

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the *Inter Partes* Review of U.S. Patent No. 11,003,191

Trial No.: Not Yet Assigned

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Inventors: Kameshwar Durvasula, et al.

Assignee: Zodiac Pool Systems LLC

Title: POOL CLEANING SYSTEM AND METHOD TO
AUTOMATICALLY CLEAN SURFACES OF A POOL USING
IMAGES FROM A CAMERA

MAIL STOP PATENT BOARD

Patent Trial and Appeal Board

United States Patent & Trademark Office

P.O. Box 1450

Alexandria, Virginia 22313-1450

PETITION FOR *INTER PARTES* REVIEW
UNDER 37 C.F.R. § 42.100

On behalf of Wybotics, Co. Ltd. f/k/a Tianjin Wangyuan Environmental Protection and Technology Co., Ltd. (“Wybotics” or “Petitioner”), and in accordance with 35 U.S.C. § 311 and 37 C.F.R. § 42.100, *inter partes* review (“IPR”) is respectfully requested for claims 1-3 of U.S. Patent No. 11,003,191 (“the ’191 Patent”).

The undersigned representative of Petitioner authorizes the Office to charge the Petition and Post-Institution Fees, and any additional fees, to Deposit Account 50-3013, ref: 103146-000007.

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LIST OF PETITIONER EXHIBITS

EX1001	U.S. Patent No. 11,003,191 (the “’191 Patent”)
EX1002	File History of the ’191 Patent
EX1003	[Reserved]
EX1004	[Reserved]
EX1005	[Reserved]
EX1006	[Reserved]
EX1007	CN 101139007 B (“Fu”)
EX1008	U.S. Patent Pub. No. 2012/0169497 (“Schnittman”)
EX1009	File History of U.S. Patent Application No. 16/416,840
EX1010	Declaration of Dr. Charles F. Reinholtz
EX1011	U.S. Provisional Application 61/428,808 (the “’808 provisional”)
EX1012	Redline comparison between Schnittman and the ’808 provisional
EX1013	U.S. Patent Pub. No. 2010/0299016 (“Benzler”)
EX1014	International Patent Pub. No. 2012/023676 (“Hong”)
EX1015	U.S. Patent Pub. No. 2012/0006352 (“Holappa”)
EX1016	U.S. Patent No. 5,205,174 (“Silverman”)
EX1017	SubjuGator 2011, University of Florida, RoboSub 2011 Competition Paper Submission
EX1018-1029	[Reserved]
EX1030	U.S. Patent No. 3,439,368 (“Myers II”), invented by Robert R. Myers, filed January 3, 1967

LIST OF PETITIONER EXHIBITS

(continued)

EX1031 U.S. Patent No. 5,351,355 (“Chiniara”), invented by Paul Chiniara,
filed May 26, 1993

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I. INTRODUCTION

This petition presents a textbook case of why Congress created *inter partes* review to improve patent quality and provide a more efficient and less expensive alternative to federal court litigation. The '191 Patent is a classic example of a “bad” patent that IPRs were designed to weed out. At the Patent Owner’s urging, the Examiner performed essentially no substantive review of the prior art, issuing only one rejection for statutory double patenting that was overcome by filing a terminal disclaimer. As a result, the '191 Patent issued even though the inventions it claims are neither novel nor nonobvious in light of the prior art. The Board should institute review and find these claims unpatentable.

The '191 Patent claims a self-propelled robotic pool cleaner having certain features to detect debris and direct the motion of the pool cleaner in response to that detection. The first robotic pool cleaners were invented in the 1960s (*see, e.g.*, EX1030), and self-propelled robotic pool cleaners have been known since at least the early 1990s (*see, e.g.*, EX1031). *See* EX1010, ¶¶80-89. Most of the elements claimed by the '191 Patent—a vehicle body, a means for moving the vehicle body, and a filter configured to retain collected debris—are common to all robotic pool cleaners and have been known in the art for decades. In fact, according to the Examiner, the only purportedly novel feature of the '191 Patent is “a controller positioned on or in the body, in electronic communication with the at least one camera, and configured to

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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.” EX1002, 133-135. But that feature is not new, either. The ’191 Patent is anticipated by at least Chinese Patent Application No. 200710119800.5 to Fu, entitled “Underwater Cleaning Robot,” which was filed almost five years before the application that resulted in the ’191 Patent. EX1003.

Fu discloses a self-propelled robotic pool cleaner having all of the elements claimed in the ’191 Patent, including its purportedly novel navigation elements. In addition to the basic elements common to all pool cleaners, Fu discloses a “control system” comprised of “a central processor, monitoring cameras, an image acquisition card, inertial navigation components, ... motor drivers, a control system box 8, cleaning driving wheel DC motors 7,” and other elements. EX1003, ¶[0024]. “The monitoring cameras 2 and the image acquisition card constitute the *environmental perception layer* of the control system.” *Id.* (emphasis added). The “inertial navigation components are installed in the robot control system box 8 and constitute the *self-attitude and positioning* layer of the control system.” *Id.* (emphasis added). The “motor drivers and cleaning driving wheel DC motors 7 constitute the cleaning driving *execution layer* of the control system.” *Id.* (emphasis added). When the robot is operated in its “autonomous mode, control signals are generated by the central processor, which autonomously plans paths and actions based on information from

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the environmental perception layer and its own attitude and positioning layer, in conjunction with a preset cleaning task, to drive the robot's execution layer and complete the underwater cleaning task.” *Id.*, ¶ [0025]. These disclosures fully anticipate the navigation elements of the '191 Patent—a controller and an image captured by a camera that cooperate to generate at least one control signal to cause movement of the body to, or away from, a certain location—the only aspect of the patent asserted as novel.

Further, even if the Board determines Fu does not anticipate all the claims of the '191 Patent, the claims are obvious in light of Fu itself or in combination with U.S. Patent Pub. No. 20100299016 to Benzler. The claims are also obvious over U.S. Patent Pub. No. 20120169497 to Schnittman, in combination with Benzler. Both Benzler and Schnittman disclose robotic vehicles that use image-based navigation to autonomously control movement of the vehicle. And Benzler teaches that a preferred embodiment for its vehicle is a “pool-robotic vehicle.” The POSA designing a pool-cleaning robot at the time of the alleged invention would have looked to pool-cleaning literature, like Fu and Benzler, and would have been motivated to consider Schnittman and Benzler together because they describe similar technology (e.g., autonomous cleaning robots that employ computer vision) and address the same problem of enabling a robot to make cleaning and navigation decisions based on an image of the cleaning surface.

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Cancellation of claims 1-3 of the '191 patent is respectfully requested.

II. THE '191 PATENT AND CLAIM CONSTRUCTION

A. Summary Of The '191 Patent

The '191 Patent, entitled "Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera," issued with three total claims, each independent. EX1001, (54), claims 1-3. The claims are directed to a self-propelled swimming pool cleaner and are substantially similar despite minor differences in wording. *Id.*, claims 1-3. Each recites (1) a vehicle body, (2) means for moving the body within the pool, (3) a filter for retaining debris collected from the pool, (4) at least one camera for capturing an image of a portion of the pool, and (5) a controller for processing the image and generating corresponding control signals for moving the body. *Id.*

The '191 Patent generally relates to "a robotic pool cleaner" that comprises a vehicle 30 with one or more propulsion mechanisms, a filter, a camera, and a controller. *Id.*, 2:67-3:3, 3:4-19, 3:31-43. The vehicle 30 uses the propulsion mechanisms, such as "wheels, rollers, tracks, or other surface contacting members powered by a motor," to move along the submerged surfaces of the pool. *Id.*, 3:31-43. Using its filter, the pool cleaner draws water from the pool and retains any debris present in the water. *Id.*, 3:8-14. One or more cameras 32 capture an image of submerged surfaces of the pool. *Id.*, 3:46-55. Controller 42 "generate[s] control

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signals for steering vehicle 30 based upon signals received from cameras 32.” *Id.*, 3:51-53, 4:44-46.

B. Patent Family And File History

The '191 Patent was filed on July 2, 2020 as U.S. Patent Application No. 16/919,750. *Id.*, (21), (22). The '191 Patent is the fifth in a series of continuation applications and claims priority back to U.S. Patent Application No. 13/545,918 (now U.S. Patent No. 9,388,595), filed July 10, 2012. *Id.*, (63). Without conceding its propriety, Petitioner applies July 10, 2012 as the priority date of the challenged claims in this Petition.

Originally filed claims 1-19 were copies of the claims filed in the parent application, U.S. Patent Application No. 16/416,840 (the “’840 application”). *Compare* EX1002 (file history of the '191 Patent), 17-19 *with* EX1009 (file history of the '840 application), 17-19. Prior to examination, the applicant filed a preliminary amendment, canceling claims 1-19 and adding new claims 20-22, which have since issued as claims 1-3 of the '191 Patent. EX1002, 38-41. The applicant explicitly characterized the newly added claims 20-22 as “variants of allowed claim 20 of the Allowed Parent,” referring to the '840 application. *Id.*, 42. The applicant went on to describe in detail how the pending claims corresponded almost verbatim to claim 20 of the Allowed Parent, which is now claim 1 of U.S. Patent No. 10,739,785. EX1002, 42-43.

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The applicant also represented to the Office that all of the claims of the '191 Patent “retain features identified by the Examiner as patentable in the Allowed Parent Application,” and offered to “submit Terminal Disclaimers in view of both the Allowed Parent Application and the Great Grandparent Patent.” *Id.* Consequently, prosecution proceeded with almost no substantive examination. The sole Office Action contained only a nonstatutory double patenting rejection that was overcome via a terminal disclaimer. *Id.*, 114-116.

The Notice of Allowance identified “a controller positioned on or in the body, in electronic communication with the at least one camera, and 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” as allegedly being inventive over the prior art. *Id.*, 133-135.

But this Petition clearly shows that the purportedly inventive feature asserted by the Examiner was very well known in the art. *See infra* Sections IV.A.2.f-h, IV.D.4.f-h. The Office failed to conduct a meaningful substantive examination of the '191 Patent, accepting the applicant's characterizations of the claims and the prior applications without vetting the claims against the relevant prior art. Had the Office conducted a complete examination, the '191 Patent would not have issued.

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C. Claim Construction And The Level Of Ordinary Skill In The Art

1. Claim Construction

In this proceeding, claims are interpreted under the same standard applied by Article III courts. *See* 37 C.F.R. § 42.100(b); *see also* 83 Fed. Reg. 197 (Oct. 11, 2018); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). Under this standard, words in a claim are given their plain meaning, which is the meaning understood by a person of ordinary skill in the art (POSA) in view of the patent and file history. *Phillips*, 415 F.3d at 1312-13. Other than the “means-plus-function” claim term discussed below, Petitioner proposes no claim terms for construction at this time.

“Where the claim to be construed contains a means-plus-function or step-plus-function limitation as permitted under 35 U.S.C. 112(f), the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.” 37 C.F.R. § 42.104(b)(3). The claim term “means for moving the vehicle body within the swimming pool,” as recited in challenged claims 1-3, is a means-plus-function (MPF) claim term governed by 35 U.S.C. § 112(f). In accordance with 37 C.F.R. § 42.104(b)(3), Petitioner identifies specific portions of the specification that describe the structure and functions for this claim term:

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Claim Limitation	Corresponding Structures	Function
[1b], [2a(ii)], [3a(ii)] means for moving the vehicle body within the swimming pool	“In one implementation, vehicle 30 is propelled along the submerged pool surfaces using <i>wheels, rollers, tracks or other surface contacting members powered by a motor and the like.</i> ... In one implementation vehicle 30 may also alternatively be propelled by means of the <i>vacuum or liquid jets.</i> ... In other implementations, vehicle 30 may include other propulsion mechanisms.” EX1001, 3:31-43.	Moving the vehicle body within the swimming pool EX1001, claims 1-3.

Thus, the corresponding structures disclosed in the specification for the “means for moving” term include “wheels, rollers, tracks or other surface contacting members powered by a motor and the like” and “vacuum or liquid jets.” EX1001, 3:31-43; *see also id.*, 10:8-28 (describing drive motor, “toothed track drive 900” and rollers 908 of Figs. 9 and 10).

2. The POSA’s Skill Level

A POSA in the relevant art as of July 10, 2012 would have possessed a bachelor’s degree in mechanical or electrical engineering or a related field, and two years’ experience in designing and developing robotic pool cleaners or similar products, with additional experience substituting for education and vice versa. EX1010, ¶¶30-34.

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III. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Grounds For Standing Under 37 C.F.R. § 42.104(a)

Wybotics certifies that the '191 Patent is eligible for IPR, and that Wybotics is not barred or estopped from requesting IPR of claims 1-3 on the challenged grounds.

