, [0007], [0027]-[0028], FIG.1 (showing control unit 11 inside the vehicle that receives images from camera 6, processes the images, and controls the drive means 12 accordingly, as explained in §§VII.E.1-VII.E.2); Renaud (EX1015), [0008], [0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner that receives images from a vision system, processes the images to identify debris, and actuates the motor to direct the cleaner to the debris, as explained in §§VII.F.1-VII.F.2).

Additionally, Fu-007’s onboard controller is already configured to execute imagebased cleaning tasks similar to Durvasula’s—analyzing captured images and generating drive signals to control the vehicle’s movement. Fu-007, pp.8–10, 14–16. A POSITA would have reasonably expected that Fu-007’s

analyzing captured images and generating drive signals to control the vehicle's movement. Fu-007, pp.8-10, 14-16. A POSITA would have reasonably expected that Fu-007's controller would implement Durvasula's specific control logic (Durvasula, [0020], [0022]-[0023]), thereby yielding predictable results. Janét, ¶111.

4. Claim 1 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render Claim 1 obvious. Janét, ¶¶112-136.

a. 1[pre] "A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising"

Durvasula discloses or suggests 1[pre]. Janét, ¶¶113-116.

Durvasula discloses a "pool cleaner" by disclosing a pool cleaning vehicle as part of a pool cleaning system. Durvasula, FIGS. 1-10 and [0002]-[0012].

Durvasula describes "[v]ehicle 30 comprises an automated powered device configured to **travel adjacent to submerged or water containing surfaces of pool 20...while cleaning such surfaces**" and "[v]ehicle 830 comprises a robotic or automated **pool cleaning device...to systematically clean surfaces of pool 22.**" Durvasula, [0014], [0046], FIGS. 1, 9 (annotated below); *see also id.*, [0031], [0045], Abstract, Claims 1, 17; Janét, ¶114.

controller could implement Durvasula's specific control logic (e.g., processing images to steer toward missed portions; Durvasula, [0020], [0022]-[0023]), thereby yielding predictable results.

4. Claim 1 Unpatentable over Durvasula and Fu-007

112. In my opinion, Durvasula and Fu-007 render Claim 1 obvious.

a. 1[pre] "A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising"

113. In my opinion, Durvasula discloses or suggests 1[pre].

114. Durvasula discloses a "pool cleaner" by disclosing a pool cleaning vehicle as part of a pool cleaning system. Durvasula, FIGS. 1-10 and [0002]-[0012].

Durvasula describes "[v]ehicle 30 comprises an automated powered device configured to **travel adjacent to submerged or water containing surfaces of pool 20...while cleaning such surfaces**" and "[v]ehicle 830 comprises a robotic or automated **pool cleaning device...to systematically clean surfaces of pool 22.**" Durvasula, [0014], [0046], FIGS. 1, 9 (annotated below). *See also* Durvasula, [0031] ("wherein controller 42 generates control signals for steering **the pool cleaning vehicle 30 of system 320**"), [0045] ("Pool cleaning system 820 is similar to pool cleaning system 520 except the pool cleaning system 820 located controller 42 in dry station 246 and includes **pool cleaning vehicle 830, a specific example of vehicle 30**"),

[omitted image] Durvasula discloses its pool cleaning vehicle as a “self-propelled” pool cleaner: “[v]ehicle 30 comprises an automated powered device,” “includes one or more propulsion mechanisms” to “move along the submerged surfaces of pool 22,” and “[c]ontroller 42 is configured to generate control signals for steering vehicle 30.” Durvasula, [0014], [0016], [0022], FIG. 1 (annotated above); <i>see also id.</i>, [0023], [0026], [0030]-[0031], [0034], FIGS. 2-10; Janét, ¶115. Durvasula discloses its pool cleaning vehicle 30 as a pool cleaner “cleaning debris from a submerged surface of a swimming pool.” <i>See, e.g.</i>, Durvasula, [0014] (“[V]ehicle 30 may include vacuum or suction devices, a liquid circulation system and a filter to draw debris, such as bacterial growth or plant growth, from such pool surfaces, wherein the drawn liquid containing such residue or foreign matter is filtered to collect the debris.”); <i>see also id.</i> [0015]-[0016], [0046], FIGS. 9-10 (annotated below)). [omitted images]	Abstract (“A pool cleaning system utilizes a powered robotic surface cleaning vehicle”), Claims 1, 17. [omitted image] 115. Durvasula discloses its pool cleaning vehicle as a “self-propelled” pool cleaner: “[v]ehicle 30 comprises an automated powered device,” “includes one or more propulsion mechanisms” to “move along the submerged surfaces of pool 22,” and “[c]ontroller 42 is configured to generate control signals for steering vehicle 30.” Durvasula, [0014], [0016], [0022], FIG. 1 (annotated above); <i>see also id.</i>, [0023], [0026], [0030]-[0031], [0034], FIGS. 2-10. 116. Durvasula discloses its pool cleaning vehicle 30 as a pool cleaner “cleaning debris from a submerged surface of a swimming pool” throughout its description, including, e.g., “vehicle 30 may include vacuum or suction devices, a liquid circulation system and a filter to draw debris, such as bacterial growth or plant growth, from such pool surfaces, wherein the drawn liquid containing such residue or foreign matter is filtered to collect the debris.” (Durvasula, [0014]; <i>see also id.</i> [0015]-[0016]); “[v]ehicle 830 comprises a robotic or automated pool cleaning device...to systematically clean surfaces of pool 22” and “[v]ehicle 830 comprises rotating brushes 902 to loosen waterline buildup and breakdown large debris” (Durvasula, [0046], FIGS. 9-10 (annotated below)). [omitted images] b. 1[a] “a. a vehicle body” 117. In my opinion, Durvasula discloses or suggests 1[a].
--	--

b. 1[a] “a. a vehicle body”

Durvasula discloses or suggests 1[a]. Janét, ¶¶117-118.

Durvasula discloses vehicle 30/830 as a vehicle body. Durvasula, [0014]-[0015], [0046], Claims 1, 17, FIGS. 1 (annotated below), 2-5, 9 (annotated below), 10. A POSITA would have understood vehicle 30/830 that travels within the pool is the claimed “vehicle body.” Janét, ¶118.

[omitted images]

c. 1[b] “b. means for moving the vehicle body within the swimming pool”

Durvasula discloses or suggests 1[b]. Janét, ¶¶119-121.

The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function for the claimed “means for” is “moving the vehicle body within the swimming pool,” and the corresponding structure includes “wheels, rollers, tracks, or other surface contacting members powered by a motor.” EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶120.

Durvasula discloses identical functionality and corresponding structure disclosed in the ’191 Patent. Janét, ¶121. **Function:** *see, e.g.,* Durvasula, [0014] (“[v]ehicle 30 comprises an automated powered device configured to **travel** adjacent to submerged or water containing surfaces of **pool 20**”); *see also id.*, Abstract, [0016], [0023], Claims 1, 17, FIGS. 9-10. **Structure:** *see, e.g., id.*, [0016] (“vehicle 30 is propelled along

118. Durvasula discloses vehicle 30/830 as a vehicle body. Durvasula, [0014]-[0015], [0046], Claims 1, 17, FIGS. 1 (annotated below), 2-5, 9 (annotated below), 10. A POSITA would have understood vehicle 30/830 that travels within the pool is the claimed “vehicle body.”

[omitted images]

c. 1[b] “b. means for moving the vehicle body within the swimming pool”

119. In my opinion, Durvasula discloses or suggests 1[b].

120. In my opinion, the format and content of 1[b] invoke claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §VI.D, the recited function for the claimed “means for” is “moving the vehicle body within the swimming pool,” and the corresponding structure in the description of the ’191 Patent is “wheels, rollers, tracks, or other surface contacting members powered by a motor.” EX1001, 3:31-43, 10:12-14, FIGS. 9-10.

121. In my opinion, Durvasula discloses identical functionality and corresponding structure disclosed in the ’191 Patent.

Function: *see, e.g.,* Durvasula, [0014] (“[v]ehicle 30 comprises an automated powered device configured to **travel** adjacent to submerged or water containing surfaces of **pool 20**”); *see also id.*, Abstract, [0016], [0023], Claims 1, 17, FIGS. 9-10.

Structure: *see, e.g., id.*, [0016] (“vehicle 30 is propelled along the submerged pool surfaces using **wheels, rollers, tracks or other surface contacting members powered by a motor**”); *see also id.*, [0046], FIGS. 9-10 (annotated below).

the submerged pool surfaces using wheels, rollers, tracks or other surface contacting members powered by a motor"); <i>see also id.</i>, [0046], FIGS. 9-10 (annotated below). [omitted images] d. 1[c] "c. a filter configured to retain debris collected from the submerged surface;" Durvasula discloses "a filter configured to retain debris" because Durvasula describes "vehicle 30 may include...a filter to draw debris" and an "internally housed filter bag" through which "loosened dirt and debris" is filtered. <i>Id.</i>, [0014], [0046]; Janét, ¶122. e. 1[d] "d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and" Durvasula discloses cameras 32 that are "configured to capture images of submerged surfaces 26, 28 of pool 22," and "cameras 32 may...be mounted to vehicle 30." Durvasula, [0013]-[0014], [0017]; Janét, ¶123. f. 1[e][i] "e. a controller (i) positioned on or in the body" The Durvasula-Fu-007 combination discloses or suggests 1[e][i]. Janét, ¶¶124-128. Durvasula discloses a controller. Janét, ¶125. Specifically, Durvasula describes controller 42 that "is in communication with vehicle 30 and cameras 32" and "is configured to generate control signals for steering vehicle 30." Durvasula, [0020],	[omitted images] d. 1[c] "c. a filter configured to retain debris collected from the submerged surface;" 122. In my opinion, Durvasula discloses "a filter configured to retain debris" because Durvasula describes "vehicle 30 may include...a filter to draw debris" and an "internally housed filter bag" through which "loosened dirt and debris" is filtered. <i>Id.</i>, [0014], [0046]. e. 1[d] "d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and" 123. In my opinion, Durvasula discloses cameras 32 that are "configured to capture images of submerged surfaces 26, 28 of pool 22," and "cameras 32 may...be mounted to vehicle 30." Durvasula, [0013]-[0014], [0017]. f. 1[e][i] "e. a controller (i) positioned on or in the body" 124. In my opinion, the Durvasula-Fu-007 combination discloses or suggests 1[e][i]. 125. Durvasula discloses a controller. Specifically, Durvasula describes controller 42 that "is in communication with vehicle 30 and cameras 32" and "is configured to generate control signals for steering vehicle 30." Durvasula, [0020], [0022]. Durvasula further describes that controller 42 "utilizes signals from camera 32 to steer vehicle 30" to "cover such missed
---	---

[0022]. Durvasula further describes that controller 42 “utilizes signals from camera 32 to steer vehicle 30” to “cover such missed portions” and “to re-clean such portions until such portions have been satisfactorily cleaned.” Durvasula, [0023].

As explained in §III.C.1 regarding the relationship between the ’918 Application and the ’191 Patent in connection with the claimed priority to the ’918 Application, Durvasula, the patent publication of the ’918 Application, fails to disclose that its controller is “positioned on or in the body.” *See also* Janét, ¶126.

Like Durvasula, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. *See* §IV.A.2. Like Durvasula, Fu-007 uses a controller to generate, in response to the captured image, at least one control signal to cause movement of the pool cleaning body within the swimming pool. Janét, ¶127. Specifically, Fu-007’s system includes monitoring camera 2, image acquisition card, central processing unit (controller) housed in control system enclosure 8, and cleaning and moving platform with independently controllable cleaning drive wheels 3 and drainage devices. Fu-007, pp.12-14, Claims 1, 3, FIGS.1-2 (annotated below); Janét, ¶127. Similar to the teaching in Durvasula for moving the pool cleaning vehicle, Fu-007 teaches the use of cleaning drive wheels, synchronous belt gears, and synchronous drive belts as part of a cleaning and moving platform to cause and control the movement of the platform during the pool cleaning operation. Fu-007, pp.8-9, 12-14, Claims 1, 3.

For the reasons explained in §IV.A.3, a POSITA would have been motivated to modify Durvasula by substituting Durvasula’s external controller with Fu-007’s onboard controller structure. Janét, ¶128. The modified system incorporates Fu-007’s central

portions” and “to re-clean such portions until such portions have been satisfactorily cleaned.” Durvasula, [0023].

126. As explained in §VI.C.1 regarding the relationship between the ’918 Application and the ’191 Patent in connection with the claimed priority to the ’918 Application, Durvasula, the patent publication of the ’918 Application, fails to disclose that its controller is “positioned on or in the body.”

127. Like Durvasula, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. *See* §VII.A.2. Like Durvasula, Fu-007 uses a controller to generate, in response to the captured image, at least one control signal to cause movement of the pool cleaning body within the swimming pool. Specifically, Fu-007’s system includes monitoring camera 2, image acquisition card, central processing unit (controller) housed in control system enclosure 8, and cleaning and moving platform with independently controllable cleaning drive wheels 3 and drainage devices. Fu-007, pp.12-14, Claims 1, 3, FIGS.1-2 (annotated below). Similar to the teaching in Durvasula for moving the pool cleaning vehicle, Fu-007 teaches the use of cleaning drive wheels, synchronous belt gears, and synchronous drive belts as part of a cleaning and moving platform to cause and control the movement of the platform during the pool cleaning operation. Fu-007, pp.8-9, 12-14, Claims 1, 3.

128. For the reasons explained in §VII.A.3, a POSITA would have been motivated to modify Durvasula by substituting Durvasula’s external controller with Fu-007’s onboard controller structure. The modified system incorporates Fu-007’s central processing unit (controller), which is housed in the “sealed drive control enclosure” inside Durvasula’s vehicle. In such modified

processing unit (controller), which is housed in the “sealed drive control enclosure” inside Durvasula’s vehicle. *Id.* In such modified system, Fu-007’s onboard controller within the cleaning and moving platform would be in electronic communication with Durvasula’s camera mounted to the vehicle body via onboard connection (per Fu-007’s image acquisition card; pp.12-14), powered by an onboard power source (per Fu-007’s rechargeable battery box; pp.12-14), and generates control signals for steering the vehicle based on camera-captured images to clean or re-clean portions of the pool (per Durvasula’s control logic). Janét, ¶128.

g. 1[e][ii] “(ii) in electronic communication with the at least one camera, and”

Durvasula-Fu-007 combination discloses or suggests 1[e][ii]. Janét, ¶¶129-131.

Durvasula describes controller 42 “communicates with...cameras 32...across a wired connection,” “across a wireless connection,” or “using a combination of both wired and wireless communication connections,” and “utilizes signals from camera 32 to steer vehicle 30.” Durvasula, [0020]-[0021], [0023]; Janét, ¶130.

As explained in §IV.A.3, §IV.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula’s system by substituting Durvasula’s external controller with an onboard controller structure taught by Fu-007, where the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007’s internal connection architecture (specifically, the camera

system, Fu-007’s onboard controller within the cleaning and moving platform would be in electronic communication with Durvasula’s camera mounted to the vehicle body via onboard connection (per Fu-007’s image acquisition card; pp.12–14), powered by an onboard power source (per Fu-007’s rechargeable battery box; pp.12–14), and generates control signals for steering the vehicle based on camera-captured images to clean or re-clean portions of the pool (per Durvasula’s control logic).

g. 1[e][ii] “(ii) in electronic communication with the at least one camera, and”

129. It is my opinion, Durvasula-Fu-007 combination discloses or suggests 1[e][ii].

130. Durvasula describes controller 42 “communicates with...cameras 32...across a wired connection,” “across a wireless connection,” or “using a combination of both wired and wireless communication connections,” and “utilizes signals from camera 32 to steer vehicle 30.” Durvasula, [0020]-[0021], [0023].

