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UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

BEATBOT TECHNOLOGY (USA) CO. LTD., DEEPWATER INNOVATION TECHNOLOGY (HONG KONG) LIMITED, and XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.,

Plaintiffs,

v.

ZODIAC POOL SYSTEMS LLC,

Defendant.

Case No. 3:25-cv-01946-GPC-JLB

PLAINTIFFS' NOTICE OF MOTION AND MOTION TO STAY

Date: April 3, 2026
Time: 1:30 PM
Courtroom: 12A, 12th Floor
Judge: Hon. Gonzalo P. Curiel
Mag Judge: Hon. Jill L. Burkhardt

TO ALL PARTIES AND THEIR COUNSEL OF RECORD:

PLEASE TAKE NOTICE THAT on April 3, 2026 at 1:30 PM, or as soon thereafter as the matter may be heard in the courtroom of the Honorable Gonzalo P. Curiel of the above-titled Court, located at Courtroom 12A of the James M. Carter and Judith N. Keep Courthouse, 333 W. Broadway, San Diego, CA 92101, Plaintiffs will and hereby do move this Court for an order to stay the litigation until Patent Office proceedings challenging the validity of the asserted patents via *inter partes* review ("IPR") are complete. Counsel for Plaintiffs notified counsel for Defendant of the intended motion and sought Defendant's position, and counsel for Defendant indicated it is discussing the motion with Defendant.

Plaintiffs' motion is made pursuant to this Court's inherent discretion to manage its docket, the early stage of this litigation, the simplification of the disputed issues in this litigation via completion of the IPR process, and the lack of any undue prejudice or tactical disadvantage to Plaintiff and is based on this Notice of Motion, the Memorandum of Points and Authorities, the Declaration of Kyle R. Canavera filed and served herewith, any reply papers submitted in support of this motion, the complete records and files of this action, and any argument or additional evidence permitted by the Court.

Dated: January 28, 2026

PERKINS COIE LLP

By: */s/ Kyle R. Canavera*
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Plaintiffs,

v.

ZODIAC POOL SYSTEMS LLC,

Defendant.

Case No. 3:25-cv-01946-GPC-JLB

PLAINTIFFS' MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF PLAINTIFFS' MOTION TO STAY

Date: April 3, 2026
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I. INTRODUCTION

Beatbot Technology (USA) Co. Ltd., Deepwater Innovation Technology (Hong Kong) Limited, and Xingmai Innovation Technology (Suzhou) Co., Ltd. (collectively, "Beatbot") respectfully request that the Court stay this case pending resolution of pending *inter partes* review ("IPR") proceedings. Beatbot's three IPR petitions challenge every single asserted claim of all three patents asserted by Zodiac Pool Systems LLC ("Zodiac"). All three asserted patents are further challenged by additional IPR petitions filed ay an unrelated third party. The Patent Office IPR proceedings will streamline the issues for trial and likely eliminate Zodiac's infringement claims entirely. The totality of circumstances and each of the factors that courts consider in determining whether to stay litigation pending IPR favor a stay in this case.

First, the early stage of this case strongly favors a stay. Nearly all of the substantive work related to this case—including invalidity contentions, claim construction, fact and expert discovery, summary judgment motions, and trial itself—is yet to come. Zodiac served its preliminary infringement contentions just over a month ago, on December 9, 2025. Beatbot's invalidity contentions are not due until February 2026, and the claim construction hearing is not scheduled until June 2026. No depositions have been taken, and expert discovery does not close until late 2026. A stay now would conserve substantial resources for both the Court and the parties.

Second, a stay will simplify the disputed issues in this case. Courts in this District, including this Court, have stayed cases even before IPRs have been instituted because of their potential to streamline litigation, and the short time period of six months between filing an IPR and the institution decision. Here, Beatbot has challenged all asserted claims of the '207, '766, and '191 Patents. If Beatbot's petitions are successful, those claims will be invalidated, and Zodiac's infringement counterclaims will be mooted entirely. Moreover, the asserted patents are also subject to concurrent IPR challenges by a third party (Wybotics) in separate

litigation, further increasing the likelihood that the Patent Office will invalidate or modify the claims. In contrast, without a stay, the Court and the parties risk expending significant resources litigating claims that may be cancelled or amended.

Third, a stay will not unduly prejudice or cause any tactical disadvantage to Zodiac. Beatbot acted with exceptional diligence, filing its IPR petitions within seven weeks of receiving Zodiac's infringement contentions and well within the one-year statutory deadline. Furthermore, although the parties are competitors, Zodiac has not moved for a preliminary injunction in this case or in the parallel Wybotics litigation, confirming that monetary damages provide adequate redress for any alleged infringement. The requested stay will be relatively short because the Patent Trial and Appeal Board ("PTAB") must decide whether to institute the IPRs by approximately July 2026.

Because all factors favor a stay, Beatbot respectfully requests the Court grant this motion to stay the instant case pending resolution of all Patent Office proceedings related to the asserted patents.

II. BACKGROUND

A. The Nature of the Dispute

On July 17, 2025, Zodiac sent a letter to Beatbot accusing Beatbot's products, including the Beatbot AquaSense 2 Ultra Robotic Pool Cleaner, of infringing U.S. Patent Nos. 11,880,207 ("the '207 Patent"), 11,262,766 ("the '766 Patent"), and 11,003,191 ("the '191 Patent"). (Declaration of Kyle R. Canavera in Support of Motion to Stay ("Canavera Decl.") ¶ 2.) The letter demanded that Beatbot cease all alleged infringing conduct. (*Id.*)

On July 31, 2025, Beatbot filed this lawsuit under the Declaratory Judgment Act, 28 U.S.C. §§ 2201–2202, seeking a declaration that its products do not infringe any claim of the '207, '766, or '191 Patents, either literally or under the doctrine of equivalents. (Dkt. No. 1.)

B. Procedural History

Zodiac filed an Answer and Counterclaims on September 22, 2025, alleging that Beatbot directly infringes, induces infringement of, and contributes to infringement of the asserted patents. (Dkt. No. 10.) Beatbot answered the counterclaims on October 14, 2025, denying all allegations of infringement and asserting affirmative defenses and counterclaims of invalidity for all three patents. (Dkt. No. 15.)

The Court issued a Case Management Order on November 19, 2025 (Dkt. No. 18.) Pursuant to that order, Zodiac served its Disclosure of Asserted Claims and Preliminary Infringement Contentions on December 9, 2025. (Canavera Decl. ¶ 3.) Zodiac asserts the following claims:

- The ’207 Patent: Claims 1–3, 5–8, 12–14, and 19;
- The ’766 Patent: Claims 1–5; and
- The ’191 Patent: Claims 1–3.

Beatbot’s Invalidity Contentions are due on February 9, 2026. (Dkt. No. 18 ¶ 5.) The parties have not yet exchanged claim construction terms, and the Claim Construction Hearing is scheduled for June 5, 2026. (*Id.* ¶ 14.)

No depositions have been taken. Fact discovery is not scheduled to close until October 5, 2026. (Dkt. No. 18 ¶ 19.) Expert discovery remains open until December 28, 2026. (*Id.* ¶ 21.)

Zodiac has not moved for a preliminary injunction at any point since sending its demand letter in July 2025. (Canavera Decl. ¶ 4.)

C. Beatbot’s Petitions for *Inter Partes* Review

On January 26, 2026, Beatbot filed three petitions for *inter partes* review (“IPR”) with the Patent Trial and Appeal Board (“PTAB”). (Canavera Decl. ¶¶ 5–7, Exs. 1–3.) Beatbot’s petitions challenge all asserted claims of the ’207, ’766, and ’191 Patents. (*Id.*)

Zodiac's optional preliminary responses to Beatbot's petitions will be due three months after the PTAB accords a filing date, which is expected to be in **April 2026**. *See* 37 C.F.R. § 42.107(b). The PTAB must decide whether to institute Beatbot's IPR petitions within three months of the preliminary response deadline, placing the expected institution decisions in **July 2026**. *See* 35 U.S.C. § 314(b). For any petitions that are instituted, the PTAB's Final Written Decisions will be due no later than one year after institution, which would be **July 2027**. *See* 35 U.S.C. § 316(a)(11).

The status of Beatbot's IPR petitions is summarized below:

Asserted Patent	**IPR No.**	**Challenged Claims**	**Est. Decision on Institution**
'207 Patent	IPR2026-00201	1–3, 5–8, 10, 12–13, 14–17, and 19	July 2026
'766 Patent	IPR2026-00200	Claims 1–5	July 2026
'191 Patent	IPR2026-00202	Claims 1–3	July 2026

D. Related Proceedings Involving the Asserted Patents

The asserted patents are also subject to other litigation and invalidity proceedings.

On September 22, 2025, Zodiac filed a First Amended Complaint against Wybotics, Co. Ltd. in the Eastern District of Texas, asserting infringement of the '207, '766, and '191 Patents. (*Zodiac Pool Sys. LLC v. Wybotics, Co. Ltd.*, Case No. 2:25-cv-00582; Canavera Decl. ¶ 8, Ex. 4.) Zodiac has not moved for a preliminary injunction in the *Wybotics* litigation. (Canavera Decl. ¶ 9.)

On November 25, 2025, Wybotics filed three IPR petitions with the PTAB challenging claims of the '207, '766, and '191 Patents. (Canavera Decl. ¶¶ 10–12, Exs. 5–7.) Zodiac's preliminary responses to the Wybotics petitions are due March

2, 2026. (Canavera Decl. ¶ 13.) Consequently, the PTAB is expected to decide whether to institute the Wybotics IPRs by early June 2026. *See* 35 U.S.C. § 314(b).

The status of the Wybotics petitions is summarized below:

Asserted Patent	IPR No.	Challenged Claims	Est. Decision on Institution
'207 Patent	IPR2026-00160	Claims 1–8, 11–14, 19	June 2026
'766 Patent	IPR2026-00159	Claims 1–5	June 2026
'191 Patent	IPR2026-00158	Claims 1–3	June 2026

III. LEGAL STANDARDS

"[D]istrict courts have broad discretion to manage their dockets, including the power to grant a stay of proceedings." *Murata Mach. USA v. Daifuku Co.*, 830 F.3d 1357, 1362 (Fed. Cir. 2016); *see also Taction Tech., Inc. v. Apple Inc.*, No. 21-CV-812, 2022 WL 228978, at *1 (S.D. Cal. Jan. 26, 2022). As this Court has held, "[c]ourts have inherent power to manage their dockets and stay proceedings, including the authority to order a stay pending conclusion of a PTO reexamination." *TAS Energy, Inc. v. San Diego Gas & Elec. Co.*, No. 12-cv-2777, 2014 WL 794215, at *3 (S.D. Cal. Feb. 26, 2014) (J. Curiel) (quoting *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1426–27 (Fed. Cir. 1988)).

Congress established the IPR procedure as an "effective and efficient alternative to often costly and protracted district court litigation." *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1291–92 (Fed. Cir. 2015). Accordingly, courts in the Southern District of California—and this Court specifically—recognize that "[t]here is a 'liberal policy in favor of granting motions to stay proceedings pending the outcome of USPTO reexamination or reissuance proceedings.'" *TAS Energy*, 2014 WL 794215, at *3 (quoting *ASCII Corp. v. STD Ent. USA, Inc.*, 844 F. Supp. 1378, 1381 (N.D. Cal. 1994)); *see also Masimo Corp. v. Wireless*, No. 19-cv-01100, 2021 WL 321481, at *2 (S.D. Cal. Feb. 1, 2021).

In exercising this discretion, courts consider three factors: "(1) whether discovery is complete and whether a trial date has been set; (2) whether a stay will simplify the issues in question and trial of the case; and (3) whether a stay would unduly prejudice or present a clear tactical disadvantage to the nonmoving party." *TAS Energy*, 2014 WL 794215, at *3 (citation omitted); *Clinicomp Int'l, Inc. v. Cerner Corp.*, No. 17-cv-2479, 2018 WL 5617694, at *2 (S.D Cal. Oct. 30, 2018) (J. Curiel) (same).

Importantly, because the PTAB must decide whether to institute an IPR within approximately six months of filing, courts in this District recognize that the relatively short turnaround supports granting stays pending institution. *See, e.g.*, *Taction Tech.*, 2022 WL 228978, at *2–3 ("Given that the PTAB will decide whether to institute the IPR within three months, the potential to save the parties and the Court from expending resources during the waiting period weighs in favor of a temporary stay."). As this Court has held, "a short stay is appropriate until the PTAB makes [the institution] decision." *Clinicomp*, 2018 WL 5617694, at *7; *see also TAS Energy*, 2014 WL 794215, at *4 (granting pre-institution stay where denial would result in a "short" stay of only four months).

IV. ARGUMENT

A. Factor No. 1: Discovery is in Its Early Stages and the Most Burdensome Phases of Litigation Have Not Begun.

"The first factor, stage of litigation, considers 'whether discovery is complete and whether a trial date has been set.'" *Clinicomp*, 2018 WL 5617694, at *2 (citing *Universal Elecs., Inc. v. Universal Remote Control, Inc.*, 943 F. Supp. 2d 1028, 1030–31 (C.D. Cal. 2013)). When, as here, "there has been no material progress in the litigation, courts in this district strongly favor granting stays pending inter partes [review]." *Id.* (citation omitted).

This case is in the preliminary stages of litigation. Zodiac served its Preliminary Infringement Contentions only about six weeks ago, on December 9,

2025. (Canavera Decl. ¶ 3.) Beatbot's Invalidity Contentions are not due until February 9, 2026. (Dkt. No. 18 ¶ 5.) No depositions have been noticed or taken, and the parties have not yet exchanged claim construction terms. Because significant milestones for the Court and parties are months away, the majority of the work in this case remains. *See Blast Motion, Inc. v. Zepp Labs, Inc.*, No. 15-CV-700, 2016 WL 5107678, at *2 (S.D. Cal. Mar. 29, 2016) ("[I]f a significant amount of discovery remains, a stay is more appropriate.").

A stay at this juncture would avoid the expenditure of resources associated with the preparation and service of Invalidity Contentions in February 2026, as well as the exchange of claim construction terms and the filing of Joint Claim Construction Charts in March 2026. Furthermore, a stay would prevent the parties from incurring the costs of Claim Construction briefing and the *Markman* hearing currently set for June 5, 2026 (Dkt. No. 18 ¶ 14), as well as fact discovery, which is not scheduled to close until October 5, 2026 (*Id.* ¶ 19). Expert discovery remains open until December 28, 2026. (*Id.* ¶ 21.)

Courts in this District grant stays where cases have progressed much further than this case. For example, in *Qualcomm Inc. v. Apple Inc.*, the court granted a pre-institution stay where contentions and discovery responses had already been served and claim construction had been briefed, noting that "significant fact and expert discovery and dispositive motion practice are still ahead." No. 17-cv-2403, 2018 WL 4104966, at *2–3 (S.D. Cal. Aug. 29, 2018). Similarly, in *TAS Energy*, this Court granted a stay even though "[o]pening claim construction briefs were filed" and the parties had exchanged contentions. 2014 WL 794215, at *3. The Court reasoned that although the case was "not in its early stages," a stay was appropriate because a "significant amount of work still remains." *Id.* Likewise, in *Tierravision, Inc. v. Google, Inc.*, the court found the stage of litigation favored a stay even though the parties had exchanged contentions and prepared claim construction briefing, since

"there [was] more work ahead of the parties and the Court than behind the parties." No. 11cv2170, 2012 WL 559993, at *1–3 (S.D. Cal. Feb. 21, 2012).

Here, Beatbot has moved for a stay prior to the invalidity contentions deadline and the commencement of the claim construction process. Because a stay was appropriate in cases like *TAS Energy* and *Qualcomm* where parties had already expended resources on contentions and briefing, a stay is warranted here where those resources have yet to be expended. *See TAS Energy*, 2014 WL 794215, at *4; *Qualcomm*, 2018 WL 4104966, at *2–3.

B. Factor No. 2: The Patent Office Proceedings Will Simplify the Issues and Reduce the Burden on the Court.

The second factor considers whether a stay will simplify the issues in question and streamline the trial. *TAS Energy*, 2014 WL 794215, at *4. This factor weighs heavily in favor of a stay when the IPR petitions cover all asserted claims. *See id.*

Here, Beatbot has filed IPR petitions challenging *all asserted claims* of the '207, '766, and '191 Patents. (Canavera Decl. ¶¶ 5–7.) Because every single claim at issue in this litigation is subject to a pending validity challenge before the PTAB, the potential for simplification is maximized.

A stay pending the outcome of these IPRs will simplify this case in one of two ways. First, if the PTAB cancels the asserted claims, the need for a trial will be eliminated entirely. *TAS Energy*, 2014 WL 794215, at *4 ("[W]aiting for the outcome of the reexamination could eliminate the need for trial if the claims are cancelled.") (citation omitted). As this Court has recognized, "[i]f the PTO grants the petitions and ultimately cancels all asserted claims, the case would be over." *Id.*

Second, even if the PTAB confirms some or all of the claims, the proceedings will still streamline the litigation. *Id.* ("[I]f the claims survive, [it would] facilitate trial by providing the court with expert opinion of the [US] PTO and clarifying the scope of the claims.") (citation omitted). The fact that the IPR proceedings have not yet been instituted does not weigh against a stay here, given the relatively short time

between filing and the PTAB's institution decision (approximately six months). As this Court has previously held, "a short stay is appropriate until the PTAB makes [the institution] decision." *Clinicomp*, 2018 WL 5617694, at *7.

The likelihood of simplification is further bolstered by the parallel proceedings involving Wybotics. As noted above, Wybotics has also filed IPR petitions challenging claims across all three asserted patents. (Canavera Decl. ¶¶ 10–12.) The fact that multiple parties are independently challenging the validity of these patents increases the probability that the PTAB will institute review on at least one petition. *See* Order Vacating Hearing and Granting Motion to Stay at 2, *Koss Corp. v. PEAG, LLC*, No. 3:21-cv-01177-CAB-JLB (S.D. Cal. Oct. 5, 2021), ECF No. 40 (finding that concurrent IPRs filed by other defendants would "potentially result in the simplification of the issues.").

Accordingly, regardless of the specific outcome at the PTAB, the issues in this litigation will be simplified. A stay avoids the risk of this Court and the parties expending resources litigating validity issues that the PTAB may simultaneously modify or eliminate. *See Clinicomp*, 2018 WL 5617694, at *4 ("A stay may also be granted in order to avoid inconsistent results, obtain guidance from the PTAB, or avoid needless waste of judicial resources.") (citation omitted).

C. Factor No. 3: A Stay Will Not Unduly Prejudice Zodiac.

The third factor considers whether a stay would unduly prejudice the nonmoving party. Courts in this District analyze the totality of the circumstances, including the timing of the IPR petitions; the timing of the request for stay; the status of the IPR proceedings; and the relationship between the parties. *Omnitracs, LLC v. Platform Sci., Inc.*, No. 20-cv-0958, 2021 WL 857005, at *4 (S.D. Cal. Mar. 8, 2021). Here, the collective weight of these issues supports staying the case.

First, the timing of the IPR petitions demonstrates that a stay will not unduly prejudice Zodiac. Beatbot filed its petitions well within the one-year statutory time limit set by 35 U.S.C. § 315(b). As courts in this District have held, "[b]ecause [the

petitioner] was statutorily entitled to file its IPR petitions at any point within the one-year limitations period, the Court does not find that its decision to do so . . . demonstrates undue delay." *Masimo Corp.*, 2021 WL 321481, at *4.

Moreover, Zodiac cannot credibly argue that Beatbot should have filed its petitions sooner because Zodiac only identified the specific asserted claims on December 9, 2025—just six weeks ago. Beatbot worked diligently to prepare its petitions following those disclosures, getting to filing within a short six weeks of receiving those contentions. Courts have found significantly longer timeframes reasonable and not prejudicial. *See Evolutionary Intel. LLC v. Yelp Inc.*, No. C-13-03587, 2013 WL 6672451, at *9 (N.D. Cal. Dec. 18, 2013) (finding IPR petitions filed five months after infringement contentions reasonable); *SAGE Electrochromics, Inc. v. View, Inc.*, No. 12-cv-06441, 2015 WL 66415, at *3-4 (N.D. Cal. Jan. 5, 2015) (finding defendant acted with "reasonable diligence" in filing petitions within six months of contentions). By filing in six weeks rather than six months, Beatbot has acted with diligence.

Second, the timing of the request for a stay is not prejudicial. Beatbot filed this motion immediately after filing its IPR petitions, ensuring that the Court and Zodiac were notified of the request at the earliest possible opportunity.

Third, the status of the IPR proceedings favors a stay. Beatbot's petitions cover *all asserted claims* of all three patents-in-suit. Given the relatively short amount of time until the PTAB decides whether to institute review (approximately July 2026), courts in this District often grant pre-institution stays. *See, e.g.*, *Taction Tech.*, 2022 WL 228978, at *2–3 (granting pre-institution stay to save resources during the waiting period); *Clinicomp*, 2018 WL 5617694, at *7 (noting "a short stay is appropriate until the PTAB makes [the institution] decision"); *TAS Energy*, 2014 WL 794215, at *4; *Qualcomm*, 2018 WL 4104966, at *2–3.

Fourth, regarding the relationship between the parties, Zodiac has failed to demonstrate the type of prejudice that would outweigh a stay. Although the parties

are competitors, Zodiac has **not** moved for a preliminary injunction in this case, nor has it done so in the parallel *Wybotics* litigation. (Canavera Decl. ¶¶ 4, 9.) Zodiac's failure to seek injunctive relief confirms that monetary damages provide adequate redress for any alleged infringement. *See Contour IP Holding, LLC v. GoPro, Inc.*, No. 17-cv-04738, 2018 WL 6574188, at *6 (N.D. Cal. Dec. 12, 2018) (noting that where monetary damages provide adequate redress, a plaintiff cannot be prejudiced by a stay). Because any harm to Zodiac is purely monetary and compensable, a stay will not result in undue prejudice.

Therefore, just like the other two, this third factor favors a stay.

V. CONCLUSION

For the foregoing reasons, Beatbot respectfully requests the Court grant its motion to stay the instant case pending resolution of all Patent Office proceedings related to the asserted patents.

Dated: January 28, 2026

PERKINS COIE LLP

By: */s/ Kyle R. Canavera*

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UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

BEATBOT TECHNOLOGY (USA) CO. LTD., DEEPWATER INNOVATION TECHNOLOGY (HONG KONG) LIMITED, and XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.,

Plaintiffs,

v.

ZODIAC POOL SYSTEMS LLC,

Defendant.

Case No. 3:25-cv-01946-GPC-JLB

DECLARATION OF KYLE R. CANAVERA IN SUPPORT OF PLAINTIFFS' MOTION TO STAY

Date: April 3, 2026
Time: 1:30 PM
Courtroom: 12A, 12th Floor
Judge: Hon. Gonzalo P. Curiel
Mag Judge: Hon. Jill L. Burkhardt

I, Kyle R. Canavera, declare:

1. I am a member of the Bar of the State of California and an attorney at the law firm of Perkins Coie LLP, counsel of record for Plaintiffs Beatbot Technology (USA) Co. Ltd., Deepwater Innovation Technology (Hong Kong) Limited, and Xingmai Innovation Technology (Suzhou) Co., Ltd. (collectively, "Beatbot"). I have personal knowledge of the facts stated in this declaration and, if called as a witness, could and would testify competently to those facts.

2. On July 17, 2025, Zodiac Pool Systems LLC ("Zodiac") sent a cease-and-desist letter to Beatbot accusing Beatbot's products, including the Beatbot AquaSense 2 Ultra Robotic Pool Cleaner, of infringing U.S. Patent Nos. 11,880,207 ("the '207 Patent"), 11,262,766 ("the '766 Patent"), and 11,003,191 ("the '191 Patent"). A true and correct copy of this letter is available at Dkt. 10-4.

3. On December 9, 2025, Zodiac served its Disclosure of Asserted Claims and Preliminary Infringement Contentions in this matter.

4. As of the date of this declaration, Zodiac has not filed a motion for preliminary injunction in this matter.

5. On January 26, 2026, Beatbot filed a petition for *inter partes* review ("IPR") with the Patent Trial and Appeal Board ("PTAB") challenging all asserted claims (claims 1–3, 5–8, 10, 12–14, 17, and 19) of the '207 Patent. A true and correct copy of the petition is attached hereto as Exhibit 1.

6. On January 26, 2026, Beatbot filed a petition for IPR with the PTAB challenging all asserted claims (claims 1–5) of the '766 Patent. A true and correct copy of the petition is attached hereto as Exhibit 2.

7. On January 26, 2026, Beatbot filed a petition for IPR with the PTAB challenging all asserted claims (claims 1–3) of the '191 Patent. A true and correct copy of the petition is attached hereto as Exhibit 3.

8. I have reviewed the docket for the United States District Court for the Eastern District of Texas. On September 22, 2025, Zodiac filed a First Amended

Complaint against Wybotics, Co. Ltd. in the case *Zodiac Pool Systems LLC v. Wybotics, Co. Ltd.*, Case No. 2:25-cv-00582, asserting infringement of the '207, '766, and '191 Patents. A true and correct copy of the relevant complaint is attached hereto as Exhibit 4.

9. I have reviewed the docket in the above-mentioned *Wybotics* matter. As of today, January 28, 2026, Zodiac has not filed a motion for preliminary injunction in that case.

10. On November 25, 2025, Wybotics, Co. Ltd. filed a petition for IPR challenging claims 1–5 of the '766 Patent, assigned IPR No. IPR2026-00159. I obtained a copy of this petition from the PTAB website. A true and correct copy of this petition is attached hereto as Exhibit 5.

11. On November 25, 2025, Wybotics, Co. Ltd. filed a petition for IPR challenging claims 1–3 of the '191 Patent, assigned IPR No. IPR2026-00158. I obtained a copy of this petition from the PTAB website. A true and correct copy of this petition is attached hereto as Exhibit 6.

12. On November 25, 2025, Wybotics, Co. Ltd. filed a petition for IPR challenging claims 1–8, 11–14, and 19 of the '207 Patent, assigned IPR No. IPR2026-00160. I obtained a copy of this petition from the PTAB website. A true and correct copy of this petition is attached hereto as Exhibit 7.

13. I have reviewed the scheduling for the above-mentioned three Wybotics IPRs. Zodiac's preliminary responses to the Wybotics petitions are due March 2, 2026.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. This declaration is executed on January 28, 2026, at Bogotá, Colombia.

/s/ Kyle R. Canavera
Kyle R. Canavera

EXHIBIT 1

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

BEATBOT TECHNOLOGY (USA) CO. LTD.,

Petitioner,

v.

ZODIAC POOL SYSTEMS LLC,

Patent Owner.

_____

PTAB Case No. IPR2026-00201

U.S. Patent No. 11,880,207 B2

_____

PETITION FOR *INTER PARTES* REVIEW
OF U.S. Patent No. 11,880,207 B2

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Exhibit List

No.	Exhibit
1001	U.S. Patent No. 11,880,207 ("'207 Patent")
1002	File History of the '207 patent ("'207FH")
1003	Declaration of Jason Janét, Ph.D. ("Janét")
1004	Curriculum Vitae of Jason Janét, Ph.D.
1005	Chinese Patent Application Publication No. CN1540119A ("Cui")
1006	German Patent Application Publication No. DE102007053310A1 ("Knoll")
1007	Chinese Patent Application Publication No. CN101139007A ("Fu-007")
1008	U.S. Patent No. 3,321,787 ("Myers")
1009	U.S. Patent No. 4,168,557 ("Rasch")
1010	Jonathan Horgan & Daniel Toal, Review of Machine Vision Applications in Unmanned Underwater Vehicles, Proc. 9th Int'l Conf. on Control, Automation, Robotics and Vision 1 (2006)
1011	U.S. Patent Application Publication No. 2013/0024025 A1 ("Hsu")
1012	U.S. Patent Application Publication No. 2008/0048870 A1 ("Laitta")

LISTING OF CHALLENGED CLAIMS

11,880,207 B2
Claim 1
1[pre] A self-propelled pool cleaning system for cleaning debris from a submerged surface of a swimming pool, comprising:
1[a] a. a vehicle body;
1[b] b. means for moving the vehicle body within the swimming pool;
1[c] c. a filter configured to retain debris collected from the submerged surface;
1[d] d. at least one camera for capturing an image of at least a first object within the swimming pool; and
1[e][i] e. a controller (i) in electronic communication with the at least one camera and
1[e][ii] (ii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first object.
Claim 2
2[pre] A pool system comprising:
2[a] at least one piece of equipment for a swimming pool or spa;
2[b] one or more cameras configured to capture video or images of at least a portion of a location including the swimming pool or spa; and
2[c][i] a controller in communication with the at least one piece of equipment and the one or more cameras,

2[c][ii] the controller configured to receive visual data from the one or more cameras and determine a control action for the at least one piece of equipment based on the received visual data.
Claim 3
3. The pool system of claim 2, wherein the at least one piece of equipment comprises a cleaning device with one or more propulsion mechanisms, the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation.
Claim 5
5. The pool system of claim 2, wherein the one or more cameras are mounted on the at least one piece of equipment.
Claim 6
6. The pool system of claim 2, wherein the one or more cameras are submergible or submerged within the swimming pool or spa.
Claim 7
7. The pool system of claim 2, wherein the controller is configured to detect a characteristic of the location based on the visual data and control the piece of equipment based on the detected characteristic.
Claim 8
8. The pool system of claim 7, wherein the characteristic comprises a cleanliness of a surface of the swimming pool, and wherein the controller is configured to control the piece of equipment based on the detected cleanliness being outside of a threshold.
Claim 10
10. The pool system of claim 2, wherein the controller is further configured to present a graphical depiction on a remote device based on the received visual data as the control action.

Claim 12
12[pre] A method for monitoring a pool system, the method comprising
12[a] receiving images of at least a portion of a location including a swimming pool or spa from one or more cameras;
12[b] determining a target area and detecting a characteristic of the target area based on the images; and
12[c] generating a control response based on the detected characteristic of the target area.
Claim 13
13[a] The method of claim 12, wherein the target area comprises a portion of a surface of the swimming pool or spa, and
13[b] wherein the characteristic comprises a cleanliness characteristic of the portion of the surface of the swimming pool or spa.
Claim 14
14. The method of claim 12, wherein generating the control response comprises controlling an operation of a piece of equipment of the swimming pool or spa.
Claim 15
15. The method of claim 12, wherein generating the control response comprises generating an alert on a remote device.
Claim 16
16. The method of claim 12, wherein generating the control response comprises wirelessly communicating with a piece of equipment for the swimming pool or spa or a remote device.
Claim 17

17[a]. The method of claim 12, wherein generating the control response comprises prompting a user on a remote device, and
17[b] wherein the method further comprises receiving a control input from the user on the remote device for controlling a piece of equipment of the swimming pool or spa.
Claim 19
19[a] The method of claim 12, wherein generating the control response comprises controlling operation of a cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation,
19[b] wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device, an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning, or a speed of the cleaning device.

I. INTRODUCTION

Petitioner requests *inter partes* review ("IPR") of claims 1-3, 5-8, 10, 12-17, and 19 ("Challenged Claims") of U.S. Patent No. 11,880,207B2 ("'207 Patent," EX1001).

II. IPR REQUIREMENTS

A. Standing

The '207 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

B. Challenged claims and relief requested

Petitioner respectfully requests cancellation of the challenged claims under 35 U.S.C.§103.

1. Prior art

Petitioner relies on Exhibits listed in the Exhibit Table and Dr. Jason A. Janét's declaration (EX1003, "Janét"). Specific invalidity grounds are listed in the table below, where all the references are prior art under AIA 35 U.S.C. §102(a)(1)-(2) or pre-AIA 35 U.S.C. §102(b).

§103	Claims	Reference(s)
1A	**1**, **2**, 3, 5-8, **12**, 13-14, 19	Cui
1B	8, 16	Cui, Fu-007
1C	10, 17	Cui, Hsu
2A	**1**, **2**, 3, 5-7, **12**, 14, 19	Knoll

§103	Claims	Reference(s)
2B	7-8, **12**, 13-14, 19	Knoll, Fu-007
2C	10, 17	Knoll, Hsu
3	**2**, 4, 7, 10, **12**, 14-16	Laitta

III. THE '207 PATENT

A. Overview

The '207 Patent describes a pool system that uses camera-based image analysis to detect pool conditions and generate control responses. EX1001, Abstract. The system includes at least a "**camera 32**"[1] positioned to capture images of a swimming pool or spa, a "**controller 42**" that analyzes the images and generates control responses for pool equipment (e.g., **vehicle 30** for cleaning). *Id.*, 2:64-5:9; FIG. 1 (annotated below).

[1] All **bold**, *italic*, or colored emphases are added by Petitioner unless otherwise specified.

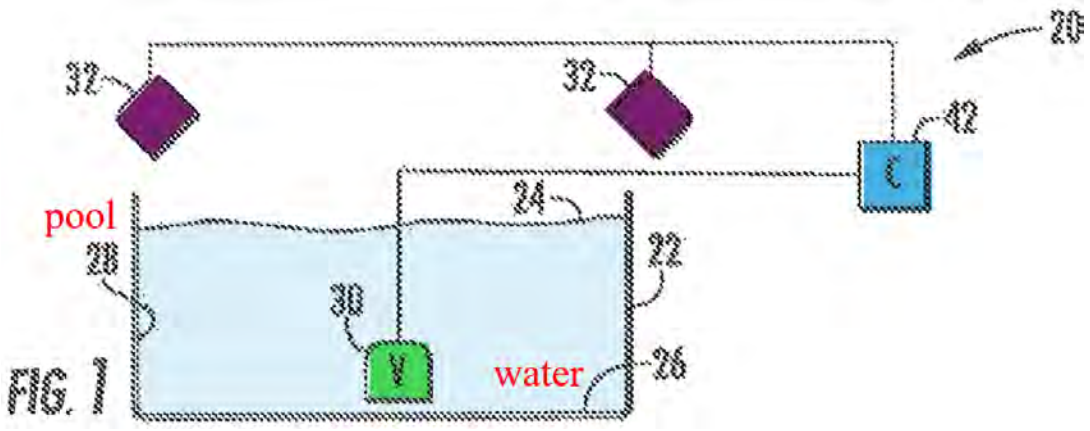


FIG. 1

The system includes a cleaning device—vehicle 30 —having a body, a **drive system**, and cleaning equipment (e.g., **brushes**). *Id.*, 10:11-30, FIG. 10 (annotated below).

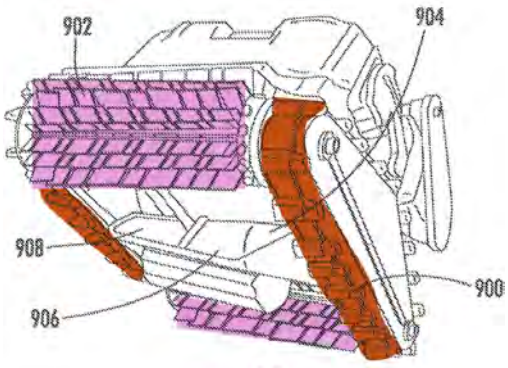


FIG. 10

The controller analyzes the images from the cameras, determines the cleanliness of submerged pool surfaces, and generates control signals to adjust the operation of the cleaning vehicle. *Id.*, 8:27-9:59.

B. Prosecution History

The '207 Patent claims priority to U.S. Patent Application No. 13/545,918 filed on July 10, 2012, which is assumed to be the priority date for all Challenged Claims for purposes of this Petition. EX1001, field (63).

The Examiner issued a Non-Final Office Action rejecting the sole pending Claim 20 for nonstatutory double patenting. EX1002, pp.82-90. Applicant filed a Terminal Disclaimer and added new Claims 21-39, which the Examiner then allowed. *Id.*, pp.92-105.

Fu-007, used in this petition, was cited in an Information Disclosure Statement (IDS) (EX1002, pp.55, 72) but was not used as a basis for claim rejections or otherwise discussed during the prosecution. Fu-007's use here is not cumulative, because Fu-007 is used here in combination with other references and the Examiner lacked expert testimony regarding the use of Fu-007 in combination with other references.

C. Level of Ordinary Skill

As of the '207 Patent's alleged priority date, a POSITA would have had a bachelor's degree in electrical engineering, mechanical engineering, physics, or computer engineering, with at least two years' experience in autonomous camera-based robotic cleaning systems. Janét, ¶30.

D. Claim Construction

For determining invalidity in this Petition, Petitioner believes no constructions are necessary except for the means-plus-function (MPF) limitation "means for moving the vehicle body" in Claim 1.

When a claim uses "means" or "module" and recites an associated function, it is presumably MPF. *See* pre-AIA 35 U.S.C. §112 ¶6 or AIA 35 U.S.C. §112(f); MPEP §2181; *TriMed, Inc. v. Stryker Corp.*, 514 F.3d 1256, 1259-60 (Fed. Cir. 2008).

Claim 1 recites a claim limitation in form of "*means for moving*…." and recites a claimed function of "moving the vehicle body within the swimming pool." EX1001, 10:50-64; Janét, ¶67. The corresponding structure described in the specification of the '207 Patent includes wheels, rollers, tracks, other surface contacting members powered by a motor, a vacuum, or a liquid jet. EX1001, 3:33-45, 10:15-17, FIGS. 9-10; Janét, ¶67.

The above described structures in the specification of the '207 Patent are the corresponding structures for the "means for moving…." Janét, ¶68.

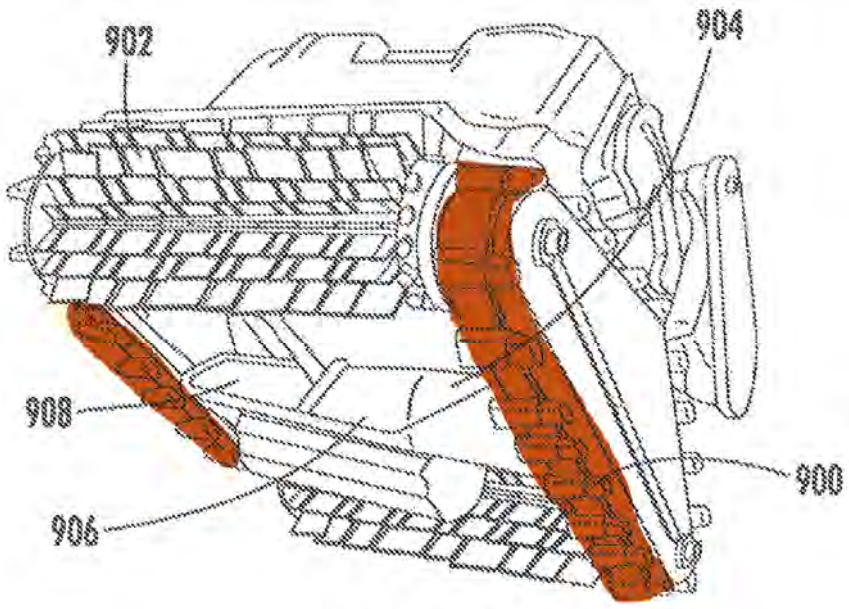


FIG. 10

IV. SPECIFIC GROUNDS

A. Ground 1A: Claims 1-3, 5-8, 12-14, and 19 are unpatentable over Cui

1. Cui

Cui (EX1005), which is analogous art, discloses a pool cleaner with debris detection capability. Cui, Title, Abstract. Cui's pool cleaner uses a camera to capture images of pool surfaces, compares them with pre-stored images of clean surfaces,

and controls the cleaner's operation based on detected debris levels/distributions. *Id.*, Abstract, pp.5-7[2].

Cui's pool cleaner comprises a housing 4 containing various components including a **water pump motor 2**, a **distance sensor 3**, a **camera 5**, a **filter bag 6**, a computer 7, sensors 8-9, a **track-type crawling mechanisms 10**, **brushes 11**, and **motors 15**. Cui, Claim 1, pp.4-5, FIGS. 1-2 (annotated below).

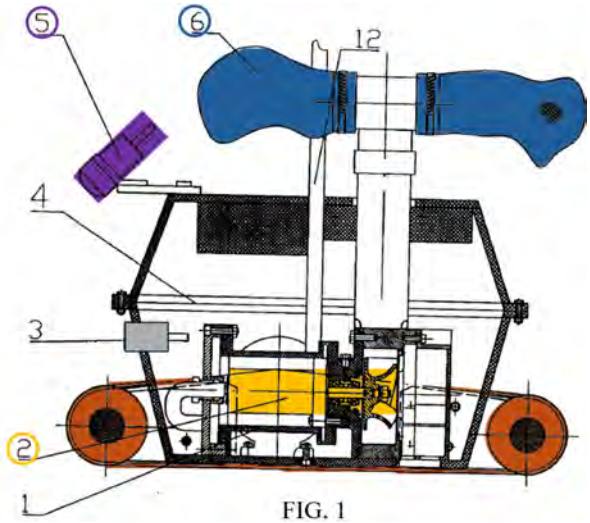


FIG. 1

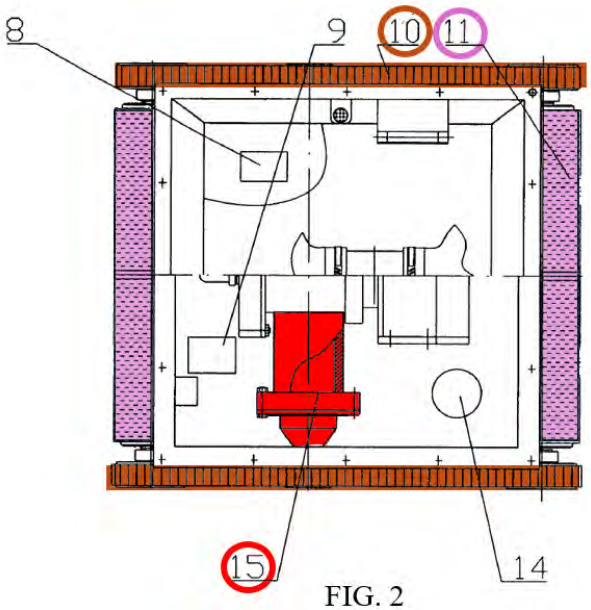


FIG. 2

Cui's computer 7 processes images and generates control signals that adjust the crawling speed based on detected debris levels/distributions. Cui, pp.4-7, FIGS.

[2] Page citations to Cui are to the original pagination in the bottom center of each page.

5-6 (below). Greater sediment/debris levels produce larger grayscale differences, causing computer 7 to adjust speed of motors 15 via relay board 20, controlling crawling speed and cleaning force. *Id.*

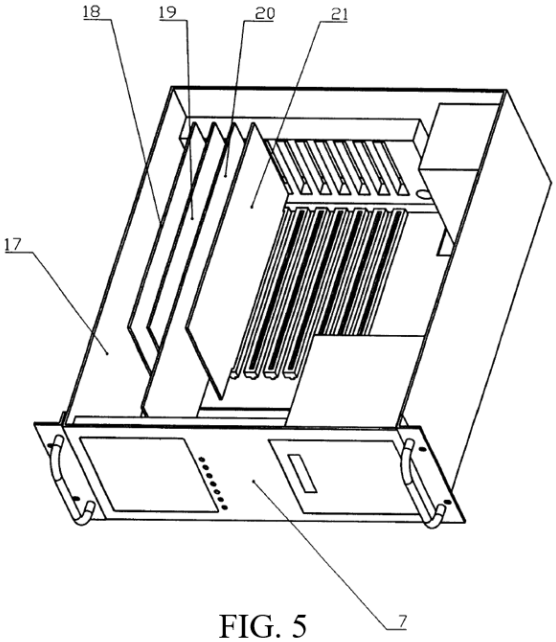


FIG. 5

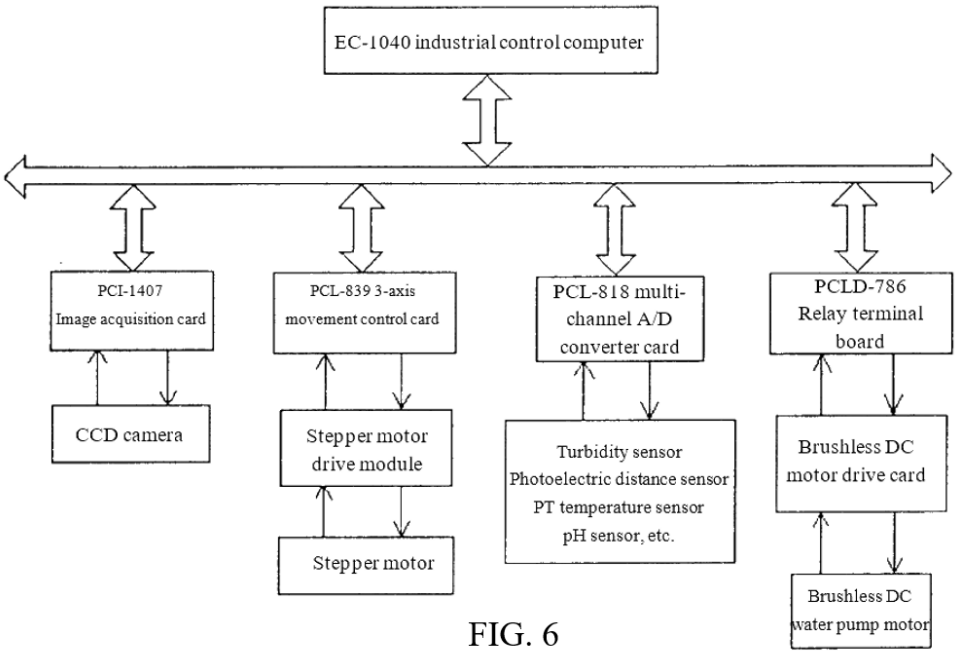


FIG. 6

2. Claim 1

Cui discloses or suggests Claim 1. Janét, ¶¶74-100.

a. 1[pre]

Cui discloses or suggests 1[pre]. Janét, ¶¶75-78.

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

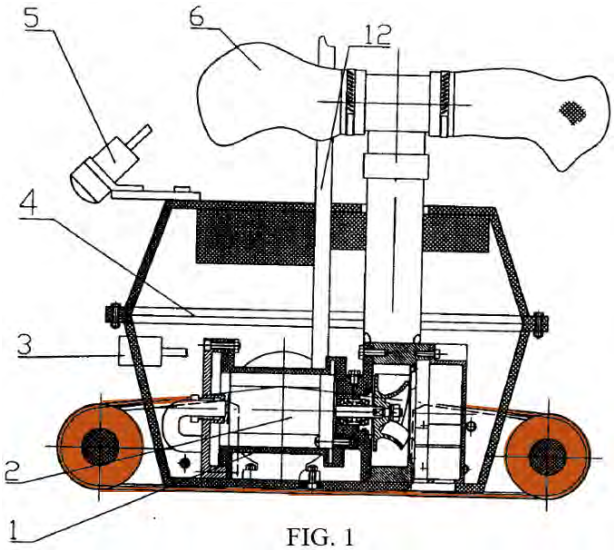


FIG. 1

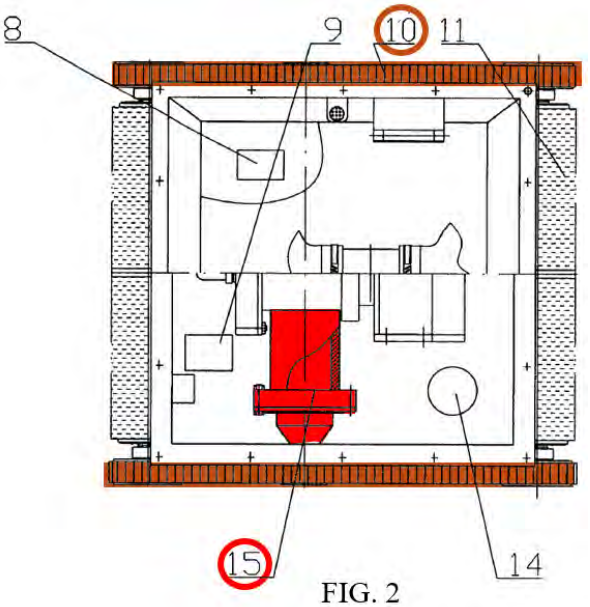


FIG. 2

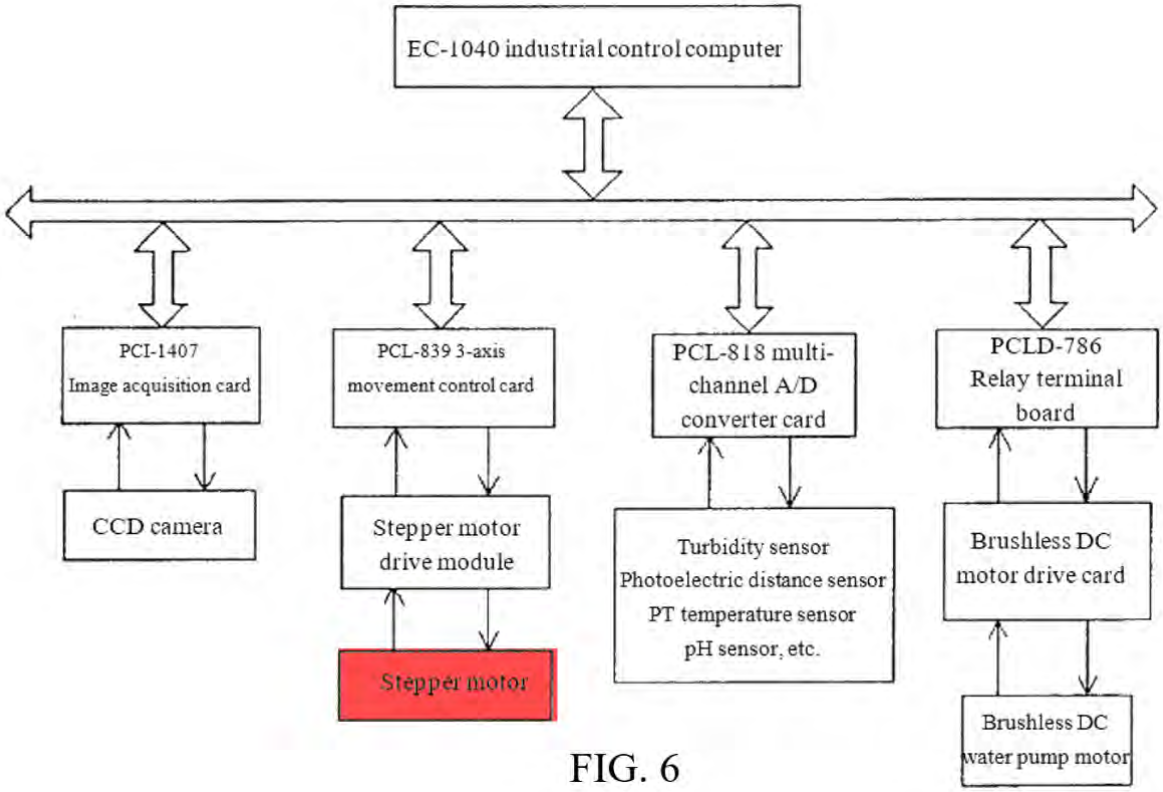


FIG. 6

Cui's cleaning vehicle is self-propelled, because under computer 7's control, motors 15 drive crawling mechanisms 10 to move it across pool surfaces. Cui, Claim 1, pp.5-6. Janét, ¶77.

Cui's system detects debris by capturing images with camera 5 and comparing them (via computer 7) with "pre-stored standard image information of a clean pool bottom"—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s)." Cui, Abstract, pp.4-7. Cui's system collects and cleans

debris using "roller brush (11)," "water pump motor (2)," and "filter bag (6)." Cui, Claim 1, pp.5-7; Janét, ¶78.

b. 1[a]

Cui discloses or suggests 1[a]. Janét, ¶¶79-80.

Cui's pool cleaner includes a vehicle body, including housing 4 with propulsion mechanisms (track-type crawling mechanisms 10, motors 15), cleaning components (motor 2, brushes 11, filter 6), and sensors (camera 5). Cui, Claim 1, pp.5-6, FIG.1 (annotated below); Janét, ¶¶80.

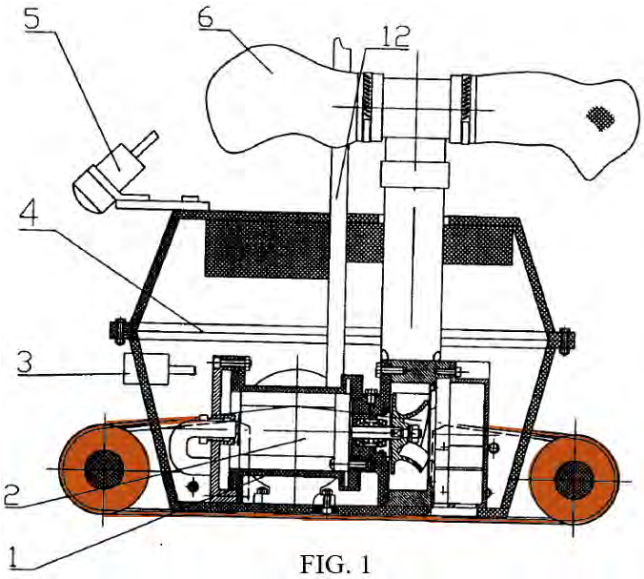


FIG. 1

c. 1[b]

Cui discloses or suggests 1[b]. Janét, ¶¶81-84.

Limitation 1[b] invokes §112(f)/¶6. As explained in §III.D, the recited function is "moving the vehicle body within the swimming pool," and the

corresponding structures include "wheels, rollers, tracks, other surface contacting members powered by a motor." EX1001, 3:33-45, 10:15-17, FIGS.9-10; Janét, ¶82.

Cui discloses **track-type crawling mechanisms 10** powered by **motors 15**. Cui, Claim 1, pp.5-6, FIGS. 1-2 (annotated below). Motors 15 are mounted on both sides of sealed motor cover 1, and track-type crawling mechanisms 10 are mounted at front and rear ends of housing 4. *Id.*; Janét, ¶83.

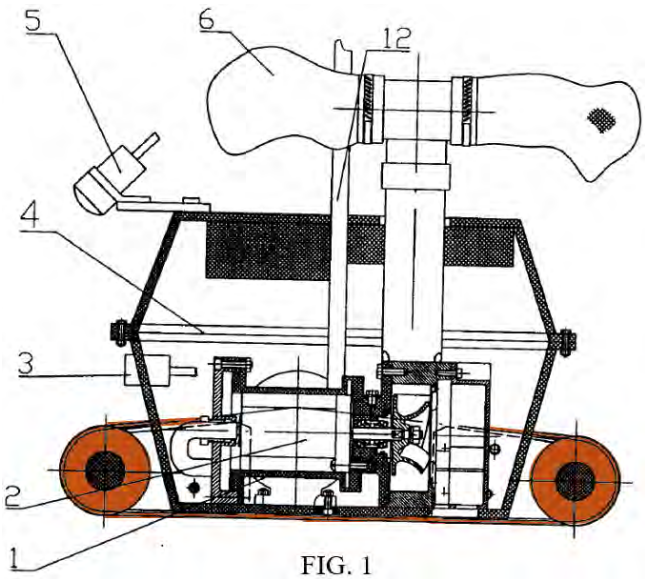


FIG. 1

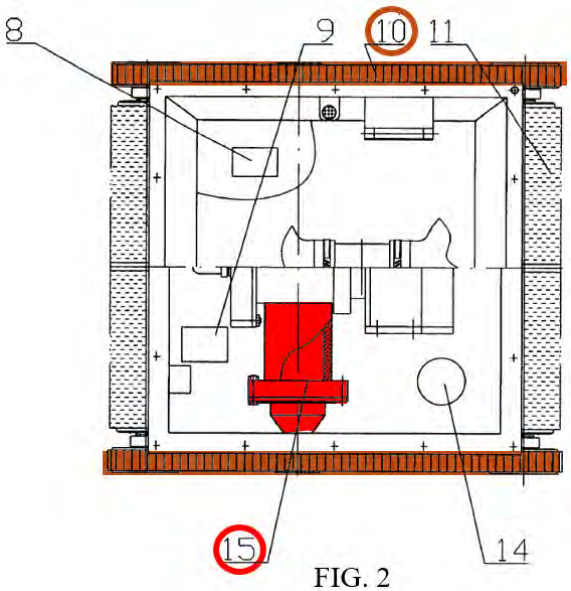


FIG. 2

A POSITA would have understood that Cui's ***track***-type crawling mechanisms 10 powered by motors 15 are substantially the same as the '207 Patent's disclosed "***tracks***...powered by a motor." Janét, ¶84. Cui's structure performs the claimed function, because motors 15 drive track-type crawling mechanisms 10, which propel the vehicle body within the pool. Cui, pp.5-7, FIGS. 1-3; EX1001, 3:33-45; Janét, ¶84.

d. 1[c]

Cui discloses or suggests 1[c]. Janét, ¶¶85-86.

Cui's system includes **filter bag 6** and **water pump motor 2**. Cui, Claim 1, p.6, FIG.1 (annotated below). A POSITA would have understood that Cui's pump motor 2 draws water containing debris from pool surfaces by suction and filter bag 6 retains this collected debris, while allowing clean water to pass through. Janét, ¶86. Thus, Cui's filter bag 6 is a filter that retains debris collected from the submerged surface. *Id.*

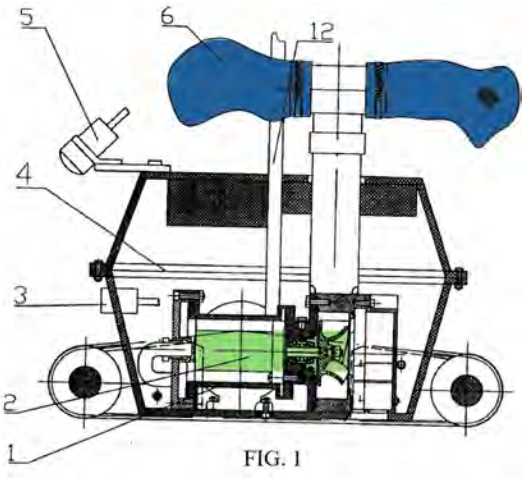


FIG. 1

e. 1[d]

Cui discloses or suggests 1[d]. Janét, ¶¶87-90.

Cui's pool cleaner includes **camera 5** positioned at the upper front end of housing 4 to observe pool surfaces ahead of the cleaner. Cui, Claim 2, FIG.1 (annotated below), pp.5-6; Janét, ¶88.

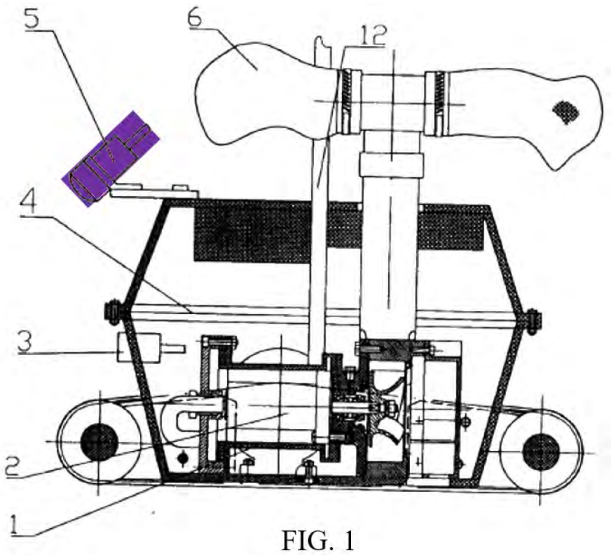


FIG. 1

Cui's camera "continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner," including images showing "sediment **at the pool bottom**." Cui, pp.6-7; Janét, ¶89.

A POSITA would have understood that Cui's camera captures images of "at least a first object within the swimming pool" because the camera observes the pool bottom surface and debris/sediment on that surface (both are physical objects within the pool), and these surfaces and debris are within the swimming pool as the cleaner operates while submerged. Janét, ¶90.

f. 1[e][i]

Cui discloses or suggests 1[e][i]. Janét, ¶¶91-94.

Cui's FIGS. 5-6 (annotated below) shows computer 7 (controller) connected to **camera 5** through **image acquisition card 21**. Cui, p.6, FIGS. 5-6.

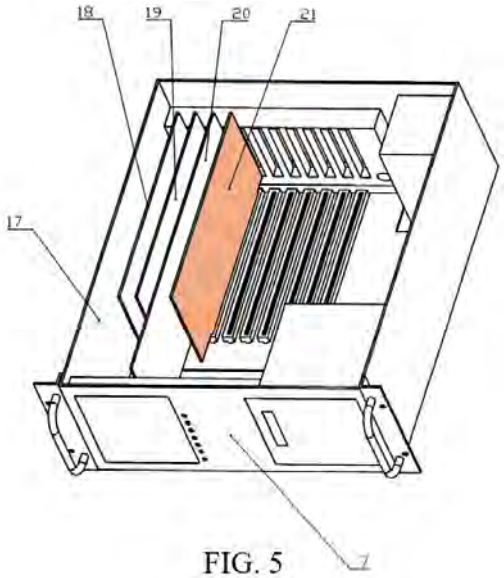


FIG. 5

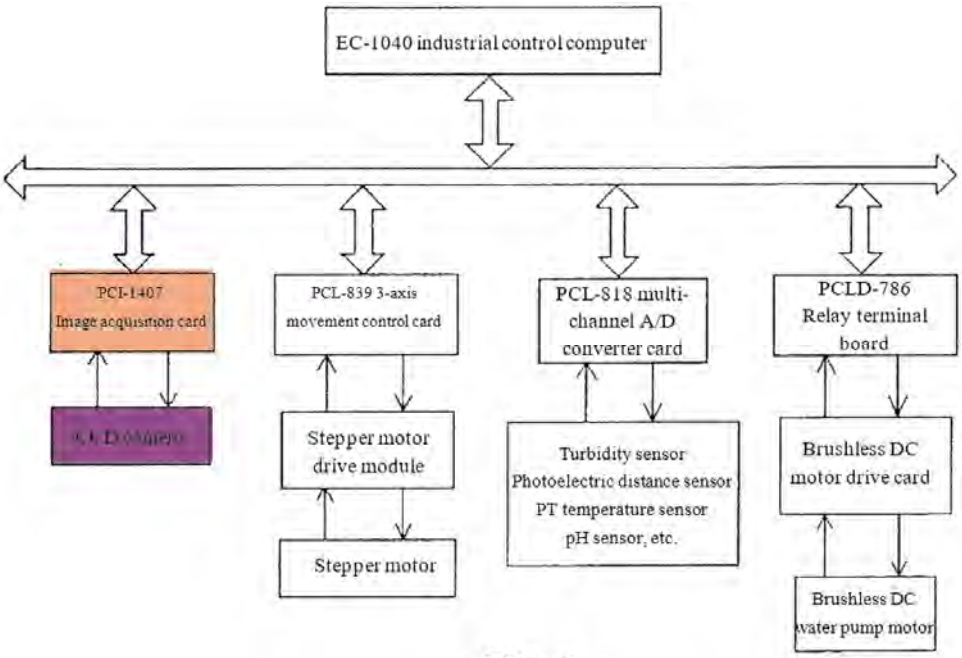


FIG. 6

Cui's camera 5 captures images of pool surfaces and debris. Cui, pp.6-7; Janét, ¶93. Cui's computer 7 processes these captured images. *Id.* Specifically, Cui describes that during operation, "the video signal undergoes A/D conversion through the high-speed image acquisition card 21 and...is compared with the original

standard image(s) of the pool bottom stored in the industrial control computer 7." Cui, pp.6-7; Janét, ¶93. Computer 7 processes the camera images to determine debris levels and generates control signals for the vehicle's motors. ***Id.*** A POSITA would have understood that Cui's computer 7 is "in electronic communication with" camera 5, because it receives camera images (via image acquisition card 21) to process them and determine debris levels. ***Id.***

g. 1[e][ii]

Cui discloses or suggests 1[e][ii]. Janét, ¶¶95-99.

As explained in §IV.A.2.f (1[e][i]), Cui's computer 7 (controller) processes images from camera 5 and generates control signals in response to the images. Specifically, Cui describes that computer 7 compares captured images with stored standard images to identify sediment/debris—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s), resulting in a high comparison output voltage." Cui, pp.6-7; Janét, ¶96. Based on this image-derived voltage signal corresponding to debris levels, "[a] pulse signal command output after processing goes through the relay terminal board 20 to separately control the drive of the two hybrid stepper motors 15." ***Id.*** These are "control signal[s]" generated "in response to the captured image." ***Id.***

As explained in §IV.A.2.c (1[b]), motors 15 drive track-type crawling mechanisms 10 that move the vehicle body. Janét, ¶97. The control signals adjust motor speed, thereby controlling movement. Cui, Abstract, pp.6-7; Janét, ¶97.

Cui's control signals cause movement "to...the first object." Janét, ¶98. As explained in §IV.A.2.e (1[d]), the "first object" includes debris or an area on a pool surface. ***Id.*** Camera 5 captures images "of the areas to be cleaned located directly in front and below the crawling direction of the cleaner." Cui, Abstract, pp.5-7; Janét, ¶98. These are images of debris ahead of the cleaner. ***Id.*** When the controller generates control signals adjusting movement speed based on detected debris in an area of a pool surface in these forward-looking images, the robot continues moving forward toward the detected debris location—i.e., the control signals cause movement "to" the first object (debris or area of a pool surface). ***Id.***

The claim limitation uses the disjunctive "or" between "to" and "away from," meaning the limitation is satisfied by teaching either alternative. Because Cui teaches control signals that cause movement "to" the first object, Cui discloses or suggests this element. Janét, ¶99.

3. Claim 2

Cui discloses or suggests Claim 2. Janét, ¶¶100-115.

a. 2[pre]

Cui discloses or suggests 2[pre]. Janét, ¶¶101-102.

Cui discloses a pool cleaning system designed for "professional or commercial swimming pools" comprising an underwater cleaning vehicle with camera 5, computer 7, sensors, motors, and cleaning mechanisms operating within a swimming pool. Cui, Title, Abstract, Claim 1, pp.5-7, FIGS. 1-6; Janét, ¶102; *see also* §IV.A.2.a (1[pre]).

b. 2[a]

Cui discloses or suggests 2[a]. Janét, ¶¶103-104.

Cui discloses a piece of equipment for a swimming pool in the form of the pool cleaner, which is designed for "professional or commercial swimming pools" and includes camera 5, motors, filter bag 6, roller brushes 11, and other cleaning components operating within the swimming pool. Cui, Title, Abstract, Claim 1, pp.5-7, FIGS.1-3; Janét, ¶104; §IV.A.2.a (1[pre]).

c. 2[b]

Cui discloses or suggests 2[b]. Janét, ¶¶105-107.

Cui's pool cleaner includes camera 5, which "continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner." Cui, p.5, FIGs.1 (annotated below), 3; Janét, ¶106; §IV.A.2.e (1[d]).

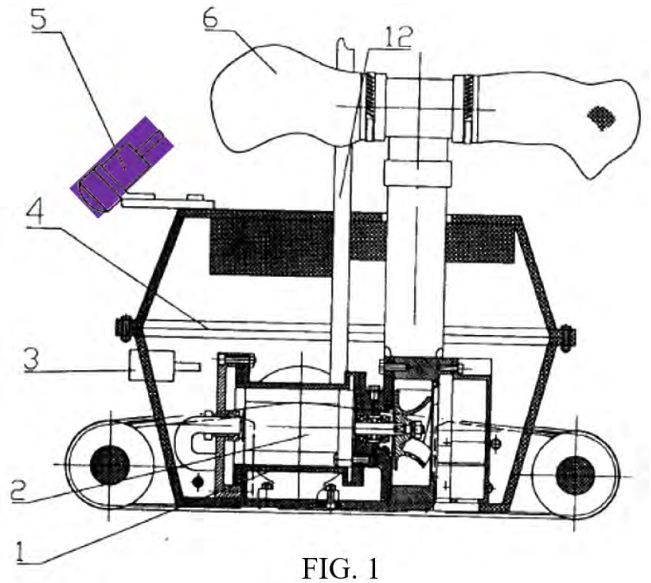


FIG. 1

A POSITA would have understood that these "areas to be cleaned" on the pool bottom constitute "a portion of a location including the swimming pool" because the pool bottom is a physical surface within the "swimming pool." Janét, ¶107.

d. 2[c][i]

Cui discloses or suggests 2[c][i]. Janét, ¶¶108-111.

Cui's FIGS. 5-6 (annotated below) shows industrial control computer 7 (controller) connected to pool cleaner components, including **CCD camera 5**, **stepper motors 15**, **sensors**, and **brushless DC water pump motor 2**, via interface cards including **image acquisition card 21**, **relay terminal board 20**, and **three-axis stepper motor control card 18**. Cui, pp.5-6, FIGS. 5-6.

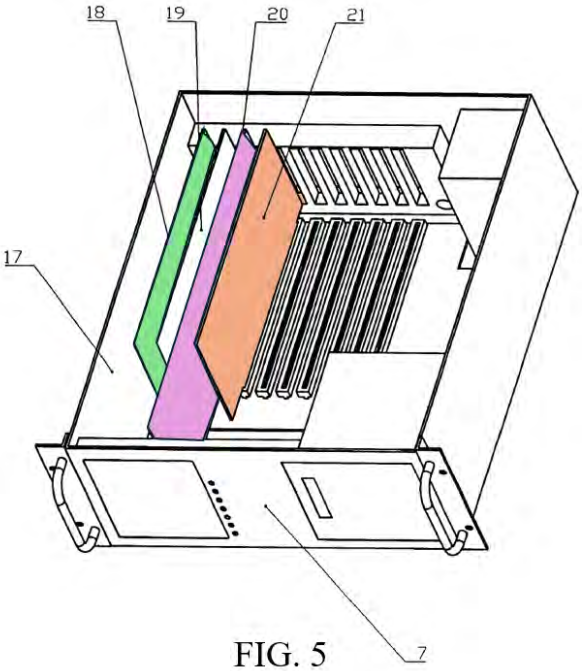

18
19
20
21
17
7

FIG. 5

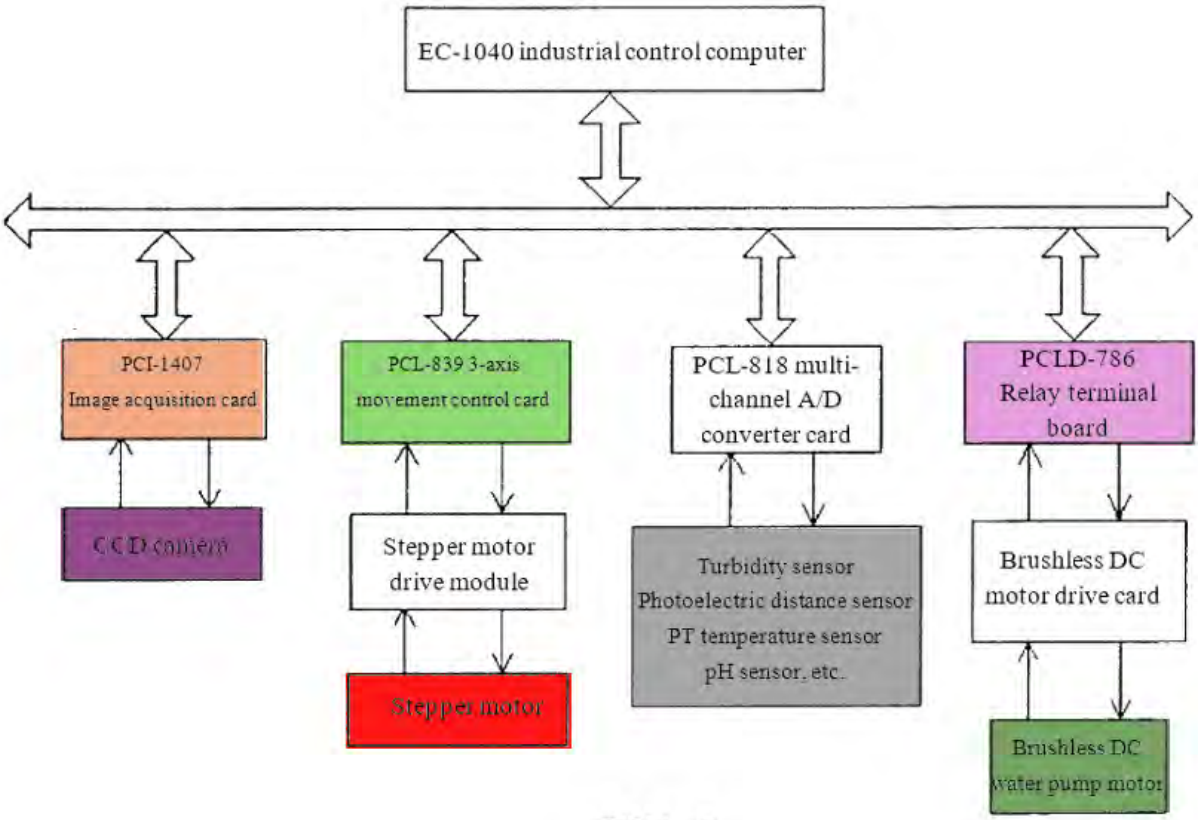

EC-1040 industrial control computer
PCI-1407
Image acquisition card
CCD camera
PCL-839 3-axis
movement control card
Stepper motor
drive module
Stepper motor
PCL-818 multi-
channel A/D
converter card
Turbidity sensor
Photoelectric distance sensor
PT temperature sensor
pH sensor, etc.
PCLD-786
Relay terminal
board
Brushless DC
motor drive card
Brushless DC
water pump motor

FIG. 6

Cui's computer 7 is "connected to the pool cleaner through the **cable assembly 12** and the **plug assembly 14**." Cui, pp.5-6, FIGS. 1-2 (annotated below); Janét, ¶110. Computer 7 is in communication with the pool cleaner (the equipment; *see* §IV.A.3.b) also because computer 7 controls the cleaner's motors based on processed sensor data—"[a] pulse signal command output after processing …to separately control the drive of the two hybrid stepper motors 15." Cui, pp.6-7; Janét, ¶110.

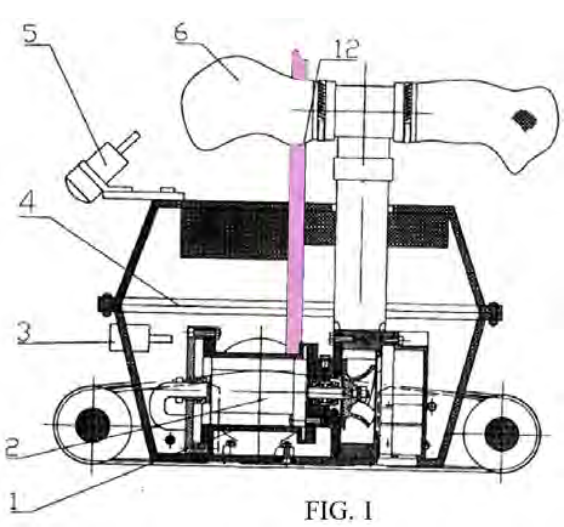


FIG. 1

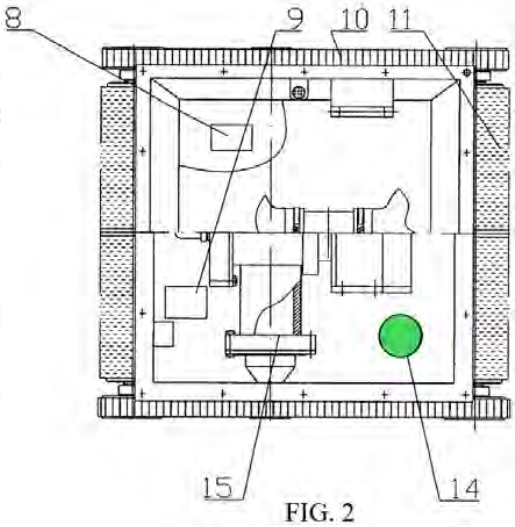


FIG. 2

Computer 7 is in electronic communication with camera 5, because it receives and processes camera images through image acquisition card 21. Cui, pp.4-7, Claim 3; Janét, ¶111; *see also* §IV.A.2.f (1[e][i]).

e. 2[c][ii]

Cui discloses or suggests 2[c][ii]. Janét, ¶¶112-114.

Specifically, Cui's computer 7 (controller) receives images (visual data) from camera 5 through image acquisition card 21. Cui, pp.4-5, FIGS. 5-6; Janét, ¶113; *see also* in §IV.A.2.f (1[e][i]), §IV.A.3.d (2[c][i]). Then, Cui's computer 7 processes the images (visual data) to determine debris levels—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s), resulting in a high comparison output voltage." Cui, pp.6-7; Janét, ¶113; *see also* §IV.A.2.g (1[e][ii]).

Based on the received visual data, Cui's controller 7 determines a control action for the pool cleaner (equipment), e.g., adjustment of the cleaner's motor/crawling speed. Cui, pp.6-7; Janét, ¶114; *see also* §IV.A.2.g (1[e][ii]).

4. Claim 3

Claim 3 depends from Claim 2. Cui discloses or suggests Claim 3. Janét, ¶¶116-119.

Cui's pool cleaner (equipment) is a cleaning device that includes track-type crawling mechanisms 10 and hybrid stepper motors 15 (propulsion mechanisms), roller brushes 11, water pump motor 2, and filter bag 6 for cleaning operations. Cui, Title, Claim 1, pp.4-6; Janét, ¶117; *see also* §IV.A.3.b (2[a]).

A POSITA would have understood that Cui's pool cleaner is "configured to travel adjacent to submerged or water-containing surfaces and to perform a cleaning operation" because it travels on pool bottoms and walls, and removes debris from pool surfaces as it travels, and these surfaces are submerged when the pool is filled with water. Janét, ¶¶118-119; *see also* §IV.A.2.a (1[pre]), §IV.A.3.b (2[a]).

5. Claim 5

Claim 5 depends from Claim 2. Cui discloses or suggests Claim 5. Janét, ¶¶120-123.

Cui describes that its **camera 5** is "mounted at the upper front end of the housing 4" of the cleaner (equipment). Cui, pp.5-6, FIG.1 (annotated below); Janét, ¶¶121-122.

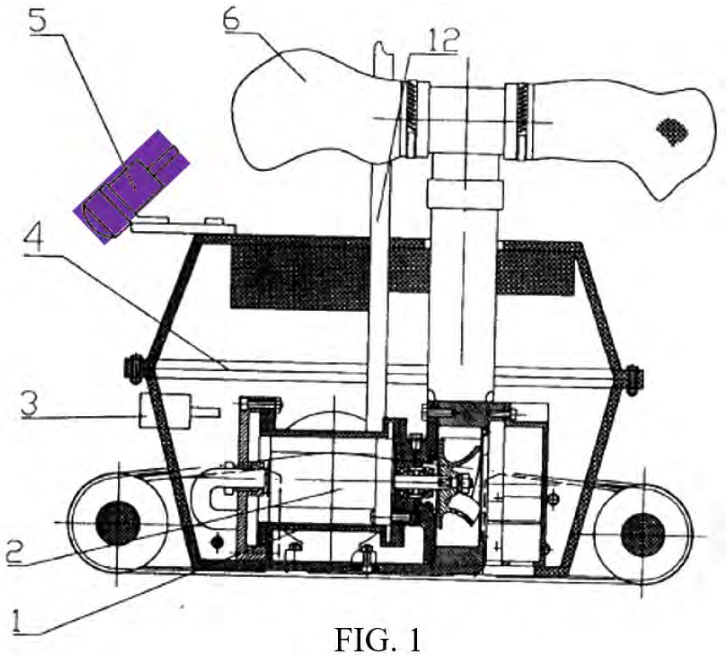


FIG. 1

Because camera 5 is mounted on housing 4 (part of the pool cleaner), camera 5 is mounted on the equipment as claimed. Cui, pp.5-6, Claim 1, FIG.1; Janét, ¶122.

6. Claim 6

Claim 6 depends from Claim 2. Cui discloses or suggests Claim 6. Janét, ¶¶124-126.

Cui's pool cleaner operates within filled pools to clean pool surfaces. Cui, Claim 1, p.7; Janét, ¶125; *see also* §IV.A.2.a (1[pre]). Cui's camera 5 is mounted on the pool cleaner. Cui, pp.5-6; FIG.1, Janét, ¶125; *see also* §IV.A.5 (Claim 5). Therefore, a POSITA would have understood that camera 5 is "submergible or submerged within the swimming pool" because it is mounted on the pool cleaner that operates submerged within the swimming pool. Janét, ¶125.

7. Claim 7

Claim 7 depends from Claim 2. Cui discloses or suggests Claim 7. Janét, ¶¶127-129.

Cui's computer 7 (controller) processes images to detect debris level/distribution on the pool area to be cleaned, and control the cleaner (equipment), e.g., its moving speed, based on detected debris level/distribution. Cui, pp.5-7, FIGS. 5-6; Janét, ¶128; *see also* §IV.A.3.e (2[c][ii]). A POSITA would have understood this debris level/distribution is a "characteristic of the location" because it describes the physical state—i.e., the cleanliness—of that pool area. Janét, ¶128.

8. Claim 8

Claim 8 depends from Claim 7, which depends from Claim 2. Cui discloses or suggests Claim 8. Janét, ¶¶130-135.

a. 8[a]

Cui discloses or suggests 8[a]. Janét, ¶¶130-131. Cui's computer 7 (controller) detects debris level/distribution (characteristic) on pool surfaces by comparing captured images with stored "clean surface" standard images. Cui, pp.5-7; Janét, ¶131; *see also* §IV.A.7 (Claim 7). A POSITA would have understood that debris levels indicate pool surface cleanliness—heavy debris indicates less clean surfaces, and minimal debris indicates cleaner surfaces. Janét, ¶131.

b. 8[b]

Cui discloses or suggests 8[b]. Janét, ¶¶132-135.

Cui's computer 7 (controller) compares captured images with stored "clean surface" images and adjusts motor speeds when detected cleanliness differs from that standard—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) **is greatly different** from the grayscale level of the original **standard image(s)**, resulting in a high comparison output voltage" that controls motor speeds. Cui, pp.5-7; Janét, ¶133; *see also* §IV.A.3.e (2[c][ii]). A POSITA would have understood that Cui's "pre-stored standard image information of a clean pool bottom" constitutes a "cleanliness threshold," because it represents

the baseline of "cleanliness" against which the current state is measured. Cui, pp.5-7; Janét, ¶133.

Furthermore, a POSITA would have understood that Cui's system determines that the cleanliness is "outside of a threshold" when the real-time image deviates from this standard image (i.e., "greatly different"). Cui's control action (adjusting motor speed) is triggered specifically because the detected cleanliness level has deviated from (i.e., outside) the standard defined by the stored image. Janét, ¶134. Accordingly, Cui's system controls the equipment based on the deviation from the standard (the threshold), thus satisfying the limitation. *Id.*, ¶¶134-135.

9. Claim 12

Cui discloses or suggests Claim 12. Janét, ¶¶136-146.

a. 12[pre]

Cui discloses or suggests 12[pre]. Janét, ¶¶137-138.

Cui discloses "a pool system" that includes a pool cleaner and computer 7. Cui, pp.5-7, FIGS. 5-6; Janét, ¶138; *see also* §IV.A.3.a (2[a]). A POSITA would have understood that Cui's method, including, among others, capturing images, detecting debris based on the images, and controlling cleaner movements based on detected debris constitutes "monitoring a pool system." *Id.*

b. 12[a]

Cui discloses or suggests 12[a]. Janét, ¶¶139-140.

Cui discloses that camera 5 captures images of pool surfaces ahead of the cleaner, and computer 7 receives the video signals (comprising multiple images captured over time) from camera 5 through image acquisition card 21 for processing. Cui, Abstract, Claim 3, pp.5-7; Janét, ¶138; *see also* §§IV.A.3.c-IV.A.3.d (2[b]-[c][i]).

c. 12[b]

Cui discloses or suggests 12[b]. Janét, ¶¶141-142.

Cui's method includes its computer 7 (controller) receiving images from camera 5, detecting debris level (characteristic) of an area based on the images, and adjusting the cleaner's crawling speed in that specific area based on the detected characteristic. Cui, pp.4-7, FIGS. 5-6; Janét, ¶142; *see also* §§IV.A.2.e-IV.A.2.g (1[d]-1[e][ii]), §§IV.A.7-IV.A.8 (Claims 7-8). Because Cui system's control action (adjusting the speed) is applied to a specific area in response to the debris detected in that same area, a POSITA would have understood or found it obvious that Cui's system determines the area, from which the images are captured, and in which the movement control will be applied, as a target area (e.g., a target area for application of updated movement controls). Janét, ¶142.

d. 12[c]

Cui discloses or suggests 12[c]. Janét, ¶¶143-146.

Cui's computer 7 assesses debris levels and generates pulse signal commands that control motor speeds to adjust cleaning force—"a corresponding cleaning force can be selected according to a varying distribution of debris on the pool bottom." Cui, Abstract, p.5; Janét, ¶144; *see also* §§IV.A.3.e&IV.A.7 (2[c][ii], Claim 7).

A POSITA would have understood that Cui's pulse signal commands constitute "a control response" generated "based on the detected characteristic" (debris level or cleanliness) of the target area. Janét, ¶145.

10. Claim 13

Claim 13 depends from Claim 12. Cui discloses or suggests Claim 13. Janét, ¶¶147-152.

a. 13[a]

Cui discloses or suggests 13[a]. Janét, ¶¶148-149.

Cui's target area is the specific area of the pool surface which computer 7 determines contains debris. Cui, pp.6-7; Janét, ¶149; *see also* §IV.A.9.b-IV.A.9.d (12[b]-[c]).

b. 13[b]

Cui discloses or suggests 13[b]. Janét, ¶¶150-151.

Cui's computer 7 detects debris level (cleanliness characteristic) of the target area, which is a "portion of the pool surface." Cui, pp.5-7; Janét, ¶151; *see also* §§IV.A.7-IV.A.8.a (Claim 7, 8[a]).

11. Claim 14

Claim 14 depends from Claim 12. Cui discloses or suggests Claim 14, because Cui's computer 7 generates pulse signal commands (control response) that control movement (operation) of a pool cleaner (equipment of the swimming pool). Cui, pp.5-7; Janét, ¶¶153-154; §IV.A.9.d (12[c]), §IV.A.3.b (2[a]).

12. Claim 19

Claim 19 depends from Claim 12. Cui discloses or suggests Claim 19. Janét, ¶¶155-160.

a. 19[a]

Cui discloses or suggests 19[a], because Cui's system generates pulse signal commands (control response) that controls motors and movement (operation) of the pool cleaner (equipment). Cui, pp.6-7; Janét, ¶156; *see also* §§IV.A.9.d (12[c]), IV.A.11 (Claim 14). Cui's pool cleaner is configured to travel adjacent to a bottom of (submerged or water-containing surfaces) of the swimming pool and performs a cleaning operation. Cui, pp.5-7; Janét, ¶156; *see also* §§IV.A.2.a (1[pre]), IV.A.4 (Claim 3), IV.A.6 (Claim 6).

b. 19[b]

Cui discloses or suggests 19[b]. Janét, ¶¶157-160.

Cui's system generates pulse signal commands (control responses) that control rotational speed of hybrid stepper motors 15, which a POSITA would have

understood controls "the crawling speed of the cleaner" (speed of the cleaning device). Cui, p.7; Janét, ¶158; *see also* §IV.A.9.d (12[c]). Cui teaches that "the crawling speed of the cleaner indirectly reflects the magnitude of the cleaning force." Cui, pp.6-7, FIG.7. Although stated in the context of Cui's turbidity-based embodiment, Cui further explains the relationship: when "the crawling speed of the cleaner slows down...the cleaning force increases." Cui, Abstract, p.9, FIG.7; Janét, ¶158. A POSITA would have understood this relationship between crawling speed and cleaning force to apply equally to Cui's image-based debris detection embodiment, as both embodiments use the same mechanical cleaning components (roller brushes 11, track-type crawling mechanisms 10) and both aim to achieve "different cleaning forces" corresponding to "different distributions of debris." Cui, Abstract, pp.4-5, 7; Janét, ¶158.

Additionally, Cui describes directional control enabling the cleaner to "move forward, backward, or turn left and right" and execute "180° turns" near pool walls "until the entire pool is cleaned," which constitutes controlling the cleaner's path. Cui, p.7; Janét, ¶159.

B. Ground 1B: Claims 8 and 16 are Unpatentable over Cui and Fu-007

1. Fu-007

Fu-007 (EX1007), which is analogue art and in the same field as the '207 Patent, discloses an underwater cleaning robot for swimming pools that operates in remote control and autonomous modes. Fu-007, Title, Abstract; Janét, ¶161.

Fu-007's system includes **monitoring camera 2** and central processing unit (controller) housed in **control system enclosure 8**, and cleaning and moving platform with **cleaning drive wheels 3** and drainage devices. Fu-007, pp.12-14,[3] Claims 1, 3, FIGS. 1-3 (annotated below); Janét, ¶162.

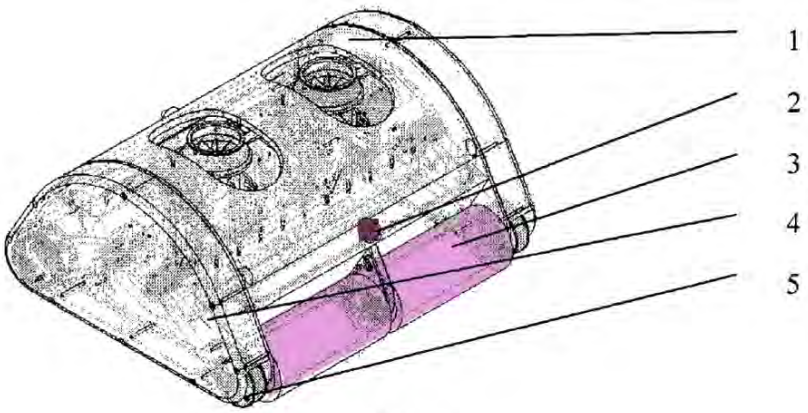


FIG. 1

[3] Page citations to Fu-007 are to the original pagination in the bottom center of each page.