B. Identification Of Challenge Under 37 C.F.R. § 42.104(b) And Relief Requested

Wybotics requests IPR on the following grounds:

Ground	Claims	Basis
Ground 1a	1-3	Fu (EX1007, CN 101139007 B) anticipates under § 102
Ground 1b	1-3	Fu renders obvious under § 103
Ground 1c	1-3	Fu in view of Benzler (EX1013, U.S. Patent Pub. No. 2010/0299016) renders obvious under § 103
Ground 2	1-3	Schnittman (EX1008, U.S. Patent Pub. No. 2012/0169497) in view of Benzler renders obvious under § 103

IV. CLAIMS 1-3 ARE UNPATENTABLE

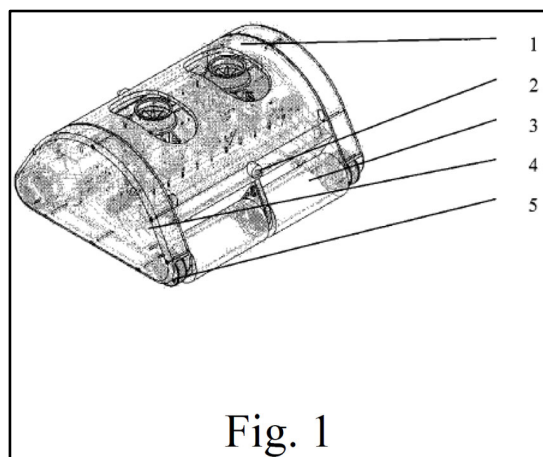
A. Ground 1a: Fu Anticipates Claims 1-3

1. Summary Of Fu

Fu, entitled “Underwater Cleaning Robot,” was filed on July 31, 2007 as Application No. 200710119800.5 in China. EX1007, (21), (22), (54). Fu issued as Grant Publication No. CN 101139007 B, and published on June 15, 2011. *Id.*, (10), (45). Fu is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

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Fu describes a robot that is designed “for the underwater cleaning of swimming pool floors and walls.” *Id.*, Abstract. An example of Fu’s underwater cleaning robot is depicted in Figure 1:

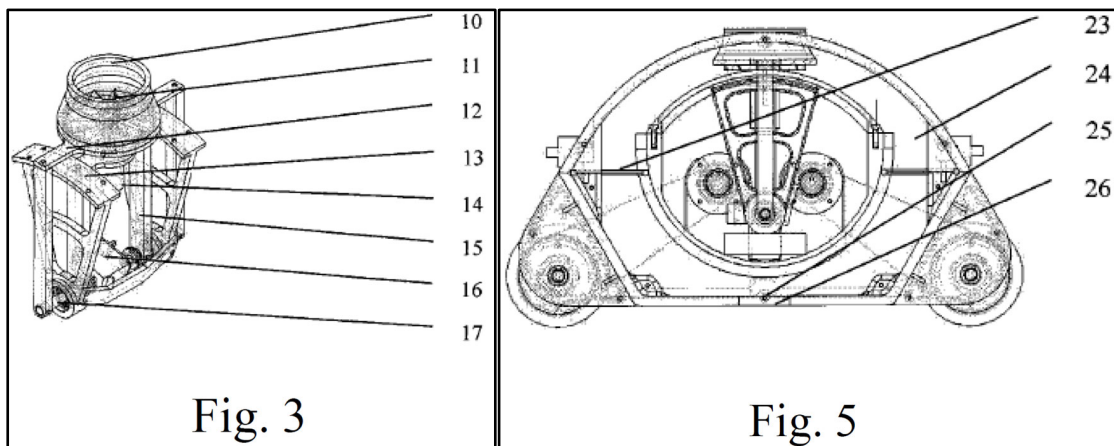


Id., Fig. 1. Fu describes two operational modes for cleaning: manual and autonomous. *Id.*, ¶[0025]. In the manual mode, a control keypad is used to manually send control signals to the robot. *Id.* In the autonomous mode, the control system autonomously plans and controls the robot’s movement and cleaning operations based on data received from sensors and cameras. *Id.*

The robot “comprises a drainage mechanism, a cleaning and mobility platform, and a control system.” *Id.*, ¶[0024], Abstract. These three units work in coordination to “perform cleaning tasks autonomously or via remote control underwater on horizontal, vertical, and inclined surfaces.” *Id.*, Abstract. The drainage mechanism performs a cleaning function by drawing pool water into the robot, filtering it to remove any debris, and discharging the filtered water back into

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the pool. *Id.*, ¶¶[0024]-[0026]. An example schematic of the drainage mechanism is illustrated in Figures 3 and 5:



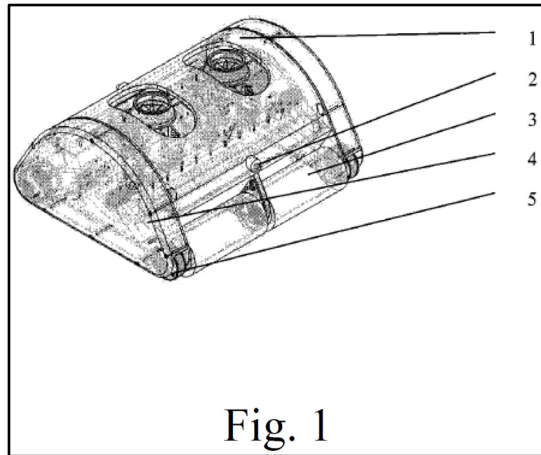
Id., Fig. 3 (water discharger), Fig. 5 (side cross-sectional view of the robot).

The drainage mechanism “comprises a water discharger [Figure 3], a water flow channel 24 ..., a water flow filter screen 23, and a water inlet [26] with an anti-backflow device 25.” *Id.*, ¶[0024]. During operation, “the drainage propeller high-speed DC motor 14 ... drives the drainage propeller 11 to rotate ... expel[ling] water from within the robot’s water flow channel 24, creating a high negative pressure inside.” *Id.*, ¶[0026]. This negative pressure “draws pool water from the bottom of the robot into the water flow channel 24 through the water inlet [26].” *Id.* Once in the flow channel 24, the “water passes through the water flow filter screen 23, which filters out debris, and the clean water is then discharged.” *Id.*

The drainage mechanism “uses the cleaning and mobility platform as a carrier and coordinates its movement with the cleaning and mobility platform.” *Id.*,

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¶[0024]. The cleaning and mobility platform, illustrated in Figure 1, comprises “a robot housing body 1, cleaning driving wheels 3, synchronous belt gears 5, and a driving synchronous belt 4.” *Id.*



Id., Fig. 1. The “cleaning driving wheels 3 are controlled by their respective motor drivers ... By using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, turning, and brush-cleaning.” *Id.*, ¶[0026]. The synchronous belt gears 5 and the driving synchronous belt 4 help drive the cleaning driving wheels 3 via a driving DC motor 7. *Id.*, ¶[0024]. In this way, the cleaning and mobility platform provides structural support and propulsion to the robot, while also performing “brush-cleaning” of the pool surface via the cleaning driving wheels 3. *Id.*, ¶[0024], [0026].

The control system autonomously controls the robot’s operation by generating control signals that drive the robot’s movement and cleaning. *Id.* As shown in Figure 6, the control system comprises “a central processor, monitoring cameras, an

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image acquisition card, inertial navigation components, a remote control signal interface, motor drivers, a control system box 8, cleaning driving wheel DC motors 7, a water outlet driving servo 16, a drainage propeller high-speed DC motor 14, a driving and control sealed housing, and a control and power management system.”

Id., ¶[0024].

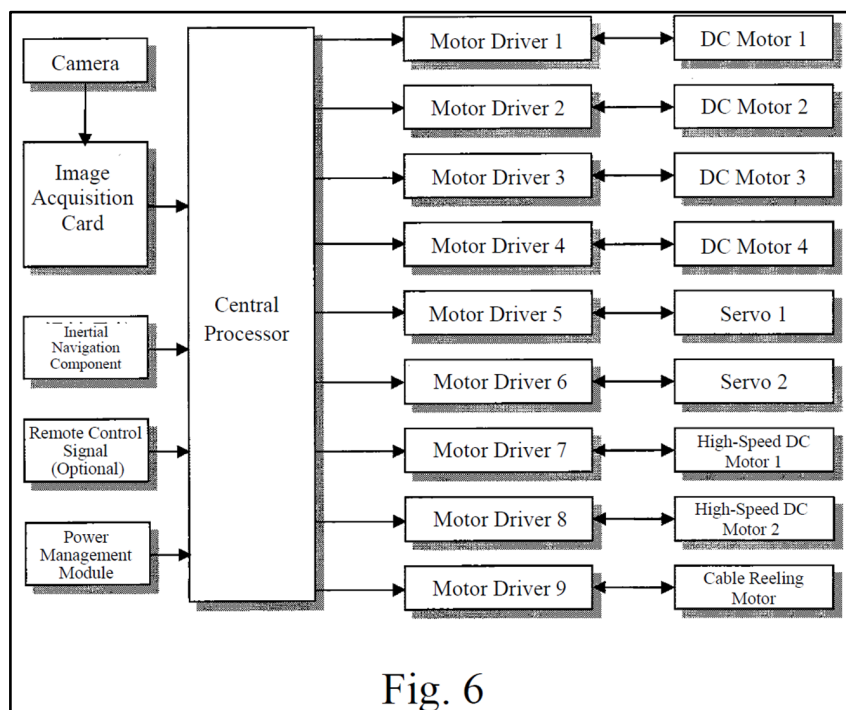


Fig. 6

Id., Fig. 6.

Fu’s monitoring cameras 2, installed on the main robot housing body 19, are in communication with the central processor via the image acquisition card. *Id.*, ¶[0024], Fig. 6. “The monitoring cameras 2 and the image acquisition card constitute the environmental perception layer,” which also “constitutes the input part of the control system.” *Id.*, ¶[0024]. The central processor receives visual

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information from the environmental perception layer, *i.e.*, monitoring cameras 2, and processes it to determine “the level of cleanliness” of the pool. *Id.*, ¶[0026]. Based on this determination, “control signals are generated by the central processor, which autonomously plans paths and actions ... to ... complete the underwater cleaning task.” *Id.*, ¶[0025]. The central processor sends these control signals to “the robot’s execution layer,” also known as the “output part of the control system,” which comprises “[t]he motor drivers and the cleaning driving wheel DC motors 7.” *Id.*, ¶¶[0024]-[0025]. Based on the control signals, the respective motor drivers and the cleaning driving wheel DC motors 7 drive the cleaning driving wheels 3. *Id.*, ¶[0026]. For example, “the speed of each wheel 3 can be adjusted,” “cleaning actions of varying intensity can be achieved,” and “the robot can perform tasks such as moving forward, backward, turning, and brush-cleaning.” *Id.*

In this way, Fu’s drainage mechanism, cleaning and mobility platform, and control system work in concert to control the underwater cleaning robot’s movement and cleaning operations based on an image captured by the monitoring cameras 2.

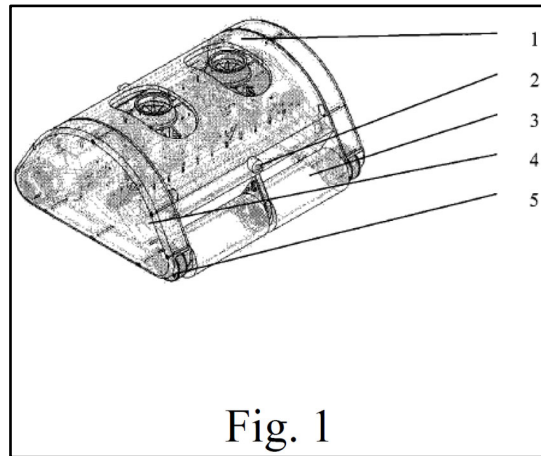
2. Independent Claim 1

- (a) **Preamble: “A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:”**

To the extent limiting, the preamble of claim 1 is disclosed by Fu. EX1010, ¶¶127-130. Fu discloses “an underwater cleaning robot” designed “for the

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underwater cleaning of swimming pool floors and walls.” EX1007, Abstract. An example of Fu’s underwater cleaning robot is depicted in Figure 1:



Id., Fig. 1. Fu’s robot includes, among other components, “a drainage mechanism [and] a cleaning and mobility platform.” *Id.*, ¶[0024]. The cleaning and mobility platform enables the robot to move around the pool and remove debris from its surfaces, *e.g.*, using brushes. *Id.*, ¶¶[0010], [0024]-[0026] (“brush-cleaning”). The drainage mechanism “draws pool water from the bottom of the robot” such that the “water passes through the water flow filter screen 23, which filters out debris, and the clean water is then discharged.” *Id.*, ¶[0026]. Thus, Fu’s underwater cleaning robot is a “pool cleaner for cleaning debris from a submerged surface of a swimming pool.”

Fu further discloses that its robot is self-propelled. Fu’s cleaning and mobility platform comprises “four independent cleaning driving wheels 3” that “are controlled by their respective motor drivers, allowing for independent movement.”