131. As explained in §VII.A.3, §VII.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula’s system by substituting Durvasula’s external controller with an onboard controller structure taught by Fu-007, where the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007’s internal connection architecture (specifically, the camera connects to the central processing unit via an “image acquisition card”). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6.

connects to the central processing unit via an “image acquisition card”). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶131.

h. 1[e][iii] “(iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.”

The Durvasula-Fu-007 combination discloses or suggests 1[e][iii]. Janét, ¶¶132-135.

Specifically, Durvasula’s controller 42 generates control signals “in response to the captured image” because controller 42 identifies a portion requiring cleaning or re-cleaning based on “signals from camera 32,” and steers vehicle 30 accordingly. Durvasula, [0022]-[0023]; Janét, ¶133. Durvasula further discloses generating control signals to cause movement “to...the first portion of the submerged surface” because Durvasula’s controller 42 steers vehicle 30 to “cover such missed portions” and to “re-clean such portions until such portions have been satisfactorily cleaned”—i.e., to the first portion identified from the captured image. Durvasula, [0023]; *see also id.*, [0026], [0044]; Janét, ¶133.

As explained in §IV.A.3, §IV.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula’s system to use Fu-007’s onboard controller structure configured to execute Durvasula’s control logic, including generating control signals to cause the body movement “to...the first portion of the submerged surface” in response to the captured image described above. Janét, ¶134.

h. 1[e][iii] “(iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.”

132. In my opinion, the Durvasula-Fu-007 combination discloses or suggests 1[e][iii].

133. Specifically, Durvasula’s controller 42 generates control signals “in response to the captured image” because controller 42 identifies a portion requiring cleaning or re-cleaning based on “signals from camera 32,” and steers vehicle 30 accordingly. Durvasula, [0022]-[0023]. Durvasula further discloses generating control signals to cause movement “to...the first portion of the submerged surface” because Durvasula’s controller 42 steers vehicle 30 to “cover such missed portions” and to “re-clean such portions until such portions have been satisfactorily cleaned”—i.e., to the first portion identified from the captured image. Durvasula, [0023]; *see also id.*, [0026], [0044].

134. As explained in §VII.A.3, §VII.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula’s system to use Fu-007’s onboard controller structure configured to execute Durvasula’s control logic, including generating control signals to cause the body movement “to...the first portion of the submerged surface” in response to the captured image described above.

135. The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching either alternative. Because the Durvasula-Fu-007 combination

The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching either alternative. Because the Durvasula-Fu-007 combination teaches control signals that cause movement “to” the first object, the Durvasula-Fu-007 combination discloses or suggests this element. Janét, ¶135. Therefore, Durvasula, in view of Fu-007, renders claim 1 obvious. Janét, ¶136. 5. Claim 2 Unpatentable over Durvasula and Fu-007 Durvasula and Fu-007 render Claim 2 obvious. Janét, ¶¶137-143. a. 2[pre] “A system for cleaning debris from a submerged surface of a swimming pool, comprising” To the extent that it is limiting, Durvasula discloses or suggests 2[pre]. Janét, ¶¶138-140. Durvasula discloses a pool cleaning system. <i>See, e.g.</i>, Durvasula, Title, Abstract (“A pool cleaning system utilizes a powered robotic surface cleaning vehicle”), FIGS. 1-5, 9, Claims 1-10, 17-20; Janét, ¶139. Durvasula discloses the pool cleaning system is for “cleaning debris from a submerged surface of a swimming pool” because Durvasula describes vehicle 30 “travel[s] adjacent to submerged or water containing surfaces of pool 20...while cleaning such surfaces,” as explained in §IV.A.4.a (1[Pre]). <i>See also</i> Durvasula, [0014]-[0015], [0046], FIGS. 9-10 (annotated below); Janét, ¶140.	teaches control signals that cause movement “to” the first object, the Durvasula-Fu-007 combination discloses or suggests this element. 136. Therefore, it is my opinion that Durvasula, in view of Fu-007, renders claim 1 obvious. 5. Claim 2 Unpatentable over Durvasula and Fu-007 137. In my opinion, Durvasula and Fu-007 render Claim 2 obvious. a. 2[pre] “A system for cleaning debris from a submerged surface of a swimming pool, comprising” 138. In my opinion, Durvasula discloses or suggests 2[pre]. 139. Durvasula discloses a pool cleaning system. <i>See, e.g.</i>, Durvasula, Title, Abstract (“A pool cleaning system utilizes a powered robotic surface cleaning vehicle”), FIGS. 1-5, 9, Claims 1-10, 17-20. 140. Durvasula discloses the pool cleaning system is for “cleaning debris from a submerged surface of a swimming pool” because Durvasula describes vehicle 30 “travel[s] adjacent to submerged or water containing surfaces of pool 20...while cleaning such surfaces,” as explained in §VII.A.4.a (1[Pre]). <i>See also</i> Durvasula, [0014]-[0015], [0046], FIGS. 9-10 (annotated below). [omitted images]
--	---

[omitted images] b. 2[a][i] “a. a self-propelled pool cleaner comprising:” Durvasula discloses 2[a][i] as explained in §IV.A.4.a (1[Pre]). Janét, ¶141. c. 2[a][ii]-2[b] Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained in §§IV.A.4.b-e (1[a]-1[d]), Durvasula discloses or suggests 2[a][ii]-2[a][iv] and 2[b]. Additionally, for at least the same reasons explained above in §§IV.A.4.f-h (1[e][i]-[iii]), the Durvasula-Fu-007 combination discloses or suggests limitations 2[a][v]-2[a][vii]. Janét, ¶142. Therefore, Durvasula, in view of Fu-007, renders Claim 2 obvious. Janét, ¶¶137-141, 143.	b. 2[a][i] “a. a self-propelled pool cleaner comprising:” 141. In my opinion, Durvasula discloses 2[a][i] as explained in §VII.A.4.a (1[Pre]). c. 2[a][ii]-2[b] 142. Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained in §§VII.A.4.b-e (1[a]-1[d]), Durvasula discloses or suggests 2[a][ii]-2[a][iv] and 2[b]. Additionally, for at least the same reasons explained above in §§VII.A.4.f-h (1[e][i]-[iii]), the Durvasula-Fu-007 combination discloses or suggests limitations 2[a][v]-2[a][vii]. 143. Therefore, it is my opinion that Durvasula, in view of Fu-007, renders Claim 2 obvious.
B. Ground 1B: Claim 3 Is Unpatentable under AIA 35 U.S.C. §103 over Durvasula. 1. Claim 3 Unpatentable over Durvasula Durvasula renders independent Claim 3 obvious. Janét, ¶¶144-151. a. 3[pre], 3[a][i] Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Durvasula discloses 3[Pre] and 3[a][i] as	B. Ground 1B: Claim 3 Is Unpatentable under AIA 35 U.S.C. §103 over Durvasula. 1. Claim 3 Unpatentable over Durvasula 144. In my opinion, Durvasula renders independent Claim 3 obvious. a. 3[pre], 3[a][i] 145. Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. In my opinion, Durvasula

explained in §§IV.A.5.a-b; <i>see also</i> §IV.A.4.a (1[Pre]); Janét, ¶145. b. 3[a][ii]-3[a][v] Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. For at least the same reasons explained in §§ IV.A.3.b-e (1[a]-1[d]), Durvasula discloses or suggests 3[a][ii]-3[a][v]. Janét, ¶146. c. 3[b][i] “b. a controller (i) in electronic communication with the at least one camera and” Durvasula discloses or suggests 3[b][i]. Janét, ¶¶147-148. Durvasula describes controller 42 “communicates with...cameras 32...across a wired connection,” “across a wireless connection,” or “using a combination of both wired and wireless communication connections,” and “utilizes signals from camera 32 to steer vehicle 30.” Durvasula, [0020]-[0021], [0023]; Janét, ¶148. d. 3[b][ii] “(ii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.” Durvasula discloses or suggests 3[b][ii]. Janét, ¶¶149-150. Durvasula’s controller 42 generates control signals “in response to the captured image” because controller 42 identifies a portion requiring cleaning or recleaning based on “signals from camera	discloses 3[Pre] and 3[a][i] as explained in §§VII.A.5.a-VII.A.5.b; <i>see also</i> §VII.A.4.a (1[Pre]). b. 3[a][ii]-3[a][v] 146. Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. It is my opinion that, for at least the same reasons explained in §§ IV.A.3.b-e (1[a]-1[d]), Durvasula discloses or suggests 3[a][ii]-3[a][v]. c. 3[b][i] “b. a controller (i) in electronic communication with the at least one camera and” 147. In my opinion, Durvasula discloses or suggests 3[b][i] for the reasons below. 148. Durvasula describes controller 42 “communicates with...cameras 32...across a wired connection,” “across a wireless connection,” or “using a combination of both wired and wireless communication connections,” and “utilizes signals from camera 32 to steer vehicle 30.” Durvasula, [0020]-[0021], [0023]. d. 3[b][ii] “(ii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.” 149. In my opinion, Durvasula discloses or suggests 3[b][ii]. 150. Durvasula’s controller 42 generates control signals “in response to the captured image” because controller 42 identifies a portion requiring cleaning or recleaning based on “signals from
---	---

32,” and steers vehicle 30 accordingly. Durvasula, [0022]-[0023]; Janét, ¶150. Durvasula further discloses generating control signals to cause movement “to...the first portion of the submerged surface” because Durvasula’s controller 42 steers vehicle 30 to “cover such missed portions” and to “re-clean such portions until such portions have been satisfactorily cleaned”—i.e., to the first portion identified from the captured image. Durvasula, [0023]; <i>see also id.</i>, [0026], [0044]; Janét, ¶150. Therefore, Durvasula renders Claim 3 obvious. Janét, ¶151	camera 32,” and steers vehicle 30 accordingly. Durvasula, [0022]-[0023]. Durvasula further discloses generating control signals to cause movement “to...the first portion of the submerged surface” because Durvasula’s controller 42 steers vehicle 30 to “cover such missed portions” and to “re-clean such portions until such portions have been satisfactorily cleaned”—i.e., to the first portion identified from the captured image. Durvasula, [0023]; <i>see also id.</i>, [0026], [0044]. 151. Therefore, it is my opinion that Durvasula renders Claim 3 obvious.
C. Ground 2A: Claims 1-2 Are Unpatentable over Cui and Fu-007 1. Cui Cui (EX1005) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1), and prior art under pre-AIA 35 U.S.C. §102(b). Janét, ¶152 Cui discloses a pool cleaner with debris detection capability for use in swimming pools. <i>See</i> Cui, Title, Abstract. Cui’s pool cleaner uses a CCD camera to continuously capture images of pool surfaces, compares them with pre-stored standard images of clean surfaces, and controls the cleaner’s operation based on detected debris levels/distributions. <i>Id.</i>, Abstract, pp.5-7;3 Janét, ¶153. Cui is analogous art with respect to Claims 1-3 of the ’191 Patent.	C. Ground 2A: Claims 1-2 Are Unpatentable under AIA 35 U.S.C. §103 and Pre-AIA 35 U.S.C. §103 over Cui with Fu-007 1. Cui 152. Cui (EX1005) is Chinese Patent Application Publication No. CN1540119A published on October 27, 2004 and is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1). In addition, similar to Fu-007, Cui is also prior art under pre-AIA 35 U.S.C. §102(b). 153. Cui discloses a pool cleaner with debris detection capability for use in swimming pools. <i>See</i> Cui, Title, Abstract. Cui’s pool cleaner uses a CCD camera to continuously capture images of pool surfaces, compares them with pre-stored standard images of clean surfaces, and controls the cleaner’s operation based on detected debris levels/distributions. <i>Id.</i>, Abstract, pp.5-74. Cui is analogous art with respect to Claims 1-3 of the ’191 Patent.

As illustrated in FIGS. 1-2 (annotated below), Cui's pool cleaner comprises a housing 4 containing various components including a **brushless DC water pump motor 2**, an **infrared distance sensor 3**, a **CCD camera 5**, a **filter bag 6**, an industrial control computer 7 with related software, sensors 8, 9, **track-type crawling mechanisms 10**, **roller brushes 11**, and **hybrid stepper motors 15**. Cui, Claim 1, pp.5-6, FIGS. 1-3.

[omitted images]

Cui's computer 7 is connected to **camera 5** through **image acquisition card 21** and processes the captured images to generate control signals that adjust the crawling speed based on detected debris levels/distributions. Cui, pp.4-7, FIGS. 5-6 (annotated below). Camera 5 captures images that undergo A/D conversion and comparison with stored standard images. *Id.* Greater sediment/debris produce larger grayscale differences, causing computer 7 to adjust speed of **motors 15** via **relay board 20**, controlling crawling speed and cleaning force. *Id.*

[omitted images]

2. Motivation to Combine

Both Cui and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve systems. Cui describes a pool cleaner using "intelligent adaptive technology with computer control" to autonomously adjust cleaning force based on debris distribution. Cui, p.5. Fu-

154. As illustrated in FIGS. 1-2 (annotated below), Cui's pool cleaner comprises a housing 4 containing various components including a brushless DC **water pump motor 2**, an **infrared distance sensor 3**, a **CCD camera 5**, a **filter bag 6**, an industrial control computer 7 with related software, sensors 8, 9, **track-type crawling mechanisms 10**, **roller brushes 11**, and **hybrid stepper motors 15**. Cui, Claim 1, pp.5-6, FIGS. 1-3.

[omitted images]

155. Cui's computer 7 is connected to **camera 5** through **image acquisition card 21** and processes the captured images to generate control signals that adjust the crawling speed based on detected debris levels/distributions. Cui, pp.4-7, FIGS. 5-6 (annotated below). Camera 5 captures images that undergo A/D conversion and comparison with stored standard images. *Id.* Greater sediment/debris produce larger grayscale differences, causing computer 7 to adjust speed of **motors 15** via **relay board 20**, controlling crawling speed and cleaning force. *Id.*

[omitted images]

156. Human-machine interface 16 of computer 7 displays pool area with different colors to indicate cleaned areas and areas to be cleaned, sensor values, and control switches. Cui, p.6, FIG. 4.

2. Reasons for Combining Cui and Fu-007

157. Both Cui and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve **autonomous pool cleaning operations**. Cui describes a pool cleaner using "intelligent adaptive technology with computer control" to autonomously adjust cleaning force

007 similarly describes an underwater cleaning robot that can “help and even replace humans to autonomously complete underwater cleaning work.” Fu-007, p.11. A POSITA would have been motivated to combine the complementary teachings of Cui and Fu-007 to achieve improved systems. Janét, ¶157.

A POSITA would have recognized that the teachings in Cui and Fu-007 are directed to the same pool cleaning technical field and provide similar technical solutions to address similar technical issues. Janét, ¶158. Specifically, both use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body within the swimming pool. *Compare* Cui, pp.5-7, FIGS. 5-7, *with* Fu-007, pp.10, 14-16, Claims 4, 7.

Additionally, both teach motorized drive mechanisms to cause and control movement of the pool cleaner during operation. *Compare* Cui, pp.5-6, Claim 1, FIGS. 1-3, *with* Fu-007, pp.8-9, 12-14, Claims 1, 3.