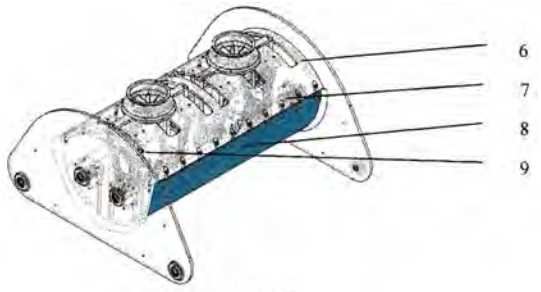


FIG. 2

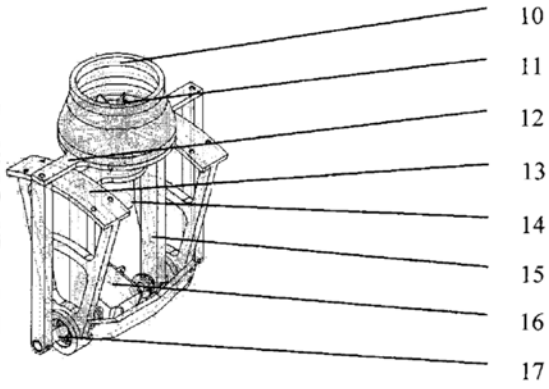


FIG. 3

Fu-007's central processing unit compares the images captured by camera 2 with a "cleanliness image threshold" to determine cleanliness level, and operates cleaning drive wheels and drainage device accordingly. Fu-007, pp.14-16, Claims 4, 7; Janét, ¶163.

Fu-007 also teaches wireless communication capability through a control signal buoyant **antenna 27** that "floats on a water surface to wirelessly communicate with the **control keyboard 31**" and "is connected to the robot via the control **signal buoyant antenna cable (35)**." Fu-007, pp.8-10, 12-16, Claims 4-5, 7, FIG. 8 (annotated below); Janét, ¶164. Fu-007 teaches controlling the robot "with the cable" for "long-term global cleaning" and using the "control signal buoyant antenna 27" to "wirelessly communicate" for "short-term local cleaning." Fu-007, pp.9-10, 14, Claim 5; Janét, ¶164.

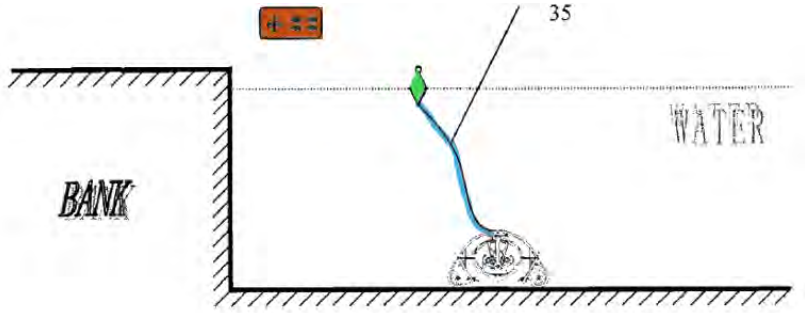


FIG. 8

2. Motivation to Combine

Both Cui and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve autonomous pool cleaning operations. Janét, ¶165. Cui describes a pool cleaner using "intelligent adaptive technology with computer control" to autonomously adjust cleaning force based on debris distribution. Cui, pp.5-7. Fu-007 similarly describes an underwater cleaning robot. Fu-007, p.11. A POSITA would have been motivated to combine their complementary teachings to improve autonomous pool cleaning. Janét, ¶165.

A POSITA would have recognized that the teachings in Cui and Fu-007 are directed to the same pool cleaning technical field and provide similar technical solutions to address similar technical issues. Janét, ¶¶166-168. Specifically, both use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body with motorized drive mechanisms. *Compare* Cui, pp.5-7, FIGS. 1-3, 5-7, *with* Fu-007, pp.8-10, 12-16, Claims 1-4, 7, FIGS.1, 6.

Accordingly, a POSITA would have investigated their teachings to seek guidance when designing pool cleaning systems. Janét, ¶168.

Cui teaches an image comparison approach that compares captured images with stored "clean surface" standard images to produce a comparison output voltage. Cui, pp.5-7. Fu-007 employs a threshold-based approach that sets "a swimming pool cleanliness image threshold" and "plans a cleaning movement" based on the comparison. Fu-007, pp.10, 14-16, Claim 7. Additionally, Cui teaches wired communication via cable assembly 12 (Cui, pp.5-6, FIGS. 1-3), and Fu-007 discloses both wired and wireless communication modes (Fu-007, pp.8-10, 12-16, FIG. 8). These represent known design alternatives in autonomous pool cleaning systems. Janét, ¶169.

A POSITA would have been motivated to modify Cui by incorporating Fu-007's teachings of threshold-based control and wireless communication capacity to advance Cui's stated goals of "intelligent adaptive technology," "high reliability," and "strong applicability." Cui, Abstract, p.5; Janét, ¶170.

A POSITA would have had a reasonable expectation of success in making these modifications because both employ similar camera-based systems, and combining Fu-007's teachings with Cui would have involved routine software and hardware modifications to Cui's existing system, yielding predictable results. Cui, pp.5-7; Fu-007, pp.10, 12-16; Janét, ¶171.

3. Claim 8

173. Claim 8 depends from Claim 7, which depends from Claim 2. The Cui-Fu-007 combination discloses or suggests Claim 8. Janét, ¶¶172-179.

a. 8[a]

Cui discloses or suggests 8[a]. *See* §IV.A.8.a (8[a]).

b. 8[b]

To the extent that this element is found not to be taught or suggested by Cui, it is disclosed or suggested by the Cui-Fu-007 combination. Janét, ¶¶174-179.

As explained in §§IV.A.7 (Claim 7) and IV.A.8.b (8[b]), Cui discloses that its computer 7 (controller) controls the cleaner (equipment) based on the detected debris level (cleanliness).

As explained in §IV.B.1, Fu-007 teaches threshold-based cleanliness control by setting "a swimming pool cleanliness image threshold," determining "a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold," and adjusting "operating conditions of the four cleaning drive wheels...to complete the cleaning task" based on the comparison. Fu-007, pp.10, 14-16, Claim 7; Janét, ¶176.

As explained in §IV.B.2, a POSITA would be motivated to incorporate Fu-007's cleanliness-threshold control logic into Cui's system, such that the modified system would set "a swimming pool cleanliness image threshold," "determine a

cleanliness level" from the images from Cui's camera, and compare this "cleanliness level" to the "threshold" to "plan[] a cleaning movement." Fu-007, pp.10, 14-16; Janét, ¶177.

179. In addition to the reasons explained in §IV.B.2, a POSITA would have recognized that Fu-007's "threshold" comparison allows the controller to "determine[] a cleanliness level" and, as a result, "autonomously plan[]" a "path and an action." Fu-007, pp.10, 14-16; Janét, ¶178. A POSITA would have understood this as an enhancement to move beyond Cui's control (slowing down for debris) and implement more energy-saving cleaning plans (e.g., cleaning only the areas outside the "threshold"), resulting in a more efficient, reliable autonomous cleaner. Janét, ¶178.

4. Claim 16

Claim 16 depends from Claim 12. The Cui-Fu-007 combination discloses or suggests Claim 16. Janét, ¶¶180-186.

Cui's computer 7 is remote from the pool cleaner, connected via **cable assembly 12** and **plug assembly 14**. Cui, pp.5-6, FIGS. 1-2 (annotated below); Janét, ¶181; *see also* §IV.A.3.d (2[c][i]).

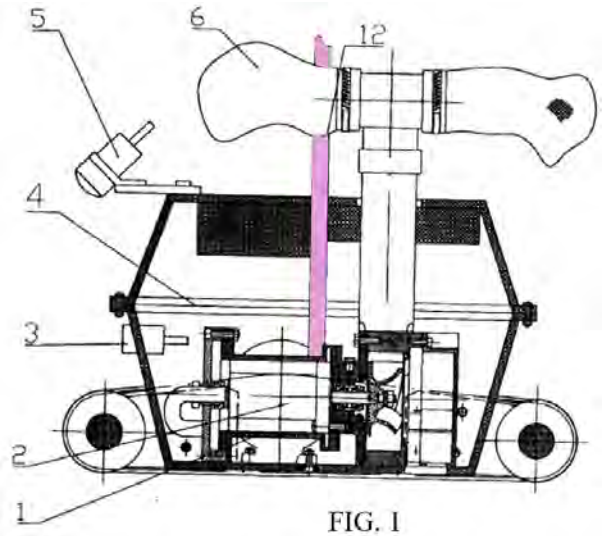


FIG. 1

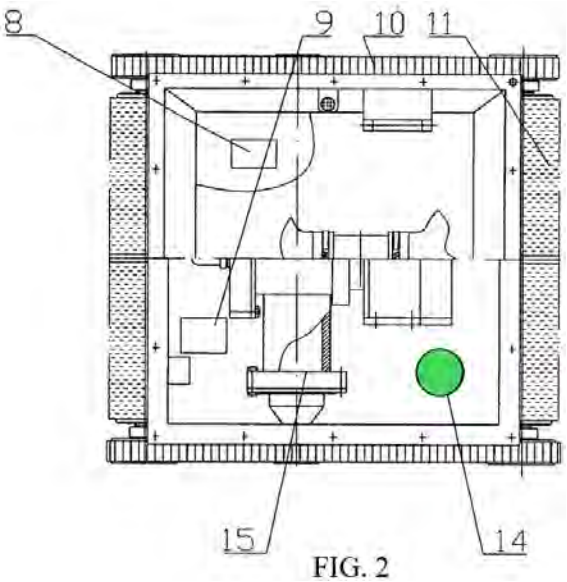


FIG. 2

As explained in §IV.B.1, Fu-007 discloses a pool cleaning robot with wireless communication capability through a control signal buoyant **antenna 27**.Fu-007, pp.8-10, 12-16, Claims 4-5, 7, FIG. 8 (annotated below); Janét, ¶182. Fu-007 teaches controlling the robot "with the cable" for "long-term global cleaning" and using wireless communication for "short-term local cleaning." Fu-007, pp.9-10, 14, Claim 5.

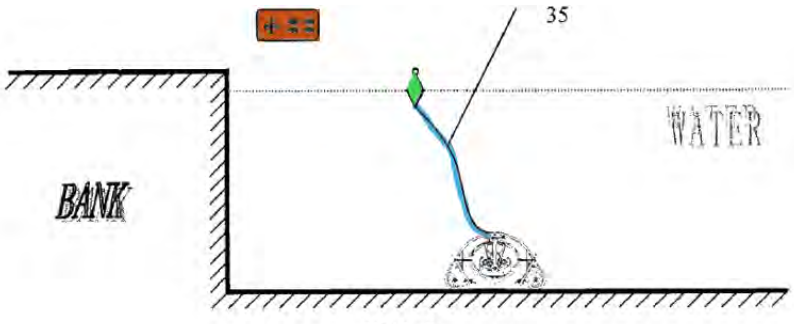


FIG. 8

As explained in §IV.B.2, a POSITA would have been motivated to combine the teachings of Cui and Fu-007 with a reasonable expectation of success. Janét, ¶184. In the modified system, Cui's computer 7 (controller) would have dual-mode (wired and wireless) communication capability, allowing it to generate control signals and communicate them either via the existing cable assembly 12 or wirelessly via Fu-007's buoyant antenna 27 to a remote device. *Id.*

In addition to the reasons explained in §IV.B.2, a POSITA would have been motivated to make this modification because adding Fu-007's wireless communication as an alternative to Cui's wired connection would have improved Cui's stated goal of "high reliability" (Cui, Abstract, p.5) by providing a redundant communication path, allowing the cleaner to be controlled even if the primary cable connection was impractical or unavailable. Janét, ¶185.

C. Ground 1C: Claims 10 and 17 are Unpatentable over Cui and Hsu

1. Hsu

Hsu (EX1011) is analogous art to the '207 Patent because Hsu addresses autonomous robotic cleaners that display cleaning coverage for user monitoring, using cameras to detect environment conditions. Hsu, Abstract, [0018]; EX1001, Abstract, 1:26-31, 9:26-47; Janét, ¶187. Additionally, Hsu explicitly states its technology "is not limited to indoor spaces," demonstrating applicability to outdoor pool cleaning environments like Cui's system. Hsu, [0019]; Janét, ¶187.

Hsu discloses a cleaning robot that includes **environment information detection device 10**, which can be "a camera, a video camera," and **map construction module 20** that constructs "an environment map based on the environment information detected by the environment information detection device." Hsu, Abstract, [0017]-[0018], [0037]-[0038], Claim 1, FIGs. 1, 5 (S12) (annotated below).

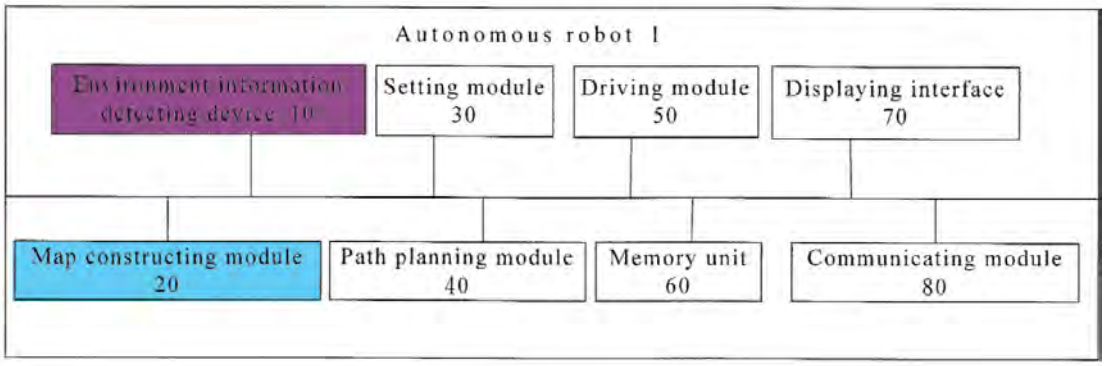


FIG. 1

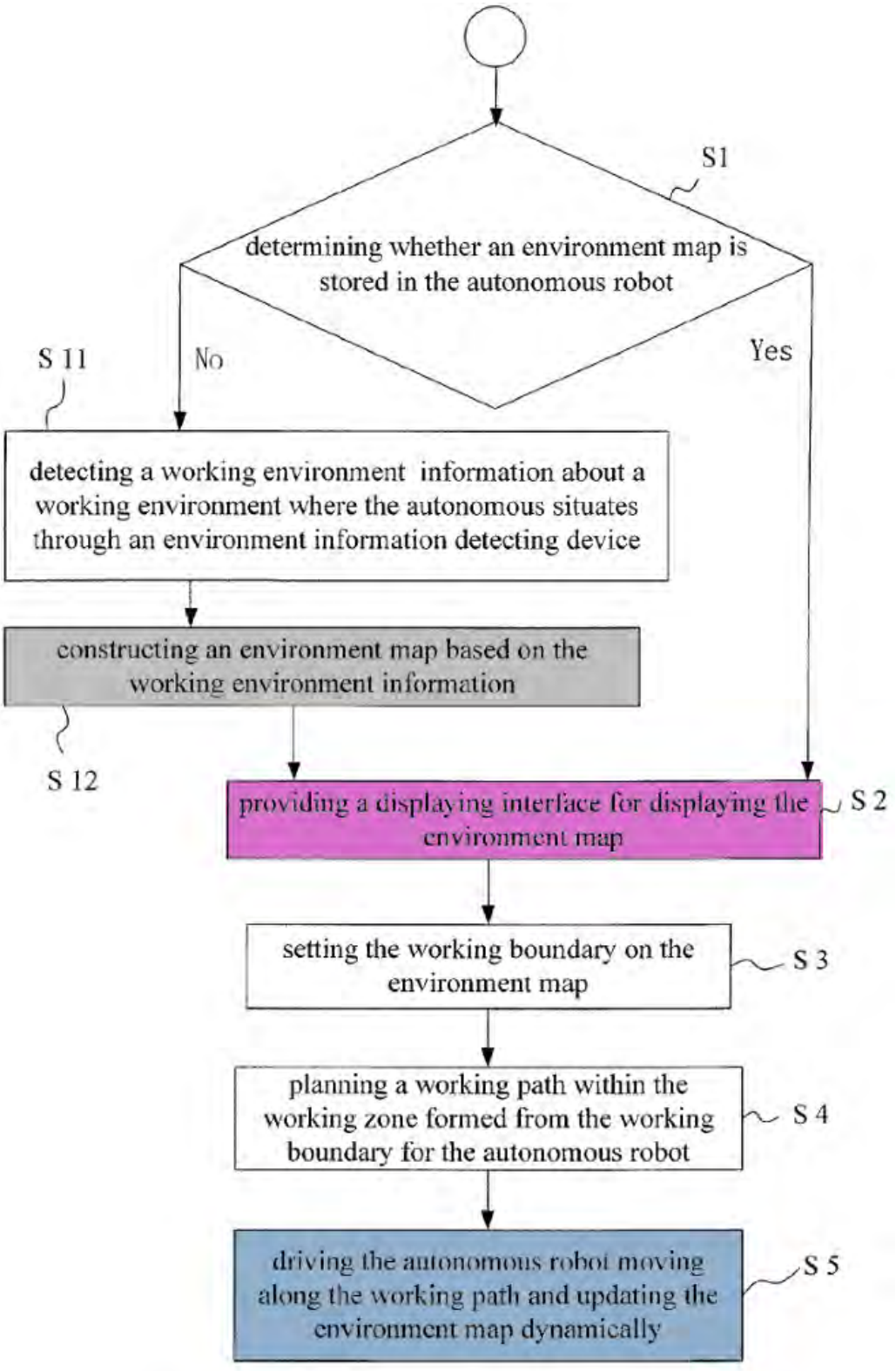

S1
determining whether an environment map is stored in the autonomous robot
No
Yes
S 11
detecting a working environment information about a working environment where the autonomous situates through an environment information detecting device
constructing an environment map based on the working environment information
S 12
providing a displaying interface for displaying the environment map
S 2
setting the working boundary on the environment map
S 3
planning a working path within the working zone formed from the working boundary for the autonomous robot
S 4
driving the autonomous robot moving along the working path and updating the environment map dynamically
S 5

FIG. 5

Hsu's environment map 120 shows the working environment including working zones, and is "updated dynamically" based on "real-time working environment information detected by the environment information detection device" while the robot is moving, which "increase[s] the accuracy of the environment map" and allows the robot to "avoid...obstacles." Hsu, [0020], [0033]-[0034], Claims 3, 6, 8-9, 12, 15-16, FIGS. 2-3, 5 (**S5**) (annotated above).

Hsu describes "The environment map 120 can be transmitted to the display screen on an external **electronic device 130** or an **electronic device 130a** by…**autonomous robot 1** via a communication platform 110." Hsu, [0021], [0028], Claim 7, FIGS. 4-5 (**S2**) (annotated below).

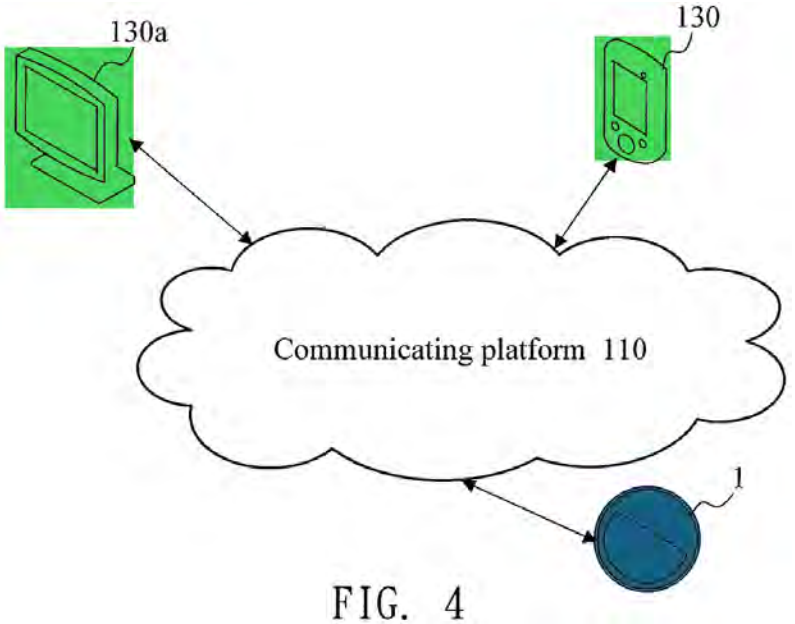


FIG. 4

2. Motivation to Combine

Both Cui and Hsu disclose autonomous cleaning robots using cameras and controllers to monitor and display cleaning progress to users. Janét, ¶191. Cui provides interface 16 so that "the working status of the cleaner can be seen at a glance." Cui, p.6. Hsu similarly provides a display interface showing an environment map that is "updated dynamically" during cleaning operations. Hsu, [0018]-[0022], [0033]-[0034]. A POSITA would have been motivated to combine the complementary teachings of Cui and Hsu to achieve improved visual monitoring of autonomous cleaning operations. Janét, ¶191.

A POSITA would have been motivated to apply Hsu's camera-based map construction to Cui's system for the following reasons. First, this modification would have advanced Cui's functionality to provide visual information to users. Janét, ¶192. Cui's camera 5 already captures images "of the areas to be cleaned," providing visual data showing actual surface conditions. Cui, pp.5-7. Using camera-captured visual data to construct the graphical depiction (per Hsu) would have allowed more accurate environment representation. Janét, ¶192.

Second, a POSITA would have been motivated to make such modification to enhance Cui's "high reliability." Cui, Abstract, p.5; Janét, ¶193. In the modified system, Cui's camera would continuously capture images of the areas to be cleaned and provide dynamically updated visual ground truth of pool surface conditions,

thereby "increase[ing] the accuracy of the environment map." Hsu, [0020], [0033]-[0034]; Janét, ¶193. This would use Cui's existing camera for dual purposes: debris detection (per Cui's existing functionality) and coverage verification (per Hsu's functionality). Moreover, Hsu' "real-time working environment information" would have allowed the cleaner to avoid obstacles and increase reliability. Hsu, [0020]; Janét, ¶193.

A POSITA would have reasonably expected success because Cui already has the necessary hardware—camera 5 and controller 7 with image processing and storage capabilities (Cui, pp.5-7, FIGS. 5-6), and the modification would have involved software changes to Cui's logic to use Hsu's camera image analysis, yielding the predictable result of camera-based coverage display. Janét, ¶194.

3. Claim 10

Claim 10 depends from Claim 2. The Cui-Hsu combination discloses or suggests Claim 10. Janét, ¶¶195-203.

Cui's computer 7 includes "a human-machine interface 16" that displays "the cleaned area...denoted by light blue, and the area that has not been cleaned yet...denoted by dark blue so that the working status of the cleaner can be seen at a glance" based on a motor-tracking formula. Cui, pp.6-7, Claim 3, FIG. 4.

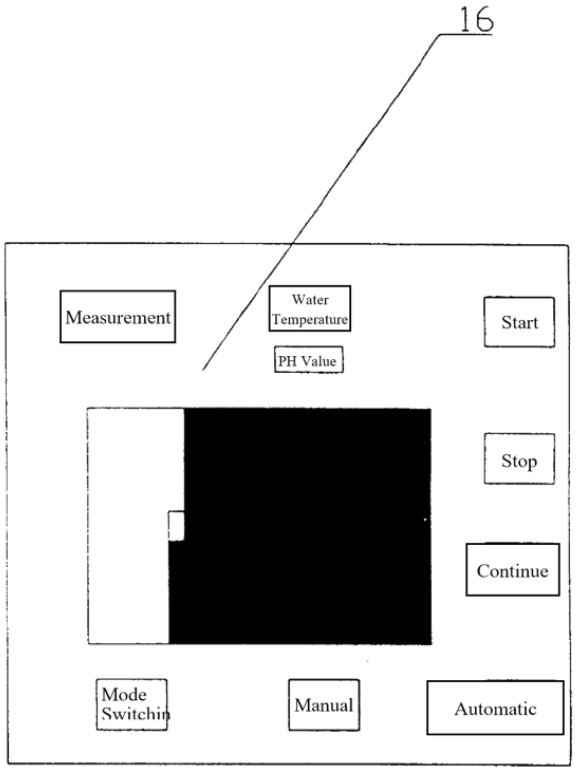


FIG. 4

Computer 7 is physically separated and accordingly remote from the pool cleaner configured to perform cleaning operations in water-filled pools. Cui, pp.4-5, FIGS. 5-6; *see also* §IV.A.2.a, IV.A.5-IV.A.6, (1[pre], Claims 5-6). Interface 16 of computer 7 displays the working status of the cleaner to a user. Cui, p.6, FIG. 4. A POSITA would have understood that interface 16 is outside the pool and physically separated and accordingly remote from the pool cleaner, constituting a remote device. Janét, ¶197. This is consistent with the '207 Patent describing **display 50/468** is outside the pool and physically separated and remote from **vehicle 30/830**. EX1001, 5:27-51, FIGS. 2-5, 9 (annotated below).

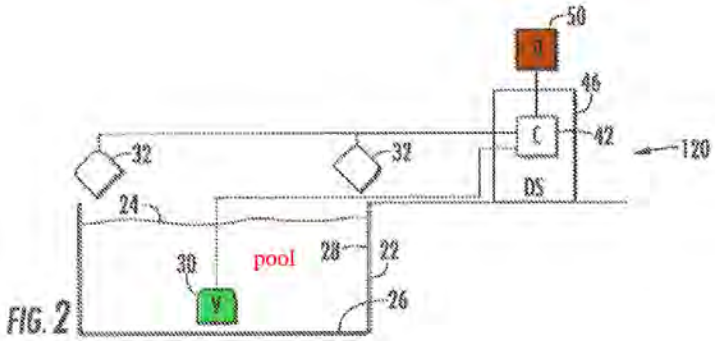


FIG. 2

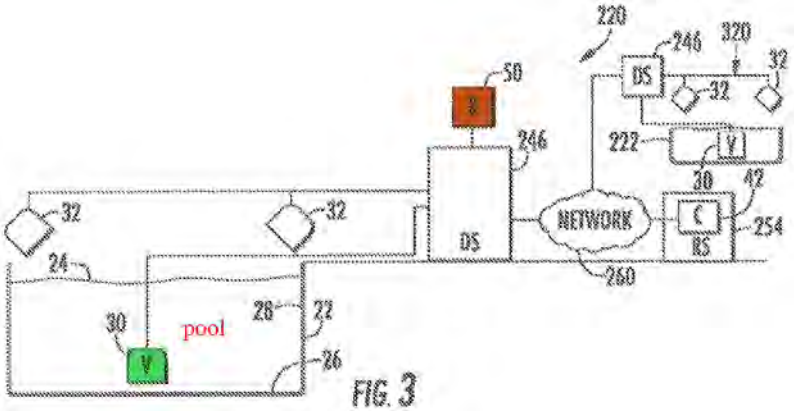


FIG. 3

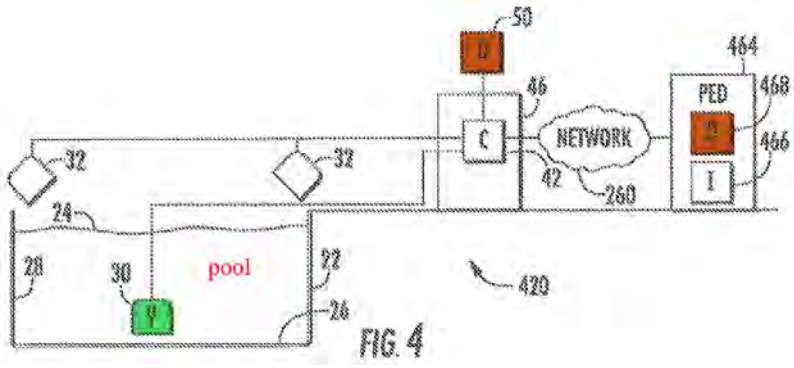


FIG. 4

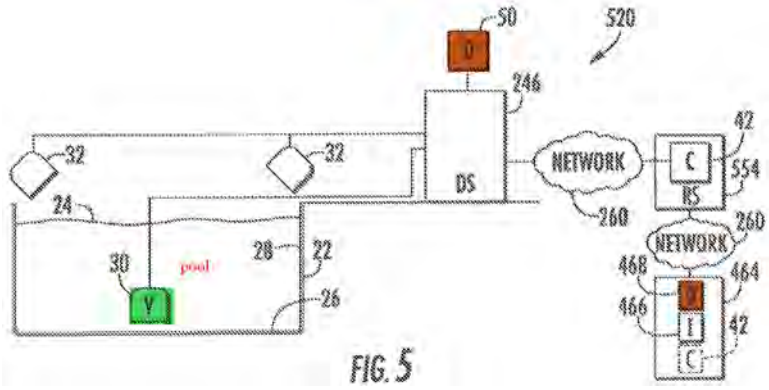


FIG. 5

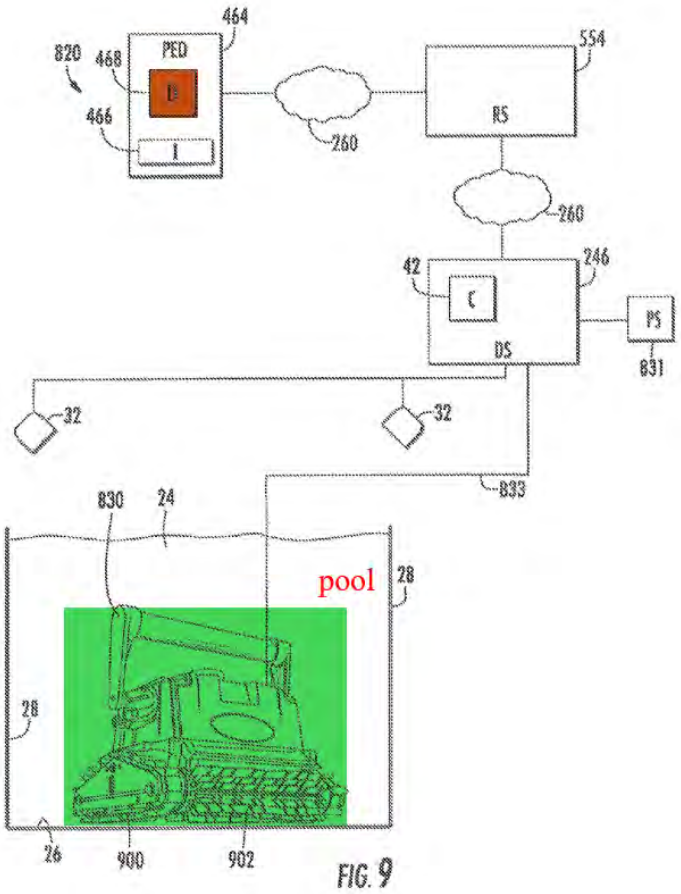


FIG. 9

The '207 Patent similarly uses remote display 50/468 to "depict the progress of **vehicle 30** in cleaning pool 22." EX1001, 5:52-61, FIGS. 7-8 (annotated below).

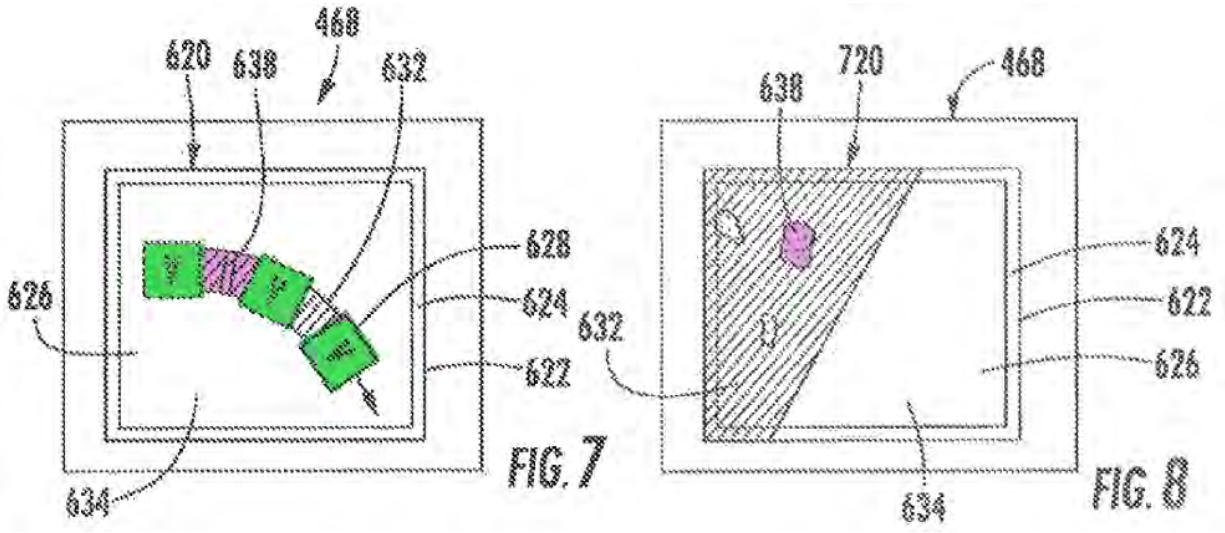


FIG. 7 FIG. 8

Hsu describes that its environment map displays the environment including working zones and is "updated dynamically" during cleaning, and that "**environment map 120** can be transmitted to the display screen on an external **electronic device 130** or an **electronic device 130a** by… **autonomous robot 1** via a communication platform 110." Hsu, [0018]-[0022], [0033]-[0034], Claims 3, 6-8, 12, 15-16, FIGS. 2, 4-5 (annotated below); §IV.C.1.

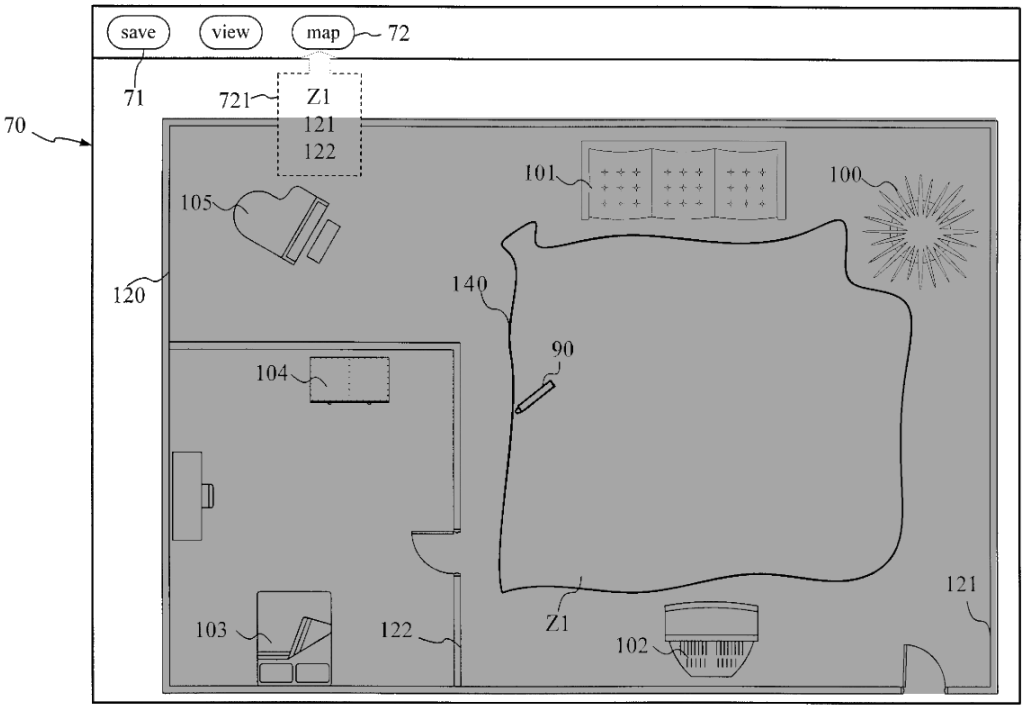


FIG. 2



FIG. 4

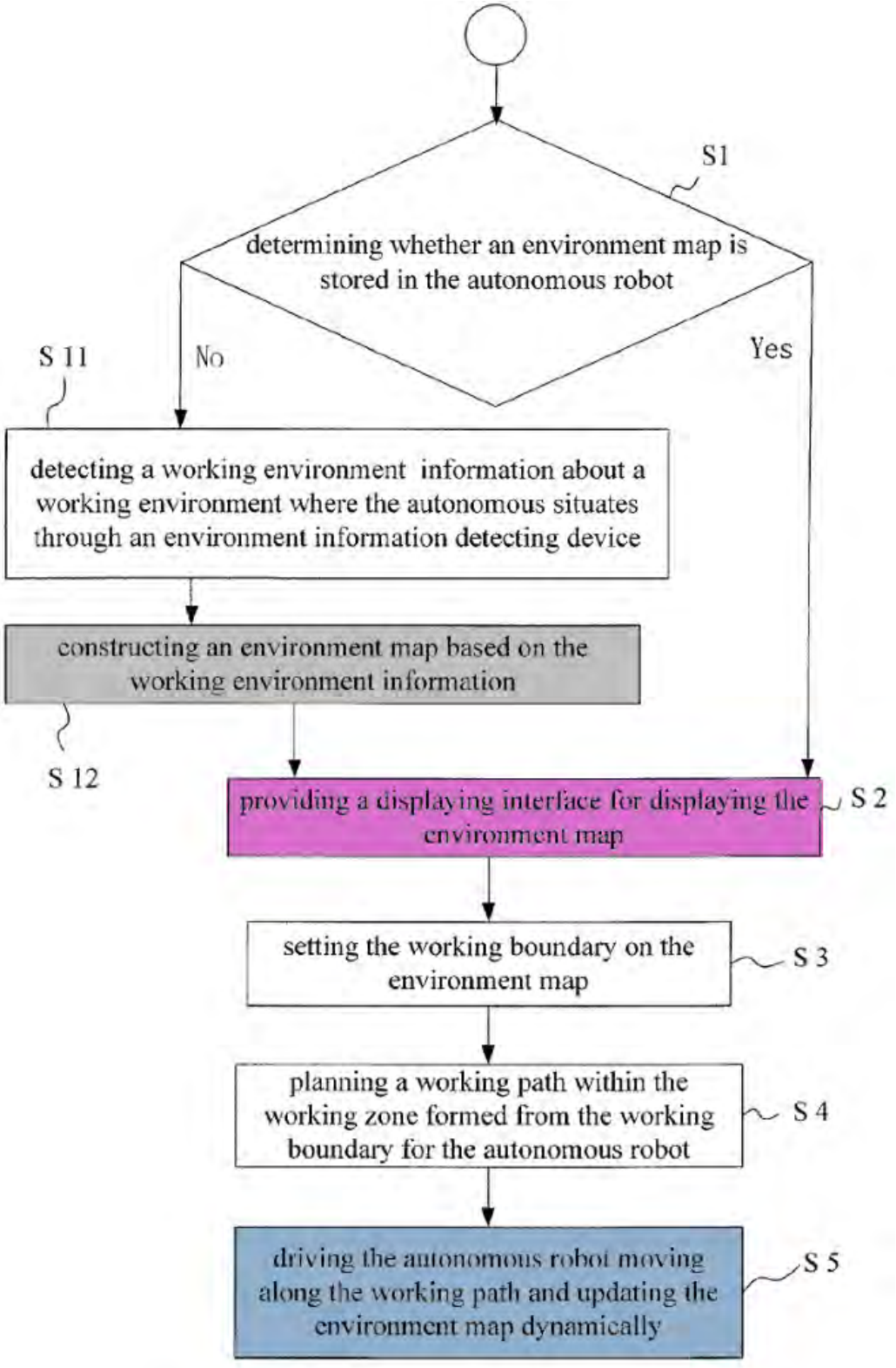

S1
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detecting a working environment information about a working environment where the autonomous situates through an environment information detecting device
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setting the working boundary on the environment map
S 3
planning a working path within the working zone formed from the working boundary for the autonomous robot
S 4
driving the autonomous robot moving along the working path and updating the environment map dynamically
S 5

FIG. 5

As explained in §IV.C.2, a POSITA would have been motivated to add Hsu's functionalities for map construction from camera data to Cui's system. Janét, ¶201. In such modified system, Cui's controller 7 would receive images from camera 5, process the images to determine a control action, and execute that control action by constructing and presenting a graphical depiction showing cleaned versus uncleaned areas based on the images (per Hsu). Hsu, [0018]-[0022], [0033]-[0034], [0037]-[0038], FIGS. 2, 4-5; Janét, ¶201. This camera-based graphical depiction—a dynamically updated map—would be presented on interface 16 (Cui's remote device) and transmitted to external devices 130/130a (Hsu's remote device) as the control action. Cui, p.6; Hsu, [0021], [0033]-[0034], Claims 3, 6-8, 12, 15-16, FIG.5; Janét, ¶201.

As explained in §IV.C.2, a POSITA would have reasonably expected success in making such modification. Janét, ¶202.

4. Claim 17

Claim 17 depends from Claim 12. The Cui-Hsu combination discloses or suggests Claim 17. Janét, ¶¶204-210.

a. 17[a]

The Cui-Hsu combination discloses or suggests 17[a]. Janét, ¶¶205-207.

Cui, as modified by Hsu, presents a graphical depiction—a dynamically updated map showing cleaned versus uncleaned areas during cleaning operations—

on interface 16 (remote device) based on camera-captured visual data. Cui, pp.6-7, FIG. 4; Hsu, [0020], [0033]-[0034], Claims 3, 6, 8-9, 12, 15-16, FIGS. 2-3, 5; Janét, ¶206; *see also* §IV.C.3 (Claim 10). Additionally, Cui teaches that interface 16 displays **icons** (e.g., "Automatic," "Manual"), allowing users to control the cleaner. Cui, p.6, FIG. 4 (annotated below); Janét, ¶206.

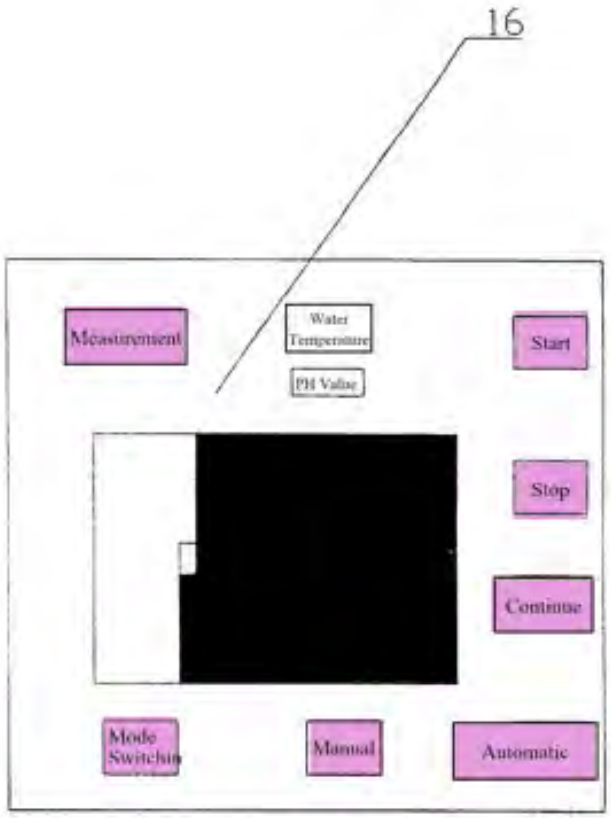


FIG. 4

A POSITA would have been motivated to combine Cui and Hsu, as explained in §IV.C.2. A POSITA would have understood or found it obvious that in the Cui-Hsu combination, dynamically updating the map and displaying these actionable icons on interface 16 (remote device) constitutes "prompting a user" because the

interface presents the active status and specific options, inviting users to select a command (e.g., prompting users to decide whether to "Stop" or select "Manual" mode based on the map). Janét, ¶207. Thus, generating the display with these control options serves as the control response that prompts users on a remote device. *Id.*

b. 17[b]

Cui discloses or suggests 17[b]. Janét, ¶¶208-210.

As explained above in §IV.C.4.a (17[a]), Cui's interface 16 includes interactive icons allowing user selections. A POSITA would have understood that Cui's system receives a control input from users when they, e.g., clicks the "Start" icon on the remote device, and this received input is used to control the pool cleaner (equipment). Cui, p.6, FIG.4; Janét, ¶209.

D. Ground 2A: Claims 1-3, 5-7, 12, 14, and 19 are Unpatentable over Knoll

1. Knoll

Knoll (EX1006), which is analogous art, discloses an autonomous robotic pool cleaning vehicle. Knoll, Title, Abstract, [0001]-[0002], [0007], [0021], [0027], FIG. 1 (reproduced below); Janét, ¶211.

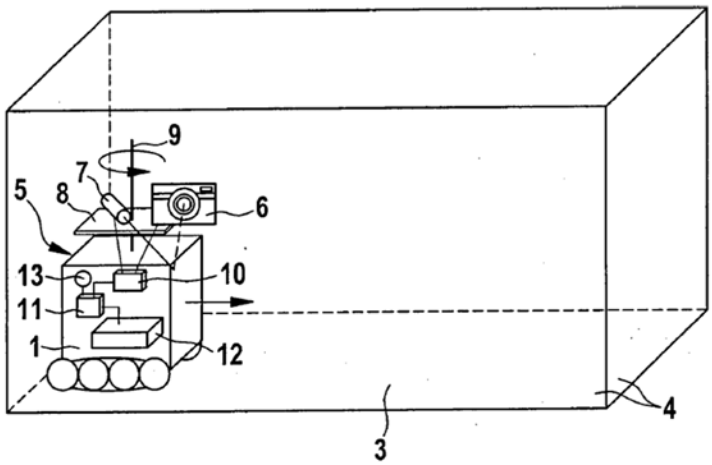


Fig. 1

Knoll's system includes robotic vehicle 1 with drive means 12, digital camera 6, and control unit 11 for controlling the drive means. Knoll, [0007], [0027]-[0028], Claim 1, FIG.1. The robotic vehicle is "a pool robot with a suction and/or filter and/or cleaning device" that operates on working area 3 formed by the pool bottom and delimited by boundary surface 4 (pool walls). Knoll, [0007], [0027]-[0028], FIG.2 (reproduced below).

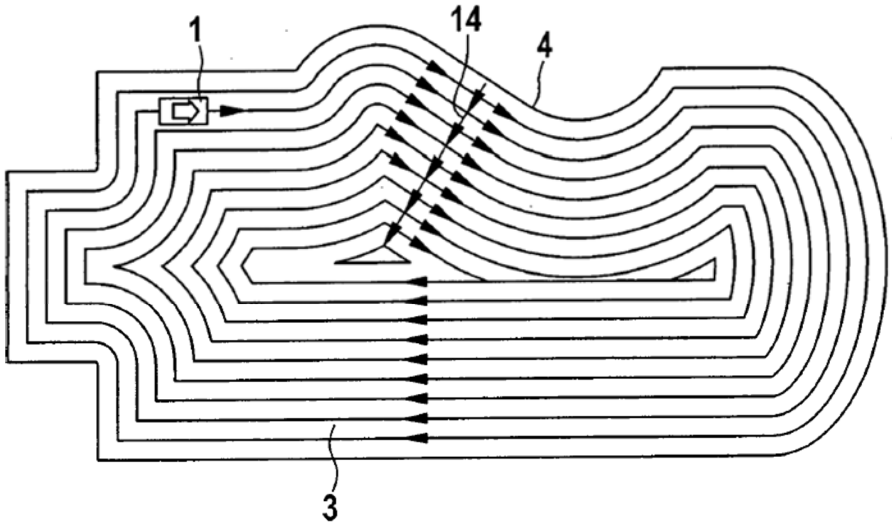


Fig. 2

2. Claim 1

Knoll discloses or suggests Claim 1. Janét, ¶¶214-243.

a. 1[pre]

Knoll discloses or suggests 1[pre]. Janét, ¶¶215-218.

Knoll discloses an "autonomous robotic vehicle 1 designed as a pool cleaning vehicle" with a **control unit 11** that controls **drive means 12** "for driving and steering." Knoll, Abstract; [0027]-[0028]; Claims 2, 4, 14, FIG. 1 (annotated below).

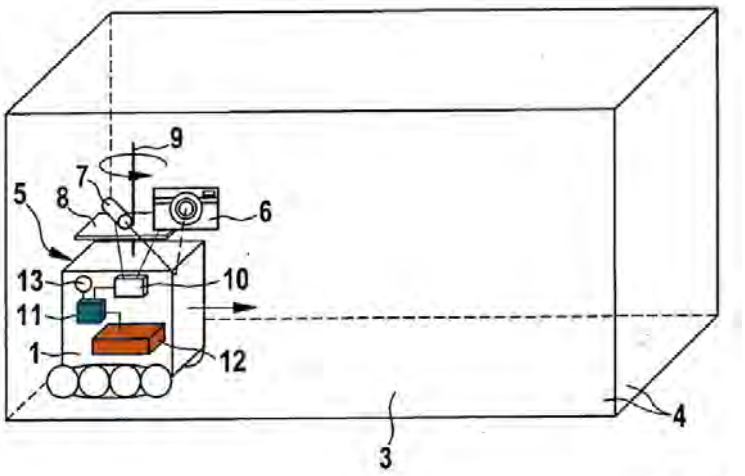


Fig. 1

Knoll's robotic vehicle is a self-propelled pool cleaning system, because it includes "suction and/or filter and/or cleaning device" and its "drive means" propels the vehicle under the control of the control unit. Knoll, [0007], [0028]; Janét, ¶217.

Knoll's robotic vehicle cleans debris from a submerged surface of a swimming pool, because it includes a suction/filter/cleaning device and operates on a working area 3 formed by the pool bottom. Knoll, [0021], [0027]-[0028], FIG. 1 (below); Janét, ¶218. A POSITA would have understood that Knoll's robotic vehicle is intended to operate in filled pools and thus cleans debris from submerged pool surfaces. Janét, ¶218.

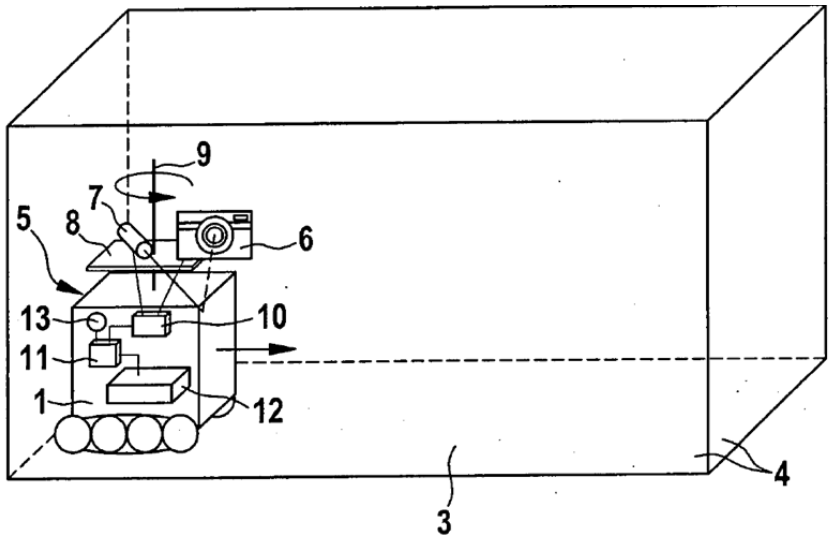


Fig. 1

b. 1[a]

Knoll discloses or suggests 1[a]. Janét, ¶¶219-220.

Knoll's robotic vehicle 1 (pool cleaning system) includes, among others, drive means 12 "for generating propulsion and for steering," control unit 11 that "controls the drive means," and "suction and/or filter and/or cleaning device." Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (below). A POSITA would have understood that Knoll's robotic vehicle includes a "vehicle body" containing these components. Janét, ¶220.

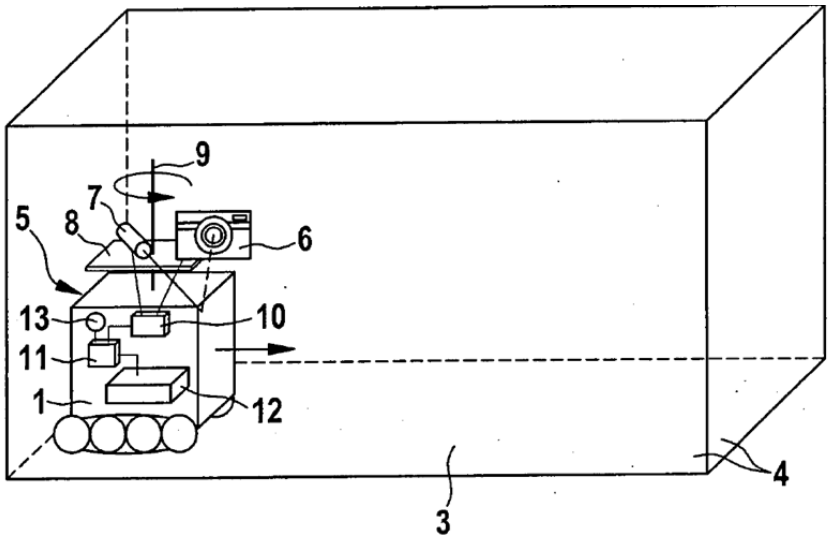


Fig. 1

c. 1[b]

Knoll discloses or suggests 1[b]. Janét, ¶¶221-224.

The format and content of 1[b] invokes §112(f)/¶6. As explained in §III.D, the function is "moving the vehicle body within the swimming pool," and the corresponding structures include wheels, rollers, tracks, other surface contacting members powered by a motor. EX1001, 3:33-45, 10:15-17, FIGS. 9-10; Janét, ¶222.

Knoll's FIG. 1 (annotated below) shows robotic vehicle 1 with **drive means 12** and **wheels** contacting the pool bottom surface.

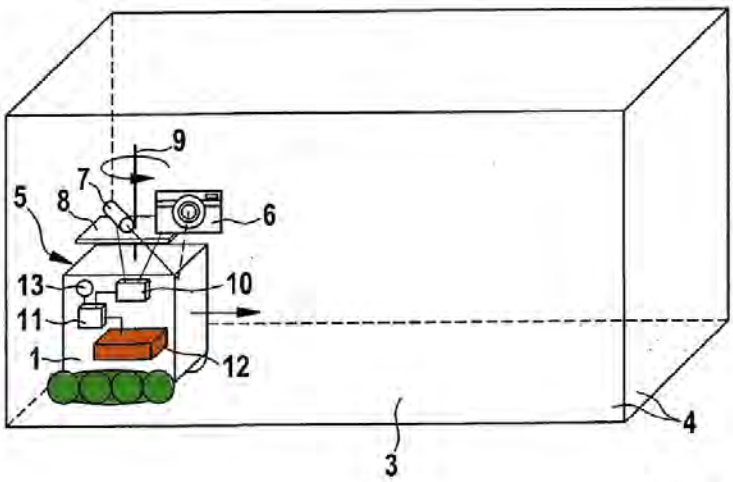


Fig. 1

Knoll describes that "drive means (12) for driving and steering the robotic vehicle (1)" are configured "for generating propulsion and for steering the robotic vehicle 1." Knoll, Abstract, Claims 1, 14, [0028]; Janét, ¶224. Knoll's drive means 12 and wheels constitute the claimed corresponding structure, because they would be powered by a motor to propel the vehicle body to travel on the pool's submerged surfaces. *See* EX1001, 3:33-39 (describing wheels that propel the vehicle "along the submerged pool surfaces" and are "powered by a motor"); Knoll, Abstract, Claims 1, 14, [0028], FIG. 1 (showing wheels); Janét, ¶224. Knoll's motor-powered wheel structure also performs the claimed function of "moving the vehicle body within the swimming pool." *Id.*

d. 1[c]

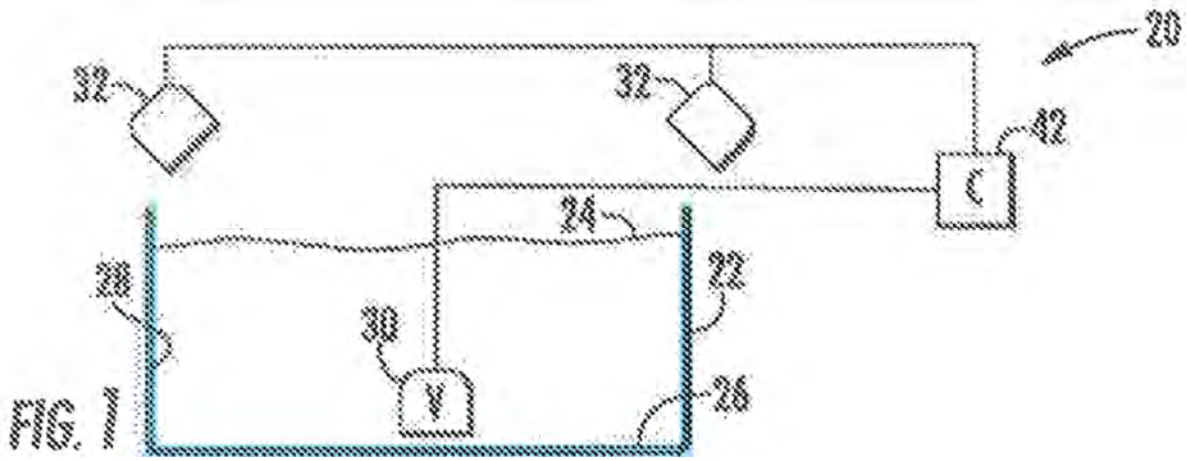
Knoll discloses or suggests 1[c]. Janét, ¶¶225-227.

Knoll discloses this limitation, because its pool cleaning robot includes "a filter device and/or suction device." Knoll, [0007], [0021]. Knoll describes its robot operates on "working area 3...formed by the bottom of the pool" and its control unit is "located inside the robotic vehicle in a **waterproof housing**." Knoll, [0008], [0027]. A POSITA would have understood that Knoll's filter device retains debris collected by its suction device from the submerged pool surface, because Knoll's robot operates on the bottom of the pool, and Knoll's filter device captures and retains debris while allowing clean water to pass through. Janét, ¶227.

e. 1[d]

Knoll discloses or suggests 1[d]. Janét, ¶¶228-233.

While the '207 Patent does not explicitly define "first object," it describes that "[i]n other implementations, cameras 32 merely capture images of **submerged surfaces 26, 28** of pool 22," which are the bottom and side walls of the pool. EX1001, 3:53-55; FIG. 1 (annotated below).



Similarly, Knoll teaches capturing images of substantially similar features by its **camera 6**—boundary surface 4 (and boundary lines) formed by pool walls that delimit "working area 3." Knoll, [0018], [0028], FIG. 1 (annotated below); Janét, ¶¶230-231.

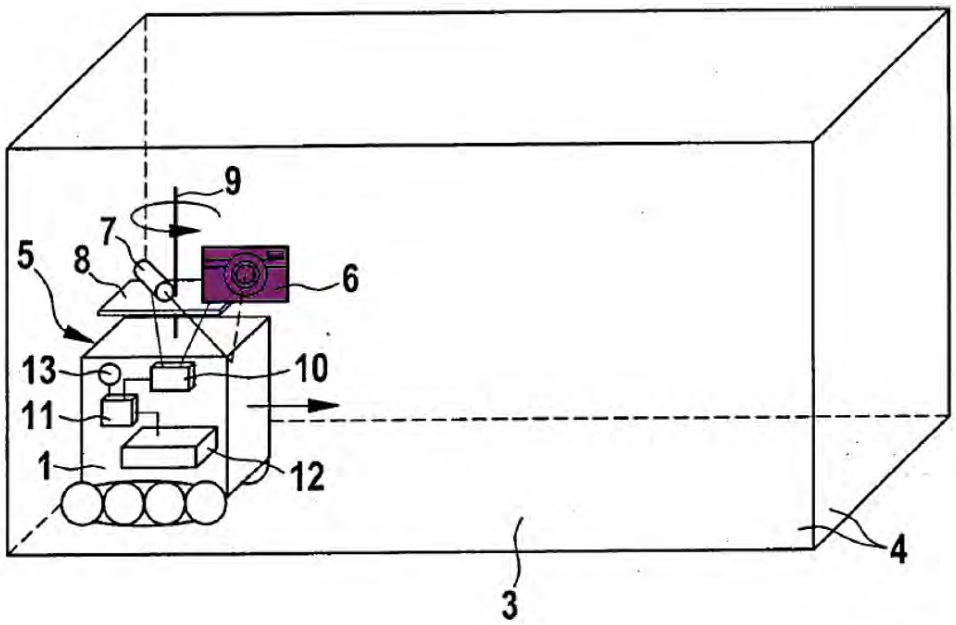


Fig. 1

Knoll describes that "a light beam is focused on the boundary line or boundary surface and **observed with a camera**," and explains that "the angle at which the light beam is **observed** changes and thus the position of **its image** on the camera's photo sensor changes" when the "distance of the boundary line or the boundary surface (measurement object) from the sensor (e.g., a camera) changes." Knoll, [0018]. Knoll explains that the boundary line/surface can be "arranged at a distance from the outer boundaries of the working area" and thus within the pool. Knoll,

[0007]. Knoll further describes a "digital camera" detecting "obstacles" (first object) when "the obstacles reflect the light beam into the digital camera." Knoll, [0015].

A POSITA would have understood that Knoll's camera captures images of the boundary line/surface or obstacle (first object) within the pool, because the "image" on the photo sensor of the camera includes the light reflected off the boundary line/surface or obstacle. Janét, ¶233.

f. 1[e][i]

Knoll discloses or suggests 1[e][i]. Janét, ¶¶234-237.

Knoll's control unit 11 constitutes a "controller," because it "has a controlling effect on the... drive means 12 for generating propulsion and for steering the robotic vehicle 1" and "automatically determine[s]" the vehicle's trajectory. Knoll, [0028]-[0029]; Janét, ¶235.

Control unit 11 (controller) is in electronic communication with camera 6, because, to calculate distance values from images captured on camera 6, control unit 11 would receive data from camera 6. Knoll, [0018], [0028] (describing its "distance-determining device uses the rotating light beam source and the rotating **camera** to determine the distance to the boundary line or boundary surface" and that the device includes "an **evaluation unit 10** for evaluating or determining the measured distance values," with "the evaluation unit 10 [being] part of a **control**

unit 11."), FIG. 1 (annotated below, illustrating **evaluation unit 10** (part of **control unit 11**) is connected to **camera 6** via a wire/cable); Janét, ¶¶236-237.

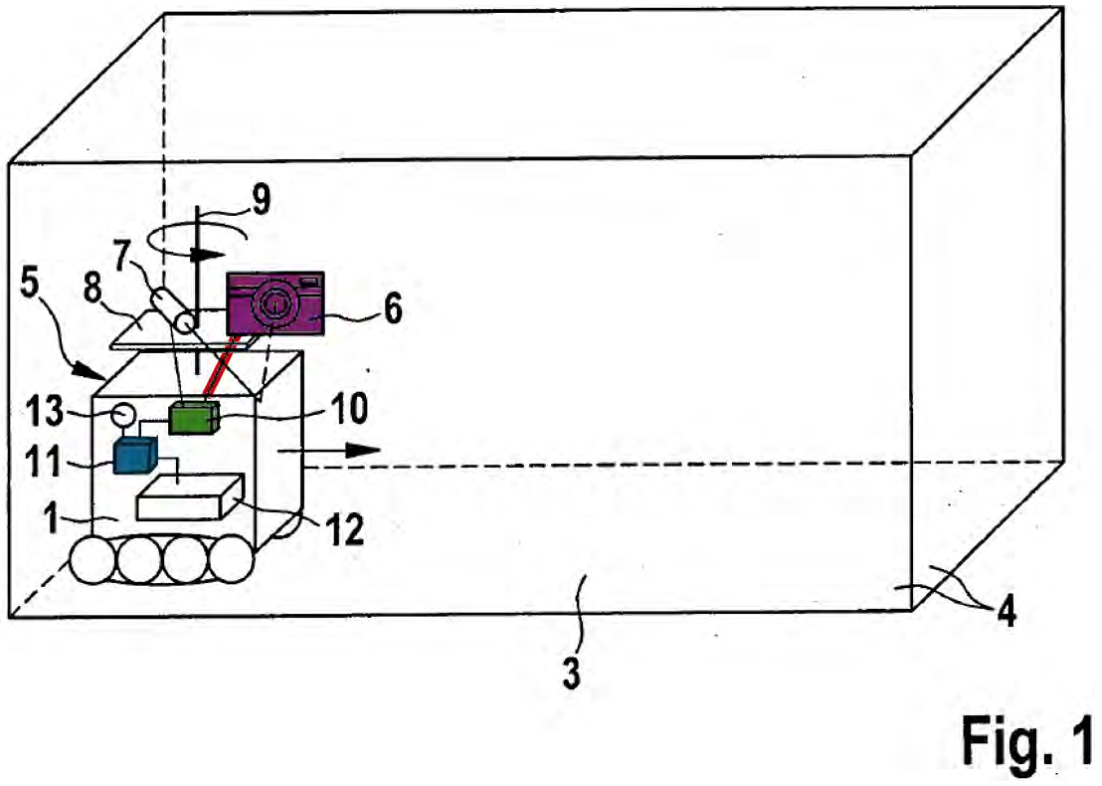


Fig. 1

g. 1[e][ii]

Knoll discloses or suggests 1[e][ii]. Janét, ¶¶238-242.

Knoll teaches that control unit 11 "controls the drive means 12 as a function of…determined smallest distance measurement values" to the boundary line or boundary surface. Knoll, [0028]. The "control signal" is generated "in response to the captured image" because, as explained in §IV.D.2.e (1[d]), the distance measurement values that form the basis for the control signal generation are derived

from **images captured by digital camera 6** observing the boundary surface (the first object). Janét, ¶239.

Knoll explains that the "trajectory for the robotic vehicle 1…was automatically determined by the control unit 11 on the basis of the determined distance to the boundary surface 4." Knoll, [0029], FIG. 2 (reproduced below).

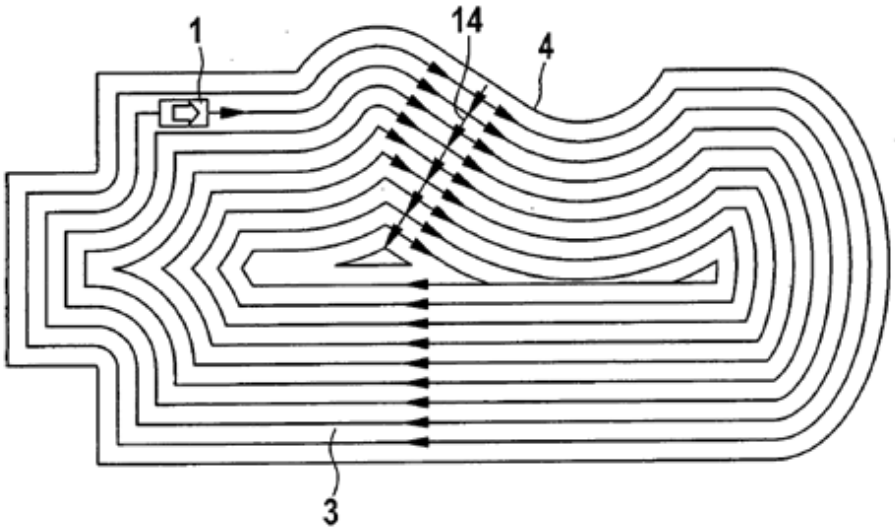


Fig. 2

A POSITA would have understood that the trajectory in Figure 2—comprising path segments following the contour of boundary line/surface 4 at different offsets—results from control unit 11's repeatedly adjusting drive means 12 (based on the measured distance, which is, in turn, determined using image data) to maintain an appropriate spacing from boundary line/surface 4. Knoll, [0029], FIG. 2; Janét, ¶241. A POSITA also would have understood that, to maintain that spacing from the boundary line/surface, Knoll's control unit 11 would generate drive-control

signals that adjust the vehicle movement based on the measured distance—causing the vehicle body to ***move away*** from the boundary line/surface (first object) when the measured distance becomes too small and ***toward*** the boundary line/surface when the measured distance becomes too large. *Id.* In this way, Knoll's control unit 11 is configured to generate, in response to the images captured by camera 6, control signals causing the vehicle movement to, or away from Knoll's boundary line/surface(first object). Janét, ¶241.

Additionally, Knoll teaches that its camera detects obstacles that "reflect the light beam into the digital camera," and the control unit is configured to cause the robot "to drive around the obstacle." Knoll, [0015]. A POSITA would have understood that to "drive around" a detected obstacle (first object), Knoll's control unit would generate signals causing the vehicle body to move ***away from*** the obstacle. Janét, ¶242.

3. Claim 2

Knoll discloses or suggests Claim 2. Janét, ¶¶244-263.

a. 2[pre]

Knoll discloses or suggests 2[pre]. Janét, ¶¶245-247.

Knoll discloses a pool cleaning system operating within a swimming pool, because it discloses "autonomous robotic vehicle 1 designed as a pool cleaning vehicle" with a **control unit 11**, **drive means 12**, and distance-determining device

5 comprising a **camera 6** that operates within a swimming pool. Knoll, [0027]-[0028], FIG. 1 (annotated below); *see also* §IV.D.2.a (1[pre]); Janét, ¶246.

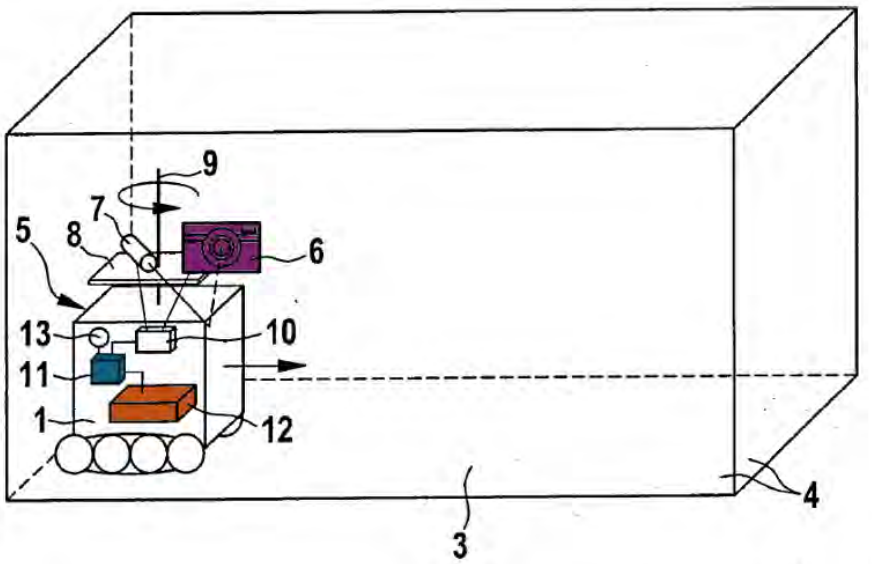


Fig. 1

b. 2[a]

Knoll discloses or suggests 2[a]. Janét, ¶¶248-249.

Knoll discloses an "autonomous robotic vehicle 1 designed as a pool cleaning vehicle" with "drive means (12)" that propel the vehicle under control of "control unit 11." Knoll, Abstract; [0027]-[0028], Claims 2, 4, 14, FIG. 1; *see also* §IV.D.2.a (1[pre]). A POSITA would have understood that Knoll's robotic vehicle (and/or various components thereof) is "equipment for a swimming pool" because it operates within the swimming pool to clean pool surfaces. Janét, ¶249.

c. 2[b]

Knoll discloses or suggests 2[b]. Janét, ¶¶250-251.

Knoll's robotic vehicle 1 includes camera 6 that captures images of the boundary line/surface (a portion of a location) of the swimming pool. Knoll, Claim 8, [0015], [0018], [0027]-[0028], FIG. 1.; *see also* §IV.D.2.e (1[d]).

d. 2[c][i]

Knoll discloses or suggests 2[c][i]. Janét, ¶¶252-255.

Knoll discloses **control unit 11** as a controller for robotic vehicle 1. Knoll, [0028], FIG. 1 (annotated below); Janét, ¶253; *see also* §§IV.D.2.a, IV.D.2.f (1[pre], 1[e][i]).

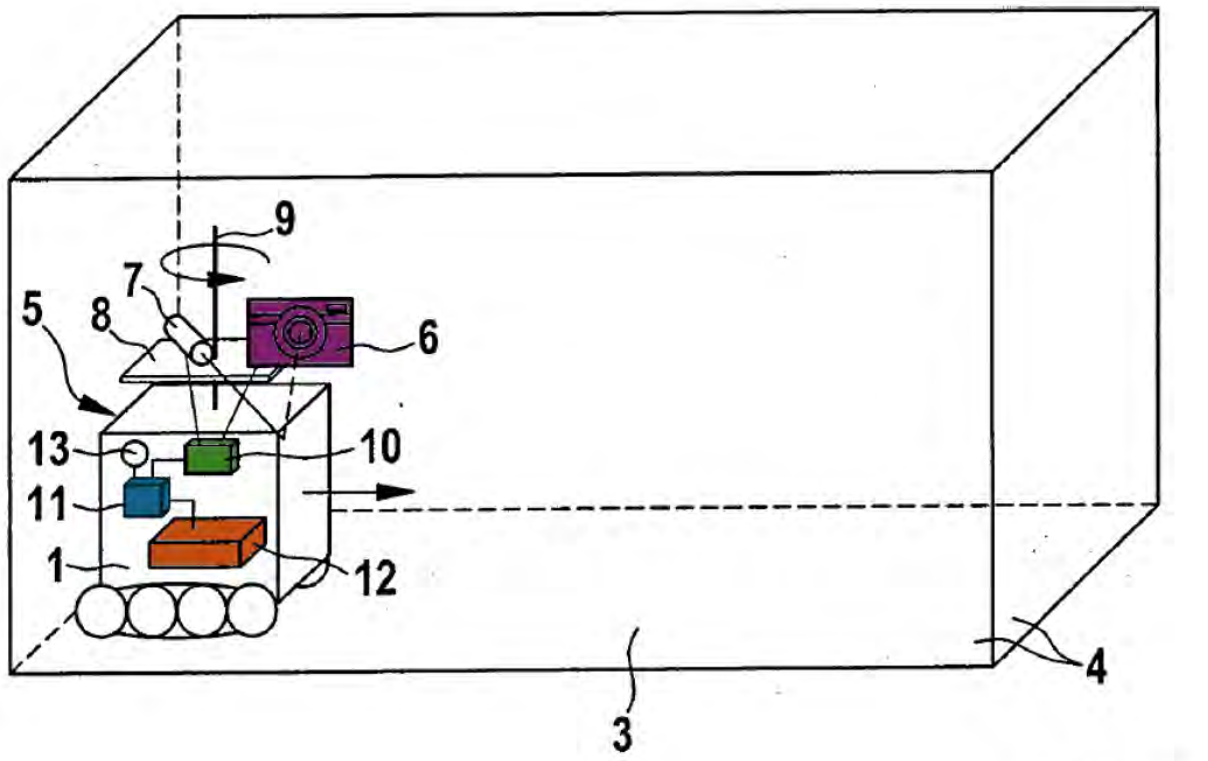


Fig. 1

Knoll's control unit controls **drive means 12** to move robotic vehicle 1 in the pool based on image-derived distance values. Knoll, [0028]-[0029], FIG. 2; Janét, ¶254; *see also* §§IV.D.2.a, IV.D.2.g (1[pre], 1[e][ii]). A POSITA would have understood that, to control drive means 12, control unit 11 would be in communication with drive means 12, and thus with vehicle 1 (equipment) because drive means 12 is part of the vehicle. Janét, ¶254.

Further, control unit 11 (controller) is in communication with **camera 6** to receive images. *See* §IV.D.2.f (1[e][i]).

e. 2[c][ii]

Knoll discloses or suggests 2[c][ii], because Knoll's controller receives images (visual data) from camera 6, and determines and generates control signal (control action) to control movement of vehicle 1 (equipment) based on the images. *See* §§IV.D.2.f-IV.D.2.g (1[e][i]-1[e][ii]); Janét, ¶¶256-263. Specifically, Knoll discloses a "control unit 11" acting as the claimed "controller" that exerts a controlling effect on the drive means 12 to automatically determine vehicle trajectory (Knoll, [0028]-[0029]). This controller is in electronic communication with digital camera 6 via an evaluation unit 10, which processes captured image data to calculate distances through triangulation by observing the position of reflected light on the camera's photo sensor ([0018], [0028], FIG. 1). Consequently, the controller generates control signals in response to these captured images to adjust

movement "to" or "away from" a first object (such as boundary surface 4 or a detected obstacle) to maintain a defined spacing or execute bypass maneuvers ([0015], [0028], [0029], FIG. 2). A POSITA would recognize this as a closed-loop feedback mechanism where image-derived distance values directly drive steering actuation to correct for navigation errors relative to objects within the pool. Janét, ¶¶256-263.

4. Claim 3

Claim 3 depends from Claim 2. Knoll discloses or suggests Claim 3. Janét, ¶¶264-267.

Knoll's robotic vehicle 1 (equipment) is "designed as a pool cleaning vehicle" with "drive means (12) for driving and steering the robotic vehicle (1)" that are "for generating propulsion and for steering." Knoll, [0027]-[0028], Abstract, Claims 1, 14, FIG. 1.

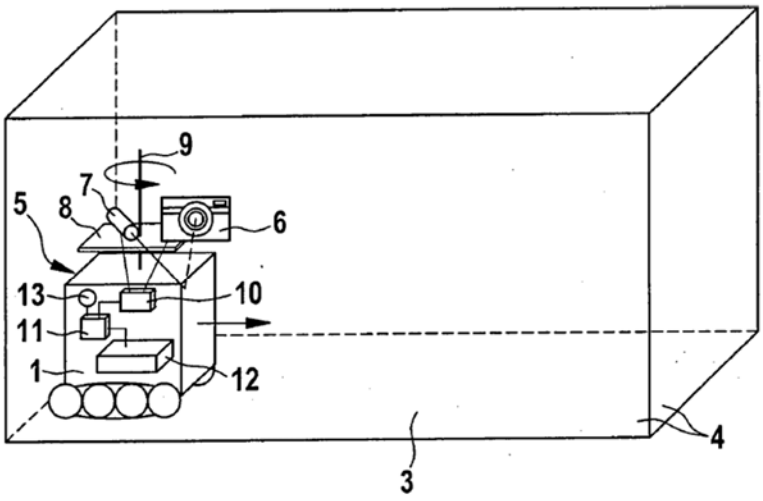


Fig. 1

The robotic vehicle includes "suction and/or filter and/or cleaning device" and operates on "working area 3...formed by the bottom of the pool" that is "delimited by four pool walls...forming a circumferential boundary surface 4." Knoll, [0027]-[0028], FIG. 1. A POSITA would have understood that Knoll's robotic vehicle comprises a "cleaning device with one or more propulsion mechanisms" because it includes suction/filter/cleaning devices and drive means configured for generating propulsion and steering. *Id.*; Janét, ¶266. A POSITA would have also understood that this cleaning device is "configured to travel adjacent to submerged or water-containing surfaces of the swimming pool" because it operates on the pool bottom and is controlled to maintain a defined distance from the pool walls (traveling adjacent to these surfaces), and these surfaces are submerged when the pool is filled with water (the normal operational environment for pools). *Id.* A POSITA would have further understood that the cleaning device "perform[s] a cleaning operation," because its suction/filter/cleaning devices remove debris from pool surfaces as it travels thereon. Janét, ¶266.

5. Claim 5

Claim 5 depends from Claim 2. Knoll discloses or suggests Claim 5. Janét, ¶¶268-270.

A POSITA would have understood Knoll's **camera 6** mounted on the vehicle (equipment) because it is "arranged on a **mounting plate 8**" attached to the vehicle body. Knoll, [0028], FIG. 1 (annotated below); Janét, ¶269.

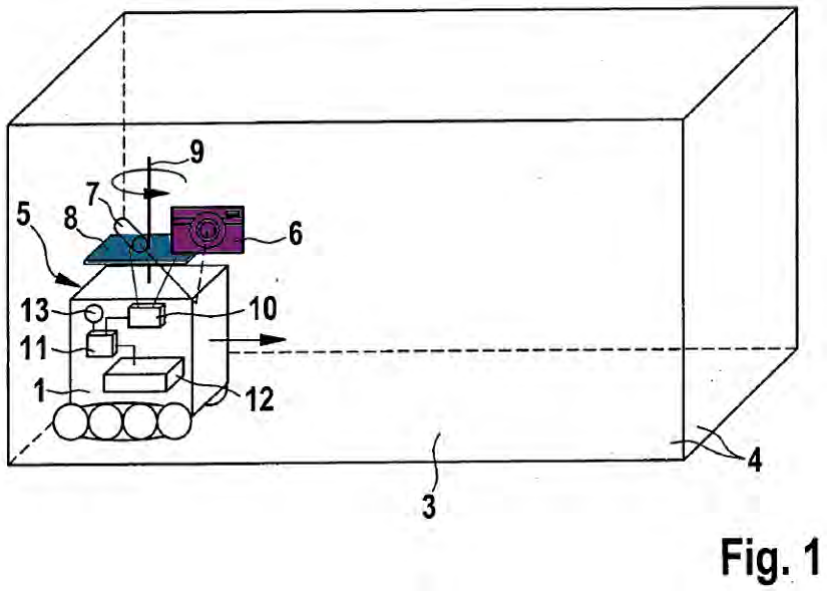


Fig. 1

6. Claim 6

Claim 6 depends from Claim 2. Knoll discloses or suggests Claim 6. Janét, ¶¶271-274.

Knoll's pool cleaning vehicle operates within the swimming pool to clean pool surfaces. *See* Knoll, [0027], [0021]; Janét, ¶272; *see also* §IV.D.3.b (2[a]). Camera 6 is mounted on robotic vehicle 1, which operates on "working area

3...formed by the **bottom of the pool**." Knoll, [0027], FIG.1; *see also* §IV.D.5 (Claim 5).

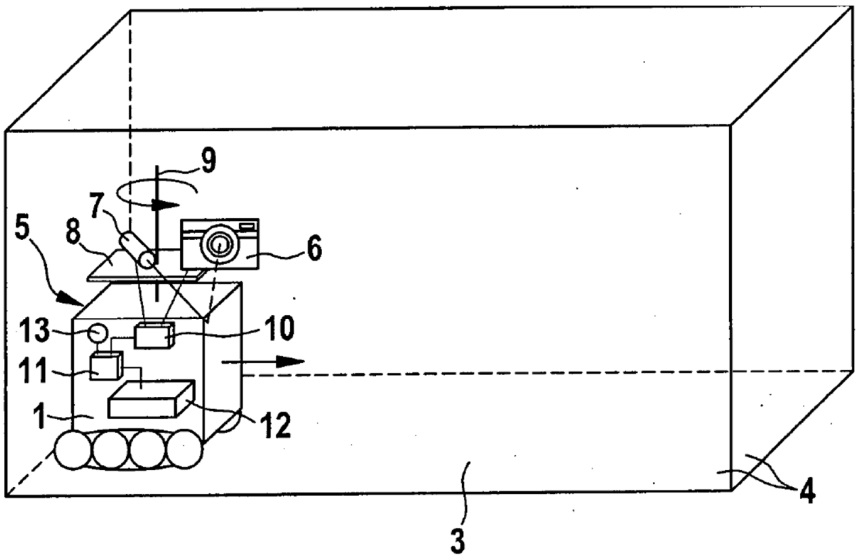


Fig. 1

A POSITA would have understood that Knoll's camera 6 is "submergible or submerged within the swimming pool" because the camera is mounted on robotic vehicle 1, which is submerged in a pool filled with water (the normal operational environment for pool cleaning devices). Janét, ¶273.

7. Claim 7

Claim 7 depends from Claim 2. Knoll discloses or suggests Claim 7. Janét, ¶¶275-277.

Knoll describes that control unit 11 (controller) **detects** presence of an obstacle (characteristic) within the working area 3 "formed by the bottom of the pool" (location) based on a captured image (visual data) and **controls** movement of vehicle

1 (equipment) based on the detected characteristic—to bypass the obstacle. *See* Knoll, [0015], [0028]. Janét, ¶276; *see also* §§IV.D.2.e-IV.D.2.g, IV.D.3.c-IV.D.3.e (1[d]-1[e][ii], 2[b]-2[c][ii]).

8. Claim 12

Knoll discloses or suggests Claim 12. Janét, ¶¶278-287.

a. 12[pre]

Knoll discloses or suggests 12[pre]. Janét, ¶¶279-281.

Knoll discloses an autonomous robotic pool cleaning system that includes a control unit processing visual date from a digital camera to detect and measure distance to boundary line/surface and/or obstacles for navigation and control. *See* Knoll, Abstract, [0027]-[0028], Claims 1-2, FIGS. 1-2; Janét, ¶280; *see also* §§IV.D.2.g and IV.D.3.d (1[e][ii]&2[c][i]).

A POSITA would have understood that Knoll's system performs the claimed method for "monitoring a pool system," because Knoll's system observes and detects swimming pool environment—specifically, the pool's boundary surfaces/lines and obstacles—to control the robot's navigation and perform its pool cleaning operations. *See, e.g.*, Knoll, [0027]-[0028]; Janét, ¶281.

b. 12[a]

Knoll discloses or suggests 12[a]. Janét, ¶¶282-283.

Knoll's control unit 11 (controller) receives visual data (images) of boundary surfaces/lines and/or obstacles from digital camera 6. *See* Knoll, [0028], FIG. 1; Janét, ¶283; *see also* §IV.D.3.d (2[c][i]). A POSITA would have understood that the visual data is "images of at least a portion of a location including a swimming pool," because the camera captures images of the boundary line/surface of the working area or obstacles within the pool. Knoll, [0018], [0027]-[0028], FIG. 1; Janét, ¶283; *see also* §IV.D.3.c (2[b]).

c. 12[b]

Knoll discloses or suggests 12[b]. Janét, ¶¶284-285.

Knoll's control unit 11 receives images from camera 6, detects presence of an obstacle (characteristic) in an area within working area 3 based on the images, and based on this detected obstacle presence, controls vehicle 1 to bypass or "drive around the obstacle at a constant distance" in that specific area. Knoll, [0015]; Janét, ¶285; *see also* §§IV.D.2.e-IV.D.2.g, IV.D.3.c-IV.D.3.e, IV.D.7 (1[d]-1[e][ii], 2[b]-2[c][ii], Claim 7). A POSITA would have understood or found it obvious that Knoll's system determines the area containing the obstacle as a "target area," because its control action (to cause bypassing motion) is applied with respect to the specific area where an obstacle is detected. Janét, ¶285.

d. 12[c]

Knoll discloses or suggests 12[c]. Janét, ¶¶286-287.

Knoll's control unit 11 detects obstacle presence (characteristic) and generates control signals that control drive means 12 (part of vehicle 1) to steer vehicle 1 to bypass or "drive around the obstacle." Knoll, [0015], [0028]; ***see also*** §§IV.D.3.e&IV.D.7 (2[c][ii], Claim 7). A POSITA would have understood that Knoll's control signals to control vehicle 1 constitute "a control response" generated "based on the detected characteristic" (obstacle presence) of the target area (the area where the obstacle is located). Janét, ¶287.

9. Claim 14

Claim 14 depends from Claim 12. Knoll discloses or suggests Claim 14. Janét, ¶¶288-290.

Knoll's control unit 11 generates the control response by controlling the operation of drive means 12 (part of robotic vehicle 1 (equipment)) to steer robotic vehicle 1 based on the detected presence of an obstacle. ***See*** Knoll, [0015], [0028], FIG. 1; Janét, ¶289; ***see also*** §§IV.D.3.e, IV.D.8.d (2[c][ii], 12[c]).

10. Claim 19

Claim 19 depends from Claim 12. Knoll discloses or suggests Claim 19. Janét, ¶¶291-297.

a. 19[a]

Knoll discloses or suggests 19[a]. Janét, ¶¶292-294.

Knoll's control unit 11 generates the control response by controlling drive means 12 to steer robotic vehicle 1 (cleaning device). *See* Knoll, [0028], [0011], [0015]; Janét, ¶293; *see also* §§IV.D.3.e, IV.D.8.d, IV.D.9 (2[c][ii], 12[c], Claim 14).

Knoll's robotic vehicle 1 is a cleaning device with propulsion mechanisms (drive means) configured to operate on the pool bottom and maintain a distance from the boundary surface 4 (and boundary lines) formed by or on pool walls (travel adjacent to submerged or water-containing surfaces of the swimming pool), and to remove debris from pool surfaces with its suction/filter/cleaning devices (perform a cleaning operation). *See* Knoll, [0007], [0011], [0015], [0021], [0027]-[0028], FIGS. 1-2; Janét, ¶294; *see also* §IV.D.4 (Claim 3).

b. 19[b]

Knoll discloses or suggests 19[b]. Janét, ¶¶295-297.

Knoll's control unit 11 controls drive means 12 to steer vehicle 1 (controlling a path or route of the cleaning device) based on detected presence of an obstacle. *See* Knoll, [0015], [0028]; Janét, ¶296; *see also* §IV.D.8.d, IV.D.9 (12[c], Claim 14).