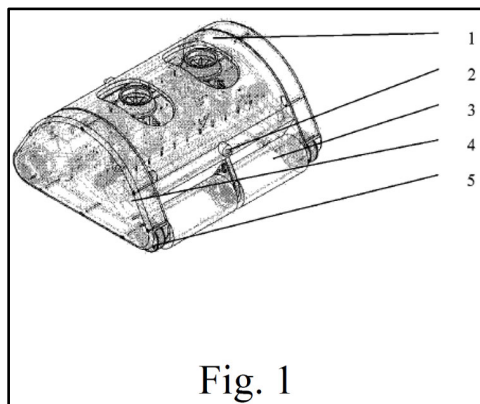
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Id., ¶[0026]. In the autonomous mode, “control signals are generated by the central processor, which autonomously plans paths and actions ... to drive the robot’s execution layer and complete the underwater cleaning task.” *Id.*, ¶[0025]. The execution layer comprises the motor drivers and the cleaning driving wheel DC motors 7, which drive the cleaning driving wheels 3. *Id.*, ¶[0024]. Fu’s robot is thus “self-propelled” because it moves without external propulsion. Fu also describes various components for powering such movement, including an onboard “rechargeable battery box.” *Id.*, ¶¶[0007], [0008], [0024], [0025].

For at least these reasons, Fu discloses the claimed “self-propelled pool cleaner [underwater cleaning robot] for cleaning debris from a submerged surface of a swimming pool.”

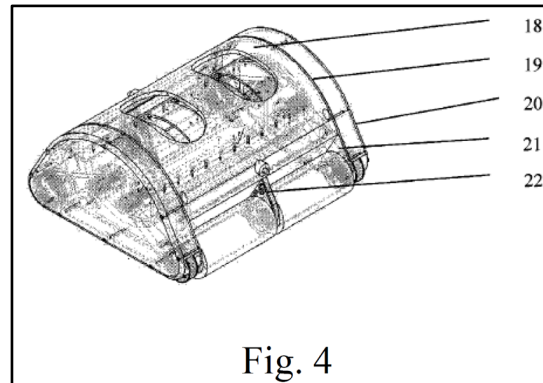
(b) Element 1a: “a vehicle body;”

Fu discloses element 1a of claim 1. EX1010, ¶¶131-133. As shown in Figure 1, Fu illustrates the “[o]verall schematic diagram of the underwater cleaning robot,” which includes “1 - robot housing body” (EX1007, ¶[0014]):



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Id., Fig. 1. Fu further specifies that the “housing body 1 comprises a robot top cover 18, robot side walls 20, and a robot main housing body 19.” *Id.*, ¶[0024].



Id., Fig. 4. Accordingly, Fu discloses the claimed “vehicle body [robot housing body 1].”

(c) Element 1b: “means for moving the vehicle body within the swimming pool;”

Fu discloses element 1b of claim 1. EX1010, ¶¶134-137. As explained in Section II.C.1 above, “means for moving the vehicle body within the swimming pool” is an MPF term, and the corresponding structures disclosed in the ’191 Patent include “wheels, rollers, tracks or other surface contacting members powered by a motor and the like.” EX1001, 3:31-43.

Fu discloses “moving the vehicle body” and a corresponding structure described in the ’191 Patent. Specifically, Fu’s robot comprises a cleaning and mobility platform that enables controlled movement of the robot body. EX1007, ¶[0024]. The cleaning and mobility platform, illustrated in Figure 1 reproduced above, comprises “a robot housing body 1, cleaning driving wheels 3, synchronous

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belt gears 5, and a driving synchronous belt 4.” *Id.* A driving DC motor 7 drives the cleaning driving wheels 3 via the synchronous belt gears 5 and the driving synchronous belt 4. *Id.*, ¶¶[0007],[0024] (“Said cleaning driving wheel DC motors [7] are equipped with reduction gearboxes and encoders. They are installed and fixed via front flanges to the side wall of the driving and control sealed housing and the side wall of the robot main housing body [19], and they drive the cleaning driving wheels [3] via synchronous belt gears [5] and synchronous belts [4].”).

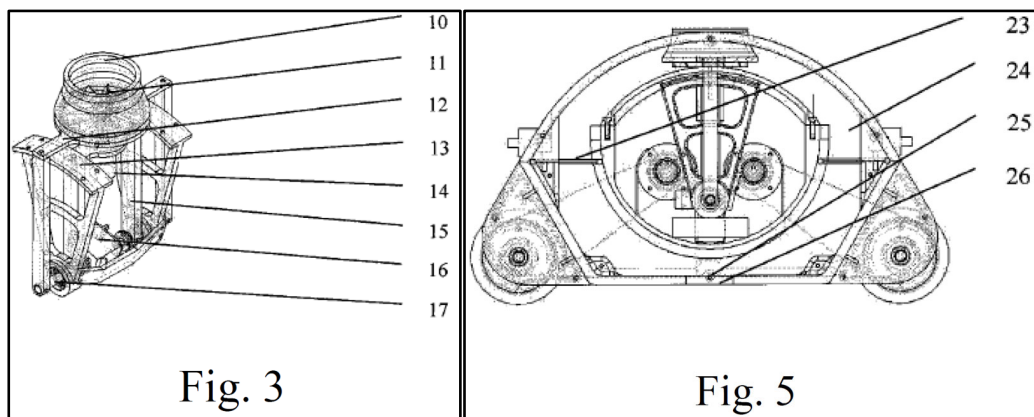
Further, the cleaning driving wheels 3 “are controlled by their respective motor drivers, allowing for independent movement.” *Id.*, ¶[0026], Fig. 1. “By using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, turning, and brush-cleaning.” *Id.*, ¶[0026]. Fu thus discloses the claimed function (“moving the vehicle body within the swimming pool”), and Fu’s driving wheels 3 powered by cleaning driving wheel DC motors 7 disclose a corresponding structure described in the ’191 Patent for performing this function. EX1010, ¶136.

In sum, Fu teaches the claimed “means for moving the vehicle body within the swimming pool [driving wheels 3 powered by cleaning driving wheel DC motors 7].”

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(d) Element 1c: “a filter configured to retain debris collected from the submerged surface;”

Fu discloses element 1c of claim 1. *Id.*, ¶¶138-141. Fu’s underwater cleaning robot includes a “drainage mechanism” that is designed to draw in pool water, filter out debris from the water, and discharge the filtered water while retaining the debris. EX1007, ¶¶[0024]-[0026]. An example schematic of the drainage mechanism is illustrated in Figures 3 and 5:



Id., Fig. 3 (water discharger), Fig. 5 (side cross-sectional view of the robot).

The drainage mechanism “comprises a water discharger, a water flow channel 24 ..., a water flow filter screen 23, and a water inlet [26] with an anti-backflow device 25.” *Id.*, ¶[0024]. During operation, “the drainage propeller high-speed DC motor 14 ... drives the drainage propeller 11 to rotate ... expel[ling] water from within the robot’s water flow channel 24, creating a high negative pressure inside.” *Id.*, ¶[0026]. This negative pressure “draws pool water from the bottom of the robot into the water flow channel 24 through the water inlet [26].” *Id.* Once in the flow

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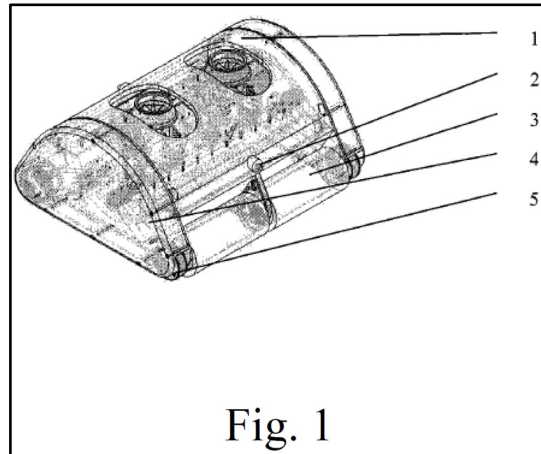
channel 24, the “water passes through the water flow filter screen 23, which filters out debris, and the clean water is then discharged.” *Id.*

Fu further makes clear that the drainage mechanism retains the debris that is filtered out from the pool water. “An anti-backflow device 25 is installed above the water inlet 26,” which opens “[w]hen water flows in through the inlet,” and closes “[w]hen the water flow stops,” thus “prevent[ing] debris from flowing out of the water flow channel 24.” *Id.* Thus, debris that is filtered out by the filter screen 23 is retained within the water flow channel 24. Fu also describes that “[w]hen the debris [inside the water flow channel 24] reaches a certain density, [the underwater cleaning robot] issues a ‘debris full’ alarm,” further confirming that the drainage mechanism is configured to retain the debris. *Id.*

Thus, Fu discloses “a filter [the filter of the drainage mechanism] configured to retain debris collected from the submerged surface.”

(e) Element 1d: “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”

Fu discloses element 1d of claim 1. EX1010, ¶¶142-144. Fu’s robot comprises “2 – monitoring camera,” as shown in Figure 1 (EX1007, ¶[0014], Fig. 1):

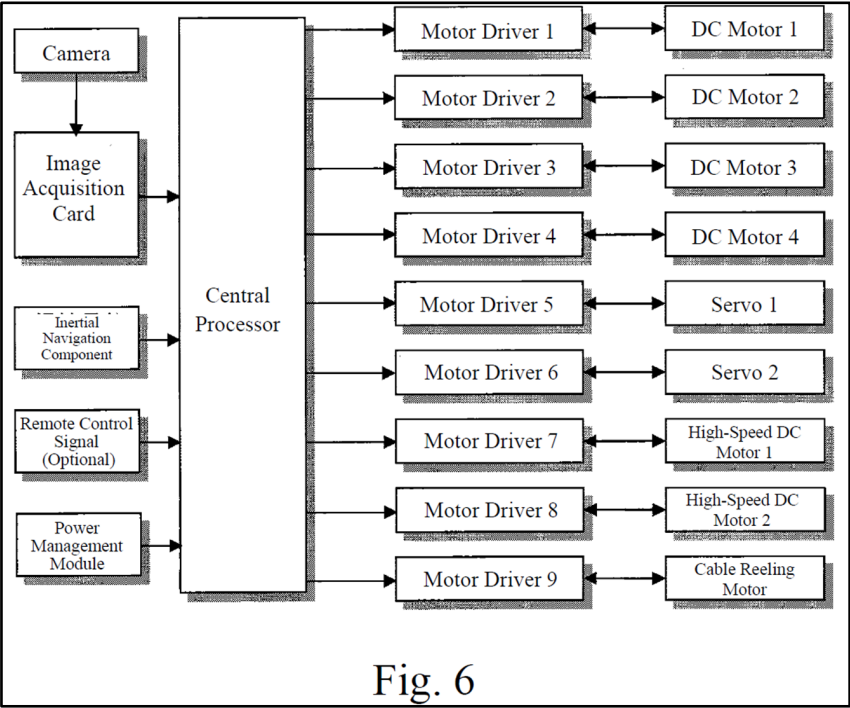


“Said monitoring cameras 2 are installed on the two front panels of the robot main housing body,” such that the cameras 2 are “on or in the body,” as claimed. *Id.*, ¶[0024]. The robot “uses its monitoring cameras 2 to capture images of the pool floor,” which is the claimed submerged surface. *Id.*, ¶[0026].

Therefore, Fu discloses “at least one camera [monitoring cameras 2] positioned on or in the body [robot housing body 1] for capturing an image of at least a first portion of the submerged surface.”

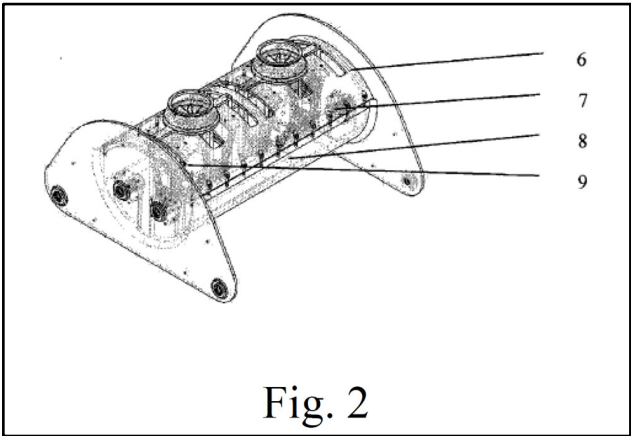
(f) Element 1e: “a controller (i) positioned on or in the body,”

Fu discloses element 1e of claim 1. EX1010, ¶¶145-147. Fu discloses a control system that includes “a central processor, monitoring cameras, an image acquisition card, ... motor drivers, a control system box 8, cleaning driving wheel DC motors 7” all of which are encapsulated within a “control system box 8.” EX1007, ¶[0024], Fig. 6.



Id., Fig. 6. “The underwater cleaning robot controls its actions according to control commands issued by the central processor.” *Id.*, ¶¶[0010], [0026].

The control system box 8 “is fixed to the bottom of the driving and control sealed housing [6],” which is within the robot housing body 1, as shown in Figure 2 below. *Id.*, ¶[0024], Fig. 2.