Accordingly, a POSITA would have investigated the technical teachings in both Cui and Fu-007 to seek guidance when designing a pool cleaning system. Janét, ¶158.

Cui teaches placing the controller (computer 7) outside the pool and separate from the pool cleaning vehicle in a tethered configuration via cable assembly 12. Cui, pp.5-6. Fu-007 teaches placing its controller within the cleaning and moving platform as part of a sealed drive control enclosure. Fu-007, pp.8-9, 12-14, Claim 4. The use of an external controller separated from the pool cleaner in Cui and the use of an onboard controller in Fu-007 had been two known design options, and a POSITA would have been motivated to modify Cui by substituting Cui’s

based on debris distribution. Cui, p.5. Fu-007 similarly describes an underwater cleaning robot that can “help and even replace humans to autonomously complete underwater cleaning work.” Fu-007, p.11. A POSITA would have been motivated to combine the complementary teachings of Cui and Fu-007 to achieve improved **autonomous pool cleaning operations**.

158. A POSITA would have recognized that the teachings in Cui and Fu-007 are directed to the same pool cleaning technical field, **are based on recognition of the same or similar technical issues in pool cleaning**, and provide similar technical solutions to address those issues. Specifically, both **references** use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body within the swimming pool. *Compare* Cui, pp.5-7, FIGS. 5-7, *with* Fu-007, pp.10, 14-16, Claims 4, 7. Additionally, both references teach motorized drive mechanisms to cause and control movement of the pool cleaner during operation. *Compare* Cui, pp.5-6, Claim 1, FIGS. 1-3, *with* Fu-007, pp.8-9, 12-14, Claims 1, 3. Accordingly, a POSITA would have investigated the technical teachings in both Cui and Fu-007 to seek guidance when designing a pool cleaning system **for specific pool cleaning considerations and applications**.

159. Cui teaches placing the controller (industrial control computer 7) outside the pool and separate from the pool cleaning vehicle in a tethered configuration via cable assembly 12. Fu-007 teaches placing its controller within the cleaning and moving platform as part of a sealed drive control enclosure **suitable for underwater operation**. Fu-007, pp.8-9, 12-14, Claim 4. The use of an external controller separated from the pool cleaner in Cui and the use of an onboard controller in Fu-007 had been two known design options. A POSITA would have

external computer 7 with Fu-007's onboard controller structure for at least two reasons. Janét, ¶159.

First, a POSITA would have been guided by Cui and Fu-007 to make such combination to advance Cui's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Janét, ¶160. Cui's reliance on an external computer and cable assembly constrains autonomy by limiting range and requiring human intervention to manage cable entanglements. *Id.* Fu-007 teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller architecture into Cui, the modified system would have enhanced Cui's autonomous operation by liberating the robot from shore-side constraints—generating control signals onboard to plan paths and complete cleaning tasks without requiring human supervision or corresponding data transmission between the underwater cleaning vehicle and an external controller. Cui, pp.5-6; Janét, ¶160.

Additionally, removing the external tether would allow the vehicle to navigate freely without cable constraints. *Id.*

been motivated to modify Cui by substituting Cui's external computer 7 with Fu-007's onboard controller structure for at least two reasons.

160. First, a POSITA would have been guided by Cui and Fu-007 to make such combination to advance Cui's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Cui's reliance on an external computer and cable assembly constrains autonomy by limiting range and requiring human intervention to manage cable entanglements. Fu-007 explicitly teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller architecture into Cui, the modified system would have enhanced Cui's autonomous operation by liberating the robot from shore-side constraints—generating control signals onboard to plan paths and complete cleaning tasks without requiring human supervision or corresponding transmission of data (e.g., images, control signals) between the underwater cleaner and an external controller (industrial computer 7). Cui, pp.5-6.

Additionally, removing the external tether would allow the vehicle to navigate freely without cable management constraints. Cui's cable assembly 12 can become tangled with pool features such as ladders, drains, and return fittings during cleaning operations, potentially interrupting the cleaning cycle and requiring user intervention. Fu-007's tetherless design avoids these complications, allowing the robot to navigate complex pool geometries without obstruction. Fu-007, pp.9-10, 14. Even if a power tether were retained, relocating the controller onboard would eliminate or reduce the need for signal transmission

Second, a POSITA would have been motivated to adopt this modification to further improve the safety of Cui's system. Janét, ¶161. Cui discloses a tethered configuration where industrial control computer 7 is connected to the cleaner via an external "cable assembly 12." Cui, pp.5-6, Claim 1, FIGS. 1-2. A POSITA would have recognized that tethered systems introduce safety risks by requiring a physical electrical connection between shore-side electronics and the submerged cleaner, creating potential pathways for electrical leakage. Janét, ¶161. A POSITA would have further recognized that this risk is exacerbated in swimming pool environments, where dissolved chemicals increase water conductivity and thus the potential for electrical current to reach pool users. *Id.*

As explained in §IV.A.3, Fu-007 teaches a safer architecture that eliminates the external tether, including the power cable. A POSITA would have been motivated to replace Cui's tethered computer arrangement with Fu-007's onboard, sealed, battery-powered architecture, because this modification would have eliminated the need for any external cables entering the water—including power cables—thereby removing the primary pathway for electrical leakage and enhancing the overall safety. Janét, ¶162.

A POSITA would have had a reasonable expectation of success in making this combination because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots, as shown by the teachings in Fu-007. *See, e.g.,* Fu-007, pp.8-10, 12-14. *See also* Knoll, [0007], [0027]-

through the tether, reducing its diameter and mass and resulting in less hydrodynamic drag and impedance to movement.

161. Second, a POSITA would have been motivated to adopt this modification to further improve the safety of Cui's system. Cui discloses a tethered configuration where industrial control computer 7 is connected to the cleaner via an external "cable assembly 12." Cui, pp.5-6, Claim 1, FIGS. 1-2. A POSITA would have recognized that tethered systems introduce safety risks by requiring a physical electrical connection between shore-side electronics and the submerged cleaner, creating potential pathways for electrical leakage into the swimming pool environment if cable insulation wears down or connections become compromised. A POSITA would have further recognized that this risk is exacerbated in swimming pool environments, where dissolved chemicals (e.g., chlorine, calcium, pH balancers, algaecides) increase water conductivity and thus the potential for electrical current to reach pool users.

162. As explained in §VII.A.3, Fu-007 teaches a safer architecture that eliminates the external tether, including the power cable. A POSITA would have been motivated to replace Cui's tethered computer arrangement with Fu-007's onboard, sealed, battery-powered architecture, because this modification would have eliminated the need for any external cables entering the water—including power cables—thereby removing the primary pathway for electrical leakage and enhancing the overall safety profile of the device for pool users.

163. A POSITA would have had a reasonable expectation of success in making this combination because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots, as shown by the teachings

[0028], FIG.1 (showing control unit 11 inside the vehicle, as explained in §§IV.E.1-IV.E.2); Renaud, [0008]- [0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner, as explained in §§IV.F.1-IV.F.2); Janét, ¶163.

Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Cui's—analyzing captured images and generating drive signals to control the vehicle's movement (e.g., adjusting drive wheels based on debris thresholds). Fu-007, pp.8-10, 14-16. Because Fu-007's controller is already configured to execute image-based cleaning tasks, a POSITA would have reasonably expected that Fu-007's controller could implement Cui's specific control logic (e.g., processing images to control crawling speed based on debris levels; Cui, pp.5-7), thereby yielding predictable results. Janét, ¶163.

3. Claim 1 Unpatentable over Cui and Fu-007

Cui and Fu-007 render Claim 1 obvious. Janét, ¶¶164-194.

a. 1[pre]

Cui discloses or suggests 1[pre]. Janét, ¶¶165-168.

Cui discloses a system designed for “professional or commercial swimming pools,” including an underwater cleaning vehicle with **track-type crawling mechanisms 10** powered by **hybrid stepper motors 15** and a computer 7 that processes sensor data

in Fu-007. *See, e.g.*, Fu-007, pp.8–10, 12–14. *See also* Knoll, [0007], [0027]-[0028], FIG.1 (showing control unit 11 inside the vehicle **that receives images from camera 6, processes the images, and controls the drive means 12 accordingly**, as explained in §§VII.E.1-VII.E.2); Renaud, [0008]- [0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner that **receives images from a vision system, processes the images to identify debris, and actuates the motor to direct the cleaner to the debris**, as explained in §§VII.F.1-VII.F.2). Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Cui's—analyzing captured images and generating drive signals to control the vehicle's movement (e.g., adjusting drive wheels based on debris thresholds). Fu-007, pp.8–10, 14–16. Because Fu-007's controller is already configured to execute image-based cleaning tasks, a POSITA would have reasonably expected that Fu-007's controller could implement Cui's specific control logic (e.g., processing images to control crawling speed based on debris levels; Cui, pp.5–7), thereby yielding predictable results.

3. Claim 1 Unpatentable over Cui and Fu-007

164. In my opinion, Cui and Fu-007 render Claim 1 obvious.

a. 1[pre] “A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising”

165. It is my opinion that Cui discloses or suggests 1[pre].

166. Cui discloses a system designed for “professional or commercial swimming pools,” including an underwater cleaning vehicle with **track-type crawling mechanisms 10** powered by

and controls the vehicle. Cui, Abstract, Claim 1, pp.5-7, FIGS. 1-2, 6 (annotated below). Janét, ¶166. [omitted images] Cui’s cleaning vehicle is self-propelled because under the control of computer 7, motors 15 drive track-type crawling mechanisms 10 to move it autonomously across pool surfaces. Cui, Claim 1, pp.5-6. Janét, ¶167. Cui’s system detects debris by capturing images with camera 5 and comparing them (via computer 7) with “pre-stored standard image information of a clean pool bottom”—“when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s).” Cui, Abstract, pp.4-7. Cui’s system collects and cleans debris using “roller brush (11),” “brushless DC water pump motor (2),” and “filter bag (6).” Cui, Claim 1, pp.5-7; Janét, ¶168. b. 1[a] Cui discloses or suggests 1[a]. Janét, ¶¶169-170. Cui’s pool cleaner includes a vehicle body, at least in the form of housing 4 with integrated propulsion mechanisms (track-type crawling mechanisms 10, motors 15), cleaning components (motor 2, brushes 11, filter 6), and sensors (camera 5). Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood this assembled structure is the claimed “vehicle body” that travels within the pool. Janét, ¶170. [omitted image]	hybrid stepper motors 15 and a computer 7 that processes sensor data and controls the vehicle. Cui, Abstract, Claim 1, pp.5-7, FIGS. 1-2, 6 (annotated below). [omitted images] 167. Cui’s cleaning vehicle is self-propelled because under the control of computer 7, motors 15 drive track-type crawling mechanisms 10 to move it autonomously across pool surfaces. Cui, Claim 1, pp.5-6. 168. Cui’s system detects debris by capturing images with camera 5 and comparing them (via computer 7) with “pre-stored standard image information of a clean pool bottom”—“when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s).” Cui, Abstract, pp.4-7. Cui’s system collects and cleans debris using “roller brush (11),” “brushless DC water pump motor (2),” and “filter bag (6).” Cui, Claim 1, pp.5-7. b. 1[a] “a. a vehicle body” 169. In my opinion, Cui discloses or suggests 1[a]. 170. Cui’s pool cleaner includes a vehicle body, at least in the form of housing 4 with integrated propulsion mechanisms (track-type crawling mechanisms 10, motors 15), cleaning components (motor 2, brushes 11, filter 6), and sensors (camera 5). Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood this assembled structure is the claimed “vehicle body” that travels within the pool.
--	--

c. 1[b] Cui discloses or suggests 1[b]. Janét, ¶171. The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding structures are “wheels, rollers, tracks, other surface contacting members powered by a motor, a vacuum, or a liquid jet.” EX1001, 3:33-45, 10:15-17, FIGS.9-10; Janét, ¶172. Cui discloses moving the vehicle body within the swimming pool. Janét, ¶173. Specifically, Cui discloses track-type crawling mechanisms 10 powered by motors 15. Cui, Claim 1, pp.5-6, FIGS. 1-2 (annotated below). Motors 15 are mounted on both sides of sealed motor cover 1, and track-type crawling mechanisms 10 are mounted at front and rear ends of housing 4. Cui, pp.5-6; Janét, ¶173. [omitted images] A POSITA would have understood that Cui’s track-type crawling mechanisms 10 powered by hybrid stepper motors 15 are substantially the same as the ’191 Patent’s disclosed “tracks...powered by a motor”—both are motorpowered track systems that contact pool surfaces to propel the vehicle body. Janét, ¶174. This structure of Cui performs the claimed function because motors 15 drive track-type crawling mechanisms 10, which contact pool surfaces and propel the vehicle body within the swimming pool. Cui, pp.5-7, FIGS. 1-3; Janét, ¶174.	[omitted image] c. 1[b] “b. means for moving the vehicle body within the swimming pool” 171. It is my opinion that Cui discloses or suggests 1[b]. 172. The format and content of 1[b] invoke claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §VI.D, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding structures are “wheels, rollers, tracks, other surface contacting members powered by a motor, a vacuum, or a liquid jet.” EX1001, 3:33-45, 10:15-17, FIGS.9-10. 173. Cui discloses moving the vehicle body within the swimming pool. Specifically, Cui discloses track-type crawling mechanisms 10 powered by motors 15. Cui, Claim 1, pp.5-6, FIGS. 1-2 (annotated below). Motors 15 are mounted on both sides of sealed motor cover 1, and track-type crawling mechanisms 10 are mounted at front and rear ends of housing 4. Cui, pp.5-6. [omitted images] 174. A POSITA would have understood that Cui’s track-type crawling mechanism 10 powered by hybrid stepper motors 15 are substantially the same as the ’191 Patent’s disclosed “tracks...powered by a motor”—both are motor-powered track systems that contact pool surfaces to propel the vehicle body. This structure of Cui performs the claimed function because motors 15 drive track-type crawling mechanisms 10, which
--	--

d. 1[c] Cui discloses or suggests 1[c]. Janét, ¶¶175-176. Cui’s system includes a filter configured to retain debris collected from the submerged surface, at least in the form of filter bag 6, which is in the water circulation system including brushless DC water pump motor 2. Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood that Cui’s pump motor 2 draws water containing debris from pool surfaces by suction and filter bag 6 retains this collected debris, while allowing clean water to pass through. Janét, ¶176. [omitted images] e. 1[d] “d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and” Cui discloses or suggests 1[d]. Janét, ¶¶177-179. Cui’s pool cleaner includes camera 5 “mounted at the upper front end of the housing 4,” which is part of the vehicle body, to observe pool surfaces ahead of the cleaner. Cui, Claim 2, FIG. 1 (annotated below), pp.5-6; Janét, ¶178. [omitted images] Cui describes that its camera “continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner,” including images showing “sediment at	contact pool surfaces and propel the vehicle body within the swimming pool. Cui, pp.5-7, FIGS. 1-3. d. 1[c] “c. a filter configured to retain debris collected from the submerged surface” 175. In my opinion, Cui discloses or suggests 1[c]. 176. Cui’s system includes a filter configured to retain debris collected from the submerged surface, at least in the form of filter bag 6, which is in the water circulation system including brushless DC water pump motor 2. Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood that Cui’s pump motor 2 draws water containing debris from pool surfaces by suction and filter bag 6 retains this collected debris, while allowing clean water to pass through. [omitted images] e. 1[d] “d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and” 177. In my opinion, Cui discloses or suggests 1[d]. 178. Cui’s pool cleaner includes camera 5 “mounted at the upper front end of the housing 4,” which is part of the vehicle body, to observe pool surfaces ahead of the cleaner. Cui, Claim 2, FIG. 1 (annotated below), pp.5-6. [omitted images]
--	--

the pool bottom.” Cui, pp.5-7. Cui describes that the captured images are “compared with the original standard image(s) of the pool bottom” to identify areas with debris requiring cleaning. Cui, pp.6-7. Janét, ¶179. A POSITA would have understood that Cui’s camera captures images of “at least a first portion of the submerged surface” because the camera observes the pool bottom surface and debris/sediment on that surface, and the pool bottom is a submerged surface when the pool is filled with water during cleaning operations, where an area with debris requiring cleaning constitutes the claimed “first portion of the submerged surface.” Cui, pp.5-7; Janét, ¶179.

f. 1[e][i]

The Cui-Fu-007 combination discloses or suggests 1[e][i], because Cui discloses a controller, Fu-007 discloses a controller inside the vehicle body, and a POSITA would have been motivated to modify Cui’s system to incorporate Fu-007’s teaching of the onboard controller. Janét, ¶¶180-185.