E. Ground 2B: Claims 7, 8, 12-14, and 19 are Unpatentable over Knoll and Fu-007

Claims 7, 8, 12-14, 19, and 20 are unpatentable over Knoll and Fu-007. Janét, ¶¶298-349.

1. Motivation to Combine

Both Knoll and Fu-007 disclose autonomous underwater pool cleaning robots using cameras and controllers to perform cleaning operations. *See, e.g.*, Knoll, Abstract, [0027]-[0028], FIG. 1; Fu-007, Abstract, pp.8-9, 12-14, Claim 4, FIG. 6; Janét, ¶299. A POSITA would have been motivated to combine the complementary teachings of Knoll and Fu-007 to achieve improved autonomous pool cleaning systems. Janét, ¶299.

A POSITA would have recognized that the teachings in Knoll and Fu-007 are directed to the same pool cleaning technical field, address similar technical challenges, and provide complementary technical solutions. Janét, ¶300. Specifically, both use a controller to process captured images and generate control signals to cause movement of the pool cleaning robot within the swimming pool. *Compare* Knoll, [0015], [0028], FIG. 1, *with* Fu-007, pp.10, 12-16, Claims 4, 7, FIG.6. Additionally, both teach motorized drive mechanisms to cause and control movement of the pool cleaner during operation. *Compare* Knoll, Abstract, [0028], Claim 1, *with* Fu-007, pp.8-10, 12-16, Claims 1, 3-4. Accordingly, a POSITA would have investigated the technical teachings in both Knoll and Fu-007 to seek guidance when designing pool cleaning systems. Janét, ¶¶301-302.

Knoll uses camera-based distance measurement (via triangulation) for navigation and obstacle avoidance. Knoll, [0015], [0018]. Fu-007 employs

threshold-based cleanliness control by determining "a cleanliness level of the bottom of the swimming pool by comparing the image(s) with [a swimming pool cleanliness image] threshold" and operating "the four cleaning drive wheels...to complete the cleaning task." Fu-007, pp.10, 14-16, Claim 7. These represent complementary approaches—Knoll providing navigation control and Fu-007 providing cleaning intensity control—that a POSITA would have combined. Janét, ¶¶303-305.

Knoll's camera 6 acquires images of boundary surface 4 for distance measurement. Knoll, [0015], [0018], [0028], FIG. 1. A POSITA would have recognized that images captured by Knoll's camera contain visual information about pool surfaces. A POSITA seeking to improve Knoll's cleaning effectiveness would have been motivated to add Fu-007's cleanliness detection and threshold-based control functionalities for the following reasons. Janét, ¶¶306-308.

First, this modification would have advanced Knoll's stated goal to achieve "complete and efficient cleaning of a pool floor and/or the pool walls." Knoll, [0007]; Janét, ¶309. A POSITA would have recognized that with Fu-007's cleanliness-based control, Knoll's system would apply more aggressive cleaning to dirtier areas and lighter cleaning to cleaner areas, thereby improving cleaning effectiveness by adapting operations based on actual surface conditions. Janét, ¶309.

Second, Fu-007 teaches that its system achieves "energy conservation, economical efficiency" by adjusting operating conditions based on detected

cleanliness (Fu-007, Abstract, p.11), and a POSITA would have been motivated to add Fu-007's functionalities to provide these benefits to Knoll's robotic vehicle. Janét, ¶310. This modification would also extend operational run-time and reduce wear on mechanical components. Janét, ¶310.

A POSITA would have had a reasonable expectation of success, because both references employ similar camera-based systems in the same pool operational environment, e.g., cameras capturing images of pool surfaces, controllers processing captured images, and motor drivers controlling drive mechanisms based on controller outputs. Knoll, [0015], [0028], FIG. 1; Fu-007, pp.8-10, 14-16, Claim 7, FIG. 6. Adding Fu-007's threshold comparison logic to Knoll's existing image processing would have been a routine software modification within ordinary skill. Janét, ¶¶311-317.

2. Claim 7

Claim 7 depends from Claim 2. Alternative to §IV.D.7, the Knoll-Fu-007 combination discloses or suggests Claim 7. Janét, ¶¶318-323.

Knoll discloses control unit 11 (controller) that processes visual data from camera 6. *See* Knoll, [0028], [0018], FIG. 1; *see also* §§IV.D.2.f-g (1[e][i]-[ii]).

Fu-007 teaches using "monitoring camera 2" to capture images of pool surfaces and determining "a cleanliness level of the bottom of the swimming pool" (characteristic of the location) "by comparing the image(s)" to "a swimming pool

cleanliness image threshold." Fu-007, pp.10, 14-16, Claim 7, FIG. 6; Janét, ¶320; *see also* §IV.B.1 (Cui-Fu-007, 8[b]).

As explained in §IV.E.1, a POSITA would have been motivated to combine the teachings of Knoll and Fu-007. Janét, ¶321. In the combined system, Knoll's robotic vehicle 1 would operate with control unit 11 processing images from camera 6 for dual purposes: (1) distance measurement for navigation (per Knoll), and (2) cleanliness detection (per Fu-007). *See* Knoll, [0015], [0018], [0028]; Fu-007, pp.10, 14-16; Janét, ¶321. Knoll's control unit 11 would determine the robot's position relative to boundary line/surface 4 (using Knoll's triangulation method) and also determine cleanliness levels of pool surfaces in the captured images (using Fu-007's threshold comparison method). *Id.* Based on detected cleanliness levels (characteristic) of pool surfaces (location), control unit 11 would control operating conditions of drive means 12 of vehicle 1 (equipment), implementing Fu-007's teaching of varying "rotational speed of each wheel" and adjusting cleaning intensity based on pool surface cleanliness. Fu-007, pp.14-16; Knoll, [0028]; Janét, ¶321. As such, areas with higher debris levels would receive more aggressive cleaning, while already-clean areas would receive lighter treatment. *Id.*

As explained in §IV.E.1, a POSITA would have reasonably expected success in combining Knoll with Fu-007, because applying Fu-007's control logic to Knoll's

existing hardware would be a routine software programming modification to Knoll's existing controller. Janét, ¶322.

3. Claim 8

Claim 8 depends from Claim 7. Knoll-Fu-007 combination discloses or suggests Claim 8. Janét, ¶¶324-329.

a. 8[a]

The Knoll-Fu-007 combination discloses or suggests 8[a]. Janét, ¶325. Specifically, as explained in §IV.E.1 (Claim 7), the Knoll-Fu-007 combination would detect a cleanliness (characteristic) of "the bottom of the swimming pool." Fu-007, pp.10, 14-16, Claims 7; Janét, ¶325; *see also* §IV.B.1 (Cui-Fu-007, 8[b]).

b. 8[b]

The Knoll-Fu-007 combination discloses or suggests 8[b]. Janét, ¶¶326-329.

Fu-007 teaches using "monitoring camera 2" to capture images of pool surfaces and determining "a cleanliness level of the bottom of the swimming pool" (characteristic of the location) "by comparing the image(s)" to "a swimming pool cleanliness image threshold." Fu-007, pp.10, 14-16, Claim 7; Janét, ¶327; *see also* §IV.B.1 (Cui-Fu-007, 8[b]).

As explained in §§IV.E.1&IV.E.1 (Knoll-Fu-007, Claim 7), with a reasonable expectation of success, a POSITA would have been motivated to add Fu-007's functionalities into Knoll's controller 11, allowing the modified controller 11 to be

configured to control operating conditions of drive means 12 of vehicle 1 (equipment) to vary "rotational speed of each wheel" and adjust cleaning intensity based on the detected cleanliness being outside of the "cleanliness image threshold." Fu-007, pp.10, 12-16; Knoll, [0028]; Janét, ¶328.

4. Claim 12

Knoll, in view of Fu-007, discloses or suggests Claim 12. Janét, ¶¶330-337. As explained in §IV.E.1, a POSITA would have been motivated to combine Knoll and Fu-007, with a reasonable expectation of success.

a. 12[pre]

Knoll discloses or suggests 12[pre]. *See* §IV.D.8.a (Knoll, 12[pre]).

b. 12[a]

Knoll discloses or suggests 12[a]. *See* §IV.D.8.b (Knoll, 12[a]).

c. 12[b]

The Knoll-Fu-007 combination discloses or suggests 12[b]. Janét, ¶¶333-334.

As explained in §§IV.E.1-3, the Knoll-Fu-007 combination's control unit 11 receives images from camera 6, detects cleanliness levels (characteristic) of pool surface areas based on the images by comparing them to a threshold, and based on this detected cleanliness, controls drive means 12 to adjust cleaning intensity (e.g., motor speed) in the specific areas. Fu-007, pp.10, 12-16; Knoll, [0028]; Janét, ¶334.

A POSITA would have understood or found it obvious that the Knoll-Fu-007 system would determine an area that contains the debris as a "target area" because it was the area being sensed by the camera for purposes of, among other things, detecting cleanliness levels. Janét, ¶334.

d. 12[c]

The Knoll-Fu-007 discloses or suggests 12[c]. Janét, ¶¶335-337.

As explained in §§IV.E.1-3, the Knoll-Fu-007 combination's control unit 11 detects cleanliness levels (characteristic) and generates control signals that control drive means 12 (part of vehicle 1) of vehicle 1 to adjust wheel speeds and cleaning intensity based on detected cleanliness levels. Fu-007, pp.10, 12-16; Knoll, [0028]; Janét, ¶336. A POSITA would have understood that the Knoll-Fu-007 combination's control signals that control drive means 12 of vehicle 1 are "a control response" that is generated "based on the detected characteristic" (cleanliness level) of the target area (the determined specific pool surface area where the cleanliness is detected). Janét, ¶336.

5. Claim 13

Claim 13 depends from Claim 12. The Knoll-Fu-007 combination discloses or suggests claim 13. Janét, ¶¶338-341. As explained in §IV.E.1, a POSITA would have been motivated to combine Knoll and Fu-007, with a reasonable expectation of success. *Id.*

a. 13[a]

As explained in §IV.E.4.c (12[b]), the Knoll-Fu-007 combination teaches or suggests determining a target area of the pool for sensing of cleanliness of "the **bottom** of the swimming pool." Fu-007, pp.10, 14-16, Claim 7; Janét, ¶339; *see also* §§IV.E.2-3 (Knoll-Fu-007, Claims 7-8). Thus, Knoll-Fu-007 combination teaches or suggests the target area comprises a portion of a surface (bottom) of the swimming pool. Janét, ¶339.

b. 13[b]

The Knoll-Fu-007 combination discloses or suggests 13[b], because as explained in §IV.E.4.c (12[b]), the Knoll-Fu-007 combination detects a cleanliness level (characteristic) of the bottom (portion of the surface) of the swimming pool. Fu-007, pp.10, 14-16, Claim 7; Janét, ¶340; *see also* §§IV.E.2-3 (Claims 7-8).

6. Claim 14

Claim 14 depends from Claim 12. The Knoll-Fu-007 combination discloses or suggests Claim 14. Janét, ¶¶342-343. As explained in §IV.E.1, a POSITA would have been motivated to combine Knoll and Fu-007, with a reasonable expectation of success. Specifically, Knoll's robotic vehicle 1 constitutes the "piece of equipment" for the swimming pool. Janét, ¶342; *see also* §IV.D.3.b (2[a]). Further, as explained above, a POSITA would have been motivated to add Fu-007's functionalities to Knoll's control unit 11 to Fu-007, thus generating a control response that controls

the operation of drive means 12 (part of robotic vehicle 1) to move robotic vehicle 1 based on the detected cleanliness levels. Fu-007, pp.10, 12-16, Claim 7; Knoll, [0028]; Janét, ¶342; *see also* §IV.E.4.d (12[c]).

7. Claim 19

Claim 19 depends from Claim 12. The Knoll-Fu-007 combination discloses or suggests Claim 19. Janét, ¶¶344-349. As explained in §IV.E.1, a POSITA would have been motivated to combine Knoll and Fu-007, with a reasonable expectation of success. *Id.*

a. 19[a]

The Knoll-Fu-007 combination discloses or suggests 19[a]. Janét, ¶¶345-346.

As explained above, the Knoll-Fu-007 combination's control unit 11 generates the control response by controlling the drive means 12, which move and steer robotic vehicle 1 (cleaning device), which is "a cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation." Fu-007, pp.10, 12-16, Claim 7; Knoll, [0028]; Janét, ¶346; *see also* §§IV.E.4.d, IV.E.6 (Knoll-Fu-007, 12[c], Claim 14), §§IV.D.4, IV.D.10.b (Knoll, Claim 3, 19[b]).

b. 19[b]

The Knoll-Fu-007 combination discloses or suggests 19[b]. Janét, ¶¶347-349.

As explained above, the Knoll-Fu-007 combination's control unit 11 controls drive means 12 to adjust wheel speeds and cleaning intensity of robotic vehicle 1 based on detected cleanliness levels. Fu-007, pp.10-11, 15; Knoll, [0028]; Janét, ¶348; *see also* §§IV.E.4.d, IV.E.6 (Knoll-Fu-007, 12[c], Claim 14). Specifically, Fu-007 teaches that "the rotational speed of each wheel 3 is adjustable" and "[t]hrough different wheel speed combinations, cleaning actions with different cleaning intensities can be implemented," thereby varying mechanical cleaning force based on detected surface conditions. Fu-007, pp.10, 14-16, Claim 7; Janét, ¶348. This constitutes controlling both the speed of the cleaning device (through adjustable wheel speeds) and the aggressiveness of mechanical cleaning (through variable cleaning intensities) as claimed. Janét, ¶348.

F. Ground 2C: Claims 10 and 17 are Unpatentable over Knoll, Fu-007, and Hsu

1. Motivation to Combine

Knoll, Fu-007, and Hsu all disclose autonomous cleaning robots using cameras and controllers to perform cleaning operations with user monitoring and control capabilities. Janét, ¶350. The Knoll-Fu-007 combination provides a pool cleaning robot with camera-based navigation (Knoll) and wireless communication capability via Fu-007's control signal buoyant antenna 27 that "floats on a water surface to wirelessly communicate" with control keyboard 31. Knoll, [0015], [0028];

Fu-007, pp.8-16, Claims 4-5, 7, FIG. 8; §IV.E.1; Janét, ¶351. Hsu provides a display interface showing a map that is "updated dynamically" and "can be transmitted to the display screen on an external electronic device," where users can interact with the map to control the robot. Hsu, [0018]-[0022], [0033]-[0034], Claims 3, 6-8, 12, 15-16, FIGS. 1-5; §IV.C.1. A POSITA would have been motivated to combine the complementary teachings of Knoll-Fu-007 and Hsu to achieve improved visual monitoring and user control of cleaning operations. Janét, ¶353.

A POSITA would have been motivated to apply Hsu's camera-based map construction, remote display, and user interaction functionalities to the Knoll-Fu-007 combination. Janét, ¶¶354-357. First, this modification would have advanced Knoll's stated goal to achieve "complete and efficient cleaning of a pool floor and/or the pool walls," with the working area being "optimized and/or completely covered." Knoll, [0007]; Janét, ¶355. A POSITA would have recognized that adding Hsu's remote map display would enable users to verify that Knoll's "complete" coverage is being achieved by visually monitoring the robot's location and progress. Janét, ¶357.

Second, a POSITA would have been motivated to make such modification to provide users with remote monitoring and control. Janét, ¶¶358-361. Hsu teaches that the map "can be transmitted to the display screen on an external electronic device 130," and that users can interact with the display to control the robot. Hsu,

[0019], [0021], Claims 7, 16, 20, FIGS. 4-5. Fu-007 similarly teaches remote user control via control keyboard 31 "to directly or indirectly control the underwater cleaning robot." Fu-007, pp.8-10, 14, Claim 5. A POSITA would have recognized that combining Hsu's graphical map display with Fu-007's user control functionality would allow users to both monitor cleaning progress and send control commands from a remote device. Janét, ¶361.

A POSITA would have reasonably expected success, because the Knoll-Fu-007 combination already has the necessary components: camera 6 capturing images of pool surfaces (Knoll), control unit 11 with image processing capabilities (Knoll), and wireless communication with a user control interface (Fu-007's antenna 27 and control keyboard 31). Knoll, [0015], [0028]; Fu-007, pp.9-10, 14; Janét, ¶¶362-370. The modification would involve routine software changes to implement Hsu's camera-based map construction and transmit the map to external devices for display and user interaction—a straightforward task yielding predictable results. *Id.*

2. Claim 10

Claim 10 depends from Claim 2. The combination of Knoll, Fu-007, and Hsu discloses or suggests Claim 10. Janét, ¶¶371-378.

Knoll teaches that control unit 11 (controller) receives images (visual data) from camera 6. Knoll, [0018], [0028], FIG. 1. Control unit 11 processes images from

camera 6 for distance measurement, obstacle detection, and navigation control. Knoll, [0015], [0018], [0028], FIG.1; Janét, ¶372; §§IV.D.2.f-IV.D.2.g, IV.D.3.d (1[e][i]-1[e][ii], 2[c][i]-2[c][ii]).

As explained in §IV.B.1, Fu-007 teaches wireless communication via control signal buoyant antenna 27 that "floats on a water surface to wirelessly communicate." Fu-007, pp.8-10, 12-16, Claims 4-5, 7, FIG. 8.

As explained in §IV.C.1, Hsu teaches that a map is constructed and "updated dynamically…based on the real-time working environment information," and "can be transmitted to the display screen on an external electronic device 130 [e.g., a PDA]." Hsu, Abstract, [0018]-[0021], [0024], [0033]-[0034], Claims 3, 6-9, 12, 15-16, FIGS. 1-5. Hsu also teaches that the dynamically updated map reflects "real-time working environment information" including detected obstacles. Hsu, [0020].

As explained in §IV.F.1, a POSITA would have been motivated to combine Knoll, Fu-007, and Hsu with a reasonable expectation of success. Janét, ¶375. In the combined system, Knoll's control unit 11 would receive images from camera 6 (visual data), construct a graphical map (graphical depiction; per Hsu) showing working area 3, boundary surface 4, robot position, and detected obstacles based on the camera images, and transmit this graphical map via Fu-007's wireless communication system to external electronic device 130 (remote device; per Hsu) for display. Knoll, [0015], [0018], [0028]; Hsu, [0018]-[0021], Claims 7, 16, FIGS.

1-4; Fu-007, pp.9-10, 14, Claim 4, FIG. 8; Janét, ¶375. The map would be updated dynamically as robot 1 moves and camera 6 captures images during cleaning operations. Hsu, [0020], [0033]-[0034], Claims 3, 6, 8-9, 12, 15-16; Janét, ¶375.

Hsu's external electronic devices 130/130a constitute "remote device" as claimed. Hsu, [0021], FIG. 4; Janét, ¶376. A POSITA would have understood that presenting the graphical map on the remote device display constitutes the "control action" based on visual data from camera 6, as recited in Claim 10. Janét, ¶376.

As explained in IV.F.1, a POSITA would have reasonably expected success in make such modification. Janét, ¶377.

3. Claim 17

Claim 17 depends from Claim 12. The Knoll-Fu-007-Hsu combination discloses or suggests Claim 17. Janét, ¶¶379-392.

a. 17[a]

The Knoll-Fu-007-Hsu combination discloses or suggests 17[a]. Janét, ¶¶380-384. As explained in §IV.F.1, a POSITA would have been motivated to combine Knoll, Fu-007, and Hsu with a reasonable expectation of success.

As explained in §IV.F.1 (Claim 10), the combined system displays a dynamically updated map of the working area on an external electronic device (remote device). Additionally, Hsu teaches that this remote interface allows users to

actively "set a working boundary" on the display screen and control the robot through electronic device 130. Hsu, [0019], [0021]; Janét, ¶382.

A POSITA would have understood that displaying this interactive map on the remote device constitutes "prompting a user," because the interface presents the user with the current status (e.g., robot position, existing boundaries) and provides the option to modify boundaries or control the robot, thereby soliciting user engagement and inviting a control decision. Janét, ¶383. Thus, the act of generating the display with these interactive boundary-setting options on a remote device serves as the control response that prompts the user on that device. *Id*.

As explained in IV.F.1, a POSITA would have reasonably expected success in make such modification. Janét, ¶384.

b. 17[b]

The Knoll-Fu-007-Hsu combination discloses or suggests 17[b]. Janét, ¶¶385-392.

Knoll teaches that "a boundary line and/or boundary surface within the meaning of the invention is not necessarily to be understood as a line or surface directly delimiting the working area," but rather "it is also possible to realize an embodiment in which the boundary line and/or the boundary surface is/are arranged at a distance from the outer boundaries of the working area." Knoll, [0007]. ***See also***

§IV.D.1. Thus, Knoll contemplates user-defined working boundaries that can be set within the pool area, not just following physical pool walls. Janét, ¶386.

Fu-007 discloses "control signal buoyant antenna 27" that "floats on a water surface to wirelessly communicate with the control keyboard 31." Fu-007, pp.8-10, 12-16, Claims 4-5, 7, FIG. 8. Fu-007 further teaches that "a control signal is sent by manual operation using the control keyboard, to directly or indirectly control the underwater cleaning robot via the control signal buoyant antenna." Fu-007, pp.8-10, 14, Claim 5; §IV.B.1.

Hsu teaches that "users can set a working boundary for the autonomous robot 1 on the display screen on the electronic device 130" and that "autonomous robot 1...can be controlled remotely such that users can assign a working zone for the autonomous robot 1 or control the autonomous robot 1 through the electronic device 130...via the communication platform 110." Hsu, [0021], FIG. 4; §IV.C.1.

In the Knoll-Fu-007-Hsu combination, users would provide control input by setting a working boundary on external electronic device 130 (remote device), defining the working zone for Knoll's robotic vehicle 1 to clean. Hsu, [0021]; Janét, ¶389. This control input would be transmitted via Hsu's communication platform 110 and Fu-007's wireless communication system (buoyant antenna 27) to Knoll's control unit 11, which would then control robotic vehicle 1 (equipment) to operate within the user-defined working zone. Hsu, [0021]; Fu-007, pp.9-10, 14, FIG. 8;

Knoll, [0027]-[0028]; Janét, ¶389. This constitutes "receiving a control input from the user on the remote device for controlling a piece of equipment of the swimming pool." Janét, ¶389.

A POSITA would have been motivated to make this combination, in addition to the reasons explained in §IV.F.1, to achieve Knoll's stated goal of optimizing "the working area" by enabling users to define custom working boundaries "arranged at a distance from the outer boundaries of the working area" via Hsu's remote interface. Knoll, [0007]; Hsu, [0021]; Janét, ¶390. This modification would have allowed users to specify particular areas requiring cleaning without physically adjusting pool-side equipment—a practical benefit that a POSITA would have recognized. Janét, ¶390.

As explained in IV.F.1, a POSITA would have reasonably expected success in make such modification. Janét, ¶391.

G. Ground 3: Claims 2, 4, 7, 12, and 14-16 are Unpatentable over Laitta

1. Laitta

Laitta (EX1012) discloses a "pool video safety...system" for monitoring "swimming pool areas." *Id.*, Abstract, [0001].

Laitta's system monitors pool 12 using a camera 14 that is "positioned to have a view of the area being observed." *Id.*, [0016]-[0017], FIGS. 1-2 (reproduced below).

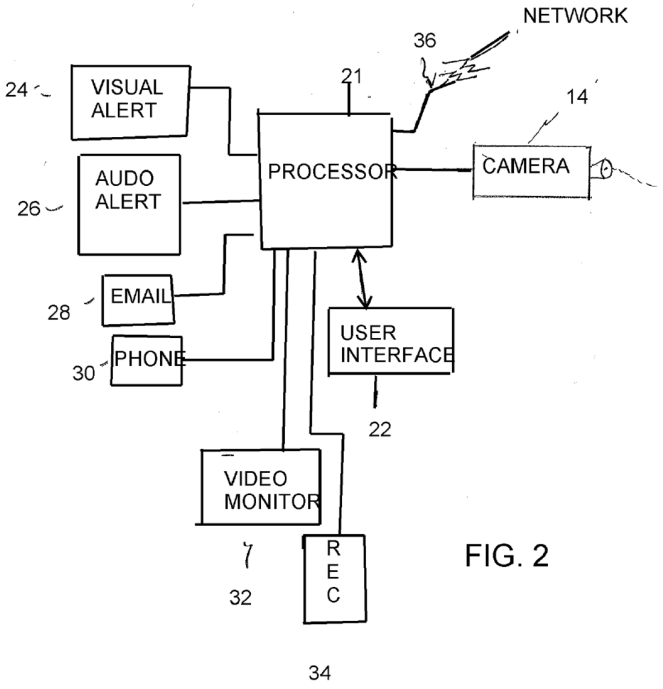


FIG. 2

Laitta discloses that "[o]n detection of an alert condition as viewed by camera 14 and interpreted by processor 21," an alarm, e.g., "a visual alert" or "audio alert" may be provided. *Id.*, [0018]. Laittai's processor utilizes criteria such as "motion," "size of object," and "speed" to "determine whether an alarm event has taken place." *Id.*, [0020].

2. Claim 2

Laitta discloses or suggests Claim 2. Janét, ¶¶393-407.

a. 2[pre]

Laitta discloses or suggests 2[pre]. Janét, ¶¶394-395.

Laitta discloses a "pool video safety...system." Laitta, Abstract, [0001]. Laitta's system monitors "pool 12" using cameras and control equipment. Laitta, [0016], FIG. 2 (below).

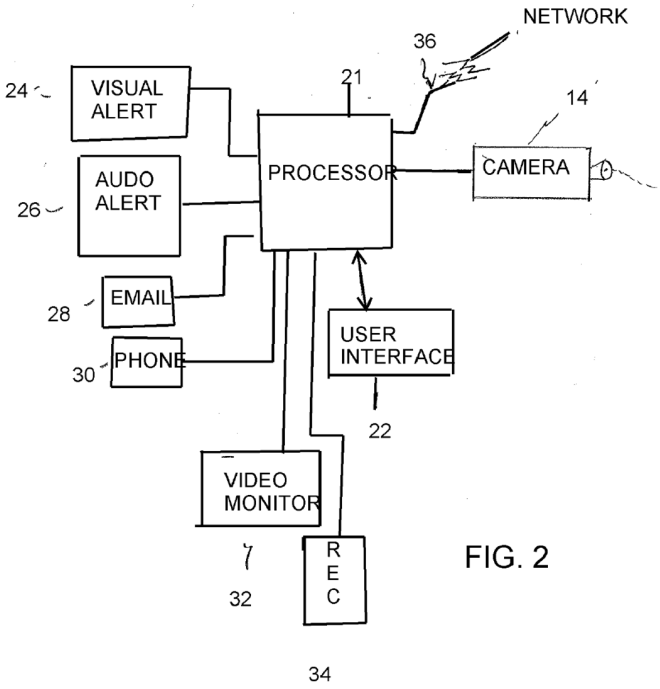


FIG. 2

b. 2[a]

Laitta discloses or suggests 2[a]. Janét, ¶¶396-397.

The '207 Patent does not define "equipment for a swimming pool or spa," but describes some device outputting "an alert...upon the **person's detected presence**." EX1001, 3:56-64. Similarly, Laitta's system includes alert devices—"a visual alert (flashing light…)" and "audio alert (horn, bell...)"—triggered "[o]n detection of an alert condition." Laitta [0016]-[0018]. Laitta's alert devices constitute "equipment

for a swimming pool" because they operate to detect entry into the pool's monitoring area. EX1001, 3:56-64; Laitta [0016]-[0018]; Janét, ¶397.

c. 2[b]

Laitta discloses or suggests 2[b]. Janét, ¶¶398-400.

Laitta's pool system includes camera(s) 14 that observe pool 12 and are "positioned to have a view of the area being observed." Laitta, [0016]-[0017], FIG. 1 (below).

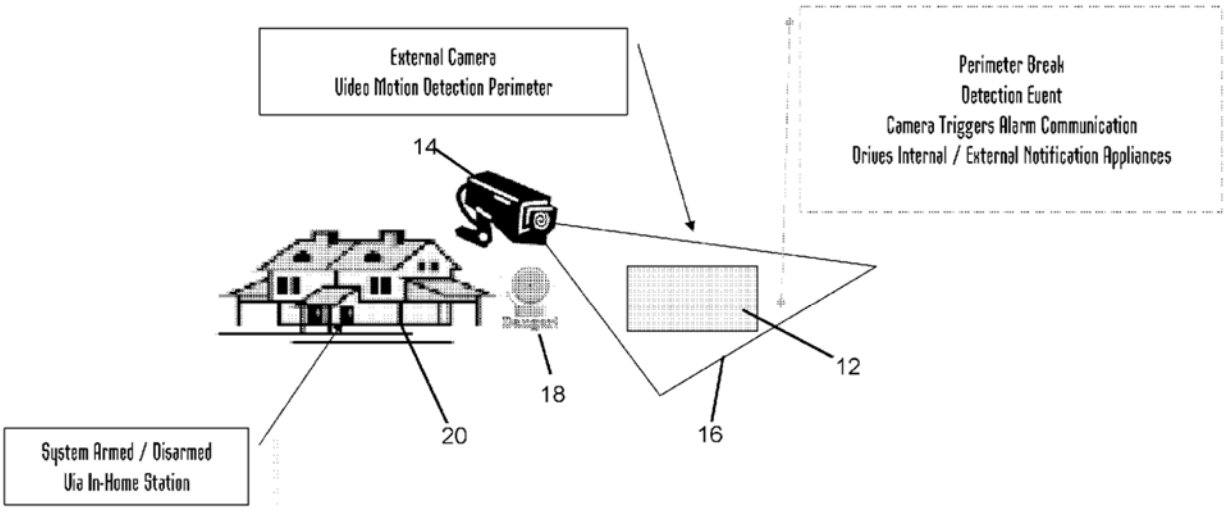


FIG. 1

Laitta describes sending "an email with attached images selected from **the images from the camera**," "a video monitor 32...enabl[ing] viewing of the **image being supplied by the camera**," and "a recorder 34...record[ing] **the images supplied by the camera** 14." *Id.*, [0018]-[0019], FIG. 2 (below). A POSITA would have understood that Laitta's camera captures those images. Janét, ¶400.

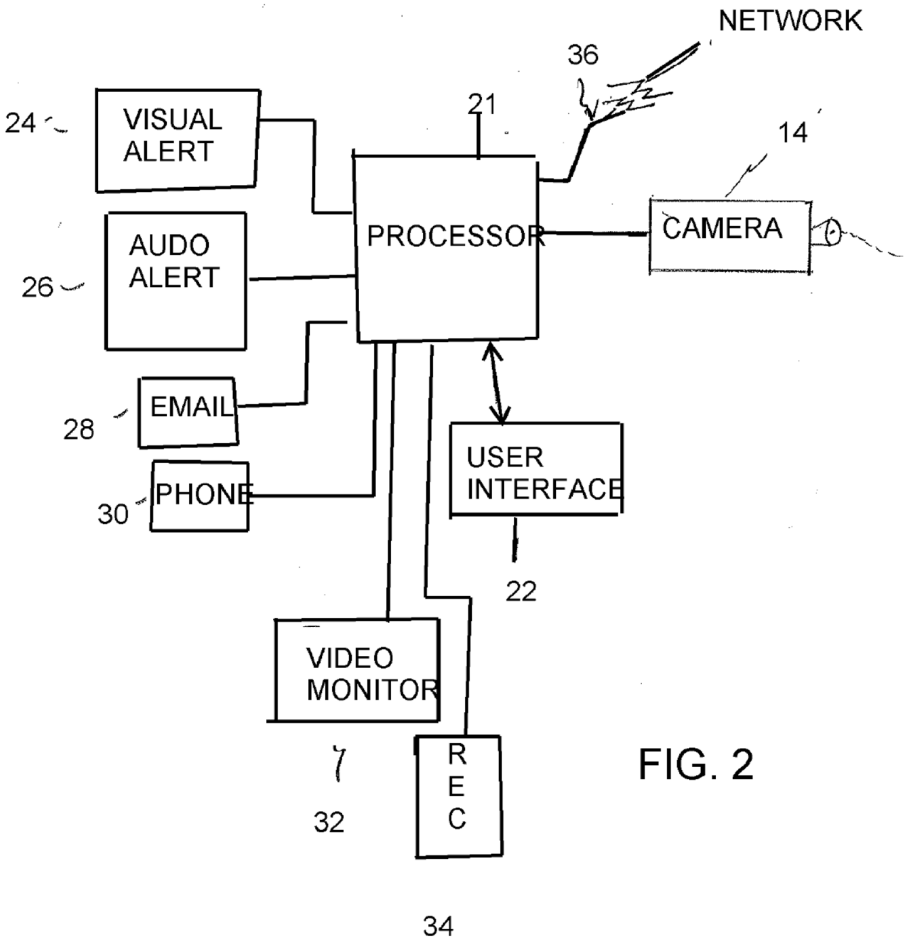


FIG. 2

d. 2[c][i]

Laitta discloses or suggests 2[c][i]. Janét, ¶¶401-404.

Laitta's system includes a processor 21 (controller) wired to camera 14 and to visual alert 24, audio alert 26, email alert 28, and/or telephone alert 30. *See* Laitta, FIG. 2 (below).

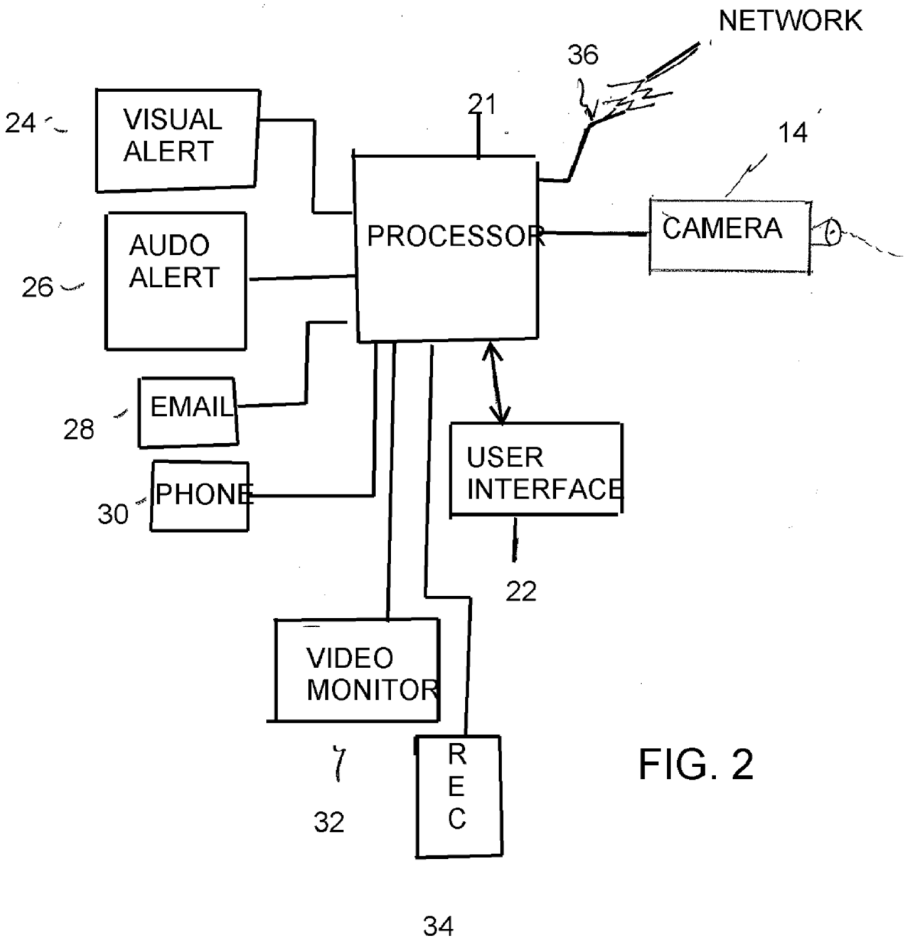


FIG. 2

Laitta describes that "[t]he output of the camera is supplied to a processor 21," which "interfaces with a visual alert 24, an audio alert 26, an email…alert 28 and a telephone alert 30." *Id.*, [0017]. Laitta further explains that "[o]n detection of an alert condition as viewed by camera 14 and interpreted by processor 21, an alarm may be sounded," including the visual, audio, email, and telephone alerts. *Id.*, [0018]. Because processor 21 receives image data from camera 14 and drives the alert devices, it is a controller in communication with both the camera(s) and the equipment.

e. 2[c][ii]

Laitta discloses or suggests 2[c][ii]. Janét, ¶¶405-406.

Laitta's processor (controller) receives visual/image data from camera 14. *See* §IV.G.2.d (2[c][i]). Laitta's processor 21 also determines a control action for alert devices (equipment) based on the received visual data, because alerts are triggered "as viewed by camera 14 and interpreted by processor 21," after which "an alarm may be sounded," with the processor interfacing with "a visual alert…, an audio alert…, an email…alert…and a telephone alert." Laitta, [0017]-[0018]. Laitta further explains the processor uses decision criteria—"motion," "size of object," and "speed"—to "determine whether an alarm event has taken place." Laitta, [0020]. Laitta's processor's determining (and generating) alert signals constitutes "determine[ing] a control action" for alert devices (equipment) based on the received visual data, because Laitta's processor analyzes images to decide whether an event occurred and then activates the visual/audio/email/telephone alert devices, based on the received visual/image data. *Id.*; Janét, ¶406.

3. Claim 7

Laitta discloses or suggests claim 7. Janét, ¶¶411-414.

Laitta's processor (controller) analyzes the visual data from camera 14 to detect a person being present or an "alarm event." Laitta, [0017]-[0018], [0020]; §§IV.G.2.d-e (2[c][i]-[ii]). A POSITA would have understood that a person being

present or an alarm event constitutes a "characteristic of the location," because it describes the state of the monitored area. Janét, ¶412.

Laitta's processor then controls the alert devices (equipment) to output alerts based on the detected characteristics (e.g., presence of a person). *See* §IV.G.2.e (2[c][ii]); Janét, ¶413.

4. Claim 12

Laitta discloses or suggests Claim 12. Janét, ¶¶415-422.

a. 12[pre]

Laitta discloses or suggests 12[pre], because it discloses "a pool video safety...system" that monitors "pool areas" using cameras and processor to detect conditions and generate responses. Laitta, Title, Abstract, [0016]-[0018], FIGS 1-2; Janét, ¶416; §IV.G.1.

b. 12[a]

Laitta discloses or suggests 12[a], beacuse Laitta's processor (controller) receives images from camera 14, and a POSITA would have understood that these are "images of at least a portion of a location including a swimming pool," as Laitta explains that "pool 12 is observed by...cameras 14 which observe the pool area" (FIG. 1, observation perimeter 16). Laitta, [0017]-[0019], FIG. 1; Janét, ¶417; §§IV.D.3.d-e (2[c][i]-2[c][ii]).

c. 12[b]

Laitta discloses or suggests 12[b]. Janét, ¶¶418-420.

Laitta discloses determining monitoring/monitored zones or sensing area (target area). Laitta, [0016]-[0018], [0022], FIG. 1; Janét, ¶419. Specifically, Laitta teaches that "observation perimeter 16...is defined around the pool" and "**monitoring zones may be set**…**which define monitored zones**…used when determining alarm conditions," while "areas in the field of view can be masked off or...be ignored or specifically observed." Laitta, [0016]-[0018], [0022], FIG. 1. Thus, Laitta's system determines the target area by defining observation perimeter 16 (or monitoring/monitored/sensing zones) and applying masking/foreground-background separation. Laitta, [0016]-[0018], [0020], FIG. 1 (below); Janét, ¶419.

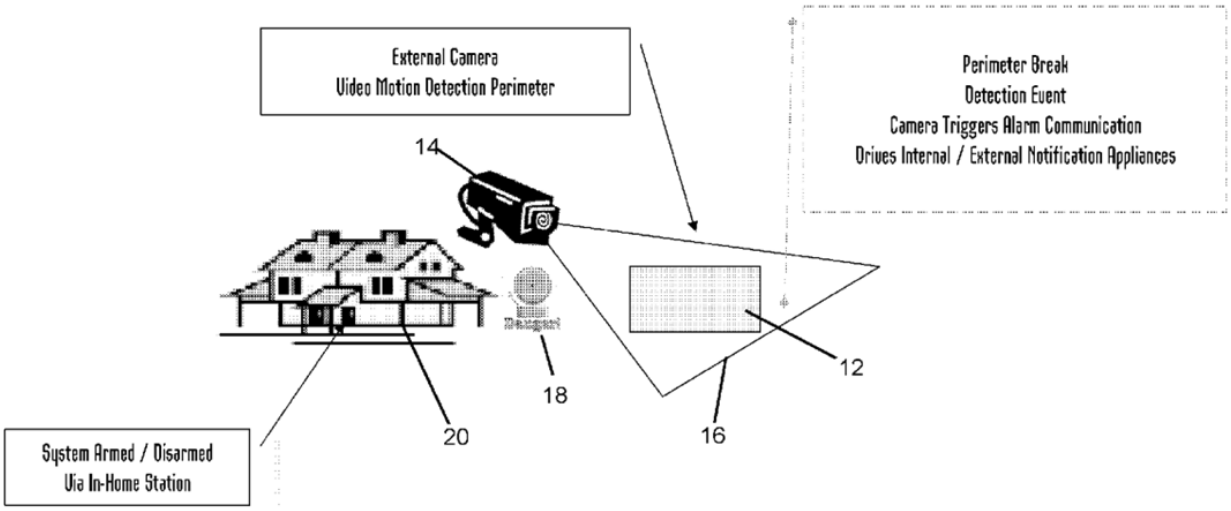


FIG. 1

Laitta also discloses detecting a characteristic of the target area based on the images, because its processor (controller) analyzes visual data to detect presence of

a person or an "alarm event" within the monitored zones (target area). *See* §IV.G.3 (Claim 7). A POSITA would have understood that this presence of a person constitutes a characteristic of the target area (i.e., its occupancy or security status), which is detected based on the processor's analysis of visual parameters like motion, size, and speed in the images. Janét, ¶420.

d. 12[c]

Laitta discloses or suggests 12[c], because its system generates a control response—actuating alert devices (e.g., visual alert 24, audio alert 26)—based on the detected occupancy or security status (characteristic) of monitoring/monitored/sensing zones (target area). Laitta, [0016]-[0018], [0020], FIGS. 1-2; Janét, ¶421; §IV.G.2.e (2[c][ii]).

5. Claim 14

Laitta discloses or suggests claim 14, because Laitta's processor generates the control response by controlling the operation of pool equipment (alert device)—visual alert 24, audio alert 26, and/or email alert 28—to produce an alert upon a detected occupancy or security status (characteristic) of monitoring/monitored/sensing zones (target area). Laitta [0016]-[0018], [0020], FIG. 2 (below); Janét, ¶423; §IV.G.2.b (2[a]) and §IV.G.4.d (12[c]).

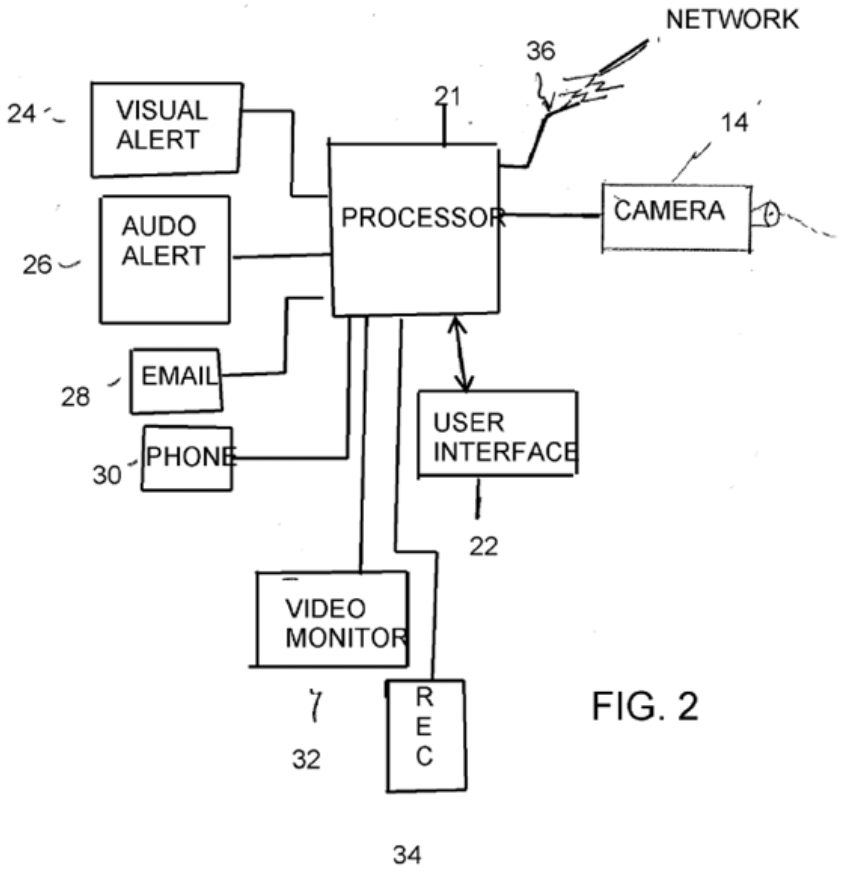


FIG. 2

6. Claim 15

Laitta discloses or suggests claim 15. Janét, ¶¶425-427.

Laitta discloses generating an alert as the control response. *See* §IV.G.5 (claim 14). Laitta also discloses that the alert is on a remote device, because it teaches an **email alert** "with attached images" and a **telephone alert** that "might call...phone numbers (**cell phone**...)," and provides "video monitor 32…to enable viewing of the image…**from a location remote** from the pool." Laitta, [0018]-[0019], [0021], FIG. 2 (below); Janét, ¶426.

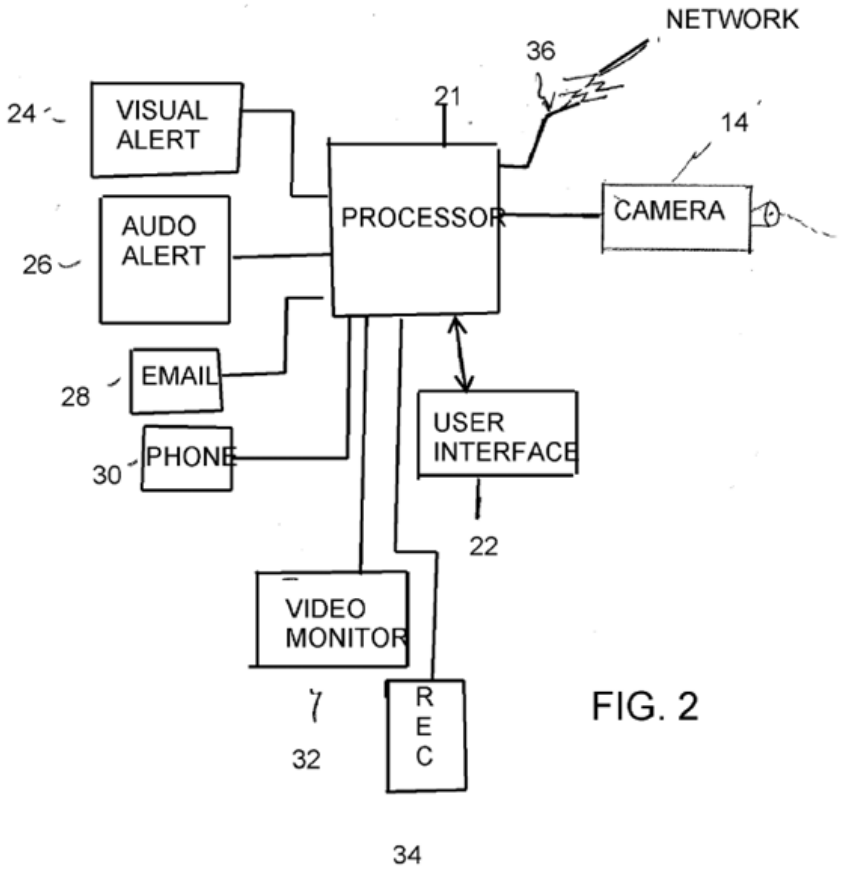


FIG. 2

7. Claim 16

Laitta discloses or suggests claim 16, because Laitta's alert (control response) includes a telephone alert calling (wireless communicating) a "cell phone" (remote device). Laitta, [0018]; Janét, ¶428; §IV.G.4.d (12[c]). Laitta also discloses an email alert (control response) "with attached images," sent via interface 36 "adapted to connect to a network," which a POSITA would have understood or found obvious to be delivered wirelessly (cellular/Wi-Fi) to, e.g., a cellphone. Laitta, [0018], [0021]; Janét, ¶428.

V. CONCLUSION

The Board should institute IPR and cancel the Challenged Claims.

VI. MANDATORY NOTICES

A. Real Party in Interest

Petitioner identifies itself as a real party in interest. The following are identified as additional real parties in interest: Deepwater Innovation Technology (Hong Kong) Limited and Xingmai Innovation Technology (Suzhou) Co., Ltd.

B. Related Matters

To the best of Petitioner's knowledge, the '207 Patent has been involved in the following cases:

- Beatbot Technology (USA) Co. Ltd. et al v. Zodiac Pool Systems LLC, No. 3:25-cv-01946 (S.D. Cal.).
- Zodiac Pool Sys. LLC v. Wybotics, Co. Ltd., Case No. 2:25-cv-00582 (E.D. Tex).
- Wybotics Inc. et al v. Zodiac Pool Systems LLC. Case No. 2-25-cv-08526 (C.D. Cal.).
- Wybotics Inc. et al v. Zodiac Pool Systems LLC, IPR2026-00158 (PTAB).

Petitioner is also concurrently filing Petitions for *Inter Partes* Review of U.S. Patent Nos. the 11,003,191 and 11,262,766, which are related to the '201 Patent challenged herein.

C. Notice of Counsel and Service Information

Petitioner consents to electronic service. All communications to the attorneys listed below may be sent to: Perkins-Service-Xingmai-Zodiac-IPRs@perkinscoie.com.

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D. Power of Attorney

A power of attorney is filed herewith according to 37 C.F.R. §42.10(b).

Respectfully submitted,

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Date: January 26, 2026

CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Pursuant to 37 C.F.R. §42.24(a), Petitioner hereby certifies that portions of the above-captioned Petition for *inter partes* review of U.S. Patent No. 11,880,207, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,961. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,
/ Kyle R. Canavera /

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Date: January 26, 2026

CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *inter partes* review of U.S. Patent No. 11,880,207 and supporting materials (Exhibits and Power of Attorney) were served via FedEx delivery on the Patent Owner at the correspondence address of record as listed on PAIR:

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Respectfully submitted,
/Meghan Bright/

Meghan Bright
Patent Paralegal

Date: January 26, 2026

EXHIBIT 2

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

BEATBOT TECHNOLOGY (USA) CO. LTD.,

Petitioner,

v.

ZODIAC POOL SYSTEMS LLC,

Patent Owner.

_____

PTAB Case No. IPR2026-00200

U.S. Patent No. 11,262,766 B2

_____

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,262,766 B2

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EXHIBIT LIST

No.	Exhibit
1001	U.S. Patent No. 11,262,766 B2 ("'766 Patent")
1002	File History of the '766 Patent
1003	Declaration of Jason Janét, Ph.D. ("Janét")
1004	Curriculum Vitae of Jason Janét, Ph.D.
1005	Chinese Publication No. CN1540119A ("Cui")
1006	German Publication No. DE102007053310A1 ("Knoll")
1007	Chinese Publication No. CN101139007A ("Fu-007")
1008	U.S. Patent No. 3,321,787 ("Myers")
1009	U.S. Patent No. 4,168,557 ("Rasch")
1010	Jonathan Horgan & Daniel Toal, Review of Machine Vision Applications in Unmanned Underwater Vehicles, Proc. 9th Int'l Conf. on Control, Automation, Robotics and Vision 1 (2006)
1011	Prosecution History of U.S. Patent No. 9,388,595
1012	Prosecution History of U.S. Patent No. 10,338,599
1013	U.S. Patent No. 9995051 B2
1014	U.S. Publication 20140015959A1 ("Durvasula")
1015	Chinese Publication No. CN101481957A ("Fu-957")
1016	U.S. Publication No. 20060053572A1 ("Porat")
1017	U.S. Publication No. 20140263087A1 ("Renaud")

LISTING OF CHALLENGED CLAIMS

U.S. Patent No. 11,262,766 B2
Claim 1
1[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
1[a] a. a vehicle body;
1[b] b. means for moving the vehicle body within the swimming pool;
1[c] c. a filter configured to retain debris collected from the submerged surface;
1[d] d. at least one camera mounted directly or indirectly to the body for capturing an image of at least a first portion of the submerged surface; and
1[e][i] e. a controller (i) positioned on or in the body,
1[e][ii] (ii) in electronic communication with the at least one camera, and
1[e][iii] (iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.
Claim 2
2[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
2[a] a. a vehicle body;
2[b] b. means for moving the vehicle body within the swimming pool;
2[c] c. a filter configured to retain debris collected from the submerged surface;

2[d] d. at least one camera carried by the body for capturing an image of at least a first portion of the submerged surface; and
2[e][i] e. a controller (i) positioned on or in the body,
2[e][ii] (ii) in electronic communication with the at least one camera, and
2[e][iii] (iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.
Claim 3
3[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
3[a] a. a vehicle body;
3[b] b. means for moving the vehicle body within the swimming pool;
3[c] c. a filter configured to retain debris collected from the submerged surface;
3[d] d. at least one camera positioned on or in, or carried by, the body for capturing an image of at least a first portion of the submerged surface; and
3[e][i] e. a controller (i) positioned on or in the body,
3[e][ii] (ii) in electronic communication with the at least one camera and a portable electronic device, and
3[e][iii] (iii) configured to generate, in response to at least one of the captured image or information from the portable electronic device, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.
Claim 4
4[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:

4[a] a. a vehicle body;
4[b] b. means for moving the vehicle body within the swimming pool;
4[c] c. a filter configured to retain debris collected from the submerged surface;
4[d] d. at least one camera for capturing an image of at least a first portion of the submerged surface; and
4[e][i] e. a controller (i) positioned on or in the body,
4[e][ii] (ii) in electronic communication with the at least one camera, and
4[e][iii] (iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.
Claim 5
5[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
5[a] a. a vehicle body;
5[b] b. means for moving the vehicle body within the swimming pool;
5[c] c. a filter configured to retain debris collected from the submerged surface;
5[d] d. a chemical dispenser on, in, or carried by the vehicle body;
5[e] e. at least one camera on, in, or carried by the vehicle body, for capturing an image of at least a first portion of the submerged surface; and
5[f][i] f. a controller (i) on, in, or carried by the vehicle body,
5[f][ii] (ii) in electronic communication with the at least one camera and

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

I. INTRODUCTION

Petitioner requests *inter partes review* ("IPR") of Claims 1-5 ("Challenged Claims") of U.S. Patent No. 11,262,766 B2 ("'766 Patent, EX1001).

II. IPR Requirements

A. Standing

The '766 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

B. Challenged claims and relief requested

Petitioner respectfully requests cancellation of Claims 1-5 under 35 U.S.C.§103.

1. Prior art

Petitioner relies on prior art under pre-AIA 35 U.S.C.§102(b) or AIA 35 U.S.C.§102(a)(1) listed in the Table of Exhibits and declaration of Dr. Jason Janét, (EX1003, "Janét"). Specific invalidity grounds are listed in the table below.

Grounds under 35 U.S.C.§103	Claims	Prior Art
1	1-5	Durvasula and Fu-007
2A	1-4	Cui and Fu-007
2B	5	Cui, Fu-007, and Porat
3A	1-2, 4	Knoll
3B	3	Knoll and Fu-957
3C	5	Knoll and Porat
4A	1-4	Renaud
4B	5	Renaud and Durvasula

III. ’766 Patent

A. Overview

The ’766 Patent describes a pool cleaning system with one or more cameras for autonomous cleaning of a pool. EX1001, 2:62-3:53. The disclosed system includes **cameras 32** that capture images of swimming pool 22, a **controller 42** that analyzes the images and generates control responses for operating a pool cleaning vehicle 30. *Id.*, 2:62-5:7, 3:44-5:8; 8:24-9:56, FIG. 1 (annotated below).

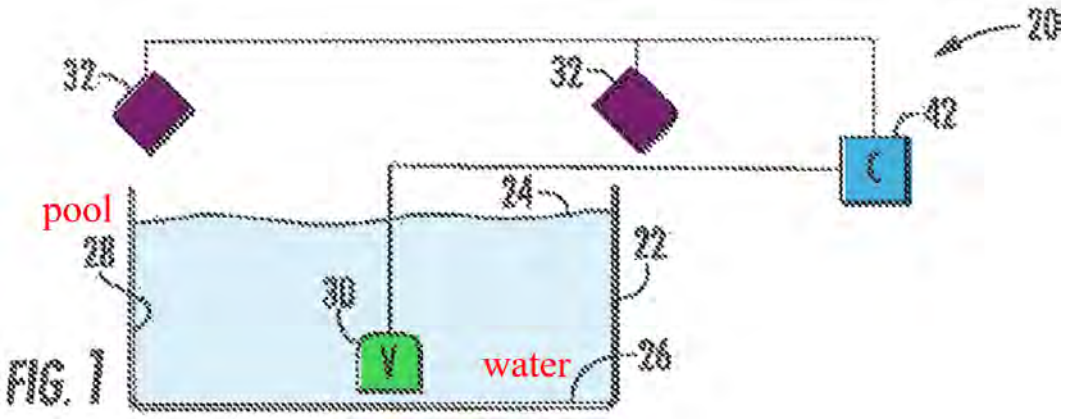


FIG. 1

The cleaning device (vehicle 30) has a body, a **drive system** for moving the body within the pool, and cleaning **brushes**. *Id.*, 3:5-43; 10:8-27, FIG. 10 (annotated below).

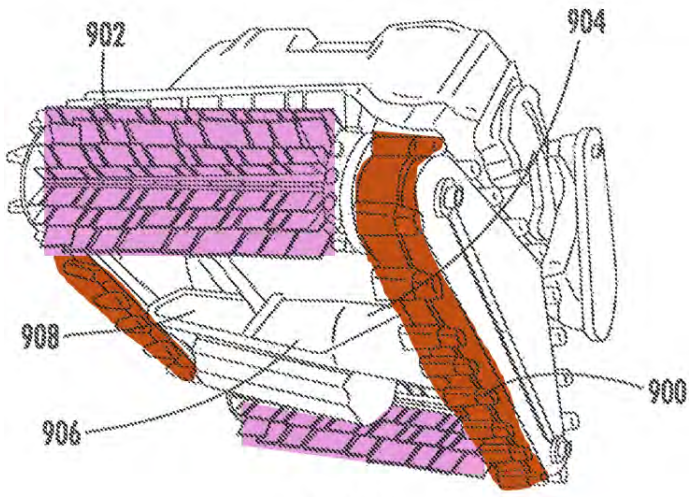


FIG. 10

Controller 42 is located in **dry station 246** outside pool 22, connected to **cameras 32**, and configured to generate control signals to cause movement of **vehicle 830**. *Id.*, 9:57-10:7; FIG.9 (annotated below). These control signals are transmitted from dry station 246 to vehicle 830. *Id.*

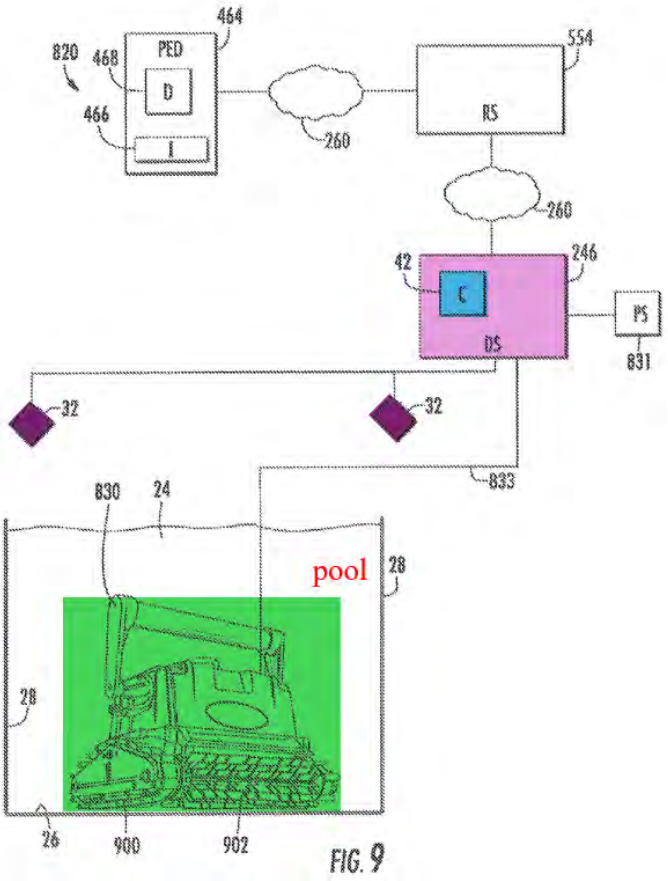


FIG. 9

B. Prosecution History

The '766 Patent issued from U.S. Application 17/143,624 ("'624 Application"), and purported to claim priority to U.S. Application No. 13/545,918 ("'918 Application") filed July 10, 2012, through a series of intermediate applications. EX1001, fields (21), (63).

Applicant filed a preliminary amendment cancelling original claims 1-19 and adding new independent claims 20-24. EX1002, pp.40-42. No prior art rejections were raised against claims 20-24; the sole issue raised was a non-statutory double patenting rejection which was overcome via a terminal disclaimer.

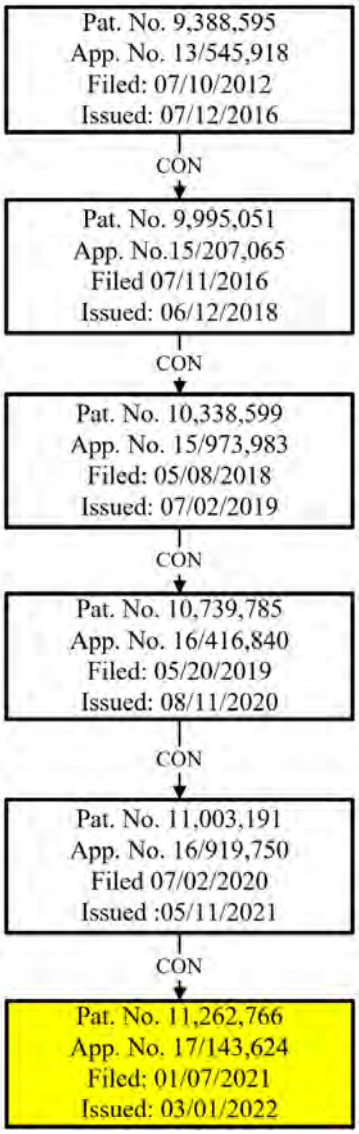
Id., 70-86, 116-118. Application claims 20-24 were issued as Claims 1-5 of the '766 Patent. *Id.*, 132-138.

Fu-007 (EX1007) was cited in an Information Disclosure Statement (IDS) (EX1002, pp.57, 93) but was not used as a basis for claim rejections or otherwise discussed during the prosecution. Fu-007 is not cumulative over the examination, because Fu-007 is used here in combination with other references, and the Examiner lacked expert testimony regarding Fu-007 combined with other references.

C. '766 PATENT'S PRIORITY DATE

The Board can consider the challenged claims' priority date. *Parus Holdings v. Google,* 70 F.4th 1365, 1373-74 (Fed. Cir. 2023). A priority claim to an earlier application is valid **only if** the earlier application, *inter alia*, provides description for the claims pursuant to 35 U.S.C.§112(a) or pre-AIA 35 U.S.C.§112¶1 under 35 U.S.C.§120. *Parus*, 70 F.4th at 1373-74; *Anascape v. Nintendo of America*, 601 F.3d 1333, 1334-35 (Fed. Cir. 2010).

The '766 Patent claims priority through a series of intermediate applications as shown by the patent family tree below:



The '766 Patent's priority chain includes the '918 Application (filed July 10, 2012), which is subject to pre-AIA 35 U.S.C.§§102-103. The remaining applications are subject to AIA 35 U.S.C.§§102-103.

35 U.S.C.§120 requires an invention claimed in a later filed application be "disclosed in the manner provided by section 112(a) (other than the requirement to disclose the best mode) in an application previously filed in the United States," to

claim priority to the earlier filed application. Thus, the disclosure in the earlier filed application must meet both the written description and enablement requirements under 35 U.S.C.§112(a). *Chiron v. Genentech*, 363 F.3d 1247, 1253 (Fed. Cir. 2004).

Under the written description requirement, the specification must "reasonably convey[] to the artisan that the inventor had possession at that time of the later claimed subject matter." *Vas-Cath v. Mahurkar*, 935 F.2d 1555, 1563 (Fed Cir. 1991). The specification demonstrates such possession by describing the claimed invention and all of its limitations. *Ariad Pharms. v. Eli Lilly*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (en banc) (citation omitted).

The '766 Patent includes five independent Claims 1-5. Representative Claim 1 recites "a controller (i) **positioned on or in the body**…(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."[1] EX001, 10:57, 59-62. Claims 2-5 recite similar limitations. *Id.*, 11:6-11, 22-29, 12:7-13, 26-31. However, as explained below, the '918 Application contains no disclosure of the above-identified claim

[1] All **bold**, *italic*, or colored emphases are added by Petitioner unless otherwise specified.

limitations. Accordingly, under 35 U.S.C.§120, Claims 1-5 of the '766 Patent are not entitled to the benefit of the July 10, 2012 filing date of the '918 Application.

Moreover, the specification also fails to satisfy the enablement requirement under 35 U.S.C.§112(a) for Claims 1-5. "It is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement." *Genentech v. Novo Nordisk*, 108 F.3d 1361, 1366 (Fed. Cir. 1997). Here, the specification is entirely silent as to the above-identified claim limitations; thus, it fails to teach how to make and use an invention encompassing those features, and the knowledge of skilled artisans cannot fill this void. This provides another reason as to why Claims 1-5 are not entitled to the alleged July 10, 2012 priority date.

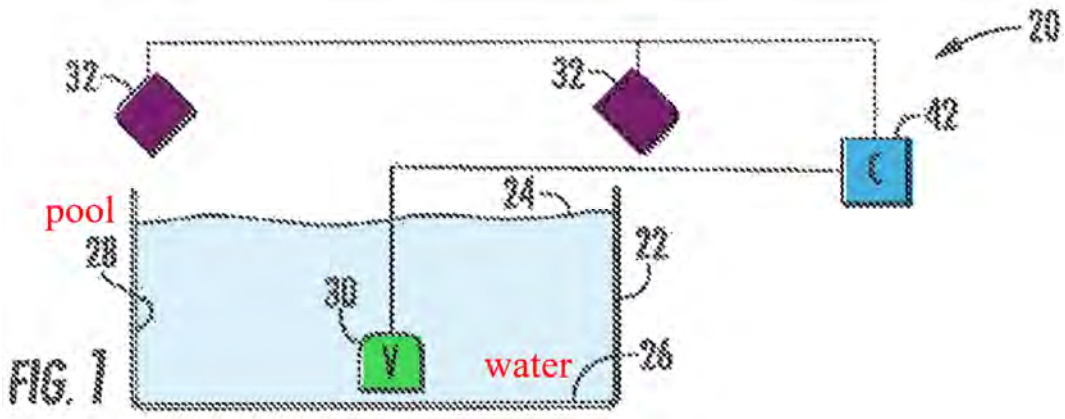
Therefore, the priority of Claims 1-5 can be no earlier than July 11, 2016, the filing date of the '918 Application's next immediate child application No. 15/207,065 (EX1013, field (22)), and Claims 1-5 are subject to AIA 35 U.S.C. §§102-103. Janet, ¶¶70-92.

1. The '918 Application does not disclose "a controller...positioned on or in the body"

The '918 Application fails to describe that its controller "positioned on or in the body," as recited in Claim 1 and similarly recited in Claims 2-5 of the '766 Patent. The '918 Application consistently describes, in its specification, drawings,

and claims, that a controller is located **outside the pool**, physically **remote** from the vehicle body inside the pool. The controller is not submerged, not collocated with the vehicle, and does not travel with the vehicle; it is connected to the vehicle through a wired or wireless communication link. EX1011, pp.23-28, 32. Therefore, the disclosed controller is **physically separated and remote from the vehicle** and does not teach a controller **on or in** the vehicle body. Janet, ¶¶81-86.

FIG. 1 of the '918 Application (annotated below) illustrates an embodiment where **controller 42** is located ***outside*** pool 22 and ***remote from*** **vehicle 30**. EX1011, p.38. Janet, ¶82.



FIGS. 2, 4, and 9 (annotated below) show embodiments where **controller 42** is part of **dry station 46/246** and/or **portable electronic device 464**, which are located ***outside*** pool 22 and ***remote from*** **vehicle 30/830**. EX1011, pp.24-25, 27-28, 32, 34, 38, 40. Janet, ¶83.

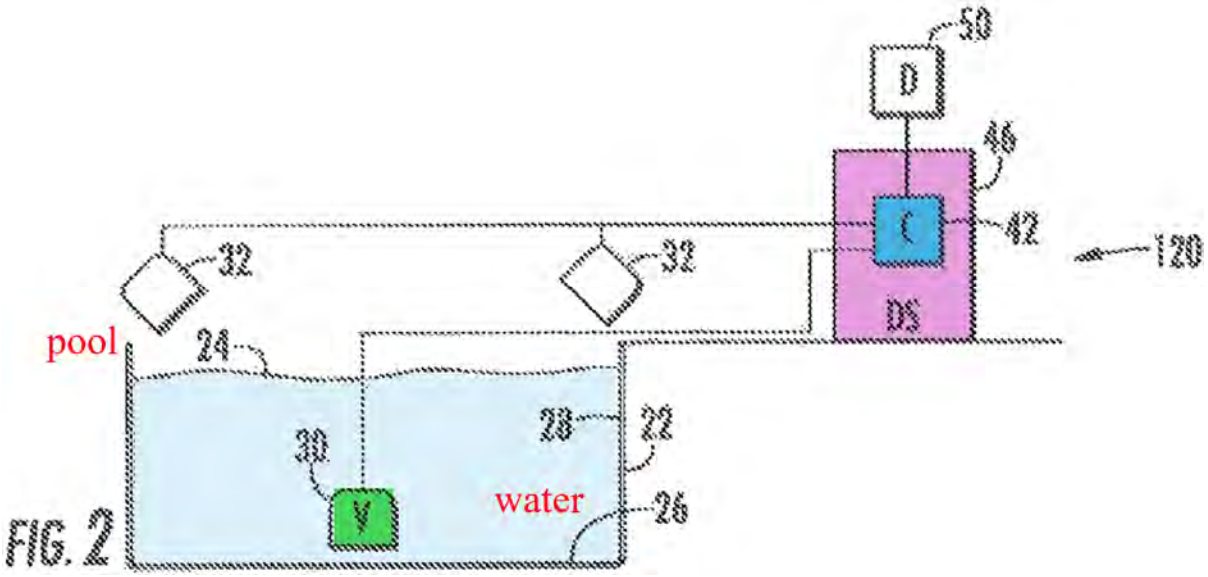

50
D
46
C
42
120
32
32
DS
pool
24
28
22
30
V
water
26

FIG. 2

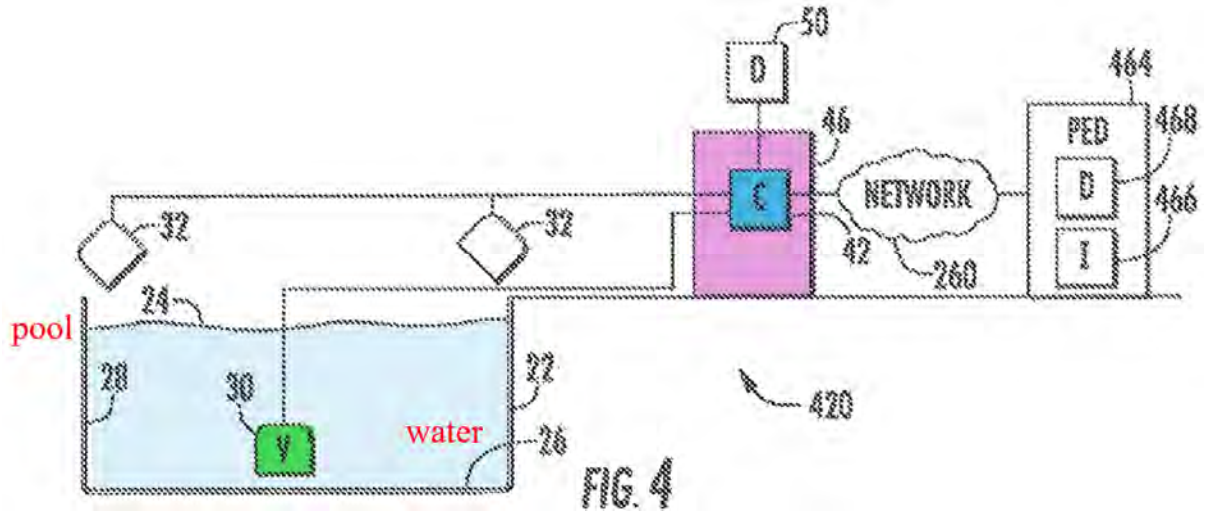

50
D
464
46
PED
468
C
NETWORK
D
466
42
260
I
32
32
24
pool
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30
32
V
water
26
420

FIG. 4

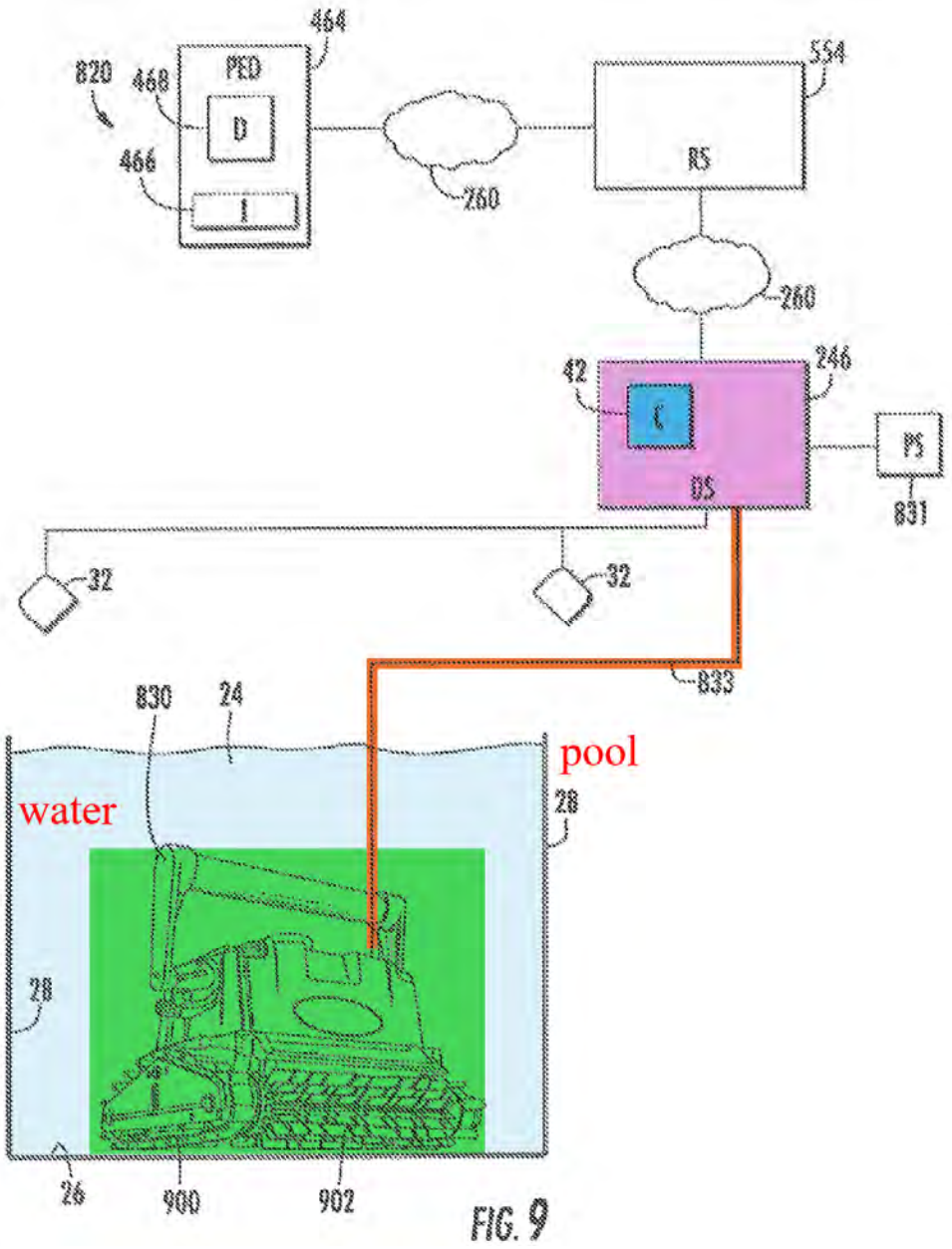


FIG. 9

Similarly, FIGS. 3 and 5 (annotated below) illustrate embodiments where **controller 42** is part of ***remote* server 254/554 *outside*** pool 22 and ***remote from* vehicle 30**. EX1011, pp. 26, 28-29, 32, 35, 38-39. **Controller 42** transmits control signals to the vehicle through **dry station 246** across **network 260**. *Id.* Other parts

of the '918 Application also describe its controller as a ***remote*** component from the vehicle and as being ***located outside the pool***. EX1011, pp. 38-40 (FIGS. 1-5, 9), 21-29, 32-35 (descriptions of FIGS. 1-5, 9), Claims 2-4, 10. The '918 Application, however, does not describe or suggest positioning the "controller...on or in the [vehicle] body." Janet, ¶84.

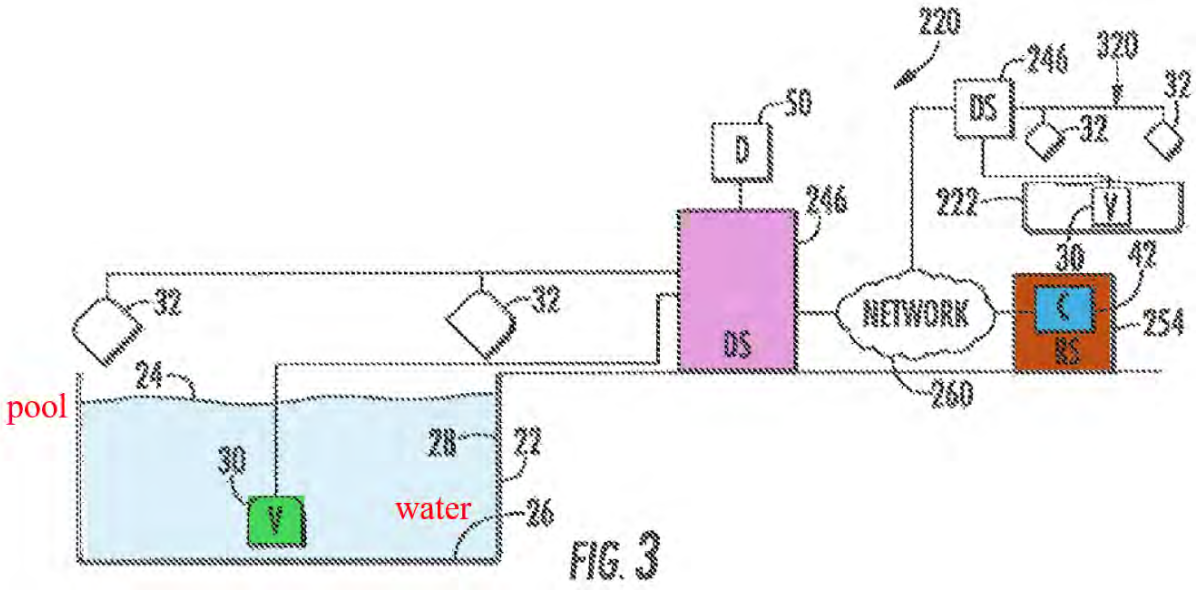


FIG. 3

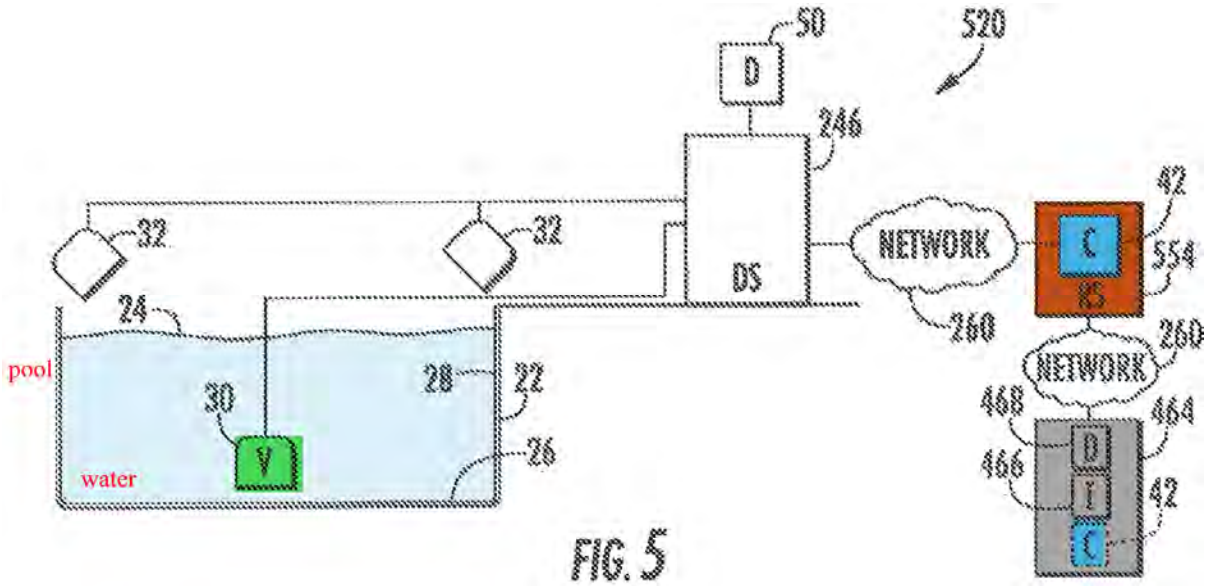


FIG. 5

The written description requirement mandates that "the specification must show the inventor actually invented the invention claimed." *Ariad Pharms.*, 598 F.3d at 1351. "One shows that one is 'in possession' of the invention by describing the invention, with all its claimed limitations, not that which makes it obvious." *Lockwood*, 107 F.3d at 1572. As explained above, the '918 Application does **not** provide written description support for the claimed limitation of "a controller…on or in the body" and further fails to meet the enablement requirement for this limitation. Accordingly, Claim 1 of the '766 Patent, as well as Claims 2-5—each reciting a limitation identical or substantially similar to the above-discussed "controller" limitation—is **not** entitled to the July 10, 2012 filing date of the '918 Application. Janét, ¶¶85-86.

2. The '918 Application does not disclose "caus[ing] movement of the body…away from…the first portion of the submerged surface"

Independently, the '918 Application fails to describe that its controller is configured to "generate, in response to the captured image, at least one control signal to cause movement of the body…***away from***…the first portion of the submerged surface," as recited in Claim 1 and similarly recited in Claims 2-5 of the '766 Patent. Janét, ¶¶87-91.

The '918 Application describes controller 42 generating control signals, in response to images captured by camera 32, to steer vehicle 30 ***to*** portions of the pool requiring cleaning or re-cleaning. For example, the '918 Application discloses that "[u]pon identifying a missed spot, controller 42 utilizes signals from camera 32 **to steer vehicle 32 [sic] cover such missed portions** of surfaces 26, 28." EX1011, p.24; *id.*, p.25 ("steer[ing] vehicle 30 back **to** such identified portions"), pp.31-32 ("steering vehicle 30 **to** re-clean portions of pool 22"; "steered back **to** such portions 638.").

These disclosures of the '918 Application, however, are limited to directing vehicle 30 **to** areas requiring cleaning. EX1011, pp.24-25, 31-32. Janet, ¶¶88-90. Notably absent is any disclosure of generating a control signal, **in response to captured images** of a portion of the submerged surface, to cause the vehicle to ***move away*** from the portion. Janét, ¶91.

Therefore, the '918 Application does not provide written description support for the limitation of the controller configured to "generate, **in response to the captured image**, at least one control signal to cause movement of the body…**away from**…the first portion of the submerged surface," and further fails to meet the enablement requirement for this limitation. Accordingly, Claims 1-5—each reciting a limitation identical or substantially similar to this limitation—are not entitled to the July 10, 2012 filing date of the '918 Application. Janét, ¶91.

In sum, because the '918 Application lacks written description support and fails to meet the enablement requirement, for the "on or in the body" and "away from" limitations, Claims 1-5 are not entitled to the July 10, 2012 filing date of the '918 Application. Instead, Claims 1-5 of the '766 Patent are entitled to a priority date no earlier than the filing date of the next application in the chain—July 11, 2016 for Application No. 15/207,065.[2] Janét, ¶¶28, 92; EX1013, field (22).

D. Level of Ordinary Skill

For the purposes of this Petition, a person of ordinary skill in the art (POSITA) would have had a bachelor's degree in electrical engineering,

[2] Petitioner reserves the right to challenge Patent Owner's entitlement to the July 11, 2016 filing date of App. No. 15/207,065 (and any later-claimed priority).

Patent Owner Zodiac Pool Systems LLC
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mechanical engineering, physics, or computer engineering, with at least two years' experience in autonomous camera-based robotic cleaning systems. Janét, ¶30.

E. Claim Construction

For determining invalidity in this Petition, Petitioner believes no constructions are necessary except for the means-plus-function (MPF) limitation "means for moving the vehicle body" in Claims 1-5.

When a claim limitation uses "means" or "module" and recites an associated function, the limitation is presumably an MPF term and be construed as such to cover the corresponding structure, material, or acts described in the specification and equivalents thereof. 35 U.S.C.§ 112(f) or 112¶6; MPEP §2181; *TriMedv. Stryker*, 514 F.3d 1256, 1259-60 (Fed. Cir. 2008).

Claims 1-5 each recite a claim limitation "*means for moving*…." and recites a claimed function of "moving the vehicle body within the swimming pool." The corresponding structure described in the '766 Patent includes wheels, rollers, tracks, or other surface contacting members powered by a motor and the like, a toothed track drive that provides traction and propulsion for vehicle, or a vacuum or liquid jet. EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶95.

The above described structures in the specification of the '766 Patent are the corresponding structures for the "means for moving the vehicle body." Janét, ¶96.

Patent Owner Zodiac Pool Systems LLC
Exhibit 2010 - Page 165 of 656

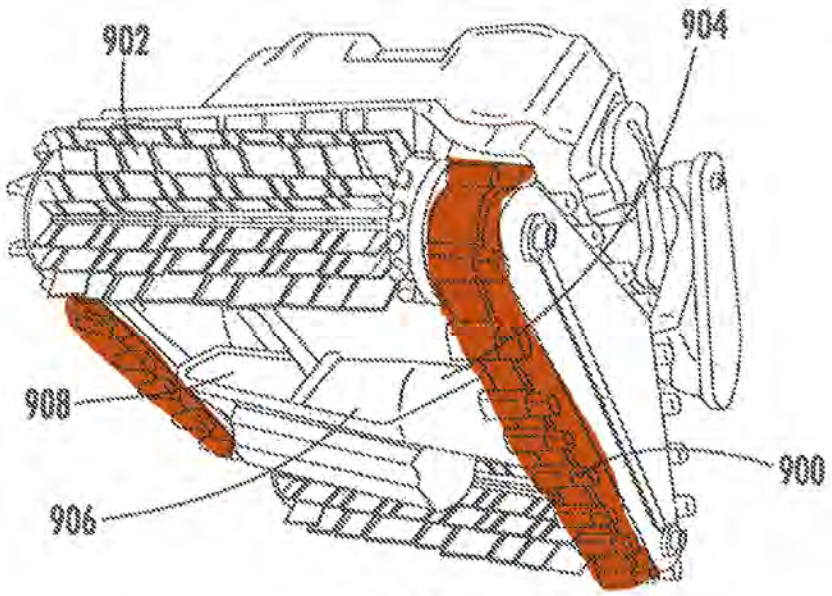


FIG. 10

IV. INVALIDITY GROUNDS

A. Ground 1: Claims 1-5 Unpatentable over Durvasula with Fu-007

1. Durvasula

Durvasula (EX1014) is U.S. Patent Application Publication No. US20140015959A1 of Patent Owner's '918 Application published on January 16, 2014. Durvasula is prior art under AIA 35 U.S.C.§102(a)(1) and pre-AIA 35 U.S.C.§102(b).

Durvasula discloses a pool cleaning system and contains technical features that are identical or similar to those of the '766 Patent and is analogous art. Janét, ¶¶97-98.

2. Fu-007

Fu-007 (EX1007) is prior art under AIA 35 U.S.C.§102(a)(1) and pre-AIA 35 U.S.C.§102(b). Janét, ¶99.

Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. Fu-007, Abstract, pp.8-10[3], 14-16, Claims 1, 4. Fu-007 is analogous art. Janét, ¶100.

Fu-007's robot includes a control system with a central processing unit housed in **control system enclosure 8**, which housed within a sealed drive control enclosure, which is "installed on...the interior of the **robot main shell 19**...to sealingly enclose the control system components" and "has waterproof properties." Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1-2, 4 (annotated below).