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- (g) Therefore, Fu’s control system, comprising the central processor that generates control signals for controlling the robot, teaches “a controller” “positioned on or in the body [robot housing body 1].” *Id.*, ¶[0026]. Element 1f: “[the controller] (ii) in electronic communication with the at least one camera, and”**

Fu discloses element 1f of claim 1. EX1010, ¶148. As seen in Figure 6 (reproduced for preceding element 1e), “the monitoring cameras (2) are connected to the central processor via the image acquisition card.” EX1007, Fig. 6, claim 1. The image acquisition card serves as an electronic interface that transmits an image from the monitoring cameras 2 to the central processor of the control system for processing, such that the controller (control system with the central processor) is “in electronic communication with the at least one camera [monitoring cameras 2],” as claimed. EX1010, ¶148.

- (h) Element 1g: “[the controller] (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.”**

Fu discloses element 1g of claim 1. *Id.*, ¶¶149-156. Fu explains that “[t]he monitoring cameras 2 and the image acquisition card constitute the environmental perception layer of the control system.” EX1007, ¶[0024]. “[I]nformation from the environmental perception layer,” *i.e.*, image captured by the monitoring cameras 2, is expressly identified as the basis upon which “control signals are generated by the central processor ... to drive the robot[]” in the autonomous mode. *Id.*, ¶[0025].

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Fu further describes its control architecture in which the image acquisition card comprises the control system's input, and the motor drivers that drive the cleaning driving wheels 3 comprise the output. *Id.*, ¶¶[0007], [0024]. As shown in Figure 6, the image acquisition card transmits the image captured by the cameras 2 to the central processor. *Id.*, Fig. 6, claim 1. Based on the captured image, "control signals are generated by the central processor, which autonomously plans paths and actions ... to drive the robot's execution layer [the motor drivers] and complete the underwater cleaning task." *Id.*, ¶[0025]. In other words, the central processor receives the captured image from the cameras 2 and generates control signals based on the captured image to instruct the motor drivers on how to move the robot. EX1010, ¶150.

Fu further describes how its central processor uses the captured image to generate control signals for moving the robot:

During the autonomous cleaning process, a pool cleanliness image threshold is set. The robot uses its monitoring cameras 2 to capture images of the pool floor and compares them with the threshold to determine the level of cleanliness. It then plans its cleaning movements and adjusts the working state of the four cleaning driving wheels 3 and the water discharger to complete the cleaning task. Specifically, the speed of each wheel 3 can be adjusted. By using different combinations of wheel speeds, cleaning actions of varying intensity can be achieved. For example, if the front wheels rotate quickly clockwise and the rear wheels rotate slowly counter-clockwise, the underwater cleaning robot will advance in the direction determined by the clockwise rotation of the front wheels.

EX1007, ¶[0026].

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Fu also explains that “[b]y using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, [and] turning,” thus confirming that the generated signals cause the robot to move “to, or away from” a pictured region based on the cleanliness determination. *Id.*

In sum, Fu’s central processor uses the image captured by the monitoring cameras 2 to assess the “level of cleanliness” of the pictured region of the pool as compared against a “pool cleanliness image threshold.” *Id.* Based on that assessment, the central processor “plans its cleaning movements and adjusts the working state of the four cleaning driving wheels 3” to “perform tasks such as moving forward, backward, [and] turning.” *Id.* Fu thus discloses the claimed controller (control system with the central processor) “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.” A POSA would have recognized that any robot movement would necessarily be “to, or away from, the first portion” captured by Fu’s monitoring cameras 2. EX1010, ¶154. Further, as Dr. Reinholtz explains, because the central processor generates control signals in response to the cleanliness level of a particular pictured region, and those control signals drive movement in “forward, backward, [or] turning” directions, a POSA would have understood that the controller directs

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the robot toward regions assessed as falling below the “pool cleanliness image threshold” and away from regions assessed as falling above. *Id.*, ¶¶149-156.

Fu anticipates claim 1. *Id.*, ¶¶126-157.

3. Independent Claim 2

Claim 2 of the '191 Patent is anticipated by Fu for the reasons explained above for claim 1. *Id.*, ¶¶158-159. Claim 2 recites limitations of claim 1, but claim 2 is broader because it removes a restriction on the claimed “filter”: Whereas claim 1 requires the filter to be a part of a “self-propelled pool cleaner,” claim 2 “allows for the possibility of the debris filter being remote from the vehicle body, hence referring to a ‘system’ including both the cleaning vehicle and the debris filter” (EX1002, 42):

A ~~self-propelled pool cleaner~~system for cleaning debris from a submerged surface of a swimming pool, comprising:

a. a self-propelled pool cleaner comprising:

~~a.i.~~ a vehicle body;

~~b.ii.~~ means for moving the vehicle body within the swimming pool;

~~c. a filter configured to retain debris collected from the submerged surface;~~

~~d.iii.~~ 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

~~e.iv.~~ a controller (i) positioned on or in the body, (ii) in electronic communication with the at least one camera, and (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

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from, the first portion of the submerged surface-; and

b. a filter configured to retain debris collected from the submerged surface by the self-propelled pool cleaner.

Because Fu anticipates the narrower claim 1 requiring the filter to be part of the pool cleaner, Fu likewise anticipates the broader claim 2 eliminating this requirement. Further, as the applicant recognized during prosecution, claim 2 does not *require* the filter to be separate from the pool cleaner; it just encompasses this “*possibility*.” *Id.* Indeed, claim 2 includes no limitations forbidding the inclusion of the filter on the pool cleaner. Thus, Fu’s pool cleaner with the onboard filter anticipates the “system for cleaning debris” of claim 2.

4. Independent Claim 3

Claim 3 of the ’191 Patent is anticipated by Fu for the reasons explained above for claim 1. EX1010, ¶¶160-161. Claim 3 recites limitations of claim 1, but claim 3 is broader because it removes the requirement that the claimed “controller” be “positioned on or in the body” of the self-propelled pool cleaner:

A ~~self-propelled pool cleaner~~system for cleaning debris from a submerged surface of a swimming pool, comprising:

a. a self-propelled pool cleaner comprising:

~~a~~i. a vehicle body;

~~b~~ii. means for moving the vehicle body within the swimming pool;

~~e~~iii. a filter configured to retain debris collected from the submerged surface; and

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~~d~~iv. 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

~~e~~b. a controller (i) ~~positioned on or in the body,~~ (ii) in electronic communication with the at least one camera, and (~~iii~~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.

Because Fu anticipates the narrower claim 1 requiring the controller to be positioned on or in the body of the pool cleaner, Fu likewise anticipates the broader claim 3 eliminating this requirement. Further, as the applicant recognized during prosecution, claim 3 does not *require* the controller to be separate from the body of the pool cleaner, but it encompasses this *possibility*. EX1002, 42-43 (claim 3 “referenc[es] a ‘system’ including both the cleaning vehicle and a controller that could be remote from the vehicle body”). Claim 3 includes no limitations forbidding the controller from being positioned on or in the body of the pool cleaner. Thus, Fu’s pool cleaner with the onboard controller anticipates the “system for cleaning debris” of claim 3.

B. Ground 1b: Claims 1-3 Would Have Been Obvious Over Fu

Fu anticipates claims 1-3 of the ’191 Patent. *See* Ground 1a. However, should the Board find that Fu does not anticipate claims 1-3 because it allegedly lacks a control signal that causes movement of the vehicle body “to, or away from, the first

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portion of the submerged surface,”¹ Fu nevertheless would have rendered obvious these claims. EX1010, ¶¶162-167.

As explained by Dr. Reinholtz, a POSA would have found it obvious to implement motion control in Fu to direct the cleaning robot toward image-identified dirty regions (*i.e.*, regions below Fu’s cleanliness threshold) and away from clean regions (*i.e.*, regions above the threshold). *Id.* Fu already teaches acquiring an image of submerged pool surfaces, comparing the image to a cleanliness image threshold, and “plan[ning] ... cleaning movements” and “adjust[ing] the working state of the four cleaning drive wheels 3 ... to complete the cleaning task” based on this comparison. EX1007, ¶[0026]. Once Fu’s system distinguishes areas as sub-threshold versus above-threshold, using that information to guide the robot’s movement towards dirtier areas and away from cleaner areas would have been a

¹ As explained in Section IV.A.2.h, such a finding would be erroneous because claims 1-3 encompass any control signal generated in response to a captured image that causes movement of the vehicle body: Once the camera captures an image of a portion of the submerged surface, the vehicle occupies some finite position relative to that portion. *Any* movement commanded by the control signal—whether forward, backward, laterally, vertically, or along any trajectory—will necessarily decrease or increase the distance between the vehicle body and that imaged portion, *i.e.*, it will be movement “to, or away from” that portion. EX1010, ¶¶149-157. Because Fu discloses the generation of a control signal in response to the captured image that causes movement of the vehicle body, it necessarily discloses element 1g and the corresponding features of claims 2 and 3. *Id.*, ¶¶149-157; 162-167.

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routine, predictable application that would have been obvious to a POSA. EX1010, ¶¶162-167.

A POSA would have been motivated to implement Fu’s pool-cleaning robot such that it moves toward dirtier (sub-threshold) regions and away from cleaner (above-threshold) regions because this would improve cleaning efficiency and task completion time. *Id.*, ¶166. The resulting behavior—spending more time in dirtier areas and less in cleaner areas—would have been the expected and desirable outcome of applying Fu’s thresholded cleanliness information to motion control. *Id.* And as explained by Dr. Reinholtz, implementing this control behavior in Fu would have required no more than routine software configuration within a POSA’s skill. *Id.* Such implementation would reflect only routine, predictable applications of well-known control techniques, requiring no new hardware and instead leveraging Fu’s disclosed central processor. *Id.* A POSA would have thus had a reasonable expectation of success in implementing Fu with the claimed “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.” *Id.*

Accordingly, even if Fu were found not to anticipate, it would have rendered obvious claims 1-3 for at least these reasons. *Id.*, ¶¶162-167.

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C. Ground 1c: Claims 1-3 Would Have Been Obvious Over Fu In View Of Benzler

1. Summary Of Benzler

Benzler, EX1013, entitled “Activation System for a Robotic Vehicle,” was filed on May 16, 2008 as PCT/EP08/56016, and published on Nov. 25, 2010 as US Patent Pub. No. 2010/0299016. EX1013, (10), (22), (43), (86). Benzler is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

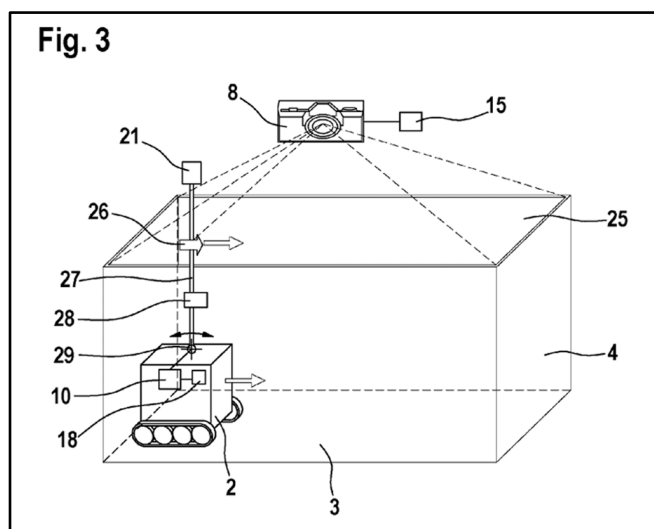
Benzler describes “an activation system (1) for a robotic vehicle (2)” that uses image-based navigation to autonomously control movement of the vehicle 2 within a work area 3. *Id.*, Abstract, ¶[0037]. The system includes at least one “camera (8) configured for generating image data of a work area (3)” and a “logic unit (10) configured for determining the position of the at least one robotic vehicle (2) based on the image data generated by the camera (8).” *Id.*, Abstract.

“The logic unit 10 calculates driving instructions for the robotic vehicle 2 based on the image data,” and the driving instructions are transmitted to the robotic vehicle 2 for execution. *Id.*, ¶¶[0044]-[0046]. Benzler further describes that the “logic unit automatically calculates a trajectory for the robotic vehicle based on the image data” “in such a way that the entire work area or a ... pre-defined section of the work area is at least almost completely driven along.” *Id.*, ¶[0024]. In a “particularly advantageous” embodiment, “the logic unit detects differently conditioned sections of the work area . . . based on the image data and then considers this information when

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calculating the driving instructions, in particular in such a way that the robotic vehicle does only or preferably move[s] on one of those [differently conditioned] sections[.]” *Id.*, ¶[0016].

Benzler describes several example embodiments of the activation system, such as “a snow cleaning vehicle, [a] leaf collecting vehicle, [a] grass collecting vehicle, thatching vehicle, or [a] weeding vehicle ...[and] as a lawnmower.” *Id.*, ¶[0023]. In a “particularly preferred” embodiment, “the robotic vehicle is construed as [a] pool-robotic vehicle, thus in particular as [a] filter vehicle and/or cleaning or purifying vehicle ... [that] drive[s] in particular on the bottom of a pool, which then creates the work area.” *Id.*, ¶[0028]. In this underwater embodiment, “[t]he external border 4 of the work area 3 is created by the surrounding pool walls.” Figure 3 illustrates a schematic of the activation system construed as a pool robotic vehicle 2 (*id.*, ¶¶[0036], [0051]-[0056]):



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Id., Fig. 3.