Cui’s pool cleaner includes **industrial control computer 7** that is separated from pool cleaner and is connected to the pool cleaner via cable 12. Cui, FIGS. 1-3. The industrial control computer 7 is “connected to the pool cleaner through the **cable assembly 12** and the **plug assembly 14**.” Cui, pp.5-6, FIGS. 1-2 (annotated below); Janét, ¶181. The industrial control computer 7 is connected to **camera 5** through **image acquisition card 21** and processes captured images to generate control signals that adjust crawling speed based on detected debris levels. Cui, pp.5-7, FIGS. 5-6 (annotated below). Cui further describes that “[t]he voltage signal is sent to...computer 7 for processing...A pulse signal command output after processing...to separately control the drive of the two hybrid stepper motors 15.” Cui, pp.6-7; *see*

179. Cui describes that its camera “continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner,” including images showing “**sediment at the pool bottom.**” Cui, pp.5-7. Cui describes that the captured images are “compared with the original standard image(s) of the pool bottom” to identify areas with debris requiring cleaning. Cui, pp.6-7. A POSITA would have understood that Cui’s camera captures images of “at least a first portion of the submerged surface” because the camera observes the pool bottom surface and debris/sediment on that surface, and the pool bottom is a submerged surface when the pool is filled with water during cleaning operations, where an area with debris requiring cleaning constitutes the claimed “first portion of the submerged surface.” Cui, pp.5-7.

f. 1[e][i] “e. a controller (i) positioned on or in the body,”

180. It is my opinion that the Cui-Fu-007 combination discloses or suggests 1[e][i], because Cui discloses a controller, Fu-007 discloses a controller inside the vehicle body, and a POSITA would have been motivated to modify Cui’s system to incorporate Fu-007’s teaching of the onboard controller.

181. Cui’s pool cleaner includes **industrial control computer 7** that is separated from pool cleaner and is connected to the pool cleaner via cable 12. Cui, FIGS. 1-3. The industrial control computer 7 is “connected to the pool cleaner through the **cable assembly 12** and the **plug assembly 14**.” Cui, pp.5-6, FIGS. 1-2 (annotated below). The industrial control computer 7 is connected to **camera 5** through **image acquisition card 21** and processes captured images to generate control signals that adjust crawling speed based on detected debris levels. Cui, pp.5-7, FIGS. 5-6 (annotated below). Cui further describes that “[t]he

<i>also</i> §IV.C.3.e (1[d]). A POSITA would have understood that Cui’s industrial control computer 7 is a “controller.” Janét, ¶181. [omitted images] Like Cui, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. <i>See</i> §IV.A.2. Like Cui, Fu-007 uses a controller to generate, in response to captured images, at least one control signal to cause movement of the pool cleaning body within the swimming pool. Janét, ¶182. <i>See also</i> §IV.C.2. Fu-007 discloses a controller positioned in the body of its cleaning and moving platform. Specifically, as explained in §§IV.A.2, IV.A.4.f, Fu-007 discloses a “central processing unit” (controller) housed in control system enclosure 8 that “installed on and fixed to the interior of the robot main shell 19...to sealingly enclose the control system components” with “waterproof properties.” Fu-007, pp.8-9, 12-14, Claim 4, FIGS.2, 4 (annotated below); Janét, ¶183. [omitted images] This onboard controller connects to the monitoring camera 2 via an internal “image acquisition card” and can be powered by an onboard “rechargeable battery box.” Fu-007, pp.12-14, Claim 4, FIGS.1, 6 (annotated below); <i>see also</i> §§IV.A.2, IV.A.4.f. Janét, ¶184. [omitted images] For the reasons explained in §IV.C.2, a POSITA would have been motivated to modify Cui’s system by substituting Cui’s	voltage signal is sent to...computer 7 for processing...A pulse signal command output after processing...to separately control the drive of the two hybrid stepper motors 15.” Cui, pp.6-7; <i>see also</i> § VII.C.3.e (1[d]). A POSITA would have understood that Cui’s industrial control computer 7 is a “controller.” [omitted images] 182. Like Cui, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. <i>See</i> §VII.A.2. Like Cui, Fu-007 uses a controller to generate, in response to captured images, at least one control signal to cause movement of the pool cleaning body within the swimming pool. <i>See also</i> §VII.C.2. 183. Fu-007 discloses a controller positioned in the body of its cleaning and moving platform. Specifically, as explained in §§VII.A.2, VII.A.4.f, Fu-007 discloses a “central processing unit” (controller) housed in control system enclosure 8 that “installed on and fixed to the interior of the robot main shell 19...to sealingly enclose the control system components” with “waterproof properties.” Fu-007, pp.8-9, 12-14, Claim 4, FIGS.2, 4 (annotated below). [omitted images] 184. This onboard controller connects to the monitoring camera 2 via an internal “image acquisition card” and can be powered by an onboard “rechargeable battery box.” Fu-007, pp.12-14, Claim 4, FIGS.1, 6 (annotated below); <i>see also</i> §§VII.A.2, VII.A.4.f. [omitted images]
--	--

external computer 7 with Fu-007's onboard controller structure. Janét, ¶185. In such modified system, Fu-007's onboard controller would be: (1) in electronic communication with Cui's camera via an onboard connection (e.g., Fu-007's image acquisition card; Fu-007, pp.12-14), (2) powered by a compatible power source (e.g., Fu-007's rechargeable battery box; *id.*), and (3) configured to generate control signals for controlling the vehicle movement (e.g., wheel speed) based on captured images to clean the pool per control logics taught by Cui and/or Fu-007. Cui, pp.5-7; Fu-007, pp.14-16; Janét, ¶185.

g. 1[e][ii]

The Cui-Fu-007 combination discloses or suggests 1[e][ii]. Janét, ¶¶186-188.

Cui describes that **computer 7** is connected to camera 5 through **image acquisition card 21**, and “the **image acquisition card 21** is connected to the **charge-coupled device (CCD) camera 5**.” Cui, Claim 3, pp.5-7, FIGS. 5-6 (annotated below). During cleaning, “camera 5...continuously captures images” and “[t]he video signal undergoes A/D conversion through the high-speed image acquisition card 21” for processing by computer 7. Cui, pp.5-7.

[omitted images]

As explained in §IV.C.2, §IV.C.3.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Cui's system by substituting Cui's external computer with Fu-007's onboard controller structure taught by Fu-007 to, e.g., eliminate external tether dependencies. *See* Fu-007, pp.8-

185. For the reasons explained in §VII.C.2, a POSITA would have been motivated to modify Cui's system by substituting Cui's external computer 7 with Fu-007's onboard controller structure. In such modified system, Fu-007's onboard controller would be: (1) in electronic communication with Cui's camera via an onboard connection (e.g., Fu-007's image acquisition card; Fu-007, pp.12–14), (2) powered by a compatible power source (e.g., Fu-007's rechargeable battery box; *id.*), and (3) configured to generate control signals for controlling the vehicle movement (e.g., wheel speed) based on captured images to clean the pool per control logics taught by Cui and/or Fu-007. Cui, pp.5–7; Fu-007, pp.14–16.

g. 1[e][ii] “(ii) in electronic communication with the at least one camera, and”

186. In my opinion, the Cui-Fu-007 combination discloses or suggests 1[e][ii].

187. Cui describes that **computer 7** is connected to camera 5 through **image acquisition card 21**, and “the **image acquisition card 21** is connected to the **charge-coupled device (CCD) camera 5**.” Cui, Claim 3, pp.5-7, FIGS. 5-6 (annotated below). During cleaning, “camera 5...continuously captures images” and “[t]he video signal undergoes A/D conversion through the high-speed image acquisition card 21” for processing by computer 7. Cui, pp.5-7.

[omitted images]

188. As explained in §VII.C.2, §VII.C.3.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been

10, 12-14, Claim 4; Janét, ¶188. In this modified system, the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007's internal connection architecture (specifically, the camera connects to the central processing unit via an "image acquisition card"). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶188. Thus, the Cui-Fu-007 combination discloses or suggests this limitation. Janét, ¶188.

h. 1[e][iii]

The Cui-Fu-007 combination discloses or suggests 1[e][iii]. Janét, ¶¶189-193.

Cui discloses or suggests that its computer 7 (controller) "generate[s], in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to...the first portion of the submerged surface." Janét, ¶190. Specifically, Cui describes that its controller compares captured images with stored standard images to identify sediment/debris—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in a high comparison output voltage." Cui, pp.6-7. Based on this image-derived signal, "[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15." *Id.*, p.7. Thus, these are "control signal[s]" generated "in response to the captured image." Janét, ¶190. As explained in §IV.C.3.e IV.C.3.e(1[d]), Cui's camera 5 captures images of areas "located directly in front and below a crawling direction of the cleaner." Cui, Abstract, pp.5-7. Therefore, when the controller generates

motivated to modify Cui's system by substituting Cui's external computer with Fu-007's onboard controller structure taught by Fu-007 to, e.g., eliminate external tether dependencies. *See* Fu-007, pp.8-10, 12-14, Claim 4. In this modified system, the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007's internal connection architecture (specifically, the camera connects to the central processing unit via an "image acquisition card"). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6. Thus, the Cui-Fu-007 combination discloses or suggests this limitation.

h. 1[e][iii] "(iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface."

189. It is my opinion that the Cui-Fu-007 combination discloses or suggests 1[e][iii].

190. Cui discloses or suggests that its computer 7 (controller) "generate[s], in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to...the first portion of the submerged surface." Specifically, Cui describes that its controller compares captured images with stored standard images to identify sediment/debris—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in a high comparison output voltage." Cui, pp.6-7. Based on this image-derived signal, "[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15." *Id.*, p.7. Thus, these are "control signal[s]" generated "in response to the captured image." As explained in §VII.C.3.e (1[d]), Cui's

signals to adjust motor speed based on detected debris, the robot continues moving forward **toward** the debris-laden area identified in the image—i.e., the control signals cause movement “to” the first portion of the submerged surface. Janét, ¶190.

Additionally, Fu-007 discloses that its controller generates control signals in response to captured images to cause movement to a targeted portion of the surface. Janét, ¶191. Specifically, Fu-007 describes that during autonomous cleaning, the central processing unit sets “a swimming pool cleanliness image threshold” and uses the monitoring camera 2 to “take image(s) of the bottom of the swimming pool.” Fu-007, pp.10, 14-16. The controller then “determines a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold” and, based on this determination, “plans a cleaning movement.” *Id.* To execute this planned movement, the controller “adjusts operating conditions of the four cleaning drive wheels 3...to complete the cleaning task.” *Id.* Fu-007 further explains that this adjustment involves changing the “rotational speed of each wheel” such that the robot “may move in a direction determined by” the specific wheel speed combinations (e.g., rotating front wheels rapidly and rear wheels slowly). *Id.* A POSITA would have understood that by planning a cleaning movement based on the determined cleanliness level and adjusting wheel speeds to move in a specific direction, Fu-007’s controller generates control signals to cause the body to move “to” the identified portion of the submerged surface (e.g., the dirty area) to “complete the cleaning task.” *Id.*; Janét, ¶191.

As explained in §IV.A.3, §IV.C.3.f IV.C.3.f(1[e][i]), a POSITA would have been motivated to modify Cui’s system to replace Cui’s external computer with Fu-007’s onboard controller structure to implement the control logics taught by Cui and/or

camera 5 captures images of areas “located directly in front and below a crawling direction of the cleaner.” Cui, Abstract, pp.5-7. Therefore, when the controller generates signals to adjust motor speed based on detected debris, the robot continues moving forward **toward** the debris-laden area identified in the image—i.e., the control signals cause movement “to” the first portion of the submerged surface.

191. Additionally, Fu-007 discloses that its controller generates control signals in response to captured images to cause movement to a targeted portion of the surface. Specifically, Fu-007 describes that during autonomous cleaning, the central processing unit sets “a swimming pool cleanliness image threshold” and uses the monitoring camera 2 to “take image(s) of the bottom of the swimming pool.” Fu-007, pp.10, 14-16. The controller then “determines a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold” and, based on this determination, “plans a cleaning movement.” *Id.* To execute this planned movement, the controller “adjusts operating conditions of the four cleaning drive wheels 3...to complete the cleaning task.” *Id.* Fu-007 further explains that this adjustment involves changing the “rotational speed of each wheel” such that the robot “may move in a direction determined by” the specific wheel speed combinations (e.g., rotating front wheels rapidly and rear wheels slowly). *Id.* A POSITA would have understood that by planning a cleaning movement based on the determined cleanliness level and adjusting wheel speeds to move in a specific direction, Fu-007’s controller generates control signals to cause the body to move “to” the identified portion of the submerged surface (e.g., the dirty area) to “complete the cleaning task.” *Id.*

Fu-007, including configuring the onboard controller to implement Fu-007's image-based navigation logic—specifically, planning movements based on image thresholds. Janét, ¶192. Indeed, a POSITA would have recognized that integrating Fu-007's ability to “plan[] a cleaning movement” and execute specific directional movements via “different wheel speed combinations” would result in more effective debris removal and improved “operating efficiency” compared to passive speed adjustment. Fu-007, pp.14-16; Janét, ¶192. The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching either alternative. Because the Cui-Fu-007 combination teaches control signals that cause movement “to” the first object, the Cui-Fu-007 combination discloses or suggests this element. Janét, ¶193. Therefore, Cui, in view of Fu-007, renders Claim 1 obvious. Janét, ¶194. 4. Claim 2 Unpatentable over Cui and Fu-007 Cui and Fu-007 render Claim 2 obvious. Janét, ¶¶195-200. a. 2[pre] Cui discloses or suggests 2[pre]. Janét, ¶¶ 196-198. Cui discloses a system designed for “professional or commercial swimming pools,” including an underwater cleaning vehicle with track-type crawling mechanisms 10 powered by hybrid stepper motors 15 and a computer 7 that processes sensor data	192. As explained in §VII.A.3, §VII.C.3.f (1[e][i]), a POSITA would have been motivated to modify Cui's system to replace Cui's external computer with Fu-007's onboard controller structure to implement the control logics taught by Cui and/or Fu-007, including configuring the onboard controller to implement Fu-007's image-based navigation logic—specifically, planning movements based on image thresholds. Indeed, a POSITA would have recognized that integrating Fu-007's ability to “plan[] a cleaning movement” and execute specific directional movements via “different wheel speed combinations” would result in more effective debris removal and improved “operating efficiency” compared to passive speed adjustment. Fu-007, pp.14-16. 193. The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching either alternative. Because the Cui-Fu-007 combination teaches control signals that cause movement “to” the first object, the Cui-Fu-007 combination discloses or suggests this element. 194. Therefore, in my opinion, Cui, in view of Fu-007, renders Claim 1 obvious. 4. Claim 2 Unpatentable over Cui and Fu-007 195. In my opinion, Cui and Fu-007 render Claim 2 obvious. a. 2[pre] “A system for cleaning debris from a submerged surface of a swimming pool, comprising” 196. It is my opinion that Cui discloses or suggests 2[pre].
---	---

and controls the vehicle. Cui, Abstract, Claim 1, pp.5-7, FIGS. 1-2, 6 (annotated below).