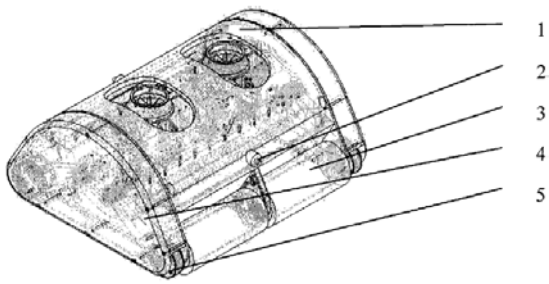


FIG. 1

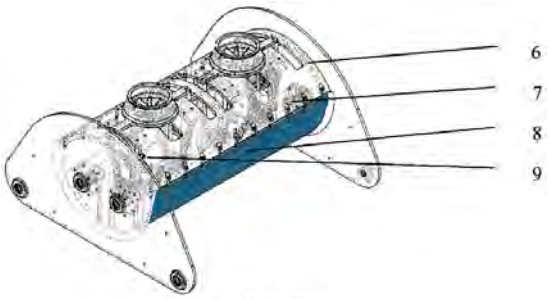


FIG. 2

[3] Page citations to Fu-007 are to the original pagination in the bottom center of each page.

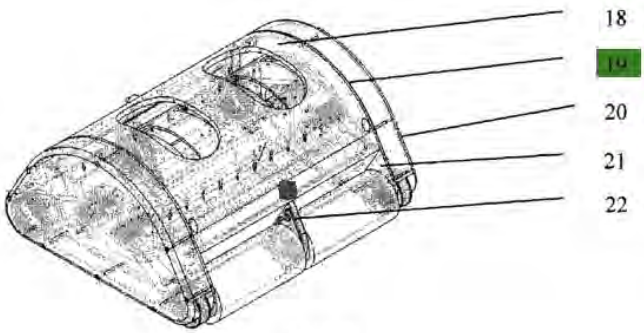


FIG. 4

Fu-007's robot also includes **monitoring camera 2** connected to the **central processing unit**. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1, 6 (annotated below).

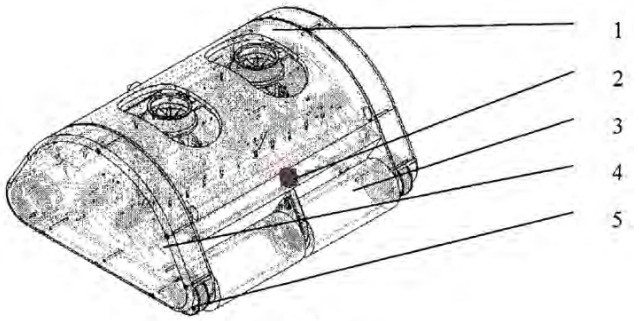


FIG. 1

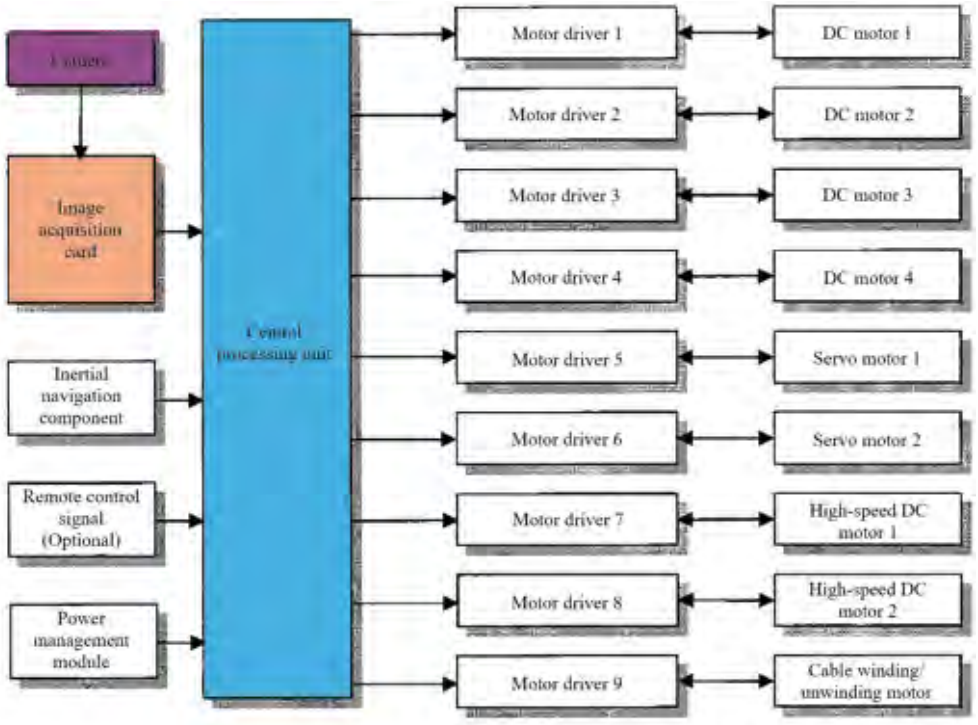


FIG. 6

3. Motivation to Combine

Both Durvasula and Fu-007 disclose underwater cleaning robots for pools using camera-based control, and both sought to improve autonomous pool cleaning. Janet, ¶105. Durvasula describes vehicle 30 as "an automated powered device" that autonomously cleans pool surfaces. Durvasula, [0014]. Fu-007 similarly describes an underwater cleaning robot that can "help and even replace humans to autonomously complete underwater cleaning work." Fu-007, p.11. POSITAs would have been motivated to combine the complementary teachings of Durvasula and Fu-007 to improve autonomous pool cleaning. Janét, ¶¶105-111.

POSITAs would have recognized that both address similar technical issues in the same pool cleaning field with similar solutions. Janét, ¶¶105-106. Both teach using a controller to generate control signals based on captured images to move the pool cleaner. *Compare* Durvasula, [0020], [0022]-[0023], *with* Fu-007, pp.10, 14-16, Claims 4, 7. Accordingly, POSITAs would have looked to both for guidance when designing pool cleaning systems. Janét, ¶¶105-106.

Fu-007 places its controller within the vehicle. Fu-007, pp.8-9, 12-14, Claim 4; Janét, ¶107. Hence, Fu-007 differs from Durvasula's placement of the controller outside the pool in a tethered configuration, or a remote server or portable electronic device (PED) (Durvasula, [0013]-[0039], [0045]-[0046], FIGS. 1-5, 9, Claims 2-4, 10). Janét, ¶107.

POSITAs would have been motivated to modify Durvasula by substituting Durvasula's external controller with Fu-007's onboard controller for various reasons. Janét, ¶¶107-111.

For example, Durvasula relies on an external controller and tether, which constrains autonomy by limiting range and requiring human intervention to manage cable entanglements, but Fu-007 moves the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11; Janét, ¶108. POSITAs would have recognized that integrating Fu-007's onboard controller

would have enhanced autonomous operations by generating control signals onboard to plan paths and complete cleaning tasks, allowing the vehicle to navigate freely without cable constraints or human interventions. Janét, ¶108.

As another example, POSITAs would have been motivated to make this modification to further improve the safety of Durvasula's system. Janét, ¶¶109-110. Durvasula discloses a tethered configuration that transmits power to the vehicle through a cable. Durvasula, [0025] ("provid[ing] electrical power to vehicle 30 in a wired fashion"), [0029], [0045], FIG.9; Janét, ¶109. Fu-007 teaches a safer architecture including a "sealed drive control enclosure" with "waterproof properties" and a "rechargeable battery box" that allows operation "without using the signal relay and cable manager 28 and the signal and power cable 33." Fu-007, pp.8-9, 12-14, Claim 4; Janét, ¶110. POSITAs would have been motivated to replace Durvasula's tethered controller configuration with Fu-007's onboard, sealed, battery-powered architecture, because this modification would have eliminated the need for the power cable—thereby removing the potential electrical leakage and enhancing the overall safety. Janét, ¶¶109-111.

POSITAs would have reasonably expected success, because positioning the controller in the vehicle body was a well-known design choice in autonomous pool cleaning robots, as shown by the teachings in Fu-007. Fu-007, pp.8-10; Knoll, [0007], [0027]-[0028], FIG.1; §§IV.D.1-IV.D.2; Renaud (EX1017), [0008]-[0009],

[0029]-[0030]; §§IV.G.1-IV.G.2; Janét, ¶111. Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Durvasula's—analyzing images and generating drive signals to move the vehicle (Fu-007, pp.8-10, 14-16) so POSITAs would have reasonably expected that Fu-007's controller would implement Durvasula's control logic (e.g., processing images to steer toward missed portions; Durvasula, [0020], [0022]-[0023]), thereby yielding predictable results. Janét, ¶111.

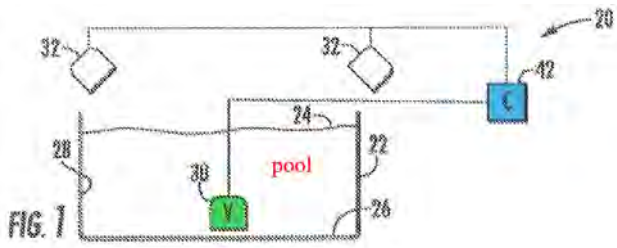
4. Claim 1 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render claim 1 obvious. Janet, ¶¶112-136.

a. 1[pre]

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

Durvasula discloses a "self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool." Durvasula, FIGS. 1-10 and [0002]-[0012], [0014], [0031], [0045]-[0046], Claims 1, 17, FIGS. 1, 9 (annotated below); Janet, ¶¶114-116.



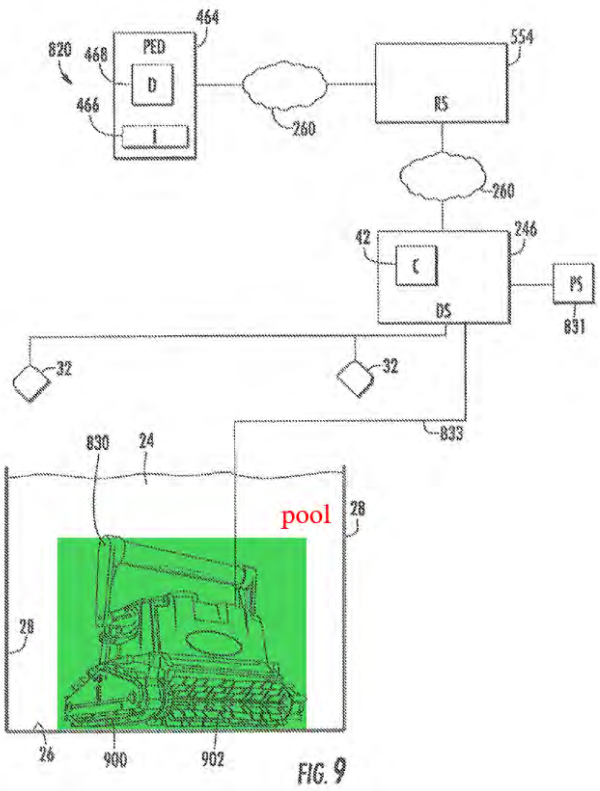


FIG. 9

b. 1[a]

Durvasula discloses vehicle 30/830 as a vehicle body. Durvasula, [0014]-[0015], [0046], Claims 1, 17, FIGS. 1 (annotated below), 2-5, 9 (annotated below), 10; Janet, ¶¶117-118.

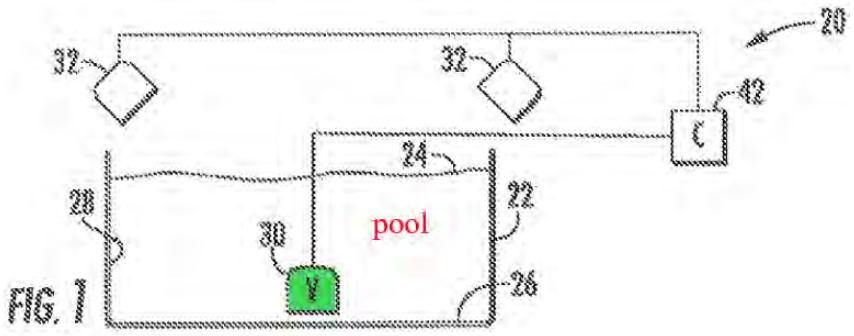


FIG. 1

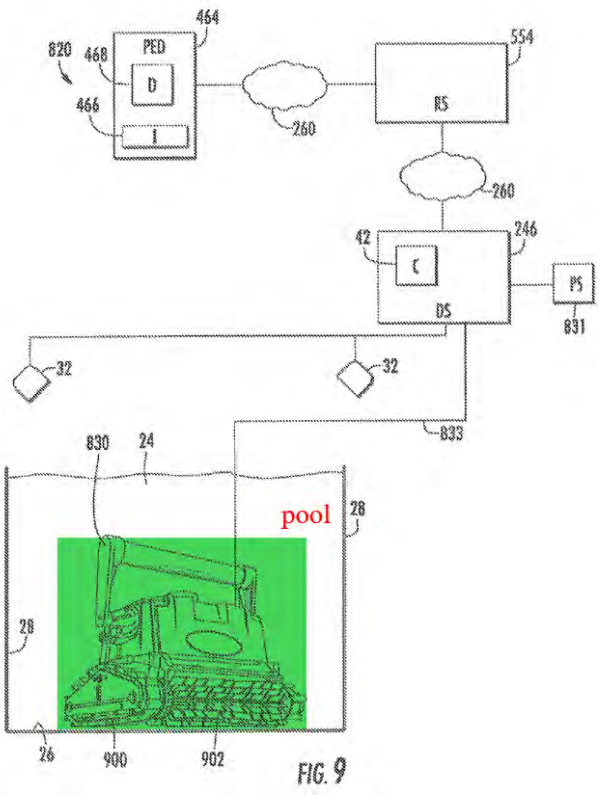


FIG. 9

c. 1[b]

Limitation 1[b] invokes §112¶6/§112(f); the function is "moving the vehicle body within the swimming pool," and the corresponding structure includes "wheels, rollers, tracks...powered by a motor." *See* §III.E.

Durvasula discloses this function and structure by describing moving the vehicle using "wheels, rollers, [or] tracks." Durvasula, [0014], [0016], [0046], Claims 1, 17, FIGS. 9-10 (annotated below); Janét, ¶¶119-121.

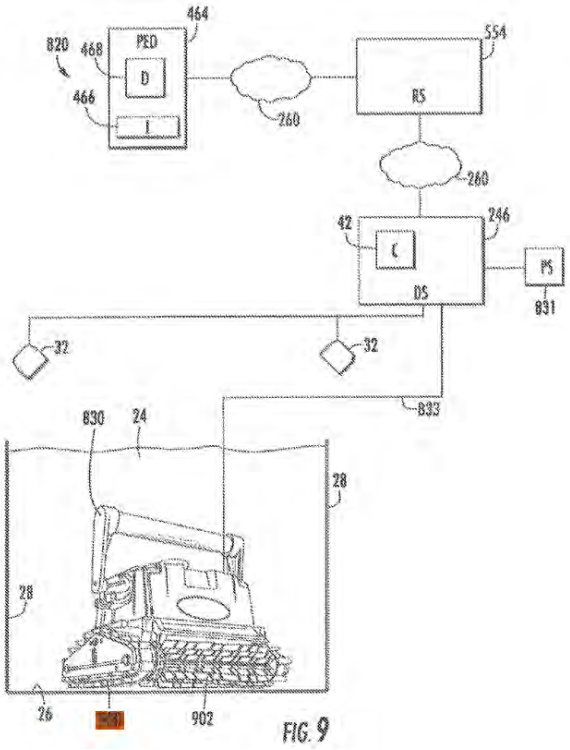


FIG. 9

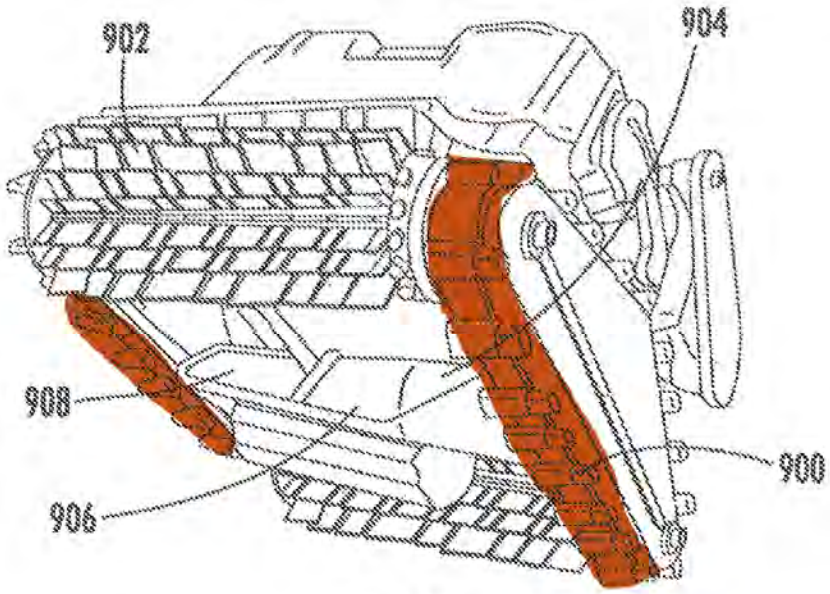


FIG. 10

d. 1[c]

Durvasula discloses 1[c]: "vehicle 30 may include…a **filter** to draw **debris**" and an "internally housed **filter bag**" through which "loosened **dirt and debris**" passes. *Id.*, [0014], [0046]; Janet, ¶122.

e. 1[d]

Durvasula discloses cameras 32 that are "configured to capture images of submerged surfaces 26, 28 of pool 22," and "cameras 32 may…be mounted to vehicle 30." Durvasula, [0013]-[0014], [0017]; Janét, ¶123.

f. 1[e][i]

The Durvasula-Fu-007 combination discloses or suggests the claimed controller in 1[e][i]. Janét, ¶¶124-128.

Durvasula describes controller 42 that "is in communication with vehicle 30 and cameras 32" and "is configured to generate control signals for steering vehicle 30." Durvasula, [0020], [0022]. Controller 42 "utilizes signals from camera 32 to steer vehicle 30" to "cover such missed portions" and "to re-clean such portions until such portions have been satisfactorily cleaned." Durvasula, [0023].

As explained in §III.C.1, Durvasula fails to disclose that its controller is "positioned on or in the body." Janét, ¶¶81-86, 125-126.

Like Durvasula, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. §IV.A.2. Fu-007's system includes monitoring camera 2, image acquisition card, central processing unit (controller)

housed in control system enclosure 8, and cleaning and moving platform with cleaning drive wheels 3. Fu-007, pp.12-14, Claims 1, 3, FIGS.1-2 (annotated below); Janét, ¶¶97-106, 127.

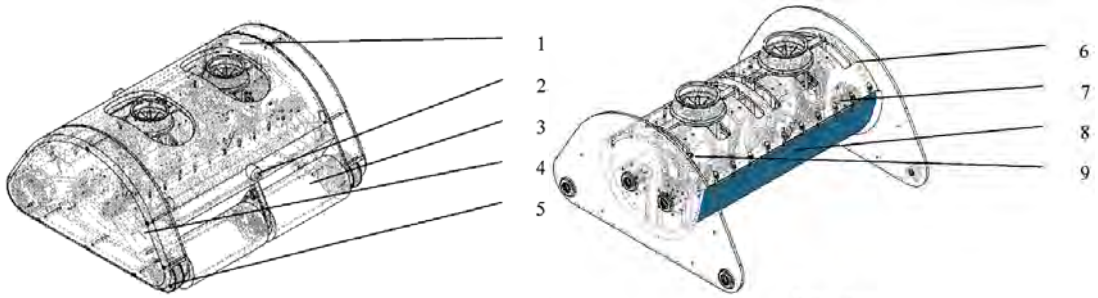


FIG. 1 FIG. 2

Similar to Durvasula, Fu-007 teaches using cleaning drive wheels, belt gears, and drive belts as part of a cleaning and moving platform to control the movement of the platform during the pool cleaning operation. Fu-007, pp.8-9, 12-14, Claims 1, 3. Janét, ¶¶95-106, 127.

For the reasons explained in §IV.A.3, POSITAs would have been motivated to modify Durvasula by substituting Durvasula's external controller with Fu-007's onboard controller structure housed in Fu-007's "sealed drive control enclosure" inside Durvasula's vehicle. Janét, ¶¶105-111, 128. Additionally, Fu-007's onboard controller would be in electronic communication with Durvasula's camera via onboard connection (per Fu-007's image acquisition card; pp.12-14), powered by an onboard power source (per Fu-007's rechargeable battery box; pp.12-14), and generates control signals for steering the vehicle based on camera-captured images

to clean or re-clean portions of the pool (per Durvasula's control logic). Janét, ¶¶105-111, 128.

g. 1[e][ii]

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

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

As explained in §§IV.A.3&IV.A.4.f (1[e][i]), POSITAs would have been motivated, and reasonably expected success, to modify Durvasula to replace Durvasula's external controller with Fu-007's onboard controller structure, where the onboard controller is in electronic communication with Durvasula's camera via Fu-007's internal connection architecture (the camera connects to the controller via an "image acquisition card"). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶¶105-111, 124-131.

h. 1[e][iii]

Durvasula's controller 42 generates control signals "in response to the captured image," because controller 42 identifies a portion requiring cleaning or re-cleaning based on "signals from camera 32," and steers vehicle 30 accordingly.

Durvasula, [0022]-[0023]; Janét, ¶133. Durvasula discloses generating control signals to cause movement "to...the first portion of the submerged surface," because Durvasula's controller 42 steers vehicle 30 to "cover such missed portions" and to "re-clean such portions." Durvasula, [0023], [0026], [0044]. Janét, ¶133.

As explained in §§IV.A.3&IV.A.4.f (1[e][i]), POSITAs would have been motivated, and reasonably expected success, to modify Durvasula's system to use Fu-007's onboard controller structure to execute Durvasula's control logic, including generating control signals to cause the body movement "to...the first portion of the submerged surface" in response to the captured image described above. Janét, ¶134. Thus, because the Durvasula-Fu-007 combination teaches control signals that cause movement "to" the first object, the Durvasula-Fu-007 combination discloses or suggests this limitation. Janét, ¶¶134-135.

5. Claim 2 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render independent Claim 2 obvious. Janét, ¶¶137-141.

a. 2[pre], 2[a]-2[c], 2[e][i]-[iii]

Limitations 2[pre], 2[a]-2[c], and 2[e][i]-2[e][iii] are identical to 1[pre], 1[a]-1[c], and 1[e][i]-1[e][iii], respectively. For the reasons in §§IV.A.4.a-IV.A.4.d (1[pre], 1[a]-1[c]), Durvasula discloses or suggests 2[pre] and 2[a]-2[c].

Additionally, for the reasons in §§IV.A.4.f-h (1[e][i]-[iii]), the Durvasula-Fu-007 combination discloses or suggests 2[e][i]-2[e][iii]. Janet, ¶138.

b. 2[d]

Limitations 2[d] and 1[d] only differ in:

<table>
<tr><td>1[d]</td><td rowspan="2">“camera”</td><td>“mounted directly or indirectly to”</td><td rowspan="2">“the body”</td></tr>
<tr><td>2[d]</td><td>“carried by”</td></tr>
</table>

Durvasula discloses 2[d], because a camera “mounted directly...to the body” (§IV.A.4.e (1[d])) is also “carried by the body.” Janet, ¶¶139-140.

6. Claim 3 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render Claim 3 obvious. Janet, ¶¶142-159.

a. 3[pre], 3[a]-3[c], 3[e][i]

Limitations 3[pre], 3[a]-3[c], and 3[e][i] are identical to 1[pre], 1[a]-1[c], and 1[e][i], respectively. For the reasons in §§IV.A.4.a-d (1[pre], 1[a]-1[c]), Durvasula discloses or suggests 3[pre] and 3[a]-3[c]. Additionally, for the reasons in §IV.A.4.f (1[e][i]), the Durvasula-Fu-007 combination discloses or suggests 3[e][i]. Janet, ¶143.

b. 3[d]

Limitations 3[d] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
3[d]		"positioned on or in, or carried by,"	

Durvasula discloses 3[d], because a camera "mounted directly...to the body" (§IV.A.4.e (1[d])) is also "positioned on or in, or carried by, the body." Janét, ¶144.

c. 3[e][ii]

As explained in §IV.A.4.g (1[e][ii]), the controller in the Durvasula-Fu-007 combination is "in electronic communication with the at least one **camera**."

Durvasula also discloses a **portable electronic device** ("PED") **464** including an input to "facilitate[] entry of inputs or commands by a person to cause **controller 42** to generate control signals varying the control of vehicle 30." Durvasula, [0032]-[0034], [0045], FIGS. 4-5, 9 (annotated below).

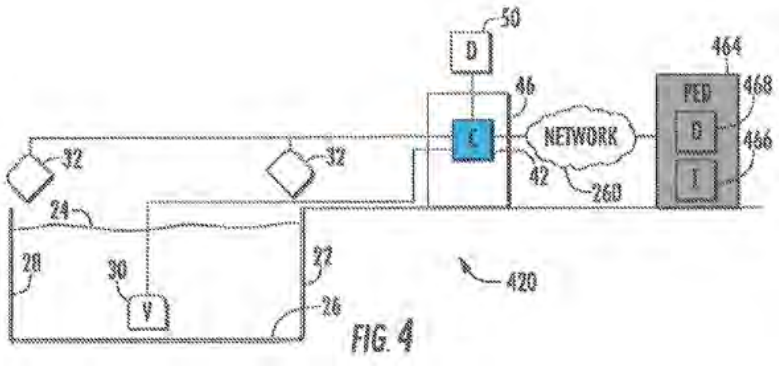


FIG. 4

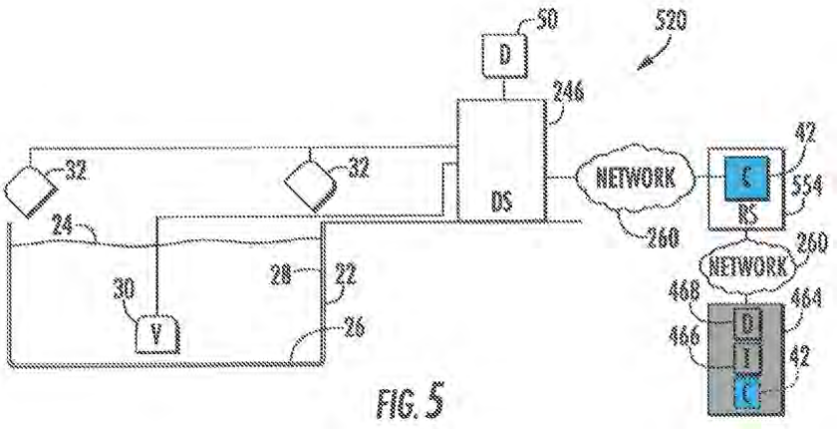

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FIG. 5

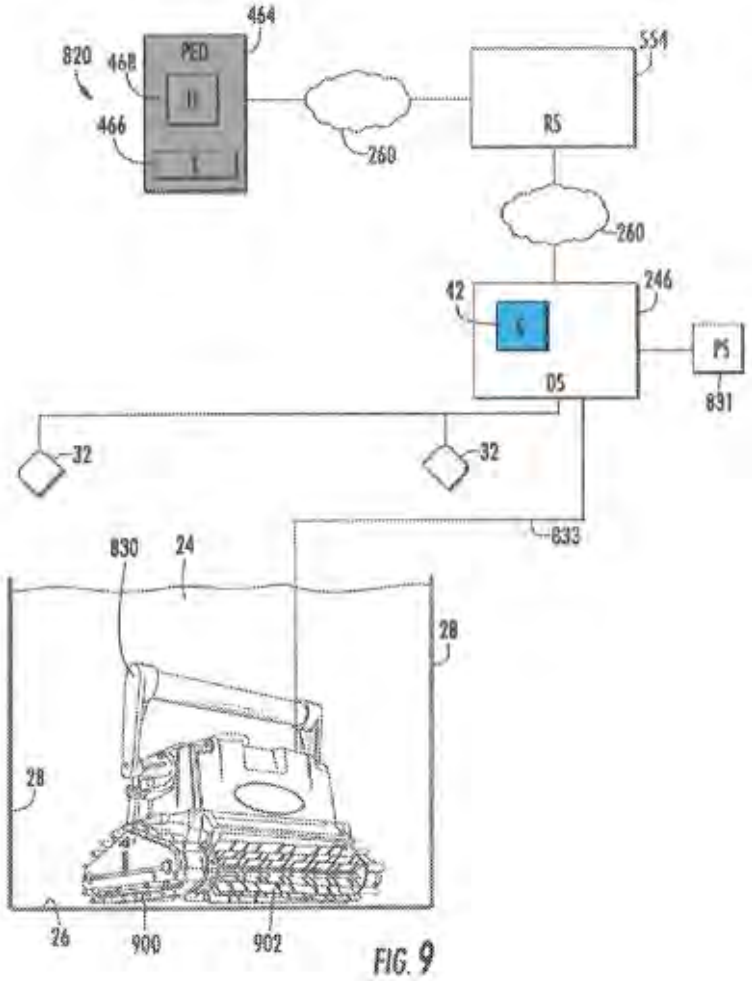

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FIG. 9

Fu-007 discloses that its robot operates in a "remote control" mode where its **central processing unit** (controller) receives commands from a **remote control keyboard 31** (PED) through a "remote control signal interface." Fu-007, pp.8-9, Claim 4, FIGS.6, 8 (annotated below). To receive signals while submerged, the robot uses a **control signal buoyant antenna 27** that "floats on a water surface to **wirelessly communicate** with the control keyboard 31" and is "configured to directly communicate with the **remote control signal interface** of the robot via the **control signal buoyant antenna cable (35)**." Fu-007, pp.8-9, 12-14, FIG. 8.

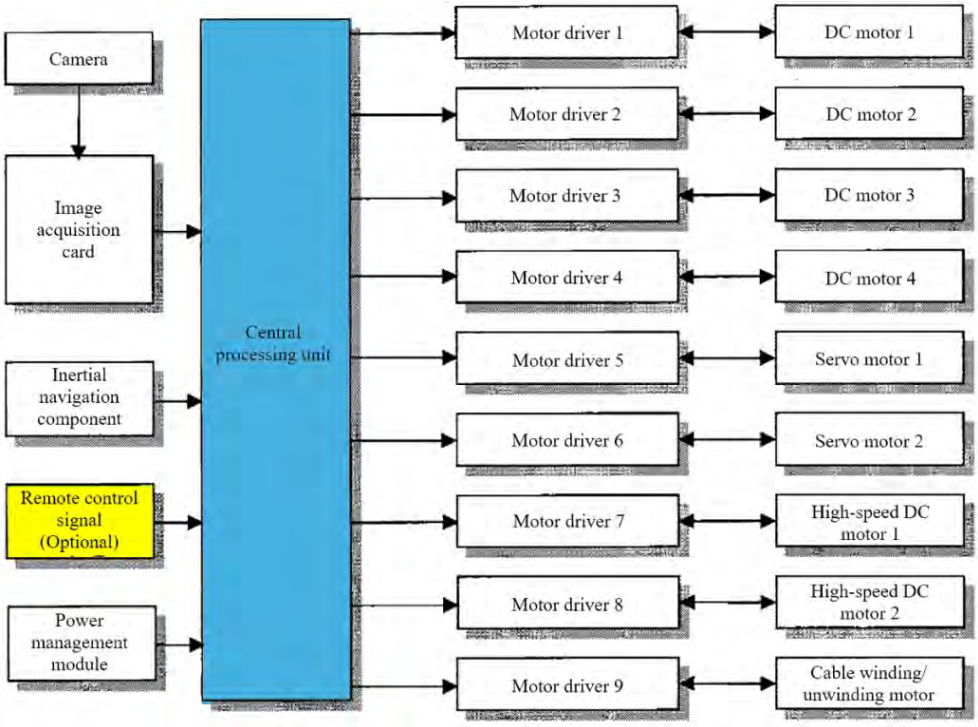


FIG. 6

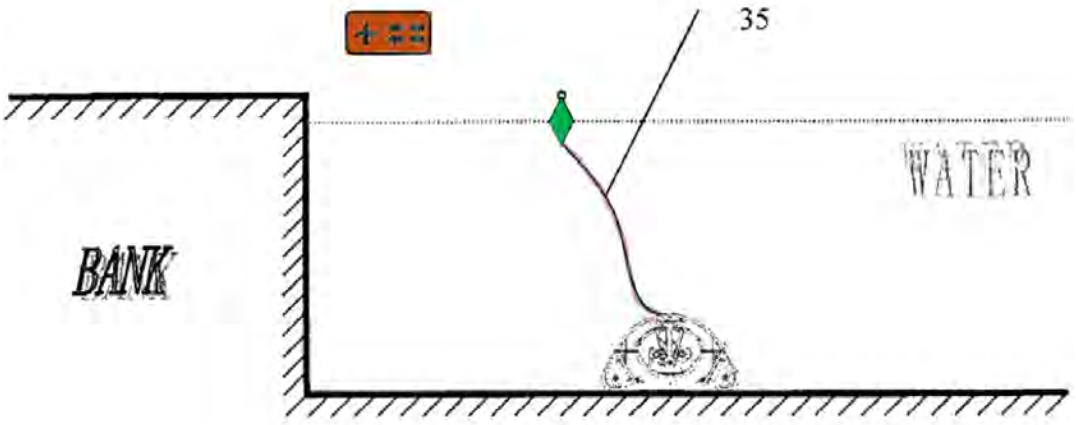


FIG. 8

POSITAs would have understood the "control keyboard 31" is a PED because it is a handle device (Fu-007, FIG. 8) distinct from the vehicle and designed to "wirelessly communicate" with the antenna. Fu-007, pp.12-14, FIG. 8; Janét, ¶150.

As explained in §IV.A.4.f (1[e][i]), POSITAs would have been motivated to replace Durvasula's controller with Fu-007's onboard controller. POSITAs would have been further motivated to establish electronic communication between Fu-007's onboard controller and Durvasula's PED using Fu-007's wireless communication mechanism. Janét, ¶151. Specifically, the combined system utilizes Fu-007's onboard wireless infrastructure (the remote control signal interface, antenna 27, and antenna cable 35) to receive signals transmitted by Durvasula's PED. Durvasula, [0033], FIGS. 4-5, 9; Fu-007, pp.12-14, FIG. 8; Janét, ¶151.

POSITAs would have been motivated to make such combination.

First, as discussed in §IV.A.4.f (1[e][i]), POSITAs would be motivated to remove Durvasula's tether to eliminate entanglement risks and electrical leakage hazards. To preserve the user's ability to manually operate the vehicle (Durvasula, [0034]), POSITAs would be motivated to utilize Fu-007's antenna-communication system, which would allow the manual control without reintroducing the safety risks of a shore-to-robot power cable. Durvasula, [0033], FIGS. 4-5, 9; Fu-007, pp.12-14, FIG. 8; Janét, ¶153.

Second, POSITAs would have recognized that using Fu-007's buoyant antenna, the user could reliably drive the robot to the wall for removal using the PED, instead of, e.g., pulling a cord or waiting for the robot to surface. Durvasula, [0033], FIGS. 4-5, 9; Fu-007, pp.12-14, FIG. 8; Janét, ¶154.

POSITAs would have reasonably expected success, because Fu-007 teaches a working implementation where its onboard controller is already configured with a "remote control signal" interface and "buoyant antenna" designed to communicate with a remote keyboard, and configuring this existing wireless interface with Durvasula's PED would have been a routine integration yielding predictable results. Fu-007, pp.12-14, FIG. 8; Janét, ¶155.

d. 3[e][iii]

As explained in §IV.A.3, IV.A.4.f-h (1[e][i]-[iii]), POSITAs would have been motivated, and reasonably expected success, to modify Durvasula's system to

use Fu-007's onboard controller to generate control signals "in response to...the **captured image**" to steer the vehicle "to...the first portion of the submerged surface" (e.g., to re-clean missed portions). Durvasula, [0022]-[0023], [0026], [0044]; Fu-007, Abstract, pp.8-9, 14-16, Claims 1, 4; Janét, ¶157. Thus, the Durvasula-Fu-007 combination satisfies this limitation through the "captured image" prong alone. *Id.*

Additionally, for reasons in §§IV.A.4.f&IV.B.5.c (1[e][i], 3[e][ii]), POSITAs would have been motivated, and reasonably expected success, to configure Fu-007's onboard controller to process control signals from Durvasula's PED and generate drive signals that cause the robot to move "to" a specific target area selected by the user (i.e., the "first portion of the submerged surface") for cleaning. Fu-007, pp.8-9, 14-16, Claim 7; Durvasula, [0033], [0036]; Janét, ¶158.

7. Claim 4 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render independent Claim 4 obvious. Janet, ¶¶160-162.

a. 4[pre], 4[a]-4[c], 4[e]

Limitations 4[pre], 4[a]-4[c], and 4[e] are identical to 1[pre], 1[a]-1[c], and 1[e], respectively. For the reasons in §§IV.A.4.a-d (1[pre], 1[a]-1[c]) and §§IV.A.4.f-h (1[e][i]-[iii]), Durvasula discloses or suggests 4[pre] and 4[a]-4[c]

and the Durvasula-Fu-007 combination discloses or suggests 4[e][i]-[iii]. Janet, ¶161.

b. 4[d]

Limitation 4[d] is nearly identical to 1[d], differing only in that 4[d] omits the requirement that the camera be "mounted directly or indirectly to the body." For the reasons in §IV.A.4.e (1[d]), Durvasula discloses 4[d]. Janet, ¶162.

8. Claim 5 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render independent claim 5 obvious. Janet, ¶¶163-168.

a. 5[pre], 5[a]-5[c]

Durvasula discloses or suggests limitations 5[pre] and 5[a]-5[c] for the reasons in §§IV.A.4.a-d (1[pre]-1[c]), because they are identical to 1[pre] and 1[a]-1[c]. Janét, ¶164.

b. 5[d]

Durvasula discloses or suggests 5[d] because it teaches "vehicle 30 may include a **chemical dispenser** to closely apply pool cleaning chemicals to the pool surfaces as the vehicle 30 traverses such surfaces." Durvasula, [0015]; Janét, ¶165.

c. 5[e]

Limitations 5[e] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"

5[e]		"on, in, or carried by"	"the vehicle body"

Durvasula discloses 5[e], because a camera "mounted directly...to the body" (§IV.A.4.e (1[d])) is also "on, in, or carried by the vehicle body." Janét, ¶166.

d. 5[f][i]

Limitations 5[f][i] and 1[e][i] only differ in:

1[e][i]	"controller"	"positioned on or in"	"the body"
5[f][i]		"on, in, or carried by"	"the vehicle body"

The Durvasula-Fu-007 combination discloses or suggests 5[f][i], because a controller "positioned on or in the body" (§IV.A.4.f (1[e][i])) is also "on, in, or carried by the vehicle body." Janét, ¶167.

e. 5[f][ii]-5[f][iii]

The Durvasula-Fu-007 combination discloses or suggests limitations 5[f][ii] and 5[f][iii] for the reasons in §§IV.A.4.f-h (1[e][ii]-[iii]), because they are identical to 1[e][ii] and 1[e][iii]. Janét, ¶168.

B. Ground 2A: Claims 1-4 Are Unpatentable over Cui with Fu-007

1. Cui

Cui (EX1005) is prior art under AIA 35 U.S.C. §102(a)(1) and pre-AIA 35 U.S.C. §102(b). Janét, ¶169.

Cui discloses a pool cleaner with debris detection capability for use in swimming pools. Cui, Title, Abstract. A CCD camera is used to capture images of pool surfaces, compare them with pre-stored standard images of clean surfaces, and control the cleaner's operation based on detected debris levels/distributions. *Id.*, Abstract, pp.5-7.[4] Cui is analogous art. Janét, ¶170.

Cui's pool cleaner comprises a housing 4 containing various components including a **water pump motor 2**, an **infrared distance sensor 3**, a **camera 5**, a **filter bag 6**, a computer 7, **track-type crawling mechanisms 10**, **roller brushes 11**, and **hybrid stepper motors 15**. Cui, Claim 1, pp.5-6, FIGS. 1-2 (annotated below).

[4] Page citations to Cui are to the original pagination in the bottom center of each page.

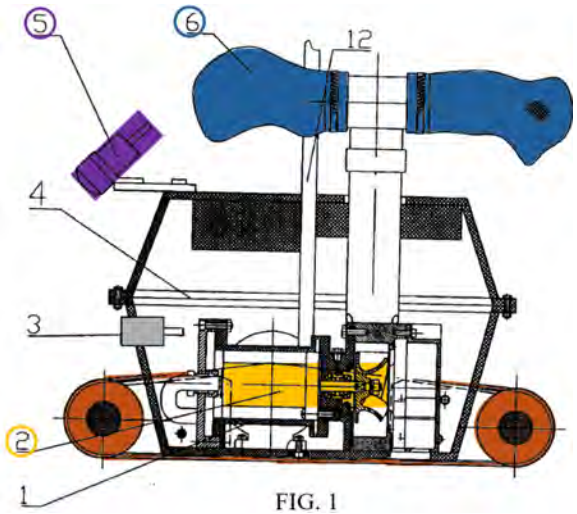


FIG. 1

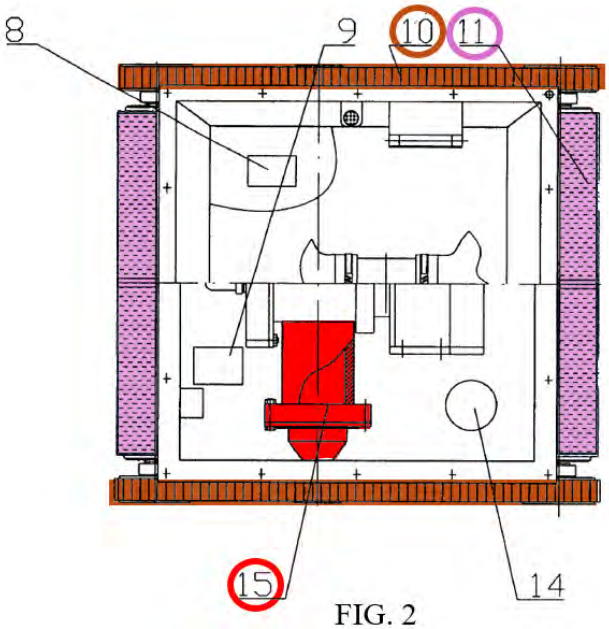


FIG. 2

Cui's computer 7 processes images from **camera 5** to detect debris levels/distributions, and generates control signals that adjust speed of **motors 15**, controlling crawling speed and cleaning force. Cui, pp.4-7, FIGS. 5-6 (annotated below).

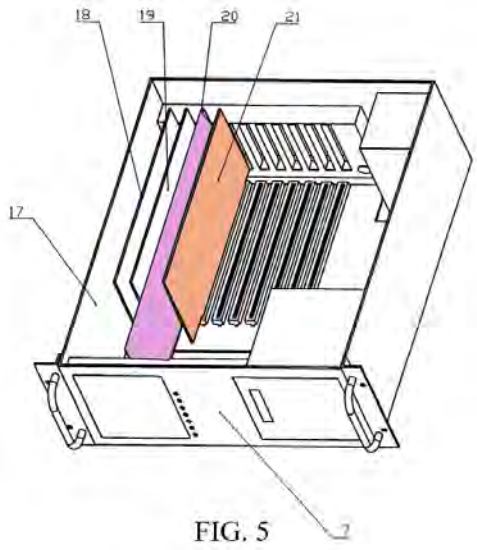


FIG. 5

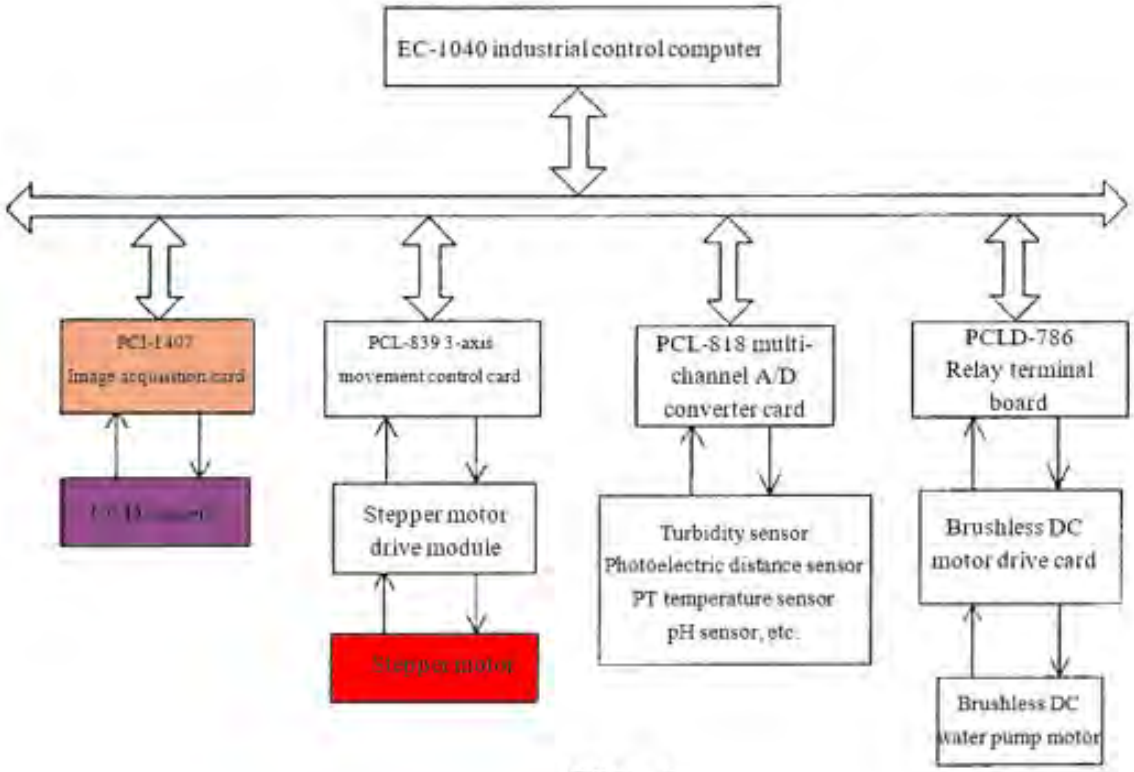


FIG. 6

2. Motivation to Combine

Both Cui and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve autonomous pool cleaning operations. Cui describes a pool cleaner using "intelligent adaptive technology with computer control" to autonomously adjust cleaning force based on debris distribution. Cui, p.5. Fu-007 similarly describes an underwater cleaning robot that can "help and even replace humans to autonomously complete underwater cleaning work." Fu-007, p.11; § IV.A.2. POSITAs would have been

motivated to combine the complementary teachings of Cui and Fu-007 to improve autonomous pool cleaning. Janét, ¶174.

POSITAs would have recognized that the teachings in Cui and Fu-007 are directed to the same pool cleaning technical field, based on recognition of t similar technical issues in pool cleaning, and provide similar technical solutions to address those issues. Janét, ¶175. Specifically, both use a controller to generate, in response to captured images, control signals to cause movement of the pool cleaning body within the swimming pool. *Compare* Cui, pp.5-7, FIGS. 5-7, *with* Fu-007, pp.10, 14-16, Claims 4, 7. Additionally, both teach motorized drive mechanisms to cause and control movement of the pool cleaner during operation. *Compare* Cui, pp.5-6, Claim 1, FIGS. 1-3, *with* Fu-007, pp.8-9, 12-14, Claims 1, 3. Accordingly, POSITAs would have investigated the technical teachings in both to seek guidance when designing a pool cleaning system for specific pool cleaning considerations and applications. Janét, ¶175.

Different from Cui's placement of the controller (computer 7) outside the pool and separate from the vehicle in a tethered configuration via cable assembly 12, Fu-007's controller is within the vehicle. Fu-007, pp.8-9, 12-14, Claim 4. The use of an external controller separated from the pool cleaner in Cui and the use of an onboard controller in Fu-007 had been two known design options. Janét, ¶176.

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

First, Cui relies on an external computer and cable assembly, which constrains autonomy by limiting range and requiring human intervention to manage cable entanglements, but Fu-007 teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11; Janét, ¶177. POSITAs would have recognized that integrating Fu-007's onboard controller into Cui would have enhanced autonomous operations by generating control signals onboard to perform cleaning tasks, allowing the vehicle to navigate without cable constraints or human supervision. Janét, ¶177.

Second, Cui discloses a tethered configuration connecting industrial control computer 7 via an external "cable assembly 12" (Cui, pp.5-6, Claim 1, FIGS. 1-2), which POSITAs would have recognized introduces safety risks of electrical leakage. Janét, ¶178. POSITAs would have been motivated to make this modification to further improve the safety of Cui's system by removing the cable. *Id.*; §IV.A.3 (explaining Fu-007's teaching of a safer system).

POSITAs would have had a reasonable expectation of success because positioning the controller on the vehicle body was a well-known design choice. Fu-007, pp.8-10, 12-14; Knoll, [0007], [0027]-[0028], FIG.1; §§IV.D.1-IV.D.2;

Renaud (EX1017), [0008]-[0009], [0029]-[0030]; §§IV.G.1-IV.G.2; Janét, ¶180. Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Cui's—analyzing captured images and generating drive signals (Fu-007, pp.8-10, 14-16)—so POSITAs would have reasonably expected it would implement Cui's specific control logic (e.g., processing images to control crawling speed based on debris levels; Cui, pp.5-7), yielding predictable results. Janét, ¶180.

3. Claim 1 is Unpatentable over Cui and Fu-007

The Cui-Fu-007 combination renders independent claim 1 obvious. Janét, ¶181-211.

a. 1[pre]

Cui discloses or suggests 1[pre]. Janét, ¶182-185.

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

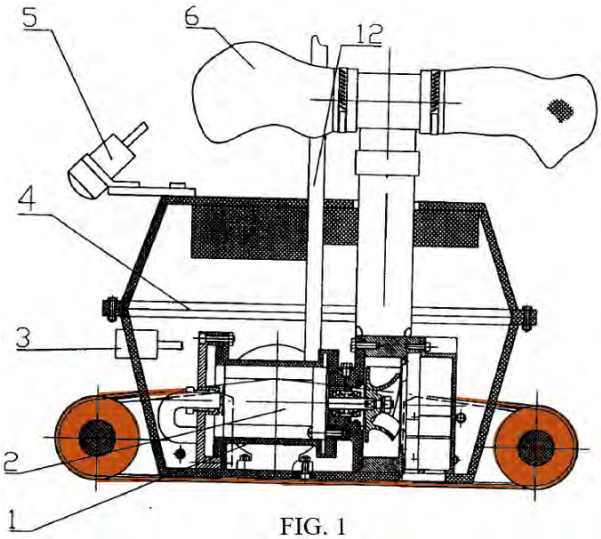


FIG. 1

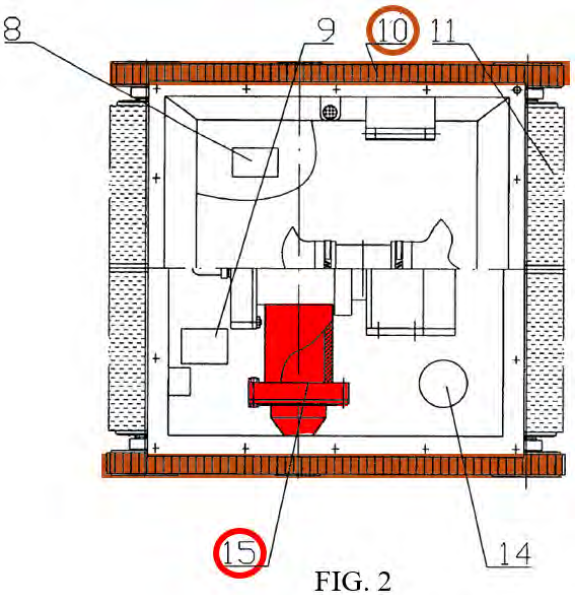


FIG. 2

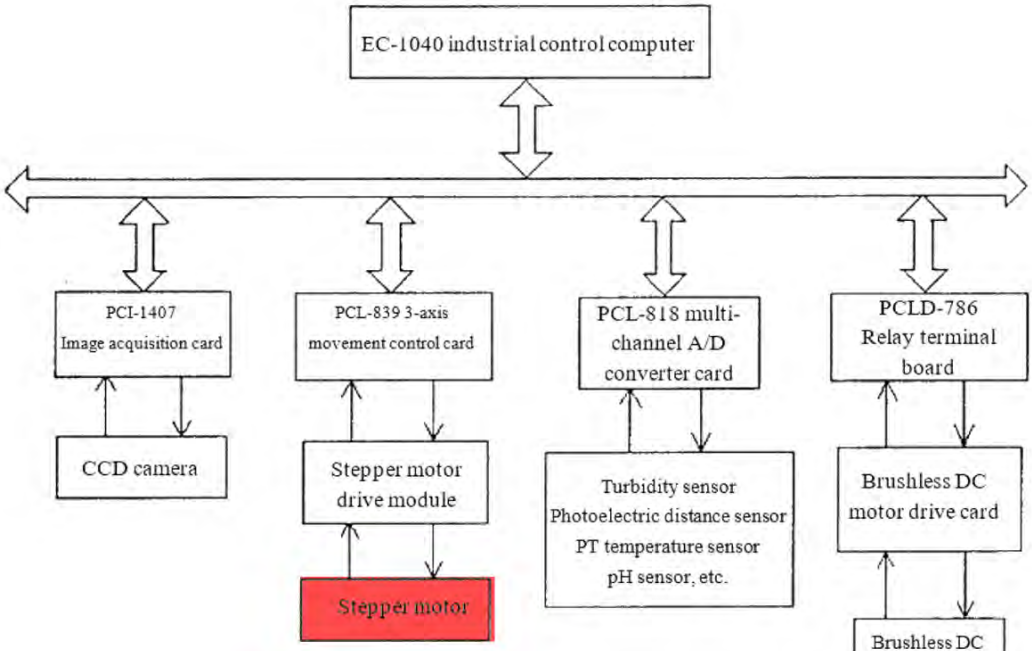


FIG. 6

Cui's cleaning vehicle is self-propelled, because computer 7 controls motors 15 to move the vehicle across pool surfaces. Cui, Claim 1, pp.5-6. Janét, ¶184.

Cui's system detects debris by comparing captured images with "pre-stored standard image information of a clean pool bottom"—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s)." Cui, Abstract, pp.4-7. Cui's system collects and cleans debris using "roller brush (11)," "brushless DC water pump motor (2)," and "filter bag (6)." Cui, Claim 1, pp.5-7; Janét, ¶185.

b. 1[a]

Cui discloses or suggests 1[a]. Janét, ¶186-187.

Cui's pool cleaner includes a vehicle body, i.e., housing 4 with integrated propulsion mechanisms (track-type crawling mechanisms 10, motors 15), cleaning components (motor 2, brushes 11, filter 6), and sensors (camera 5). Cui, Claim 1, pp.5-6, FIG.1 (annotated below). POSITAs would have understood this assembled structure constitutes a "vehicle body." Janét, ¶187.

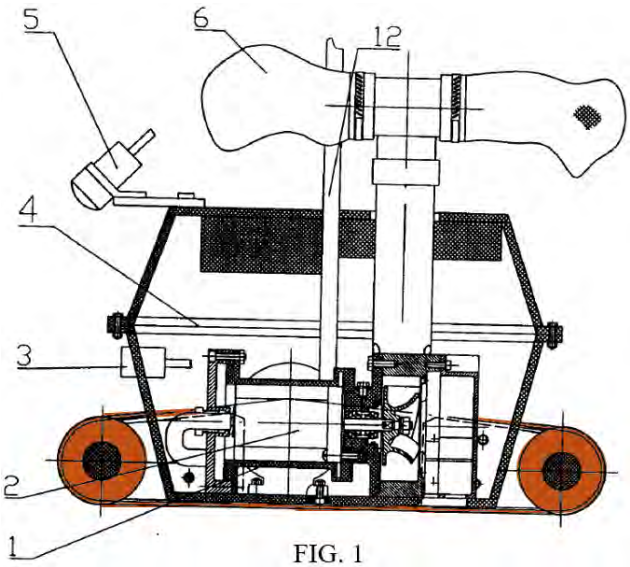


FIG. 1

c. 1[b]

Cui discloses or suggests 1[b]. Janét, ¶188-191.

Limitation 1[b] invokes §112¶6/§112(f); the function is "moving the vehicle body within the swimming pool," and the corresponding structure includes "**tracks**...powered by a motor." *See* §III.E.

Cui discloses this function and structure by disclosing moving the vehicle via **track-type crawling mechanisms 10** powered by **motors 15**. Cui, Claim 1, pp.5-7, FIGS. 1-2 (annotated below); EX1001, 3:33-45; Janét, ¶190-191.

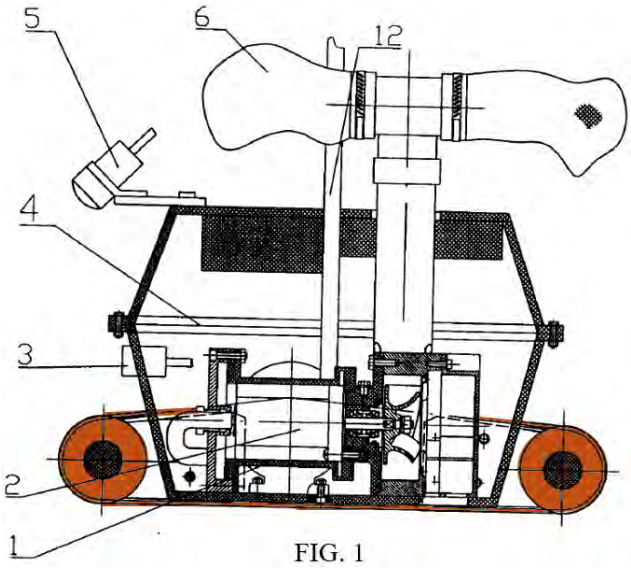


FIG. 1

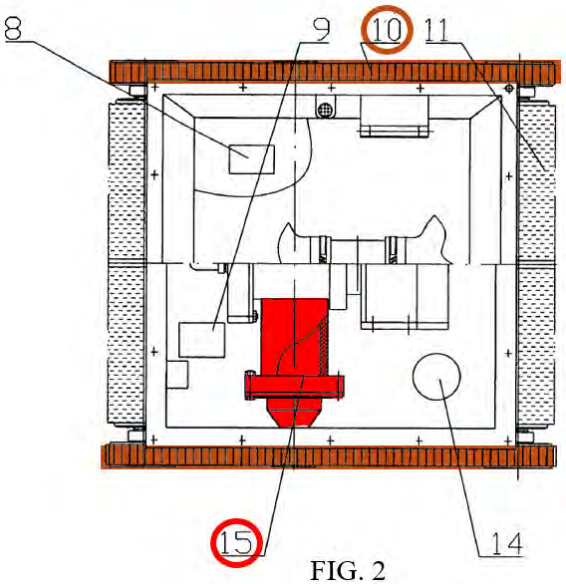


FIG. 2

d. 1[c]

Cui discloses or suggests 1[c]. Janét, ¶192-193.

Cui's system includes a **pump motor 2** and **filter bag 6** (filter) that retains debris collected from the submerged surface. Cui, Claim 1, pp.5-6, FIG.1 (annotated below). POSITAs would have understood Cui's pump motor draws water containing debris from pool surfaces and filter bag retains the debris. Janét, ¶193.

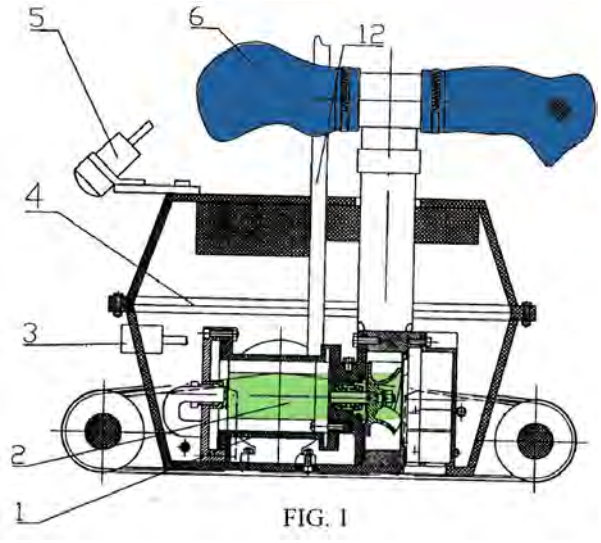


FIG. 1

e. 1[d]

Cui discloses or suggests 1[d]. Janét, ¶194-196.

Cui discloses a **camera 5** "**mounted at** the upper front end of the **housing 4**" to observe pool surfaces. Cui, Claim 2, FIG. 1 (annotated below), pp.5-6; Janét, ¶195.

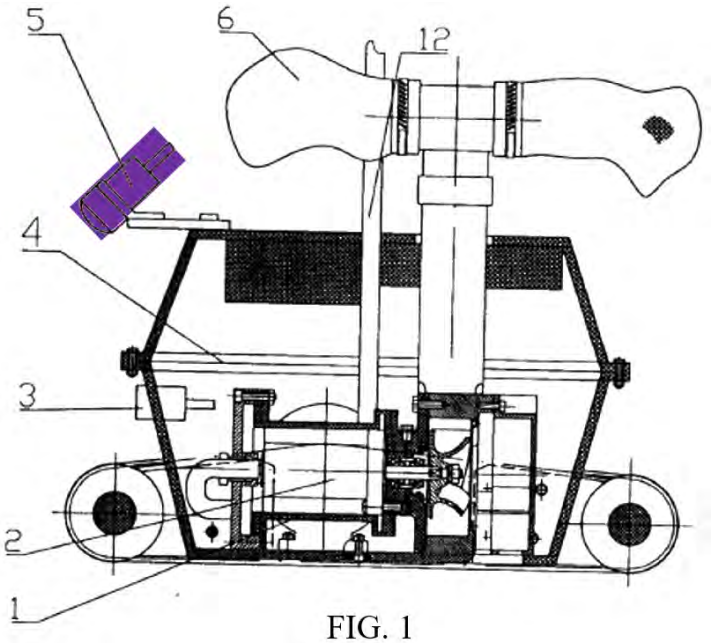


FIG. 1

Cui's camera "continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner," including "sediment **at the pool bottom**," which are "compared with the original standard image(s) of the pool bottom" to identify debris. Cui, pp.5-7; Janét, ¶196. POSITAs would have understood that Cui's camera captures images of "at least a first portion of the submerged surface" because the camera observes the pool bottom—a submerged surface during cleaning—and debris/sediment thereon, and the area with debris constitutes the claimed "first portion." *Id.*

f. 1[e][i]

The Cui-Fu-007 combination discloses or suggests 1[e][i], because Cui discloses a controller, Fu-007 discloses a controller inside the vehicle body, and POSITAs would have been motivated to modify Cui's system to incorporate Fu-007's teaching of the onboard controller. Janét, ¶197.

Cui's pool cleaner includes **computer 7** (controller) separated from pool cleaner and is connected to the pool cleaner via cable 12. Cui, FIGS. 1-3. Computer 7 is connected to "the pool cleaner through the **cable assembly 12** and the **plug assembly 14**," and to **camera 5** through **image acquisition card 21** and processes captured images to generate control signals that adjust crawling speed based on detected debris levels. Cui, pp.5-7, FIGS. 1-2, 5-6 (annotated below); Janét, ¶198. Cui describes that "[t]he voltage signal is sent to...computer 7 for

processing…A pulse signal command output after processing…to separately control the drive of the two hybrid stepper motors 15." Cui, pp.6-7; §IV.B.3.e (1[d]). POSITAs would have understood that Cui's computer 7 is a "controller." Janét, ¶198.

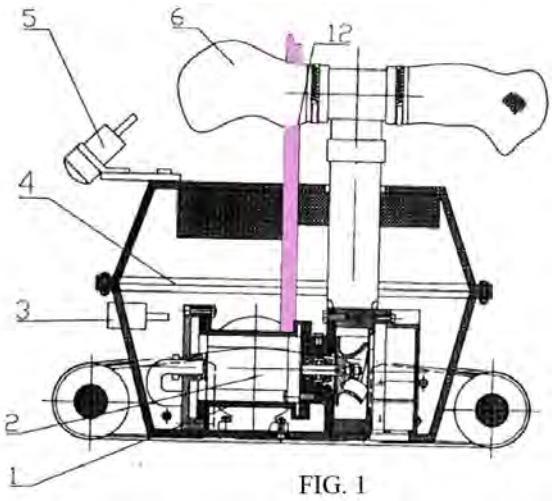


FIG. 1

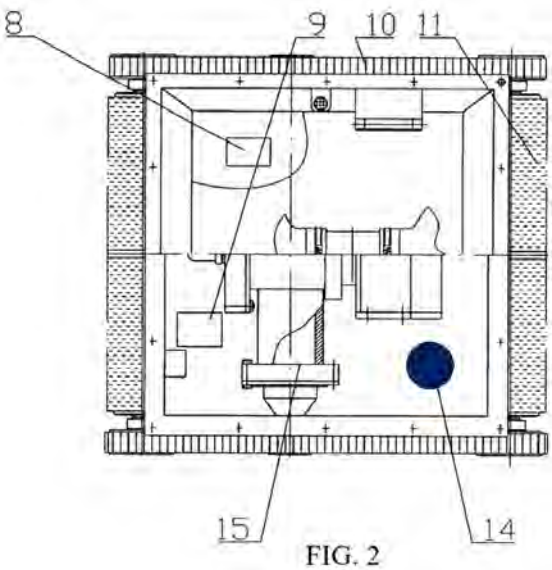


FIG. 2

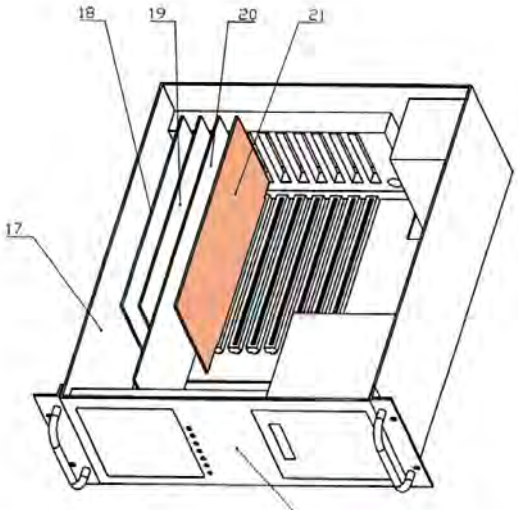


FIG. 5

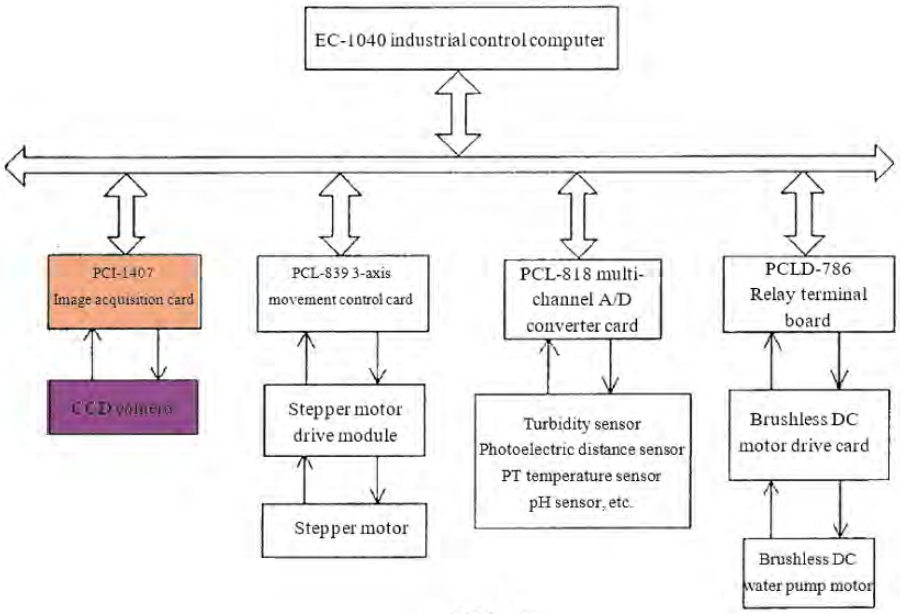


FIG. 6

Like Cui, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control through a controller to generate, in response to captured images, control signals to move the pool cleaning body. §IV.A.2; Janét, ¶199.

Fu-007 discloses a controller positioned in the body of its cleaning and moving platform. §§IV.A.2&IV.A.4.f; Fu-007, pp.8-9, 12-14, Claim 4, FIGS.2, 4 (annotated below); Janét, ¶200.

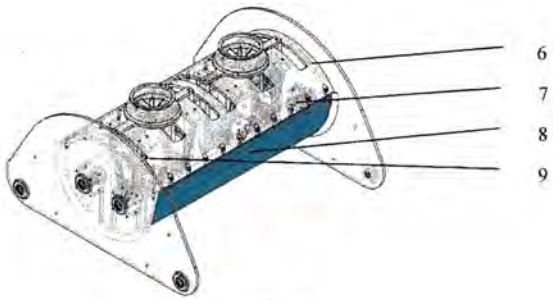


FIG. 2

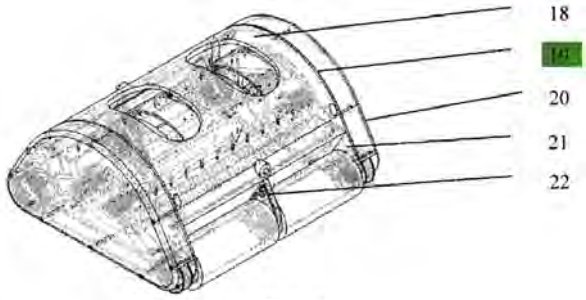


FIG. 4

This onboard controller connects to **monitoring camera 2**. Fu-007, pp.12-14, Claim 4, FIGS.1, 6 (annotated below); §IV.A.4.f. Janét, ¶201.

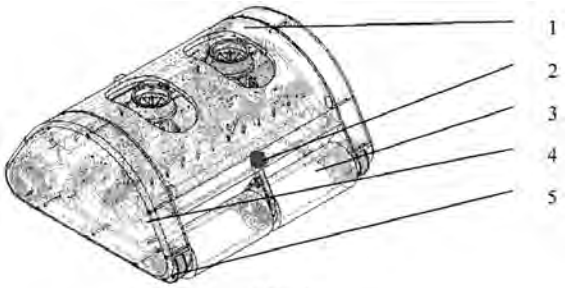


FIG. 1

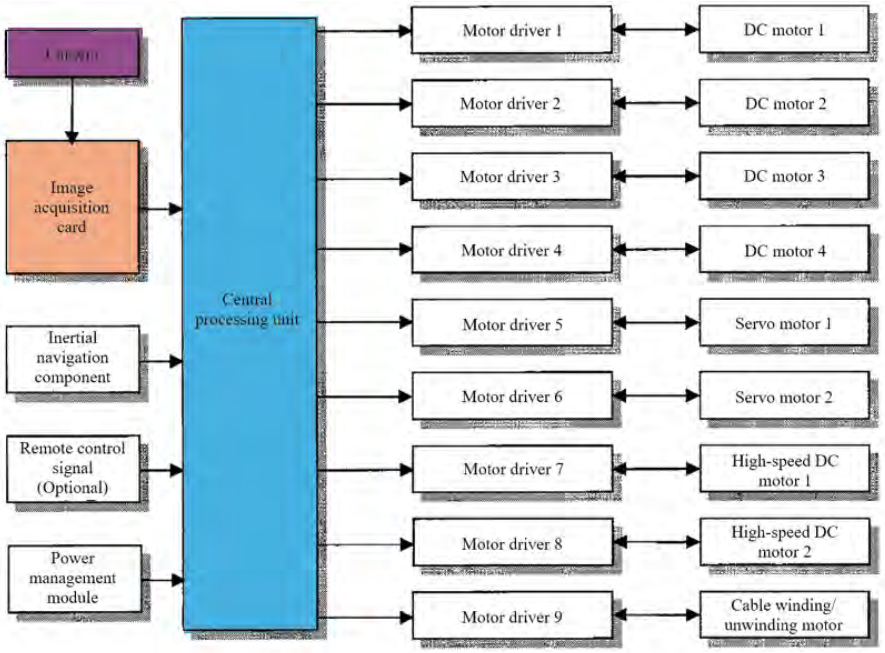


FIG. 6

For the reasons explained in §IV.B.2, POSITAs would have been motivated to modify Cui's system by substituting Cui's external computer 7 with Fu-007's onboard controller structure. Janét, ¶202. The modified system's onboard controller would be: (1) in electronic communication with Cui's camera via an onboard connection (e.g., Fu-007's image acquisition card; Fu-007, pp.12-14), (2) powered by Fu-007's rechargeable battery box (*id.*), and (3) configured to generate control signals for controlling the vehicle movement (e.g., wheel speed) based on captured images to clean the pool per control logics of Cui and/or Fu-007. Cui, pp.5-7; Fu-007, pp.14-16; Janét, ¶202.

g. 1[e][ii]

The Cui-Fu-007 combination discloses or suggests 1[e][ii]. Janét, ¶¶203-205.

Cui's **computer 7** is connected to camera 5 through **image acquisition card 21**. Cui, Claim 3, pp.5-7, FIGS. 5-6 (annotated below). During cleaning, "camera 5...continuously captures images" and "[t]he video signal undergoes A/D conversion through the high-speed image acquisition card 21" for processing by computer 7. Cui, pp.5-7.

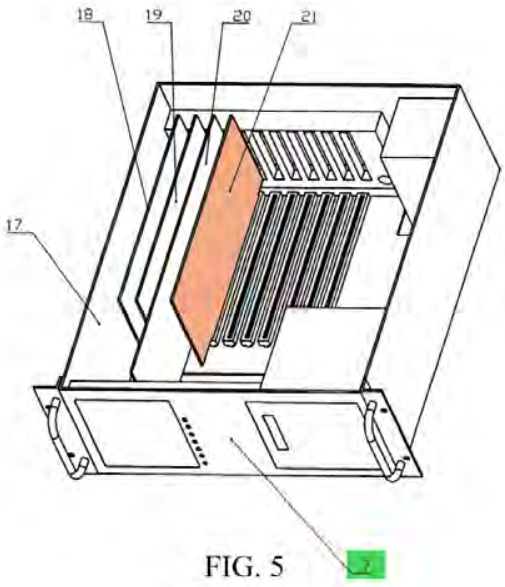


FIG. 5

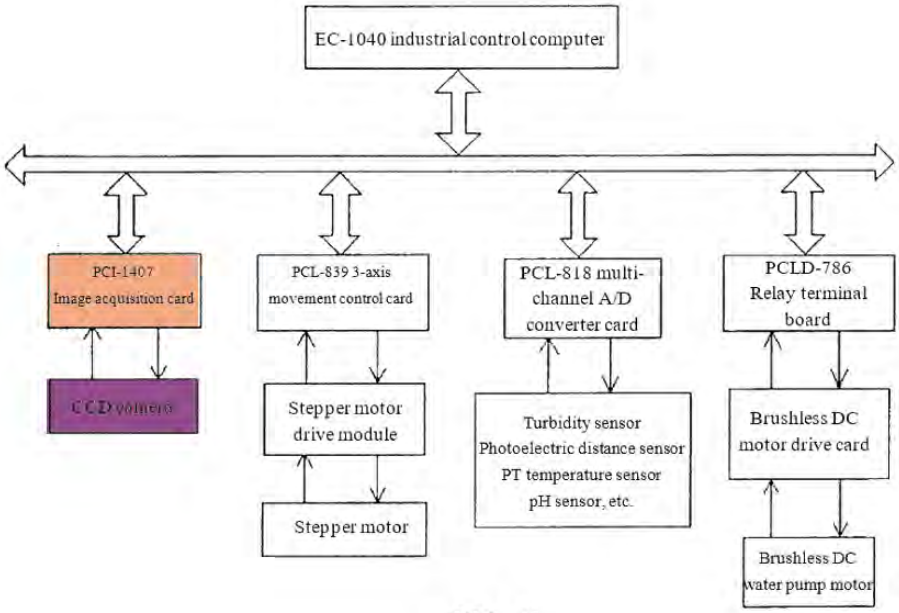


FIG. 6

As explained in §§IV.B.2&IV.B.3.f (1[e][i]), POSITAs would have been motivated, and reasonably expected success, to modify Cui's system by substituting Cui's external computer with Fu-007's onboard controller structure to, e.g., eliminate external tether dependencies. Fu-007, pp.8-10, 12-14, Claim 4; Janét, ¶205. In this modified system, the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007's internal connection architecture. Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶205.

h. 1[e][iii]

Cui's controller compares captured images with stored standard images to identify sediment/debris—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in

a high comparison output voltage." Cui, pp.6-7. Based on this image-derived signal, "[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15." *Id.*, p.7. Thus, these are "control signal[s]" generated "in response to the captured image." Janét, ¶207. As explained in §IV.B.3.e (1[d]), Cui's camera 5 captures images of areas "located directly in front and below a crawling direction of the cleaner." Cui, Abstract, pp.5-7. Therefore, when the controller generates signals to adjust motor speed based on detected debris, the robot continues moving **toward** the debris-laden area identified in the image—i.e., the control signals cause movement "to" the first portion of the submerged surface. Janét, ¶207.

Additionally, Fu-007's onboard controller generates control signals in response to captured images to cause movement to a targeted portion of the surface. Janét, ¶208. Specifically, Fu-007 describes that its central processing unit (controller) sets "a swimming pool cleanliness image threshold" and uses camera 2 to "take image(s) of the bottom of the swimming pool." Fu-007, pp.10, 14-16. The controller then "determines a cleanliness level of the bottom of the swimming pool by comparing the image(s) with the threshold" and, based on this determination, "plans a cleaning movement" and "adjusts operating conditions of the four cleaning drive wheels 3...to complete the cleaning task." *Id.* And this adjustment involves changing the "rotational speed of each wheel" such that the robot "may

move in a direction determined by" the specific wheel speed combinations (e.g., rotating front wheels rapidly and rear wheels slowly). *Id.* POSITAs would have understood that by planning a cleaning movement based on the determined cleanliness level and adjusting wheel speeds to move in a specific direction, Fu-007's controller generates control signals to cause the body to move "to" the identified portion of the submerged surface (e.g., the dirty area) to "complete the cleaning task." *Id.*; Janét, ¶208.

As explained in §§IV.B.2&IV.B.3.f (1[e][i]), POSITAs would have been motivated to modify Cui's system to replace Cui's external computer with Fu-007's onboard controller structure to implement the control logics of Cui and/or Fu-007, including configuring the onboard controller to implement Fu-007's image-based navigation logic—planning movements based on image thresholds. Janét, ¶209. POSITAs would have recognized that integrating Fu-007's ability to "plan[] a cleaning movement" and execute specific directional movements would result in more effective and efficient cleaning. Fu-007, pp.14-16; Janét, ¶209.

4. Claim 2 Unpatentable over Cui and Fu-007

The Cui-Fu-007 combination renders Claim 2 obvious. Janét, ¶¶212-215.

a. 2[pre], 2[a]-2[c], 2[e]

Limitations 2[pre], 2[a]-2[c], and 2[e] are identical to 1[pre], 1[a]-1[c], and 1[e], respectively. For the reasons in §§IV.B.3.a-d (1[pre], 1[a]-1[c]), Cui discloses

or suggests 2[pre] and 2[a]-2[c]. Additionally, for the reasons in §§IV.B.3.f-h (1[e][i]-[iii]), the Cui-Fu-007 combination discloses or suggests limitation 2[e]. Janét, ¶213.

b. 2[d]

Limitations 2[d] and 1[d] only differ in:

<table>
<tr><td>1[d]</td><td rowspan="2">“camera”</td><td>“mounted directly or indirectly to”</td><td rowspan="2">“the body”</td></tr>
<tr><td>2[d]</td><td>“carried by”</td></tr>
</table>

Cui discloses 2[d] because a camera “mounted directly...to the body” (§IV.B.3.e (1[d])) is also “carried by the body.” Janét, ¶214.

5. Claim 3 Unpatentable over Cui and Fu-007

The Cui-Fu-007 combination renders Claim 3 obvious. Janét, ¶¶216-232.

a. 3[pre], 3[a]-3[c], 3[e][i]

Limitations 3[pre], 3[a]-3[c], and 3[e][i] are identical to 1[pre], 1[a]-1[c], and 1[e][i], respectively. For the reasons in §§IV.B.3.a-IV.B.3.d (1[pre], 1[a]-1[c]), Cui discloses or suggests 3[pre] and 3[a]-3[c]. Additionally, for the reasons in §IV.B.3.f (1[e][i]), the Cui-Fu-007 combination discloses or suggests limitation 3[e][i]. Janét, ¶217.

b. 3[d]

Limitations 3[d] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
3[d]		"positioned on or in, or carried by,"	

Cui discloses 3[d], because a camera "mounted directly...to the body" (§IV.B.3.e (1[d])) is also "positioned on or in, or carried by, the body." Janét, ¶218.

c. 3[e][ii]

The Cui-Fu-007 combination discloses or suggests 3[e][ii]. Janét, ¶¶219-227.

As explained in §IV.B.3.g (1[e][ii]), the Cui-Fu-007 combination discloses or suggests the controller "in electronic communication with the at least one **camera**."

The Cui-Fu-007 combination also discloses or suggests the controller "in electronic communication with...a **portable electronic device**." Janét, ¶221.

Cui's computer 7 includes "a human-machine interface 16" displaying "the cleaned area...denoted by light blue, and the area that has not been cleaned yet...denoted by dark blue so that the working status of the cleaner can be seen at a glance." Cui, pp.6-7, Claim 3, FIG. 4. Importantly, Cui discloses that "[a]utomatic and manual switches are provided on the left of the panel diagram" of this

interface, along with "'start', 'stop', and 'continue' switches." Cui, p.6, FIG. 4. Thus, Cui contemplates a system where the user can intervene, select modes (automatic vs. manual), and control the operation of the cleaner. Janét, ¶222.

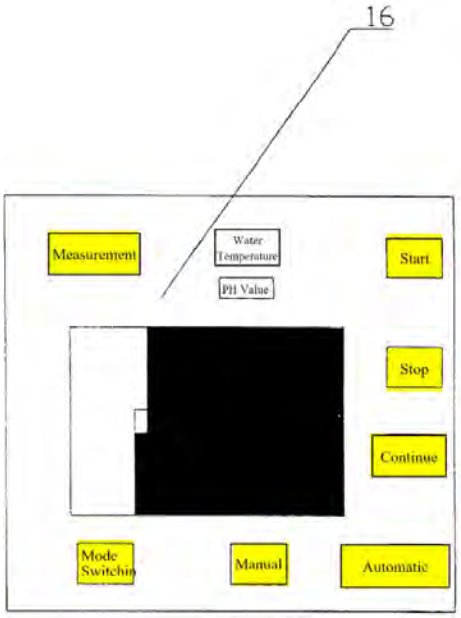


FIG. 4

Fu-007 similarly discloses that two modes of its cleaning robot: "remote control [manual] and autonomous control." Fu-007, Abstract. Fu-007 describes that "[i]n the manual mode, a control signal is sent by manual operation using the **control keyboard (31)**" to "control the underwater cleaning robot via...**buoyant antenna (27)**" that "floats on a water surface to wirelessly communicate with the control keyboard 31" and is "connected to the robot via the **control signal buoyant antenna cable 35**." Fu-007, pp.12-14, FIG. 8 (annotated below); Janét, ¶223.

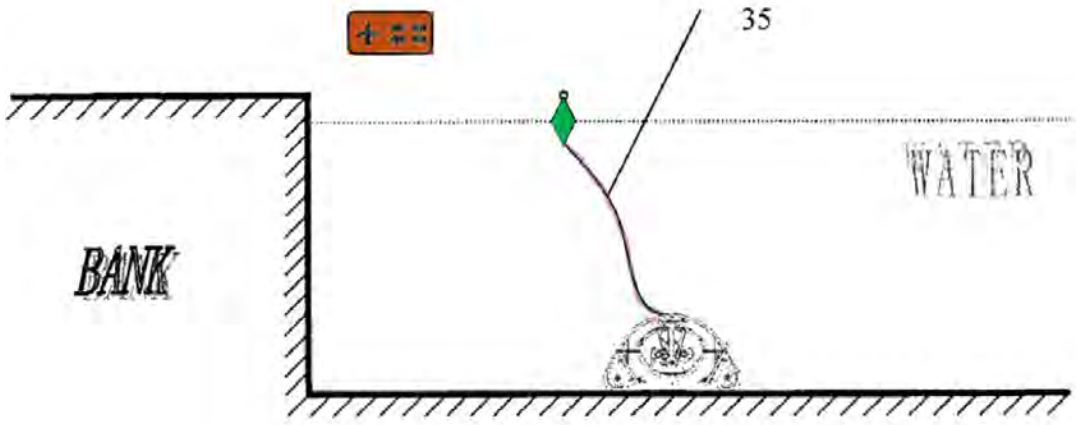


FIG. 8

As explained in §IV.B.3.f (1[e][i]), POSITAs would have been motivated by the disclosure of wireless communication link between portable control keyboard 31 (PED) and the robot in Fu-007 to modify Cui's system to eliminate the external cable and move the controller onboard to improve autonomy and safety. Janét, ¶224. POSITAs would have been further motivated to incorporate Fu-007's "manual mode" functionality (including the control keyboard and buoyant antenna and cable). resulting in a modified system with a dual-mode (wired and wireless) capability, just as Fu-007 disclosed. Fu-007, pp.12-14, FIG. 8; Cui, pp.6-7, Claim 3, FIG. 4; Janét, ¶224.

POSITAs would have made such a modification to preserve Cui's existing manual control capabilities. Cui, pp.6-7, Claim 3, FIG. 4; Janét, ¶225. Cui's system relies on a "human-machine interface" with "manual switches" to allow the user to direct the robot. Cui, p.6. Removing the physical tether (as proposed in 1[e][i])

disconnects this wired interface, and POSITAs would have recognized that utilizing Fu-007's wireless "control keyboard" and "manual mode" provides a functional substitute, restoring the user's ability to manually "start," "stop," or steer the robot. Fu-007, pp.12-14; Cui, pp.6-7; Janét, ¶225.

Additionally, Fu-007 teaches that the wireless antenna mode is specifically advantageous for "short-term local cleaning." Fu-007, p.14. POSITAs would have been motivated to add this capability of Fu-007 to Cui's robot to allow for, e.g., quick cleaning tasks. *Id.*; Janét, ¶226.

POSITAs would have reasonably expected success because Cui already discloses a controller configured to accept "manual" inputs from an interface (Cui, p.6.) and Fu-007 discloses an onboard controller configured to receive "manual mode" signals from a wireless keyboard via an antenna. Fu-007, p.14; Janét, ¶227. Adding Fu-007's wireless input structure to trigger the manual control logic already present in Cui's system would have been a routine integration of known electronic control modules, yielding predictable results. *Id.*

d. 3[e][iii]

The Cui-Fu-007 combination discloses or suggests 3[e][iii]. Janét, ¶¶228-232.

The limitation requires the controller to generate signals in response to at least **one of** the captured **image or the PED**. Janét, ¶229.

The Cui-Fu-007 system satisfies this limitation through the "captured image" prong alone, because as explained in §§IV.B.3.f-h (1[e][i]-[iii]), POSITAs would have been motivated, and reasonably expected success, to incorporate Fu-007's onboard controller and control logic to Cui's system to generate control signals "in response to...the captured image" to steer the vehicle to debris-laden areas (the first portion of the submerged surface). Cui, pp.6-7; Fu-007, pp.14-16; Janét, ¶230.

Additionally, as explained in §IV.B.5.c (3[e][ii]), POSITAs would have been motivated, and reasonably expected success, to modify Cui's system to incorporate Fu-007's "control keyboard" (PED) and "manual mode" functionality to preserve manual control capabilities in the untethered system, allowing the onboard controller is configured to receive information (manual commands) from the PED and accordingly generate control signals to steer the vehicle "to" a specific portion of the submerged surface. Fu-007, pp.12-14, FIG. 8; Cui, pp.6-7, Claim 3, FIG. 4; Janét, ¶231.

6. Claim 4 Unpatentable over Cui and Fu-007

Cui and Fu-007 render Claim 4 obvious. Janét, ¶¶233-236.

a. 4[pre], 4[a]-4[c], 4[e]

Limitations 4[pre], 4[a]-4[c], and 4[e] are identical to limitations 1[pre], 1[a]-1[c], and 1[e], respectively. For the reasons in §§IV.B.3.a-IV.B.3.d (1[pre],

1[a]-1[c]), Cui discloses or suggests 4[pre] and 4[a]-4[c]. Additionally, for the reasons in §§IV.B.3.f-IV.B.3.h (1[e][i]-[iii]), the Cui-Fu-007 combination discloses or suggests limitation 4[e]. Janét, ¶234.

b. 4[d]

Limitation 4[d] is nearly identical to limitation 1[d], differing only in that 4[d] omits the requirement that the camera be "mounted directly or indirectly to the body." Cui discloses 4[d], because a camera "mounted directly...to the body" (§IV.B.3.e (1[d])) satisfies the broader requirement. Janét, ¶235.

C. Ground 2B: Claim 5 is Unpatentable over Cui, Fu-007, and Porat

1. Porat

Porat (EX1016) is prior art under AIA 35 U.S.C.§102(a)(1) and pre-AIA 35 U.S.C.§102(b). Janét, ¶237. Porat is analogous art to the '766 Patent. Janét, ¶238.