Benzler discloses a camera 8 for guiding the pool cleaning implementation of the robotic vehicle 2. *Id.*, ¶[0053]. The camera 8 transmits data via the logic unit 10 to the “control unit 18, which controls the not shown drive means” for driving the pool cleaning vehicle 2. *Id.*, ¶[0054]. The camera 8 may capture a “differently conditioned” portion of the submerged pool surface, such as a cleaned or not cleaned portion of the surface, and control the position of the vehicle 2 accordingly. *Id.*, ¶[0016].

2. Obviousness Of The “To, Or Away From” Limitation Over Fu In View Of Benzler

If the Board determines that Fu alone does not anticipate or render obvious the claimed “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,” claims 1-3 are nonetheless obvious over Fu in combination with Benzler. EX1010, ¶¶168-176.

A POSA would have been motivated to combine Fu and Benzler to yield the claimed control signal for causing movement “to, or away from” a portion of the submerged surface captured by the camera. *Id.*, ¶¶170-175. As detailed in Section IV.A.2.h above, Fu discloses capturing images, comparing them to a cleanliness threshold to determine a level of cleanliness, and then planning movement and adjusting the working state of a robot’s drive wheels to complete a cleaning task. EX1007, ¶[0026]. Benzler, like Fu, describes an autonomous robotic cleaning system

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that makes movement and cleaning decisions based on an image of the cleaning surface or work area, including “differently conditioned” sections of the work area. EX1013, Abstract, ¶¶[0016], [0018], [0028], [0037], [0044]-[0046], [0053]. In particular, Benzler describes an activation system for a robotic vehicle 2 that includes (i) a digital camera 8 for capturing an image of the work area, and (ii) a logic unit 10 that evaluates the image to generate driving instructions for the robotic vehicle 2. *Id.*, Abstract.

In a “particularly preferred” embodiment, Benzler’s robotic vehicle is a “pool-robotic vehicle ... in particular as a filter vehicle and/or cleaning or purifying vehicle,” which drives on the bottom of a pool to perform its cleaning function. *Id.*, ¶[0028]. Benzler further explains that “the internal or external logic unit automatically calculates a trajectory for the robotic vehicle based on the image data that is in particular continuously determined by the external camera.” *Id.*, ¶[0024]. These disclosures confirm that Benzler, like Fu, is directed to an autonomous robotic cleaner that uses an image to guide its movement and cleaning, and in particular, includes an embodiment where the cleaning is performed in a pool environment using camera-based navigation. The similar disclosures of Fu and Benzler would have motivated a POSA to consider these references together.

Benzler further describes embodiments in which the robotic vehicle is implemented as an autonomous lawnmower, a snow cleaning vehicle, a gas collecting

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vehicle, a thatching vehicle, a weeding vehicle, etc. *Id.*, ¶[0023]. In the autonomous lawnmower embodiment, for instance, “the logic unit ... is ... construed in such a way that differently conditioned sections (mowed/not mowed) ... are detected and the driving instructions are calculated in such a way that preferably the mowed section ... is driven along.” *Id.*, ¶¶[0018], [0045]. Benzler also discloses that in embodiments, “the logic unit detects differently conditioned sections of the work area, for example a mowed or a not mowed section of the work area based on the image data and then considers this information when calculating the driving instructions, in particular in such a way that the robotic vehicle does only or preferably move on one of those sections, in particular the not mowed lawn section.” *Id.*, ¶[0016]. Thus, Benzler uses an image to cause motion “only or preferably” toward target sections and away from non-target sections. *Id.*, ¶¶[0016], [0018], [0045].

A POSA would have been motivated to incorporate Benzler’s classification-driven motion control into Fu because it is a known technique for improving coverage efficiency and cleaning performance, satisfies design needs to prioritize dirty areas and reduce redundant cleaning, and represents one of a finite, predictable set of control options once regions are classified with respect to a threshold. EX1010, ¶174. Applying Benzler’s classification-driven motion to Fu’s thresholded cleanliness determinations would have yielded the claimed control signal for causing movement “to, or away from” a portion of the submerged surface captured by the

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camera, with the robot moving toward sub-threshold (dirtier) regions and away from above-threshold (cleaner) regions. *Id.* A POSA would also have had a reasonable expectation of success. The combination does not require new hardware or unconventional algorithms; Fu already discloses the cameras, processor, and wheels, and it “plans” movement and “adjusts” wheel states based on cleanliness determinations. Implementing Benzler’s classification-based movement entails routine controller configuration that would have been within a POSA’s skill. *Id.*, ¶175.

In sum, even if Fu alone were deemed insufficient, the combination of Fu with Benzler renders obvious the “to, or away from” control-signal limitation of claims 1-3 by teaching and motivating the use of an image to control motion toward target (dirtier) regions and away from non-target (cleaner) regions, with a reasonable expectation of success. *Id.*, ¶176.

D. Ground 2: Claims 1-3 Would Have Been Obvious Over Schnittman In View Of Benzler

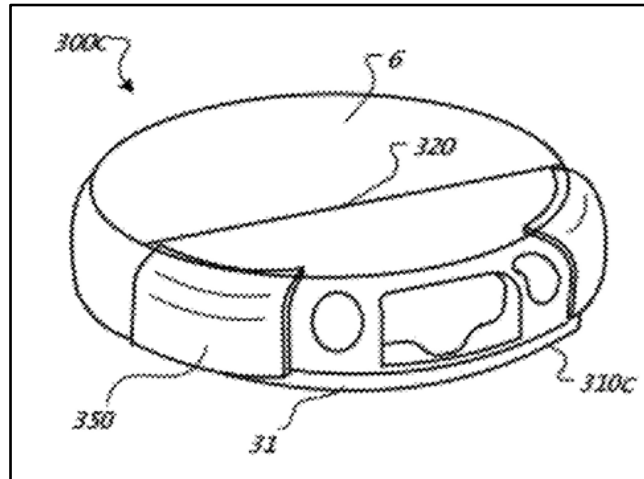
1. Summary Of Schnittman

Schnittman, EX1008, entitled “Debris Monitoring,” was filed December 30, 2011, and published July 5, 2012. EX1008, (22), (43). Schnittman incorporates by reference and claims priority to U.S. Provisional Application No. 61/428,808 (the “’808 provisional”), filed December 30, 2010. *Id.*, (60). Schnittman is prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (e).

Schnittman discloses an autonomous cleaning robot having a debris monitoring

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system and onboard sensing for navigation and safety. *Id.*, Abstract, ¶¶[0002], [0004]-[0006]. An example of Schnittman's autonomous cleaning robot is depicted in Figure 3C:



Id., Fig. 3C. Embodiments of Schnittman's cleaning robot include a drive assembly, cleaning assemblies, and a sensor suite, enabling behaviors such as debris-dependent spot cleaning, edge/cliff avoidance, and autonomous return to a maintenance/charging station. *Id.*, Fig. 2; ¶¶[0113], [0118]-[0119], [0191]-[0203], [0113], [0216]-[0227].

In embodiments, Schnittman's cleaning robot further includes a dedicated microprocessor 245 that executes routines and issues control signals to move the robot (*id.*, ¶¶[0118]-[0119]):

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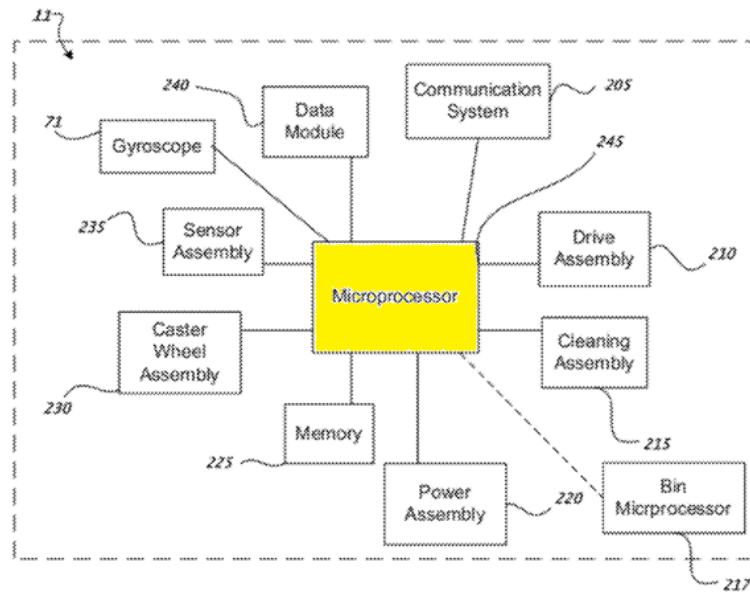


FIG. 2

Id., Fig. 2. As seen above, the microprocessor 245 is connected to drive assembly 210, which includes differentially driven right and left wheels, wheel motors, and encoders.

Id., ¶[0119]. “The drive assembly 210 is operable to receive commands from the microprocessor 245.” *Id.*

Schnittman further discloses that “in some implementations, the robot 11 includes a camera 1190 disposed toward the forward portion of the robot 11, with a field of view beyond the perimeter of the robot 11” (*id.*, ¶[0204]):

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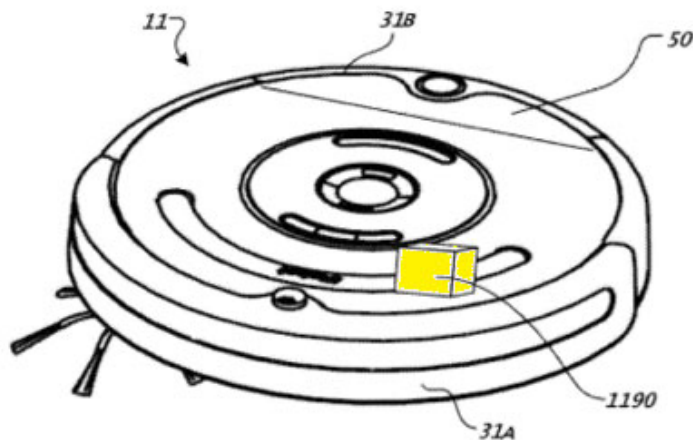


FIG. 11

Id., Fig. 11; *see also id.*, ¶[0045] (“In some implementations, the debris sensor includes a camera directed substantially forward of the cleaning apparatus. In certain implementations, the camera is movable to scan an area substantially forward of the cleaning apparatus.”).

The camera 1190 is “in communication with the microprocessor 245,” such that “movement of the robot 11 over the cleaning surface can be based at least in part on the detection of debris and/or an obstacle by the camera 1190.” *Id.*, ¶[0204]. For example, “the microprocessor 245 can process the signal from the camera 1190 to recognize debris on the cleaning surface and maneuver the robot 11 toward the debris.” *Id.*

Schnittman is analogous art to the '191 Patent because (1) it is from the same field of endeavor as the '191 Patent, and (2) it is reasonably pertinent to the problem

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faced by the inventors of the '191 Patent. EX1010, ¶109; *see Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019).

First, the '191 Patent and Schnittman are in the same field of endeavor: autonomous cleaning robots. *Compare* EX1001, 1:20-2:32 (automated, robotic cleaners for cleaning surfaces) *with* EX1008, ¶¶[0002]-[0003] (“This application relates to robots, and more particularly to autonomous coverage robots” for “removing debris from a surface.”).

Second, Schnittman is reasonably pertinent to at least one problem purportedly addressed by the '191 Patent: Ensuring “that all portions of ... pool surfaces are satisfactorily cleaned.” EX1001, 1:23-28. Specifically, as explained herein, Schnittman describes adaptive cleaning based on detected debris: In response to an identification of debris on a surface, Schnittman’s autonomous cleaning robot can perform various actions, including altering its path, running spot cleaning patterns, and steering toward the debris. EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203]. This focuses cleaning efforts where they are most necessary and enables better cleaning coverage, helping to ensure satisfactory cleaning of a surface. EX1010, ¶109. A POSA making a debris detecting pool cleaner would have thus “consulted [Schnittman] and applied [its] teachings in seeking a solution to the problem [the POSA] was attempting to solve.” *Airbus S.A.S.*, 941 F.3d at 1382.

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2. Schnittman Is Prior Art As Of December 30, 2010

As noted above, Schnittman claims priority to the '808 provisional, filed December 30, 2010. The specification of the '808 provisional supports at least claim 1 of Schnittman, and therefore Schnittman is entitled to the December 30, 2010 priority filing date of the '808 provisional, and is prior art as of that date.