[omitted images]

Cui's system detects debris by capturing images with camera 5 and comparing them (via computer 7) with "pre-stored standard image information of a clean pool bottom"—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s)." Cui, Abstract, pp.4-7. Cui's system collects and cleans debris using "roller brush (11)," "brushless DC water pump motor (2)," and "filter bag (6)." Cui, Claim 1, pp.5-7; Janét, ¶198.

b. 2[a][i]

Cui discloses 2[a][i] as explained in §IV.C.3.a (1[Pre]). Janét, ¶199.

c. 2[a][ii]-2[b]

Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained above in §§IV.C.3.b-e (1[a]-1[d]), Cui discloses or suggests 2[a][ii]-2[a][iv] and 2[b]. Additionally, for at least the same reasons explained above in §§IV.C.3.f-h (1[e][i]-[iii]), the Cui-Fu-007 combination discloses or suggests limitations 2[a][v]-2[a][vii]. Janét, ¶200.

197. Cui discloses a system designed for "professional or commercial swimming pools," including an underwater cleaning vehicle with **track-type crawling mechanisms 10** powered by **hybrid stepper motors 15** and a computer 7 that processes sensor data and controls the vehicle. Cui, Abstract, Claim 1, pp.5-7, FIGS. 1-2, 6 (annotated below).

[omitted images]

198. Cui's system detects debris by capturing images with camera 5 and comparing them (via computer 7) with "pre-stored standard image information of a clean pool bottom"—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s)." Cui, Abstract, pp.4-7. Cui's system collects and cleans debris using "roller brush (11)," "brushless DC water pump motor (2)," and "filter bag (6)." Cui, Claim 1, pp.5-7.

b. 2[a][i] "a. a self-propelled pool cleaner comprising:"

199. In my opinion, Cui discloses 2[a][i] as explained in §VII.C.3.a (1[Pre]).

c. 2[a][ii]-2[b]

200. Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained above in §§VII.C.3.b-e (1[a]-1[d]), Cui discloses or suggests 2[a][ii]-2[a][iv] and 2[b]. Additionally, for at least the same reasons explained above in §§VII.C.3.f-h (1[e][i]-[iii]), the Cui-Fu-007 combination discloses or suggests

	limitations 2[a][v]-2[a][vii]. Therefore, it is my opinion that Cui, in view of Fu-007, renders Claim 2 obvious.
D. Ground 2B: Claim 3 Is Unpatentable over Cui 1. Claim 3 Unpatentable over Cui Cui render Claim 3 obvious. Janét, ¶¶201-208. a. 3[pre], 3[a][i] Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Cui discloses 3[Pre] and 3[a][i] as explained in §§IV.C.4.a-b; <i>see also</i> §IV.C.3.a (1[Pre]). b. 3[a][ii]-3[a][v] Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. For at least the same reasons explained above in §§IV.C.3.b-e (1[a]-1[d]), Cui discloses or suggests 3[a][ii]-3[a][v]. c. 3[b][i] Cui discloses or suggests 3[b][i]. Janét, ¶¶204-205. Cui describes that computer 7 is connected to camera 5 through image acquisition card 21, and “the image acquisition card 21 is connected to the charge-coupled device (CCD) camera 5.” Cui, Claim 3, pp.5-7, FIGS. 5-6 (annotated below). During cleaning, “camera 5...continuously captures images” and “[t]he video signal undergoes A/D conversion through the high-speed	D. Ground 2B: Claim 3 Is Unpatentable under AIA 35 U.S.C. §103 and Pre-AIA AIA 35 U.S.C. §103 over Cui 1. Claim 3 Unpatentable over Cui 201. In my opinion, Cui renders Claim 3 obvious. a. 3[pre], 3[a][i] 202. Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Cui discloses 3[Pre] and 3[a][i] as explained in §§VII.C.4.a-b; <i>see also</i> §VII.C.3.a (1[Pre]). b. 3[a][ii]-3[a][v] 203. Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. For at least the same reasons explained above in §§VII.C.3.b-e(1[a]-1[d]), Cui discloses or suggests 3[a][ii]-3[a][v]. c. 3[b][i] “(i) in electronic communication with the at least one camera, and” 204. It is my opinion that Cui discloses or suggests 3[b][i]. 205. Cui describes that computer 7 is connected to camera 5 through image acquisition card 21, and “the image acquisition card 21 is connected to the charge-coupled device (CCD) camera 5.” Cui, Claim 3, pp.5-7, FIGS. 5-6 (annotated below). During cleaning, “camera 5...continuously captures images” and “[t]he video signal undergoes A/D conversion through the high-

image acquisition card 21” for processing by computer 7. Cui, pp.5-7. [omitted images] d. 3[b][ii] Cui discloses or suggests 3[b][ii]. Janét, ¶¶206-207. Cui discloses or suggests that its computer 7 (controller) “generate[s], in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to...the first portion of the submerged surface.” Janét, ¶207. Specifically, Cui describes that its controller compares captured images with stored standard images to identify sediment/debris—“when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in a high comparison output voltage.” Cui, pp.6-7. Based on this image-derived signal, “[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15.” <i>Id.</i>, p.7. Thus, these are “control signal[s]” generated “in response to the captured image.” Janét, ¶207. As explained in §IV.C.3.e (1[d]), Cui’s camera 5 captures images of areas “located directly in front and below a crawling direction of the cleaner.” Cui, Abstract, pp.5-7. Therefore, when the controller generates signals to adjust motor speed based on detected debris, the robot continues moving forward toward the debris-laden area	speed image acquisition card 21” for processing by computer 7. Cui, pp.5-7. [omitted images] d. 3[b][ii] “(ii) configured to generate, in response to at least one of the captured image or information from the portable electronic device, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.” 206. In my opinion, Cui discloses or suggests 3[b][ii]. 207. Cui discloses or suggests that its computer 7 (controller) “generate[s], in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to...the first portion of the submerged surface.” Specifically, Cui describes that its controller compares captured images with stored standard images to identify sediment/debris—“when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in a high comparison output voltage.” Cui, pp.6-7. Based on this image-derived signal, “[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15.” <i>Id.</i>, p.7. Thus, these are “control signal[s]” generated “in response to the captured image.” As explained in §VII.C.3.e (1[d]), Cui’s camera 5 captures images of areas “located directly in front and below a crawling direction of the cleaner.” Cui, Abstract, pp.5-7. Therefore, when the controller generates signals to adjust motor speed based on detected debris, the robot continues moving forward toward the debris-laden area identified in the image—
--	---

identified in the image—i.e., the control signals cause movement “to” the first portion of the submerged surface. Janét, ¶207. Therefore, Cui renders Claim 3 obvious. Janét, ¶¶201-208.	i.e., the control signals cause movement “to” the first portion of the submerged surface. 208. Therefore, it is my opinion that Cui renders Claim 3 obvious.
E. Ground 3: Claims 1-3 Are Unpatentable over Knoll 1. Knoll Knoll (EX1006) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1), and prior art under pre-AIA 35 U.S.C. §102(b). <i>See</i> §III.C, <i>supra</i>; Janét, ¶209. Knoll discloses “a pool robotic vehicle, in particular a pool cleaning robot, whose working element is, for example, a filter device and/or suction device and/or cleaning device” and disclose features of an autonomous pool cleaner with camera-based navigation capacities. Knoll, Title, Abstract, [0021], Claims 1-14, [0001]- [0002], [0007], [0027], Fig. 1 (reproduced below). Knoll is analogous art. Janét, ¶210. [omitted image] Knoll’s system includes robotic vehicle 1 with drive means 12, distance-determining device 5 comprising digital camera 6 and light beam source 7 rotatably mounted on mounting plate 8, and	E. Ground 3: Claims 1-3 Are Unpatentable under AIA 35 U.S.C. §103 and Pre-AIA AIA 35 U.S.C. §103 over Knoll 1. Knoll 209. Knoll (EX1006) is German Patent Application Publication No. Publication No. DE102007053310A1 published on June 10, 2009. Knoll is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1) because it was published more than one year before the effective filing date of the ’191 Patent which is no earlier than July 11, 2016. <i>See</i> §VI.C, <i>supra</i>. In addition, Knoll is also prior art under pre-AIA 35 U.S.C. §102(b). 210. Knoll discloses “a pool robotic vehicle, in particular a pool cleaning robot, whose working element is, for example, a filter device and/or suction device and/or cleaning device” and disclose features of an autonomous pool cleaner with camera-based navigation capacities. Knoll, Title, Abstract, [0001]- [0002], [0007], [0021], Claims 1-14, Fig. 1 (reproduced below, described in [0027]). Knoll is analogous art with respect to Claims 1-3 of the ’191 Patent. [omitted image] 211. Knoll’s system includes robotic vehicle 1 with drive means 12, distance-determining device 5 comprising digital camera 6 and light beam source 7 rotatably mounted on mounting plate 8,

control unit 11 for controlling the drive means. <i>See</i> Knoll, [0007], [0027]-[0028], FIGS. 1-2. The robotic vehicle is “a pool robot with a suction and/or filter and/or cleaning device” that operates on working area 3 formed by the pool bottom and delimited by boundary surface 4 (pool walls). <i>Id.</i> Knoll’s camera 6 captures images of the boundary surface, which evaluation unit 10 processes to derive “quasi-continuously determined smallest distance measurement values” relative to the boundary. Knoll, [0028]. Control unit 11 uses these image-derived values to “automatically calculate[] a trajectory” and generate control signals that “control[] the drive means 12” to move the vehicle “away from or toward” the boundary to maintain a “defined distance.” Knoll, [0028], Claim 2, FIG. 2 (reproduced below). [omitted image] 2. Claim 1 Unpatentable over Knoll a. 1[pre] Knoll discloses or suggests 1[pre]. Janét, ¶¶213-217. Knoll discloses an “autonomous robotic vehicle 1 designed as a pool cleaning vehicle” with “drive means (12) for driving and steering” and a control unit 11 that controls drive means 12 and is “designed to automatically calculate a trajectory.” Knoll, Abstract; [0027]-[0028]; Claims 2, 14, FIG. 1 (annotated below); Janét, ¶214. [omitted image]	and control unit 11 for controlling the drive means. <i>See</i> Knoll, [0007], [0027]-[0028], FIGS. 1-2. The robotic vehicle is “a pool robot with a suction and/or filter and/or cleaning device” that operates on working area 3 formed by the pool bottom and delimited by boundary surface 4 (pool walls). <i>Id.</i> 212. Knoll’s camera 6 captures images of the boundary surface, which evaluation unit 10 processes to derive “quasi-continuously determined smallest distance measurement values” relative to the boundary. Knoll, [0028]. Control unit 11 uses these image-derived values to “automatically calculate[] a trajectory” and generate control signals that “control[] the drive means 12” to move the vehicle “away from or toward” the boundary to maintain a “defined distance.” Knoll, [0028], Claim 2, FIG. 2 (reproduced below). [omitted image] 2. Claim 1 Unpatentable over Knoll a. 1[pre] “A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:” 213. In my opinion, Knoll discloses or suggests 1[pre]. 214. Knoll discloses an “autonomous robotic vehicle 1 designed as a pool cleaning vehicle” with “drive means (12) for driving and steering” and a control unit 11 that controls drive means 12 and is “designed to automatically calculate a trajectory.” Knoll, Abstract; [0027]-[0028]; Claims 2, 14, FIG. 1 (annotated below). [omitted image]
--	--

Knoll's robotic vehicle is a self-propelled pool cleaner because it is a "pool robot with a suction and/or filter and/or cleaning device" and its drive means autonomously propels the vehicle under the control of control unit 11. Knoll, [0007], [0028]; Janét, ¶215.

Knoll's robotic vehicle equipped with a suction/filter/cleaning device, cleans debris from a submerged surface of a swimming pool because it operates on "working area 3...formed by the bottom of the pool" and achieves "a complete and efficient cleaning of a pool floor and/or the pool walls." Knoll, [0007], [0027]-[0028], FIG. 1 (below); Janét, ¶216.

[omitted image]

A POSITA would have understood that Knoll's robotic vehicle (pool cleaner) cleans debris from submerged pool surfaces—including working area 3 (pool bottom) and pool walls—because the pool bottom and walls are submerged when the pool is in normal service, and pool-cleaning robots are intended to operate in filled pools to clean debris from these submerged surfaces. Janét, ¶217.

b. 1[a]

Knoll discloses or suggests 1[a]. Janét, ¶¶218-220.

Knoll's robotic vehicle 1 (pool cleaning system) includes various components: **drive means 12** "for generating propulsion and for steering," **control unit 11** that "controls the drive means" and is "designed to automatically calculate a trajectory of the robotic vehicle," and "suction and/or filter and/or cleaning

215. Knoll's robotic vehicle is a self-propelled pool cleaner because it is a "pool robot with a suction and/or filter and/or cleaning device" and its drive means autonomously propels the vehicle under the control of control unit 11. Knoll, [0007], [0028].

216. Knoll's robotic vehicle equipped with a suction/filter/cleaning device, cleans debris from a submerged surface of a swimming pool because it operates on "working area 3...formed by the bottom of the pool" and achieves "a complete and efficient cleaning of a pool floor and/or the pool walls." Knoll, [0007], [0027]-[0028], FIG. 1 (below).