Porat discloses an automated robotic pool cleaner 10 with a housing 12, and electrochemical chlorine generator 30 "mounted on the interior of the housing." Porat, Abstract, [0028]-[0029], FIGS. 1-2 (annotated below).

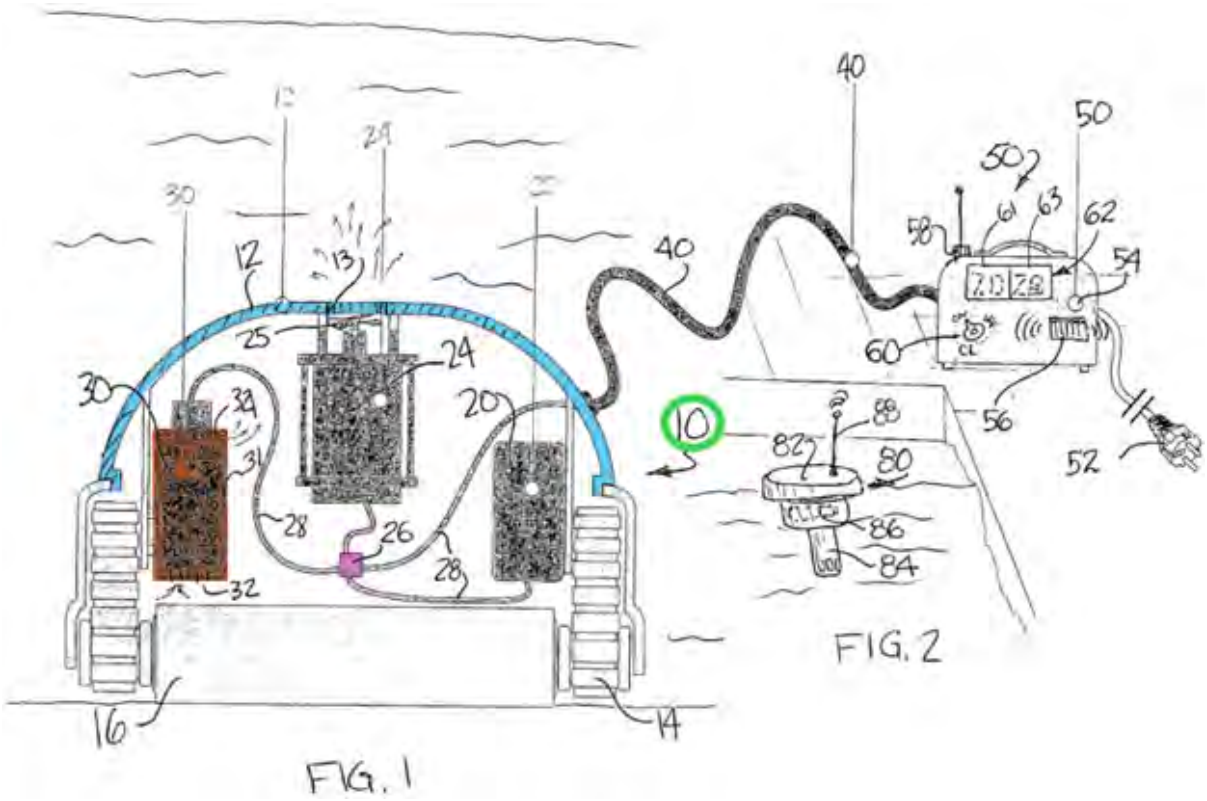


FIG. 2

FIG. 1

Porat's **electronic processor/controller 26** controls electrochemical chlorine generator 30, which includes an outlet to "distribute the chlorine into the water proximate the exterior of the pool cleaner housing." *Id.*, Abstract, [0008], [0010], [0029], Claims 1, 8-9, FIG. 1 (above).

2. Motivation to Combine

Both the Cui-Fu-007 combination and Porat disclose automated self-propelled robotic pool cleaners, and both sought to improve pool maintenance operations. As explained in §IV.B.2, the Cui-Fu-007 combination provides a pool cleaner using camera-based control to autonomously adjust cleaning operations. As explained in §IV.C.1, Porat similarly describes a robotic pool cleaner designed to

improve pool maintenance by providing "a method and apparatus for generating and adding chlorine to pools that is essentially self-contained." Porat, [0005]. POSITAs would have been motivated to combine the complementary teachings of Cui, Fu-007, and Porat to improve autonomous pool maintenance. Janét, ¶242.

POSITAs would have recognized that the teachings in the Cui-Fu-007 combination and Porat provide similar technical solutions to address similar issues. Janét, ¶243. *Compare* Cui, pp.4-6, Claim 1, FIGS. 1-3, *with* Fu-007, pp.7-10, 12-16, Claims 1-3, FIGS.1-3, 4, *and* Porat, [0028], Claims 1-2; §IV.C.1. Accordingly, POSITAs would have investigated the technical teachings in Cui, Fu-007, and Porat to seek guidance when designing a pool cleaning system for specific pool maintenance considerations and applications. Janét, ¶243.

Porat discloses an onboard "electrochemical chlorine generator" (chemical dispenser) distributing chlorine "as the cleaner moves across the pool surfaces." Porat, [0009], [0028], FIGS. 1-2; §IV.C.1. POSITAs would have been motivated to modify the Cui-Fu-007 combination by incorporating Porat's onboard chemical dispenser for at least two reasons. Janét, ¶244.

First, POSITAs would have been guided by Cui, Fu-007, and Porat to make such combination to enhance the cleaning effectiveness of the Cui-Fu-007 pool cleaner by combining mechanical debris removal with Porat's chemical dispenser. Janét, ¶245. POSITAs would have recognized that by incorporating Porat's

chemical dispenser into the Cui-Fu-007 combination, the modified system would have enhanced overall pool maintenance capability—allowing debris removal and chemical application in a single device. *Id.*

Second, POSITAs would have been motivated to adopt this modification to improve convenience and reduce cost. Janét, ¶246. Porat notes conventional generators are expensive and require professional installation, whereas an integrated dispenser is "efficiently and effectively distribut[ing]" chlorine for "uniform concentration," "essentially self-contained," and requires "no installation services...[or] specialized electrical power connections." Porat, [0002], [0005], [0007]; §IV.C.1. POSITAs would have recognized that incorporating Porat's dispenser into Cui-Fu-007 provides these advantages. Janét, ¶246.

POSITAs would have reasonably expected that adding Porat's chemical dispenser into the Cui-Fu-007 cleaner would not require significant modification given their shared components, yielding predictable results. Janét, ¶247.

3. Claim 5 Unpatentable over Cui, Fu-007, and Porat

The Cui-Fu-007-Porat combination renders Claim 5 obvious. Janét, ¶¶248-258.

a. 5[pre], 5[a]-5[c]

Cui discloses or suggests limitations 5[pre] and 5[a]-5[c] for the reasons in §§IV.B.3.a-d (1[pre]-1[c]), because they are identical to 1[pre] and 1[a]-1[c]. Janét, ¶249.

b. 5[d]

The Cui-Fu-007-Porat combination discloses or suggests 5[d]. Janét, ¶¶250-254.

As explained in §IV.B.3.b (1[a]), Cui discloses a pool cleaner comprising a vehicle body including housing 4. Cui, pp.5-6, Claim 1, FIG. 1. Porat describes that **chlorine generator 30** "mounted on the interior of the **housing**" of **pool cleaner 10** and controlled by **integrated circuit device 26**. Porat, [0028], FIGS. 1-2 (annotated below).

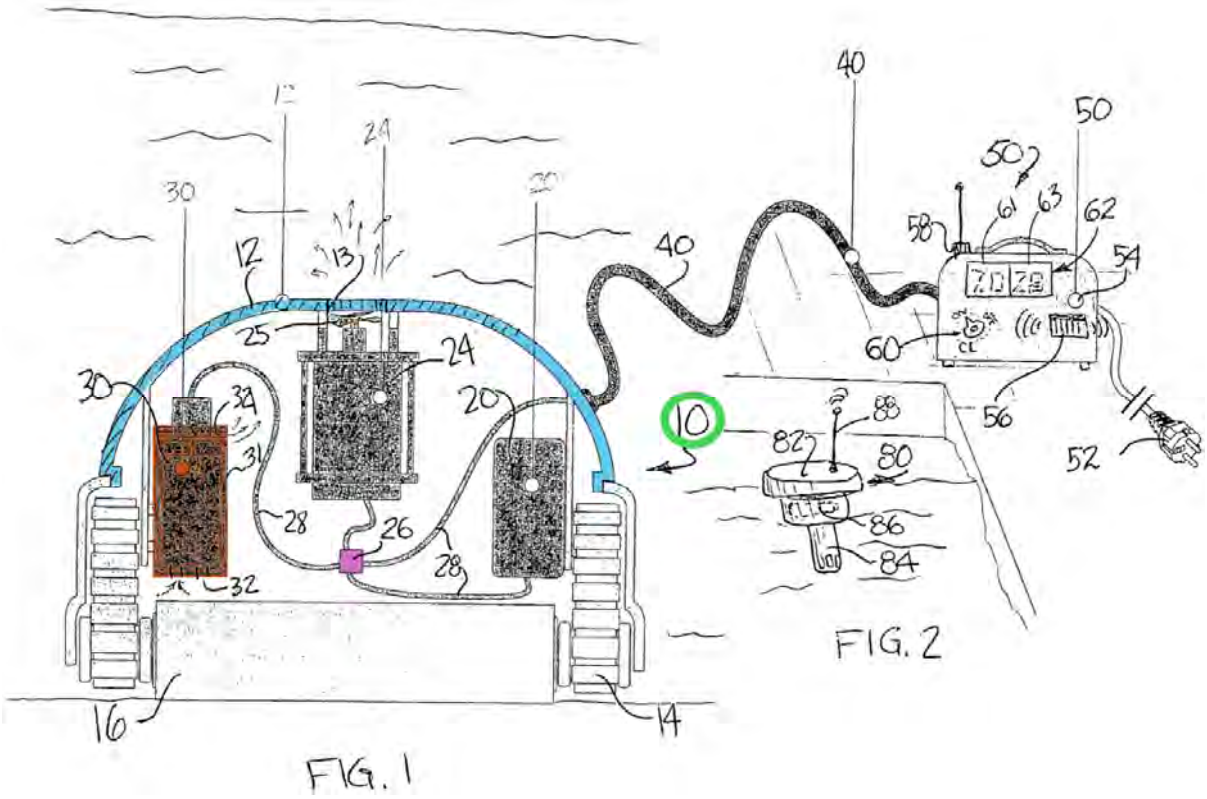


FIG. 1 FIG. 2

As explained in §IV.C.2, POSITAs would have been motivated to add Porat's onboard chemical dispenser to the Cui-Fu-007 combination. Janét, ¶252.

c. 5[e]

Limitations 5[e] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
5[e]		"on, in, or carried by"	"the vehicle body"

Cui discloses 5[e], because a camera "mounted directly...to the body" (§IV.B.3.e (1[d])) is also "on, in, or carried by the vehicle body." Janét, ¶255.

d. 5[f][i]

Limitations 5[f][i] and 1[e][i] only differ in:

1[e][i]	"controller"	"positioned on or in"	"the body"
5[f][i]		"on, in, or carried by"	"the vehicle body"

The Cui-Fu-007 combination discloses 5[f][i], because a controller "positioned on...the body" (§IV.B.3.f (1[e][i])) is also "on, in, or carried by the vehicle body." Janét, ¶256.

e. 5[f][ii]-5[f][iii]

The Cui-Fu-007 combination discloses or suggests limitations 5[f][ii] and 5[f][iii] for the reasons in §§IV.B.3.g-h (1[e][ii]-[iii]), because they are identical to 1[e][ii] and 1[e][iii]. Janét, ¶257.

D. Ground 3A: Claims 1-2 and 4 are Unpatentable under §103 over Knoll

1. Knoll

Knoll (EX1006) is prior art under AIA 35 U.S.C.§102(a)(1) and pre-AIA 35 U.S.C. §102(b). Janét, ¶259.

Knoll discloses an autonomous pool robotic cleaning vehicle with camera-based navigation. Knoll, Title, Abstract, [0001]-[0002], [0007], [0021], [0027], Claims 1-14, FIG. 1 (below). Knoll is analogous art to the '766 Patent. Janét, ¶¶260–262.

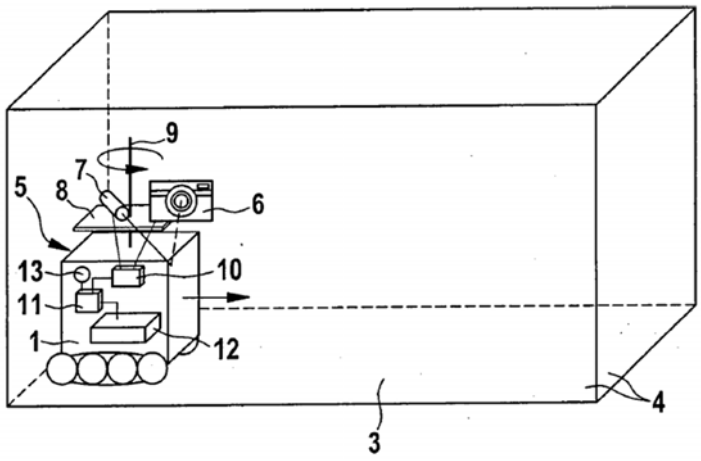


Fig. 1

Knoll's robotic vehicle 1 includes drive means 12, camera 6, light beam source 7, and control unit 11 for controlling the drive means. Knoll, [0007], [0027] [0028], FIGS. 1-2.

Knoll's camera 6 captures images of the boundary surface, which evaluation unit 10 processes to derive "smallest distance measurement values" relative to the boundary. Knoll, [0028]. Control unit 11 uses these image-derived values to "automatically calculate[] a trajectory" and generate control signals that "control[] the drive means 12" to move the vehicle. Knoll, [0028], Claim 2, FIG. 2 (reproduced below).

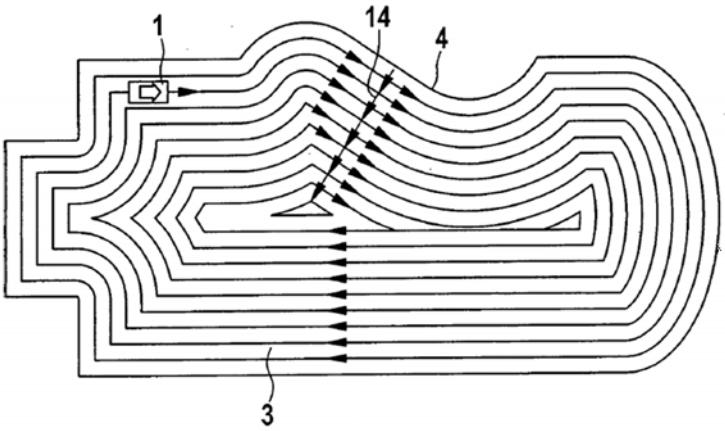


Fig. 2

2. Claim 1 is Unpatentable over Knoll

Knoll renders Claim 1 obvious. Janét, ¶¶263-297.

a. 1[pre]

Knoll discloses or suggests 1[pre]. Janét, ¶¶264-268.

Knoll discloses an "**autonomous robotic** vehicle 1 designed as a pool cleaning vehicle" with "drive means (12) for driving and steering" and a **control unit 11** that controls **drive means 12** and is "designed to **automatically calculate** a trajectory." Knoll, Abstract; [0027]-[0028]; Claims 2, 14, FIG. 1 (annotated below); Janét, ¶267.

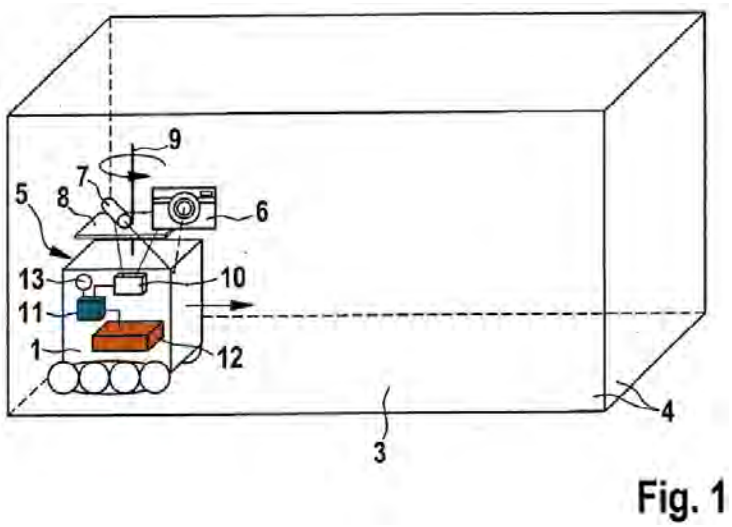


Fig. 1

Knoll, Fig. 1 (annotated)

Knoll's robotic vehicle is a self-propelled pool cleaner that cleans debris from a submerged surface of a swimming pool, because it is a "pool robot with a suction and/or filter and/or cleaning device," its drive means autonomously propels the vehicle under the control of control unit 11, and it operates on "working area 3...formed by the bottom of the pool" and cleans "a pool floor and/or the pool walls." Knoll, [0007], [0027]-[0028], FIG. 1 (below); Janét, ¶268.

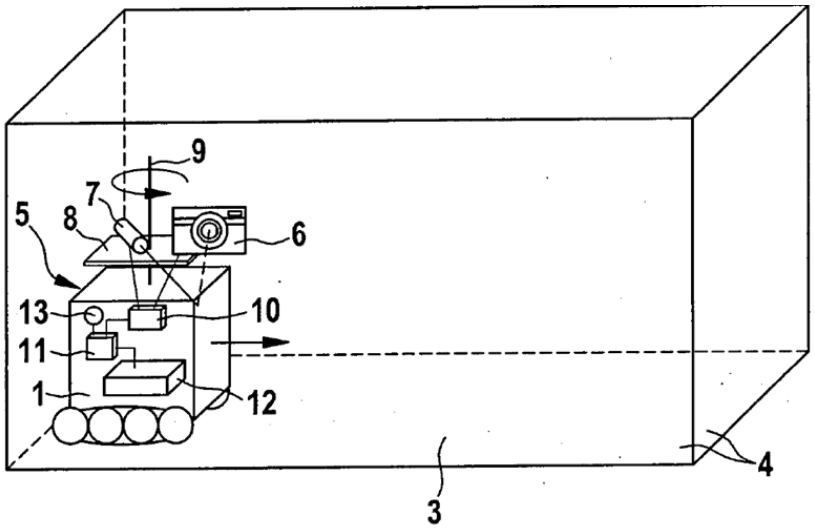


Fig. 1

b. 1[a]

Knoll discloses or suggests 1[a]. Janét, ¶¶269-271.

Knoll's robotic vehicle 1 (system) includes **drive means 12**, **control unit 11**, and suction and/or filter and/or cleaning device. Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below). POSITAs would have understood that Knoll's robotic vehicle—comprising the integrated physical structure housing these components—includes a "vehicle body." Janét, ¶¶270–271.

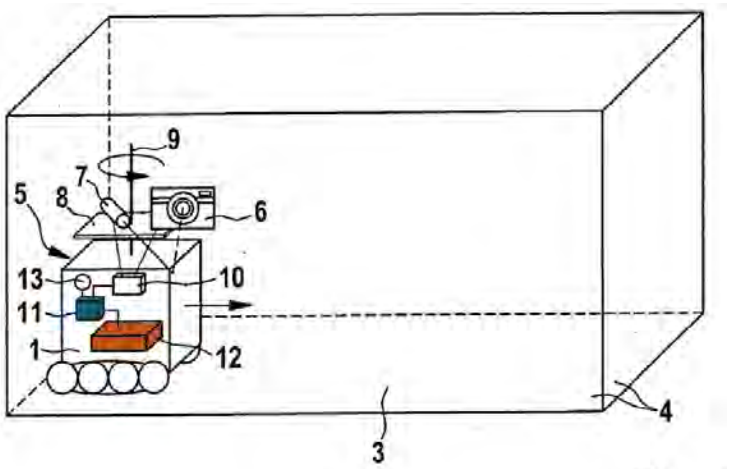


Fig. 1

c. 1[b]

Limitation 1[b] invokes §112¶6/§112(f); the function is "moving the vehicle body within the swimming pool," and the corresponding structure includes "**wheels**...powered by a motor." *See* §III.E.

Knoll discloses this function and structure. Janét, ¶¶272-276. Specifically, Figure 1 shows robotic vehicle 1 with **wheels** contacting the pool bottom, and Knoll describes "**drive means** (12)...for generating propulsion and for steering." Knoll, Abstract, [0028], Claims 1, 14, FIG. 1 (annotated below). POSITAs would have understood "drive means 12" comprises motors powering the wheels, thereby disclosing the corresponding structure. Janét, ¶¶275–276.

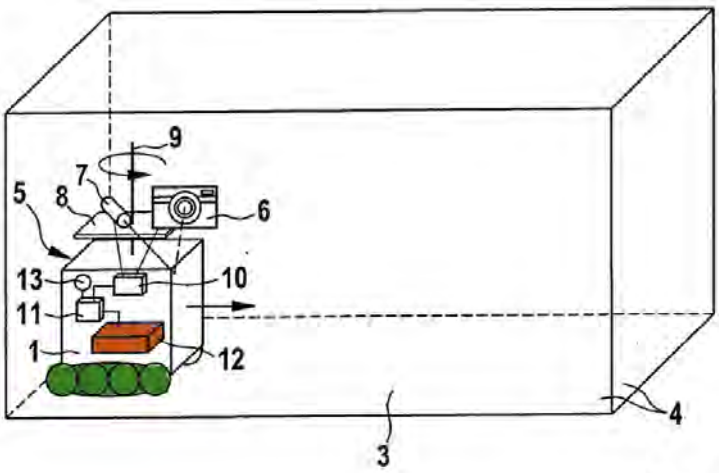


Fig. 1

d. 1[c]

Knoll discloses or suggests 1[c]. Janét, ¶¶277-279.

Knoll discloses 1[c], because its pool cleaning robot includes "a filter device and/or suction device." Knoll, [0007], [0021]. Knoll describes its robot operates on "working area 3...formed by the bottom of the pool" and its control unit is "located inside the robotic vehicle in a waterproof housing." Knoll, [0008], [0027]. POSITAs would have understood that Knoll's suction device draws water containing debris from the pool's submerged surfaces by suction, and the filter device retains this collected debris. Janét, ¶¶278–279.

e. 1[d]

Knoll discloses or suggests 1[d]. Janét, ¶¶280-285.

Knoll discloses 1[d], because Knoll discloses a "distance-determining device 5 (sensor device), which...comprises a...digital **camera 6**" mounted on robotic vehicle 1. Knoll, [0028], FIG. 1 (annotated below); Janét, ¶¶281.

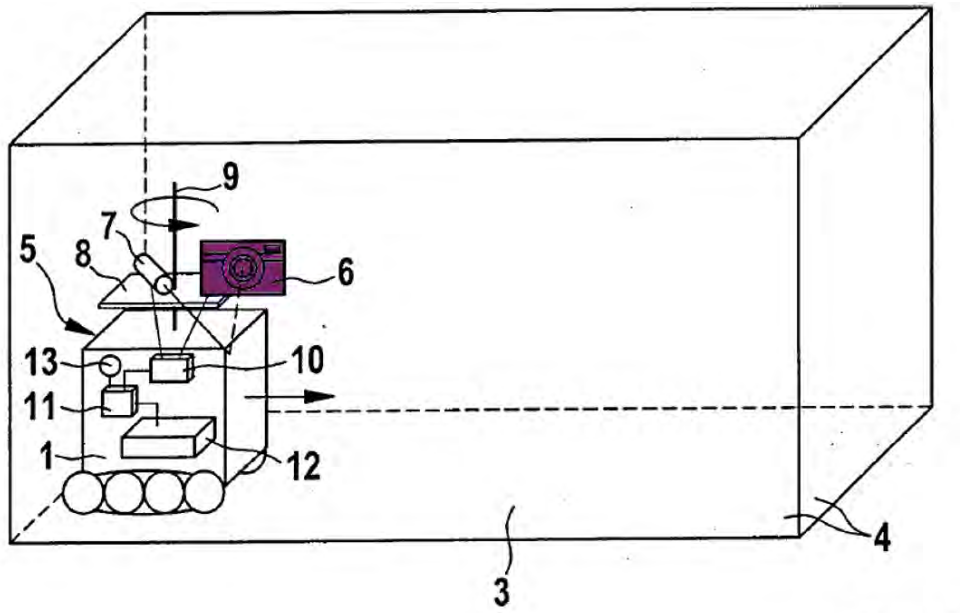


Fig. 1

As explained in §IV.D.2.b (1[a]), Knoll's robotic vehicle includes a "vehicle body," and POSITAs would have understood that camera 6, part of distance-determining device 5 arranged on robotic vehicle 1, is "mounted directly or indirectly to the body." Janét, ¶¶282.

Knoll also discloses "capturing an image of at least a first portion of the submerged surface." Janét, ¶¶283–285. Knoll's camera 6 observes "boundary surface 4" (pool walls), which are submerged surfaces. Knoll, [0007], [0018] (""a light beam is focused on the boundary line or boundary surface and **observed with**

a camera"), [0027]-[0028], FIG. 1; §IV.D.2.a; Janét, ¶¶285. POSITAs would have understood camera 6 captures images of "at least a first portion of the submerged surface" because it views the pool walls/floor to detect the reflected light within the scene. *Id.*

f. 1[e][i]

Knoll discloses or suggests 1[e][i]. Janét, ¶¶286-289.

Knoll's robotic vehicle 1 includes **control unit 11** (controller) inside the vehicle body that controls movement of the vehicle via **drive means 12**. Knoll, Abstract, [0008] ("the **control unit** is preferably **located inside the robotic vehicle** in a waterproof **housing**"), [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below); Janét, ¶¶289.

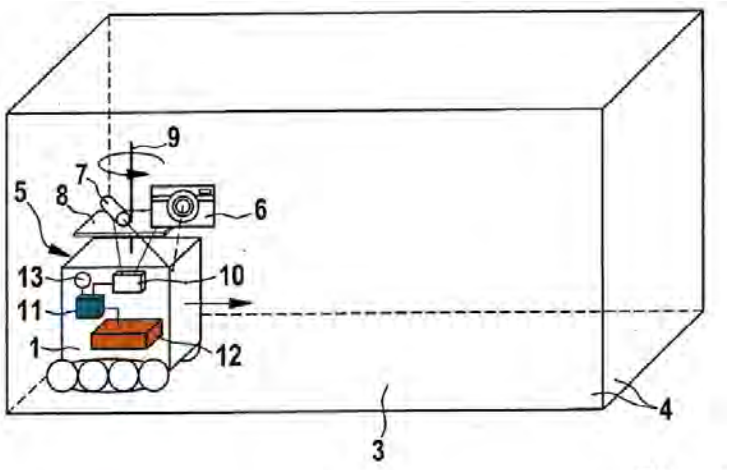


Fig. 1

g. 1[e][ii]

Knoll discloses or suggests its control unit (controller) is in electronic communication with camera 6, because it receives and processes image data from camera 6. Knoll, [0018], [0028], FIG. 1 (annotated below); Janét, ¶¶290–292. Knoll explains that "the distance-determining device uses...the rotating **camera** to determine the distance to the boundary line or boundary surface" and that the device includes an **evaluation unit 10**, part of a **control unit 11**, for determining the measured distance values. *Id.*

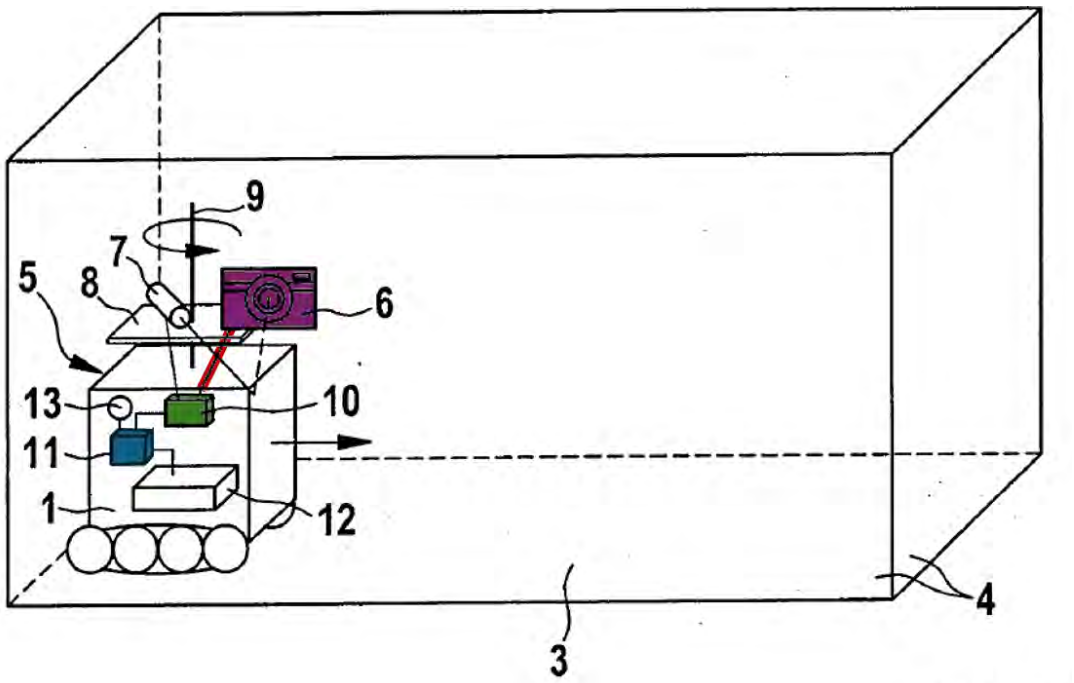


Fig. 1

h. 1[e][iii]

Knoll discloses or suggests 1[e][iii]. Janét, ¶¶293-296.

Knoll discloses generating control signals "in response to the captured image." Knoll's control unit 11 (controller) receives sensor information from distance-determining device 5 (which includes camera 6) and "controls the drive means 12 as a function of...quasi-continuously determined smallest distance measurement values." Knoll, [0028]. POSITAs would have understood that Knoll's control unit generates control signals "in response to the captured image" because the control signals are based on distance measurements derived from images captured by camera 6. Knoll, [0018]; Janét, ¶¶294.

Knoll also discloses generating control signals to cause movement "to, or away from," a portion of boundary surface 4 (first portion of the submerged surface), because Knoll's control unit controls drive means 12 so that "the robotic vehicle maintains a defined distance from the boundary line and/or boundary surface" as the vehicle travels. Knoll, [0011], Claim 4, FIG. 2 (below); §IV.D.2.e; Janét, ¶¶295.

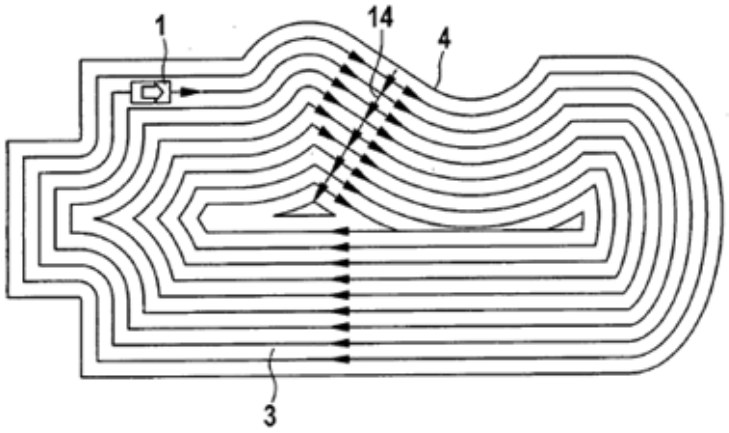


Fig. 2

POSITAs would have understood that, to maintain a defined distance from boundary surface 4, Knoll's control unit generates control signals that move the vehicle body **away** from boundary surface 4 when the distance becomes too small and **toward** it when too large. Janét, ¶296.

3. Claim 2 Unpatentable over Knoll

Knoll renders Claim 2 obvious. Janét, ¶¶298-301.

a. 2[pre], 2[a]-2[c], 2[e][i]-[iii]

Limitations 2[pre], 2[a]-2[c], and 2[e][i]-[iii] are identical to 1[pre], 1[a]-1[c], and 1[e][i]-[iii], respectively. For the reasons in §§IV.D.2.a-d, f-h (1[pre], 1[a]-1[c], 1[e][i]-[iii]), Knoll discloses or suggests 2[pre], 2[a]-2[c], 2[e][i]-[iii].

b. 2[d]

Limitations 2[d] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
2[d]		"carried by"	

Knoll discloses 2[d], because Knoll's camera "mounted directly...to the body" (§IV.D.2.e (1[d])) is also "carried by the body." Janét, ¶300.

4. Claim 4 Unpatentable over Knoll

Knoll renders Claim 4 obvious. Janét, ¶¶302-305.

a. 4[pre], 4[a]-4[c], 4[e][i]-[iii]

Limitations 4[pre], 4[a]-4[c], and 4[e][i]-[iii] are identical to 1[pre], 1[a]-1[c], and 1[e][i]-[iii], respectively. For the reasons in §§IV.D.2.a-d, f-h (1[pre], 1[a]-1[c], 1[e][i]-[iii]), Knoll discloses or suggests 4[pre], 4[a]-4[c], and 4[e][i]-[iii].

b. 4[d]

Limitation 4[d] is nearly identical to limitation 1[d], differing only in that 4[d] omits the requirement the camera be "mounted directly or indirectly to the body." Janét, ¶304. Knoll discloses 4[d], because a camera "mounted directly...to the body" (§IV.D.2.e (1[d])) satisfies the broader requirement. ***Id.***

E. Ground 3B: Claim 3 Is Unpatentable over Knoll and Fu-957

1. Fu-957

Fu-957 (EX1015), which is analogous art, discloses a pool cleaning robot comprising a cleaning robot main unit with a filter, housing body, transmission systems, cleaning rollers, and control circuit board. Fu-957, Abstract, Claim 1-2, pp.6-7[5], FIGS. 1-2 (below); Janét, ¶¶306-310.

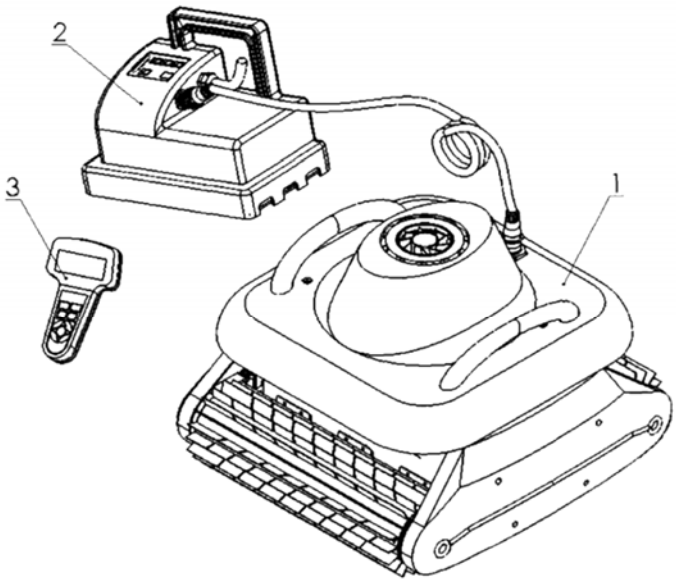


Figure 1

[5] [5] Page citations to Fu-957 are to the original pagination in the bottom center of each page.

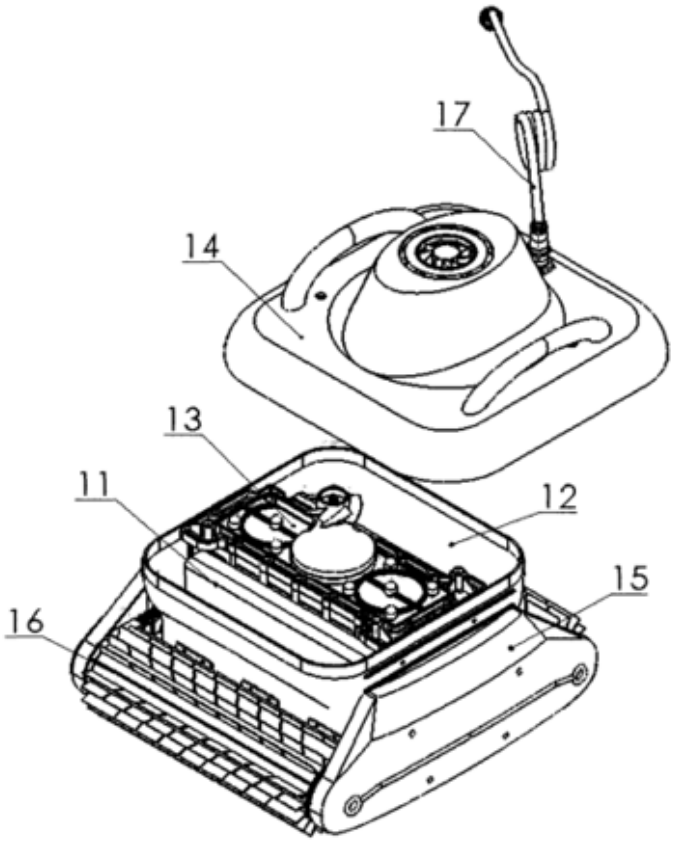


Figure 2

Fu-957's underwater controller includes a microcontroller (MCU) that processes sensor data and generates control signals to control the drive motors 139A and thereby the transmission systems 15. *Id.*, pp.7-9, 16-18, FIGS. 13, 15-16.

Fu-957's system also includes a **remote controller 3** is a portable handheld device comprising a display screen 33, membrane keys 39, communication circuit board 34, and battery box 35. *Id.*, p.14, Claim 6, FIG. 4 (below). The remote controller provides two-way communication with the cleaning robot main unit via the **power control box 2** and **self-buoyant cable 17**, enabling the display screen to

show "an operating status of the cleaning robot main unit" and the keys to "set an automatic work mode and manual operations." *Id.*, Abstract, Claim 6, pp.10, 14, FIGS.12-13 (annotated below).

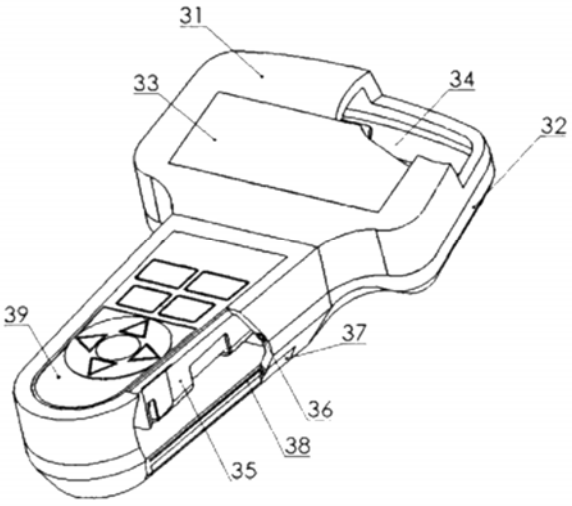


Figure 4

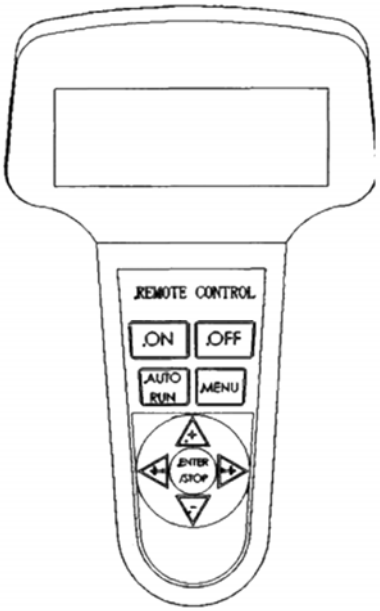


Figure 12

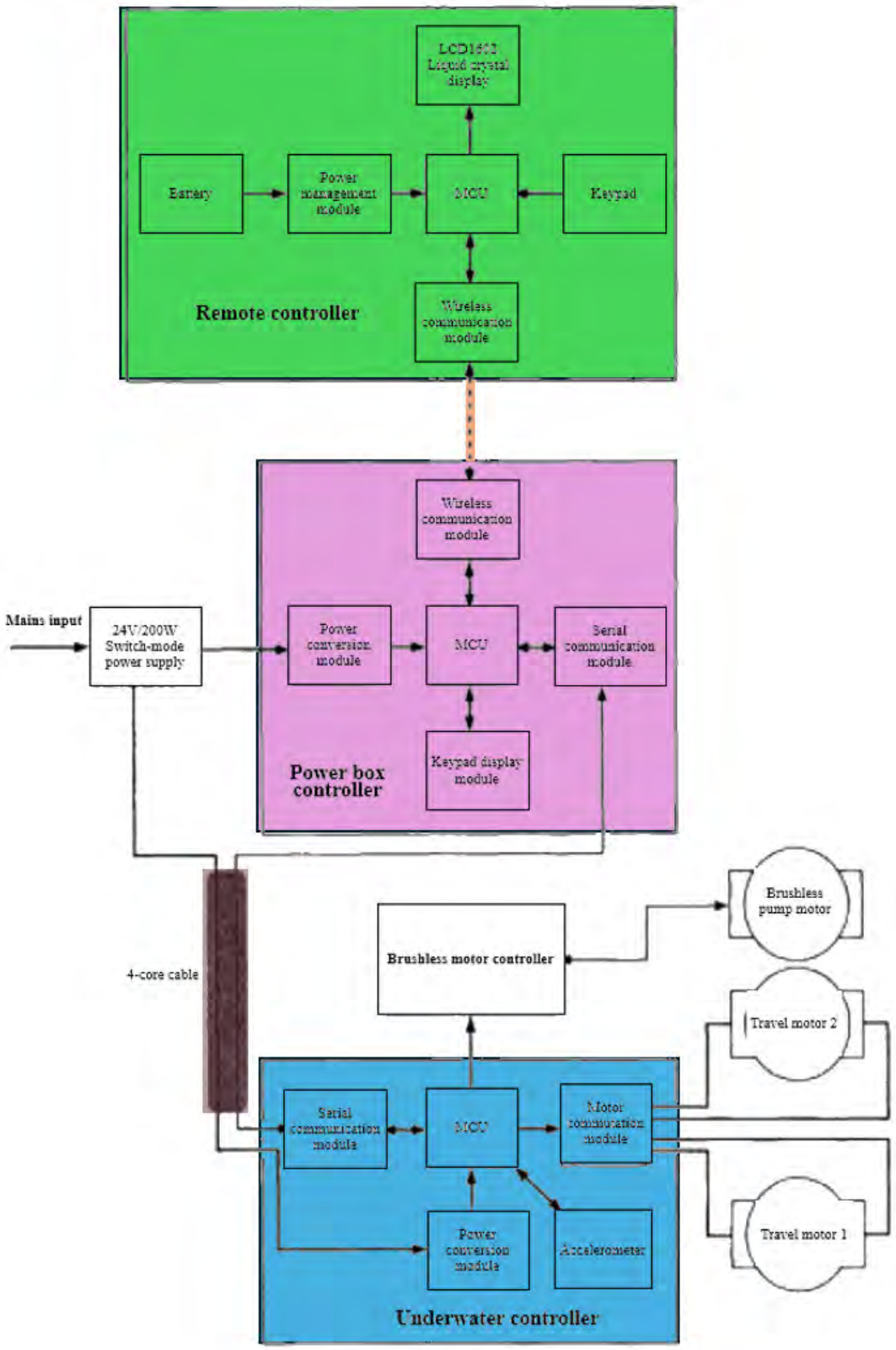

LCD1602 Liquid crystal display
Battery
Power management module
MCU
Keypad
Remote controller
Wireless communication module
Wireless communication module
Mains input
24V/200W Switch-mode power supply
Power conversion module
MCU
Serial communication module
Keypad display module
Power box controller
Brushless pump motor
Brushless motor controller
4-core cable
Travel motor 2
Serial communication module
MCU
Motor communication module
Power conversion module
Accelerometer
Travel motor 1
Underwater controller

Figure 13

When the keys are pressed, the cleaning robot main unit "crawl[s] and clean[s] along the path controlled by the operator's intention." *Id.*, p.18.

2. Motivations to Combine

Both Knoll and Fu-957 disclose autonomous pool cleaning robots, and both sought to improve pool cleaning operations. *See* Knoll, [0005], [0007]; Fu-957, Abstract; Janét, ¶315. POSITAs would have been motivated to add complementary teachings of Fu-957 to Knoll to improve pool cleaning with, e.g., enhanced user control Fu-957 teaches (Fu-957, pp.10, 14). Janét, ¶315.

POSITAs would have recognized that both are directed to the same pool cleaning technical field and provide similar technical solutions to address similar issues. Janét, ¶316. Specifically, both disclose self-propelled pool cleaners having an onboard controller that processes sensor data and generates control signals for navigation. *Compare* Knoll, [0007]-[0008], [0027]-[0028], FIG. 1 *with* Fu-957, Abstract, Claim 1, pp.6-10, 16-18; §IV.E.1. Thus, POSITAs would have investigated the technical teachings in both to seek guidance when designing a pool cleaning system. Janét, ¶316.

Knoll's robotic vehicle 1 operates autonomously under the control of control unit 11. Knoll, [0028], Claim 2. Fu-957 discloses a portable remote controller 3 that enables two-way communication with the pool cleaner and allows user control of cleaning operations. *See* §IV.E.1.

POSITAs would have been motivated to add Fu-957's remote control functionalities into Knoll to enable users to manually direct Knoll's cleaner to specific areas or override automatic operation when desired, complementing Knoll's autonomous cleaning capabilities. Knoll, Abstract, [0027]-[0028]; Fu-957, p.18; Janét, ¶318.

POSITAs would also have been motivated to make this modification to add Fu-967's remote monitoring (Fu-957, p.10, Claim 6) to Knoll, providing users with real-time monitoring into Knoll's cleaning operations and alert users to potential problems, thereby improving user experience and facilitating timely maintenance. Janét, ¶319.

POSITAs would reasonably expected success because Fu-957 demonstrates a working implementation of two-way communication between a portable remote controller and an underwater pool cleaning robot via a power control box relay. §IV.E.1; Fu-957, pp.10, 18, Claim 6, FIG. 13; Janét, ¶320. Because Fu-957's communication architecture—including portable remote controller 3, power control box relay 2, and cable connection 17—is already designed for integration with a pool cleaning robot having an onboard controller, POSITAs would have reasonably expected that Fu-957's communication architecture could be integrated with Knoll, yielding predictable results. Janét, ¶320.

3. Claim 3 Unpatentable over Knoll and Fu-957

The Knoll-Fu-957 combination renders Claim 3 obvious. Janét, ¶¶321-333.

a. 3[pre], 3[a]-3[c], 3[e][i]

Knoll discloses 3[pre], 3[a]-3[c], and 3[e][i] for the reasons in §§IV.D.2.a-d, f (1[pre]-1[c], 1[e][i]), because they are identical to 1[pre], 1[a]-1[c], and 1[e][i]. Janét, ¶322.

b. 3[d]

Limitation 3[d] is nearly identical to 1[d], differing only:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
3[d]		"positioned on or in, or carried by,"	

Knoll discloses 3[d], because a camera "mounted directly...to the body" (§IV.D.2.e (1[d])) is also "positioned on or in, or carried by, the body." Janét, ¶323.

c. 3[e][ii]

The Knoll-Fu-957 combination discloses or suggests 3[e][ii]. Janet, ¶¶324-330.

As explained in §IV.D.2.g (1[e][ii]), Knoll discloses the controller "in electronic communication with the at least one **camera**."

The Knoll-Fu-957 combination discloses the controller "in electronic communication with...a **portable electronic device**." Janét, ¶326.

Fu-957 discloses a portable remote controller 3 (portable electronic device, "PED") for user control of pool cleaning operations. Fu-957, Title, Abstract, Claims 1, 6, FIGS. 1, 4, 12; §IV.E.1; Janét, ¶327. Fu-957 further discloses electronic communication between remote controller 3 (PED) and the underwater controller inside the cleaning robot main unit via power control box 2. As shown in FIG. 13 (annotated below), Fu-957's remote controller 3 communicates wirelessly with power control box 2, which communicates with the underwater controller via self-buoyant cable 17. Fu-957, Claim 6, p.14, FIG. 13.

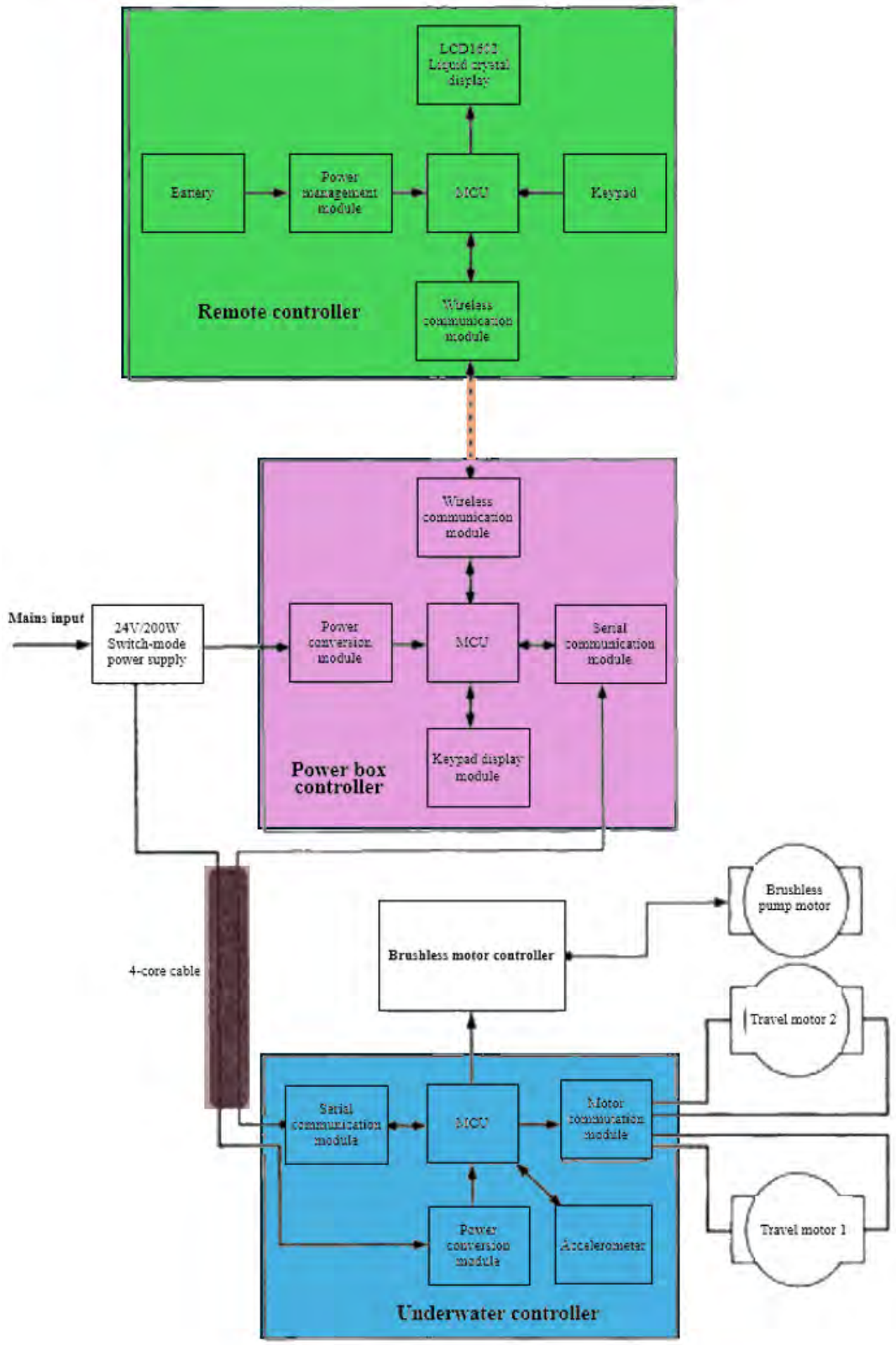

LCD1602 Liquid crystal display
Battery
Power management module
MCU
Keypad
Remote controller
Wireless communication module
Wireless communication module
Mains input
24V/200W Switch-mode power supply
Power conversion module
MCU
Serial communication module
Keypad display module
Power box controller
4-core cable
Brushless motor controller
Brushless pump motor
Travel motor 2
Serial communication module
MCU
Motor communication module
Power conversion module
Accelerometer
Travel motor 1
Underwater controller

Figure 13

As explained in §IV.E.2, POSITAs would have been motivated to combine Knoll with Fu-957's remote controller (PED) and communication/control mechanism between an onboard controller and the remote controller. Janét, ¶329.

In the Knoll-Fu-957 combination, Knoll's control unit 11 (controller) would be: (1) in electronic communication with camera 6 (as explained in §IV.D.2.g) and a PED (per Fu-957's remote controller 3); (2) configured to receive control commands from Fu-957's PED via power control box 2; and (3) configured to generate control signals to control the vehicle to "crawl and clean along the path controlled by the operator's intention" based on signals indicating the pressed manual control keys. §IV.E.2; Knoll, [0008], [0028]; Fu-957, Claim 6, pp.10, 14, 18, FIG. 13; Janét, ¶330. As explained in §IV.E.2, POSITAs would have a reasonable expectation of success in implementing this combination. Janét, ¶330.

d. 3[e][iii]

Knoll discloses or suggests 3[e][iii] because as explained in §IV.D.2.h (1[e][iii]), Knoll discloses control unit 11 configured to generate, "in response to...the captured image," at least one control signal to cause movement "to, or away from, the first portion of the submerged surface. Knoll, [0011], [0018], [0028]; Janét, ¶¶331-332.

F. Ground 3C: Claim 5 Is Unpatentable over Knoll and Porat

1. Motivation to Combine

Both Knoll and Porat disclose autonomous pool cleaning robots. *See* §IV.D.1, §IV.C.1. POSITAs would have been motivated to combine the teachings of Knoll and Porat to improve pool cleaning. Janét, ¶334.

POSITAs would have recognized that both provide complementary technical solutions to address pool maintenance issues. Janét, ¶335. Both references disclose self-propelled pool cleaners having drive means for moving the pool cleaner and an onboard controller for navigation. *Compare* Knoll, [0007]-[0008], [0027]-[0028], FIG. 1, *with* Porat, Abstract, [0029], FIGS. 1-2. Accordingly, POSITAs would have investigated both to seek guidance when designing a pool cleaning system. Janét, ¶335.

Porat discloses an integrated electrochemical generator 30 (chemical dispenser) for "produc[ing] and distribut[ing] chlorine ions...as the cleaner moves". Porat, [0009], [0028], Claim 1. POSITAs would have been motivated to including Porat's chemical dispenser to Knoll to create a single autonomous device capable of performing both mechanical cleaning and chemical sanitization in one pass. Janét, ¶¶336-337. Additionally, POSITAs would have recognized that because Knoll's vehicle traverses the pool surfaces along calculated trajectories, equipping it with Porat's dispenser would "efficiently and effectively distribute[] the

chlorine" into the water as the cleaner travels. Knoll, [0005], [0010]-[0012]; Porat, Abstract, [0009], [0028], Claim 1; Janét, ¶338.

POSITAs would have reasonably expected success because incorporating a chemical dispenser into a robotic pool cleaner like Knoll's had been well-known, and such modification to Knoll would have yielded predictable results. Porat, [0028]; Durvasula, [0015]; Knoll, [0007], [0027]-[0028]; Janét, ¶339.

2. Claim 5 Unpatentable over Knoll and Porat

The Knoll-Porat combination renders Claim 5 obvious. Janét, ¶¶340-350.

a. 5[pre], 5[a]-5[c], 5[f][ii]-5[f][iii]

Limitations 5[pre], 5[a]-5[c], 5[f][ii], and 5[f][iii] are identical to limitations 1[pre], 1[a]-1[c], 1[e][ii], and 1[e][iii], respectively. For the reasons in §§IV.D.2.a-d and IV.D.2.g-h (1[pre], 1[a]-1[c], 1[e][ii]-[iii]), Knoll discloses or suggests 5[pre], 5[a]-5[c], and 5[f][ii]-5[f][iii]. Janét, ¶341.

b. 5[d]

The Knoll-Porat combination discloses or suggests 5[d]. Janét, ¶¶342-346.

As explained in §IV.D.2.b (1[a]), Knoll discloses robotic vehicle 1 comprising a vehicle body including housing 2. Janét, ¶343.

As explained in §IV.C.1, Porat discloses a robotic pool cleaner with an **onboard electrochemical generator 30** (chemical dispenser) that "produc[es] chlorine" and "distributes chlorine ions...as the cleaner moves." Porat, Abstract,

[0009], [0028]; Janét, ¶[344. Porat, Abstract, [0009], [0028], Claims 1, 11, 16, FIGS. 1-2 (annotated below).

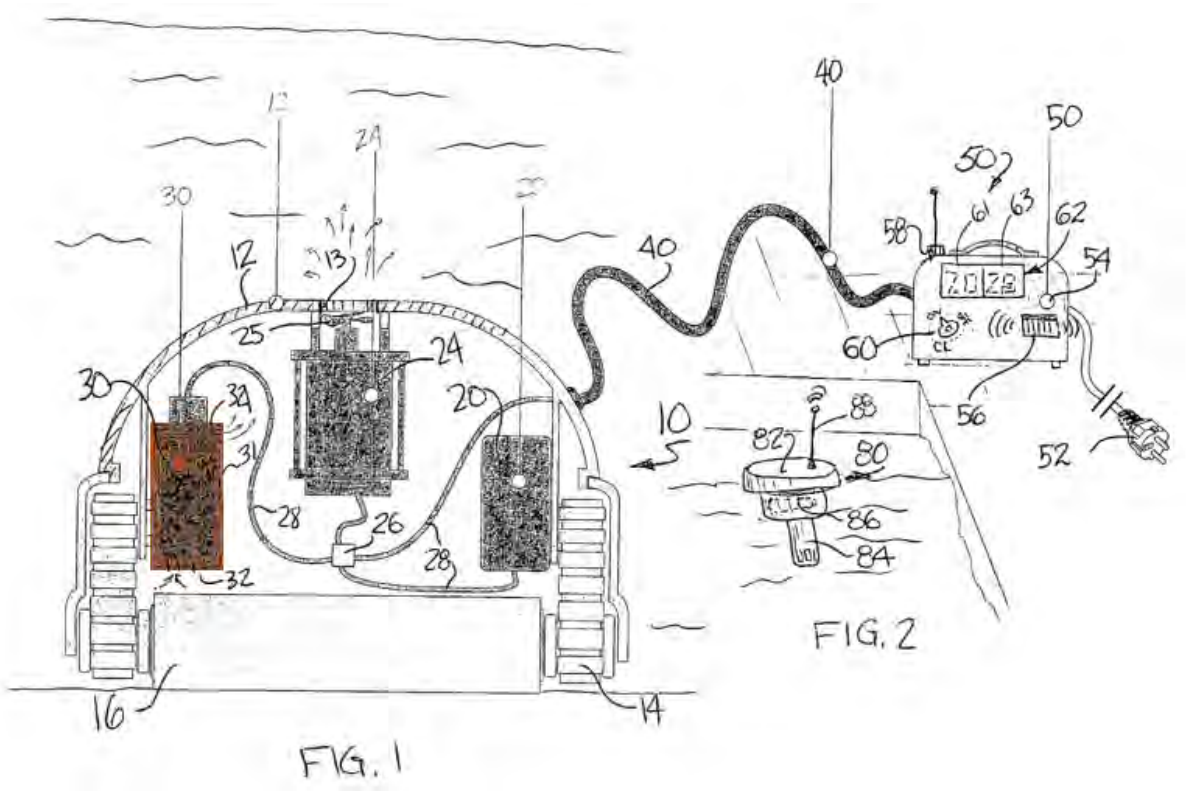


FIG. 2

FIG. 1

As explained in §IV.F.1, POSITAs would have been motivated to incorporate Porat's chemical dispenser into Knoll's housing 2 (vehicle body) with a reasonable expectation of success.

c. 5[e]

Limitations 5[e] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
5[e]		"on, in, or carried by"	"the vehicle body"

As explained above in §IV.D.2.e (1[d]), Knoll discloses "at least one camera mounted directly...to the body." Thus, Knoll also discloses limitation 5[e], because a camera that is "mounted directly...to the body" is also "on, in, or carried by the vehicle body." Janét, ¶347.

d. 5[f][i]

Limitations 5[f][i] and 1[e][i] only differ in:

1[e][i]	"controller"	"positioned on or in"	"the body"
5[f][i]		"on, in, or carried by"	"the vehicle body"

Knoll discloses 5[e], because a camera "mounted directly...to the body" (§IV.D.2.f (1[d])) is also "on, in, or carried by the vehicle body." Janét, ¶348.

e. 5[f][ii]-5[f][iii]

Limitations 5[f][ii] and 5[f][iii] are identical to limitations 1[e][ii] and 1[e][iii], respectively. For the reasons in §§IV.D.2.g-h (1[e][ii] and 1[e][iii]), Knoll discloses or suggests 5[f][ii] and 5[f][iii]. Janet, ¶349.

G. Ground 4A: Claims 1-4 Are Unpatentable under §103 over Renaud

1. Renaud

Renaud (EX1017) is prior art and is analogous art. Janet, ¶¶351-352.

Renaud discloses a "pool cleaner." Renaud, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3 (**cleaners 200/200a'/200b'/200c'/200**"; annotated below).

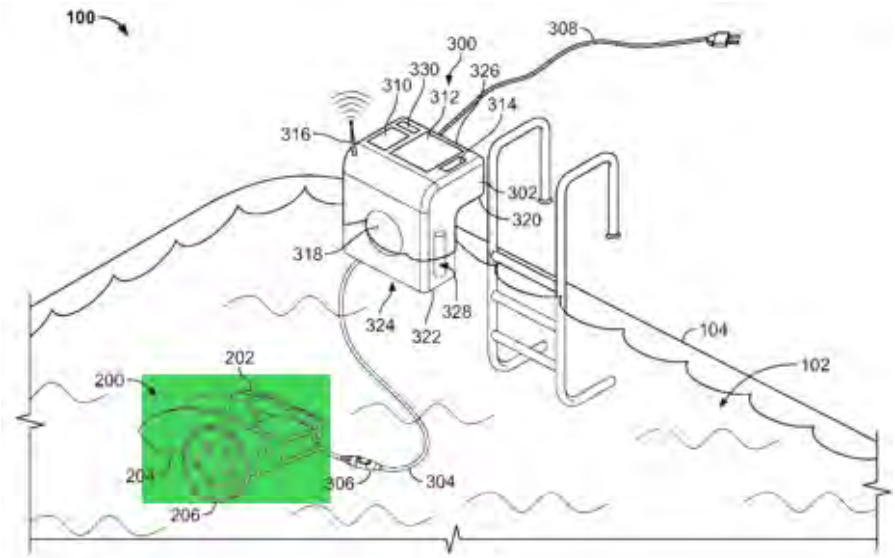


FIG. 1

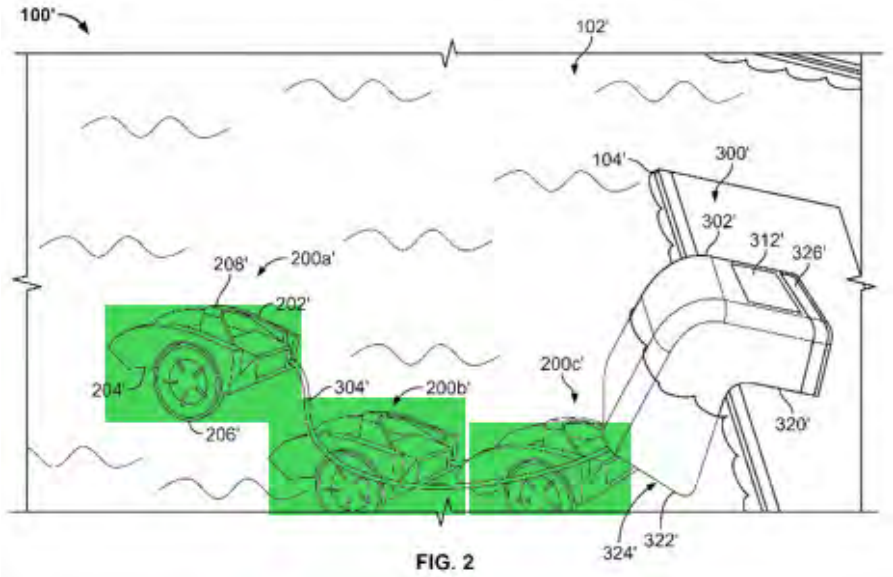


FIG. 2

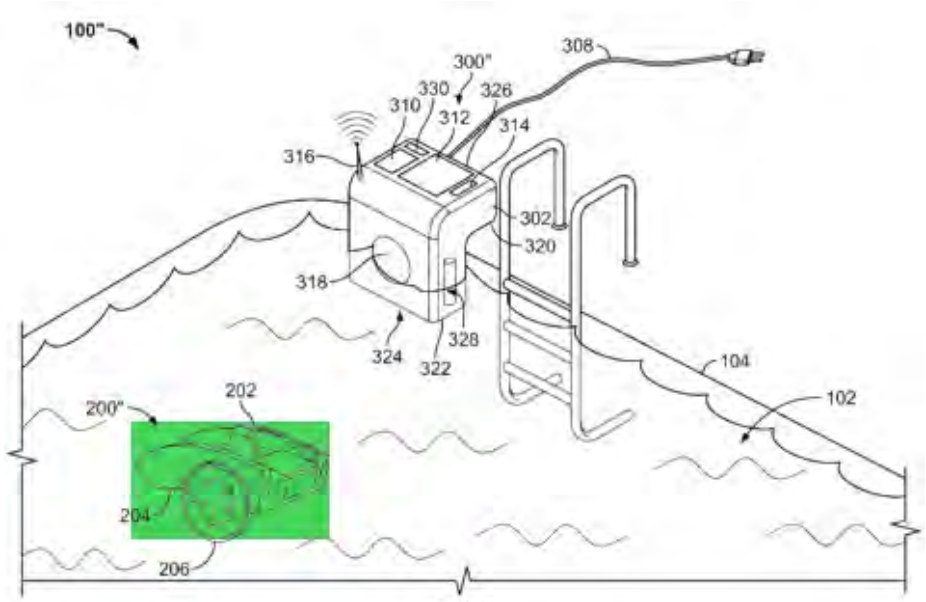


FIG. 3

2. Claim 1 Unpatentable over Renaud

Renaud renders Claim 1 obvious. Janét, ¶¶353-381 .

a. 1[pre]

Renaud discloses or suggests 1[pre]. Janét, ¶¶354-357.

Renaud discloses a "pool cleaner." Renaud, Abstract, [0002], [0022]-[0023], [0037], [0039], FIGS. 1-3 (**cleaners 200/200a'/200b'/200c'/200**"; annotated below). Renaud describes that its robotic pool cleaners move along the pool floor and/or walls to clean debris from the pool surfaces. Renaud, [0003].

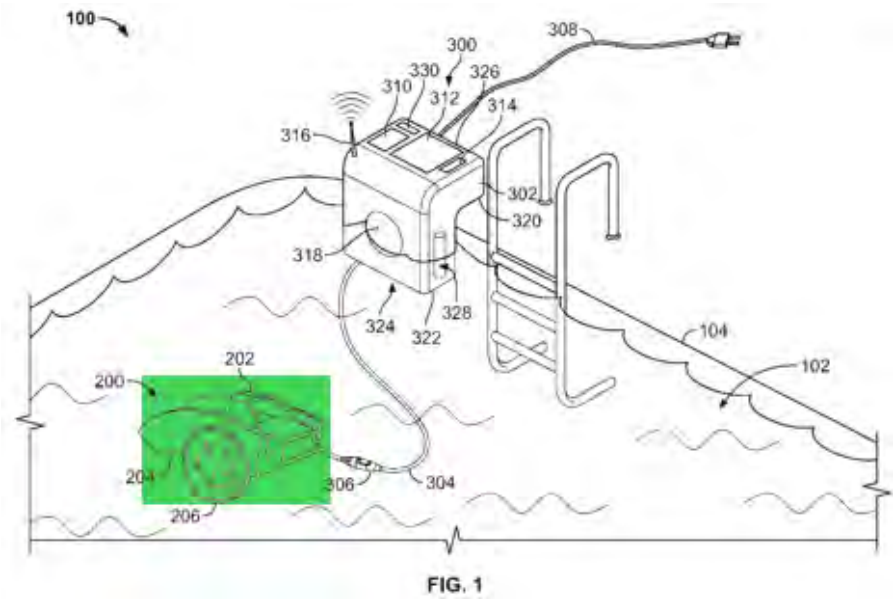

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FIG. 1

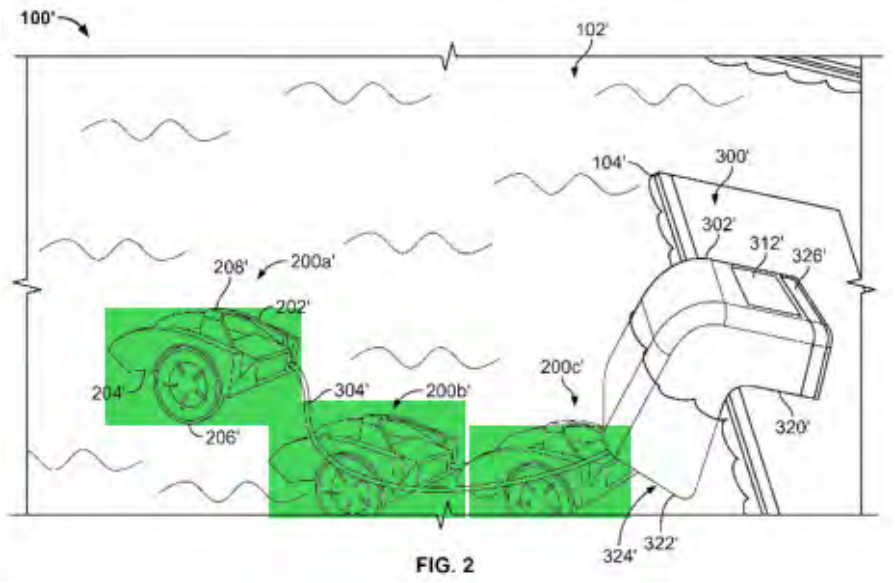

100'
102'
104'
300'
302'
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324'
322'

FIG. 2

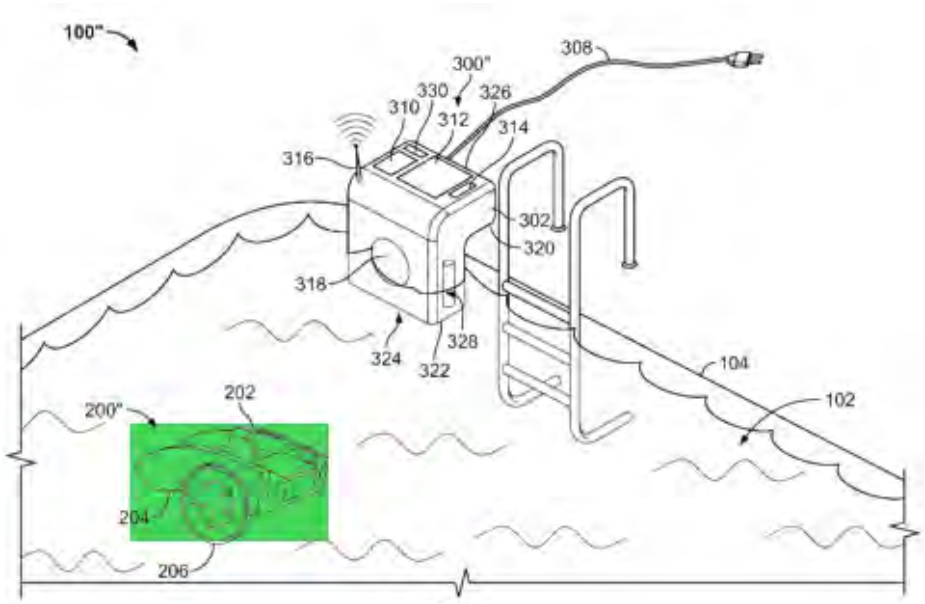


FIG. 3

Renaud's pool cleaner is "self-propelled" because it includes "an electronically commutated motor," "wheels 206...for moving the cleaner 200 in the swimming pool," and a "vision system...communicat[ing] with the cleaner 200 to drive...wheels 206...in the direction of the area of debris." Renaud, [0023], [0025], [0030]; Janét, ¶356.

Renaud's pool cleaner also "clean[s] debris from a submerged surface of a swimming pool" because it "cleans near, the walls...of the pool" in "bottom mode" and uses "a suction pump impeller" to "collect the debris in the swimming pool" and collects "debris collected from the swimming pool 102" into "a debris container" located in housing 202. Renaud, [0022]-[0023], [0030]; Janét, ¶357.

b. 1[a]

Renaud discloses or suggests 1[a], because Renaud's cleaner 200 "includes a housing 202 which includes a plurality of components," such as a motor, a storage device, and a processing device, a debris container, and wheels 206, and POSITAs would have understood that the assembled structure of cleaner 200 constitutes the "vehicle body." Renaud, [0023], [0025], FIGS. 1-3; Janét, ¶359.

c. 1[b]

Renaud discloses or suggests 1[b]. Janét, ¶¶360-363.

Limitation 1[b] invokes §112¶6/§112(f); the function is "moving the vehicle body within the swimming pool," and the corresponding structure includes "wheels...powered by a motor." *See* §III.E.

Renaud discloses this function and structure by describing cleaner 200 including **wheels 206** powered by a motor to move the cleaner within the pool. Renaud, [0009], [0023], [0025], [0030], FIGS. 1-3 (annotated below); Janét, ¶362-363.

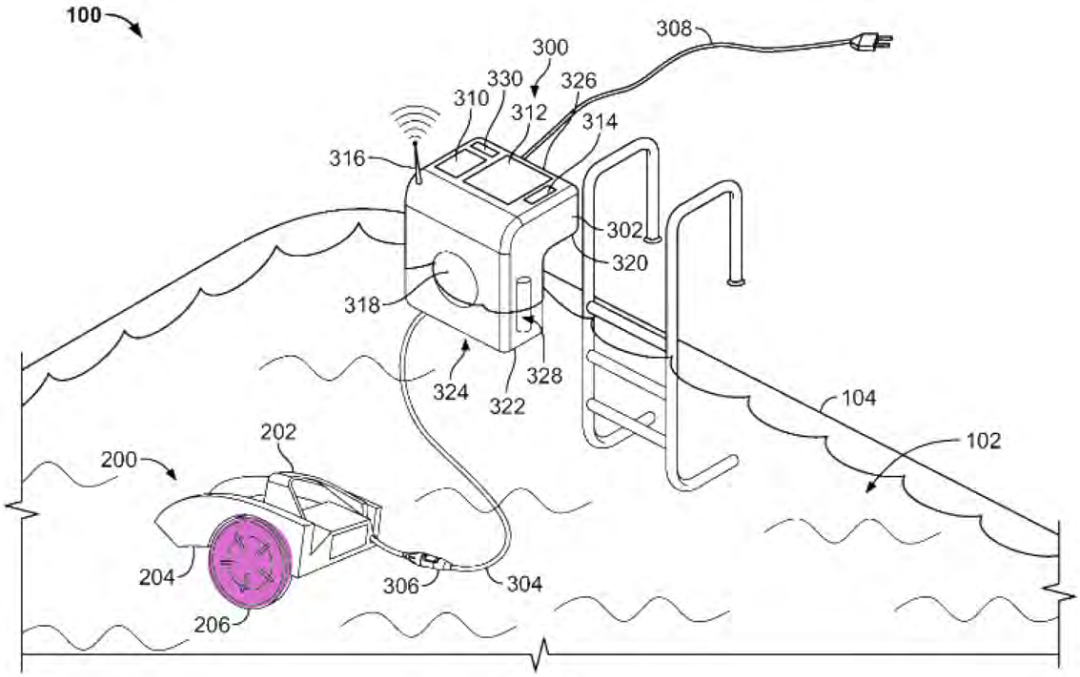

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FIG. 1

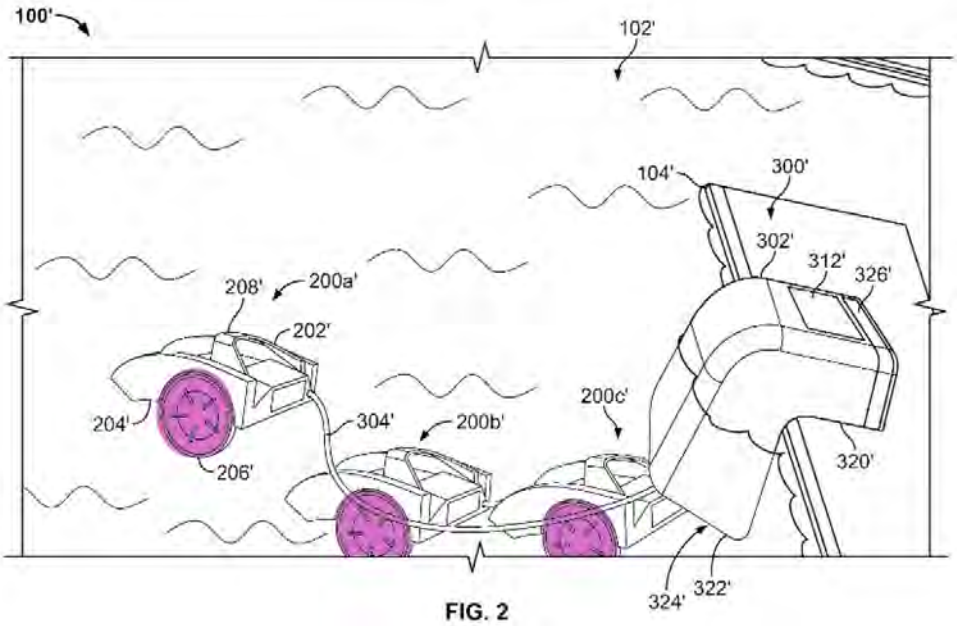

100'
102'
104'
300'
302'
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208'
200a'
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304'
200b'
200c'
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324'
322'

FIG. 2

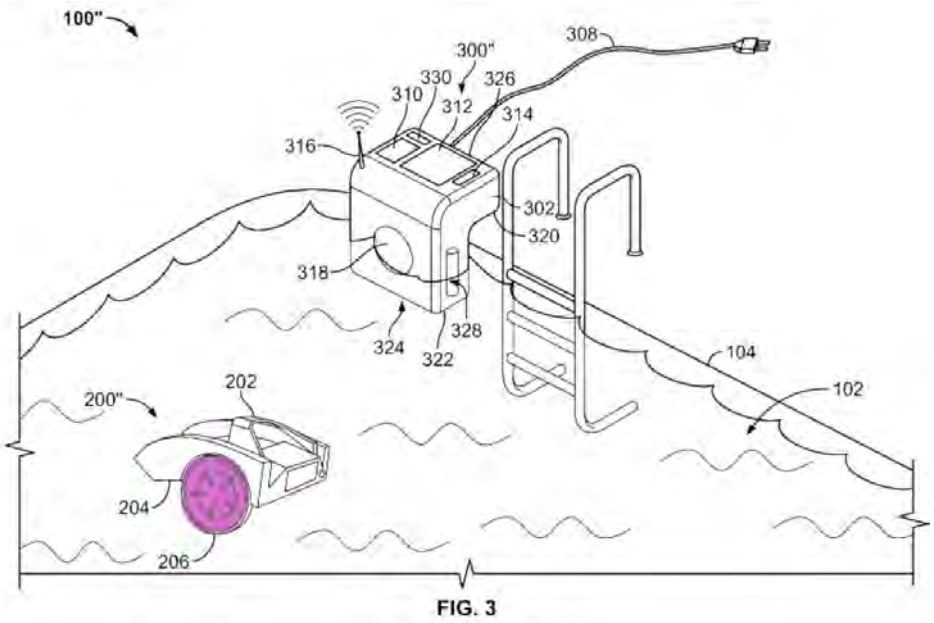


FIG. 3

d. 1[c]

Renaud discloses or suggests "a filter configured to retain debris" because Renaud's cleaner 200 includes a debris container/bag and uses "a suction pump impeller to collect the debris" in the pool into the debris container located in housing 202. Renaud, Abstract, [0006], [0015], [0022], [0023], [0030], [0033], [0036], Claim 20; Janét, ¶364-367.

e. 1[d]

Renaud discloses or suggests 1[d]. Janét, ¶368-370.

Renaud discloses "at least one camera mounted directly or indirectly to the body" because Renaud describes cleaner 200 includes a housing and a vision system, which includes a camera, and the vision system is inside "inside the cleaner 200." Renaud, [0008]; *see also id.*, [0029], Claim 1; Janét, ¶369-370.

Renaud discloses the camera "for capturing an image of at least a first portion of the submerged surface" because its vision system "identify[ies] areas on the pool floor, walls...where debris or dirt exists..., such as at the bottom" by "sensing areas of optical contrast." Renaud, [0029], [0031]; Janét, ¶369. POSITAs would understand Renaud's camera captures images to identify these "areas of debris" (first portion) on the floor and walls (submerged surfaces). *Id.*

f. 1[e][i]

Renaud discloses or suggests 1[e][i] because it includes a "processing device..., such as a microprocessor, **inside...cleaner 200**" which interacts with the camera to control the cleaner. Renaud, [0008]-[0009], [0029]-[0030]; Janét, ¶¶371-374.

Specifically, Renaud's processing device "access[es] the programmed data" to "identify areas...where debris or dirt exists" and "actuate the motor to direct the swimming pool cleaner to the debris." Renaud, [0009], [0029]-[0030]; Janét, ¶372. POSITAs would understand that this device—which processes data and generates signals to control the motor—constitutes the claimed "controller." Janét, ¶373. Further, Renaud's processing device is inside cleaner 200 and thus is "positioned...in" cleaner 200 (body). Janét, ¶374; IV.G.2.b. Renaud describes cleaner 200 includes "a vision system" with "sensors (e.g., camera) and

programming stored on the storage device for processing by the **processing device**." Renaud, [0008].

g. 1[e][ii]

Renaud discloses or suggests that its processing device (controller) is in electronic communication with the camera, because it describes that "the sensors [e.g., camera] of the vision system can **interact with** the...processing device [controller] to identify areas on the pool floor." Renaud, [0008], [0029]; Janét, ¶¶XXXX.

h. 1[e][iii]

Renaud discloses or suggests 1[e][iii]. Janét, ¶¶376-380.

Renaud discloses or suggests that its processing device (controller) generates control signals "in response to the captured image." Janét, ¶¶377-379.

Specifically, Renaud's vision system "includes sensors (e.g., camera) and programming stored on the storage device for processing by the processing device," and the processing device "access[es] the programmed data related to the vision system for actuating the motor." Renaud, [0008], [0029]. The vision system "identifies areas of debris by sensing areas of optical contrast…generated by a foreign object, debris and/or dirt" on pool floor and walls (submerged surfaces), and sensors "provide location information to the processor...for directing the swimming pool cleaner to the debris." Renaud, [0008], [0031]; Janét, ¶378.

Renaud also describes that its processing device controls a controller to actuate the motor for movement of the cleaner." Renaud, [0025].

POSITAs would have understood that Renaud's processing device (the claimed "controller") processes the programming and image data to generate the control signals that actuate the motors, causing the vehicle body to **move to** the debris area (the first portion), because it identifies debris based on "optical contrast"—i.e., based on visual/image data from the camera. Janét, ¶379.

Renaud also discloses the processing device generating control signals to cause movement "to...the first portion." Specifically, "[u]pon identifying debris...the vision system [via the processing device] can actuate the motor to direct the swimming pool cleaner to the debris." Renaud, [0009], Claim 3, [0030] (steer wheels "in the direction of the area of debris"), [0025]. POSITAs would understand that the processing device generates these signals to actuate the motor and steer the vehicle specifically to the "area of debris" (first portion). Janét, ¶380.

3. Claim 2 is Unpatentable over Renaud

Renaud renders Claim 2 obvious. Janét, ¶¶382-385.

a. 2[pre], 2[a]-2[c], 2[e]

Limitations 2[pre], 2[a]-2[c], and 2[e][i]-[iii] are identical to limitations 1[pre], 1[a]-1[c], and 1[e], respectively. For the reasons in §§IV.G.2.a-d, IV.G.2.f-

h (1[pre], 1[a]-1[c], 1[e][i]-1[e][iii]), Renaud discloses or suggests 2[pre] and 2[a]-2[c]. Janét, ¶383.

b. 2[d]

Limitations 2[d] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
2[d]		"carried by"	

Renaud discloses 2[d], because a camera "mounted directly...to the body" (§IV.G.2.e (1[d])) is also "carried by the body." Janét, ¶384.

4. Claim 3 Unpatentable over Renaud

Renaud renders Claim 3 obvious. Janét, ¶¶386-397.

a. 3[pre], 3[a]-3[c], 3[e][i]

Limitations 3[pre], 3[a]-3[c], and 3[e][i] are identical to limitations 1[pre], 1[a]-1[c], and 1[e][i], respectively. For the reasons in §§IV.G.2.a-d, f (1[pre], 1[a]-1[c], 1[e][i]), Renaud discloses or suggests 3[pre], 3[a]-3[c], and 3[e][i]. Janét, ¶387.

b. 3[d]

Limitations 3[d] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
3[d]		"positioned on or in, or carried by,"	

Renaud discloses 3[d], because a camera "mounted directly...to the body" (§IV.G.2.e (1[d])) is also "positioned on or in, or carried by, the body." Janét, ¶388.

c. 3[e][ii]

Renaud discloses or suggests 3[e][ii]. Janét, ¶¶389-394.

As explained in §IV.G.2.g (1[e][ii]), Renaud discloses the controller "in electronic communication with the at least one camera." Renaud also discloses that its controller is "in electronic communication with…a portable electronic device." Janét, ¶390.

Renaud discloses a docking station 300 that communicates with the cleaner 200 via a wireless antenna 316 and transceiver to send/receive signals. Renaud, [0026], [0033], FIG. 1 (below).

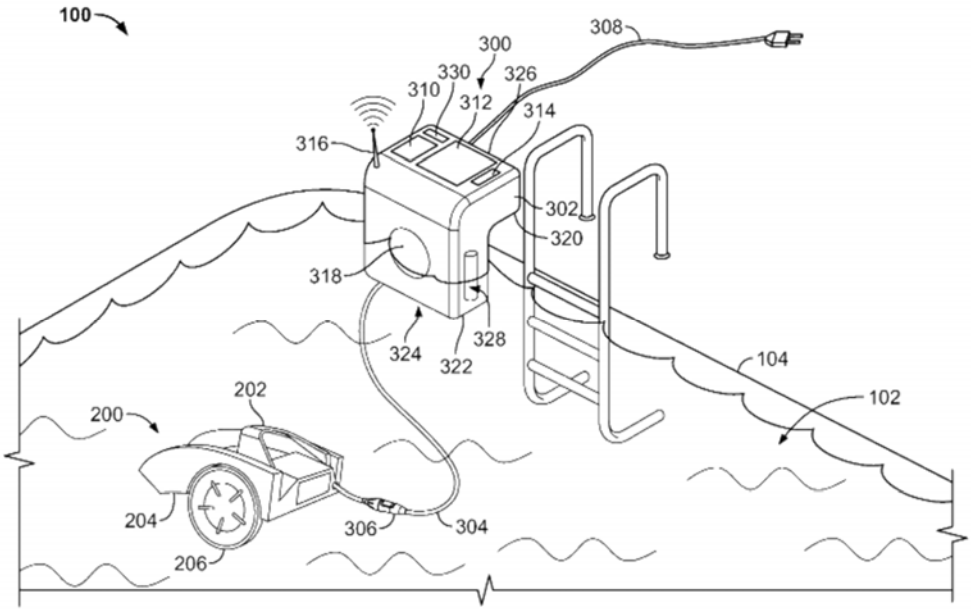


FIG. 1

Renaud further discloses the station is self-powered via a battery pack and includes a user interface 330 for accessing "cleaning paths" to control the cleaner. Renaud, [0032]-[0032].

POSITAs would have understood or found it obvious that Renaud docking station 300 is the "portable electronic device" in communication with the controller of cleaner 200 via wireless antenna 316, because the explicit disclosure of a "battery pack located in the docking station 300" (Renaud, [0033]) demonstrates a design choice for portability, allowing operation independent of fixed wall outlets. Janét, ¶393.

Additionally, Renaud discloses "a remote control... and/or joystick...allow[ing] a user to manually control the position" of cleaner 200.

Renaud, [0032]. POSITAs would have understood or found it obvious that these devices are "portable electronic devices," at least because these terms—remote control and joystick—describe handheld, carried by a user to operate cleaner 200 from a distance. Janét, ¶394. Furthermore, these devices are "in electronic communication" with the controller of cleaner 200 because Renaud discloses they are used to "manually control the position" of the cleaner (Renaud, [0032]), a function that necessarily requires transmitting control signals to the cleaner's internal controller to actuate the motors. Janét, ¶394.

d. 3[e][iii]

The limitation requires the controller to generate signals in response to **one of** the captured image **or** the PED. Janét, ¶¶395-396. As explained in §IV.G.2.h (1[e][iii]), Renaud discloses the controller configured to generate, "in response to...the captured image," at least one control signal to cause movement "to, or away from, the first portion of the submerged surface."