A later patent enjoys the priority date of the provisional on which it is based so long as the provisional's specification "contain[s] a written description of the invention ... in such full, clear, concise, and exact terms, to enable an ordinarily skilled artisan to practice the invention claimed in [the later patent or published patent application]." *Amgen Inc. v. Sanofi*, 872 F.3d 1367, 1380 (Fed. Cir. 2017) (quotation omitted). Similarly, "the written description of the provisional must adequately support the claims of the non-provisional application." *Id.* (quotation omitted); *see also Apple Inc. v. Int'l Trade Comm'n*, 725 F.3d 1356, 1372 (Fed. Cir. 2013).

As shown in the chart below, Schnittman enjoys the December 30, 2010 priority date of the '808 provisional because the '808 provisional fully supports at least claim 1 of Schnittman:

Schnittman (US2012/0169497, EX1008)	U.S. Provisional Application 61/428,808 (EX1011)
1[a] A debris monitoring system comprising:	"In one aspect, a debris monitoring system includes a receptacle, a first and a second emitter, and a first receiver." EX1011, ¶[0003].
1[b] a receptacle defining an opening to receive debris into the receptacle, the opening	"In one aspect, a debris monitoring system includes a receptacle , a first and a second emitter, and a first

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having a top portion and a bottom portion, the top portion above the bottom portion as debris is received into the receptacle;	receiver. The receptacle defines an opening to receive debris into the receptacle.” <i>Id.</i>, ¶[0003]. “In certain implementations, the opening has a top portion and a bottom portion, the top portion above the bottom portion as debris is received into the receptacle” <i>Id.</i>, ¶[0006].
1[c] a first and a second emitter, each arranged to emit a signal across at least a portion of the opening; and	“In one aspect, a debris monitoring system includes a receptacle, a first and a second emitter, and a first receiver.... The first and second emitter are each arranged to emit a signal across at least a portion of the opening.” <i>Id.</i>, ¶[0003].
1[d] a first receiver proximate to the first emitter to receive reflections of the signal emitted by the first emitter, the first receiver disposed along a top portion of the opening and toward the opening to receive an unreflected portion of the signal emitted by the second emitter across the largest dimension of the opening.	“In one aspect, a debris monitoring system includes a receptacle, a first and a second emitter, and a first receiver.... The first receiver is proximate to the first emitter to receive reflections of the signal emitted by the first emitter, and the first receiver is disposed toward the opening to receive an unreflected portion of the signal emitted by the second emitter across at least a portion of the opening.” <i>Id.</i>, ¶[0003]. “In some implementations, the first receiver and the second emitter are disposed substantially opposite one another across the largest dimension of the opening.” <i>Id.</i>, ¶[0005]. “In certain implementations, the opening has a top portion and a bottom portion, the top portion above the bottom portion as debris is received into the receptacle, and the first and second emitters and the first receiver each disposed toward a top portion of the opening, with the first receiver disposed above the first and second emitters.” <i>Id.</i>, ¶[0006]. “The debris monitoring system of claim 21 wherein the opening has a top portion and a bottom portion,

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	the top portion above the bottom portion as debris is received into the receptacle, and the first and second emitters and the first receiver each disposed toward a top portion of the opening , with the first receiver disposed above the first and second emitters.” <i>Id.</i> , claim 24.
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Additionally, the '808 provisional application describes the subject matter that Petitioner relies upon as prior art in the Schnittman publication. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1380-81 (Fed. Cir. 2015). EX1012 is a redline comparison showing textual differences between the '808 provisional and Schnittman. In this redline, blue and underlined text reflects material present in Schnittman but not in the '808 provisional, while unmarked text reflects material common to both documents. Additionally, the Petition-cited passages of Schnittman are highlighted in yellow. As shown in EX1012, none of the Petition-cited passages of Schnittman appear as blue, underlined text. Instead, each highlighted passage appears in the unmarked text, demonstrating that every portion of Schnittman relied upon in the Petition is present verbatim or in substance in the '808 provisional. Additionally, all of the figures of Schnittman cited in the Petition (i.e., Figs. 1A, 1B, 1C, 2, 3C, 10A, 10B, 11, 14D) are present in the '808 provisional.

3. Motivations to Combine

Schnittman discloses an autonomous cleaning robot 11 with movement and cleaning decisions tied to an image received from a debris sensor, including embodiments where the debris sensor is a camera 1190. EX1008, Abstract, ¶¶[0002],

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[0004]-[0006], [0045], [0204]. The visual information may include “detection of debris and/or an obstacle by the camera 1190.” *Id.*, ¶[0204]. Schnittman explains that the camera 1190 is in communication with a microprocessor 245, such that movement of the robot 11 over the cleaning surface is based on this visual information, for *e.g.*, “to avoid obstacles and/or debris larger than a specific size,” or “to recognize debris on the cleaning surface and maneuver the robot 11 toward the debris.” *Id.* [0204]-[0205].

Importantly, Schnittman is not limited to any specific environment; its teachings apply generally to cleaning robots that navigate and make cleaning decisions based on a visual analysis of the surface being cleaned. As explained by Dr. Reinholtz, this image-based control represented a state-of-the-art approach to autonomous cleaning at the time of the '191 Patent, and a POSA designing a pool-cleaning robot would have recognized that Schnittman's teachings and stated advantages (*e.g.*, robust, debris-responsive cleaning coverage) could be advantageously leveraged in a pool-cleaning context. EX1010, ¶180; EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203].

The POSA designing a pool-cleaning robot at the time of the alleged invention would have also looked to pool-cleaning literature, like Benzler. Benzler, like Schnittman, describes an autonomous robotic cleaning system that makes movement and cleaning decisions based on an image of the cleaning surface or work area.

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EX1013, Abstract, ¶¶[0028], [0037], [0044]-[0046], [0053]. In particular, Benzler describes an activation system for a robotic vehicle 2 that includes a digital camera 8 for capturing an image of the work area and a logic unit 10 that evaluates the image data to generate driving instructions for the robotic vehicle 2. *Id.*, Abstract.

In a “particularly preferred” embodiment, the robotic vehicle is a “pool-robotic vehicle ... in particular as [a] filter vehicle and/or cleaning or purifying vehicle,” which drives on the bottom of a pool to perform its cleaning function. *Id.*, ¶[0028]. Benzler further explains that “the internal or external logic unit automatically calculates a trajectory for the robotic vehicle based on the image data that is in particular continuously determined by the external camera.” *Id.*, ¶[0024]. These disclosures confirm that Benzler, like Schnittman, is directed to an autonomous robotic cleaner that uses an image to guide its movement and cleaning, and in particular, includes an embodiment where the cleaning is performed in a pool environment using camera-based navigation.

A POSA would have been motivated to consider Schnittman and Benzler together because they describe similar technology (*e.g.*, autonomous cleaning robots that employ computer vision) and address the same problem: enabling a robot to make cleaning and navigation decisions based on an image of the cleaning surface. EX1010, ¶¶179-192. At the time of the ’191 Patent, POSAs working in the field of autonomous, image-based cleaning robots, whether for floors, lawns, or pools, were addressing the

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same core problem: how to use visual information to enable a robot to perceive its cleaning surface, and execute cleaning operations autonomously. *Id.* Both Schnittman and Benzler address that problem, and offer complementary, overlapping teachings that a POSA would have recognized as related. *Id.*

At the time of the alleged invention (July 2012), a POSA would have understood that the robotics principles underlying such image-based cleaners, like those developed by leading cleaning robot manufacturers such as iRobot (assignee of Schnittman), were readily adaptable to different environments and mediums. *Id.*, ¶185. Robotics, like any other technology, develops by building on existing technology and adapting existing technology to new contexts. *Id.* POSAs working in the field of autonomous pool cleaners were not working in isolation; they routinely drew on technologies from the broader field of autonomous cleaning robots. *Id.* Indeed, Benzler itself confirms this: it describes the same image-driven framework as Schnittman, with Benzler applying this framework to both land and water environments. EX1013, ¶¶[0028], [0037], [0044]-[0046].

Benzler would have also reinforced a POSA's understanding that Schnittman's cleaning robot could be advantageously adapted for use in a pool-cleaning context. For example, Benzler's teaching of a "moisture-sealed housing" for the internal logic unit (*id.*, ¶[0011]) explicitly contemplates operation in wet environments, providing a practical implementation detail that a POSA would have readily incorporated when

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adapting Schnittman's camera-based cleaning robot for underwater use. Likewise, for instance, Benzler's teaching of "pool robotic vehicles [that] drive in particular on the bottom of a pool" using wheels powered by a drive motor (*id.*, ¶¶[0028], [0051], Fig. 3) reinforces that Schnittman's similar motor-powered wheels 45 could be readily adapted for underwater use. Schnittman's image-based debris detection and navigation system, combined with Benzler's known underwater implementation of a similar image-based robotic pool cleaner, would predictably yield an image-based underwater pool cleaner that is driven based on visual data of the pool surface.

Additionally, Benzler describes other embodiments in which the robotic vehicle is implemented as an autonomous lawnmower, a snow cleaning vehicle, a gas collecting vehicle, a thatching vehicle, a weeding vehicle, etc. *Id.*, ¶[0023]. In the autonomous lawnmower embodiment, for instance, "the logic unit ... is ... construed in such a way that differently conditioned sections (mowed/not mowed) ... are detected and the driving instructions are calculated in such a way that preferably the mowed section ... is driven along." *Id.*, ¶¶[0018], [0045]. Like the pool cleaning vehicle embodiment, this embodiment is based on the same image-driven activation system: the camera captures an image of the work area, and the logic unit interprets the captured image to determine how that area is "conditioned" and where to move next. *Id.*, ¶¶[0016], [0040]-[0045]. By describing the same image-based system across multiple domains, land and water alike, Benzler demonstrates that a POSA

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understood how to adapt the principles of image-based robotic navigation and cleaning across various environments and mediums.

Furthermore, a POSA would have had a reasonable expectation of success in making this combination. EX1010, ¶188. As explained by Dr. Reinholtz, by the time of the '191 Patent, the necessary adaptations to render a system water-ready were straightforward and within a POSA's skill, with such adaptations including moisture-sealing or potting electronics, waterproofing housings, ensuring stable mobility and traction along submerged pool surfaces to counter buoyancy and slippage, and applying known image-processing techniques to extract useful information from underwater camera imagery. *Id.*

For example, in the same period, the use of cameras on underwater vehicles was known (*see, e.g.*, EX1014, WO 2012/0236676 (“underwater sediment cleaning apparatus ... wherein the controller ... comprises: a camera unit controlling an image captured by a camera ... wherein the camera unit ... [is] connected to the central processing unit”), EX1015, U.S. Pat. Pub. 2012/0006352) (“Robotic submersible cleaning system” including “use of an intelligent camera system 81 [to] assist in maintaining the positional accuracy as the HullBUG cleaning system navigates along an underwater surface”), EX1016, U.S. Patent No. 5,205,174 (“apparatus and method of ... inspecting a submerged surface of a fluid reservoir” including a “navigation camera 6”), and researchers documented effective techniques to improve the

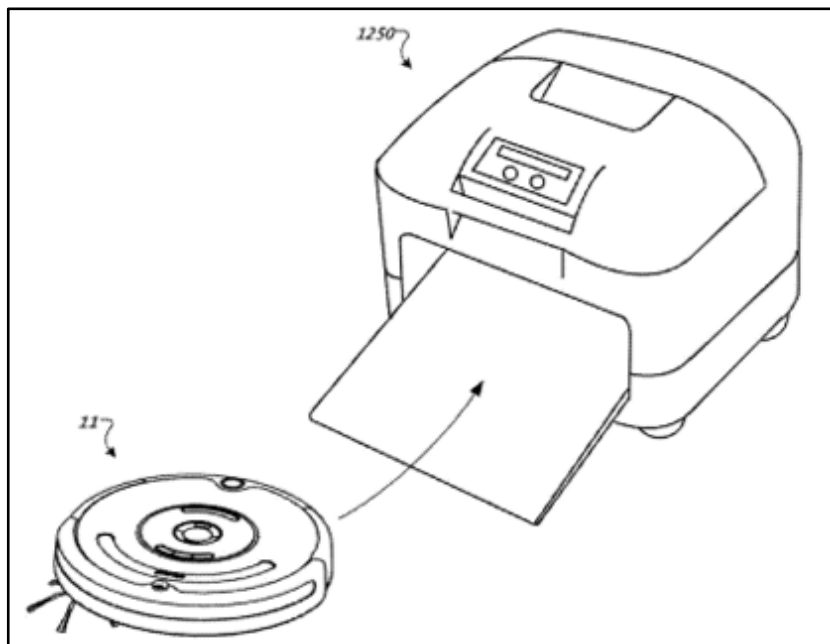
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effectiveness of underwater imaging. Literature from around the time of the '191 Patent described various normalization, filtering, and color-space methods that robustly extract target information from underwater environments in real time. *See* EX1017, 7. These developments would have reinforced a skilled artisan's motivation and reasonable expectation of success in adapting Schnittman to Benzler's pool-cleaning context. Thus, a POSA seeking to develop an autonomous pool-cleaning robot would have been motivated to extend the teachings of Schnittman to the underwater context, with Benzler providing clear guidance and confirmation that such an adaption was both known and would be successful.