[omitted image]

217. A POSITA would have understood that Knoll's robotic vehicle (pool cleaner) cleans debris from submerged pool surfaces—including working area 3 (pool bottom) and pool walls—because the pool bottom and walls are submerged when the pool is in normal service, and pool-cleaning robots are intended to operate in filled pools to clean debris from these submerged surfaces.

b. 1[a] "a. a vehicle body;"

218. It is my opinion that Knoll discloses or suggests 1[a].

219. Knoll's robotic vehicle 1 (pool cleaning system) includes various components: **drive means 12** "for generating propulsion and for steering," **control unit 11** that "controls the drive means" and is "designed to automatically calculate a trajectory of the robotic vehicle," and "suction and/or filter and/or cleaning

device.” Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below). [omitted image] A POSITA would have understood that Knoll’s robotic vehicle—comprising the integrated physical structure housing these components—constitutes the claimed “vehicle body.” Janét, ¶220. c. 1[b] Knoll discloses or suggests 1[b]. Janét, ¶¶221-225. The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding structure is wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet. EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶222. Knoll’s Fig 1 (annotated below) shows robotic vehicle 1 with drive means 12 and wheels contacting the pool bottom surface within working area 3. Knoll, Fig. 1. [omitted image] Knoll describes that “drive means (12) for driving and steering the robotic vehicle (1)” are configured “for generating propulsion and for steering the robotic vehicle 1.” Knoll, Abstract, [0028], Claims 1, 14. A POSITA would have understood that Knoll’s drive means 12 comprises motor(s)	device.” Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below). [omitted image] 220. A POSITA would have understood that Knoll’s robotic vehicle—comprising the integrated physical structure housing these components—constitutes the claimed “vehicle body.” c. 1[b] “b. means for moving the vehicle body within the swimming pool;” 221. In my opinion, Knoll discloses or suggests 1[b]. 222. The format and content of 1[b] invoke claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §VI.D, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding structure is wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet. EX1001, 3:31-43, 10:12-14, FIGS. 9-10. 223. Knoll’s Fig 1 (annotated below) shows robotic vehicle 1 with drive means 12 and wheels contacting the pool bottom surface within working area 3. Knoll, Fig. 1. [omitted image] 224. Knoll describes that “drive means (12) for driving and steering the robotic vehicle (1)” are configured “for generating propulsion and for steering the robotic vehicle 1.” Knoll, Abstract, [0028], Claims 1, 14. A POSITA would have understood that Knoll’s drive means 12 comprises motor(s)
--	--

powering the wheels, because generating propulsion and steering for a wheeled robotic vehicle needs motor-driven wheel rotation. Janét, ¶224. A POSITA would have understood that Knoll thus discloses the claimed function and corresponding structure: wheels contact the submerged pool surfaces and are powered by a motor to propel the vehicle body within the swimming pool. Janét, ¶225. Specifically, the '191 Patent discloses wheels that propel the vehicle “along the submerged pool surfaces” and are “powered by a motor” (EX1001, 3:33-39), and Knoll similarly discloses wheels (Figure 1) that contact the pool bottom surface and are powered by motor(s) (as part of drive means 12) to move robotic vehicle 1 within the pool. Janét, ¶225. d. 1[c] Knoll discloses or suggests 1[c]. Janét, ¶¶226-228. Knoll discloses this limitation because its pool cleaning robot includes “a filter device and/or suction device.” Knoll, [0007], [0021]. Knoll describes its robot operates on “working area 3...formed by the bottom of the pool” and its control unit is “located inside the robotic vehicle in a waterproof housing.” Knoll, [0008], [0027]. A POSITA would have understood that Knoll’s suction device draws water containing debris from the pool’s submerged surfaces by suction, and the filter device retains this collected debris, because Knoll’s robot operates on the bottom of the pool and has “waterproof housing” for its control unit (Knoll, [0008]), and the filters in pool cleaning systems, like Knoll’s, capture and	powering the wheels, because generating propulsion and steering for a wheeled robotic vehicle needs motor-driven wheel rotation. 225. A POSITA would have understood that Knoll thus discloses the claimed function and corresponding structure: wheels contact the submerged pool surfaces and are powered by a motor to propel the vehicle body within the swimming pool. Specifically, the '191 Patent discloses wheels that propel the vehicle “along the submerged pool surfaces” and are “powered by a motor” (EX1001, 3:33-39), and Knoll similarly discloses wheels (Figure 1) that contact the pool bottom surface and are powered by motor(s) (as part of drive means 12) to move robotic vehicle 1 within the pool. d. 1[c] “c. a filter configured to retain debris collected from the submerged surface;” 226. In my opinion, Knoll discloses or suggests 1[c]. 227. Knoll discloses this limitation because its pool cleaning robot includes “a filter device and/or suction device.” Knoll, [0007], [0021]. Knoll describes its robot operates on “working area 3...formed by the bottom of the pool” and its control unit is “located inside the robotic vehicle in a waterproof housing.” Knoll, [0008], [0027]. 228. A POSITA would have understood that Knoll’s suction device draws water containing debris from the pool’s submerged surfaces by suction, and the filter device retains this collected debris, because Knoll’s robot operates on the bottom of the pool and has “waterproof housing” for its control unit (Knoll, [0008]), and the filters in pool cleaning systems, like Knoll’s, capture and
--	--

retain debris while allowing clean water to pass through, preventing debris from recirculating back into the pool. Janét, ¶228.

e. 1[d]

Knoll discloses or suggests 1[d]. Janét, ¶¶229-234.

Knoll discloses “at least one camera positioned on or in the body,” because Knoll describes “robotic vehicle 1 is equipped with a distance-determining device 5 (sensor device), which...comprises a...digital **camera 6**.” Knoll, [0028], FIG. 1 (annotated below); Janét, ¶230.

[omitted image]

As explained in §IV.E.2.b (1[a]), Knoll’s robotic vehicle is the claimed “vehicle body,” and a POSITA would have understood that camera 6, which is part of distance-determining device 5 arranged on robotic vehicle 1, is “positioned on or in the body.” Janét, ¶231.

Knoll also discloses “the at least one camera...for capturing an image of at least a first portion of the submerged surface.” Janét, ¶232. As explained in §IV.E.2.a (1[pre]), Knoll’s pool cleaning robot achieves “a complete and efficient cleaning of a pool floor and/or the pool walls,” where the pool bottom (working area 3) and pool walls (boundary surface 4) are submerged surfaces. Knoll, [0007], [0027]-[0028].

retain debris while allowing clean water to pass through, preventing debris from recirculating back into the pool.

e. 1[d] “d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and”

229. In my opinion, Knoll discloses or suggests 1[d].

230. Knoll discloses “at least one camera positioned on or in the body,” because Knoll describes “robotic vehicle 1 is equipped with a distance-determining device 5 (sensor device), which...comprises a...digital **camera 6**.” Knoll, [0028], FIG. 1 (annotated below).

[omitted image]

231. As explained in §VII.E.2.b (1[a]), Knoll’s robotic vehicle is the claimed “vehicle body,” and a POSITA would have understood that camera 6, which is part of distance-determining device 5 arranged on robotic vehicle 1, is “positioned on or in the body.”

232. Knoll also discloses “the at least one camera...for capturing an image of at least a first portion of the submerged surface.” As explained in §VII.E.2.a (1[pre]), Knoll’s pool cleaning robot achieves “a complete and efficient cleaning of a pool floor and/or the pool walls,” where the pool bottom (working area 3) and pool walls (boundary surface 4) are submerged surfaces. Knoll, [0007], [0027]-[0028].

Knoll describes that camera 6 is positioned to observe boundary surface 4 formed by pool walls. Knoll, [0028], FIG. 1. Knoll explains that “a light beam is focused on the boundary line or boundary surface and **observed with a camera**,” and that “the angle at which the light beam is **observed** changes and thus the position of **its image** on the **camera**’s photo sensor changes” as the “distance of the boundary line or the boundary surface (measurement object) from the sensor (e.g., a **camera**) changes.” Knoll, [0018].

A POSITA would have understood that camera 6 captures images of “at least a first portion of the submerged surface” because: (1) the pool walls (boundary surface 4) observed by camera 6 are themselves submerged surfaces that Knoll’s robot cleans; and (2) for triangulation to determine distance, the camera captures an image of a scene—not merely a point or line—and the camera’s field of view encompasses portions of the submerged pool surfaces (first portion), e.g., pool bottom and/or walls, within the scene where the light beam is reflected. Knoll, [0018], [0027]-[0028]; Janét, ¶234.

f. 1[e][i]

Knoll discloses or suggests 1[e][i]. Janét, ¶¶235-238.

Knoll’s robotic vehicle 1 includes a **control unit 11** inside the vehicle body that controls **drive means 12** and is “designed to automatically calculate a trajectory of the robotic vehicle,” and “suction and/or filter and/or cleaning device.” Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below).

[omitted image]

233. Knoll describes that camera 6 is positioned to observe boundary surface 4 formed by pool walls. Knoll, [0028], FIG. 1. Knoll explains that “a light beam is focused on the boundary line or boundary surface and **observed with a camera**,” and that “the angle at which the light beam is **observed** changes and thus the position of **its image** on the **camera**’s photo sensor changes” as the “distance of the boundary line or the boundary surface (measurement object) from the sensor (e.g., a **camera**) changes.” Knoll, [0018].

234. A POSITA would have understood that camera 6 captures images of “at least a first portion of the submerged surface” because: (1) the pool walls (boundary surface 4) observed by camera 6 are themselves submerged surfaces that Knoll’s robot cleans; and (2) for triangulation to determine distance, the camera captures an image of a scene—not merely a point or line—and the camera’s field of view encompasses portions of the submerged pool surfaces (first portion), e.g., pool bottom and/or walls, within the scene where the light beam is reflected. Knoll, [0018], [0027]-[0028].

f. 1[e][i] “e. a controller (i) positioned on or in the body,”

235. In my opinion, Knoll discloses or suggests 1[e][i].

236. Knoll’s robotic vehicle 1 includes a **control unit 11** inside the vehicle body that controls **drive means 12** and is “designed to automatically calculate a trajectory of the robotic vehicle,” and “suction and/or filter and/or cleaning device.” Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below).

[omitted image]

Knoll's robotic vehicle 1 includes various components: **drive means 12** "for generating propulsion and for steering," **control unit 11** that "controls the drive means" and is "designed to automatically calculate a trajectory of the robotic vehicle," and "suction and/or filter and/or cleaning device." Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below).

[omitted image]

Knoll discloses the controller "positioned...in the body" because Knoll describes "the **control unit** is preferably **located inside the robotic vehicle** in a waterproof housing or in the camera." Knoll, [0008], FIG. 1 (annotated above). As explained in §IV.E.2.b (1[a]), robotic vehicle 1 is the claimed "vehicle body." A POSITA would have understood that control unit 11 located "inside the robotic vehicle" is "positioned on or in the body." Janét, ¶238.

g. 1[e][ii]

Knoll discloses or suggests 1[e][ii]. Janét, ¶¶239-241.

Knoll discloses its control unit (controller) is in electronic communication with camera 6, because it receives and processes image data from camera 6. *See, e.g.*, Knoll, [0018], [0028]; Janét, ¶240. Specifically, Knoll explains that "the distance-determining device uses the rotating light beam source and the rotating camera to determine the distance to the boundary line or boundary surface by triangulation" and that the device includes "an **evaluation unit 10** for evaluating or determining the

237. Knoll's robotic vehicle 1 includes various components: **drive means 12** "for generating propulsion and for steering," **control unit 11** that "controls the drive means" and is "designed to automatically calculate a trajectory of the robotic vehicle," and "suction and/or filter and/or cleaning device." Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below).

[omitted image]

238. Knoll discloses the controller "positioned...in the body" because Knoll describes "the **control unit** is preferably **located inside the robotic vehicle** in a waterproof housing or in the camera." Knoll, [0008], FIG. 1 (annotated above). As explained in §VII.E.2.b (1[a]), robotic vehicle 1 is the claimed "vehicle body." A POSITA would have understood that control unit 11 located "inside the robotic vehicle" is "positioned on or in the body."

g. 1[e][ii] "(ii) in electronic communication with the at least one camera, and"

239. In my opinion, Knoll discloses or suggests 1[e][ii]. 240.

Knoll discloses its control unit (controller) is in electronic communication with camera 6, because it receives and processes image data from camera 6. *See, e.g.*, Knoll, [0018], [0028]. Specifically, Knoll explains that "the distance-determining device uses the rotating light beam source and the rotating camera to determine the distance to the boundary line or boundary surface by triangulation" and that the device includes "an **evaluation unit 10** for evaluating or determining the

measured distance values,” with “the evaluation unit 10 [being] part of a **control unit 11**.” Knoll, [0018], [0028], FIG. 1 (annotated below; showing **evaluation unit 10** (part of **control unit 11**) is connected to **camera 6** via a wire/cable; Janét, ¶240.

[omitted image]

Knoll further explains that “a light beam is focused on the boundary line or boundary surface and observed with a camera,” and that as “the angle at which the light beam is observed changes...the **position of its image on the camera’s photo sensor changes**,” with “[t]he distance...then **calculated from the change in position**.” Knoll, [0018]. A POSITA would have understood that control unit 11 is in electronic communication with camera 6 because, to calculate distance values from images captured on the camera, evaluation unit 10, part of control unit 11, would receive data from camera 6 for processing. Knoll, [0018], [0028]; Janét, ¶241.

h. 1[e][iii]

Knoll discloses or suggests 1[e][iii]. Janét, ¶¶242-246.

Knoll discloses generating control signals “in response to the captured image.” Specifically, Knoll’s control unit 11 receives sensor information from distance-determining device 5 (which includes camera 6) and “controls the drive means 12 as a function of...quasi-continuously determined smallest distance measurement values.” Knoll, [0028]. Knoll also explains that the distance measurement values are derived from images captured

measured distance values,” with “the evaluation unit 10 [being] part of a **control unit 11**.” Knoll, [0018], [0028], FIG. 1 (annotated below; showing **evaluation unit 10** (part of **control unit 11**) is connected to **camera 6** via a wire/cable.

[omitted image]

241. Knoll further explains that “a light beam is focused on the boundary line or boundary surface and observed with a camera,” and that as “the angle at which the light beam is observed changes...the **position of its image on the camera’s photo sensor changes**,” with “[t]he distance...then **calculated from the change in position**.” Knoll, [0018]. A POSITA would have understood that control unit 11 is in electronic communication with camera 6 because, to calculate distance values from images captured on the camera, evaluation unit 10, part of control unit 11, would receive data from camera 6 for processing. Knoll, [0018], [0028].

h. 1[e][iii] “(iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.”

242. In my opinion, Knoll discloses or suggests 1[e][iii].

243. Knoll discloses generating control signals “in response to the captured image.” Specifically, Knoll’s control unit 11 receives sensor information from distance-determining device 5 (which includes camera 6) and “controls the drive means 12 as a function of...quasi-continuously determined smallest distance measurement values.” Knoll, [0028]. Knoll also explains that the distance measurement values are derived from images captured

by camera 6, where “the position of its image on the camera’s photo sensor changes” based on the distance to boundary surface 4, and “[t]he distance...is then calculated from the change in position.” Knoll, [0018]. A POSITA would have understood that Knoll’s control unit generates control signals “in response to the captured image” because the control signals are based on distance measurements derived from images captured by camera 6. Janét, ¶243.

Knoll also discloses generating control signals to cause movement “to, or away from, the first portion of the submerged surface.” Janét, ¶244. As explained in §IV.E.2.e (1[d]), a portion of boundary surface 4 captured by camera 6 constitutes the “first portion of the submerged surface.” Knoll further explains that control unit 11 controls drive means 12 “in such a way that the robotic vehicle maintains a defined distance from the boundary line and/or boundary surface” as the vehicle travels working area 3 in a plurality of laps. Knoll, [0011], Claim 4, FIG. 2 (below).

[omitted image]

A POSITA would have understood that, to maintain a defined distance from boundary surface 4 (first portion of the submerged surface), Knoll’s control unit generates control signals that cause the vehicle body to **move away** from boundary surface 4 when the measured distance becomes too small and **toward** boundary surface 4 when the measured distance becomes too large. Janét, ¶245.

3. Claim 2 Unpatentable over Knoll

Knoll renders Claim 2 obvious. Janét, ¶¶247-254.

by camera 6, where “the position of its image on the camera’s photo sensor changes” based on the distance to boundary surface 4, and “[t]he distance...is then calculated from the change in position.” Knoll, [0018]. A POSITA would have understood that Knoll’s control unit generates control signals “in response to the captured image” because the control signals are based on distance measurements derived from images captured by camera 6.