5. Claim 4 Unpatentable over Renaud

Renaud renders Claim 4 obvious. Janét, ¶¶398-401.

a. 4[pre], 4[a]-4[c], 4[e][i]-[iii]

Limitations 4[pre], 4[a]-4[c], and 4[e][i]-[iii] are identical to limitations 1[pre], 1[a]-1[c], and 1[e][i]-[iii], respectively. For the reasons in §§IV.G.2.a-c and

IV.G.2.f-h (1[pre], 1[a]-1[c], 1[e][i]-[iii]), Renaud discloses or suggests 4[pre], 4[a]-4[c], and 4[e][i]-[iii]. Janét, ¶399.

b. 4[d]

Limitation 4[d] is nearly identical to limitation 1[d], differing only in that 4[d] omits the requirement that the camera be "mounted directly or indirectly to the body." Renaud discloses or suggests 4[d], because Renaud's camera "mounted directly...to the body" (§IV.G.2.e (1[d])) satisfies the broader requirement. Janét, ¶400.

H. Ground 4B: Claim 5 Is Unpatentable over Renaud and Durvasula

1. Motivation to Combine

Both Renaud and Durvasula disclose autonomous robotic pool cleaners. *See* §§IV.A.1, IV.G.1. POSITAs would have been motivated to combine the teachings of Renaud and Durvasula to improve pool cleaning and sanitization. Janét, ¶402.

POSITAs would have recognized that the teachings in Renaud and Durvasula are directed to the same pool cleaning technical field and provide complementary technical solutions to address similar issues. Janét, ¶403. Specifically, both disclose self-propelled pool cleaners having a housing, drive means for moving the pool cleaner over pool surfaces, a filter or debris container for collecting debris, and a controller for navigation. *Compare* Renaud, [0008], [0023], [0025], FIGS. 1-3, *with* Durvasula, [0014]-[0016], [0020]-[0022], FIGS. 1,

9-10. Accordingly, POSITAs would have investigated the technical teachings in both Renaud and Durvasula to seek guidance when designing a pool cleaning system for specific pool cleaning considerations and applications. Janét, ¶403.

Both Renaud and Durvasula contemplate sanitization in addition to mechanical debris removal, but differ in their approach. Janét, ¶404. Renaud discloses a UV light on the bottom surface of the cleaner "for disinfecting and/or killing bacteria and other undesired organisms in the swimming pool." Renaud, [0010], [0040]. Durvasula discloses "a chemical dispenser to closely apply pool cleaning chemicals to the pool surfaces as the vehicle 30 traverses such surfaces." Durvasula, [0015].

POSITAs would have been motivated to modify Renaud by incorporating Durvasula's chemical dispenser. Janét, ¶¶405-406.

First, POSITAs would have been motivated to enhance the sanitization functionalities already taught by Renaud. Janét, ¶405. Renaud already contemplates a clear design intent to integrate sanitization with debris removal, disclosing a UV light "for disinfecting and/or killing bacteria and other undesired organisms." Renaud, [0010], [0040]. POSITAs would have recognized that incorporating Durvasula's chemical dispenser would provide a complementary chemical treatment, thereby achieving multi-modal sanitization (UV and chemical) alongside mechanical cleaning. Durvasula, [0015]; Renaud, [0040]; Janét, ¶405.

Second, POSITAs would have recognized that because Renaud's cleaner traverses pool surfaces using its vision system to identify and navigate to debris, equipping it with Durvasula's chemical dispenser would efficiently and effectively distribute pool cleaning chemicals throughout the pool as the cleaner moves. Renaud, [0029]-[0031]; Durvasula, [0015]; Janét, ¶406.

POSITAs would have reasonably expected success, because incorporating a chemical dispenser into a robotic pool cleaner like Renaud's had been well-known, and incorporating Durvasula's chemical dispenser into Renaud's cleaner body would have yielded predictable results. Porat, [0028]; Durvasula, [0015]; Renaud, [0010], [0023], [0040]; Janét, ¶407.

2. Claim 5 Unpatentable over Renaud and Durvasula

The Renaud-Durvasula combination renders Claim 5 obvious. Janét, ¶¶ 408-417.

a. 5[pre], 5[a]-5[c], 5[f][ii]-5[f][iii]

Limitations 5[pre], 5[a]-5[c], 5[f][ii], and 5[f][iii] are identical to limitations 1[pre], 1[a]-1[c], 1[e][ii], and 1[e][iii], respectively. For the reasons in §§IV.G.2.a-c and IV.G.2.g-h (1[pre], 1[a]-1[c], 1[e][ii]-[iii]), Renaud discloses or suggests 5[pre], 5[a]-5[c], and 5[f][ii] and 5[f][iii]. Janét, ¶409.

b. 5[d]

As explained in §IV.G.2.b (1[a]), Renaud discloses cleaner 200 comprising a vehicle body. Renaud, [0022]-[0023], [0037], [0039], FIGS. 1-3.

As explained in §IV.A.8.b (5[d]), Durvasula discloses a chemical dispenser to "closely apply pool cleaning chemicals to the pool surfaces as the vehicle 30 traverses such surfaces." Durvasula, [0015]. POSITAs would have understood that Durvasula's chemical dispenser constitutes "a chemical dispenser on, in, or carried by the vehicle body" because it is incorporated into vehicle 30 and applies chemicals "as the vehicle 30 traverses" the pool surfaces. *Id.*; Janét, ¶412.

As explained in §IV.H.1, POSITAs would have been motivated to incorporate Durvasula's chemical dispenser into Renaud's cleaner 200 (vehicle body) to enhance the cleaning functionalities taught by Renaud. Janét, ¶413. Renaud already contemplates a clear design intent to integrate sanitization with debris removal, disclosing a UV light on the bottom surface "for disinfecting and/or killing bacteria and other undesired organisms." Renaud, [0010], [0040]. POSITAs would have recognized that incorporating Durvasula's chemical dispenser would provide a complementary chemical residual that persists in the water column long after the cleaner has passed. Durvasula, [0015]; Janét, ¶413. Also as explained in §IV.H.1, POSITAs would have had a reasonable expectation of success to implement this combination.

In the Renaud-Durvasula combination, Renaud's cleaner 200 would include Durvasula's chemical dispenser carried by Renaud's housing 202 (vehicle body), thereby disclosing "a chemical dispenser on, in, or carried by the vehicle body." §IV.H.1; Renaud, [0022]-[0023], FIGS. 1-3; Durvasula, [0015]; Janét, ¶¶414.

c. 5[e]

Limitations 5[e] and 1[d] only differ in:

1[d]	"camera"	"mounted directly or indirectly to"	"the body"
5[e]		"on, in, or carried by"	"the vehicle body"

Renaud discloses or suggests 5[e], because a camera "mounted directly...to the body" (§IV.G.2.e (1[d])) is also "on, in, or carried by the vehicle body." Janét, ¶415.

d. 5[f][i]

Limitations 5[f][i] and 1[e][i] only differ in:

1[e][i]	"controller"	"positioned on or in"	"the body"
5[f][i]		"on, in, or carried by"	"the vehicle body"

Renaud discloses or suggests 5[f][i], because Renaud's controller "positioned on or in the body" (§IV.G.2.f (1[e][i])) is also "on, in, or carried by the vehicle body." Janét, ¶416.

V. CONCLUSION

The Board should institute IPR and cancel Claims 1-5.

VI. MANDATORY NOTICES

A. Real Party in Interest

All real parties in interest for this Petition includes Petitioner, Deepwater Innovation Technology (Hong Kong) Limited and Xingmai Innovation Technology (Suzhou) Co., Ltd.

B. Related Matters

To the best of Petitioner's knowledge, the '766 Patent has been involved in the following cases:

- *Beatbot Technology (USA) Co. Ltd. et al v. Zodiac Pool Systems LLC*, No. 3:25-cv-01946 (S.D. Cal.).
- *Zodiac Pool Sys. LLC v. Wybotics, Co. Ltd.*, Case No. 2:25-cv-00582 (E.D. Tex).
- *Wybotics Inc. et al v. Zodiac Pool Systems LLC*, Case No. 2-25-cv-08526 (C.D. Cal.).
- *Wybotics Inc. et al v. Zodiac Pool Systems LLC*, IPR2026-00159 (PTAB).

Petitioner is also concurrently filing Petitions for *Inter Partes* Review of U.S. Patent Nos. 11,880,207 and 11,003,191, which are related to the '766 Patent challenged herein.

C. Notice of Counsel and Service Information

Petitioner consents to electronic service. All communications to the attorneys listed below may be sent to: Perkins-Service-Xingmai-Zodiac-IPRs@perkinscoie.com.

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D. Power of Attorney

A power of attorney is filed herewith according to 37 C.F.R. §42.10(b).

Respectfully submitted,

/ Kyle R. Canavera /

Kyle R. Canavera
Reg. No. 72,167
Attorney for Petitioner

PERKINS COIE LLP
11452 El Camino Real Ste 300
San Diego, CA 92130-2080

Date: January 26, 2026

CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(D)

Pursuant to 37 C.F.R. §42.24(a), Petitioner hereby certifies that portions of the above-captioned Petition for *inter partes* review of U.S. Patent No. 11,262,766, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,979. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

/ Kyle R. Canavera /

Kyle R. Canavera
Reg. No. 72,167
Attorney for Petitioner

Date: January 26, 2026
PERKINS COIE LLP
11452 El Camino Real Ste 300
San Diego, CA 92130-2080

CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *inter partes* review of U.S. Patent No. 11,262,766 and supporting materials (Exhibits and Power of Attorney) were served via FedEx delivery on the Patent Owner at the correspondence address of record as listed on PAIR:

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

A courtesy copy was also sent via electronic mail to Patent Owner's litigation counsel listed below:

Christopher Samuel Leah - cleah@kilpatricktownsend.com
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Respectfully submitted,

/Meghan Bright/

Meghan Bright
Patent Paralegal

Date: January 26, 2026

EXHIBIT 3

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

BEATBOT TECHNOLOGY (USA) CO. LTD.,

Petitioner,

v.

ZODIAC POOL SYSTEMS LLC,

Patent Owner.

_____

PTAB Case No. IPR2026-00202

U.S. Patent No. 11,003,191 B2

_____

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,003,191 B2

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EXHIBIT LIST

No.	Exhibit
1001	U.S. Patent No. 11,003,191 B2 ("'191 Patent")
1002	File History of the '191 Patent
1003	Declaration of Jason Janét, Ph.D. ("Janét")
1004	Curriculum Vitae of Jason Janét, Ph.D.
1005	Chinese Publication No. CN1540119A ("Cui")
1006	German Publication No. DE102007053310A1 ("Knoll")
1007	Chinese Publication No. CN101139007A ("Fu-007")
1008	U.S. Patent No. 3,321,787 ("Myers")
1009	U.S. Patent No. 4,168,557 ("Rasch")
1010	Jonathan Horgan & Daniel Toal, Review of Machine Vision Applications in Unmanned Underwater Vehicles, Proc. 9th Int'l Conf. on Control, Automation, Robotics and Vision 1 (2006)
1011	Prosecution History of U.S. Patent No. 9,388,595
1012	Prosecution History of U.S. Patent No. 10,338,599
1013	U.S. Patent No. 9995051 B2
1014	U.S. Publication 20140015959A1 ("Durvasula")
1015	U.S. Publication No. 20140263087A1 ("Renaud")

LISTING OF CHALLENGED CLAIMS

U.S. Patent No. 11,003,191 B2
Claim 1
1[pre] A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
1[a] a. a vehicle body;
1[b] b. means for moving the vehicle body within the swimming pool;
1[c] c. a filter configured to retain debris collected from the submerged surface;
1[d] d. at least one camera positioned on or in the body for capturing an image of at least a first portion of the submerged surface; and
1[e][i] e. a controller (i) positioned on or in the body,
1[e][ii] (ii) in electronic communication with the at least one camera, and
1[e][iii] (iii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.
Claim 2
2[pre] A system for cleaning debris from a submerged surface of a swimming pool, comprising:
2[a][i] a. a self-propelled pool cleaner comprising:
2[a][ii] i. a vehicle body;
2[a][iii] ii. means for moving the vehicle body within the swimming pool;

2[a][iv] 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
2[a][v] iv. a controller (i) positioned on or in the body,
2[a][vi] (ii) in electronic communication with the at least one camera, and
2[a][vii] (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; and
2[b] b. a filter configured to retain debris collected from the submerged surface by the self-propelled pool cleaner.
Claim 3
3[pre] A system for cleaning debris from a submerged surface of a swimming pool, comprising:
3[a][i] a. a self-propelled pool cleaner comprising:
3[a][ii] i. a vehicle body;
3[a][iii] ii. means for moving the vehicle body within the swimming pool;
3[a][iv] iii. a filter configured to retain debris collected from the submerged surface;
3[a][v] 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
3[b][i] b. a controller (i) in electronic communication with the at least one camera and
3[b][ii] (ii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.

I. INTRODUCTION

Petitioner requests *inter partes review* ("IPR") of Claims 1-3 ("Challenged Claims") of U.S. Patent No. 11,003,191 B2 ("'191 Patent," EX1001).

II. IPR Requirements

A. Standing

The '191 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

B. Challenged claims and relief requested

Petitioner respectfully requests cancellation of Claims 1-3 under 35 U.S.C. §103.

1. Prior art

Petitioner relies on Exhibits listed in the Table of Exhibits and declaration of Dr. Jason Janét, (EX1003, "Janét"). Specific invalidity grounds are listed in the table below, where all the references are prior art under pre-AIA 35 U.S.C. §102(b) or AIA 35 U.S.C. §102(a)(1).

Grounds under 35 U.S.C. §103	Claims	Prior Art
1A	1-2	Durvasula and Fu-007
1B	3	Durvasula
2A	1-2	Cui and Fu-007
2B	3	Cui
3	1-3	Knoll
4	1-3	Renaud

III. ’191 Patent

A. Overview

The ’191 Patent describes a pool system that uses camera-based image analysis to detect pool conditions and generate control responses. EX1001, Abstract.

Claims 1-3 of the ’191 Patent are directed to self-propelled pool cleaner or systems. EX1001, 10:50-12:16.

As illustrated in FIG. 1 (annotated below), the system includes **camera 32** positioned to capture images of a swimming pool 22, a **controller 42** that analyzes the images and generates control responses for operating a pool cleaning equipment. EX1001, 2:61-5:7.

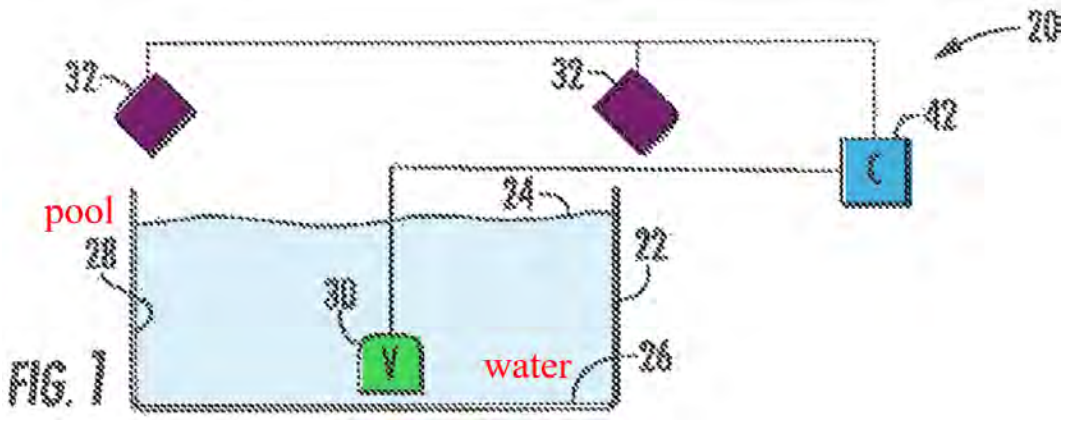


FIG. 1

The system includes a cleaning device (vehicle 30 as illustrated in FIG. 1 (annotated above)), a **drive system** such as one or more propulsion devices or drives, e.g. toothed track drive 900 in FIG. 10 (annotated below), coupled to the vehicle for moving the vehicle, and cleaning equipment (e.g., **brushes**). EX1001, 3:4-43; 10:8-27. Cameras 32 capture video or images of the pool, and controller 42 analyzes the images to determine the cleanliness of submerged pool surfaces and generates control signals to adjust the operation of vehicle 30. EX1001, 3:44-5:7; 8:24-9:56.

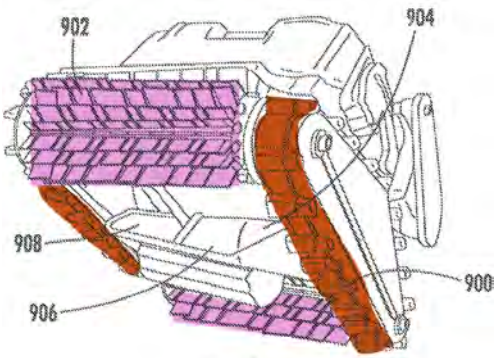


FIG. 10

As illustrated in FIG. 9 (annotated below), **controller 42** is located in **dry station 246** outside pool 22, is in electronic communication with **cameras 32**, and is configured to generate control signals to cause movement of **vehicle 830**. EX1001, 9:57-10:7. These control signals are transmitted from dry station 246 to vehicle 830. *Id.*

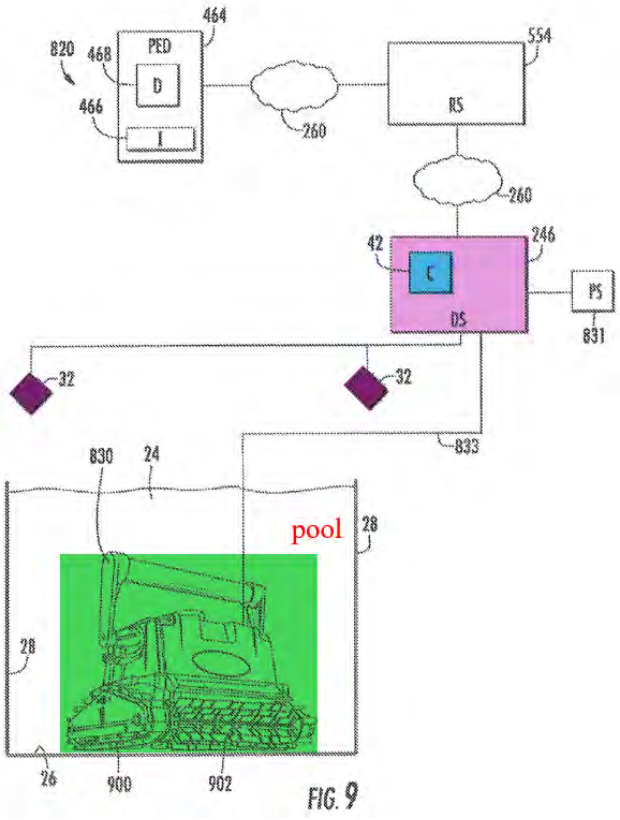


FIG. 9

B. Prosecution History

The '191 Patent issued from U.S. Application 16/919,750 ("'750 Application"). EX1001, field (21). The '750 Application purported to claim

priority, through a series of continuation applications, to U.S. Application No. 13/545,918 ("'918 Application") filed on July 10, 2012. EX1001, field (63).

Original Claims 1-19 of the '750 Application were copies of claims from an earlier Application No. 15/973,983 in the priority chain, issued as U.S. Patent No. 10,338,599 ("'599 Patent"). *Compare* EX1002 at 17-19 *with* EX1012 at 24-26. Applicant concurrently filed a preliminary amendment cancelling original Claims 1-19 and adding new independent Claims 20-22. EX1002, pp.40-41.

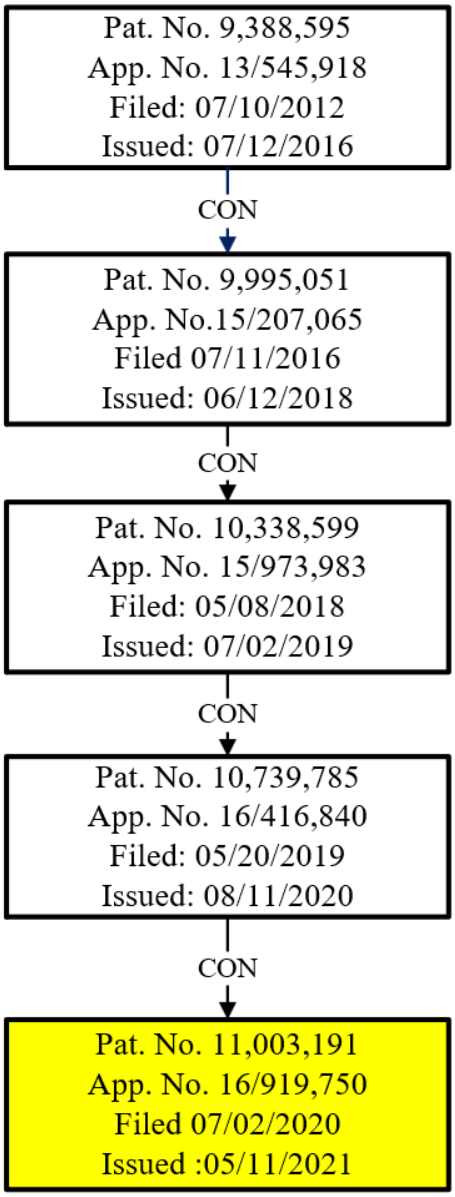
During the original examination, no prior art rejections were raised against Claims 20-22. The sole issue raised was a non-statutory double patenting rejection that was overcome via a terminal disclaimer. *Id.*, 64-72, 114-116. Claims 20-22 were issued as Claims 1-3 of the '191 Patent. *Id.*, 128-136. In the Notice of Allowability, the Examiner indicated that the references of record fail to disclose the features regarding the controller. *Id.*, 132-136.

Fu-007 (EX1007), used in this Petition, was cited in an Information Disclosure Statement (IDS) (EX1002, pp.56, 96) but was not used as a basis for claim rejections or otherwise discussed during the prosecution. Fu-007's use in this Petition is not cumulative, because Fu-007 is used here in combination with other references and the Examiner lacked expert testimony regarding the use of Fu-007 in combination with other references.

C. '191 PATENT'S PRIORITY DATE

The Board can consider the challenged claims' priority date. *See Parus Holdings, Inc. v. Google LLC,* 70 F.4th 1365, 1373-74 (Fed. Cir. 2023); *Indivior UK Ltd. v. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021). A priority claim to an earlier application is valid only if the earlier application, *inter alia*, provides description for the claims pursuant to 35 U.S.C. §112(a) (or pre-AIA 35 U.S.C. §112, first paragraph) under 35 U.S.C. §120. *Parus*, 70 F.4th at 1373-74; *Anascape, Ltd. v. Nintendo of Am., Inc.*, 601 F.3d 1333, 1334-35 (Fed. Cir. 2010).

The '191 Patent claims priority through a series of purported continuation applications to the '918 Application filed on July 10, 2012 as shown by the patent family tree below:



Therefore, the priority chain of the '191 Patent includes the '918 Application, filed on July 10, 2012, which predates the March 16, 2013 effective date of the America Invents Act (AIA) and is subject to pre-AIA 35 U.S.C. §§102-103, and the remaining earlier applications, filed after the AIA effective date, which are subject to AIA 35 U.S.C. §§102-103, as explained below.

The '191 Patent includes three independent Claims 1-3. Taking Claim 1 as representative, Claim 1 recites "a controller (i) **positioned on or in the body**" 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 from**, the first portion of the submerged surface."[1] *Id.*, 10:60, 62-65. Claim 2 recites the above-quoted limitations (i) and (iii). *Id.*, 11:8, 10-14. Claim 3 recites the above-quoted limitation (iii). *Id.*, 12:11-15.

As explained below, none of the above-quoted limitations in Claims 1-3 were disclosed as part of the specification of the '918 Application as originally filed.

35 U.S.C. §120 requires an invention claimed in a later filed application be "disclosed in the manner provided by section 112(a) (other than the requirement to disclose the best mode) in an application previously filed in the United States," in order to have the benefit of priority of the earlier filed application. As such, the disclosure in the earlier filed application must meet both the written description and enablement requirements under 35 U.S.C. §112(a) in disclosing the invention

[1] All **bold**, *italic*, or colored emphases are added by Petitioner unless otherwise specified.

claimed in the later filed application. *Chiron Corp. v. Genentech, Inc.*, 363 F.3d 1247, 1253 (Fed. Cir. 2004).

Under the written description requirement in 35 U.S.C. §112(a), the specification must "reasonably convey[] to the artisan that the inventor had possession at that time of the later claimed subject matter." *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed Cir. 1991). The specification demonstrates such possession by describing the claimed invention and all of its limitations. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (en banc) (*citing Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997) ("One shows that one is 'in possession' of the invention by describing the invention, with all its claimed limitations, not that which makes it obvious.")).

As explained below, the '918 Application does not provide a written description for each and every feature of Claims 1-3 of the '191 Patent. Accordingly, under 35 U.S.C. §120, Claims 1-3 of the '191 Patent are not entitled to the benefit of the July 10, 2012 filing date of the '918 Application.

Moreover, because the '918 Application contains no disclosure of the above-identified claim limitations, the specification also fails to satisfy the enablement requirement under 35 U.S.C. §112(a) for Claims 1-3. "It is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement." *Genentech, Inc. v. Novo*

Nordisk A/S, 108 F.3d 1361, 1366 (Fed. Cir. 1997). Where, as here, the specification is entirely silent as to the above-identified claim limitations as explained below—including features of the controller identified as absent from the prior art of record in the Notice of Allowability (EX1002, pp.132-136)—it necessarily fails to teach a skilled artisan how to make and use an invention encompassing those features, and the knowledge of skilled artisans cannot fill this void. This provides an independent basis under 35 U.S.C. §120 for concluding that Claims 1-3 are not entitled to the benefit of the July 10, 2012 filing date of the '918 Application.

Each of Claims 1-3 is entitled to a priority date in the priority chain after the '918 Application and can be no earlier than July 11, 2016, the filing date of the '918 Application's next immediate child application No. 15/207,065. EX1013, field (22). Each of Claims 1-3 is subject to AIA 35 U.S.C. §§102-103.

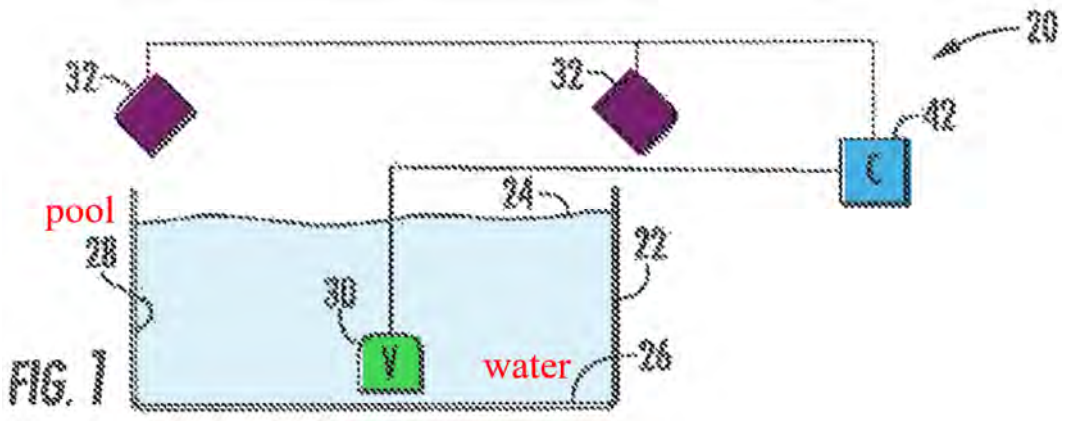
1. The '918 Application does not disclose "a controller...positioned on or in the body"

The '918 Application fails to describe "a controller…positioned on or in the body," as recited in Claim 1 and similarly recited in Claim 2 of the '191 Patent. Janét, ¶¶81-86.

The '918 Application, however, consistently describes—in its specification, drawings, and claims—that the controller is located **outside the pool**, physically

remote from the vehicle body submerged inside the pool. The controller is not submerged, not collocated with the vehicle, and does not travel with the vehicle; it is connected to the vehicle only through a wired or wireless communication link. EX1011, pp.23-28, 32. Therefore, in the '918 Application, the disclosed controller is **physically separated and remote from the vehicle** and does not describe that its controller is **on or in** the vehicle body which is inside the pool.

Specifically, FIG. 1 of the '918 Application (annotated below) illustrates an embodiment where **controller 42** is located outside pool 22 and remote from **vehicle 30**. EX1011, p.38; Janét, ¶82.



FIGS. 2, 4, and 9 (annotated below) show embodiments where **controller 42** is part of **dry station 46/246**, and/or **portable electronic device 464**, located outside pool 22 and remote from **vehicle 30/830**. EX1011, pp.24-25, 27-28, 32, 34, 38, 40; Janét, ¶83.

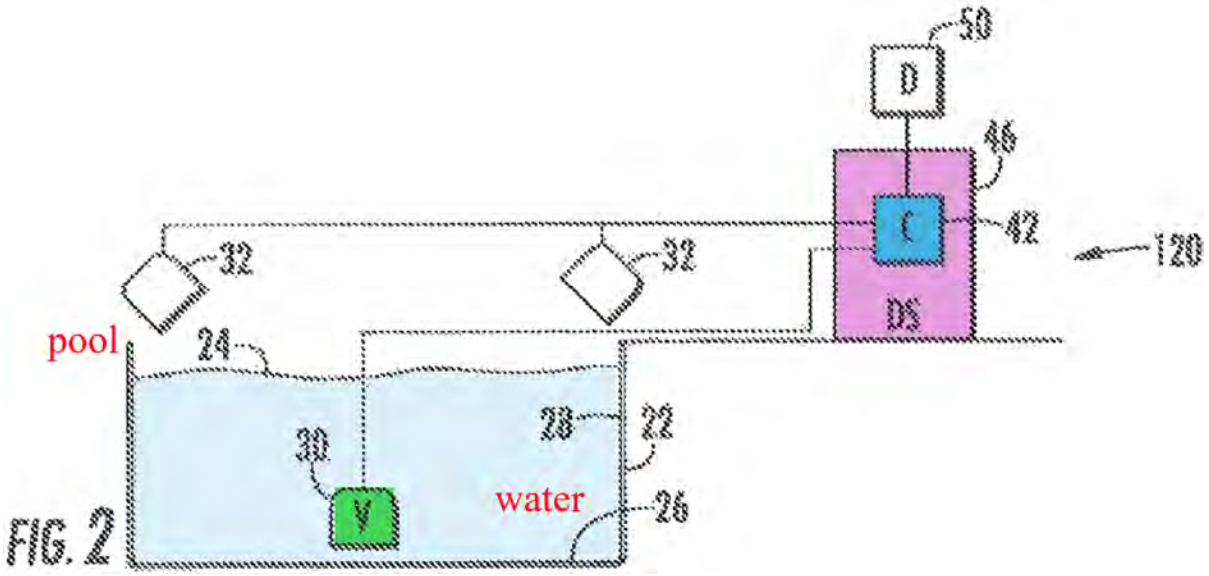

50
D
46
C
42
120
32
32
DS
pool
24
28
22
30
V
water
26

FIG. 2

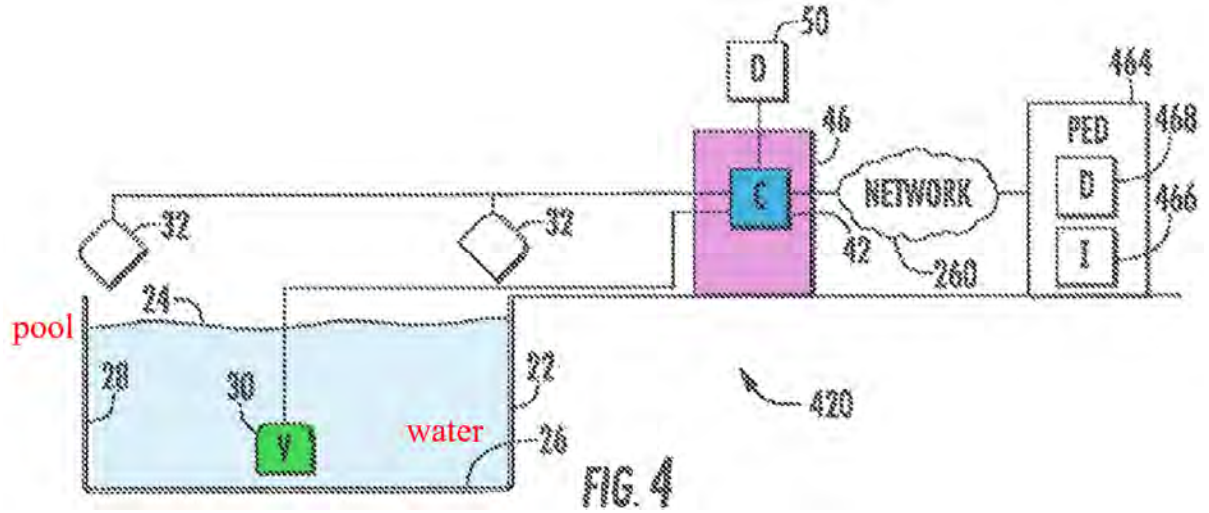

50
D
464
46
PED
468
C
NETWORK
D
466
32
32
42
260
I
pool
24
28
30
22
V
water
26
420

FIG. 4

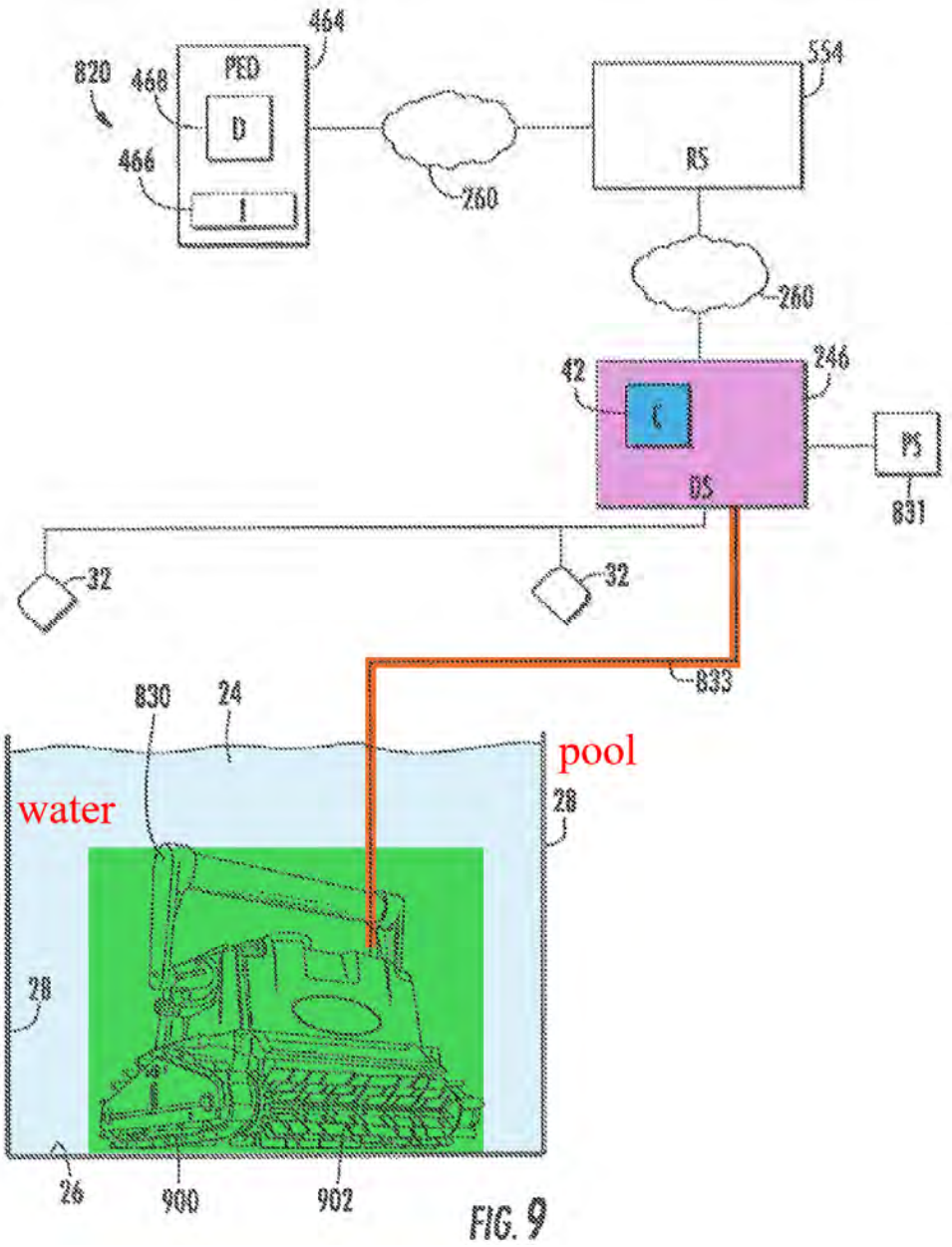


FIG. 9

FIGS. 3 and 5 (annotated below) show embodiments where **controller 42** is part of ***remote* server 254/554**, located outside pool 22 and remote from **vehicle 30**. EX1011, pp. 26, 28-29, 32, 35, 38-39. **Controller 42** transmits control signals to the vehicle through **dry station 246** across **network 260**. *Id.* Other parts of

the '918 Application also disclose its controller as a **remote** component from the vehicle and as being **located outside the pool** (e.g., as part of a dry station, a portable electronic device, or a remote server). *See, e.g.*, EX1011, pp. 38-40 (FIGS. 1-5, 9), 21-29, 32-33 (descriptions of FIGS. 1-5, 9); Janét, ¶84.

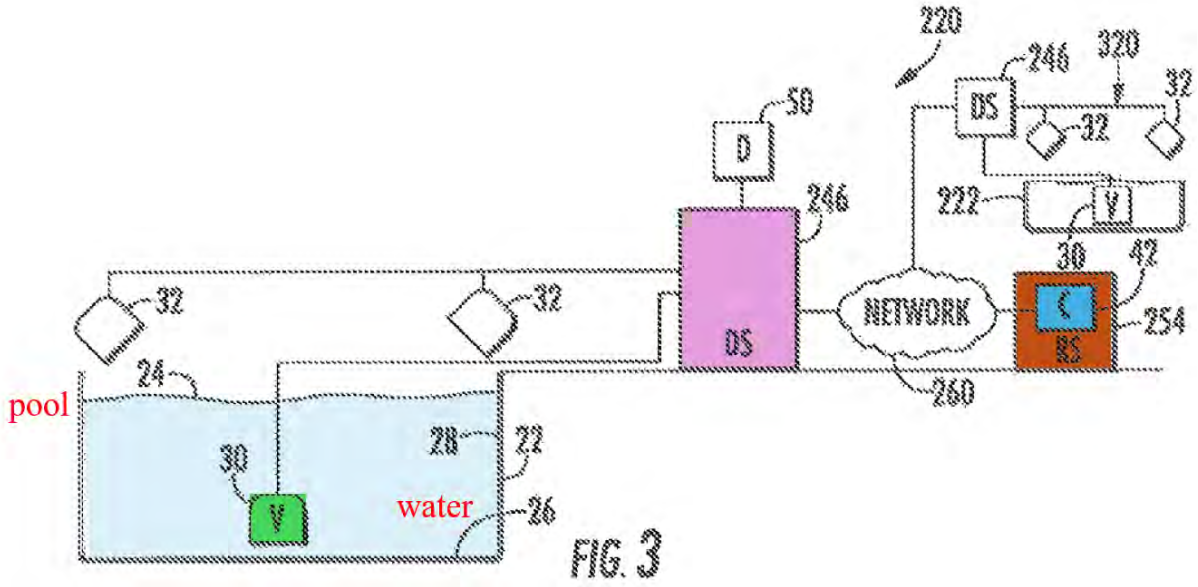


FIG. 3

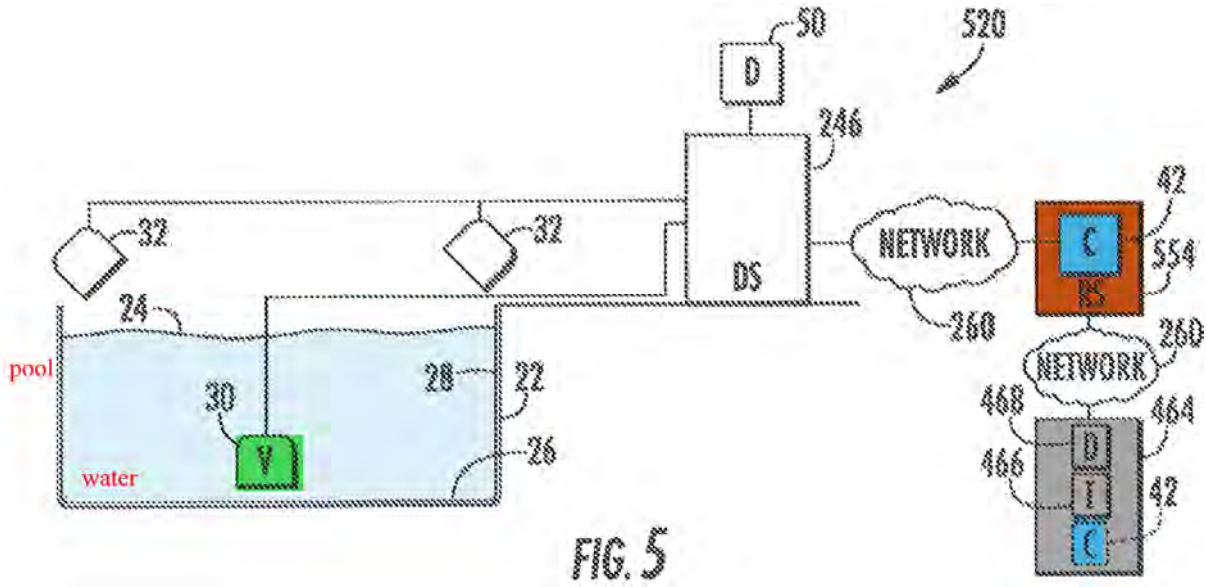


FIG. 5

Accordingly, the '918 Application repeatedly describes and depicts its controller as a **remote** component from the vehicle and as being **located outside the pool** (e.g., as part of a dry station, a portable electronic device, or a remote server), communicating with the vehicle over a network and/or through a dry station. ***See, e.g.***, EX1011, pp. 38-40 (FIGS. 1-5, 9), 21-29, 32-35 (descriptions of FIGS. 1-5, 9, Claims 2-4, 10); Janét, ¶85. The '918 Application does not describe or suggest any alternative controller configuration, such as positioning the controller on or in the vehicle body. Janét, ¶85.

The written description requirement mandates that "the specification must show the inventor actually invented the invention claimed." *Ariad Pharms.*, 598 F.3d at 1351. "One shows that one is 'in possession' of the invention by describing the invention, with all its claimed limitations, not that which makes it obvious." *Lockwood*, 107 F.3d at 1572. Here, the '918 Application does **not** provide written description support for the claimed limitation of "a controller…positioned on or in the body" and further fails to meet the enablement requirement for the claimed limitation under 35 U.S.C. §120. Accordingly, Claims 1-2 of the '191 Patent are not entitled to the July 10, 2012 filing date of the '918 Application. Janét, ¶86.

2. The '918 Application does not disclose "caus[ing] movement of the body…away from…the first portion of the submerged surface"

Independently, the '918 Application fails to describe that its controller is configured to "generate, in response to the captured image, at least one control signal to cause movement of the body…***away from***…the first portion of the submerged surface," as recited in Claim 1 and similarly recited in Claims 2-3 of the '191 Patent. Janét, ¶87.

The '918 Application describes controller 42 generating control signals, in response to images captured by camera 32, to steer vehicle 30 ***to*** or towards portions of the pool requiring cleaning or re-cleaning. Janét, ¶88. For example, the '918 Application discloses that "[u]pon identifying a missed spot, controller 42 utilizes signals from camera 32 **to steer vehicle 32 [sic] cover such missed portions** of surfaces 26, 28." EX1011, p.24. The '918 Application further discloses that "controller 42 uses signals from cameras 32 **to steer vehicle 34 [sic] such areas to re-clean** such portions until such portions have been satisfactorily cleaned." *Id.*; *see also id.*, p.25 ("causing controller 42 to generate control signals using signals from camera 32 **to steer vehicle 30 back to such identified portions** where such portions may be cleaned"), pp.31-32 ("controller 42 generates control signals steering vehicle 30 to re-clean portions of pool 22, such as portions 638"; "As illustrated in FIG. 8, different portions 638 may be visibly distinguished from

one another through color, text or markings indicating either differences in the cleanliness of such portions 638 or indicating different recommended cleaning strategies or approaches that may be selected by a person using input 466 when **vehicle 30 is steered back to such portions 638 for re-cleaning using signals from camera 32**."). In each above description, the '918 Application describes steering vehicle 30 to or towards a portion of pool 22 for cleaning. Janét, ¶88.

The '918 Application's disclosure of image-based control signals is limited to directing vehicle 30 toward areas requiring cleaning. EX1011, pp.24-25, 31-32. Notably absent is any disclosure of generating a control signal, in response to a captured image of a portion of the submerged surface, to cause the vehicle to move ***away*** from the portion. Janét, ¶89.

The '918 Application's image-driven control is steering the vehicle ***to*** missed/insufficiently cleaned areas. EX1011, pp.24-25, 31-33; Janét, ¶90.

Indeed, the '918 Application does not provide written description support for the claimed limitation of the controller configured to "generate, in response to the captured image, at least one control signal to cause movement of the body…***away from***…the first portion of the submerged surface," and further fails to meet the enablement requirement for the claimed limitation under 35 U.S.C. §120. Accordingly, Claims 1-3 of the '191 Patent are not entitled to the July 10, 2012 filing date of the '918 Application. Janét, ¶91.

In sum, because the '918 Application lacks written description support, and fails to meet the enablement requirement in its disclosure, for the claimed limitations "on or in the body" in Claims 1-2 and "away from" in Claims 1-3 of the '191 Patent, Claims 1-3 are not entitled to the July 10, 2012 filing date of the '918 Application. Janét, ¶92. Instead, Claims 1-3 of the '191 Patent are entitled to a priority date no earlier than the filing date of the next application in the chain—July 11, 2016 for Application No. 15/207,065.[2] *Id.*; EX1013, field (22).

D. Level of Ordinary Skill

For the purposes of this Petition, a person of ordinary skill in the art (POSITA) would have had a bachelor's degree in electrical engineering, mechanical engineering, physics, or computer engineering, with at least two years' experience in autonomous camera-based robotic cleaning systems. Janét, ¶30.

E. Claim Construction

For determining invalidity in this Petition, Petitioner believes no constructions are necessary except for the means-plus-function (MPF) limitation "means for moving the vehicle body" in Claims 1-3.

[2] Petitioner reserves the right to challenge Patent Owner's entitlement to the July 11, 2016 filing date of App. No. 15/207,065 (and any later-claimed priority).

When a claim limitation uses "means" or "module" and recites an associated function, the limitation is presumably an MPF term and be construed as such to cover the corresponding structure, material, or acts described in the specification and equivalents thereof. *See* 35 U.S.C. § 112(f) or ¶6; MPEP §2181; ***TriMed, Inc. v. Stryker Corp.***, 514 F.3d 1256, 1259-60 (Fed. Cir. 2008).

Claims 1-3 each recite a claim limitation in form of "***means for moving***…." and recites a claimed function of "moving the vehicle body within the swimming pool." EX1001, 10:50-12:16; Janét, ¶¶93-95. The corresponding structure described in the specification of the '191 Patent includes wheels, rollers, tracks, or other surface contacting members powered by a motor and the like, a toothed track drive that provides traction and propulsion for vehicle, or a vacuum or liquid jet. EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶95.

The above-described structures in the specification of the '191 Patent are the corresponding structures for the "means for moving the vehicle body." Janét, ¶96.

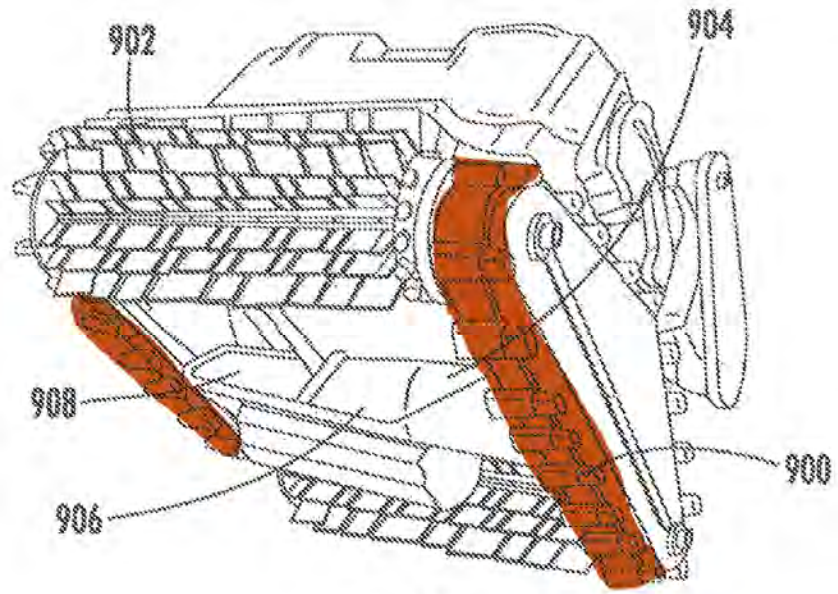


FIG. 10

IV. INVALIDITY GROUNDS

A. Ground 1A: Claims 1-2 Are Unpatentable over Durvasula and Fu-007.

1. Durvasula

Durvasula (EX1014) is U.S. Patent Application Publication No. US20140015959A1 of Patent Owner's '918 Application that was published on January 16, 2014. Durvasula is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1) and pre-AIA 35 U.S.C. §102(b). *See* §III.C; Janét, ¶97.

Durvasula discloses a pool cleaning system and contains technical features that are identical or similar to those of the '191 Patent and is analogous art with respect to Claims 1-3 of the '191 Patent. Janét, ¶98.

2. Fu-007

Fu-007 (EX1007) discloses an underwater cleaning robot for swimming pools using camera-based control. Fu-007, Abstract, pp.8-10, 14-16, Claims 1, 4. Fu-007 is analogue art with respect to the subject matter of Claims 1-3 of the '191 Patent. Janét, ¶¶99-100.

Fu-007's robot includes a control system with a central processing unit (controller) housed in **control system enclosure 8**. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1-2 (annotated below).

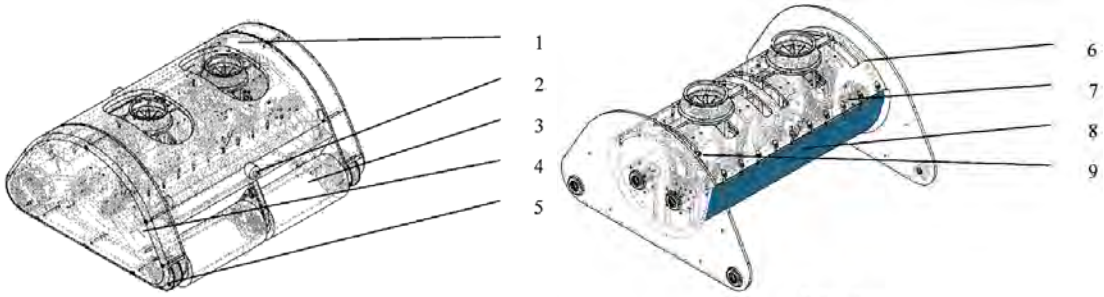


FIG. 1 FIG. 2

Control system enclosure 8 is housed within a sealed drive control enclosure, which is "installed on and fixed to the interior of the **robot main shell 19**...to sealingly enclose the control system components" and has "waterproof properties." Fu-007, pp.8-9, 12-14, Claim 4, FIG. 4 (annotated below).

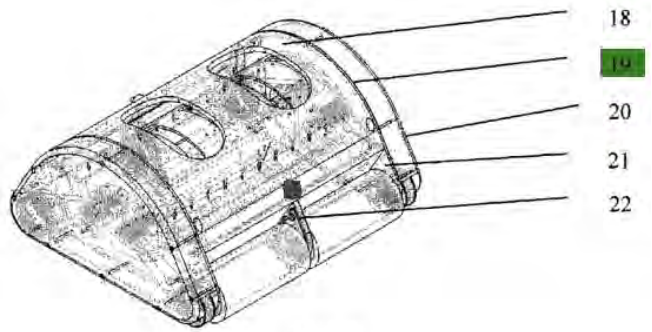


FIG. 4

Fu-007's robot also includes **monitoring camera 2** "installed on two front panels of the **robot main shell 19**" and connected to the **central processing unit** via **image acquisition card**. Fu-007, pp.8-9, 12-14, Claim 4, FIGS. 1, 4, 6 (annotated).

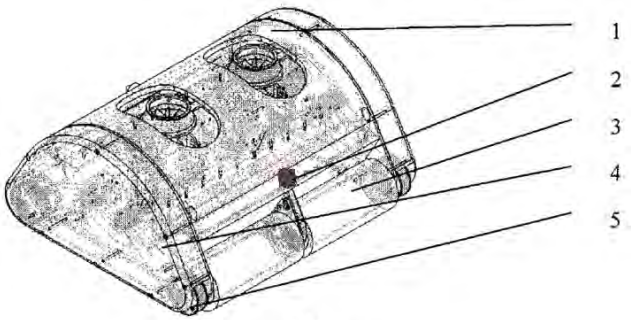


FIG. 1

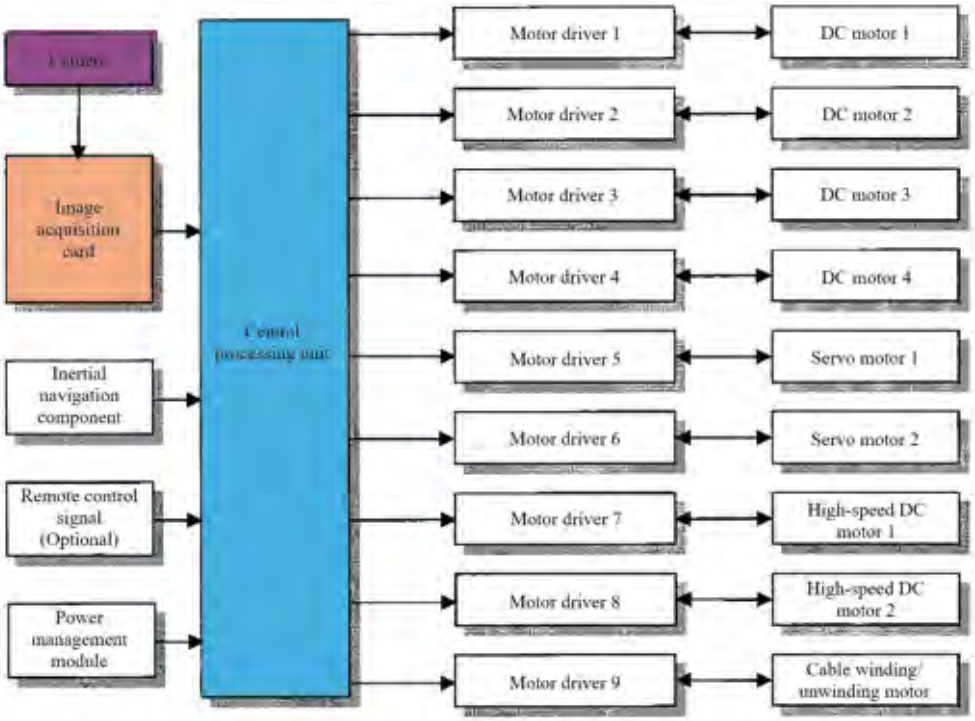


FIG. 6

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

3. Motivation to Combine

Both Durvasula and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve systems. Durvasula describes vehicle 30 as "an automated powered device" that

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

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

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

First, a POSITA would have been guided by Durvasula and Fu-007 to make such combination to advance Durvasula's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Janét, ¶108. Durvasula's reliance on an external controller and tether constrains autonomy by limiting range and often requiring human intervention to manage cable entanglements. *Id.* Fu-007 teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller, the modified system would have enhanced autonomous operations—generating control signals onboard to plan paths and complete cleaning tasks without requiring human supervision or corresponding data transmission between the underwater cleaner and an external controller. Cui, pp.5-6; Janét, ¶108. Additionally, removing the external tether would allow the vehicle to navigate freely without cable constraints. *Id.*

Second, a POSITA would have been motivated to adopt this modification to further improve the safety of Durvasula's system. Janét, ¶109. Durvasula discloses a tethered configuration that transmits both control signals and power to the vehicle through an external cable. Durvasula, [0045], FIG.9; *see also id.*, [0025] ("dry station 46 further provides electrical power to vehicle 30 in a wired

fashion"), [0029] ("dry station 246 further provides part of vehicle 30 across a wired cable or wired connection"). A POSITA would have recognized that tethered systems introduce safety risks by requiring a physical electrical connection between shore-side components and the submerged cleaner, creating potential pathways for electrical leakage. Janét, ¶109. A POSITA would have further recognized that this risk is exacerbated in swimming pool environments, where dissolved chemicals increase water conductivity and thus the potential for electrical current to reach pool users. Janét, ¶109.

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

A POSITA would have had a reasonable expectation of success in making this combination, because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots. ***See, e.g.***, Fu-007, pp.8-10. ***See also*** Knoll, [0007], [0027]-[0028], FIG.1 (showing control unit 11 inside the vehicle, as explained in §§IV.E.1-IV.E.2); Renaud (EX1015), [0008]-[0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner, as explained in §§IV.F.1-IV.F.2); Janét, ¶111. Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Durvasula's—analyzing captured images and generating drive signals to control the vehicle's movement. Fu-007, pp.8-10, 14-16. A POSITA would have reasonably expected that Fu-007's controller would implement Durvasula's specific control logic (Durvasula, [0020], [0022]-[0023]), thereby yielding predictable results. Janét, ¶111.

4. Claim 1 Unpatentable over Durvasula and Fu-007

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

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

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

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

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

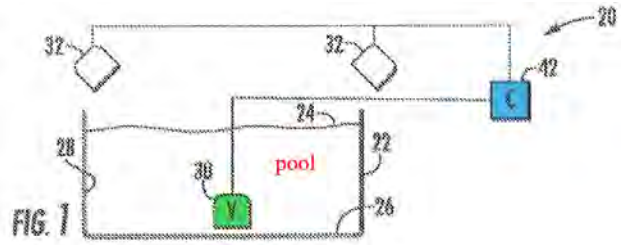


FIG. 1

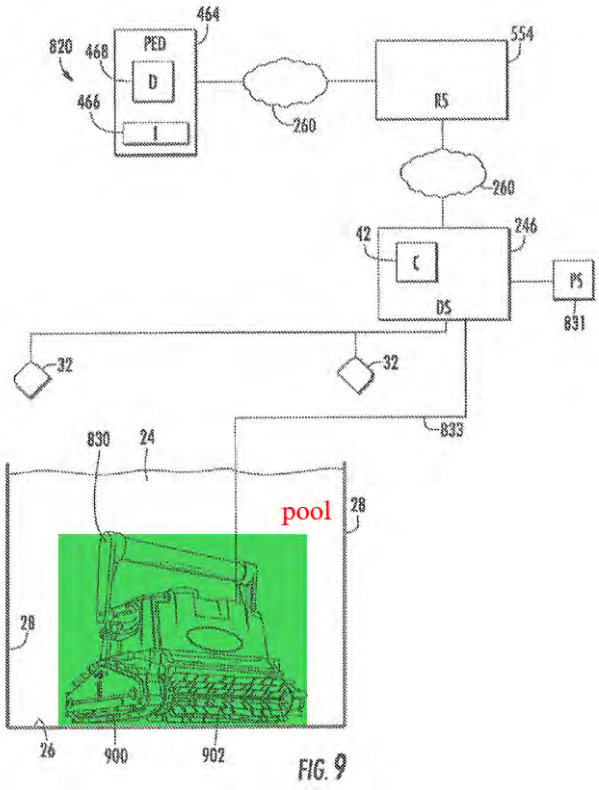


FIG. 9

Durvasula discloses its pool cleaning vehicle as a "self-propelled" pool cleaner: "[v]ehicle 30 comprises an **automated powered** device," "includes one or more propulsion mechanisms" to "move along the submerged surfaces of pool 22," and "**[c]ontroller 42** is configured to generate control signals for steering **vehicle 30**." Durvasula, [0014], [0016], [0022], FIG. 1 (annotated above); *see also id.*, [0023], [0026], [0030]-[0031], [0034], FIGS. 2-10; Janét, ¶115.

Durvasula discloses its pool cleaning vehicle 30 as a pool cleaner "cleaning debris from a submerged surface of a swimming pool." *See, e.g.*, Durvasula, [0014] ("[V]ehicle 30 may include vacuum or suction devices, a liquid circulation system and a filter **to draw debris**, such as bacterial growth or plant growth, from such pool surfaces, wherein the drawn liquid containing such residue or foreign matter is filtered **to collect the debris**."); *see also id.* [0015]-[0016], [0046], FIGS. 9-10 (annotated below)).

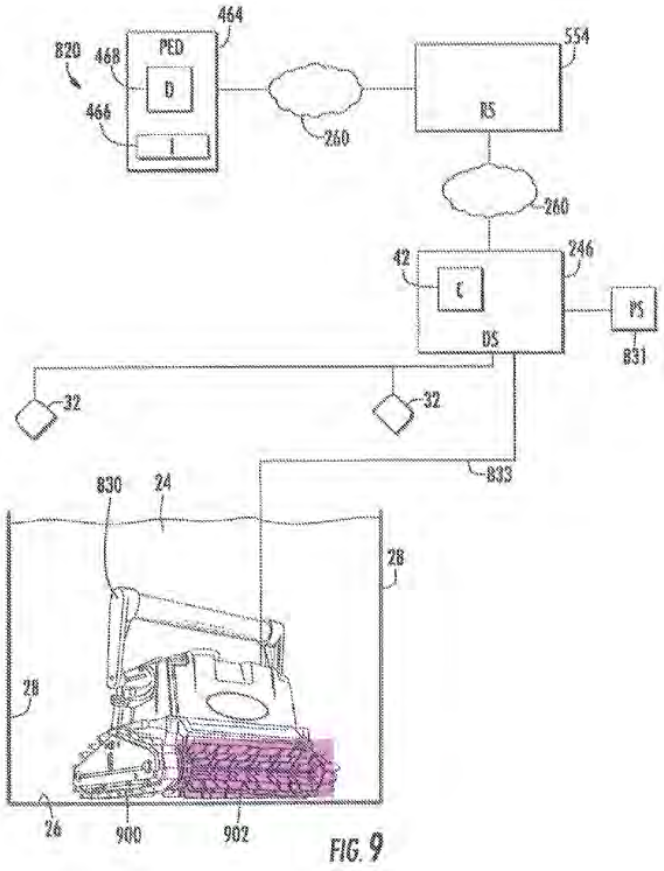


FIG. 9

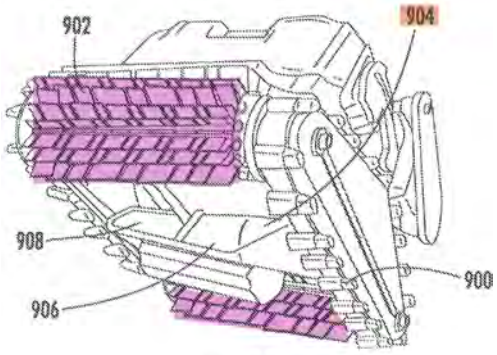


FIG. 10

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

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

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

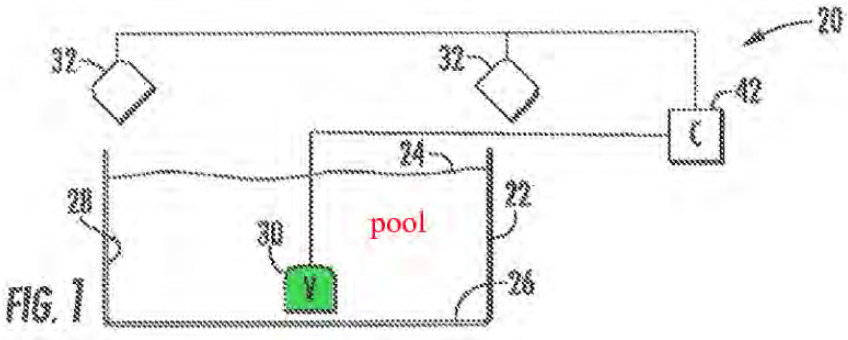


FIG. 1

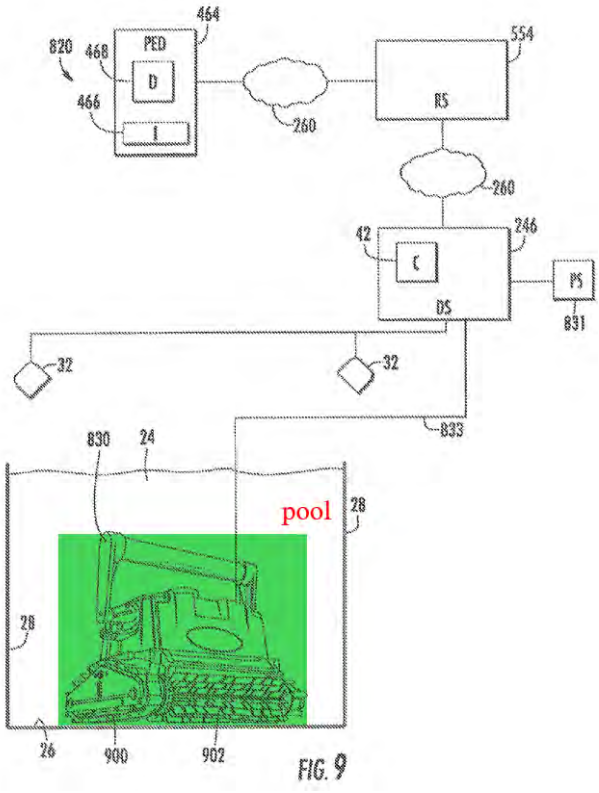


FIG. 9

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

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

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

Durvasula discloses identical functionality and corresponding structure disclosed in the '191 Patent. Janét, ¶121. **Function**: *see, e.g.*, Durvasula, [0014] ("[v]ehicle 30 comprises an automated powered device configured to **travel** adjacent to submerged or water containing surfaces of **pool** 20"); *see also id.*, Abstract, [0016], [0023], Claims 1, 17, FIGS. 9-10. **Structure**: *see, e.g.*, *id.*, [0016] ("vehicle 30 is propelled along the submerged pool surfaces using **wheels, rollers, tracks or other surface contacting members powered by a motor**"); *see also id.*, [0046], FIGS. 9-10 (annotated below).

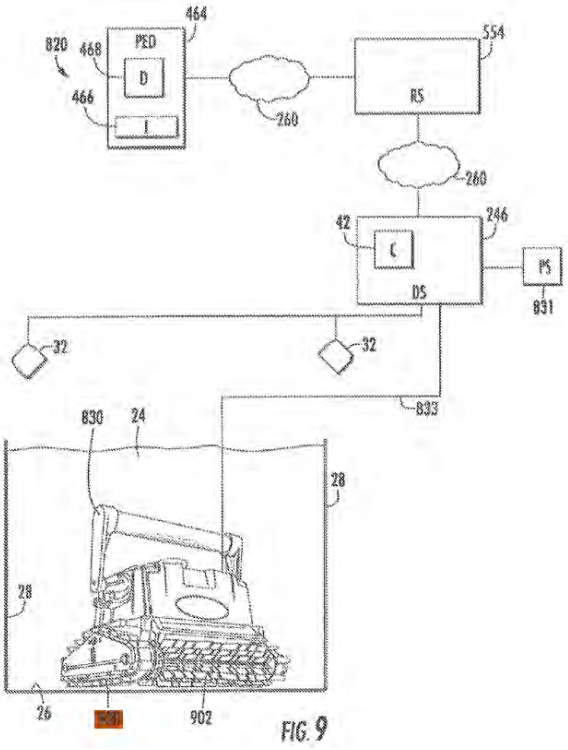


FIG. 9

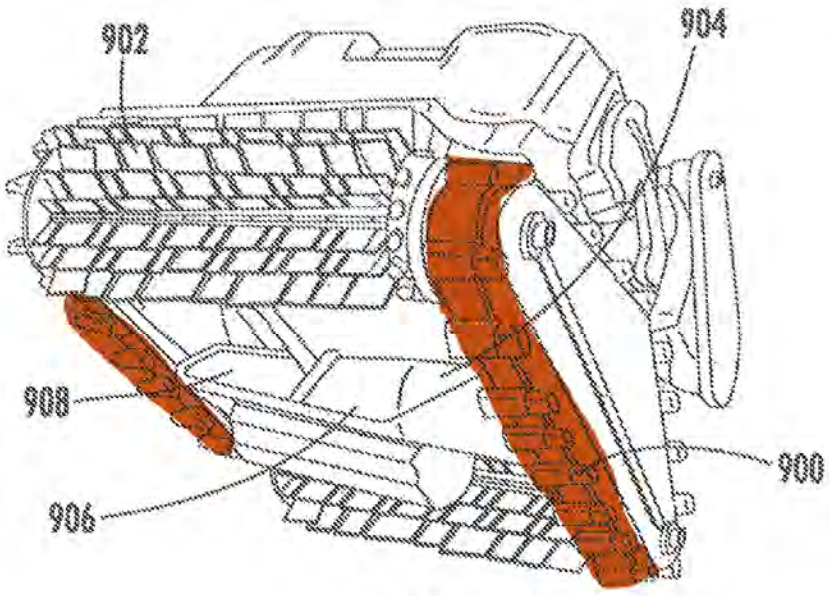


FIG. 10

d. 1[c] "c. a filter configured to retain debris collected from the submerged surface;"

Durvasula discloses "a filter configured to retain debris" because Durvasula describes "vehicle 30 may include…a **filter** to draw **debris**" and an "internally housed **filter bag**" through which "loosened **dirt and debris**" is filtered. *Id.*, [0014], [0046]; Janét, ¶122.

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

Durvasula discloses cameras 32 that are "configured to capture images of submerged surfaces 26, 28 of pool 22," and "cameras 32 may…be mounted to vehicle 30." Durvasula, [0013]-[0014], [0017]; Janét, ¶123.

f. **1[e][i] "e. a controller (i) positioned on or in the body"**

The Durvasula-Fu-007 combination discloses or suggests 1[e][i]. Janét, ¶¶124-128.

Durvasula discloses a controller. Janét, ¶125. Specifically, Durvasula describes controller 42 that "is in communication with vehicle 30 and cameras 32" and "is configured to generate control signals for steering vehicle 30." Durvasula, [0020], [0022]. Durvasula further describes that controller 42 "utilizes signals from camera 32 to steer vehicle 30" to "cover such missed portions" and "to re-clean such portions until such portions have been satisfactorily cleaned." Durvasula, [0023].

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

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

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

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

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

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

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

As explained in §IV.A.3, §IV.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula's system by substituting Durvasula's external controller with an onboard controller structure

taught by Fu-007, where the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007's internal connection architecture (specifically, the camera connects to the central processing unit via an "image acquisition card"). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶131.

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

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

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

As explained in §IV.A.3, §IV.A.4.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Durvasula's system to

use Fu-007's onboard controller structure configured to execute Durvasula's control logic, including generating control signals to cause the body movement "to...the first portion of the submerged surface" in response to the captured image described above. Janét, ¶134.

The claim limitation uses the disjunctive "or" between "to" and "away from," meaning the limitation is satisfied by teaching either alternative. Because the Durvasula-Fu-007 combination teaches control signals that cause movement "to" the first object, the Durvasula-Fu-007 combination discloses or suggests this element. Janét, ¶135.

Therefore, Durvasula, in view of Fu-007, renders claim 1 obvious. Janét, ¶136.

5. Claim 2 Unpatentable over Durvasula and Fu-007

Durvasula and Fu-007 render Claim 2 obvious. Janét, ¶¶137-143.

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

To the extent that it is limiting, Durvasula discloses or suggests 2[pre]. Janét, ¶¶138-140.

Durvasula discloses a pool cleaning system. *See, e.g.*, Durvasula, Title, Abstract ("A pool cleaning system utilizes a powered robotic surface cleaning vehicle"), FIGS. 1-5, 9, Claims 1-10, 17-20; Janét, ¶139.

Durvasula discloses the pool cleaning system is for "cleaning debris from a submerged surface of a swimming pool" because Durvasula describes vehicle 30 "travel[s] adjacent to submerged or water containing surfaces of pool 20…while cleaning such surfaces," as explained in §IV.A.4.a (1[Pre]). *See also* Durvasula, [0014]-[0015], [0046], FIGS. 9-10 (annotated below); Janét, ¶140.

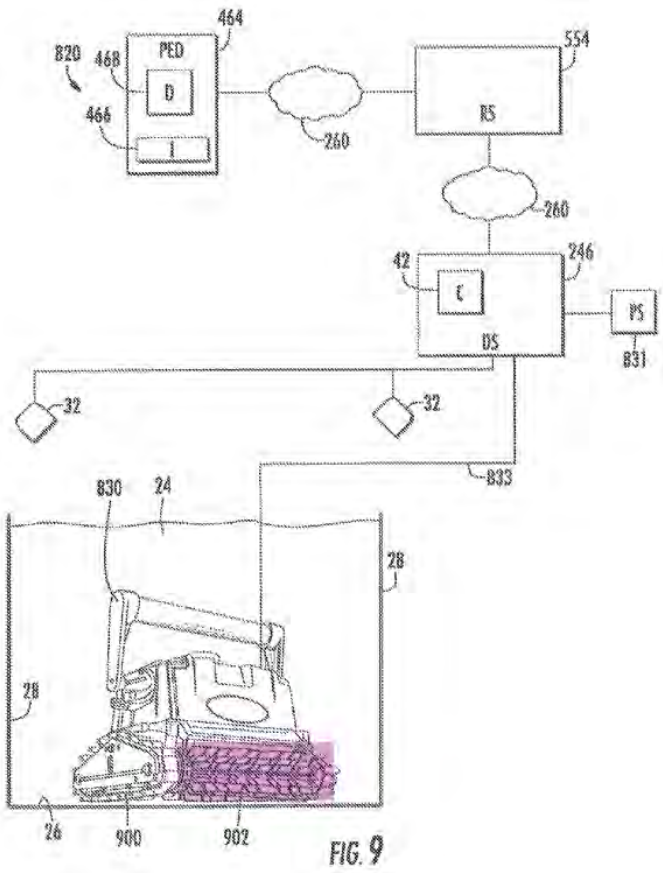


FIG. 9

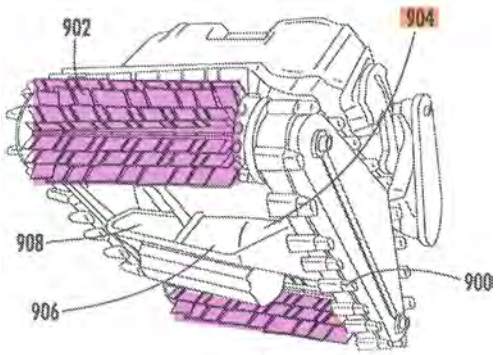


FIG. 10

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

Durvasula discloses 2[a][i] as explained in §IV.A.4.a (1[Pre]). Janét, ¶141.

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

Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c]. For at least the same reasons explained in §§IV.A.4.b-e (1[a]-1[d]), Durvasula discloses or suggests 2[a][ii]-2[a][iv] and 2[b]. Additionally, for at least the same reasons explained above in §§IV.A.4.f-h (1[e][i]-[iii]), the Durvasula-Fu-007 combination discloses or suggests limitations 2[a][v]-2[a][vii]. Janét, ¶142.

Therefore, Durvasula, in view of Fu-007, renders Claim 2 obvious. Janét, ¶¶137-141, 143.

B. Ground 1B: Claim 3 Is Unpatentable under AIA 35 U.S.C. §103 over Durvasula.

1. Claim 3 Unpatentable over Durvasula

Durvasula renders independent Claim 3 obvious. Janét, ¶¶144-151.

a. 3[pre], 3[a][i]

Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Durvasula discloses 3[Pre] and 3[a][i] as explained in §§IV.A.5.a-b; *see also* §IV.A.4.a (1[Pre]); Janét, ¶145.

b. 3[a][ii]-3[a][v]

Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. For at least the same reasons explained in §§ IV.A.3.b-e (1[a]-1[d]), Durvasula discloses or suggests 3[a][ii]-3[a][v]. Janét, ¶146.

c. 3[b][i] "b. a controller (i) in electronic communication with the at least one camera and"

Durvasula discloses or suggests 3[b][i]. Janét, ¶¶147-148.

Durvasula describes controller 42 "communicates with...cameras 32…across a wired connection," "across a wireless connection," or "using a combination of both wired and wireless communication connections," and "utilizes signals from camera 32 to steer vehicle 30." Durvasula, [0020]-[0021], [0023]; Janét, ¶148.

d. 3[b][ii] "(ii) configured to generate, in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface."

Durvasula discloses or suggests 3[b][ii]. Janét, ¶¶149-150.

Durvasula's controller 42 generates control signals "in response to the captured image" because controller 42 identifies a portion requiring cleaning or re-cleaning based on "signals from camera 32," and steers vehicle 30 accordingly. Durvasula, [0022]-[0023]; Janét, ¶150. Durvasula further discloses generating control signals to cause movement "to...the first portion of the submerged surface" because Durvasula's controller 42 steers vehicle 30 to "cover such missed portions" and to "re-clean such portions until such portions have been satisfactorily cleaned"—i.e., to the first portion identified from the captured image. Durvasula, [0023]; *see also id.*, [0026], [0044]; Janét, ¶150.

Therefore, Durvasula renders Claim 3 obvious. Janét, ¶151.

C. Ground 2A: Claims 1-2 Are Unpatentable over Cui and Fu-007

1. Cui

Cui (EX1005) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1), and prior art under pre-AIA 35 U.S.C. §102(b). Janét, ¶152

Cui discloses a pool cleaner with debris detection capability for use in swimming pools. *See* Cui, Title, Abstract. Cui's pool cleaner uses a CCD camera to continuously capture images of pool surfaces, compares them with pre-stored standard images of clean surfaces, and controls the cleaner's operation based on

detected debris levels/distributions. *Id.*, Abstract, pp.5-7;[3] Janét, ¶153. Cui is analogous art with respect to Claims 1-3 of the '191 Patent.

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

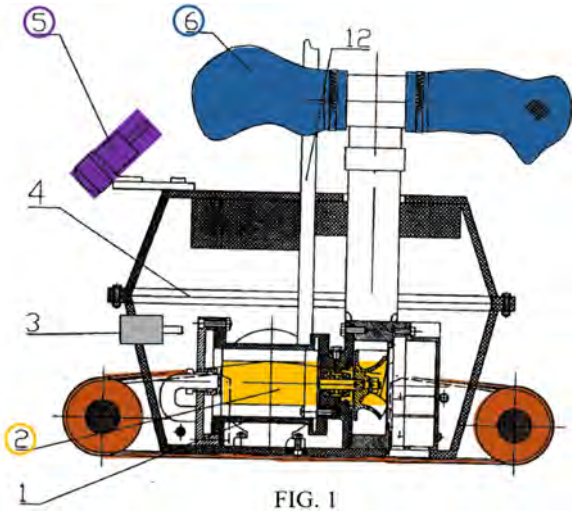


FIG. 1

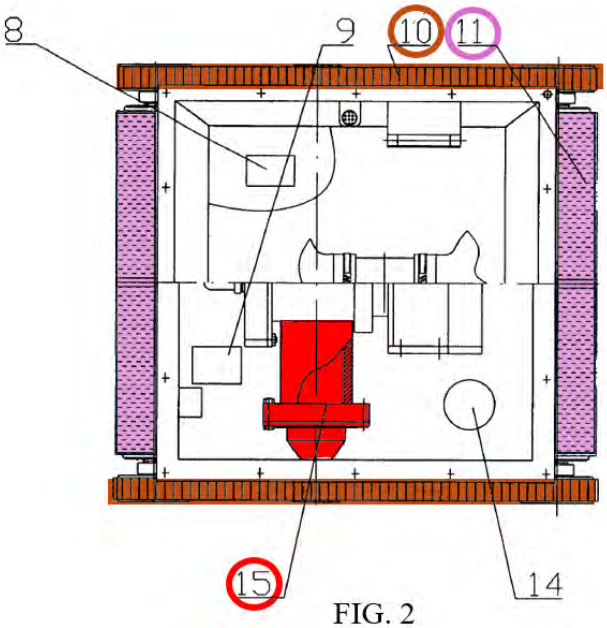


FIG. 2

Cui, FIGS. 1-2 (annotated)

[3] Page citations to Cui are to the original pagination in the bottom center of each page.

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

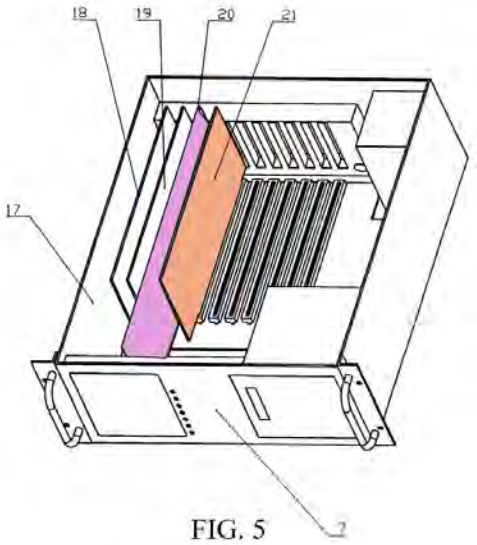


FIG. 5

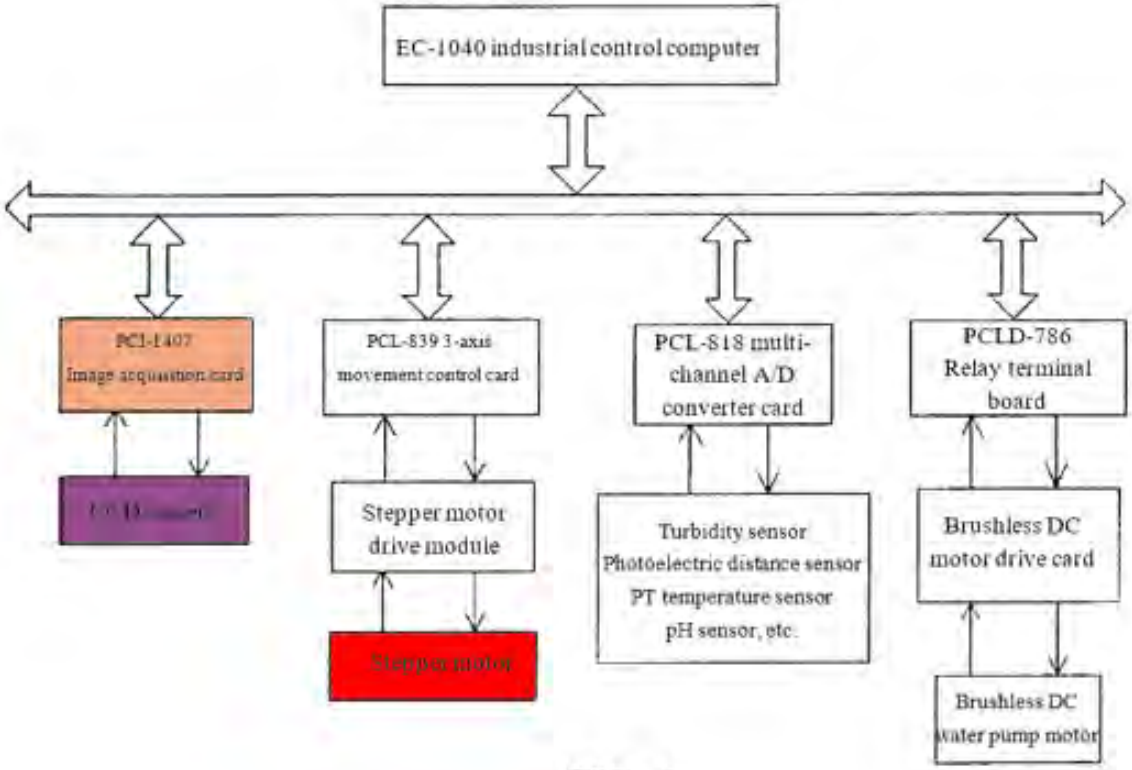

EC-1040 industrial control computer
PCI-1407
Image acquisition card
PCL-839 3-axis
movement control card
PCL-818 multi-
channel A/D
converter card
PCLD-786
Relay terminal
board
Stepper motor
drive module
Turbidity sensor
Photoelectric distance sensor
PT temperature sensor
pH sensor, etc.
Brushless DC
motor drive card
Brushless DC
water pump motor

FIG. 6

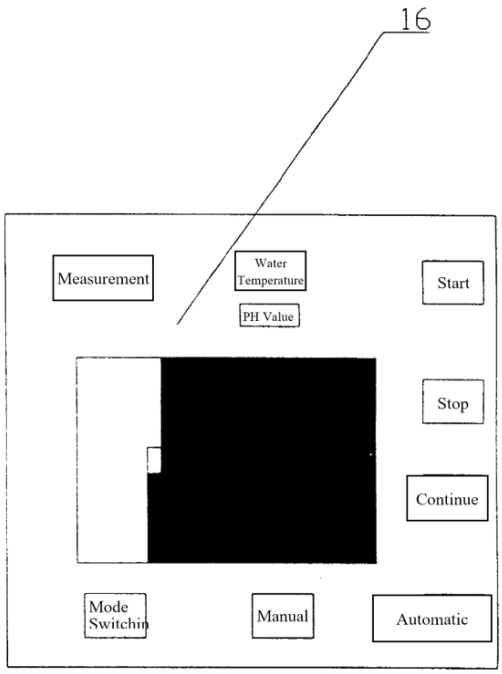

16
Measurement
Water
Temperature
PH Value
Start
Stop
Continue
Mode
Switchin
Manual
Automatic

FIG. 4

2. Motivation to Combine

Both Cui and Fu-007 disclose underwater cleaning robots for swimming pools using camera-based control, and both sought to improve systems. Cui describes a pool cleaner using "intelligent adaptive technology with computer control" to autonomously adjust cleaning force based on debris distribution. Cui, p.5. Fu-007 similarly describes an underwater cleaning robot that can "help and even replace humans to autonomously complete underwater cleaning work." Fu-007, p.11. A POSITA would have been motivated to combine the complementary teachings of Cui and Fu-007 to achieve improved systems. Janét, ¶157.

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

Cui teaches placing the controller (computer 7) outside the pool and separate from the pool cleaning vehicle in a tethered configuration via cable assembly 12. Cui, pp.5-6. Fu-007 teaches placing its controller within the cleaning and moving platform as part of a sealed drive control enclosure. Fu-007, pp.8-9, 12-14, Claim 4. The use of an external controller separated from the pool cleaner in Cui and the use of an onboard controller in Fu-007 had been two known design options, and a POSITA would have been motivated to modify Cui by substituting Cui's external computer 7 with Fu-007's onboard controller structure for at least two reasons. Janét, ¶159.

First, a POSITA would have been guided by Cui and Fu-007 to make such combination to advance Cui's goal of autonomous pool cleaning by eliminating physical dependencies on external infrastructure. Janét, ¶160. Cui's reliance on an external computer and cable assembly constrains autonomy by limiting range and requiring human intervention to manage cable entanglements. *Id.* Fu-007 teaches that moving the architecture onboard—specifically positioning the controller, camera connection, and power source within the body—allows the robot to operate autonomously. Fu-007, p.11. A POSITA would have recognized that by integrating Fu-007's onboard controller architecture into Cui, the modified system would have enhanced Cui's autonomous operation by liberating the robot from shore-side constraints—generating control signals onboard to plan paths and complete

cleaning tasks without requiring human supervision or corresponding data transmission between the underwater cleaning vehicle and an external controller. Cui, pp.5-6; Janét, ¶160. Additionally, removing the external tether would allow the vehicle to navigate freely without cable constraints. *Id.*

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

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

cables—thereby removing the primary pathway for electrical leakage and enhancing the overall safety. Janét, ¶162.

A POSITA would have had a reasonable expectation of success in making this combination because positioning the controller on the vehicle body was a well-known design choice in autonomous pool cleaning robots, as shown by the teachings in Fu-007. ***See, e.g.***, Fu-007, pp.8-10, 12-14. ***See also*** Knoll, [0007], [0027]-[0028], FIG.1 (showing control unit 11 inside the vehicle, as explained in §§IV.E.1-IV.E.2); Renaud, [0008]- [0009], [0029]-[0030] (disclosing a processing device/microprocessor inside the cleaner, as explained in §§IV.F.1-IV.F.2); Janét, ¶163. Additionally, Fu-007's onboard controller is already configured to execute image-based cleaning tasks similar to Cui's—analyzing captured images and generating drive signals to control the vehicle's movement (e.g., adjusting drive wheels based on debris thresholds). Fu-007, pp.8-10, 14-16. Because Fu-007's controller is already configured to execute image-based cleaning tasks, a POSITA would have reasonably expected that Fu-007's controller could implement Cui's specific control logic (e.g., processing images to control crawling speed based on debris levels; Cui, pp.5-7), thereby yielding predictable results. Janét, ¶163.