4. Independent Claim 1

(a) Preamble

To the extent limiting, Schnittman in view of Benzler would have rendered obvious the preamble of claim 1. EX1010, ¶¶194-197. Schnittman discloses autonomous robotic cleaners for removing debris from cleaning surfaces (*e.g.*, floors). EX1008, ¶¶[0002], [0023], [0033]. For instance, Figure 14D depicts an exemplary autonomous robotic cleaner 11 and its maintenance station 1250 (*id.*, ¶¶[0097], [0216]-[0217]):



Id., Fig. 14D. In embodiments, Schnittman’s autonomous robotic cleaners include “debris agitator[s],” such as brushes, that “sweep or otherwise agitate debris from the cleaning surface.” *Id.*, ¶¶[0026], [0027], [0031], [0115], [0119], [0128], [0130]-[0131]. Schnittman thus discloses autonomous robotic cleaners “for cleaning debris from a ... surface,” as recited in the preamble of claim 1.

Further, Schnittman’s autonomous robotic cleaners are “self-propelled” because they include an onboard drive system and wheels that move and steer the robot without external propulsion. *See, e.g., id.*, ¶¶[0005] (“The drive system is coupled to the housing and configured to maneuver the robot across a cleaning surface.”), [0112] (“installed along either side of the robot body 31 are differentially driven wheels 45, each rotatable about a transverse axis, to mobilize the robot 11”), [0119] (“right and left wheel motors” for the respective “right and left differentially

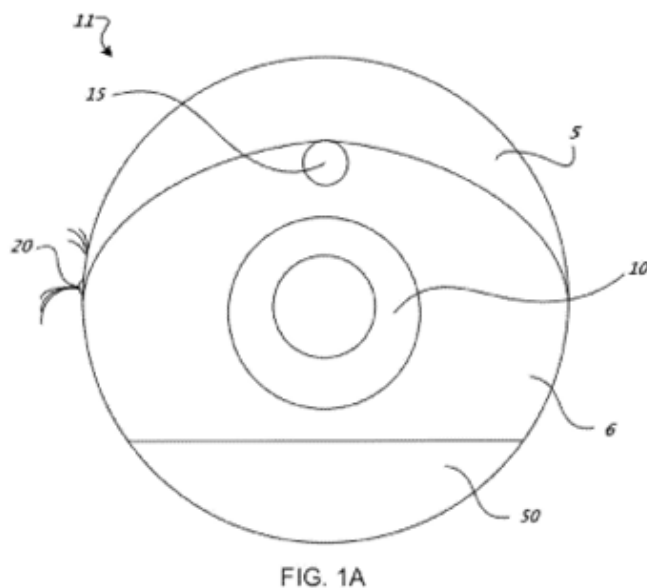
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driven wheels 45”). In embodiments, power for moving Schnittman’s autonomous robotic cleaners is provided via an onboard battery that is charged at a maintenance station (*e.g.*, the maintenance station 1250 shown above). *Id.*, ¶¶[0048], [0050], [0054], [0115], [0118], [0216]-[0217], [0221], [0227], [0230].

Thus, Schnittman’s autonomous robotic cleaners disclose a “self-propelled ... cleaner for cleaning debris from a ... surface,” and as explained above, a POSA would have been motivated to apply Schnittman’s teachings in the pool-cleaning context for cleaning submerged surfaces in view of Benzler. Section IV.D.3. Therefore, Schnittman in view of Benzler renders obvious the “self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool” recited in the preamble of claim 1. EX1010, ¶¶194-197.

(b) Element 1a

Schnittman discloses element 1a of claim 1. *Id.*, ¶¶198-200. Schnittman states that embodiments of its autonomous robotic cleaners include “a robot body 31 (*e.g.*, a chassis and/or housing) which carries an outer shell 6 connected to a bumper 5” (EX1008, ¶[0111]):



Id., Fig. 1A. In embodiments, the robot body 31 “carries a control panel 10 and an omnidirectional receiver 15, which has a 360 degree line of vision for detection of signals emitted towards the robot 11 from substantially all directions.” *Id.*, ¶[0111].

Schnittman’s robot body 31 discloses the claimed “vehicle body.” EX1010, ¶¶198-200.

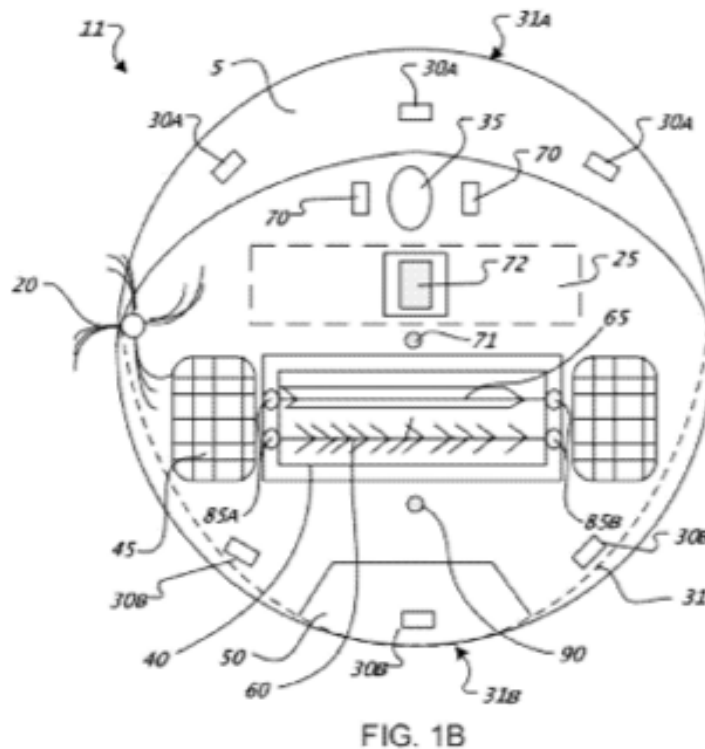
(c) Element 1b

Schnittman in view of Benzler would have rendered obvious element 1b of claim 1. *Id.*, ¶¶201-204. As explained in Section II.C.1 above, “means for moving the vehicle body within the swimming pool” is an MPF term, and the corresponding structures disclosed in the ’191 Patent include “wheels, rollers, tracks or other surface contacting members powered by a motor and the like.” EX1001, 3:31-43.

Schnittman discloses “moving the vehicle body” and a corresponding structure described in the ’191 Patent. As explained above for the preamble of claim 1,

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Schnittman's autonomous robotic cleaners include an onboard drive system (also referred to as a "drive assembly") for moving the robot, including its body. EX1008, ¶¶[0005], [0040], [0044], [0119], [0177]. The drive system "includes right and left differentially driven wheels 45, right and left wheel motors, and wheel encoders" in embodiments (*id.*, ¶[0119]):



Id., Fig. 1B.

Schnittman's "drive system is coupled to the [robot's] housing and configured to maneuver the robot across a cleaning surface." *Id.*, ¶[0005]. Further, the drive system is "operable to receive commands from the microprocessor 245" for controlling the movement of the robot. *Id.*, ¶¶[0119], [0177]. Schnittman thus discloses the claimed function ("moving the vehicle body"), and Schnittman's

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wheels 45 powered by right and left wheel motors disclose a corresponding structure described in the '191 Patent for performing this function. EX1010, ¶203.

While Schnittman does not disclose moving its autonomous cleaning robots “within [a] swimming pool” specifically, as explained above, a POSA would have been motivated to apply Schnittman’s teachings in the pool-cleaning context in view of Benzler. Section IV.D.3. For instance, Benzler’s teaching of “pool robotic vehicles [that] drive in particular on the bottom of a pool” using wheels powered by a drive motor (Ex. 1013, ¶¶[0028], [0051], Fig. 3) provides a drive system similar to that of Schnittman, reinforcing that Schnittman’s similar motor-powered wheels 45 could be readily adapted for underwater use. Therefore, Schnittman in view of Benzler renders obvious the “means for moving the vehicle body within the swimming pool (drive system).” EX1010, ¶¶201-204.

(d) Element 1c

Schnittman in view of Benzler would have rendered obvious element 1c of claim 1. *Id.*, ¶¶205-206. Schnittman discloses that embodiments of its autonomous robotic cleaners include an “internal filter 54” (EX1008, ¶[0117]):

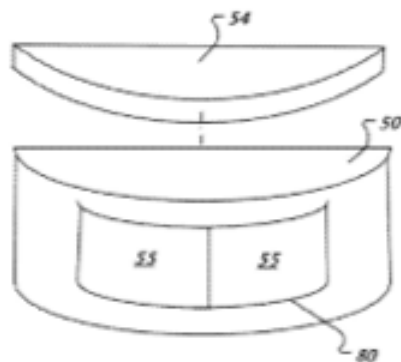


FIG. 1C

Id., Fig. 1C; *see also id.*, ¶¶[0120]-[0124], [0129].

Schnittman's internal filter 54 is configured to retain debris collected from a cleaning surface, such as a "submerged surface" in a pool-cleaner implementation of Schnittman's robotic cleaner in view of Benzler. EX1010, ¶206. In embodiments, the internal filter 54 is part of the robot's cleaning bin 50, with the internal filter 54 retaining collected debris. *Id.*; EX1008, ¶¶[0117], [0121], [0123]-[0124] (internal filter must be cleaned to remove collected debris), [0129], [0242], [0248]. As explained by Dr. Reinholtz, a pool-cleaner implementation of Schnittman would include a filter like that described in Schnittman, with the filter retaining debris collected by the robot while passing filtered, clean water back into the swimming pool. EX1010, ¶206. Such on-board filters for pool-cleaning robots were well-known at the time of the alleged invention, and a POSA would have understood how to modify or replace Schnittman's filter for use in Benzler's pool-cleaning context. *Id.* A POSA's motivation for making such modifications is explained above in Section IV.D.3. Therefore, Schnittman in view of Benzler renders obvious "a filter [internal

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filter 54] configured to retain debris collected from the submerged surface.” *Id.*, ¶¶205-206.

(e) Element 1d

Schnittman in view of Benzler would have rendered obvious element 1d of claim 1. *Id.*, ¶¶207-210. Schnittman discloses that embodiments of its autonomous robotic cleaners include a camera, such as the exemplary camera 1190 of Figure 11:

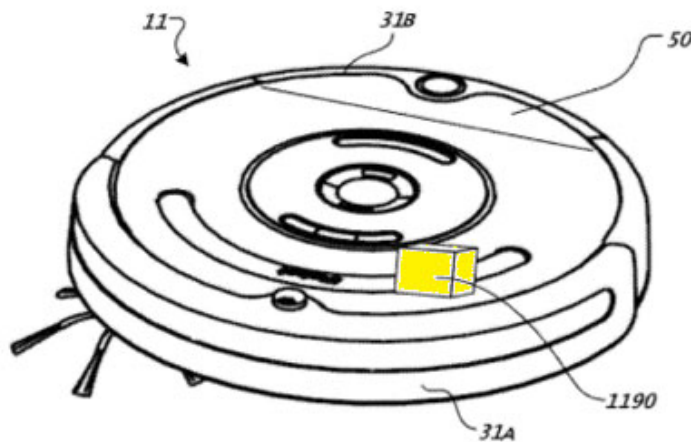


FIG. 11

EX1008, Fig. 11; *see also id.*, ¶¶[0045], [0204]-[0205].

As seen above, Schnittman’s camera is positioned on or in the body of the robot. *Id.*, ¶[0204] (“Referring to FIG. 11, in some implementations, the robot 11 includes a camera 1190 disposed toward the forward portion of the robot 11, with a field of view beyond the perimeter of the robot 11.”). The camera captures an image of at least a first portion of a cleaning surface. EX1010, ¶208. Specifically, the camera “scan[s] an area substantially forward of the [robot]” as the “robot [moves] over the cleaning

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surface.” EX1008, ¶¶[0045], [0204]. The camera is “in communication with [a] microprocessor 245,” and the “microprocessor 245 ... process[es] [a] signal from the camera ... to recognize debris on the cleaning surface and maneuver the robot 11 toward the debris.” *Id.*, ¶[0204]. As explained by Dr. Reinholtz, a POSA would have thus understood that Schnittman’s camera captures an image of at least a portion of the cleaning surface: The microprocessor could not “recognize debris on the cleaning surface” absent an image of the cleaning surface captured by the camera. EX1010, ¶208.

While Schnittman does not disclose capturing an image of a “submerged [underwater] surface” specifically, a pool-cleaner implementation of Schnittman in view of Benzler would capture such an image, and a POSA would have been motivated to pursue such an implementation for the reasons in Section IV.D.3 above. *Id.*, ¶¶179-192, 210. Accordingly, Schnittman in view of Benzler renders obvious the claimed “at least one camera [camera 1190] positioned on or in the body for capturing an image of at least a first portion of the submerged surface.” *Id.*, ¶¶207-210.