244. Knoll also discloses generating control signals to cause movement “to, or away from, the first portion of the submerged surface.” As explained in §VII.E.2.e (1[d]), a portion of boundary surface 4 captured by camera 6 constitutes the “first portion of the submerged surface.” Knoll further explains that control unit 11 controls drive means 12 “in such a way that the robotic vehicle maintains a defined distance from the boundary line and/or boundary surface” as the vehicle travels working area 3 in a plurality of laps. Knoll, [0011], Claim 4, FIG. 2 (below).

[image omitted]

245. A POSITA would have understood that, to maintain a defined distance from boundary surface 4 (first portion of the submerged surface), Knoll’s control unit generates control signals that cause the vehicle body to **move away** from boundary surface 4 when the measured distance becomes too small and **toward** boundary surface 4 when the measured distance becomes too large.

246. Therefore, in my opinion, Knoll renders Claim 1 obvious.

3. Claim 2 Unpatentable over Knoll

247. In my opinion, Knoll renders Claim 2 obvious.

a. 2[pre]

Knoll discloses or suggests 2[pre]. Janét, ¶¶248-251.

Knoll discloses a system operating within a swimming pool, because it discloses “autonomous robotic vehicle 1 designed as a pool cleaning vehicle” with a **control unit 11**, **drive means 12**, and distance-determining device 5 comprising a **camera 6** that operates within a swimming pool. Knoll, [0027]-[0028], FIG. 1 (annotated below); *see also* §IV.E.2.a (1[pre]); Janét, ¶249.

[omitted image]

Knoll’s robotic vehicle equipped with a suction/filter/cleaning device, cleans debris from a submerged surface of a swimming pool because it operates on “working area 3...formed by the bottom of the pool” and achieves “a complete and efficient cleaning of a pool floor and/or the pool walls.” Knoll, [0007], [0027]-[0028], FIG. 1 (below); *see also* §IV.E.2.a (1[pre]); Janét, ¶250.

[omitted image]

A POSITA would have understood that Knoll’s system, through the robotic vehicle (pool cleaner), cleans debris from submerged pool surfaces—including working area 3 (pool bottom) and pool walls—because the pool bottom and walls are submerged when the pool is in normal service, and pool-cleaning robots are intended to operate in filled pools to clean debris from these submerged surfaces. Janét, ¶251. *See also* §IV.E.2.a (1[pre]).

a. 2[pre] “A system for cleaning debris from a submerged surface of a swimming pool, comprising”

248. In my opinion, Knoll discloses or suggests 2[pre].

249. Knoll discloses a system operating within a swimming pool, because it discloses “autonomous robotic vehicle 1 designed as a pool cleaning vehicle” with a **control unit 11**, **drive means 12**, and distance-determining device 5 comprising **camera 6** that operates within a swimming pool. Knoll, [0027]-[0028], FIG. 1 (annotated below); *see also* §VII.E.2.a (1[pre]).

[omitted image]

250. Knoll’s robotic vehicle equipped with a suction/filter/cleaning device, cleans debris from a submerged surface of a swimming pool because it operates on “working area 3...formed by the bottom of the pool” and achieves “a complete and efficient cleaning of a pool floor and/or the pool walls.” Knoll, [0007], [0027]-[0028], FIG. 1 (below); *see also* §VII.E.2.a (1[pre]).

[omitted image]

251. A POSITA would have understood that Knoll’s system, through the robotic vehicle (pool cleaner), cleans debris from submerged pool surfaces—including working area 3 (pool bottom) and pool walls—because the pool bottom and walls are submerged when the pool is in normal service, and pool-cleaning robots are intended to operate in filled pools to clean debris from these submerged surfaces. *See also* §VII.E.2.a (1[pre]).

b. 2[a][i] Knoll discloses 2[a][i] as explained in §IV.E.2.a (1[Pre]). Janét, ¶252. c. 2[a][ii]-2[b] Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained above in §§IV.E.2.b-h (1[a]-1[e][iii]), Knoll discloses or suggests 2[a][ii]-2[b]. Janét, ¶253. 4. Claim 3 Unpatentable over Knoll Knoll renders Claim 3 obvious. Janét, ¶255-258. a. 3[pre], 3[a][i] Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Knoll discloses 3[Pre] and 3[a][i] as explained in §§IV.E.3.a-b; <i>see also</i> §IV.E.2.a (1[Pre]). Janét, ¶256. b. 3[a][ii]-3[b][ii] Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in	b. 2[a][i] “a self-propelled pool cleaner comprising:” 252. In my opinion, Knoll discloses 2[a][i] as explained in §VII.E.2.a (1[Pre]). c. 2[a][ii]-2[b] 253. Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained above in §§VII.E.2.b-h (1[a]-1[e][iii]), Knoll discloses or suggests 2[a][ii]-2[b]. 254. Therefore, in my opinion, Knoll renders Claim 2 obvious. 4. Claim 3 Unpatentable over Knoll 255. In my opinion, Knoll renders Claim 3 obvious. a. 3[pre], 3[a][i] 256. Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Knoll discloses 3[Pre] and 3[a][i] as explained in §§VII.E.3.a-b; <i>see also</i> §VII.E.2.a (1[Pre]). b. 3[a][ii]-3[b][ii] 257. Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in
---	---

§§IV.E.2.b-e, IV.E.2.g (1[a]-1[d], 1[e][ii]-1[e][iii]), Knoll discloses or suggests 3[a][ii]-3[b][ii]. Janét, ¶257.	§§VII.E.2.b-e, VII.E.2.g (1[a]-1[d], 1[e][ii]- 1[e][iii]), Knoll discloses or suggests 3[a][ii]-3[b][ii]. 258. Therefore, in my opinion, Knoll renders Claim 3 obvious.
F. Ground 4: Claims 1-3 Are Unpatentable over Renaud 1. Renaud Renaud (EX1015) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1). <i>See</i> §III.C, <i>supra</i>; Janét, ¶259. As explained below, Renaud discloses a self-propelled pool cleaning robot using controls based on camera images. Renaud is analogous art with respect to Claims 1-3 of the '191 Patent. Janét, ¶260. 2. Claim 1 Unpatentable over Renaud Renaud renders Claim 1 obvious. Janét, ¶¶261-289. a. 1[pre] Renaud discloses or suggests 1[pre]. Janét, ¶¶262-265. Renaud discloses a “swimming pool cleaner.” Renaud, Title, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3	F. Ground 4: Claims 1-3 Are Unpatentable under 35 U.S.C. §103 over Renaud 1. Renaud 259. Renaud (EX1015) is U.S. Publication No. 20140263087A1 published on September 18, 2014. Renaud is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1) because it was published more than one year before the effective filing date of the '191 Patent which is no earlier than July 11, 2016. <i>See</i> §VI.C, <i>supra</i>. 260. As explained below, Renaud discloses a self-propelled pool cleaning robot using controls based on camera images. Renaud is analogous art with respect to Claims 1-3 of the '191 Patent. 2. Claim 1 Unpatentable over Renaud 261. In my opinion, Renaud renders Claim 1 obvious. a. 1[pre] “A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:” 262. In my opinion, Renaud discloses or suggests 1[pre]. 263. Renaud discloses a “swimming pool cleaner.” Renaud, Title, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3

(cleaners 200/200a' (“positioned at the water line”) /200b' (“positioned at the bottom of the swimming pool”)/200c' (“positioned in a docking orientation relative to the docking station”)/200”). Renaud further describes that “[r]obotic swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls to clean the necessary surfaces from, e.g., debris, sediment, and the like.” Renaud, [0003]. [images omitted] Renaud discloses the pool cleaner is “self-propelled” because Renaud describes cleaner 200 includes “a motor, e.g., an electronically commutated motor” and “wheels 206, e.g., rollers, tracks, and the like, for moving the cleaner 200 in the swimming pool 102.” Renaud, [0023], [0025]. Renaud further describes that “the vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris.” Renaud, [0030]. A POSITA would have understood that a robotic cleaner with an onboard motor that drives and steers wheels for movement under the control of the onboard vision system is “self-propelled.” Janét, ¶264. Renaud discloses the pool cleaner “cleaning debris from a submerged surface of a swimming pool” because Renaud describes cleaner 200 “traverses, and cleans near, the walls (e.g., vertical or horizontal walls) of the pool” in “bottom mode” and “rises to the water surface and cleans the water surface” in “top mode.” Renaud, [0022]. Renaud further describes cleaner 200 uses “a suction pump impeller” to “collect the debris in the swimming pool” and collects “debris collected from the swimming pool 102” into “a debris container” located in housing	(cleaners 200/200a' (“positioned at the water line”) /200b' (“positioned at the bottom of the swimming pool”)/200c' (“positioned in a docking orientation relative to the docking station”)/200”). Renaud further describes that “[r]obotic swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls to clean the necessary surfaces from, e.g., debris, sediment, and the like.” Renaud, [0003]. [images omitted] 264. Renaud discloses the pool cleaner is “self-propelled” because Renaud describes cleaner 200 includes “a motor, e.g., an electronically commutated motor” and “wheels 206, e.g., rollers, tracks, and the like, for moving the cleaner 200 in the swimming pool 102.” Renaud, [0023], [0025]. Renaud further describes that “the vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris.” Renaud, [0030]. A POSITA would have understood that a robotic cleaner with an onboard motor that drives and steers wheels for movement under the control of the onboard vision system is “self-propelled.” 265. Renaud discloses the pool cleaner “cleaning debris from a submerged surface of a swimming pool” because Renaud describes cleaner 200 “traverses, and cleans near, the walls (e.g., vertical or horizontal walls) of the pool” in “bottom mode” and “rises to the water surface and cleans the water surface” in “top mode.” Renaud, [0022]. Renaud further describes cleaner 200 uses “a suction pump impeller” to “collect the debris in the swimming pool” and collects “debris collected from the swimming pool 102” into “a debris container” located in housing
--	---

202. Renaud, [0023], [0030]. A POSITA would have understood that cleaner 200 cleans a submerged surface below the water surface at least when operating in “bottom mode.” Janét, ¶265. b. 1[a] Renaud discloses or suggests 1[a]. Janét, ¶¶266-267. As explained in §IV.F.2.a (1[pre]), Renaud discloses cleaner 200/200a’ (“positioned at the water line”)/200b’ (“positioned at the bottom of the swimming pool 102”)/200c’ (“positioned in a docking orientation relative to the docking station 300”)/200”. Renaud, [0022]-[0023], [0037], [0039], FIGS. 1-3 (annotated above). Renaud describes “cleaner 200 includes a housing 202 which includes a plurality of components therein,” including “a motor, e.g., an electronically commutated motor, a storage device, and a processing device,” as well as “a debris container,” and “wheels 206, e.g., rollers, tracks, and the like.” Renaud, [0023], [0025], FIGS. 1-3. A POSITA would have understood that the assembled structure of cleaner 200—comprising housing 202 and the components within or carried by it—that travels within the pool constitutes the claimed “vehicle body.” Janét, ¶267. c. 1[b] Renaud discloses or suggests 1[b]. Janét, ¶¶268-271. The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding	202. Renaud, [0023], [0030]. A POSITA would have understood that cleaner 200 cleans a submerged surface below the water surface at least when operating in “bottom mode.” b. 1[a] “a. a vehicle body;” 266. In my opinion, Renaud discloses or suggests 1[a]. 267. As explained in §VII.F.2.a (1[pre]), Renaud discloses cleaner 200/200a’ (“positioned at the water line”)/200b’ (“positioned at the bottom of the swimming pool 102”)/200c’ (“positioned in a docking orientation relative to the docking station 300”)/200”. Renaud, [0022]-[0023], [0037], [0039], FIGS. 1-3 (annotated above). Renaud describes “cleaner 200 includes a housing 202 which includes a plurality of components therein,” including “a motor, e.g., an electronically commutated motor, a storage device, and a processing device,” as well as “a debris container,” and “wheels 206, e.g., rollers, tracks, and the like.” Renaud, [0023], [0025], FIGS. 1-3. A POSITA would have understood that the assembled structure of cleaner 200—comprising housing 202 and the components within or carried by it—that travels within the pool constitutes the claimed “vehicle body.” c. 1[b] “b. means for moving the vehicle body within the swimming pool;” 268. In my opinion, Renaud discloses or suggests 1[b]. 269. The format and content of 1[b] invoke claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §VI.D, the recited function is “moving the vehicle body within the swimming pool,” and the corresponding
---	---

structure is “wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet.” EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶269. Renaud discloses identical function because it describes cleaner 200 “includes wheels 206...for moving the cleaner 200 in the swimming pool 102.” Renaud, [0025]. Renaud further describes the “vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris.” Renaud, [0030]. <i>See also</i> Renaud, [0003] (“Robotic swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls”). Renaud discloses identical corresponding structure. Renaud describes cleaner 200 includes “wheels 206, e.g., rollers, tracks, and the like” powered by “a motor, e.g., an electronically commutated motor.” Renaud, [0009], [0023], [0025], FIGS. 1-3 (annotated below). [Images omitted] d. 1[c] Renaud discloses or suggests 1[c]. Janét, ¶¶272-275. As explained in §IV.F.2.a (1[pre]), Renaud’s cleaner 200 collects debris from submerged surfaces of the swimming pool. Renaud, [0022], [0023], [0030]. Renaud discloses “a filter configured to retain debris” because Renaud describes cleaner 200 includes “debris container” or “debris bag” for “collecting the debris collected from the	structure is “wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet.” EX1001, 3:31-43, 10:12-14, FIGS. 9-10. 270. Renaud discloses identical function because it describes cleaner 200 “includes wheels 206...for moving the cleaner 200 in the swimming pool 102.” Renaud, [0025]. Renaud further describes the “vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris.” Renaud, [0030]. <i>See also</i> Renaud, [0003] (“Robotic swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls”). 271. Renaud discloses identical corresponding structure. Renaud describes cleaner 200 includes “wheels 206, e.g., rollers, tracks, and the like” powered by “a motor, e.g., an electronically commutated motor.” Renaud, [0009], [0023], [0025], FIGS. 1-3 (annotated below). [images omitted] d. 1[c] “c. a filter configured to retain debris collected from the submerged surface;” 272. In my opinion, Renaud discloses or suggests 1[c]. 273. As explained in §VII.F.2.a (1[pre]), Renaud’s cleaner 200 collects debris from submerged surfaces of the swimming pool. Renaud, [0022], [0023], [0030]. 274. Renaud discloses “a filter configured to retain debris” because Renaud describes cleaner 200 includes “debris container” or “debris bag” for “collecting the debris collected
---	--