3. Claim 1 Unpatentable over Cui and Fu-007

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

a. 1[pre]

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

Cui discloses a system designed for "professional or commercial swimming pools," including an underwater cleaning vehicle with **track-type crawling mechanisms 10** powered by **hybrid stepper motors 15** and a computer 7 that processes sensor data and controls the vehicle. Cui, Abstract, Claim 1, pp.5-7, FIGS. 1-2, 6 (annotated below). Janét, ¶166.

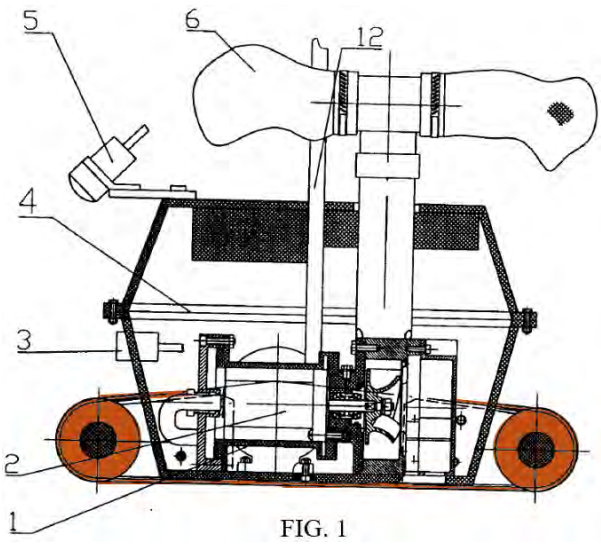


FIG. 1

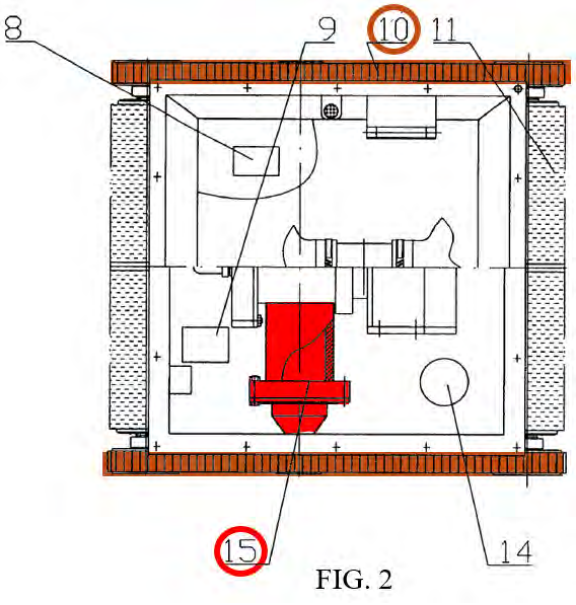


FIG. 2

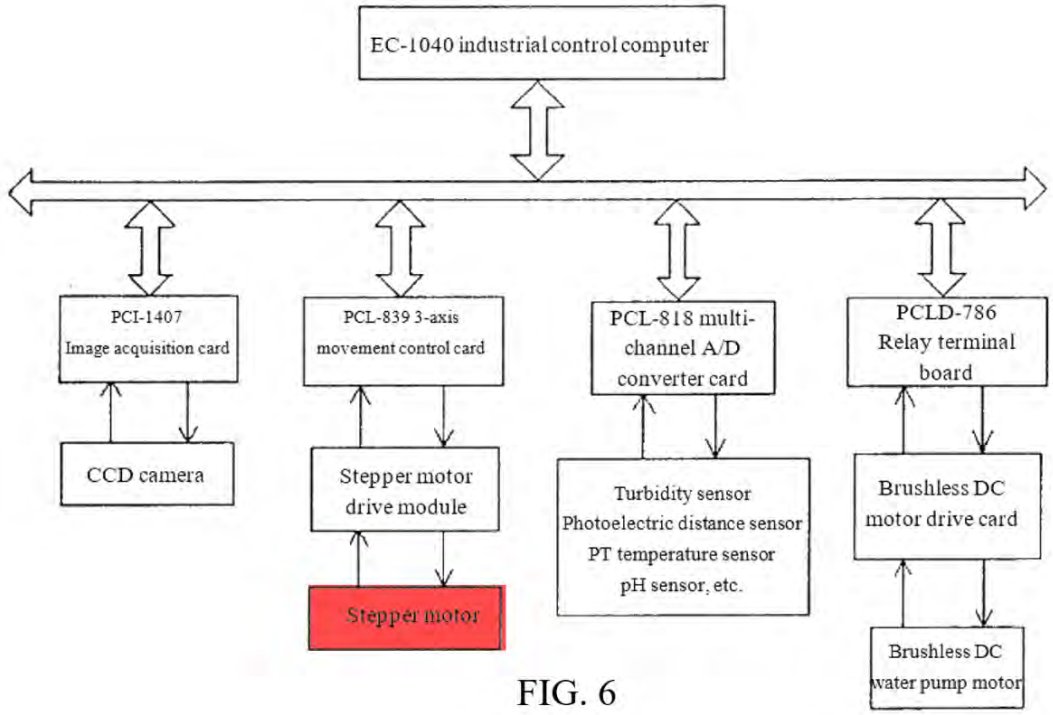


FIG. 6

Cui's cleaning vehicle is self-propelled because under the control of computer 7, motors 15 drive track-type crawling mechanisms 10 to move it autonomously across pool surfaces. Cui, Claim 1, pp.5-6. Janét, ¶167.

Cui's system detects debris by capturing images with camera 5 and comparing them (via computer 7) with "pre-stored standard image information of a clean pool bottom"—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different from the grayscale level of the original standard image(s)." Cui, Abstract, pp.4-7. Cui's system collects and cleans debris using "roller brush (11)," "brushless DC water pump motor (2)," and "filter bag (6)." Cui, Claim 1, pp.5-7; Janét, ¶168.

b. 1[a]

Cui discloses or suggests 1[a]. Janét, ¶¶169-170.

Cui's pool cleaner includes a vehicle body, at least in the form of housing 4 with integrated propulsion mechanisms (track-type crawling mechanisms 10, motors 15), cleaning components (motor 2, brushes 11, filter 6), and sensors (camera 5). Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood this assembled structure is the claimed "vehicle body" that travels within the pool. Janét, ¶170.

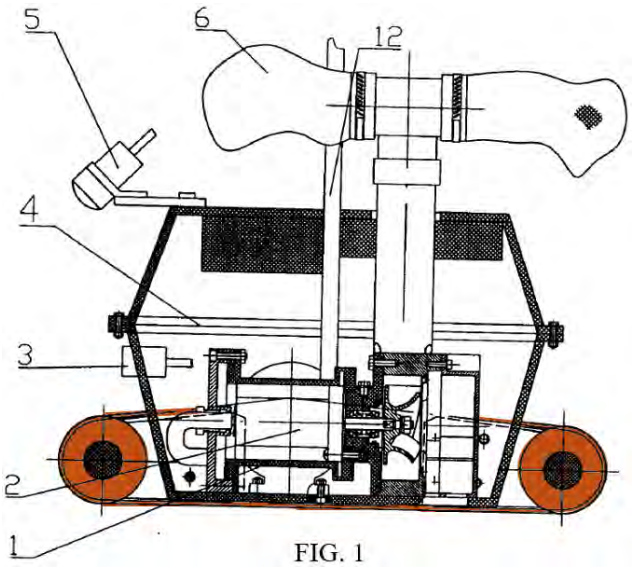


FIG. 1

c. 1[b]

Cui discloses or suggests 1[b]. Janét, ¶171.

The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is "moving the vehicle body within the swimming pool," and the

corresponding structures are "wheels, rollers, **tracks**, other surface contacting members powered by a motor, a vacuum, or a liquid jet." EX1001, 3:33-45, 10:15-17, FIGS.9-10; Janét, ¶172.

Cui discloses moving the vehicle body within the swimming pool. Janét, ¶173. Specifically, Cui discloses **track-type crawling mechanisms 10** powered by **motors 15**. Cui, Claim 1, pp.5-6, FIGS. 1-2 (annotated below). Motors 15 are mounted on both sides of sealed motor cover 1, and track-type crawling mechanisms 10 are mounted at front and rear ends of housing 4. Cui, pp.5-6; Janét, ¶173.

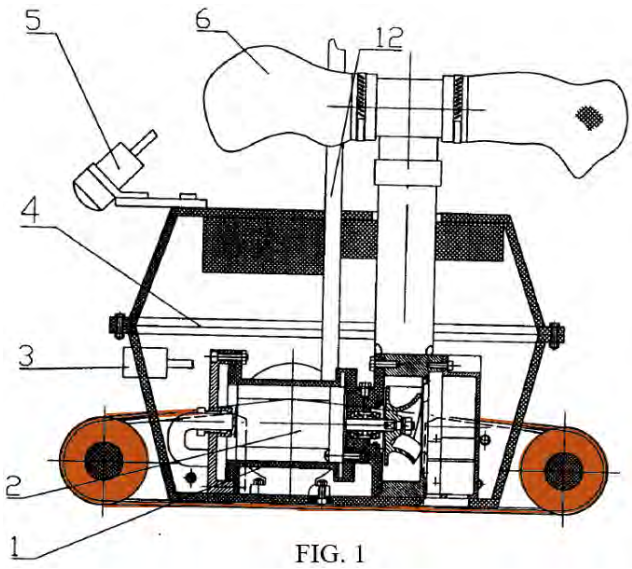


FIG. 1

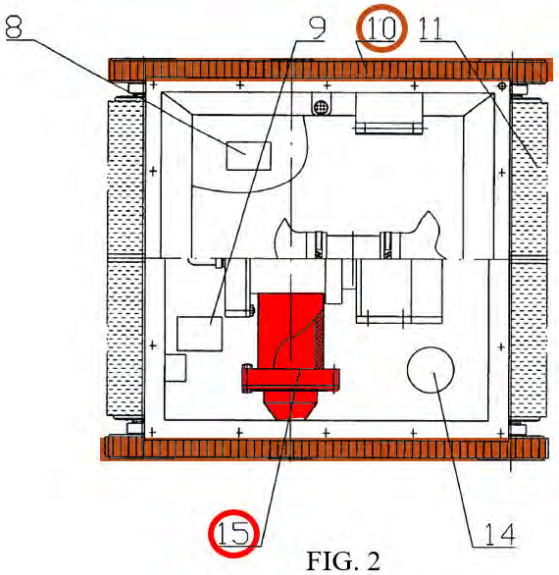


FIG. 2

A POSITA would have understood that Cui's **track-type** crawling mechanisms 10 powered by hybrid stepper motors 15 are substantially the same as

the '191 Patent's disclosed "**tracks**...powered by a motor"—both are motor-powered track systems that contact pool surfaces to propel the vehicle body. Janét, ¶174. This structure of Cui performs the claimed function because motors 15 drive track-type crawling mechanisms 10, which contact pool surfaces and propel the vehicle body within the swimming pool. Cui, pp.5-7, FIGS. 1-3; Janét, ¶174.

d. 1[c]

Cui discloses or suggests 1[c]. Janét, ¶¶175-176.

Cui's system includes a filter configured to retain debris collected from the submerged surface, at least in the form of **filter bag 6**, which is in the water circulation system including **brushless DC water pump motor 2**. Cui, Claim 1, pp.5-6, FIG.1 (annotated below). A POSITA would have understood that Cui's pump motor 2 draws water containing debris from pool surfaces by suction and filter bag 6 retains this collected debris, while allowing clean water to pass through. Janét, ¶176.

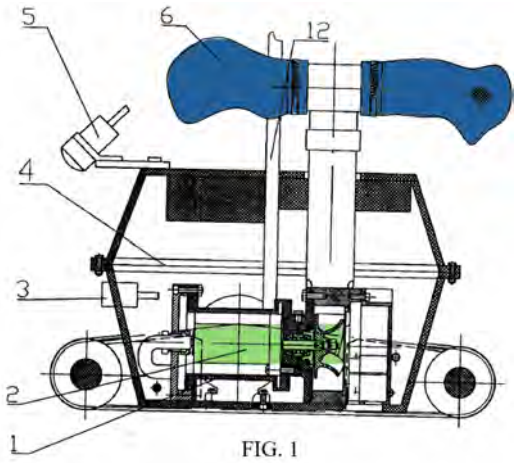


FIG. 1

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

Cui discloses or suggests 1[d]. Janét, ¶¶177-179.

Cui's pool cleaner includes **camera 5** "**mounted at** the upper front end of the **housing 4**," which is part of the vehicle body, to observe pool surfaces ahead of the cleaner. Cui, Claim 2, FIG. 1 (annotated below), pp.5-6; Janét, ¶178.

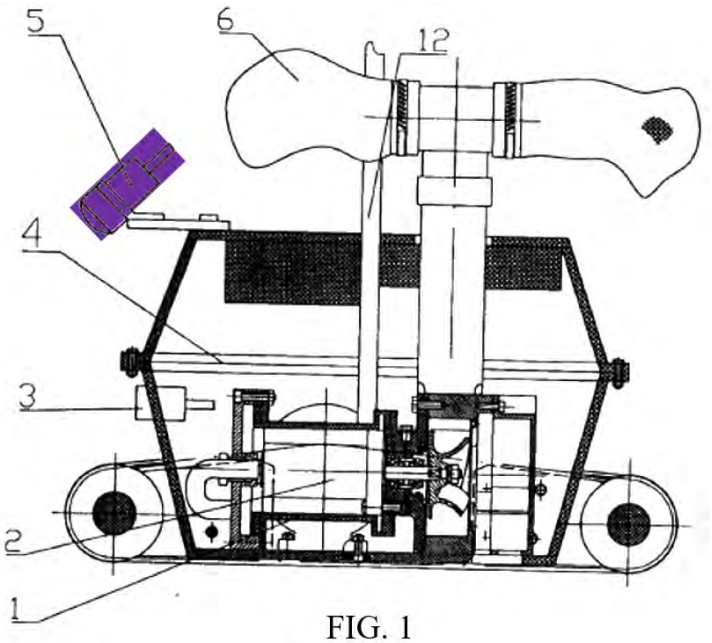


FIG. 1

Cui describes that its camera "continuously captures images of areas to be cleaned located directly in front and below a crawling direction of the cleaner," including images showing "sediment **at the pool bottom**." Cui, pp.5-7. Cui describes that the captured images are "compared with the original standard image(s) of the pool bottom" to identify areas with debris requiring cleaning. Cui, pp.6-7. Janét, ¶179. A POSITA would have understood that Cui's camera captures

images of "at least a first portion of the submerged surface" because the camera observes the pool bottom surface and debris/sediment on that surface, and the pool bottom is a submerged surface when the pool is filled with water during cleaning operations, where an area with debris requiring cleaning constitutes the claimed "first portion of the submerged surface." Cui, pp.5-7; Janét, ¶179.

f. 1[e][i]

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

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

Cui, pp.6-7; *see also* §IV.C.3.e (1[d]). A POSITA would have understood that Cui's industrial control computer 7 is a "controller." Janét, ¶181.

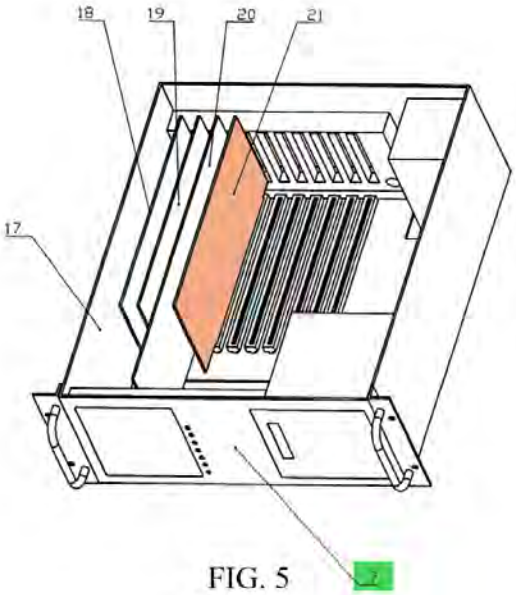


FIG. 5

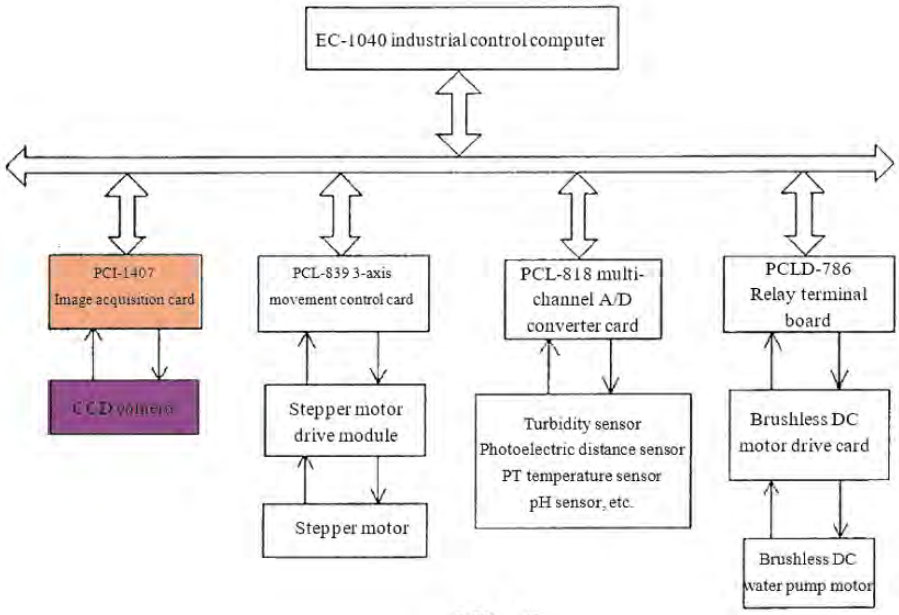


FIG. 6

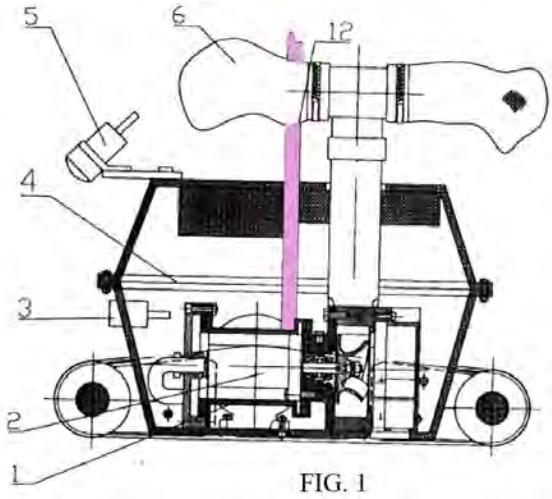


FIG. 1

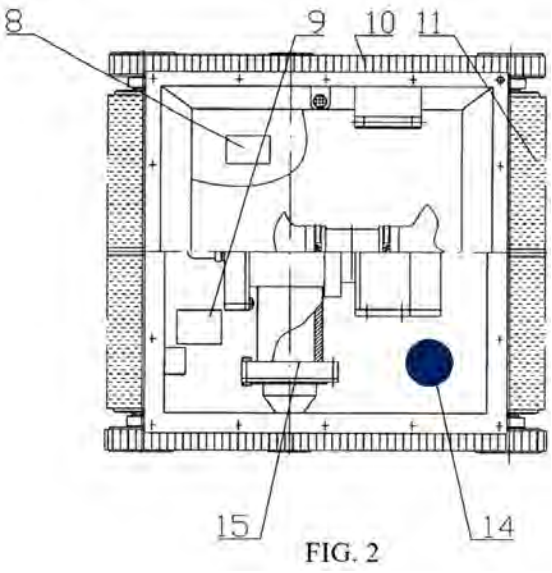


FIG. 2

Like Cui, Fu-007 discloses an underwater cleaning robot for swimming pools using camera-based control. *See* §IV.A.2. Like Cui, Fu-007 uses a controller to generate, in response to captured images, at least one control signal to cause movement of the pool cleaning body within the swimming pool. Janét, ¶182. *See also* §IV.C.2.

Fu-007 discloses a controller positioned in the body of its cleaning and moving platform. Specifically, as explained in §§IV.A.2, IV.A.4.f, Fu-007 discloses a "central processing unit" (controller) housed in **control system enclosure 8** that "installed on and fixed to the interior of the **robot main shell 19**...to sealingly enclose the control system components" with "waterproof properties." Fu-007, pp.8-9, 12-14, Claim 4, FIGS.2, 4 (annotated below); Janét, ¶183.

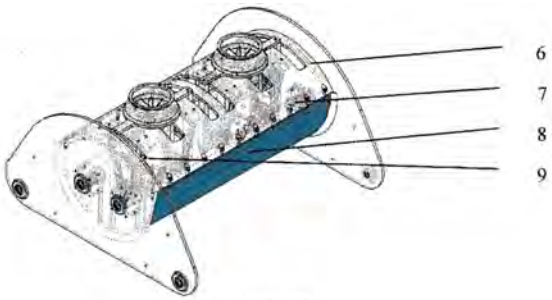


FIG. 2

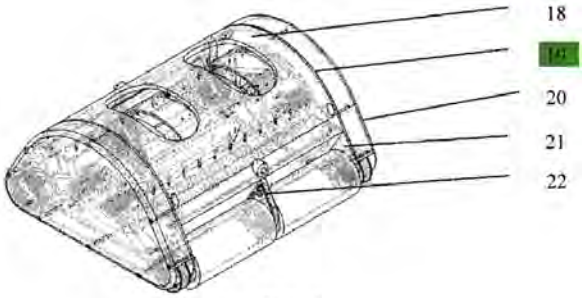


FIG. 4

This onboard controller connects to the **monitoring camera 2** via an internal "image acquisition card" and can be powered by an onboard "rechargeable battery box." Fu-007, pp.12-14, Claim 4, FIGS.1, 6 (annotated below); *see also* §§IV.A.2, IV.A.4.f. Janét, ¶184.

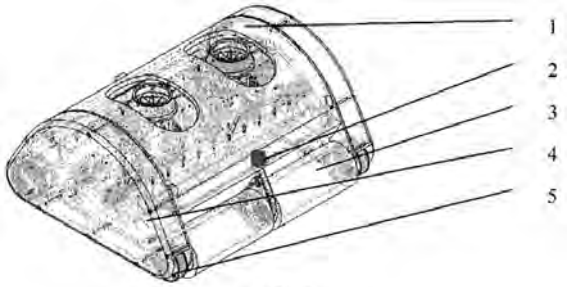


FIG. 1

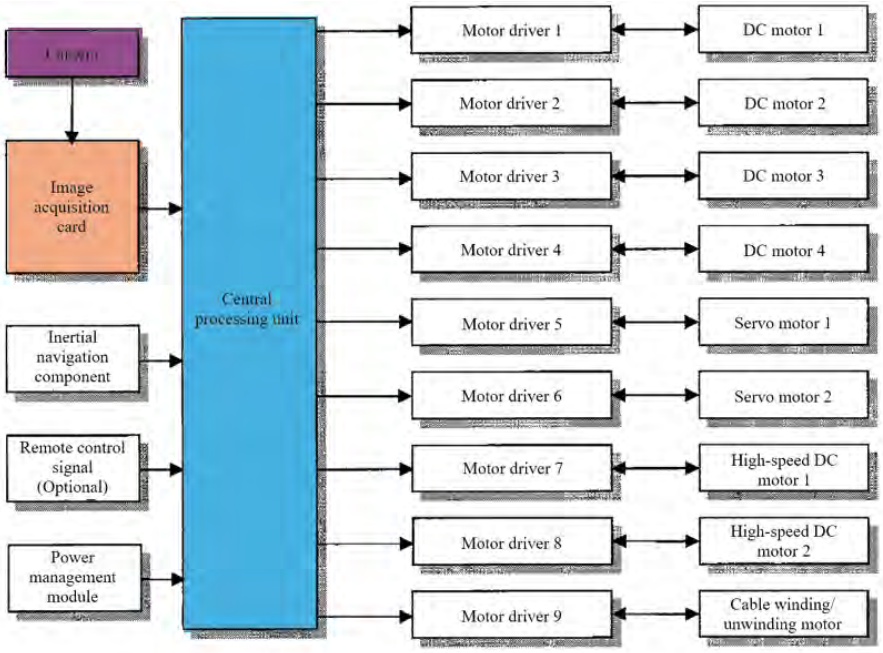


FIG. 6

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

g. 1[e][ii]

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

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

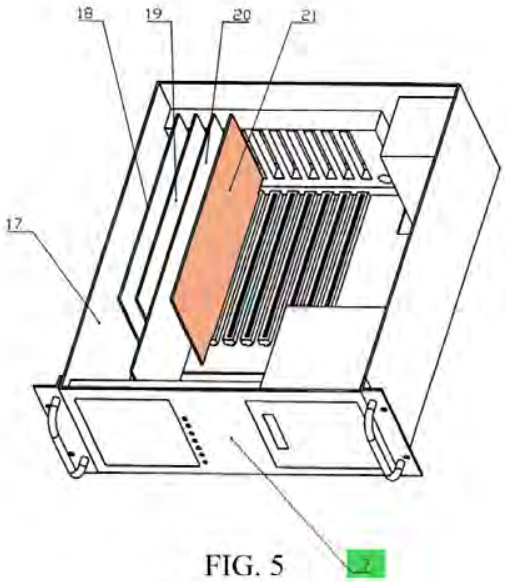


FIG. 5

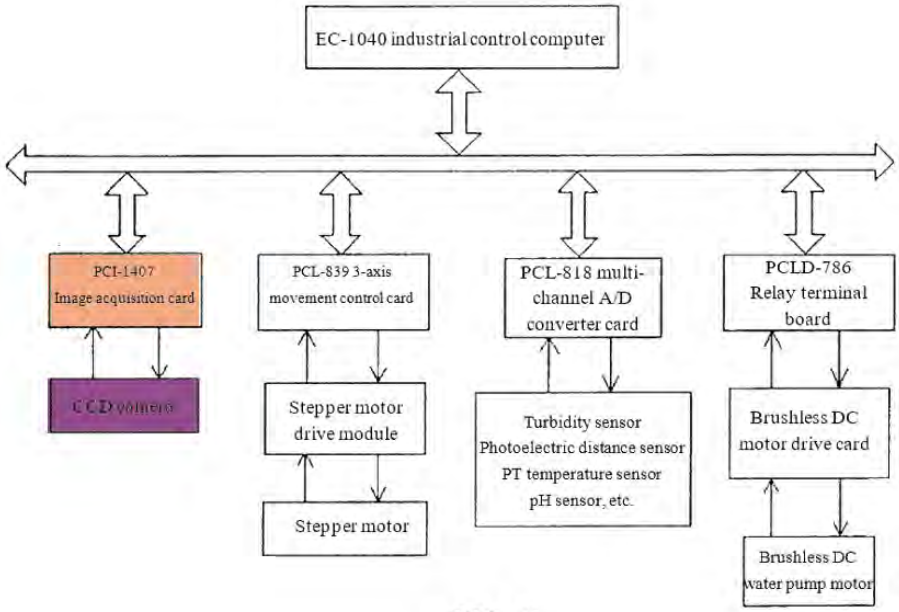


FIG. 6

As explained in §IV.C.2, §IV.C.3.f (1[e][i]), with a reasonable expectation of success, a POSITA would have been motivated to modify Cui's system by substituting Cui's external computer with Fu-007's onboard controller structure taught by Fu-007 to, e.g., eliminate external tether dependencies. *See* Fu-007, pp.8-10, 12-14, Claim 4; Janét, ¶188. In this modified system, the onboard controller is in electronic communication with the camera (mounted to the vehicle body) via Fu-007's internal connection architecture (specifically, the camera connects to the central processing unit via an "image acquisition card"). Fu-007, pp.12-14, Claim 4, FIGS. 1, 4, 6; Janét, ¶188. Thus, the Cui-Fu-007 combination discloses or suggests this limitation. Janét, ¶188.

h. 1[e][iii]

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

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

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

As explained in §IV.A.3, §IV.C.3.f IV.C.3.f(1[e][i]), a POSITA would have been motivated to modify Cui's system to replace Cui's external computer with Fu-007's onboard controller structure to implement the control logics taught by Cui and/or Fu-007, including configuring the onboard controller to implement Fu-007's image-based navigation logic—specifically, planning movements based on image thresholds. Janét, ¶192. Indeed, a POSITA would have recognized that integrating Fu-007's ability to "plan[] a cleaning movement" and execute specific directional movements via "different wheel speed combinations" would result in more effective debris removal and improved "operating efficiency" compared to passive speed adjustment. Fu-007, pp.14-16; Janét, ¶192.

The claim limitation uses the disjunctive "or" between "to" and "away from," meaning the limitation is satisfied by teaching either alternative. Because the Cui-Fu-007 combination teaches control signals that cause movement "to" the first object, the Cui-Fu-007 combination discloses or suggests this element. Janét, ¶193.

Therefore, Cui, in view of Fu-007, renders Claim 1 obvious. Janét, ¶194.

4. Claim 2 Unpatentable over Cui and Fu-007

Cui and Fu-007 render Claim 2 obvious. Janét, ¶¶195-200.

a. 2[pre]

Cui discloses or suggests 2[pre]. Janét, ¶¶ 196-198.

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

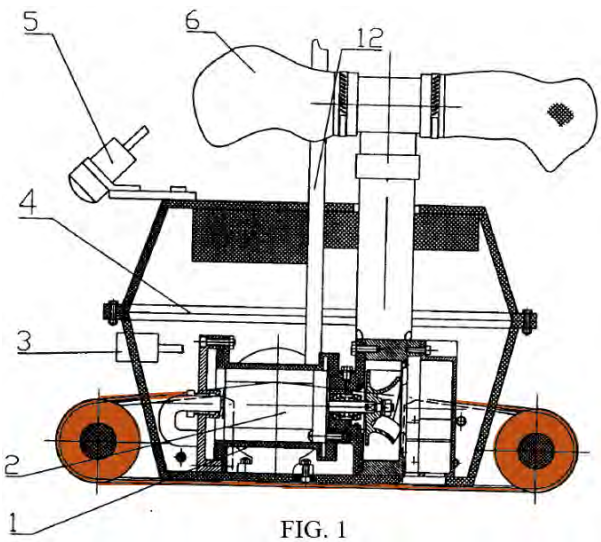


FIG. 1

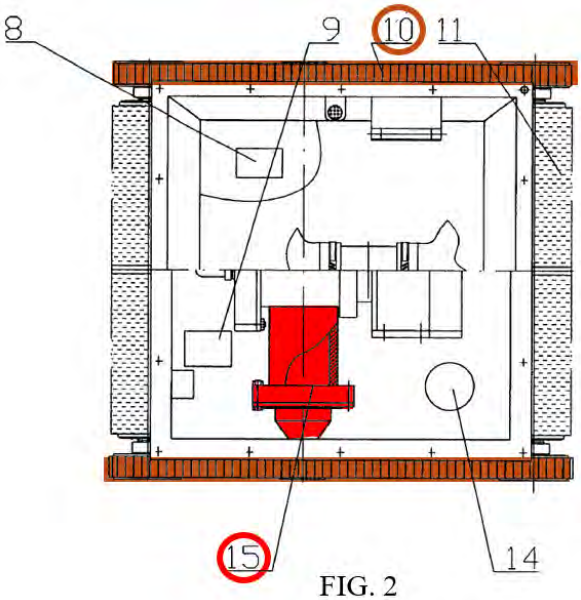


FIG. 2

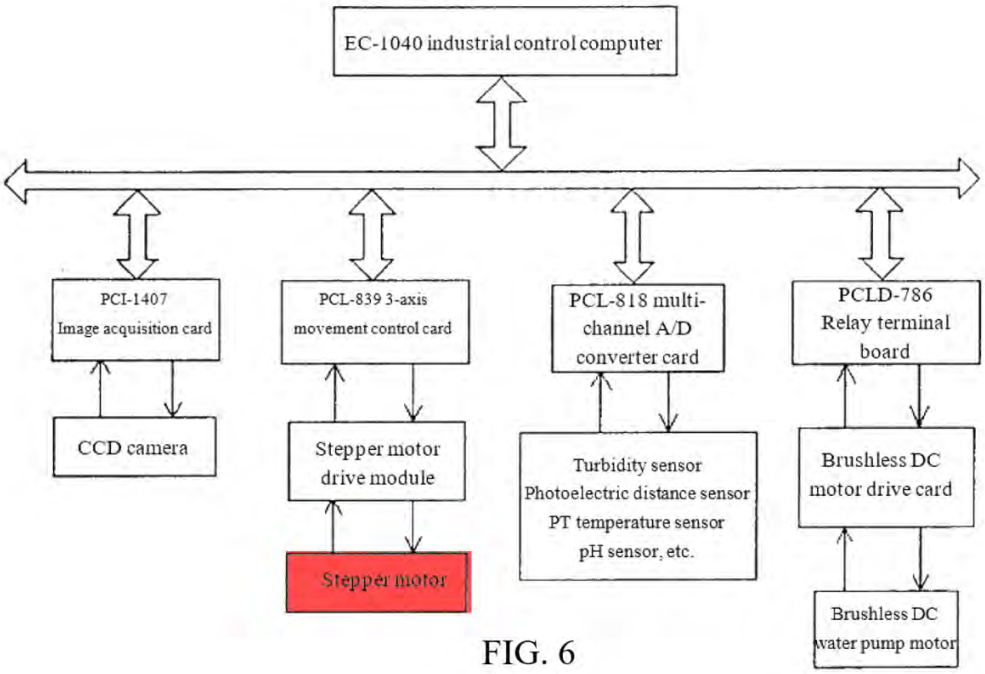


FIG. 6

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

b. 2[a][i]

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

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

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

D. Ground 2B: Claim 3 Is Unpatentable over Cui

1. Claim 3 Unpatentable over Cui

Cui render Claim 3 obvious. Janét, ¶¶201-208.

a. 3[pre], 3[a][i]

Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Cui discloses 3[Pre] and 3[a][i] as explained in §§IV.C.4.a-b; *see also* §IV.C.3.a (1[Pre]).

b. 3[a][ii]-3[a][v]

Limitations 3[a][ii]-3[a][v] are exactly the same as limitations 1[a]-1[d], respectively. For at least the same reasons explained above in §§IV.C.3.b-e (1[a]-1[d]), Cui discloses or suggests 3[a][ii]-3[a][v].

c. 3[b][i]

Cui discloses or suggests 3[b][i]. Janét, ¶¶204-205.

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

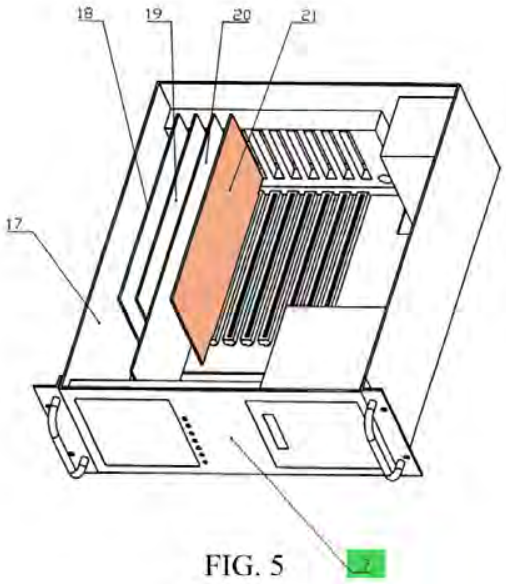


FIG. 5

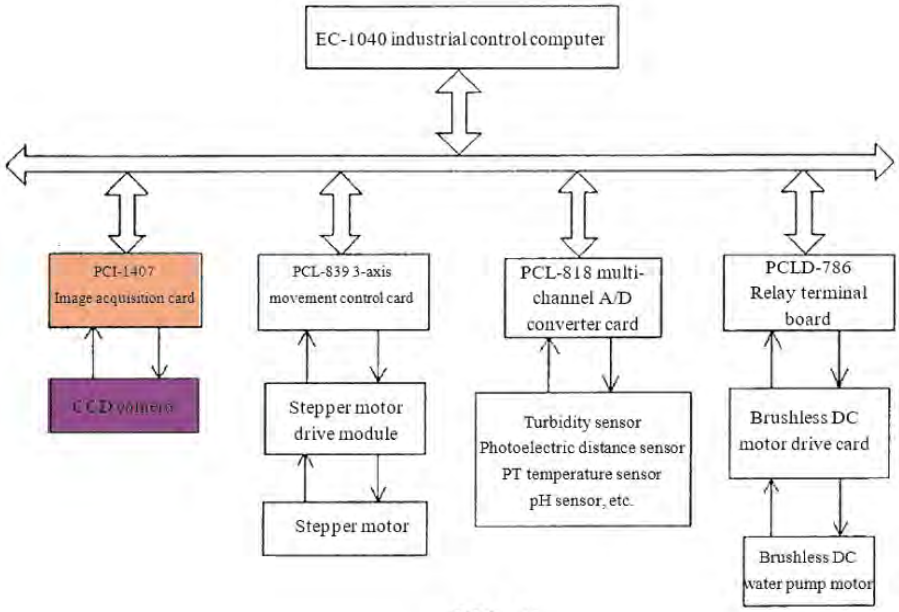


FIG. 6

d. 3[b][ii]

Cui discloses or suggests 3[b][ii]. Janét, ¶¶206-207.

Cui discloses or suggests that its computer 7 (controller) "generate[s], in response to the captured image, at least one control signal to cause movement of the body within the swimming pool to...the first portion of the submerged surface." Janét, ¶207. Specifically, Cui describes that its controller compares captured images with stored standard images to identify sediment/debris—"when there is a lot of sediment at the pool bottom, the grayscale level of the real-time captured image(s) is greatly different...resulting in a high comparison output voltage." Cui, pp.6-7. Based on this image-derived signal, "[a] pulse signal command output after processing...separately control[s] the drive of the two hybrid stepper motors 15." *Id.*, p.7. Thus, these are "control signal[s]" generated "in response to the captured

image." Janét, ¶207. As explained in §IV.C.3.e (1[d]), Cui's camera 5 captures images of areas "located directly in front and below a crawling direction of the cleaner." Cui, Abstract, pp.5-7. Therefore, when the controller generates signals to adjust motor speed based on detected debris, the robot continues moving forward **toward** the debris-laden area identified in the image—i.e., the control signals cause movement "to" the first portion of the submerged surface. Janét, ¶207.

Therefore, Cui renders Claim 3 obvious. Janét, ¶¶201-208.

E. Ground 3: Claims 1-3 Are Unpatentable over Knoll

1. Knoll

Knoll (EX1006) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1), and prior art under pre-AIA 35 U.S.C. §102(b). *See* §III.C, *supra*; Janét, ¶209.

Knoll discloses "a pool robotic vehicle, in particular a pool cleaning robot, whose working element is, for example, a filter device and/or suction device and/or cleaning device" and disclose features of an autonomous pool cleaner with camera-based navigation capacities. Knoll, Title, Abstract, [0021], Claims 1-14, [0001]-[0002], [0007], [0027], Fig. 1 (reproduced below). Knoll is analogous art. Janét, ¶210.

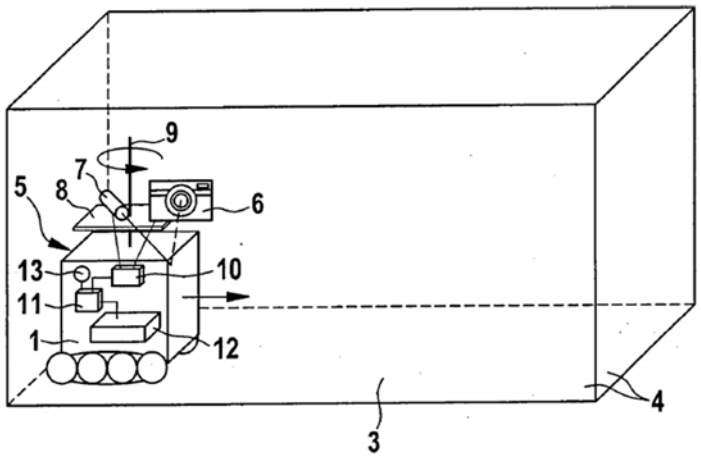


Fig. 1

Knoll's system includes robotic vehicle 1 with drive means 12, distance-determining device 5 comprising digital camera 6 and light beam source 7 rotatably mounted on mounting plate 8, and control unit 11 for controlling the drive means. *See* Knoll, [0007], [0027]-[0028], FIGS. 1-2. The robotic vehicle is "a pool robot with a suction and/or filter and/or cleaning device" that operates on working area 3 formed by the pool bottom and delimited by boundary surface 4 (pool walls). *Id.*

Knoll's camera 6 captures images of the boundary surface, which evaluation unit 10 processes to derive "quasi-continuously determined smallest distance measurement values" relative to the boundary. Knoll, [0028]. Control unit 11 uses these image-derived values to "automatically calculate[] a trajectory" and generate control signals that "control[] the drive means 12" to move the vehicle "away from

or toward" the boundary to maintain a "defined distance." Knoll, [0028], Claim 2, FIG. 2 (reproduced below).

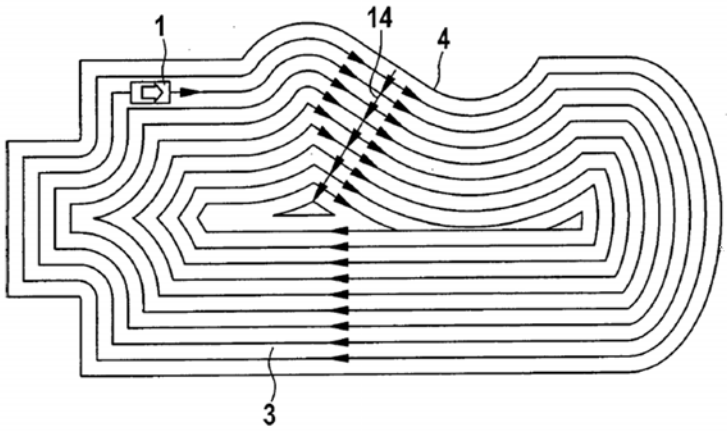


Fig. 2

2. Claim 1 Unpatentable over Knoll

a. 1[pre]

Knoll discloses or suggests 1[pre]. Janét, ¶¶213-217.

Knoll discloses an "autonomous robotic vehicle 1 designed as a pool cleaning vehicle" with "drive means (12) for driving and steering" and a **control unit 11** that controls **drive means 12** and is "designed to automatically calculate a trajectory." Knoll, Abstract; [0027]-[0028]; Claims 2, 14, FIG. 1 (annotated below); Janét, ¶214.

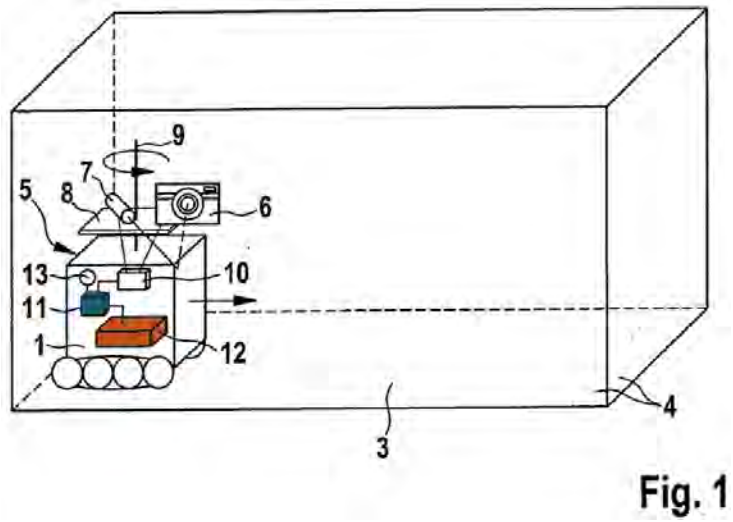


Fig. 1

Knoll, Fig. 1 (annotated)

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

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

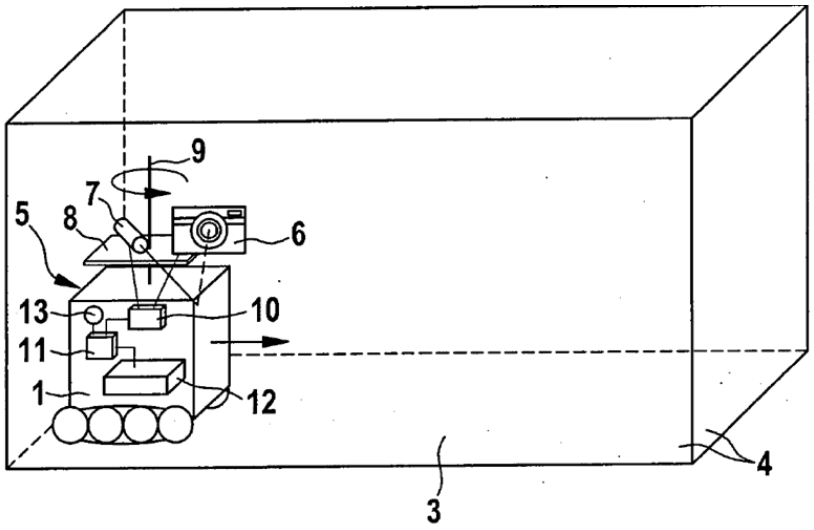


Fig. 1

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

b. 1[a]

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

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

device." Knoll, Abstract, [0007], [0021], [0027]-[0028], Claims 1-2, 14, FIG.1 (annotated below).

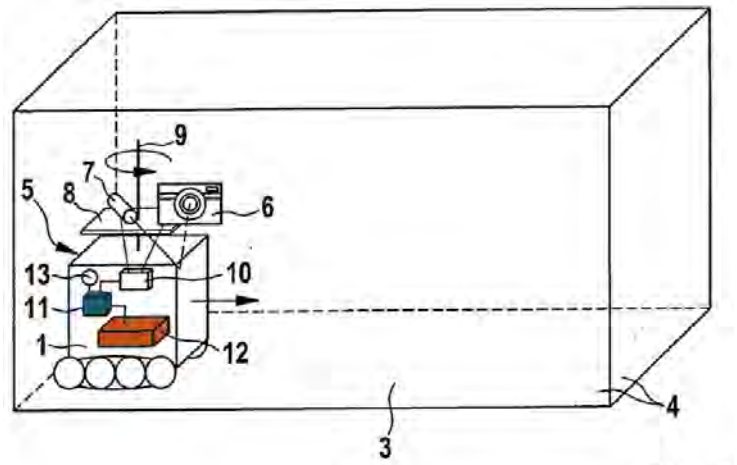


Fig. 1

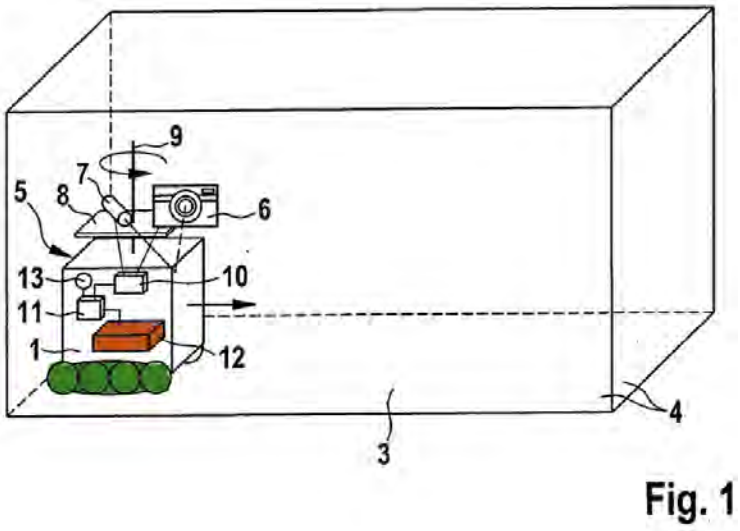
A POSITA would have understood that Knoll's robotic vehicle—comprising the integrated physical structure housing these components—constitutes the claimed "vehicle body." Janét, ¶220.

c. 1[b]

Knoll discloses or suggests 1[b]. Janét, ¶¶221-225.

The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is "moving the vehicle body within the swimming pool," and the corresponding structure is wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet. EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶222.

Knoll's Fig 1 (annotated below) shows robotic vehicle 1 with **drive means 12** and **wheels** contacting the pool bottom surface within working area 3. Knoll, Fig. 1.



Knoll, Fig. 1 (annotated)

Knoll describes that "drive means (12) for driving and steering the robotic vehicle (1)" are configured "for generating propulsion and for steering the robotic vehicle 1." Knoll, Abstract, [0028], Claims 1, 14. A POSITA would have understood that Knoll's drive means 12 comprises motor(s) powering the wheels, because generating propulsion and steering for a wheeled robotic vehicle needs motor-driven wheel rotation. Janét, ¶224.

A POSITA would have understood that Knoll thus discloses the claimed **function** and corresponding **structure**: **wheels** contact the submerged pool surfaces and are **powered by a motor** to **propel the vehicle body** within the

swimming pool. Janét, ¶225. Specifically, the '191 Patent discloses wheels that propel the vehicle "along the submerged pool surfaces" and are "powered by a motor" (EX1001, 3:33-39), and Knoll similarly discloses wheels (Figure 1) that contact the pool bottom surface and are powered by motor(s) (as part of drive means 12) to move robotic vehicle 1 within the pool. Janét, ¶225.

d. 1[c]

Knoll discloses or suggests 1[c]. Janét, ¶¶226-228.

Knoll discloses this limitation because its pool cleaning robot includes "a filter device and/or suction device." Knoll, [0007], [0021]. Knoll describes its robot operates on "working area 3...formed by the bottom of the pool" and its control unit is "located inside the robotic vehicle in a waterproof housing." Knoll, [0008], [0027].

A POSITA would have understood that Knoll's suction device draws water containing debris from the pool's submerged surfaces by suction, and the filter device retains this collected debris, because Knoll's robot operates on the bottom of the pool and has "waterproof housing" for its control unit (Knoll, [0008]), and the filters in pool cleaning systems, like Knoll's, capture and retain debris while allowing clean water to pass through, preventing debris from recirculating back into the pool. Janét, ¶228.

e. 1[d]

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

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

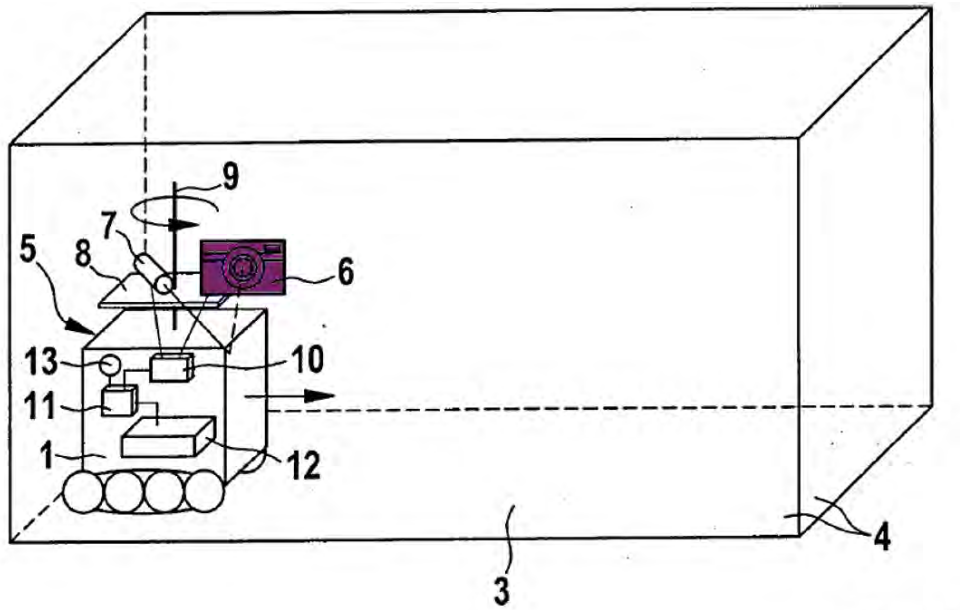


Fig. 1

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

Knoll also discloses "the at least one camera...for capturing an image of at least a first portion of the submerged surface." Janét, ¶232. As explained in

§IV.E.2.a (1[pre]), Knoll's pool cleaning robot achieves "a complete and efficient cleaning of a pool floor and/or the pool walls," where the pool bottom (working area 3) and pool walls (boundary surface 4) are submerged surfaces. Knoll, [0007], [0027]-[0028].

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

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

f. 1[e][i]

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

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

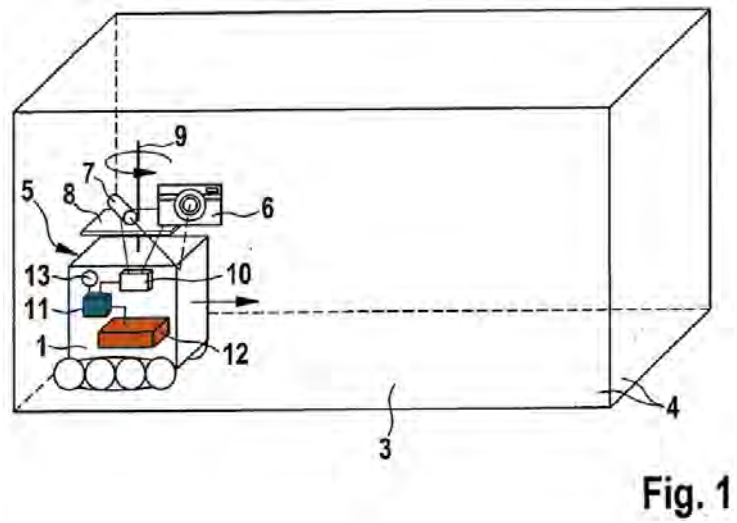


Fig. 1

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

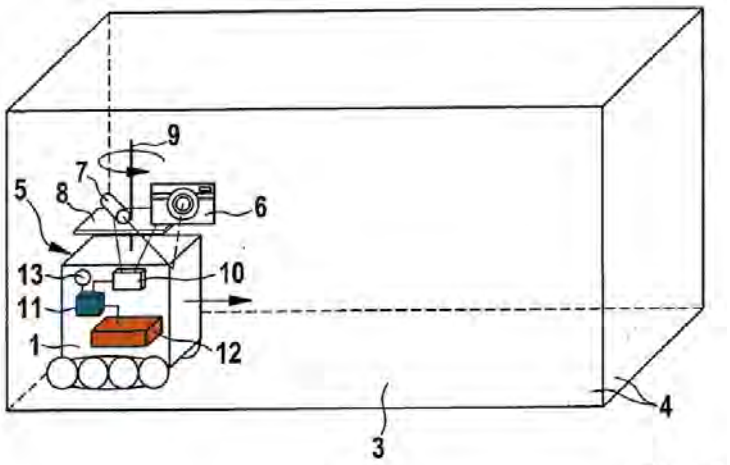


Fig. 1

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

g. 1[e][ii]

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

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

triangulation" and that the device includes "an **evaluation unit 10** for evaluating or determining the measured distance values," with "the evaluation unit 10 [being] part of a **control unit 11**." Knoll, [0018], [0028], FIG. 1 (annotated below; showing **evaluation unit 10** (part of **control unit 11**) is connected to **camera 6** via a wire/cable; Janét, ¶240.

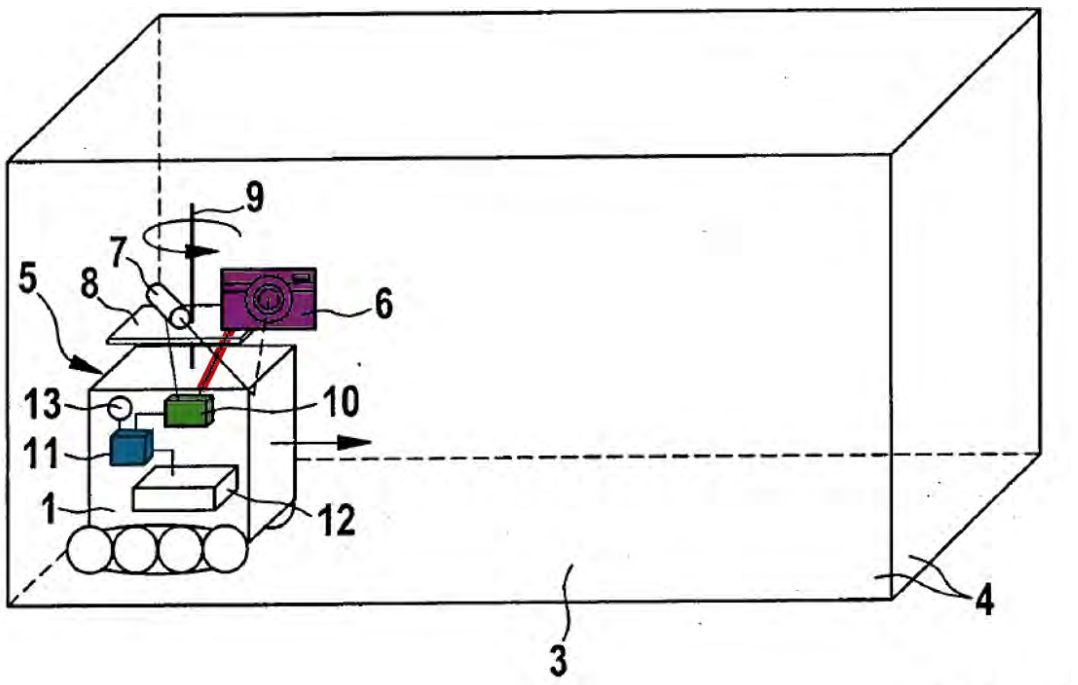


Fig. 1

Knoll further explains that "a light beam is focused on the boundary line or boundary surface and observed with a camera," and that as "the angle at which the light beam is observed changes…the **position of its image on the camera's photo sensor changes**," with "[t]he distance…then **calculated from the change in position**." Knoll, [0018]. A POSITA would have understood that control unit 11 is

in electronic communication with camera 6 because, to calculate distance values from images captured on the camera, evaluation unit 10, part of control unit 11, would receive data from camera 6 for processing. Knoll, [0018], [0028]; Janét, ¶241.

h. 1[e][iii]

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

Knoll discloses generating control signals "in response to the captured image." Specifically, Knoll's control unit 11 receives sensor information from distance-determining device 5 (which includes camera 6) and "controls the drive means 12 as a function of...quasi-continuously determined smallest distance measurement values." Knoll, [0028]. Knoll also explains that the distance measurement values are derived from images captured by camera 6, where "the position of its image on the camera's photo sensor changes" based on the distance to boundary surface 4, and "[t]he distance...is then calculated from the change in position." Knoll, [0018]. A POSITA would have understood that Knoll's control unit generates control signals "in response to the captured image" because the control signals are based on distance measurements derived from images captured by camera 6. Janét, ¶243.

Knoll also discloses generating control signals to cause movement "to, or away from, the first portion of the submerged surface." Janét, ¶244. As explained

in §IV.E.2.e (1[d]), a portion of boundary surface 4 captured by camera 6 constitutes the "first portion of the submerged surface." Knoll further explains that control unit 11 controls drive means 12 "in such a way that the robotic vehicle maintains a defined distance from the boundary line and/or boundary surface" as the vehicle travels working area 3 in a plurality of laps. Knoll, [0011], Claim 4, FIG. 2 (below).

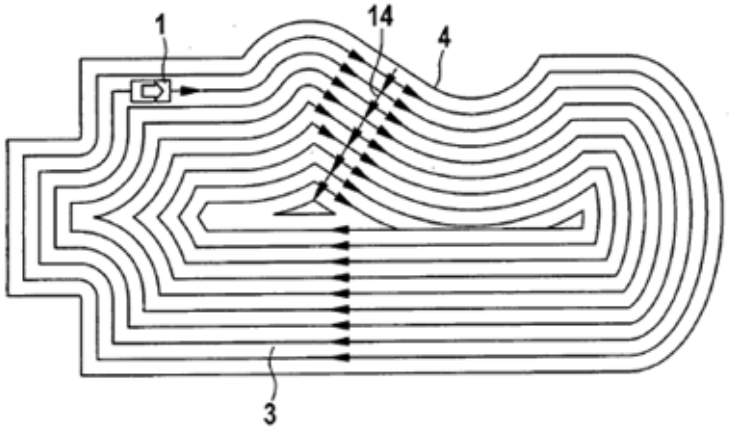


Fig. 2

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

3. Claim 2 Unpatentable over Knoll

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

a. 2[pre]

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

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

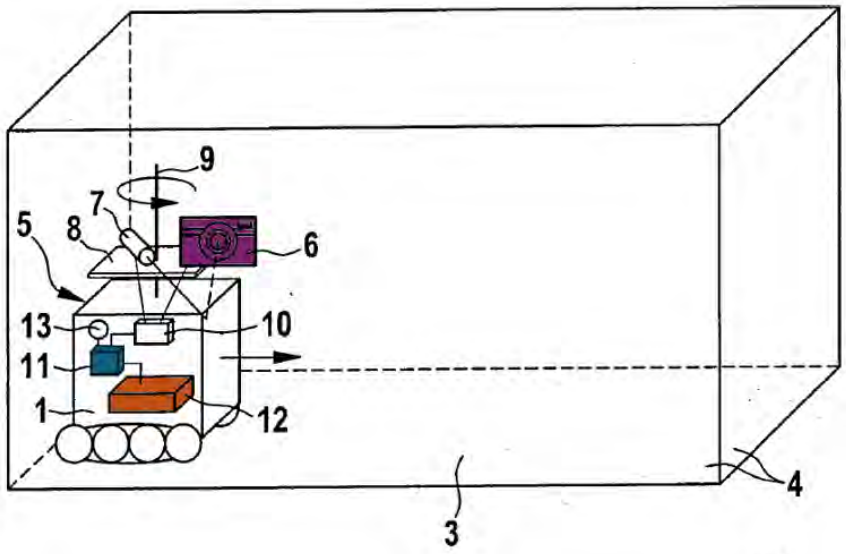


Fig. 1

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

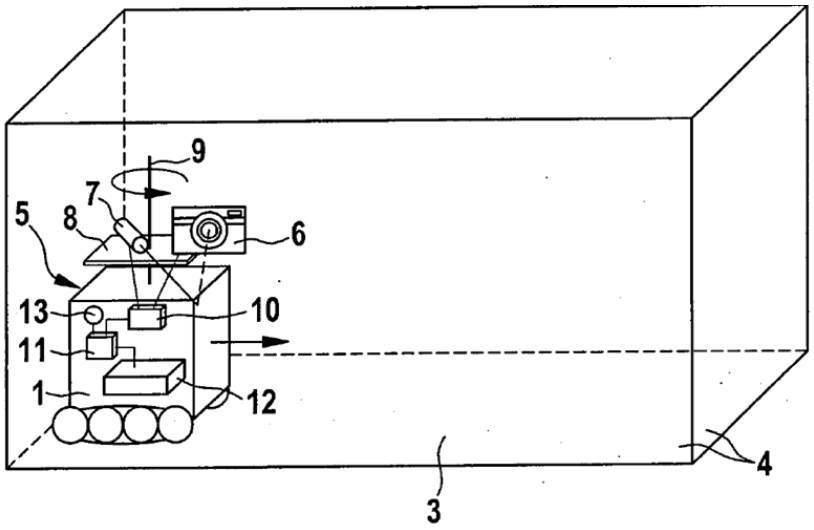


Fig. 1

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

b. 2[a][i]

Knoll discloses 2[a][i] as explained in §IV.E.2.a (1[Pre]). Janét, ¶252.

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

Limitations 2[a][ii]-2[a][vii] are identical to limitations 1[a]-1[b] and 1[d]-1[e][iii], respectively, and limitation 2[b] is substantially similar to limitation 1[c].

For at least the same reasons explained above in §§IV.E.2.b-h (1[a]-1[e][iii]), Knoll discloses or suggests 2[a][ii]-2[b]. Janét, ¶253.

4. Claim 3 Unpatentable over Knoll

Knoll renders Claim 3 obvious. Janét, ¶255-258.

a. 3[pre], 3[a][i]

Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Knoll discloses 3[Pre] and 3[a][i] as explained in §§IV.E.3.a-b; *see also* §IV.E.2.a (1[Pre]). Janét, ¶256.

b. 3[a][ii]-3[b][ii]

Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in §§IV.E.2.b-e, IV.E.2.g (1[a]-1[d], 1[e][ii]-1[e][iii]), Knoll discloses or suggests 3[a][ii]-3[b][ii]. Janét, ¶257.

F. Ground 4: Claims 1-3 Are Unpatentable over Renaud

1. Renaud

Renaud (EX1015) is prior art under AIA 35 U.S.C. §102(a)(1) and is not subject to exceptions under AIA 35 U.S.C. §102(b)(1). *See* §III.C, *supra*; Janét, ¶259.

As explained below, Renaud discloses a self-propelled pool cleaning robot using controls based on camera images. Renaud is analogous art with respect to Claims 1-3 of the '191 Patent. Janét, ¶260.

2. Claim 1 Unpatentable over Renaud

Renaud renders Claim 1 obvious. Janét, ¶¶261-289.

a. 1[pre]

Renaud discloses or suggests 1[pre]. Janét, ¶¶262-265.

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

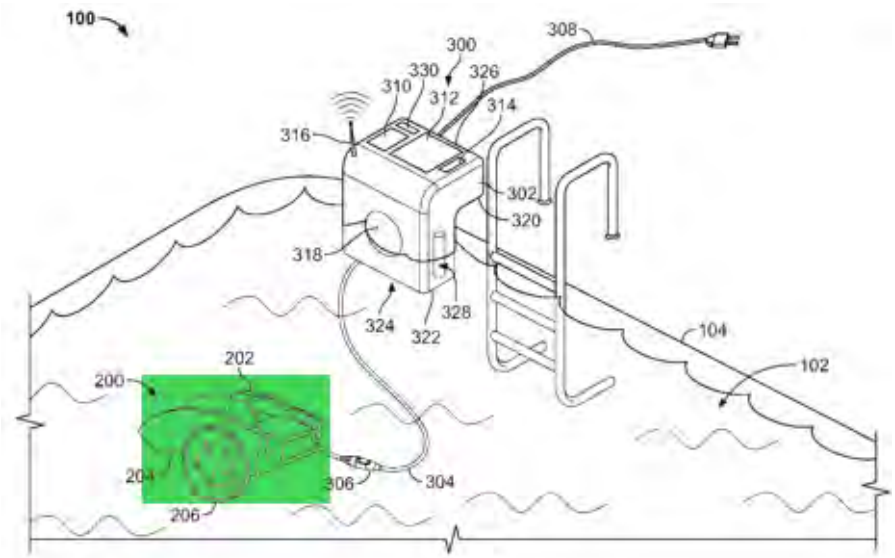

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FIG. 1

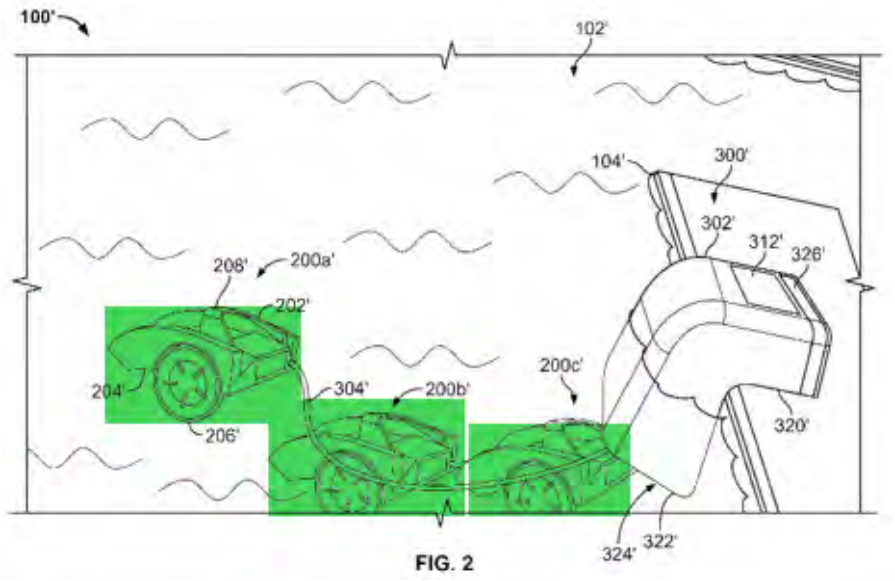

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FIG. 2

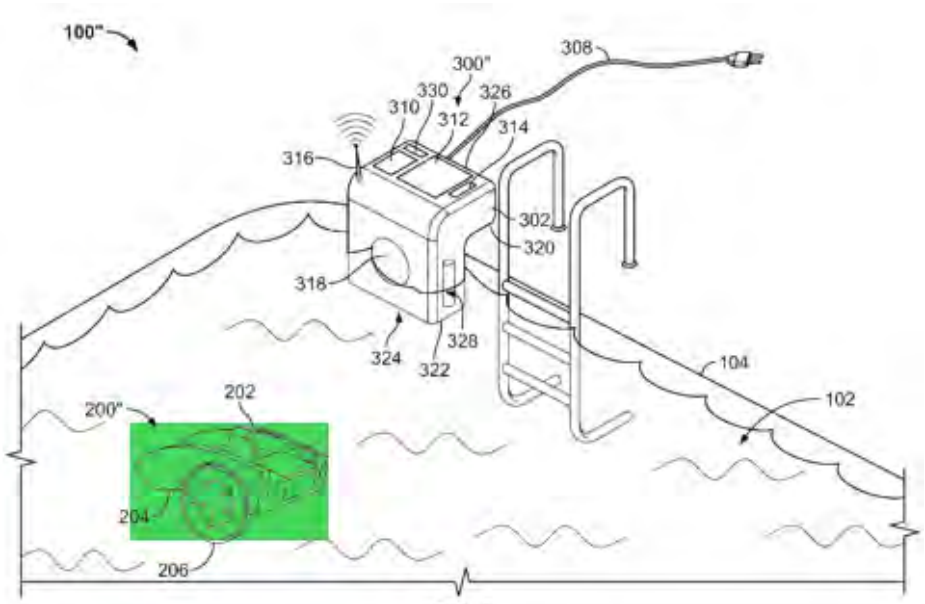


FIG. 3

Renaud discloses the pool cleaner is "self-propelled" because Renaud describes cleaner 200 includes "a motor, e.g., an electronically commutated motor" and "wheels 206, e.g., rollers, tracks, and the like, for moving the cleaner 200 in the swimming pool 102." Renaud, [0023], [0025]. Renaud further describes that "the vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris." Renaud, [0030]. A POSITA would have understood that a robotic cleaner with an onboard motor that drives and steers wheels for movement under the control of the onboard vision system is "self-propelled." Janét, ¶264.

Renaud discloses the pool cleaner "cleaning debris from a submerged surface of a swimming pool" because Renaud describes cleaner 200 "traverses, and cleans near, the walls (e.g., vertical or horizontal walls) of the pool" in "bottom

mode" and "rises to the water surface and cleans the water surface" in "top mode." Renaud, [0022]. Renaud further describes cleaner 200 uses "a suction pump impeller" to "collect the debris in the swimming pool" and collects "debris collected from the swimming pool 102" into "a debris container" located in housing 202. Renaud, [0023], [0030]. A POSITA would have understood that cleaner 200 cleans a submerged surface below the water surface at least when operating in "bottom mode." Janét, ¶265.

b. 1[a]

Renaud discloses or suggests 1[a]. Janét, ¶¶266-267.

As explained in §IV.F.2.a (1[pre]), Renaud discloses **cleaner 200/200a'** ("positioned at the water line")/**200b'** ("positioned at the bottom of the swimming pool 102'")/**200c'** ("positioned in a docking orientation relative to the docking station 300'")/**200"**. Renaud, [0022]-[0023], [0037], [0039], FIGS. 1-3 (annotated above). Renaud describes "cleaner 200 includes a housing 202 which includes a plurality of components therein," including "a motor, e.g., an electronically commutated motor, a storage device, and a processing device," as well as "a debris container," and "wheels 206, e.g., rollers, tracks, and the like." Renaud, [0023], [0025], FIGS. 1-3. A POSITA would have understood that the assembled structure of cleaner 200—comprising housing 202 and the components within or carried by it—that travels within the pool constitutes the claimed "vehicle body." Janét, ¶267.

c. 1[b]

Renaud discloses or suggests 1[b]. Janét, ¶¶268-271.

The format and content of 1[b] evokes claim interpretation under AIA 35 U.S.C. §112(f), or pre-AIA 35 U.S.C. §112 ¶6. As explained in §III.E, the recited function is "moving the vehicle body within the swimming pool," and the corresponding structure is "wheels, rollers, tracks, or other surface contacting members powered by a motor, or vacuum or liquid jet." EX1001, 3:31-43, 10:12-14, FIGS. 9-10; Janét, ¶269.

Renaud discloses identical function because it describes cleaner 200 "includes wheels 206…for **moving the cleaner 200** in the swimming pool 102." Renaud, [0025]. Renaud further describes the "vision system can communicate with the cleaner 200 to drive and/or steer the wheels 206 of the cleaner 200 in the direction of the area of debris." Renaud, [0030]. *See also* Renaud, [0003] ("Robotic swimming pool cleaners are generally designed to move along the swimming pool floor and/or walls").

Renaud discloses identical corresponding structure. Renaud describes cleaner 200 includes "**wheels 206**, e.g., rollers, tracks, and the like" powered by "a **motor**, e.g., an electronically commutated **motor**." Renaud, [0009], [0023], [0025], FIGS. 1-3 (annotated below).

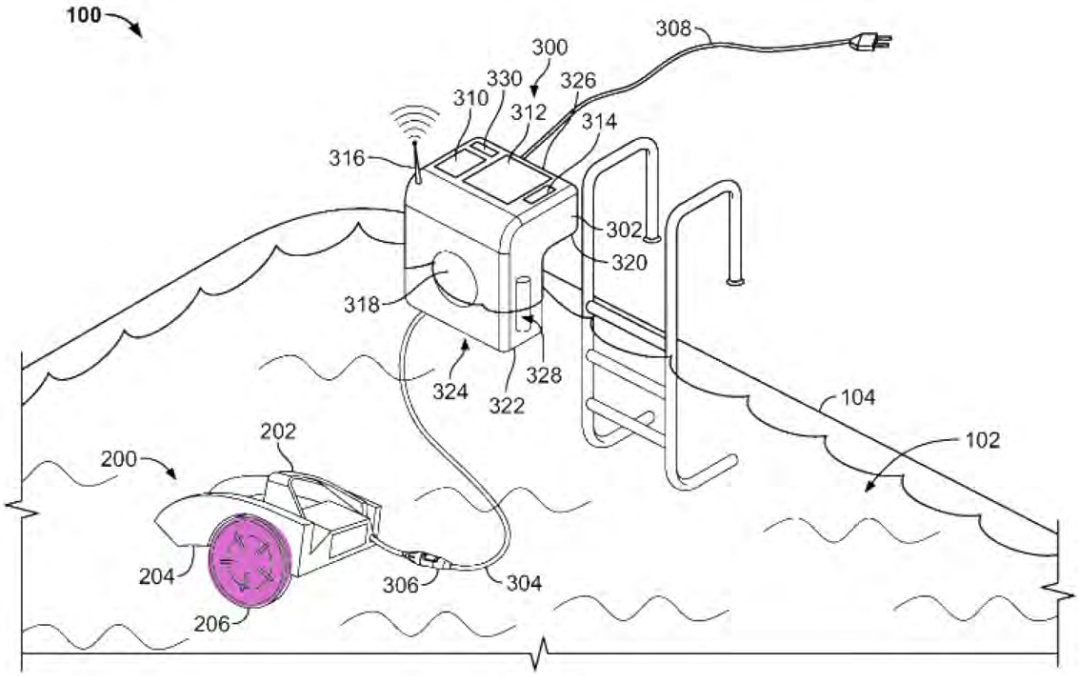

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FIG. 1

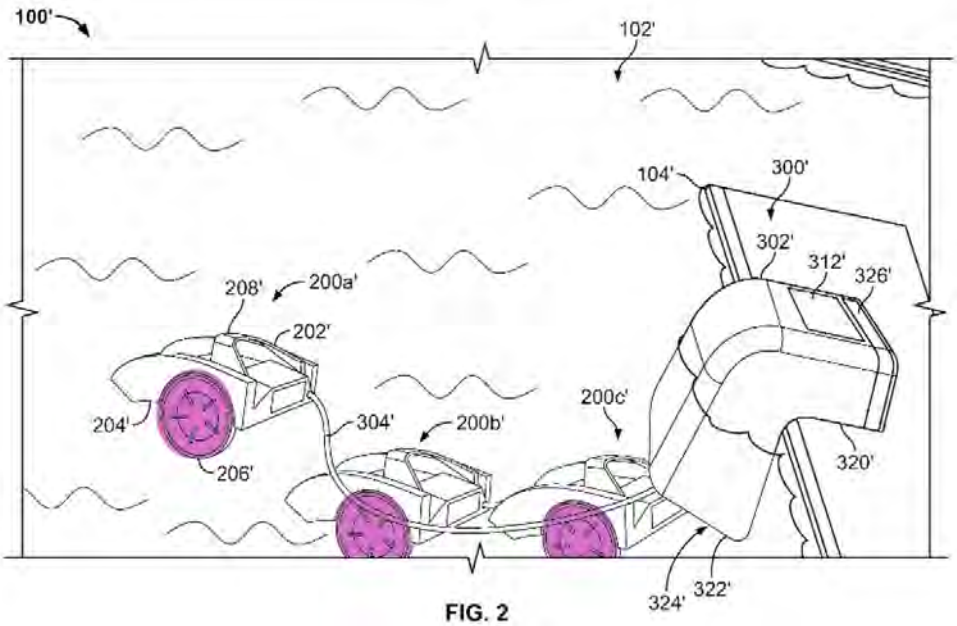

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FIG. 2

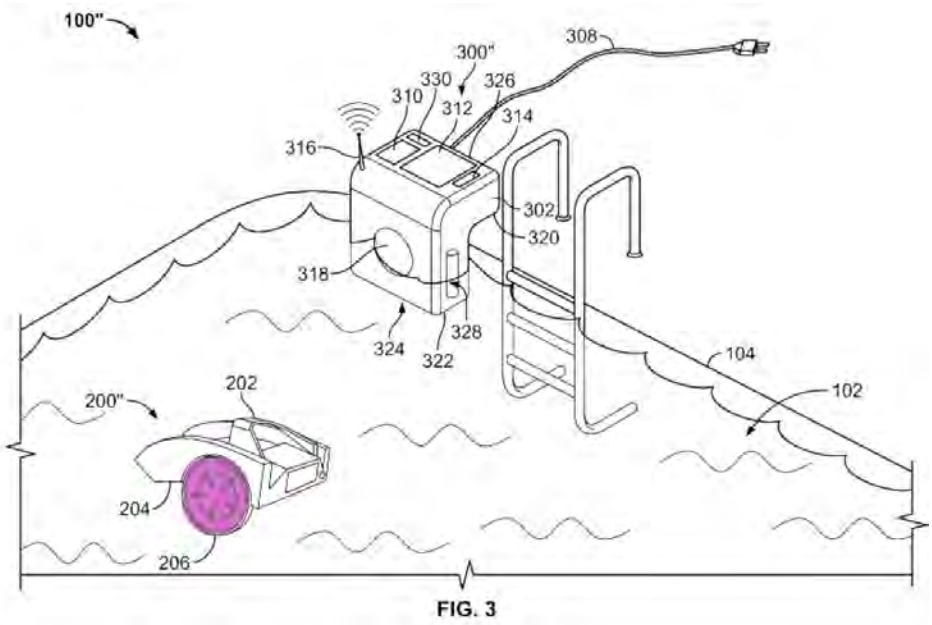


FIG. 3

d. 1[c]

Renaud discloses or suggests 1[c]. Janét, ¶¶272-275.

As explained in §IV.F.2.a (1[pre]), Renaud's cleaner 200 collects debris from submerged surfaces of the swimming pool. Renaud, [0022], [0023], [0030].

Renaud discloses "a filter configured to retain debris" because Renaud describes cleaner 200 includes "debris container" or "debris bag" for "collecting the debris collected from the swimming pool 102." Renaud, Abstract, [0006], [0015], [0023], [0030], Claim 20. Renaud also describes cleaner 200 uses "a suction pump impeller to collect the debris in the swimming pool into the debris container located in the housing 202 of the cleaner 200." Renaud, [0030].

Renaud further describes "[t]he self-cleaning of the debris container, e.g., a debris bag" where "the debris container of the cleaner 200 can be cleaned/emptied

into the debris container of the docking station 300." Renaud, [0033], [0036]. A POSITA would have understood that Renaud's debris container/debris bag of cleaner 200 retains debris—otherwise, there would be no need to clean or empty the debris container/bag of cleaner 200 as Renaud describes. Janét, ¶275.

e. 1[d]

Renaud discloses or suggests 1[d]. Janét, ¶¶276-278.

Renaud discloses "at least one camera positioned on or in the body" because Renaud describes cleaner 200 includes a housing and a vision system, which includes a camera. Renaud, [0008], Claim 1. As explained in §IV.F.2.b (1[a]), cleaner 200 includes the claimed "vehicle body." Renaud discloses the camera "for capturing an image of at least a first portion of the submerged surface" because Renaud describes "the sensors of the vision system can interact with the controller and/or processing device to identify **areas on the pool floor, walls** and/or water line **where debris or dirt exists** in the swimming pool 102, such as at the **bottom (on the horizontal or vertical walls)**." Renaud, [0029]. Renaud further describes the vision system "identifies **areas of debris** by sensing areas of **optical contrast**, for example, **generated by a foreign object, debris and/or dirt**." Renaud, [0031]. A POSITA would have understood that a camera of the vision system captures images to facilitate identification of specific "areas of debris" or "areas of optical contrast" (first portion) on pool floor and walls (submerged surfaces), which

constitute the claimed "at least a first portion of the submerged surface." Janét, ¶277.

Renaud discloses or suggests the camera is "positioned on or in the body" because Renaud explicitly identifies the camera as a component of the "vision system" (Renaud, [0008]) and physically locates the vision system "inside the cleaner 200" (e.g., "the vision system can include a PCB...disposed inside the cleaner 200") (Renaud, [0029]). Janét, ¶278.

f. 1[e][i]

Renaud discloses or suggests 1[e][i] because it includes a "processing device..., such as a microprocessor, **inside...cleaner 200**" disposed **inside the cleaner 200**," which interacts with the camera to control the cleaner. Renaud, [0008]-[0009], [0029]-[0030]. Janét, ¶¶279-282.

Renaud describes cleaner 200 includes "a vision system" with "sensors (e.g., **camera**) and programming stored on the storage device for processing by the **processing device**." Renaud, [0008]. Renaud further describes "the vision system can include "[a] **processing device** (not shown), such as a **microprocessor**, **inside of the cleaner 200**...can access the programmed data related to the vision system for **actuating the motor**." Renaud, [0029]. Renaud describes "the **sensors** of the vision system can **interact with** the controller and/or **processing device** to identify areas on the pool floor, walls and/or water line where debris or dirt exists." *Id.*

Renaud also describes that "[u]pon identifying debris located in the swimming pool, the vision system can **actuate the motor** to direct the swimming pool cleaner to the debris." Renaud, [0009]. *See also* Renaud, [0030] ("the vision system can communicate with one or more motors of the cleaner 200, to **actuate, or control the speed of, the motor**.").

A POSITA would have understood that Renaud's processing device/microprocessor (controller) receiving data from the camera, processing that data, and generating signals to actuate/control the motor—constitutes the claimed "controller." Janét, ¶281.

As explained in §IV.F.2.b (1[a]), cleaner 200 is the claimed "vehicle body." A POSITA would have understood that the PCB and/or processing device "disposed inside the cleaner 200" is positioned "on or in the body." Janét, ¶282.

g. 1[e][ii]

Renaud discloses or suggests that its processing device (controller) is in electronic communication with the at least one camera because it describes that "the sensors [e.g., camera] of the vision system can **interact with** the...processing device [controller] to identify areas on the pool floor." Renaud, [0008], [0029]; Janét, ¶283.

h. 1[e][iii]

Renaud discloses or suggests 1[e][iii]. Janét, ¶¶284-288.

Renaud discloses or suggests that its processing device (controller) generates control signals "in response to the captured image." Specifically, Renaud's vision system "includes sensors (e.g., camera) and programming stored on the storage device for processing by the processing device," and the processing device "access[es] the programmed data related to the vision system for actuating the motor." Renaud, [0008], [0029]. The vision system "identifies areas of debris by sensing areas of optical contrast…generated by a foreign object, debris and/or dirt" on pool floor and walls (submerged surfaces), and sensors "provide location information to the processor...for directing the swimming pool cleaner to the debris." Renaud, [0008], [0031]. Renaud also describes that its processing device controls a controller to actuate the motor for movement of the cleaner." Renaud, [0025].

A POSITA would have understood that Renaud's processing device (the claimed "controller") processes the programming and image data to generate the control signals that actuate the motors, causing the vehicle body to move to the debris area (the first portion), because it identifies debris based on "optical contrast"—i.e., based on visual/image data from the camera. Janét, ¶287.

Renaud also discloses the processing device generating control signals to cause movement "to...the first portion." Specifically, "[u]pon identifying debris...the vision system [via the processing device] can actuate the motor to

direct the swimming pool cleaner to the debris." Renaud, [0009], Claim 3, [0030] (steer wheels "in the direction of the area of debris"), [0025]. A POSITA would understand that the processing device generates these signals to actuate the motor and steer the vehicle specifically to the "area of debris" (first portion). Janét, ¶288.

The claim limitation uses the disjunctive "or" between "to" and "away from," meaning the limitation is satisfied by teaching either alternative. Because Renaud teaches control signals that cause movement "to" the first object, Renaud discloses or suggests this element. Janét, ¶289.

3. Claim 2 Unpatentable over Renaud

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

a. 2[pre]

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

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

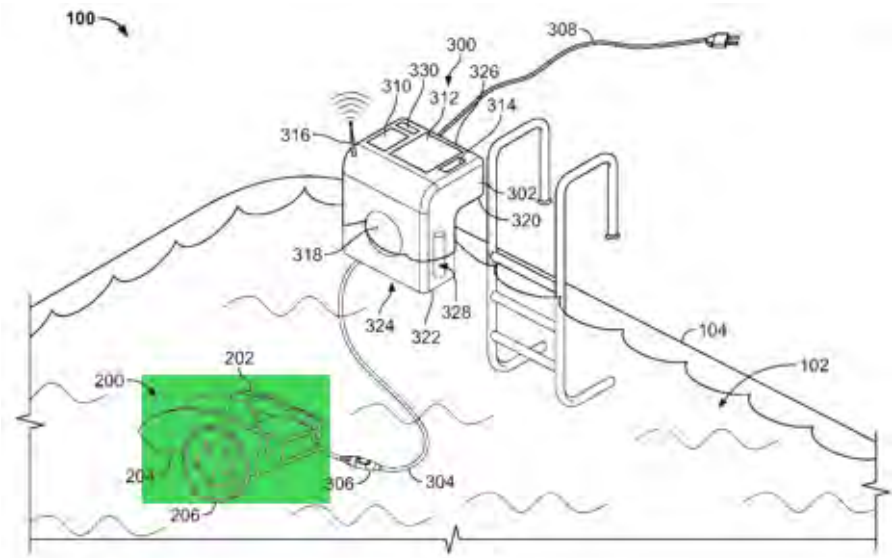

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FIG. 1

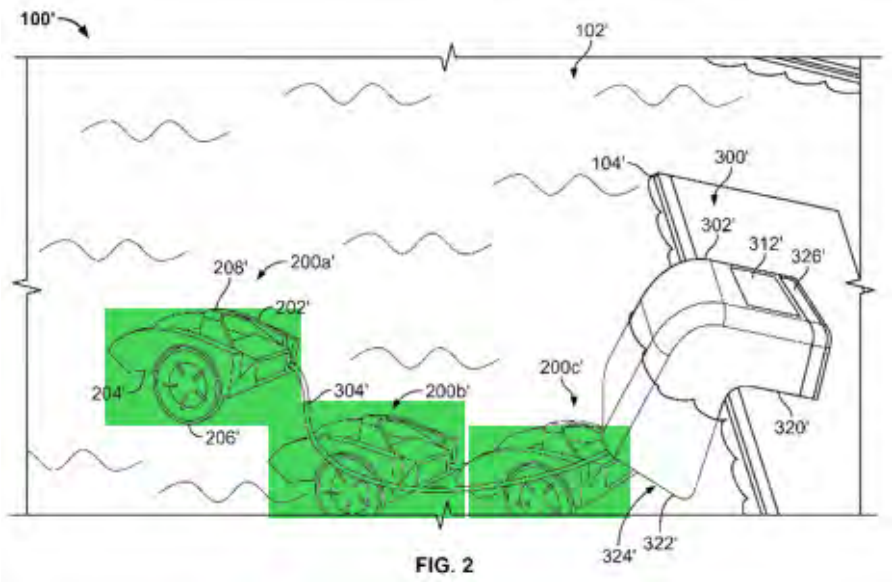

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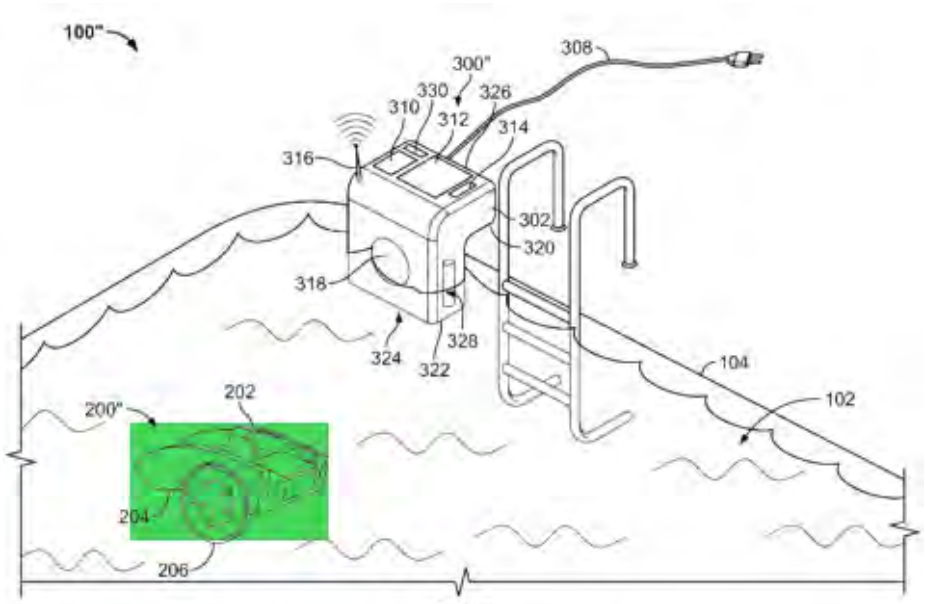


FIG. 3

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

b. 2[a][i]

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

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

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

4. Claim 3 Unpatentable over Renaud

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

a. 3[pre], 3[a][i]

Limitations 3[pre] and 3[a][i] are exactly the same as limitations 2[Pre] and 2[a][i]. Renaud discloses 3[Pre] and 3[a][i] as explained in §§IV.F.3.a-b; *see also* §IV.F.2.a (1[Pre]). Janét, ¶298.

b. 3[a][ii]-3[b][ii]

Limitations 3[a][ii]-3[b][ii] are exactly the same as or substantially similar to limitations 1[a]-1[d] and 1[e][ii]-1[e][iii], respectively. For at least the same reasons explained above in §§IV.F.2.b-e, IV.F.2.g-h (1[a]-1[d], 1[e][ii]-1[e][iii]), Renaud discloses or suggests 3[a][ii]-3[b][ii]. Janét, ¶299.