(f) Element 1e

Schnittman discloses element 1e of claim 1. *Id.*, ¶¶211-213. Schnittman discloses that embodiments of its autonomous robotic cleaners include a microprocessor, an example of which is the microprocessor 245 of Figure 2 (EX1008, ¶[0118]):

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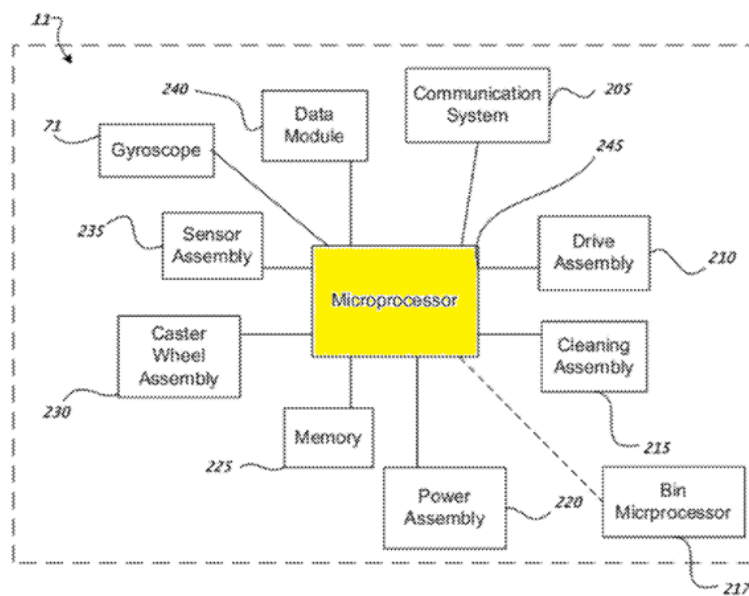


FIG. 2

Id., Fig. 2 (annotated).

Schnittman's microprocessors are "capable of executing routines and generating and sending control signals" for "controlling [the robot's] drive assembly" and other components. *Id.*, ¶¶[0118]-[0119], [0177]. In the example of Schnittman's Figure 2, the routines executed by the microprocessor 245 are stored in the memory 225, and a data module 240 is configured to "upload new software routines or values to the robot 11." *Id.*, ¶[0118]. Schnittman's microprocessor discloses the claimed "controller" because it controls operation of the autonomous cleaning robot and is similar to controllers described in the '191 Patent. EX1010, ¶212. For instance, the '191 Patent describes that its controller may be implemented using "one or more processing units ... that execute[] sequences of instructions contained in a memory," with the execution of such sequences "caus[ing] the processing unit to perform steps

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such as generating control signals.” EX1001, 4:16-26 (“The instructions may be loaded in a random access memory (RAM) for execution by the processing unit from a read only memory (ROM), a mass storage device, or some other persistent storage.”). Schnittman’s microprocessor 245 likewise executes routines stored in memory to generate control signals for controlling the robot, and the microprocessor 245 thus discloses the claimed “controller.” EX1008, ¶¶[0118]-[0119], [0177].

Schnittman’s microprocessor 245 is also positioned on or in the body of the robot, as claimed. In the example of Figure 2, the microprocessor 245 is part of the robot 11, and thus would be positioned on or in the robot’s body. EX1008, ¶¶[0118] (“The robot 11 includes a microprocessor 245 ...”). Further, Schnittman states that the microprocessor is “included within the robot 11.” *Id.* Therefore, Schnittman’s microprocessor 245 teaches “a controller” that is “positioned on or in the body.”

(g) Element 1f

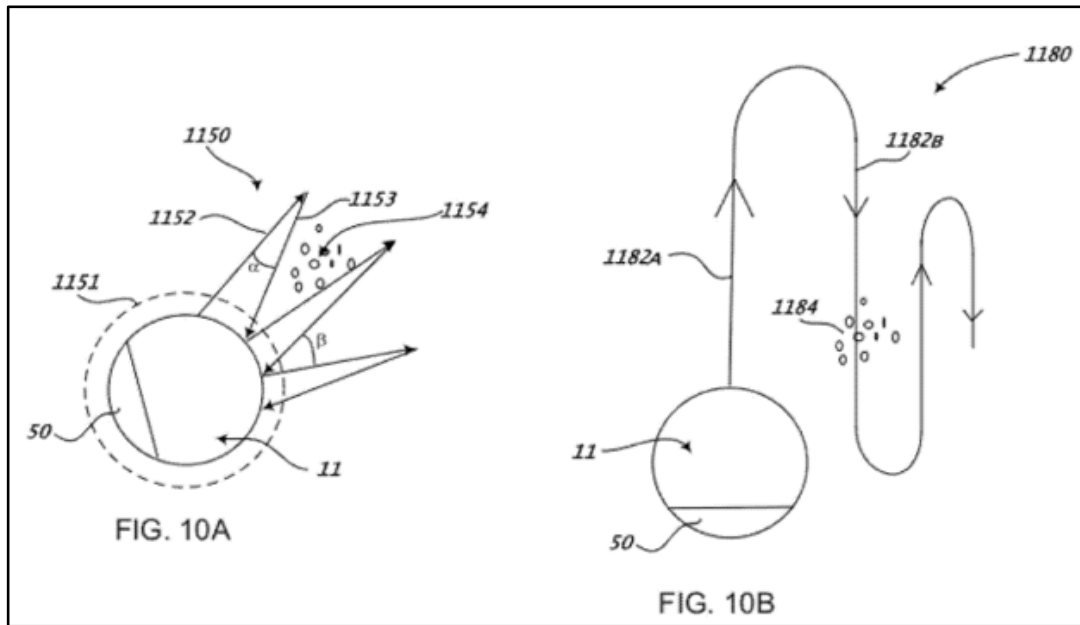
Schnittman discloses element 1f of claim 1. EX1010, ¶214. Schnittman discloses that its microprocessor (“controller”) is in communication with the robot’s camera and configured to process signals from the camera: “[C]amera 1190 can be in communication with the microprocessor 245 [T]he microprocessor 245 can process the signal from the camera 1190 to recognize debris on the cleaning surface and maneuver the robot 11 toward the debris. Additionally or alternatively, the microprocessor 245 can process the signal from the camera 1190 to recognize

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obstacles and/or debris in the vicinity of the robot 11 and maneuver the robot 11 to avoid obstacles and/or debris” EX1008, ¶¶[0204]-[0205]. Schnittman thus discloses the claimed controller [microprocessor 245] “in electronic communication with the at least one camera [camera 1190].” EX1010, ¶214.

(h) Element 1g

Schnittman in view of Benzler would have rendered obvious element 1g of claim 1. *Id.*, ¶¶215-220. Schnittman discloses that its microprocessor (“controller”) generates commands (“control signals”) to cause movement of the robot and its body: “The drive assembly 210 is connected to the microprocessor 245” and “is operable to receive commands from the microprocessor 245.” EX1008, ¶[0119]; *see also id.*, ¶[0177] (“The microprocessor [245] can move the robot 11 through one or more of the spot coverage patterns below by controlling the drive assembly 210 based at least in part on a signal received from the gyroscope 71.”). The control signals generated by Schnittman’s microprocessor can cause the robot to move based on detected debris and/or in different cleaning patterns, including those of Figures 10A and 10B (*id.*, ¶¶[0177], [0191]-[0203]):



Id., Figs. 10A, 10B. Accordingly, Schnittman discloses the claimed controller configured to generate control signals to cause movement of the robot's body. EX1010, ¶¶215-220.

Schnittman further discloses the generation of such control signals “in response to the captured image.” Schnittman states that its camera “can be in communication with the microprocessor 245 such that the movement of the robot 11 over the cleaning surface can be based at least in part on the detection of debris and/or an obstacle by the camera 1190.” EX1008, ¶[0204]. Schnittman further explains that its microprocessor “can process the signal from the camera” and control movement of the robot accordingly. *Id.*, ¶¶[0204]-[0205]. A POSA would thus understand that Schnittman's microprocessor generates control signals for moving the robot based on (“in response to”) the image captured by the robot's camera. EX1010, ¶217. Such

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control signals “cause movement of the [robot’s] body ... to, or away from, the first portion of the ... surface,” as claimed:

[T]he microprocessor 245 can process the signal from the camera 1190 to recognize debris on the cleaning surface and ***maneuver the robot 11 toward the debris***. Additionally or alternatively, the microprocessor 245 can process the signal from the camera 1190 to recognize obstacles and/or debris in the vicinity of the robot 11 and ***maneuver the robot 11 to avoid obstacles and/or debris*** larger than a specific size threshold (e.g., a value less than about the smallest opening defined by the cleaning head).

EX1008, ¶¶[0204]-[0205].

As explained by Dr. Reinholtz, the image captured by Schnittman’s camera depicts a portion of the cleaning surface (*see* Element 1d above), and the microprocessor processes the image to recognize debris in it. EX1010, ¶218. Based on the recognized debris in the image, the microprocessor generates control signals for moving the robot toward or away from the portion of the cleaning surface having the recognized debris. *Id.* Accordingly, Schnittman discloses the claimed controller “configured to generate, in response to the captured image, at least one control signal to cause movement of the body ... to, or away from, the first portion of the [cleaning] surface.”

While Schnittman does not disclose the generation of control signals for causing movement “within the swimming pool” and toward a portion of a “submerged [underwater] surface” specifically, a POSA would have understood, in view of Benzler, how to adapt Schnittman’s autonomous robotic cleaners for use in this

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context and would have been motivated to do so for the reasons in Section IV.D.3 above. *Id.*, ¶219. Therefore, Schnittman in view of Benzler renders obvious “a controller [microprocessor 245]” “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.” *Id.*, ¶¶215-220.

Schnittman in view of Benzler renders obvious claim 1 of the '191 Patent. *Id.*, ¶¶193-220.

5. Independent Claim 2

Claim 2 of the '191 Patent is unpatentable over Schnittman in view of Benzler for the reasons explained above for claim 1. *See also* Section IV.A.3.

6. Independent Claim 3

Claim 3 of the '191 Patent is unpatentable over Schnittman in view of Benzler for the reasons explained above for claim 1. *See also* Section IV.A.4.

V. CONCLUSION

Petitioner respectfully requests IPR of claims 1-3 of the '191 Patent.

VI. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(a)(1)

Pursuant to 37 C.F.R. § 42.8(a)(1), the mandatory notices identified in 37 C.F.R. § 42.8(b) are provided below as part of this Petition.

A. 37 C.F.R. § 42.8(b)(1): Real Parties-In-Interest

The real parties-in-interest are Wybotics Inc., Wybotics, Co. Ltd., and Tianjin Zhuhui Commercial, Tianjin Wangyuan Industry and Trade, and Ms. Fu Guilan.

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

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner is aware of the following lawsuits that involve the '191 Patent:

- *Zodiac Pool Systems LLC v. Wybotics, Co. Ltd. f/k/a Tianjin Wangyuan Environmental Protection and Technology Co.*, 2:25-cv-582-JRG-RSP (E.D. Tex. Filed May 23, 2025).
- *Wybotics Inc. v. Zodiac Pool Systems LLC*, 2:25-cv-08526 CAS (AGRx) (C.D. Cal. Filed Sept. 9, 2025).

Petitioner is also concurrently filing Petitions for *Inter Partes* Review of the U.S. Patent Nos. 11,262,766 and 11,880,207, which are related to the '191 Patent challenged herein.

C. 37 C.F.R. § 42.8(b)(3), (4): Lead And Back-Up Counsel And Service Information

Petitioner provides the following designation of counsel:

PETITION FOR *INTER PARTES* REVIEW OF PATENT NO. 11,003,191

Lead Counsel	Back-up Counsel
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PETITION FOR *INTER PARTES* REVIEW OF PATENT NO. 11,003,191

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney for Petitioner accompanies this petition. Please address all correspondence to lead and back-up counsel at the addresses above. Petitioner also consents to electronic service by email at the email addresses listed above.

Dated: November 25, 2025

Respectfully submitted,

/Joshua R. Nightingale/

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing petition for *Inter Partes* Review of U.S. Patent No. 11,003,191, including all exhibits, was served on November 25, 2025 via Express Mail delivery directed to the attorney of record for the patent at the following address:

John Pratt
Kilpatrick Townsend & Stockton LLP - East Coast
Mailstop: IP Docketing - 22
1100 Peachtree Street
Suite 2800
Atlanta, GA 30309

In addition, a courtesy copy of the foregoing petition for *Inter Partes* Review of U.S. Patent No. 11,003,191, including all exhibits, were served on litigation counsel for Patent Owner Zodiac Pool Systems LLC at the following addresses:

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Date: November 25, 2025

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CERTIFICATE OF WORD COUNT UNDER 37 C.F.R. § 42.24(a)

I, the undersigned, do hereby certify that the attached petition contains 12,539 words, as measured by the Word Count function of Microsoft Word. This is less than the limit of 14,000 words as specified by 37 C.F.R. § 42.24(a)(1)(i).

Date: November 25, 2025

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