swimming pool 102.” Renaud, Abstract, [0006], [0015], [0023], [0030], Claim 20. Renaud also describes cleaner 200 uses “a suction pump impeller to collect the debris in the swimming pool into the debris container located in the housing 202 of the cleaner 200.” Renaud, [0030]. Renaud further describes “[t]he self-cleaning of the debris container, e.g., a debris bag” where “the debris container of the cleaner 200 can be cleaned/emptied into the debris container of the docking station 300.” Renaud, [0033], [0036]. A POSITA would have understood that Renaud’s debris container/debris bag of cleaner 200 retains debris—otherwise, there would be no need to clean or empty the debris container/bag of cleaner 200 as Renaud describes. Janét, ¶275. e. 1[d] Renaud discloses or suggests 1[d]. Janét, ¶¶276-278. Renaud discloses “at least one camera positioned on or in the body” because Renaud describes cleaner 200 includes a housing and a vision system, which includes a camera. Renaud, [0008], Claim 1. As explained in §IV.F.2.b (1[a]), cleaner 200 includes the claimed “vehicle body.” Renaud discloses the camera “for capturing an image of at least a first portion of the submerged surface” because Renaud describes “the sensors of the vision system can interact with the controller and/or processing device to identify areas on the pool floor, walls and/or water line where debris or dirt exists in the swimming pool 102, such as at the bottom (on the horizontal or vertical walls).” Renaud, [0029]. Renaud further describes the vision system “identifies	from the swimming pool 102.” Renaud, Abstract, [0006], [0015], [0023], [0030], Claim 20. Renaud also describes cleaner 200 uses “a suction pump impeller to collect the debris in the swimming pool into the debris container located in the housing 202 of the cleaner 200.” Renaud, [0030]. 275. Renaud further describes “[t]he self-cleaning of the debris container, e.g., a debris bag” where “the debris container of the cleaner 200 can be cleaned/emptied into the debris container of the docking station 300.” Renaud, [0033], [0036]. A POSITA would have understood that Renaud’s debris container/debris bag of cleaner 200 retains debris—otherwise, there would be no need to clean or empty the debris container/bag of cleaner 200 as Renaud describes. e. 1[d] “d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and” 276. In my opinion, Renaud discloses or suggests 1[d]. 277. Renaud discloses “at least one camera positioned on or in the body” because Renaud describes cleaner 200 includes a housing and a vision system, which includes a camera. Renaud, [0008], Claim 1. As explained in §VII.F.2.b (1[a]), cleaner 200 includes the claimed “vehicle body.” Renaud discloses the camera “for capturing an image of at least a first portion of the submerged surface” because Renaud describes “the sensors of the vision system can interact with the controller and/or processing device to identify areas on the pool floor, walls and/or water line where debris or dirt exists in the swimming pool 102, such as at the bottom (on the horizontal or vertical walls).” Renaud, [0029]. Renaud further describes the vision
--	---

areas of debris by sensing areas of optical contrast, for example, generated by a foreign object, debris and/or dirt." Renaud, [0031]. A POSITA would have understood that a camera of the vision system captures images to facilitate identification of specific "areas of debris" or "areas of optical contrast" (first portion) on pool floor and walls (submerged surfaces), which constitute the claimed "at least a first portion of the submerged surface." Janét, ¶277. Renaud discloses or suggests the camera is "positioned on or in the body" because Renaud explicitly identifies the camera as a component of the "vision system" (Renaud, [0008]) and physically locates the vision system "inside the cleaner 200" (e.g., "the vision system can include a PCB...disposed inside the cleaner 200") (Renaud, [0029]). Janét, ¶278. f. 1[e][i] Renaud discloses or suggests 1[e][i] because it includes a "processing device..., such as a microprocessor, inside...cleaner 200" disposed inside the cleaner 200," which interacts with the camera to control the cleaner. Renaud, [0008]-[0009], [0029]-[0030]. Janét, ¶¶279-282. Renaud describes cleaner 200 includes "a vision system" with "sensors (e.g., camera) and programming stored on the storage device for processing by the processing device." Renaud, [0008]. Renaud further describes "the vision system can include "[a] processing device (not shown), such as a microprocessor, inside of the cleaner 200...can access the programmed data related to the vision system for actuating the motor." Renaud, [0029]. Renaud describes "the sensors of the vision system can interact with the controller and/or processing device to identify	system "identifies areas of debris by sensing areas of optical contrast, for example, generated by a foreign object, debris and/or dirt." Renaud, [0031]. A POSITA would have understood that a camera of the vision system captures images to facilitate identification of specific "areas of debris" or "areas of optical contrast" (first portion) on pool floor and walls (submerged surfaces), which constitute the claimed "at least a first portion of the submerged surface." 278. Renaud discloses or suggests the camera is "positioned on or in the body" because Renaud explicitly identifies the camera as a component of the "vision system" (Renaud, [0008]) and physically locates the vision system "inside the cleaner 200" (e.g., "the vision system can include a PCB...disposed inside the cleaner 200") (Renaud, [0029]). f. 1[e][i] "e. a controller (i) positioned on or in the body," 279. In my opinion, Renaud discloses or suggests 1[e][i] because it describes a "processing device..., such as a microprocessor, inside...cleaner 200," which interacts with the camera to control the cleaner. Renaud, [0008]-[0009], [0029]-[0030]. 280. Renaud describes cleaner 200 Includes "a vision system" with "sensors (e.g., camera) and programming stored on the storage device for processing by the processing device." Renaud, [0008]. Renaud further describes "the vision system can include "[a] processing device (not shown), such as a microprocessor, inside of the cleaner 200...can access the programmed data related to the vision system for actuating the motor." Renaud, [0029]. Renaud describes "the sensors of the vision system can interact with the controller and/or processing
---	--

areas on the pool floor, walls and/or water line where debris or dirt exists.” <i>Id.</i> Renaud also describes that “[u]pon identifying debris located in the swimming pool, the vision system can actuate the motor to direct the swimming pool cleaner to the debris.” Renaud, [0009]. <i>See also</i> Renaud, [0030] (“the vision system can communicate with one or more motors of the cleaner 200, to actuate, or control the speed of, the motor.”). A POSITA would have understood that Renaud’s processing device/microprocessor (controller) receiving data from the camera, processing that data, and generating signals to actuate/control the motor—constitutes the claimed “controller.” Janét, ¶281. As explained in §IV.F.2.b (1[a]), cleaner 200 is the claimed “vehicle body.” A POSITA would have understood that the PCB and/or processing device “disposed inside the cleaner 200” is positioned “on or in the body.” Janét, ¶282. g. 1[e][ii] Renaud discloses or suggests that its processing device (controller) is in electronic communication with the at least one camera because it describes that “the sensors [e.g., camera] of the vision system can interact with the...processing device [controller] to identify areas on the pool floor.” Renaud, [0008], [0029]; Janét, ¶283. h. 1[e][iii]	device to identify areas on the pool floor, walls and/or water line where debris or dirt exists.” <i>Id.</i> Renaud also describes that “[u]pon identifying debris located in the swimming pool, the vision system can actuate the motor to direct the swimming pool cleaner to the debris.” Renaud, [0009]. <i>See also</i> Renaud, [0030] (“the vision system can communicate with one or more motors of the cleaner 200, to actuate, or control the speed of, the motor.”). 281. A POSITA would have understood that Renaud’s processing device/microprocessor (controller) receiving data from the camera, processing that data, and generating signals to actuate/control the motor—constitutes the claimed “controller.” 282. In my opinion, as explained in §VII.F.2.b (1[a]), cleaner 200 is the claimed “vehicle body.” A POSITA would have understood that processing device “disposed inside the cleaner 200” is positioned “on or in the body.” g. 1[e][ii] “(ii) in electronic communication with the at least one camera, and” 283. In my opinion, Renaud discloses or suggests that its processing device (controller) is in electronic communication with the at least one camera because it describes that “the sensors [e.g., camera] of the vision system can interact with the...processing device [controller] to identify areas on the pool floor.” Renaud, [0008], [0029]. h. 1[e][iii] “(iii) configured to generate, in response to the captured image, at least one control signal to cause
---	---

Renaud discloses or suggests 1[e][iii]. Janét, ¶¶284-288. Renaud discloses or suggests that its processing device (controller) generates control signals “in response to the captured image.” Specifically, Renaud’s vision system “includes sensors (e.g., camera) and programming stored on the storage device for processing by the processing device,” and the processing device “access[es] the programmed data related to the vision system for actuating the motor.” Renaud, [0008], [0029]. The vision system “identifies areas of debris by sensing areas of optical contrast...generated by a foreign object, debris and/or dirt” on pool floor and walls (submerged surfaces), and sensors “provide location information to the processor...for directing the swimming pool cleaner to the debris.” Renaud, [0008], [0031]. Renaud also describes that its processing device controls a controller to actuate the motor for movement of the cleaner.” Renaud, [0025]. A POSITA would have understood that Renaud’s processing device (the claimed “controller”) processes the programming and image data to generate the control signals that actuate the motors, causing the vehicle body to move to the debris area (the first portion), because it identifies debris based on “optical contrast”—i.e., based on visual/image data from the camera. Janét, ¶287. Renaud also discloses the processing device generating control signals to cause movement “to...the first portion.” Specifically, “[u]pon identifying debris...the vision system [via the processing	movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.” 284. In my opinion, Renaud discloses or suggests 1[e][iii]. 285. Renaud discloses or suggests that its processing device (controller) generates control signals “in response to the captured image.” 286. Specifically, Renaud’s vision system “includes sensors (e.g., camera) and programming stored on the storage device for processing by the processing device,” and the processing device “access[es] the programmed data related to the vision system for actuating the motor.” Renaud, [0008], [0029]. The vision system “identifies areas of debris by sensing areas of optical contrast...generated by a foreign object, debris and/or dirt” on pool floor and walls (submerged surfaces), and sensors “provide location information to the processor...for directing the swimming pool cleaner to the debris.” Renaud, [0008], [0031]. Renaud also describes that its processing device controls a controller to actuate the motor for movement of the cleaner.” Renaud, [0025]. 287. A POSITA would have understood that Renaud’s processing device (the claimed “controller”) processes the programming and image data to generate the control signals that actuate the motors, causing the vehicle body to move to the debris area (the first portion), because it identifies debris based on “optical contrast”—i.e., based on visual/image data from the camera. 288. The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching
--	---

device] can actuate the motor to direct the swimming pool cleaner to the debris.” Renaud, [0009], Claim 3, [0030] (steer wheels “in the direction of the area of debris”), [0025]. A POSITA would understand that the processing device generates these signals to actuate the motor and steer the vehicle specifically to the “area of debris” (first portion). Janét, ¶288. The claim limitation uses the disjunctive “or” between “to” and “away from,” meaning the limitation is satisfied by teaching either alternative. Because Renaud teaches control signals that cause movement “to” the first object, Renaud discloses or suggests this element. Janét, ¶289.

3. Claim 2 Unpatentable over Renaud

Renaud renders Claim 2 obvious. Janét, ¶¶290-296.

a. 2[pre]

Renaud discloses or suggests 2[pre]. Janét, ¶¶291-293.

Renaud discloses a system associated with a “swimming pool cleaner.” Renaud, Title, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3 (**cleaners 200/200a’** (“positioned at the water line”) /**200b’** (“positioned at the bottom of the swimming pool”) /**200c’** (“positioned in a docking orientation relative to the docking station”) /**200**”). Renaud further describes that **[r]obotic** swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls to clean the necessary surfaces from, e.g., debris, sediment, and the like.” Renaud, [0003].

[images omitted]

either alternative. Because Renaud teaches control signals that cause movement “to” the first object, Renaud discloses or suggests this element. This is because Renaud explicitly tasks the processing device with the high-level logic: it receives the sensor data ([0029]) and “actuates” the controller/motor to move the cleaner ([0025], [0029]). Thus, a POSITA would understand that the “processing device” generates the necessary signals to “direct” or “steer” the cleaner specifically to the debris identified by the camera. Renaud, [0009], [0030].

289. Therefore, in my opinion, Renaud renders Claim 1 obvious.

3. Claim 2 Unpatentable over Renaud

290. In my opinion, Renaud renders Claim 2 obvious.

a. 2[pre] “A system for cleaning debris from a submerged surface of a swimming pool, comprising”

291. In my opinion, Renaud discloses or suggests 2[pre].

292. Renaud discloses a system associated with a “swimming pool cleaner.” Renaud, Title, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3 (**cleaners 200/200a’** (“positioned at the water line”) /**200b’** (“positioned at the bottom of the swimming pool”) /**200c’** (“positioned in a docking orientation relative to the docking station”) /**200**”). Renaud further describes that “**[r]obotic** swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls to clean the necessary surfaces from, e.g., debris, sediment, and the like.” Renaud, [0003].

Renaud discloses the pool cleaner of the system “cleaning debris from a submerged surface of a swimming pool” because Renaud describes cleaner 200 “traverses, and cleans near, the walls (e.g., vertical or horizontal walls) of the pool” in “bottom mode” and “rises to the water surface and cleans the water surface” in “top mode.” Renaud, [0022]. Renaud further describes cleaner 200 uses “a suction pump impeller” to “collect the debris in the swimming pool” and collects “debris collected from the swimming pool 102” into “a debris container” located in housing 202. Renaud, [0023], [0030]. A POSITA would have understood that the system, through the cleaner 200, cleans a submerged surface below the water surface at least when operating in “bottom mode.” Janét, ¶293.

b. 2[a][i]

Renaud discloses 2[a][i] as explained in §IV.F.2.a (1[Pre]). Janét, ¶294.

c. 2[a][ii]-2[b]

Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]- 1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained in §§IV.F.2.b-h (1[a]-1[e][iii]), Renaud discloses or suggests 2[a][ii]-2[b]. Janét, ¶295.

4. Claim 3 Unpatentable over Renaud

Renaud renders Claim 3 obvious. Janét, ¶¶297-300.

[images omitted]

293. Renaud discloses the pool cleaner of the system “cleaning debris from a submerged surface of a swimming pool” because Renaud describes cleaner 200 “traverses, and cleans near, the walls (e.g., vertical or horizontal walls) of the pool” in “bottom mode” and “rises to the water surface and cleans the water surface” in “top mode.” Renaud, [0022]. Renaud further describes cleaner 200 uses “a suction pump impeller” to “collect the debris in the swimming pool” and collects “debris collected from the swimming pool 102” into “a debris container” located in housing 202. Renaud, [0023], [0030]. A POSITA would have understood that the system, through the cleaner 200, cleans a submerged surface below the water surface at least when operating in “bottom mode.”

b. 2[a][i] “a self-propelled pool cleaner comprising:”

294. In my opinion, Renaud discloses 2[a][i] as explained in §VII.F.2.a (1[Pre]).

c. 2[a][ii]-2[b]

295. Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. In my opinion, for at least the same reasons explained in §§VII.F.2.b-h (1[a]-1[e][iii]), Renaud discloses or suggests 2[a][ii]-2[b].

296. Therefore, in my opinion, Renaud renders Claim 2 obvious.

4. Claim 3 Unpatentable over Renaud

a. 3[pre], 3[a][i] Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Renaud discloses 3[Pre] and 3[a][i] as explained in §§IV.F.3.a-b; <i>see also</i> §IV.F.2.a (1[Pre]). Janét, ¶298. b. 3[a][ii]-3[b][ii] Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in §§IV.F.2.b-e, IV.F.2.g-h (1[a]-1[d], 1[e][ii]-1[e][iii]), Renaud discloses or suggests 3[a][ii]-3[b][ii]. Janét, ¶299.	297. In my opinion, Renaud renders Claim 3 obvious. a. 3[pre], 3[a][i] 298. Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. In my opinion, Renaud discloses 3[Pre] and 3[a][i] as explained in §§VII.F.3.a-b; <i>see also</i> §VII.F.2.a (1[Pre]). b. 3[a][ii]-3[b][ii] 299. Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in §§VII.F.2.b-e, VII.F.2.g-h (1[a]-1[d], 1[e][ii]-1[e][iii]), Renaud discloses or suggests 3[a][ii]-3[b][ii]. 300. Therefore, it is my opinion that Renaud renders Claim 3 obvious.
---	--