V. CONCLUSION

The Board should institute IPR and cancel Claims 1-3.

VI. MANDATORY NOTICES

A. Real Party in Interest

Petitioner identifies itself as a real party in interest. The following are identified as additional real parties in interest: Deepwater Innovation Technology (Hong Kong) Limited and Xingmai Innovation Technology (Suzhou) Co., Ltd.

B. Related Matters

To the best of Petitioner's knowledge, the '191 Patent has been involved in the following cases:

- *Beatbot Technology (USA) Co. Ltd. et al v. Zodiac Pool Systems LLC*, No. 3:25-cv-01946 (S.D. Cal.).
- *Zodiac Pool Sys. LLC v. Wybotics, Co. Ltd.*, Case No. 2:25-cv-00582 (E.D. Tex).
- *Wybotics Inc. et al v. Zodiac Pool Systems LLC*, Case No. 2-25-cv-08526 (C.D. Cal.).
- *Wybotics Inc. et al v. Zodiac Pool Systems LLC*, IPR2026-00159 (PTAB).

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

C. Notice of Counsel and Service Information

Petitioner consents to electronic service. All communications to the attorneys listed below may be sent to: Perkins-Service-Xingmai-Zodiac-IPRs@perkinscoie.com.

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Babak Tehranchi Reg. No. 55,937 Perkins Coie LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080	

Phone: 858.720.5700 Fax: 858.720.5799 tehranchi-ptab@perkinscoie.com	

D. Power of Attorney

A power of attorney is filed herewith according to 37 C.F.R. §42.10(b).

Respectfully submitted,

/ Kyle R. Canavera /

Kyle R. Canavera
Reg. No. 72,167
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Date: January 26, 2026

CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(D)

Pursuant to 37 C.F.R. §42.24(a), Petitioner hereby certifies that portions of the above-captioned Petition for *inter partes* review of U.S. Patent No. 11,003,191, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,976. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

/ Kyle R. Canavera /

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Attorney for Petitioner

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *inter partes* review of U.S. Patent No. 11,003,191 and supporting materials (Exhibits and Power of Attorney) were served via FedEx delivery on the Patent Owner at the correspondence address of record as listed on PAIR:

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

A courtesy copy was also sent via electronic mail to Patent Owner's litigation counsel listed below:

Christopher Samuel Leah - cleah@kilpatricktownsend.com
Kathleen Rose Geyer - kgeyer@ktslaw.com
Steven David Moore - stevemoore@velaw.com

Respectfully submitted,

/Meghan Bright/

Meghan Bright
Patent Paralegal

Date: January 26, 2026

EXHIBIT 4

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

ZODIAC POOL SYSTEMS LLC and ZODIAC POOL CARE EUROPE, Plaintiff, v. WYBOTICS, CO. LTD. f/k/a Tianjin Wangyuan Environmental Protection and Technology Co., Ltd., Defendant.	Case No. 2:25-cv-582

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT AGAINST WYBOTICS, CO. LTD.

Plaintiffs Zodiac Pool Systems LLC ("ZPS") and Zodiac Pool Care Europe ("ZPCE") (collectively, "Plaintiffs" or "Zodiac"), for their First Amended Complaint against Defendant Wybotics, Co. Ltd. f/k/a Tianjin Wangyuan Environmental Protection and Technology Co., Ltd. ("Wybotics" or "Defendant"), allege as follows:

INTRODUCTION

1. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. § 271, et seq., arising from Defendant's acts of infringement of United States Patent Nos. 8,393,031 (the "'031 Patent"); 8,393,029 (the "'029 Patent"); 11,880,207 (the "'207 Patent"); 11,262,766 (the "'766 Patent"); and 11,003,191 (the "'191 Patent") (collectively the "Asserted Patents").

THE PARTIES

2. Plaintiff Zodiac Pool Systems LLC is a Delaware limited liability company with its corporate headquarters located at 2077 Convention Center Concourse #300, Atlanta, GA 30337.

3. Plaintiff Zodiac Pool Care Europe is a French company with its corporate headquarters located at ZA La Balme, 31450 Belberaud, France.

4. Defendant Wybotics, Co. Ltd. f/k/a Tianjin Wangyuan Environmental Protection and Technology Co., Ltd. is a foreign company organized and existing under the laws of China with its principal place of business located at No. 30, Zhongnan 4th Street, West-Zone Teda, 300462, Tianjin, China. Defendant does business in Texas and in the Eastern District of Texas, directly or indirectly. *See* Ex. 1 (identifying Wybotics as a vendor at the November 2024 International Pool, Spa, Patio Expo in Dallas, TX); *see also* Ex. 2 (import records showing Wybotics' importation of products into Texas); Ex. 3 (Wybotics publication and advertisement in the Longview News-Journal in Longview, TX). Wybotics is responsible for importing, making, marketing, distributing, offering for sale, and/or selling Wybotics-branded and/or Wybotics-manufactured robotic pool cleaners in the United States (directly or indirectly), including in this District.

5. Wybotics induces its affiliates, distributors, retail partners, and customers in the making, using, selling, offering for sale, and/or importing throughout the United States, including within this District, infringing products (such as Wybotics-branded and/or Wybotics-manufactured robotic pool cleaners) and placing such products into the stream of commerce via established distribution channels knowing or understanding that such products would be sold and used in the United States, including in the Eastern District of Texas. Wybotics purposefully has directed and directs its products, including but not limited to Wybot C1, Wybot C1 Pro, Wybot C1 Max, Wybot

C2 Vision, Wybot M2, Wybot S2, Wybot S2 Pro, Wybot S2 Solar, Wybot S2 Solar Vision, AquaClean, Winny HJ3172, Bugson, Bugson Plus, and Aquamoto Scrubo Pro (the "Accused Products") into established distribution channels within this District and the U.S. nationally. *See* Ex. 4 ("Orders will be shipped by USPS, UPS or Amazon Logistics US. We currently only ship to locations within the continental United States"); *see also* Ex. 5 (translated to: "All of our products can be sold normally in the United States"); Ex. 6 (showing U.S. on the "Customer Distribution Map" and stating "[w]e are selling worldwide including EU, US…"); Ex. 3 (Wybotics publication and advertisement in the Longview News-Journal in Longview, TX). Additionally, Wybotics sells and offers to sell the Accused Products through its websites, wybotpool.com and wybotics.com, which may be accessed throughout the United States, the State of Texas, and this District. *See* Ex. 7.

JURISDICTION AND VENUE

6. This action arises under the laws of the United States, 35 U.S.C. §§ 101, 271, 283, 284, and 285, for patent infringement. This Court has original subject matter jurisdiction over the asserted claims pursuant to 28 U.S.C. §§ 1331 and 1338(a).

7. This Court has personal jurisdiction over Wybotics in this action because Wybotics has committed acts within Texas (and this District) giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction of Wybotics would not offend traditional notions of fair play and substantial justice. Wybotics has committed acts of patent infringement and induced and contributed to acts of patent infringement by others in this District and in Texas by, among other things, making, using, importing, offering to sell, and/or selling products that infringe the Asserted Patents. Moreover, Wybotics engages in other persistent courses of conduct and derives substantial revenue from products and/or services provided to

individuals in this District and in Texas. Wybotics also has purposefully established systematic and continuous contacts with this District and should reasonably expect to be brought into court here. For example, on information and belief, Wybotics has imported products, including potentially infringing products, through a port in Houston, TX which were destined for a buyer in Georgetown, TX. *See* Ex. 2. Furthermore, Wybotics was a vendor at the International Pool, Spa, and Patio Expo in Dallas, TX November 12–14, 2024. *See* Ex. 1. Wybotics has also directly advertised its products, including the Accused Products, in a publication in the Longview News-Journal, a newspaper in the City of Longview, Texas in this District. *See* Ex. 3.

8. Alternatively, and/or in addition, this Court has jurisdiction over Wybotics under Federal Rule of Civil Procedure 4(k)(2). This action arises from actions of Wybotics directed toward the United States, including (1) committing at least a portion of the infringing acts alleged herein and (2) regularly transacting business, soliciting business, and deriving revenue from the sale of goods and services, including infringing goods and services, to individuals in the United States. Therefore, Wybotics has purposefully availed itself to the benefits of the United States including this District, and the exercise of jurisdiction over Wybotics would not offend traditional notions of fair play and substantial justice.

9. Venue over this action is proper in this Court pursuant to 28 U.S.C. § 1391(c)(3) because Wybotics is a foreign company, and a defendant not resident in the United States may be sued in any judicial district.

THE ASSERTED PATENTS

10. On March 12, 2013, the United States Patent and Trademark Office issued United States Patent No. 8,393,031 (the "'031 Patent"), entitled "Apparatus For Cleaning A Submerged Surface With Removable Filtration Device" naming Philippe Pichon and Emmanuel Mastio as

inventors. A true and correct copy of the ’031 Patent is attached to this Complaint as Exhibit 8 and incorporated herein by reference.

11. The ’031 Patent is valid and enforceable.

12. The ’031 Patent relates to a robotic pool cleaner that comprises a filtering device with two shells. *See* Ex. 8, Abstract. The first and second shells of the filtering device are fitted together such that the first shell “acts as a pocket for recovering debris” and the second shell “acts as a liquid inlet conduit.” *Id.* at 2:53-56. Furthermore, the two shells are capable of being movable relative to one another for ease of emptying the collected debris and cleaning the filtering device. *Id.* at 2:59-67.

13. ZPCE owns by assignment all right, title and interest in, and has standing to sue for infringement of the ’031 Patent.

14. ZPS holds an exclusive license from ZPCE granting it all substantial rights in and thus standing to sue for infringement of the ’031 Patent.

15. Plaintiffs have the right to assert all causes of action arising under the ’031 Patent and the right to recover any remedies for infringement of it, including the right to sue for past infringement.

16. On March 12, 2013, the United States Patent and Trademark Office issued United States Patent No. 8,393,029 (the “’029 Patent”), entitled “Apparatus For Cleaning A Submerged Surface Including A Brushing Device Driven By Members For Driving The Apparatus On The Submerged Surface” naming Philippe Pichon and Emmanuel Mastio as inventors. A true and correct copy of the ’029 Patent is attached to this Complaint as Exhibit 9 and incorporated herein by reference.

17. The ’029 Patent is valid and enforceable.

18. The ’029 Patent relates to a robotic pool cleaner for cleaning an immersed surface that comprises a brush driven by the wheels of the cleaner. *See* Ex. 9, Abstract. In one embodiment, the brush is joined to a wheel by means of a brush pinion engaged with a toothed ring on the wheel, causing the rotation of the brush in the same direction as the rotation of the wheel. *Id.* at 3:30-34.

19. ZPCE owns by assignment all right, title, and interest in, and has standing to sue for infringement of the ’029 Patent.

20. ZPCE has the right to assert all causes of action arising under the ’029 Patent and the right to recover any remedies for infringement of it, including the right to sue for past infringement.

21. On January 23, 2024, the United States Patent and Trademark Office issued United States Patent No. 11,880,207 (the “’207 Patent”), entitled “Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera” naming Kameshwar Durvasula and William Londono Correa as inventors. A true and correct copy of the ’207 Patent is attached to this Complaint as Exhibit 18 and incorporated herein by reference.

22. The ’207 Patent is valid and enforceable.

23. The ’207 Patent relates to a robotic pool cleaner for cleaning debris from a submerged surface of a swimming pool by using a camera to capture images in the swimming pool and using a controller to control the cleaner in response to the captured images. *See* Ex. 18, Abstract. In one embodiment, the camera captures an image of a portion of the pool and the controller controls the robotic pool cleaner based on the image that was taken. *Id.* at 1:60-2:35.

24. ZPS owns by assignment all right, title, and interest in, and has standing to sue for infringement of the ’207 Patent.

25. ZPS has the right to assert all causes of action arising under the ’207 Patent and the right to recover any remedies for infringement of it, including the right to sue for past infringement.

26. On March 1, 2022, the United States Patent and Trademark Office issued United States Patent No. 11,262,766 (the “’766 Patent”), entitled “Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera” naming Kameshwar Durvasula and William Londono Correa as inventors. A true and correct copy of the ’766 Patent is attached to this Complaint as Exhibit 19 and incorporated herein by reference.

27. The ’766 Patent is valid and enforceable.

28. The ’766 Patent relates to a robotic pool cleaner for cleaning debris from a surface of a swimming pool by using a camera to capture images in the swimming pool and using a controller to control the cleaner in response to the captured images. *See* Ex. 19, Abstract. In one embodiment, the camera captures an image of a portion of the pool and the controller controls the robotic pool cleaner based on the image that was taken. *Id.* at 1:58-2:33.

29. ZPS owns by assignment all right, title, and interest in, and has standing to sue for infringement of the ’766 Patent.

30. ZPS has the right to assert all causes of action arising under the ’766 Patent and the right to recover any remedies for infringement of it, including the right to sue for past infringement.

31. On May 11, 2021, the United States Patent and Trademark Office issued United States Patent No. 11,003,191 (the “’191 Patent”), entitled “Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera” naming Kameshwar Durvasula and William Londono Correa as inventors. A true and correct copy of the ’191 Patent is attached to this Complaint as Exhibit 20 and incorporated herein by reference.

32. The ’191 Patent is valid and enforceable.

33. The ’191 Patent relates to a robotic pool cleaner for cleaning debris from a surface of a swimming pool by using a camera to capture images in the swimming pool and using a controller to control the cleaner in response to the captured images. *See* Ex. 20, Abstract. In one embodiment, the camera captures an image of a portion of the pool and the controller controls the robotic pool cleaner based on the image that was taken. *Id.* at 1:57-2:32.

34. ZPS owns by assignment all right, title, and interest in, and has standing to sue for infringement of the ’191 Patent.

35. ZPS has the right to assert all causes of action arising under the ’191 Patent and the right to recover any remedies for infringement of it, including the right to sue for past infringement.

FACTUAL BACKGROUND

36. On July 29, 2022, Zodiac filed a complaint in the ITC against several respondents including Wybotics for the infringement of the ’031 and ’029 Patents. *In the Matter of Certain Robotic Pool Cleaners, Products Containing the Same, and Components Thereof*, Inv. No. 337-TA-1326, Complaint (July 29, 2022) (the “ITC Investigation”).

37. On the same day, July 29, 2022, ZPCE also filed a complaint in the District Court for the Central District of California against the entities named in the ITC complaint for the infringement of the ’031 and ’029 Patents. *Zodiac Pool Care Europe v. Wybotics, Co. Ltd. et al*, CDCA-2-22-cv-05271, Dkt. 1 (July 29, 2022) (the “CDCA Action”).

38. During the ITC Investigation, Wybotics represented that it had stopped manufacturing, importing, and selling the ITC Accused Products, and it would no longer manufacture, import, or sell the products at issue, which included Winny HJ3172, Bugson, Bugson Plus, and Aquamoto Scrubo Pro (the “ITC Accused Products”). *See* Ex. 10 (excerpt from *Certain Robotic Pool Cleaners*, Respondents’ Initial Markman Brief (Dec. 20, 2022); Ex. 11 (excerpt from

Id., Respondents Letter to ALJ (Feb. 22, 2023)); Ex. 12 (excerpt from *Id.*, Complainants Responsive Letter to ALJ (Feb. 24, 2023)).

39. As a result of Wybotics' representations, on February 20, 2023, Zodiac moved to terminate the investigation in the ITC as to Wybotics and Tianjin Pool & Spa Corporation ("TPS") "because 'Wybotics [] provided sworn representations that it [] stopped importing and selling the [ITC] Accused Products and will no longer import or sell the [ITC] Accused Products.'" *Robotic Pool Cleaners*, Order No. 16, Initial Determination (February 21, 2023) (quoting Zodiac's Unopposed Motion to Withdraw Complaint and Terminate Investigation as to Wybotics Respondents February 20, 2023).

40. On March 29, 2023, relying on the representations by Wybotics in the ITC Investigation, ZPCE filed a voluntary dismissal without prejudice as to Wybotics and TPS in the CDCA Action, electing not to seek damages for the past sale of the ITC Accused Products so long as Wybotics ceased its infringement. *Id.*, Dkt. 24 (March 29, 2023).

41. On information and belief, for a brief period of time, Wybotics abided by its representations to the ITC and sold non-infringing versions of its robotic pool cleaners. However, Wybotics has again started selling infringing products, including the Wybot C1, Wybot C1 Pro, Wybot C1 Max, Wybot S2, Wybot S2 Pro, and AquaClean, which are each non-materially different with respect to the infringing features covered by the '031 Patent. Wybotics' recent sales of products that are not materially different from the ITC Accused Products with respect to the infringing features flies in the face of the sworn representations that it made during the ITC Investigation—namely that Wybotics had stopped manufacturing, importing, and selling the ITC Accused Products and had no plans to do so in the future.

42. Additionally, despite making the sworn representations, Wybotics began advertising on its website that it "did not make any commitments . . . or sign any agreement," so "all of [its] products can be sold normally in the United States." Ex. 5.

43. On June 4, 2024, Zodiac sent Wybotics a letter notifying Wybotics of its infringement of the '207, '766, and '191 Patents at least by importing and/or offering the Wybot M2, which includes a Vision Tech system, for sale. Ex. 21. Three days later, on June 7, 2024, Wybotics confirmed receipt of Zodiac's letter, stating that "[Wybotics'] legal counsel will be in touch with you to discuss this matter further." Ex. 22. Having not heard from Wybotics or its purported legal counsel for over three weeks, Zodiac sent Wybotics a letter on July 1, 2024, inquiring into the status of any response from its purported legal counsel. Ex. 23. On July 9, 2024, Wybotics' counsel finally responded to Zodiac informing it that Wybotics would address Zodiac's letter in August. Ex. 24. However, on August 27, 2024, Wybotics' counsel indicated that Wybotics needed more time to respond to the letter. Ex. 24.

44. On information and belief, Wybotics removed the Wybot M2 for sale from its website after July 17, 2024, but before August 5, 2024. *See* Ex. 25 (showing the Wybot M2 available for purchase on July 17, 2024); Ex. 26 (showing the same webpage for purchasing the Wybot M2 as removed and no longer available for purchase on August 5, 2024).

45. On information and belief, Wybotics started offering the Wybot M2 for sale again without responding to or notifying Zodiac and expanded its offering of products implementing the infringing Vision Tech system to include the Wybot C2 Vision at some time on or before March 19, 2025, and the Wybot S2 Solar Vision at some time on or before May 12, 2025. Exs. 27, 28, 29. Additionally, on information and belief, Wybotics actively showcased the infringing Vision

Tech system and Wybot M2 at the International Pool, Spa, and Patio Expo in Dallas, Texas on November 9–11, 2024.

46. Having not heard from Wybotics since August 27, 2024, and having found Wybotics to be offering the infringing Wybot M2 for sale again, as well as additional infringing products, namely the Wybot C2 Vision, Wybot S2 Solar, and Wybot S2 Solar Vision, Zodiac sent yet another letter to Wybotics on June 2, 2025. Ex. 30. On June 12, 2025, Wybotics finally responded to Zodiac's letters but refused to stop selling the infringing products. Ex. 31.

47. As a result, Zodiac now brings this action, seeking relief both as to the newly introduced infringing products (*i.e.*, Wybot C1, Wybot C1 Pro, Wybot C1 Max, Wybot C2 Vision, Wybot M2, Wybot S2, Wybot S2 Pro, Wybot S2 Solar, Wybot S2 Solar Vision, and AquaClean) and the ITC Accused Products, as well as any others that meet or have met the limitations of the Asserted Patents.

COUNT I

Infringement of U.S. Patent No. 8,393,031

48. Zodiac re-alleges and incorporates by reference the allegations of the preceding paragraphs as if set forth fully herein.

49. Without license or authorization and in violation of 35 U.S.C. § 271(a), Wybotics has infringed and continues to infringe the '031 Patent by importing into this district and elsewhere in the United States, using, offering for sale, and/or selling within this district and elsewhere in the United States, products related to swimming pool cleaners which incorporate each and every element of one or more of the claims of the '031 Patent and therefore are covered by the '031 Patent, including but not limited to the Accused Products.

50. Wybotics directly infringes one or more claims of the ’031 Patent, including but not limited to claim 1, either literally or under the doctrine of equivalents by using, selling, offering for sale, or importing into the United States the Accused Products and will continue to do so unless enjoined by this Court.

51. The Accused Products meet each and every limitation of at least claim 1 of the ’031 Patent. Exemplary infringement claim charts are attached to this Complaint for the Wybot C1 (*see* Exhibit 13) and Wybotics HJ3172 (*see* Exhibit 14) and are incorporated herein by reference.

52. Wybotics also indirectly infringes the ’031 Patent within the United States by inducement under 35 U.S.C. § 271(b). Wybotics knowingly and intentionally induced, and continues to induce, others in this judicial district and throughout the United States, including but not limited to Wybotics’ customers and/or ultimate end users, to directly infringe one or more claims of the ’031 Patent, such as claim 1. Wybotics does so, *inter alia*, by (1) providing instructions or information to explain how to use the Accused Products in an infringing manner; and (2) touting these infringing uses of the Accused Products in Wybotics’ Wybot C1 Operating Manual. *See* Ex. 15; *see also* Ex. 16.

53. Wybotics also indirectly infringes the ’031 Patent by contributing to direct infringement by Wybotics’ customers and/or ultimate end users under 35 U.S.C. § 271(c) by providing the Accused Products, which, as evidenced by Wybotics’ own advertising materials, are specifically made for use in a manner infringing one or more claims of the ’031 Patent, such as claim 1, and have no substantial non-infringing uses.

54. On information and belief, Wybotics imports the Accused Products into the United States for further sale in the United States. *See* Ex. 2.

55. Zodiac has suffered and continues to suffer monetary damages and other injuries as a result of Wybotics' past and continuing infringement under 35 U.S.C. § 271. Zodiac has suffered damages in the form of lost profits, lost sales, and/or lost opportunities. Zodiac is entitled to recover damages to compensate Plaintiff for Wybotics' infringing activities in an amount to be determined at trial, but in no event less than a reasonable royalty.

56. Zodiac has been and continues to be irreparably injured by Wybotics' past and continuing infringement, inducement of infringement, and/or contributory infringement of the '031 Patent, and Wybotics' infringing activities will continue unless enjoined by this Court pursuant to 35 U.S.C. § 283.

57. Wybotics' infringement, inducement of infringement, and/or contributory infringement of the '031 Patent has been and continues to be willful, deliberate, and with knowledge of the '031 Patent, such that Zodiac is entitled to recover enhanced damages pursuant to 35 U.S.C. § 284 and attorney's fees and other expenses of litigation pursuant to 35 U.S.C. § 285. For example, Wybotics learned of the '031 Patent at least as early as July 29, 2022, the filing date of the ITC Investigation and CDCA Action. Additionally, as stated above, Wybotics represented in the ITC Investigation that it was no longer manufacturing the ITC Accused Products, but subsequently began manufacturing the non-materially different Accused Products while also advertising on its website that it had not made any commitments during the ITC Investigation and can freely manufacture, import, and sell in the United States. *Supra* Factual Background.

COUNT II

Infringement of U.S. Patent No. 8,393,029

58. Zodiac re-alleges and incorporates by reference the allegations of the preceding paragraphs as if set forth fully herein.

59. Without license or authorization and in violation of 35 U.S.C. § 271(a), Wybotics has infringed and/or continues to infringe the ’029 Patent by importing into this district and elsewhere in the United States, using, offering for sale, and/or selling within this district and elsewhere in the United States, products related to swimming pool cleaners which incorporate each and every element of one or more of the claims of the ’029 Patent and therefore are covered by the ’029 Patent, including but not limited to the Accused Products.

60. Wybotics directly infringed and/or infringes one or more claims of the ’029 Patent, including but not limited to claim 1, either literally or under the doctrine of equivalents by using, selling, offering for sale, or importing into the United States the Accused Products that embody each element of at least one of the claims of the ’029 Patent and will continue to do so unless enjoined by this Court.

61. The Accused Products meet each and every limitation of at least claim 1 of the ’029 Patent. An infringement claim chart is attached to this Complaint for the Wybotics HJ3172 and is incorporated herein by reference. *See* Ex. 17.

62. Wybotics also indirectly infringed and/or infringes the ’029 Patent within the United States by inducement under 35 U.S.C. § 271(b). Wybotics learned of the ’029 Patent at least as early as receipt of a letter dated February 12, 2016. Since then, Wybotics knowingly and intentionally induced, and continues to induce, others in this judicial district and throughout the United States, including but not limited to Wybotics’ customers and/or ultimate end users, to

directly infringe one or more claims of the ’029 Patent, such as claim 1. Wybotics does so, *inter alia*, by (1) providing instructions or information to explain how to use the Accused Products in an infringing manner; and (2) touting these infringing uses of the Accused Products in Wybotics’ HJ3172 Operating Manual. *See* Ex. 16.

63. Wybotics also indirectly infringed and/or infringes the ’029 Patent by contributing to direct infringement by Wybotics’ customers and/or ultimate end users under 35 U.S.C. § 271(c) by providing the Accused Products, which, as evidenced by Wybotics’ own advertising materials, are specifically made for use in a manner infringing one or more claims of the ’029 Patent, such as claim 1, and have no substantial non-infringing uses.

64. On information and belief, Wybotics imported and/or imports the Accused Products into the United States for further sale in the United States.

65. ZPCE has suffered and continues to suffer monetary damages and other injuries as a result of Wybotics’ past and continuing infringement under 35 U.S.C. § 271. ZPCE has suffered damages in the form of lost profits, lost sales, and/or lost opportunities. ZPCE is entitled to recover damages to compensate ZPCE for Wybotics’ infringing activities in an amount to be determined at trial, but in no event less than a reasonable royalty.

66. ZPCE has been and continues to be irreparably injured by Wybotics’ past and continuing infringement, inducement of infringement, and/or contributory infringement of the ’029 Patent, and Wybotics’ infringing activities will continue unless enjoined by this Court pursuant to 35 U.S.C. § 283.

67. Wybotics’ infringement, inducement of infringement, and/or contributory infringement of the ’029 Patent has been and continues to be willful, deliberate, and with knowledge of the ’029 Patent, such that ZPCE is entitled to recover enhanced damages pursuant

to 35 U.S.C. § 284 and attorney's fees and other expenses of litigation pursuant to 35 U.S.C. § 285.

COUNT III

Infringement of U.S. Patent No. 11,880,207

68. Zodiac re-alleges and incorporates by reference the allegations of the preceding paragraphs as if set forth fully herein.

69. Without license or authorization and in violation of 35 U.S.C. § 271(a), Wybotics has infringed and/or continues to infringe the '207 Patent by importing into this district and elsewhere in the United States, using, offering for sale, and/or selling within this district and elsewhere in the United States, products related to swimming pool cleaners which incorporate each and every element of one or more of the claims of the '207 Patent and therefore are covered by the '207 Patent, including but not limited to the Accused Products.

70. Wybotics directly infringed and/or infringes one or more claims of the '207 Patent, including but not limited to claim 2, either literally or under the doctrine of equivalents by using, selling, offering for sale, or importing into the United States the Accused Products that embody each element of at least one of the claims of the '207 Patent and will continue to do so unless enjoined by this Court.

71. The Accused Products meet each and every limitation of at least claim 2 of the '207 Patent. An infringement claim chart is attached to this Complaint for the Wybot M2 and is incorporated herein by reference. *See* Ex. 32.

72. Wybotics also indirectly infringed and/or infringes the '207 Patent within the United States by inducement under 35 U.S.C. § 271(b). Wybotics learned of the '207 Patent at least as early as receipt of a letter dated June 4, 2024. Since then, Wybotics knowingly and

intentionally induced, and continues to induce, others in this judicial district and throughout the United States, including but not limited to Wybotics' customers and/or ultimate end users, to directly infringe one or more claims of the '207 Patent, such as claim 2. Wybotics does so, *inter alia*, by (1) providing instructions or information to explain how to use the Accused Products in an infringing manner; and (2) touting these infringing uses of the Accused Products on Wybotics' website and in Wybotics' Wybot M2 User Manual. *See* Exs. 28 and 33.

73. Wybotics also indirectly infringed and/or infringes the '207 Patent by contributing to direct infringement by Wybotics' customers and/or ultimate end users under 35 U.S.C. § 271(c) by providing the Accused Products, which, as evidenced by Wybotics' own advertising materials, are specifically made for use in a manner infringing one or more claims of the '207 Patent, such as claim 1, and have no substantial non-infringing uses.

74. On information and belief, Wybotics imported and/or imports the Accused Products into the United States for further sale in the United States.

75. ZPS has suffered and continues to suffer monetary damages and other injuries as a result of Wybotics' past and continuing infringement under 35 U.S.C. § 271. ZPS has suffered damages in the form of lost profits, lost sales, and/or lost opportunities. ZPS is entitled to recover damages to compensate ZPS for Wybotics' infringing activities in an amount to be determined at trial, but in no event less than a reasonable royalty.

76. ZPS has been and continues to be irreparably injured by Wybotics' past and continuing infringement, inducement of infringement, and/or contributory infringement of the '207 Patent, and Wybotics' infringing activities will continue unless enjoined by this Court pursuant to 35 U.S.C. § 283.

77. Wybotics' infringement, inducement of infringement, and/or contributory infringement of the '207 Patent has been and continues to be willful, deliberate, and with knowledge of the '207 Patent, such that ZPS is entitled to recover enhanced damages pursuant to 35 U.S.C. § 284 and attorney's fees and other expenses of litigation pursuant to 35 U.S.C. § 285.

COUNT IV

Infringement of U.S. Patent No. 11,262,766

78. Zodiac re-alleges and incorporates by reference the allegations of the preceding paragraphs as if set forth fully herein.

79. Without license or authorization and in violation of 35 U.S.C. § 271(a), Wybotics has infringed and/or continues to infringe the '766 Patent by importing into this district and elsewhere in the United States, using, offering for sale, and/or selling within this district and elsewhere in the United States, products related to swimming pool cleaners which incorporate each and every element of one or more of the claims of the '766 Patent and therefore are covered by the '766 Patent, including but not limited to the Accused Products.

80. Wybotics directly infringed and/or infringes one or more claims of the '766 Patent, including but not limited to claim 4, either literally or under the doctrine of equivalents by using, selling, offering for sale, or importing into the United States the Accused Products that embody each element of at least one of the claims of the '766 Patent and will continue to do so unless enjoined by this Court.

81. The Accused Products meet each and every limitation of at least claim 4 of the '766 Patent. An infringement claim chart is attached to this Complaint for the Wybot M2 and is incorporated herein by reference. *See* Ex. 34.

82. Wybotics also indirectly infringed and/or infringes the ’766 Patent within the United States by inducement under 35 U.S.C. § 271(b). Wybotics learned of the ’766 Patent at least as early as receipt of a letter dated June 4, 2024. Since then, Wybotics knowingly and intentionally induced, and continues to induce, others in this judicial district and throughout the United States, including but not limited to Wybotics’ customers and/or ultimate end users, to directly infringe one or more claims of the ’766 Patent, such as claim 4. Wybotics does so, *inter alia*, by (1) providing instructions or information to explain how to use the Accused Products in an infringing manner; and (2) touting these infringing uses of the Accused Products on Wybotics’ website and in Wybotics’ Wybot M2 User Manual. *See* Exs. 28 and 33.

83. Wybotics also indirectly infringed and/or infringes the ’766 Patent by contributing to direct infringement by Wybotics’ customers and/or ultimate end users under 35 U.S.C. § 271(c) by providing the Accused Products, which, as evidenced by Wybotics’ own advertising materials, are specifically made for use in a manner infringing one or more claims of the ’766 Patent, such as claim 1, and have no substantial non-infringing uses.

84. On information and belief, Wybotics imported and/or imports the Accused Products into the United States for further sale in the United States.

85. ZPS has suffered and continues to suffer monetary damages and other injuries as a result of Wybotics’ past and continuing infringement under 35 U.S.C. § 271. ZPS has suffered damages in the form of lost profits, lost sales, and/or lost opportunities. ZPS is entitled to recover damages to compensate ZPS for Wybotics’ infringing activities in an amount to be determined at trial, but in no event less than a reasonable royalty.

86. ZPS has been and continues to be irreparably injured by Wybotics’ past and continuing infringement, inducement of infringement, and/or contributory infringement of the

'766 Patent, and Wybotics' infringing activities will continue unless enjoined by this Court pursuant to 35 U.S.C. § 283.

87. Wybotics' infringement, inducement of infringement, and/or contributory infringement of the '766 Patent has been and continues to be willful, deliberate, and with knowledge of the '766 Patent, such that ZPS is entitled to recover enhanced damages pursuant to 35 U.S.C. § 284 and attorney's fees and other expenses of litigation pursuant to 35 U.S.C. § 285.

COUNT V

Infringement of U.S. Patent No. 11,003,191

88. Zodiac re-alleges and incorporates by reference the allegations of the preceding paragraphs as if set forth fully herein.

89. Without license or authorization and in violation of 35 U.S.C. § 271(a), Wybotics has infringed and/or continues to infringe the '191 Patent by importing into this district and elsewhere in the United States, using, offering for sale, and/or selling within this district and elsewhere in the United States, products related to swimming pool cleaners which incorporate each and every element of one or more of the claims of the '191 Patent and therefore are covered by the '191 Patent, including but not limited to the Accused Products.

90. Wybotics directly infringed and/or infringes one or more claims of the '191 Patent, including but not limited to claim 3, either literally or under the doctrine of equivalents by using, selling, offering for sale, or importing into the United States the Accused Products that embody each element of at least one of the claims of the '191 Patent and will continue to do so unless enjoined by this Court.

91. The Accused Products meet each and every limitation of at least claim 3 of the '191 Patent. An infringement claim chart is attached to this Complaint for the Wybot M2 and is incorporated herein by reference. *See* Ex. 35.

92. Wybotics also indirectly infringed and/or infringes the '191 Patent within the United States by inducement under 35 U.S.C. § 271(b). Wybotics learned of the '191 Patent at least as early as receipt of a letter dated June 4, 2024. Since then, Wybotics knowingly and intentionally induced, and continues to induce, others in this judicial district and throughout the United States, including but not limited to Wybotics' customers and/or ultimate end users, to directly infringe one or more claims of the '191 Patent, such as claim 3. Wybotics does so, *inter alia*, by (1) providing instructions or information to explain how to use the Accused Products in an infringing manner; and (2) touting these infringing uses of the Accused Products on Wybotics' website and in Wybotics' Wybot M2 User Manual. *See* Exs. 28 and 33.

93. Wybotics also indirectly infringed and/or infringes the '191 Patent by contributing to direct infringement by Wybotics' customers and/or ultimate end users under 35 U.S.C. § 271© by providing the Accused Products, which, as evidenced by Wybotics' own advertising materials, are specifically made for use in a manner infringing one or more claims of the '191 Patent, such as claim 1, and have no substantial non-infringing uses.

94. On information and belief, Wybotics imported and/or imports the Accused Products into the United States for further sale in the United States.

95. ZPS has suffered and continues to suffer monetary damages and other injuries as a result of Wybotics' past and continuing infringement under 35 U.S.C. § 271. ZPS has suffered damages in the form of lost profits, lost sales, and/or lost opportunities. ZPS is entitled to recover

damages to compensate ZPS for Wybotics' infringing activities in an amount to be determined at trial, but in no event less than a reasonable royalty.

96. ZPS has been and continues to be irreparably injured by Wybotics' past and continuing infringement, inducement of infringement, and/or contributory infringement of the '191 Patent, and Wybotics' infringing activities will continue unless enjoined by this Court pursuant to 35 U.S.C. § 283.

97. Wybotics' infringement, inducement of infringement, and/or contributory infringement of the '191 Patent has been and continues to be willful, deliberate, and with knowledge of the '191 Patent, such that ZPS is entitled to recover enhanced damages pursuant to 35 U.S.C. § 284 and attorney's fees and other expenses of litigation pursuant to 35 U.S.C. § 285.

PRAYER FOR RELIEF

WHEREFORE, Zodiac respectfully requests that the Court:

A. Enter judgment that Wybotics has infringed at least one or more claims of the '031 Patent, directly and/or indirectly, literally and/or under the doctrine of equivalents;

B. Enter judgment that Wybotics has infringed at least one or more claims of the '029 Patent, directly and/or indirectly, literally and/or under the doctrine of equivalents;

C. Enter judgment that Wybotics has infringed at least one or more claims of the '207 Patent, directly and/or indirectly, literally and/or under the doctrine of equivalents;

D. Enter judgment that Wybotics has infringed at least one or more claims of the '766 Patent, directly and/or indirectly, literally and/or under the doctrine of equivalents;

E. Enter judgment that Wybotics has infringed at least one or more claims of the '191 Patent, directly and/or indirectly, literally and/or under the doctrine of equivalents;

F. Award Zodiac its actual damages as a result of Wybotics' infringing activities;

G. Permanently enjoin Wybotics from continuing to infringe, induce infringement, or contribute to infringement of the ’031 patent, pursuant to 35 U.S.C. § 283;

H. Permanently enjoin Wybotics from continuing to infringe, induce infringement, or contribute to infringement of the ’029 patent, pursuant to 35 U.S.C. § 283;

I. Permanently enjoin Wybotics from continuing to infringe, induce infringement, or contribute to infringement of the ’207 patent, pursuant to 35 U.S.C. § 283;

J. Permanently enjoin Wybotics from continuing to infringe, induce infringement, or contribute to infringement of the ’766 patent, pursuant to 35 U.S.C. § 283;

K. Permanently enjoin Wybotics from continuing to infringe, induce infringement, or contribute to infringement of the ’191 patent, pursuant to 35 U.S.C. § 283;

L. Award Zodiac damages in an amount to be proven at trial because of the injury suffered by reason of Wybotics’ infringement of the ’031 Patent;

M. Award ZPCE damages in an amount to be proven at trial because of the injury suffered by reason of Wybotics’ infringement of the ’029 Patent;

N. Award ZPS damages in an amount to be proven at trial because of the injury suffered by reason of Wybotics’ infringement of the ’207 Patent;

O. Award ZPS damages in an amount to be proven at trial because of the injury suffered by reason of Wybotics’ infringement of the ’766 Patent;

P. Award ZPS damages in an amount to be proven at trial because of the injury suffered by reason of Wybotics’ infringement of the ’191 Patent;

Q. Increase the damages awarded to Zodiac by three times the amount found to be Zodiac’s actual damages, as authorized by 35 U.S.C. § 284 as a result of Wybotics’ willful infringement of the ’031 Patent;

R. Increase the damages awarded to ZPCE by three times the amount found to be ZPCE's actual damages, as authorized by 35 U.S.C. § 284 as a result of Wybotics' willful infringement of the '029 Patent;

S. Increase the damages awarded to ZPS by three times the amount found to be ZPS's actual damages, as authorized by 35 U.S.C. § 284 as a result of Wybotics' willful infringement of the '207 Patent;

T. Increase the damages awarded to ZPS by three times the amount found to be ZPS's actual damages, as authorized by 35 U.S.C. § 284 as a result of Wybotics' willful infringement of the '766 Patent;

U. Increase the damages awarded to ZPS by three times the amount found to be ZPS's actual damages, as authorized by 35 U.S.C. § 284 as a result of Wybotics' willful infringement of the '191 Patent;

V. Award Zodiac its expenses of litigation, including reasonable attorney's fees pursuant to 35 U.S.C. § 285;

W. Award Zodiac prejudgment interest, post-judgment interest, and costs pursuant to 35 U.S.C. § 284; and

X. Award Zodiac such other and further relief as the Court deems just and proper.

JURY DEMAND

Zodiac, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury on all issues so triable.

Dated: September 22, 2025

Respectfully submitted,

/s/ Steven D. Moore

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Attorneys for Zodiac Pool Systems LLC and Zodiac Pool Care Europe

CERTIFICATE OF SERVICE

I, Robert Botchway, hereby certify that on September 22, 2025, I served the document entitled: **FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT AGAINST WYBOTICS, CO. LTD** on the interested parties in this action, as follows:

☒ [By First Class Mail] I am readily familiar with my employer's practice for collecting and processing documents for mailing with the United States Postal Service. On the date listed herein, following ordinary business practice, I served the within document at my place of business, by placing a true copy thereof, enclosed in a sealed envelope, with first class postage thereon fully prepaid, for collection and mailing with the United States Postal Service, where it would be deposited with the United States Postal Service that same day in the ordinary course of business.

Officer for Defendant: Wybotics, Co. Ltd.
Jose Valles 12121 SW 112th Ave Miami, FL 33176

☐ [By Overnight Courier] I caused each envelope to be delivered by a commercial carrier service for overnight delivery to the offices of the addressee(s).

☒ [By Electronic Transmission] I caused said document to be sent by electronic transmission to the e-mail address indicated for the parties listed below from email address RBotchway@ktslaw.com.

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/s/ Robert Botchway
Robert Botchway

EXHIBIT 5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the *Inter Partes* Review of U.S. Patent No. 11,262,766

Trial No.: Not Yet Assigned

Issued: March 1, 2022

Filed: January 7, 2021

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 1-5 of U.S. Patent No. 11,262,766 ("the '766 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	[Reserved]
EX1002	[Reserved]
EX1003	U.S. Patent No. 11,262,766 (the "'766 Patent")
EX1004	File History of the '766 Patent
EX1005	[Reserved]
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EX1011	U.S. Provisional Application 61/428,808 (the "'808 provisional")
EX1012	Redline comparison between Schnittman and the '808 provisional
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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	U.S. Patent No. 8,364,309 ("Bailey")
EX1019	U.S. Patent Pub. No. 2011/0139727 ("Hui")

LIST OF PETITIONER EXHIBITS
(continued)

EX1020-1029	[Reserved]
EX1030	U.S. Patent No. 3,439,368 ("Myers II"), invented by Robert R. Myers, filed January 3, 1967
EX1031	U.S. Patent No. 5,351,355 ("Chiniara"), invented by Paul Chiniara, filed May 26, 1993

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 '766 Patent is a classic example of a "bad" patent that IPRs were designed to weed out. 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 '766 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 '766 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 '766 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 '766 Patent is "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." But that feature is not new, either. The '766 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 '766 Patent. EX1003.

Fu discloses a self-propelled robotic pool cleaner having all of the elements claimed in the '766 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. EX1007, ¶ [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

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 '766 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 '766 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.

The Board should cancel claims 1-5 of the '766 Patent.

II. THE '766 PATENT AND CLAIM CONSTRUCTION

A. Summary Of The '766 Patent

The '766 Patent, entitled "Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera," issued with five total claims, each independent. EX1003, (54), claims 1-5. The claims are directed generally to a self-propelled swimming pool cleaner that uses an image captured by a camera to control the pool cleaner. *Id*., claims 1-5.

The '766 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*., 3:1-19, 3:31-43. Vehicle 30 uses 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*., 3:9-14. One or more cameras 32 capture an image of submerged surfaces of the pool. *Id*., 3:46-55. Controller 42 "generate[s] control 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 '766 Patent was filed on Jan. 7, 2021 as U.S. Patent Application No. 17/143,624. *Id*., (21), (22). The '766 Patent is sixth in a series of continuation

applications claiming priority 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.

Originally filed claims 1-19 were copies of claims filed in a parent application, U.S. Patent Application No. 16/416,840 (the "'840 application"). *Compare* EX1004, 17-19 *with* EX1009, 17-19. Prior to examination, the applicant filed a preliminary amendment, canceling claims 1-19 and adding new claims 20-24, which have since issued as claims 1-5 of the '766 Patent. EX1004, 38-42.

No prior art rejections were issued against the claims. The sole Office Action contained only a nonstatutory double patenting rejection that was overcome via a terminal disclaimer. *Id*., 70-86, 116-118. The Notice of Allowance identified claim 1's "controller" limitation as allegedly inventive. *Id*., 133-137 (also identifying the "controller" limitations of claims 2-5 as allegedly inventive).

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.F.4.f-h. The Office failed to conduct a meaningful substantive examination of the '766 Patent; the application was filed as a continuation in a long series of allowed continuations, and the Examiner issued only a nonstatutory double patenting rejection without vetting the claims against relevant prior art. Had the Office conducted a complete examination, the '766 Patent would not have issued.

Patent Owner Zodiac Pool Systems LLC
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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.

"Where the claim to be construed contains a means-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 term "means for moving the vehicle body within the swimming pool," as recited in claims 1-5, is a means-plus-function (MPF) 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 term:

Claim Limitation	**Corresponding Structure**	**Function**

[1b], [2b], [3b], [4b], [5b] means for moving the vehicle body within the swimming pool	"In one implementation, vehicle 30 is propelled along the submerged pool surfaces using ***wheels, rollers, tracks or other surface contacting members powered by a motor and the like***. … In one implementation vehicle 30 may also alternatively be propelled by means of the ***vacuum or liquid jets***. … In other implementations, vehicle 30 may include other propulsion mechanisms." EX1003, 3:32-43.	Moving the vehicle body within the swimming pool EX1003, claims 1-5.

Thus, the corresponding structures disclosed for "means for moving" include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like" and "vacuum or liquid jets." EX1003, 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. POSA's Skill Level

A POSA 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.

Patent Owner Zodiac Pool Systems LLC
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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 '766 Patent is eligible for IPR, and that Wybotics is not barred or estopped from requesting IPR of claims 1-5 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	1-4	Fu (EX1007, CN 101139007 B) anticipates under § 102
Ground 1b	1-4	Fu renders obvious under § 103
Ground 1c	1-4	Fu in view of Benzler (EX1013, U.S. Patent Pub. No. 2010/0299016) renders obvious under § 103
Ground 1d	5	Fu in view of Hui (EX1019, U.S. Patent Pub. No. 2011/0139727) renders obvious under § 103
Ground 1e	5	Fu in view of Benzler further in view of Hui renders obvious under § 103
Ground 2a	1, 2, 4	Schnittman (EX1008, U.S. Patent Pub. No. 20120169497) in view of Benzler renders obvious under § 103
Ground 2b	3	Schnittman in view of Benzler further in view of Bailey (EX1018, U.S. Patent No. 8,364,309) renders obvious under § 103
Ground 2c	5	Schnittman in view of Benzler further in view of Hui renders obvious under § 103

IV. CLAIMS 1-5 ARE UNPATENTABLE

A. Ground 1a: Fu Anticipates Claims 1-4

1. Summary Of Fu

Fu, entitled "Underwater Cleaning Robot," was filed on July 31, 2007 as Application No. 200710119800.5 in China. EX1007, (19), (21), (22). 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).

Fu describes a robot designed "for the underwater cleaning of swimming pool floors and walls." *Id.*, Abstract.

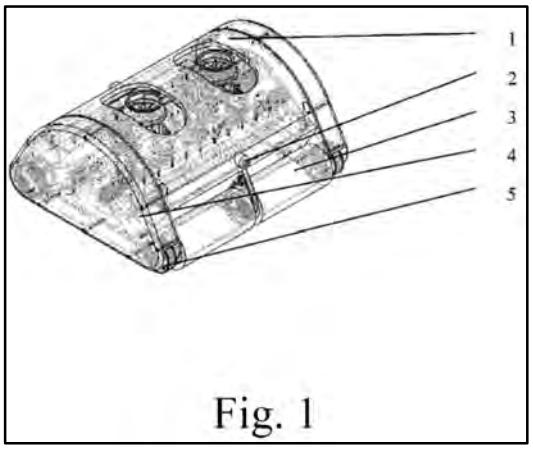


Fig. 1

Id., Fig. 1. The underwater cleaning robot has two operational modes: (i) manual mode, where a control keypad is used to send control signals to the robot; and (ii) autonomous mode, where the control system controls the robot's operations based on an image received from cameras. *Id.*, ¶[0025].

The robot "comprises a drainage mechanism, a cleaning and mobility platform, and a control system." *Id.*, ¶[0024]. These three units coordinate to

"perform cleaning tasks autonomously or via remote control underwater on horizontal, vertical, and inclined surfaces." *Id*., Abstract. The drainage mechanism filters pool water by drawing in water, filtering it to remove any debris, and discharging the filtered water into the pool. *Id*., ¶¶[0024]-[0026]. The cleaning and mobility platform provides structural support and propulsion to the robot, while also performing "brush-cleaning" of the pool surface via cleaning driving wheels 3. *Id*. The control system autonomously controls the robot's operations by generating control signals based on an image received from monitoring cameras 2, that are installed on the robot's housing. *Id.*

2. 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, claim 1's preamble is disclosed by Fu. EX1010, ¶¶225-228. Fu discloses "an underwater cleaning robot" designed "for the underwater cleaning of swimming pool floors and walls." EX1007, Abstract.

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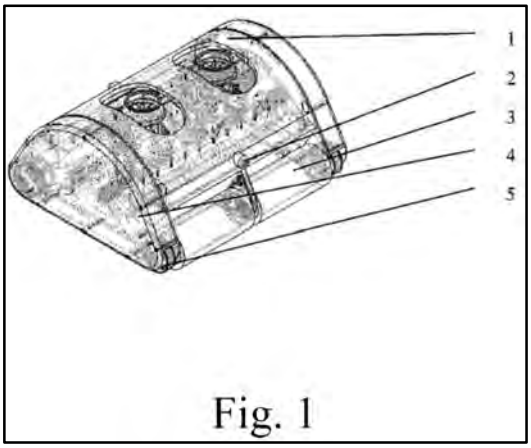


Fig. 1

Id., Fig. 1 (underwater cleaning robot). Fu's robot comprises "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's robot is also self-propelled. The robot's cleaning and mobility platform comprises "four independent cleaning driving wheels 3" that "are controlled by their respective motor drivers, allowing for independent movement." *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

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complete the underwater cleaning task." *Id.*, ¶[0025]. The execution layer comprises motor drivers and cleaning driving wheel DC motors 7, which drive 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].

Thus, Fu discloses a "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. EX1010, ¶¶229-231. Figure 1 illustrates "[o]verall schematic diagram of the underwater cleaning robot," including "1 - robot housing body" (EX1007, ¶[0014]):

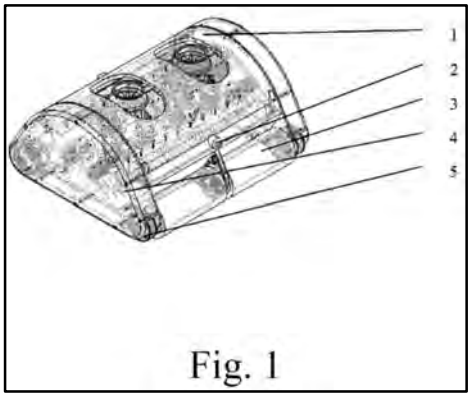


Fig. 1

Id., Fig. 1. The "housing body 1 comprises a robot top cover 18, robot side walls 20, and a robot main housing body 19." *Id.*, ¶[0024].

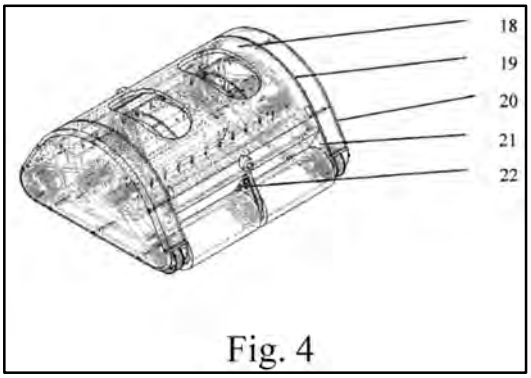


Fig. 4

Id., Fig. 4. Accordingly, Fu discloses "a vehicle body [robot housing body 1]."

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

Fu discloses element 1b. EX1010, ¶¶232-235. The term "means for moving the vehicle body within the swimming pool" is an MPF term, whose corresponding structures include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like." EX1003, 3:31-43; Section II.C.1.

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, comprises "a robot housing body 1, cleaning driving wheels 3, synchronous belt gears 5, and a driving synchronous belt 4." *Id.* A driving DC motor 7 drives cleaning driving wheels 3 via synchronous belt gears 5 and 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

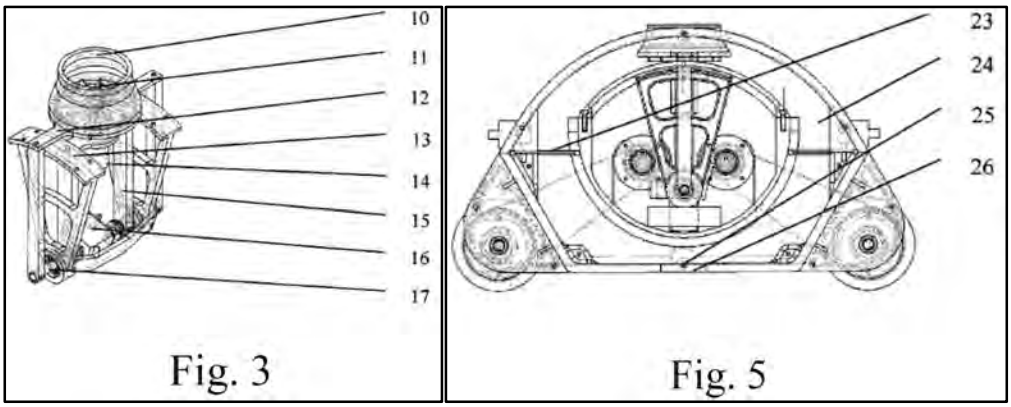
driving wheels [3] via synchronous belt gears [5] and synchronous belts [4].").

Further, cleaning driving wheels 3 "are controlled by their respective motor drivers, allowing for independent movement." *Id.*, ¶[0026]. "By using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, turning, and brush-cleaning." *Id*, ¶[0026].

Thus, Fu teaches "means for moving the vehicle body within the swimming pool [driving wheels 3 powered by cleaning driving wheel DC motors 7]."

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

Fu discloses element 1c. EX1010, ¶¶236-239. Fu's robot includes a "drainage mechanism" designed to draw in pool water, filter out debris from the water, and discharge the filtered water while retaining the debris. EX1007, ¶¶[0024]-[0026]. Figures 3 and 5 illustrate an example schematic of the drainage mechanism:



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

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 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 also retains the debris that is filtered out from the 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, the debris is retained within water flow channel 24. Fu also describes that "[w]hen the debris [inside flow channel 24] reaches a certain density, [the robot] issues a 'debris full' alarm," further confirming that the drainage mechanism retains the debris. *Id*.

Thus, Fu discloses "a filter [filter screen 23 of Fu's drainage mechanism] configured to retain debris collected from the submerged surface."

(e) Element 1d: "at least one camera mounted directly or indirectly to the body for capturing an image of at least a first portion of the submerged surface; and"

Fu discloses element 1d. EX1010, ¶¶240-242. Fu's robot comprises "2 – monitoring camera":

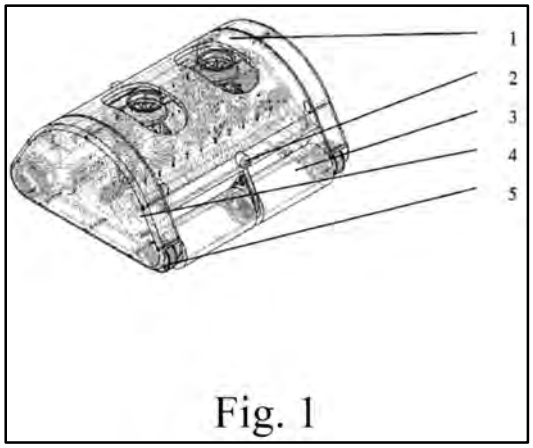


Fig. 1

EX1007, ¶[0014], Fig. 1. "Said monitoring cameras 2 are installed on the two front panels of the robot main housing body," such that cameras 2 are "mounted directly or indirectly to the body". *Id.*, ¶[0024]. The robot "uses its monitoring cameras 2 to capture images of the pool floor," which is the "submerged surface." *Id.*, ¶[0026].

Therefore, Fu discloses "at least one camera [monitoring cameras 2] mounted directly or indirectly to the body [robot housing body 1] for capturing an image of at least a first portion of the submerged surface [pool floor]."

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

Fu discloses element 1e. EX1010, ¶¶243-246. Fu discloses a control system comprising "a central processor, monitoring cameras, an image acquisition card, …

motor drivers, … [and] cleaning driving wheel DC motors 7," all encapsulated within a "control system box 8." EX1007, ¶[0024].

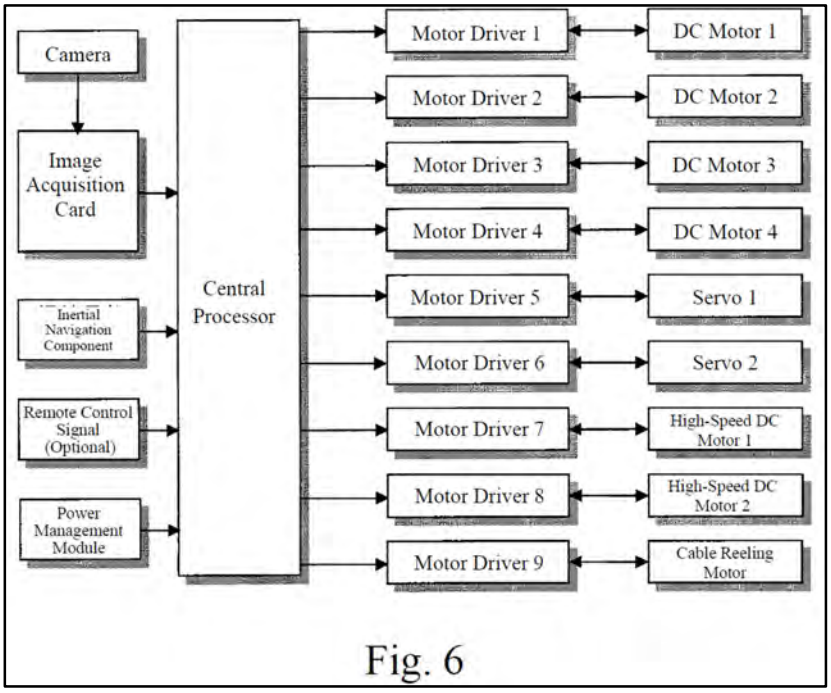


Fig. 6

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

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:

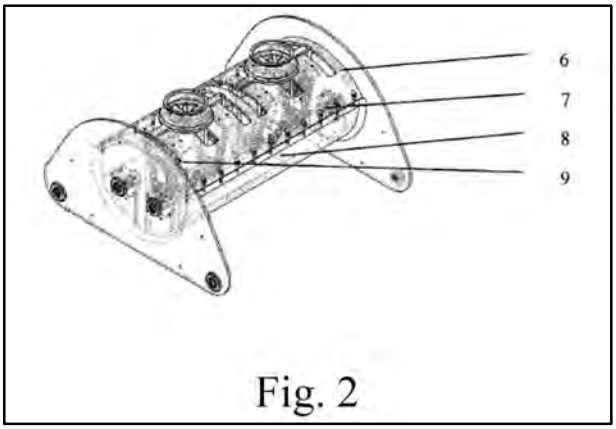


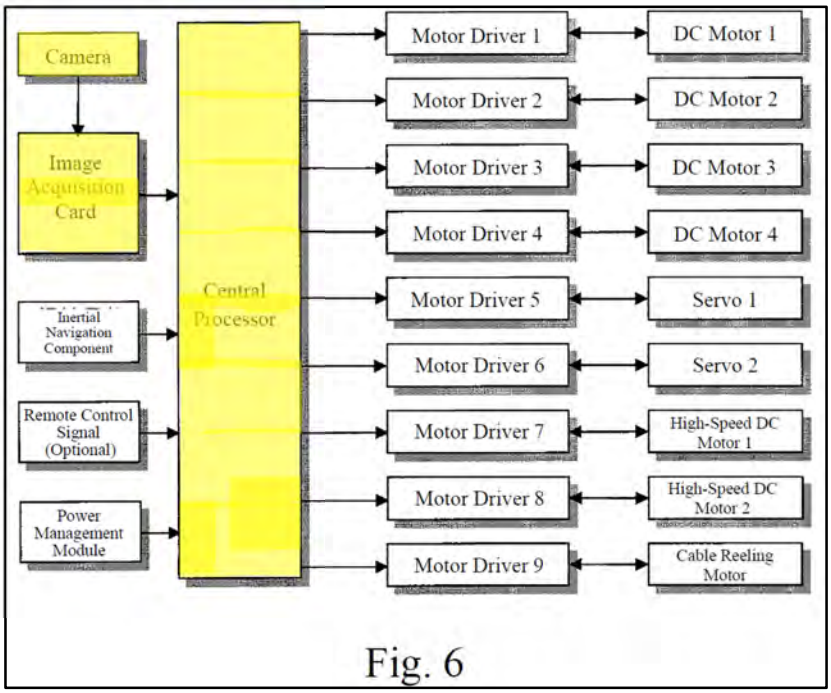
Fig. 2

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Id., ¶[0024], Fig. 2. 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].

(g) Element 1f: "[the controller] (ii) in electronic communication with the at least one camera, and"

Fu discloses element 1f. EX1010, ¶247. "[T]he monitoring cameras (2) are connected to the central processor via the image acquisition card." EX1007, Fig. 6, claim 1.



Id., Fig. 6 (annotated). The image acquisition card serves as an electronic interface that transmits an image from monitoring cameras 2 to the central processor for processing, such that the controller (control system with central processor) is "in electronic communication with the at least one camera [monitoring cameras 2]."

EX1010, ¶247.

(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. *Id.*, ¶¶248-252. Fu explains that "[t]he monitoring cameras 2 and the image acquisition card constitute the environmental perception layer of the control system," which "constitutes the input part of the control system." EX1007, ¶[0024]. "[I]nformation from the environmental perception layer," *i.e.*, image captured by 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].

As shown in Figure 6, the central processor receives the image captured by cameras 2 via the image acquisition card. *Id.*, claim 1, Fig. 6. 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 [*i.e.*, motor drivers that drive wheels 3] and complete the underwater cleaning task." *Id.*, ¶[0025].

Fu further describes this process in detail:

> 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].

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.*

Thus, Fu's central processor receives the image captured by cameras 2 to assess the "level of cleanliness" of the pictured region *Id.*, ¶¶[0024]-[0026]. 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.*, ¶[0026]. A POSA would have recognized that any robot movement would necessarily be "to, or away from, the first portion" captured by Fu's cameras 2. EX1010, ¶¶251-252.

Further, as Dr. Reinholtz explains, because the central processor generates control signals in response to the "level of cleanliness" of a pictured region, and those signals drive movement in "forward, backward, [or] turning" directions, a POSA would have understood that the controller directs the robot toward regions

assessed as falling below the "pool cleanliness image threshold" and away from regions assessed as falling above. *Id.*

Thus, Fu discloses discloses the controller (control system with 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."

Fu anticipates claim 1. *Id.*, ¶¶224-253.

3. Claim 2

Claim 2 is anticipated by Fu for the reasons explained for claim 1. *Id.*, ¶¶254-255. Claim 2 recites all the limitations of claim 1, with the only difference being that claim 2 recites "at least one camera carried by the body," whereas claim 1 recites "at least one camera mounted directly or indirectly to the body":

> ~~1~~2. A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
>
> a. a vehicle body;
>
> b. means for moving the vehicle body within the swimming pool;
>
> c. a filter configured to retain debris collected from the submerged surface;
>
> d. at least one camera ~~mounted directly or indirectly to~~carried by the body for capturing an image of at least a first portion of the submerged surface; and
>
> e. a controller (i) positioned on or in the body, (ii) in electronic communication with the at least one camera, and (iii) 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.

These limitations are substantially the same, differing only in wording. A camera that is "mounted directly or indirectly to the body" is, by definition, "carried by the body." Thus, Fu anticipates claim 2. *Id.*, ¶¶254-255.

4. Independent Claim 3

Claim 3 is anticipated by Fu. *Id.*, ¶¶256-257. The preamble and elements 3a-3c of claim 3 are the same as the preamble and elements 1a-1c of claim 1:

> ~~1~~3. A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
>
> a. a vehicle body;
>
> b. means for moving the vehicle body within the swimming pool;
>
> c. a filter configured to retain debris collected from the submerged surface;
>
> d. at least one camera ~~mounted directly or indirectly to~~positioned on or in, or carried by, the body for capturing an image of at least a first portion of the submerged surface; and
>
> e. a controller (i) positioned on or in the body, (ii) in electronic communication with the at least one camera and a portable electronic device, and (iii) configured to generate, in response to at least one of the captured image or information from the portable electronic device, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface.

Similarly, element 3d is substantially the same as element 1d, differing only in

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wording. A camera that is "mounted directly or indirectly to the body" is, by definition, "positioned on or in, or carried by the body." Therefore, the preamble and elements 3a-3d are disclosed by Fu for the reasons explained for claim 1.

(a) Element 3e: "a controller (i) positioned on or in the body,"

Fu discloses element 3e for the reasons explained for element 1e. Section IV.A.2.f; EX1010, ¶258.

(b) Element 3f: "[the controller] (ii) in electronic communication with the at least one camera and a portable electronic device, and"

Fu discloses element 3f. *Id.*, ¶¶259-266. As explained for element 1f, Fu discloses that the controller (control system with central processor) is "in electronic communication with the at least one camera [monitoring cameras 2]." Section IV.A.2.g.

Additionally, Fu teaches a "portable electronic device." In the manual mode, "control signals are issued by manual operation of a control keypad [31] and [these signals] control the underwater cleaning robot directly or indirectly via the control signal floating antenna [27]." EX1007, ¶¶[0008], [0025]. Figures 7 and 8 show an example control keypad 31 as a remote, external unit that is untethered to the robot, underscoring that it is a separate, portable electronic device:

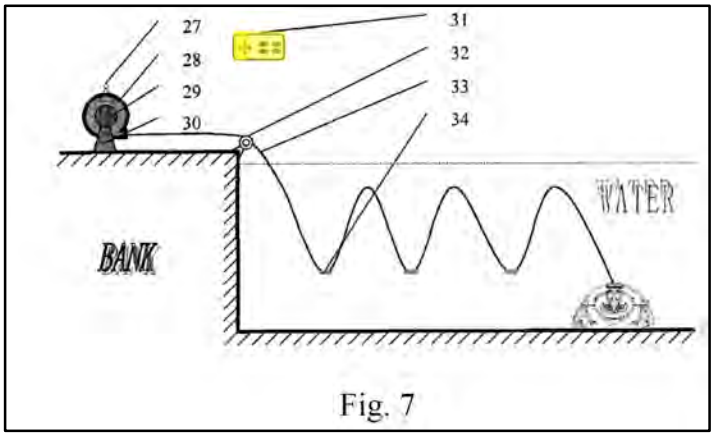


Fig. 7

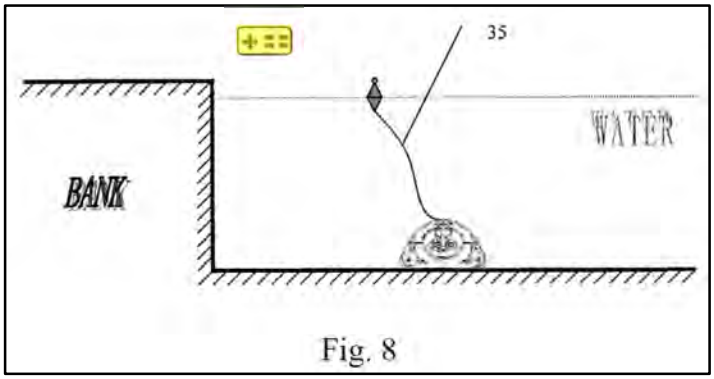


Fig. 8

Id., Figs. 7, 8 (annotated). These figures also show that control keypad 31 includes various buttons for user input for controlling the robot.

Fu further explains that control signal floating antenna 27 "communicate[s] wirelessly with the control keypad 31" to receive the control signals. *Id.*, ¶¶[0007], [0024]. Antenna 27 then transmits those signals to the central processor via the remote control signal interface. *Id.*, ¶¶[0007], [0008], [0024]-[0025].

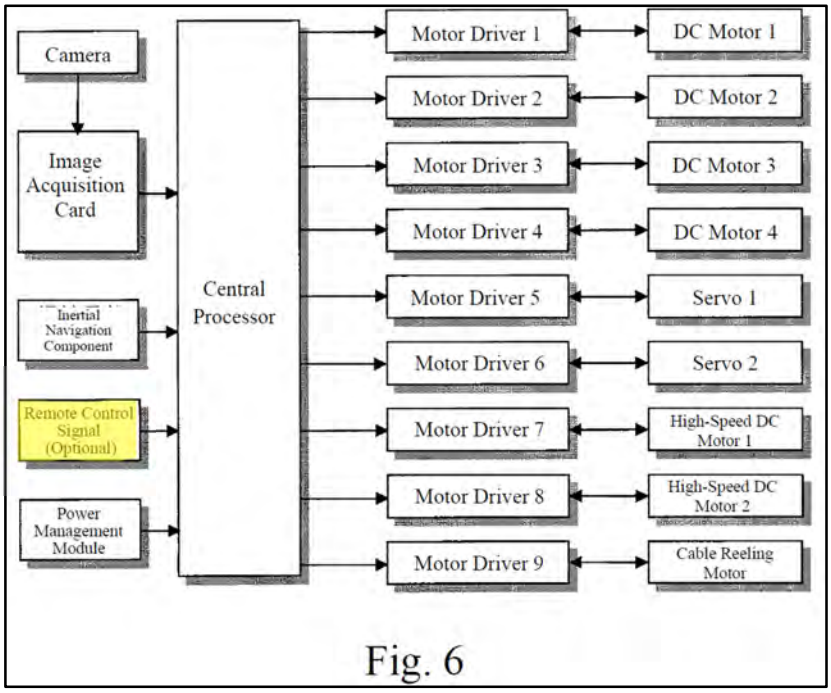


Fig. 6

Id., Fig. 6 (annotated). In one embodiment, where the robot performs "long-duration, global cleaning" (Figure 7), antenna 27 transmits the control signals from control keypad 31 to the remote control signal interface via signal and power cable 33. *Id.*, ¶¶[0007], [0008], [0024]-[0025]. In another embodiment, where the robot performs "short-duration, local cleaning" (Figure 8), antenna 27 transmits the control signals from control keypad 31 to the remote control signal interface via control signal floating antenna cable 35. *Id.*

In sum, remote control keypad 31 sends electronic control signals to antenna 27, which relays those signals, via cable 33 or cable 35, to the remote control signal interface, which relays those signals to the central processor of the control system. *Id.*.

Fu further reinforces that its control system can interface with various types of portable electronic devices. For example, Fu discloses that "the signal relay and cable manager 28 can be connected to an external display device to show the working status and relevant performance indicators of the underwater cleaning robot," thus confirming that Fu contemplates various types of portable electronic devices, including display devices. *Id*., ¶[0024].

Therefore, Fu's controller (control system with central processor) is "in electronic communication with the at least one camera [monitoring cameras 2] and a portable electronic device [control keypad 31]." EX1010, ¶¶259-266.

(c) Element 3g: "[the controller] (iii) configured to generate, in response to at least one of the captured image or information from the portable electronic device, at least one control signal to cause movement of the body within the swimming pool to, or away from, the first portion of the submerged surface."

Fu discloses element 3g. *Id.*, ¶¶267-269. As explained for element 1g, Fu's controller (control system with central processor) is "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." Section IV.A.2.h.

Additionally, as explained for element 3f, in the manual cleaning mode, control signals, *i.e.*, "information," issued by the portable electronic device (control keypad 31) are relayed to the central processor that directs the robot's operations

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based on those signals. Section IV.A.4.b; Section IV.A.2.h.

Therefore, Fu discloses the controller (control system with central processor) "configured to generate, in response to at least one of the captured image [image captured by monitoring cameras 2] or information from the portable electronic device [control signals from control keypad 31], at least one control signal to cause movement of the body [robot housing body 1] within the swimming pool to, or away from, the first portion of the submerged surface."

Thus, Fu anticipates claim 3. EX1010, ¶¶256-270.

5. Independent Claim 4

Claim 4 is anticipated by Fu for the reasons explained for claim 1. *Id.*, ¶¶271-273. Claim 4 recites all the limitations of claim 1, but claim 4 is broader because it does not require the "at least one camera" to be "mounted directly or indirectly to the body" as claim 1 does:

> ~~1~~4. A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
>
> a. a vehicle body;
>
> b. means for moving the vehicle body within the swimming pool;
>
> c. a filter configured to retain debris collected from the submerged surface;
>
> d. at least one camera ~~mounted directly or indirectly to the body~~ for capturing an image of at least a first portion of the submerged surface; and

> e. 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 from, the first portion of the submerged surface.

Because Fu anticipates the narrower claim 1, Fu likewise anticipates the broader claim 4.

Thus, Fu anticipates claim 4. *Id.*, ¶¶271-273.

B. Ground 1b: Claims 1-4 Would Have Been Obvious Over Fu

Fu anticipates claims 1-4. *See* Section IV.A. However, to the extent the Board finds that Fu does not anticipate claims 1-4 for allegedly lacking at least one control signal that causes movement of the vehicle body "to, or away from, the first portion of the submerged surface,"[1] Fu nevertheless would have rendered obvious these claims. EX1010, ¶¶274-277.

[1] As explained in Section IV.A.2.h, such a finding would be erroneous because claims 1-4 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, ¶¶248-253. 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 2-4. *Id.*, ¶¶248-253, 274-277.

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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]. A POSA would have found it obvious to implement motion control in Fu to direct the cleaning robot (i) toward image-identified dirty regions (*i.e.*, regions below Fu's cleanliness threshold), and (ii) away from clean regions (*i.e.*, regions above the threshold). EX1010, ¶275. Once Fu distinguishes areas as sub-threshold versus above-threshold, using that information to guide the robot towards dirtier areas and away from cleaner areas would have been a routine, predictable application obvious to a POSA. *Id.*

A POSA would have been motivated to do so because this would improve cleaning efficiency and task completion time. *Id.*, ¶276. The resulting behavior—spending more time in dirtier areas and less in cleaner areas—would have been the expected and desirable outcome. *Id.* Likewise, 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 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 "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, Fu would have rendered obvious claims 1-4. *Id.*, ¶¶274-277.

C. Ground 1c: Claims 1-4 Would Have Been Obvious Over Fu In View Of Benzler

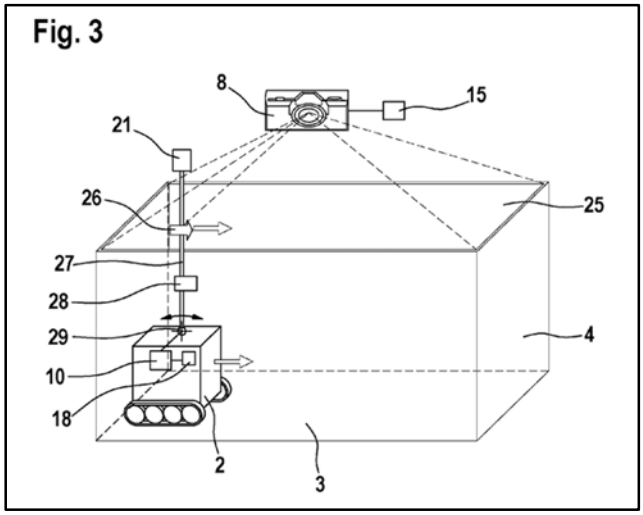
1. Summary Of Benzler

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 U.S. 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 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 robotic vehicle 2 for execution. *Id.*, ¶¶[0044]-[0046].

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 pool embodiment, "[t]he external border 4 of the work area 3 is created by the surrounding pool walls." Figure 3 illustrates the activation system as pool robotic vehicle 2 (*id.*, ¶¶[0036], [0051]-[0056]):



Id., Fig. 3.

Camera 8 transmits data via logic unit 10 to control unit 18, "which controls the not shown drive means" for driving robotic cleaning vehicle 2. *Id.*, ¶[0054].

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

To the extent the Board determines that Fu alone does not anticipate or render obvious the "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 1-4 are nonetheless obvious over Fu in combination with Benzler. EX1010, ¶¶278-283.

The similar disclosures of Fu and Benzler would have motivated a POSA to consider them together. *Id.*, ¶¶279-282. Fu discloses capturing an image of the pool floor, comparing it to a cleanliness threshold to determine a level of cleanliness, and then adjusting the robot's operations accordingly. EX1007, ¶[0026]. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1; EX1013, Abstract, ¶¶[0016], [0018], [0028], [0037], [0044]-[0046], [0053]. Thus, Benzler, like Fu, is directed to an autonomous robotic cleaner that uses an image to guide its operations, particularly in a pool-cleaning embodiment.

Benzler describes various embodiments of its robotic vehicle, such as an autonomous lawnmower. EX1013, ¶[0023]. In this embodiment, "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], [0023], [0045]. 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

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 image-based 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, ¶282. Applying Benzler's classification-driven motion to Fu's thresholded cleanliness determinations would have yielded the control signal for causing movement "to, or away from" a portion of the submerged surface captured by the 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

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routine controller configuration that would have been within a POSA's skill. *Id.*, ¶282.

Thus, Fu in view of Benzler renders obvious the "to, or away from" control-signal limitation of claims 1-4 by teaching and motivating use of an image to control motion toward target (dirtier) regions and away from non-target (cleaner) regions. *Id.*, ¶¶278-283.

Claims 1-4 would have been obvious over Fu in view of Benzler. *Id.*, ¶¶278-283.

D. Ground 1d: Claim 5 Would Have Been Obvious Over Fu In View Of Hui

1. Summary Of Hui

Hui, EX1019, entitled "Pool Cleaning Vehicle Having Structure for Cleaning and Sanitizing Pool Water," was filed on Nov. 18, 2008 as U.S. Patent Application No. 12/272,908, and published on June 16, 2011 as U.S. Patent Pub. No. 2011/0139727. EX1019, (10), (21), (22), (43), (54). Hui is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

Hui discloses an automated pool cleaning vehicle "which includes the ability for cleaning and sanitizing pool water." EX1019, Abstract, ¶[0001]. The cleaning is performed via "a filter bag, which traps dirt and debris and prevents its return to the pool water," while the sanitizing is performed via "a chemical dispenser [30] for adding chemicals to pool water." *Id.*, ¶[0012]. The chemical dispenser has "a hollow

interior suitable for storing chemicals for sanitizing pool water," and is configured to release the chemicals, such as chlorine, as water passes through it. *Id*., Abstract, ¶¶[0006], [0018], [0022], [0041]. The chemical dispenser may be within the housing (Figure 2), or connected externally to the housing (Figures 8 and 9):

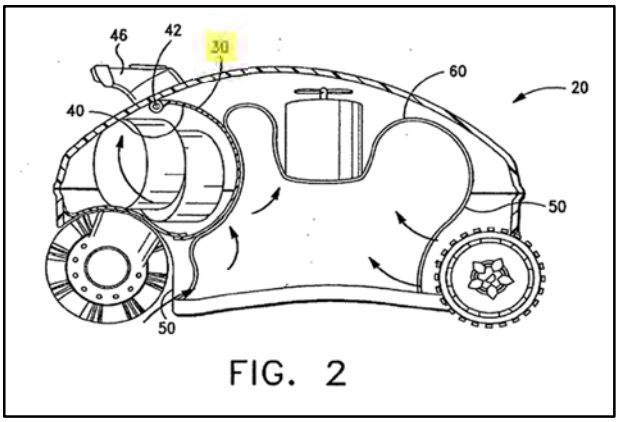
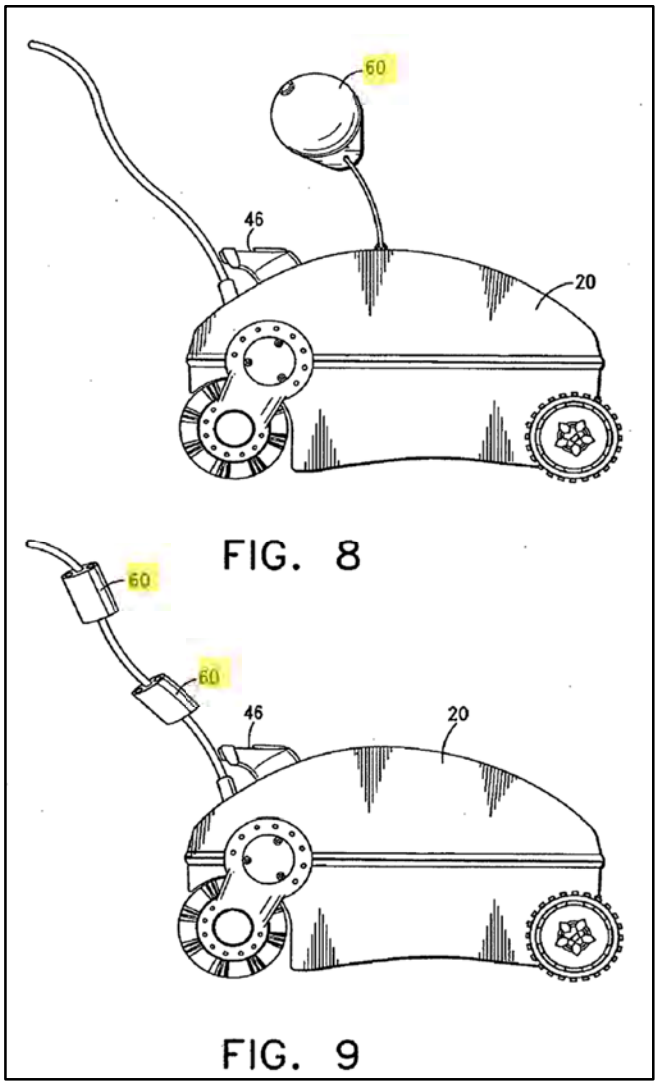


FIG. 2

Id., Fig. 2.



Id., Figs. 8-9 (annotated), ¶[0053] (showing "chemical packet inside the container [60]").

In Figure 2, chemical dispenser member 30 is place within a compartment 40 of swimming pool vehicle 20. *Id*., ¶¶[0042]-[0043]. Chemical dispenser 30 contains chemical packets 32 whose seal dissolves upon contact with water, allowing the chemical content to mix with the passing water. *Id*., ¶¶[0022], [0039]-[0040], [0047]. Chemical dispenser 30 is downstream of filter bag 60 such that water entering through

inlets 50 first passes through filter bag 60, where dirt and debris are trapped, and then continues to chemical dispenser 30, where the filtered water mixes with the chemicals. *Id*., ¶¶[0046], [0050]-[0051]. Thus, the water exiting through the outlet of compartment 40 is both free of debris, as well as sanitized. *Id*., ¶[0052]. In this way, Hui's pool cleaning vehicle performs both mechanical filtration and chemical sanitization, with chemical dispenser 30 being placed "on, in, or carried by" the vehicle body.

2. Independent Claim 5

Claim 5 would have been obvious over Fu in view of Hui. EX1010, ¶¶284-292. The preamble and elements 5a-5c of claim 5 are the same as the preamble and elements 1a-1c of claim 1:

> ~~1~~5. A self-propelled pool cleaner for cleaning debris from a submerged surface of a swimming pool, comprising:
>
> a. a vehicle body;
>
> b. means for moving the vehicle body within the swimming pool;
>
> c. a filter configured to retain debris collected from the submerged surface;
>
> d. a chemical dispenser on, in, or carried by the vehicle body;
>
> ~~d~~e. at least one camera ~~mounted directly or indirectly to the~~on, in, or carried by the vehicle body, for capturing an image of at least a first portion of the submerged surface; and
>
> ~~e~~f. a controller (i) ~~positioned~~ on ~~or~~, in, or carried by the vehicle body, (ii) in electronic communication with the at least one camera~~,~~ and (iii)

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> 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.

Similarly, elements 5e and 5f are substantially the same as elements 1d and 1e-1g respectively, differing only in wording. *See* Section IV.A.2.e-h. Therefore, the preamble and elements 5a-5c and 5e-5f are disclosed by Fu for the reasons explained in Ground 1a for claim 1.

Claim 5 additionally recites element 5d, analyzed below.

(a) Element 5d: "a chemical dispenser on, in, or carried by the vehicle body;"

Element 5d would have been obvious over Fu in view of Hui. EX1010, ¶¶287-291. Hui's pool cleaning vehicle discloses chemical dispenser 30 that may be "on, in, or carried by" the vehicle body. Section IV.D.1; EX1019, ¶[0012], Figs. 2, 8-9. A POSA would have been motivated to combine Hui's chemical dispenser with Fu's autonomous pool cleaning robot to provide an improved pool cleaning system capable of both mechanical filtration and chemical sanitization. EX1010, ¶¶288-290. Both Fu and Hui are directed to the same field: automated pool cleaning robots that filter pool water; and both share a common functional architecture: a self-propelled underwater vehicle with inlets, outlets, and an internal water flow path where filtration occurs. EX1007, ¶¶[0024], [0026]; EX1019, ¶¶[0046], [0050]-[0051]. Fu's robot comprises a drainage mechanism that draws pool water through water inlet 26 into the robot's water flow channel 24, passes the water through water flow filter screen 23 to

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remove debris, and then discharges the filtered water back into the pool. EX1007, ¶¶[0024], [0026].

A POSA would recognize that Hui's chemical dispenser enhances Fu's robot by adding a sanitization step with a simple modification. EX1010, ¶¶288-290. It is commonly known by even laymen that removal of debris alone is insufficient to maintain safe swimming conditions. *Id*. In fact, most swimming pools utilize some method of water sanitization to eliminate harmful microorganisms, addition of chlorine being the most common method. *Id*. Hui recognizes this need, explaining that "it is simply not enough for the water to be clean or in other words, relatively free of dirt and debris, it must be sanitary." EX1019, ¶[0005]. Accordingly, a POSA would have been motivated to incorporate Hui's chemical dispenser 30 into Fu's robot to achieve a predictable improvement—a pool cleaning robot that filters as well as sanitizes pool water. EX1010, ¶¶288-290.

As explained by Dr. Reinholtz, a POSA would have had a reasonable expectation of success in combining these references. *Id.*, ¶290. Fu's robot already provides a water flow path within water flow channel 24, which is analogous to Hui's water flow path. EX1007, ¶¶[0024], [0026]; EX1019, ¶¶[0046], [0050]-[0051]. A POSA could easily integrate Hui's chemical dispenser 30 within Fu's water flow channel 24 such that the filtered water passes through the chemical dispenser before being discharged into the pool. EX1010, ¶290. Alternatively, a POSA could also

mount Hui's chemical dispenser 30 externally to Fu's robot as Hui teaches in its embodiments of Figures 8 and 9. *Id.* Either configuration would expose the pool water to chemical dispenser 30 in the same manner as in Hui, thereby enhancing Fu's robot to perform both cleaning and sanitizing functions. *Id.*

Accordingly, Fu in view of Hui renders obvious element 5d's "a chemical dispenser [Hui's chemical dispenser 30] on, in, or carried by the vehicle body [robot housing body 1]."

Claim 5 would have been obvious over Fu in view of Hui. *Id.*, ¶¶284-292.

E. Ground 1e: Claim 5 Would Have Been Obvious Over Fu In View of Benzler, In Further View Of Hui

Claim 5 would have been obvious over Fu and Hui. Section IV.D.2. However, to the extent the Board finds that Fu does not disclose the "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," claim 5 is nonetheless obvious over Fu in view of Benzler, in further view of Hui. EX1010, ¶¶293-294. A POSA would have been motivated to combine Fu and Benzler to yield the control signal for causing movement "to, or away from" a portion of the submerged surface for the reasons explained for Ground 1c. Section IV.C.2. A POSA would further have been motivated to add Hui's chemical dispenser 30 to the Fu/Benzler robot for the reasons stated in Ground 1d, *e.g.*, to advantageously enable sanitization of the pool water along with filtration. Section IV.D.2.

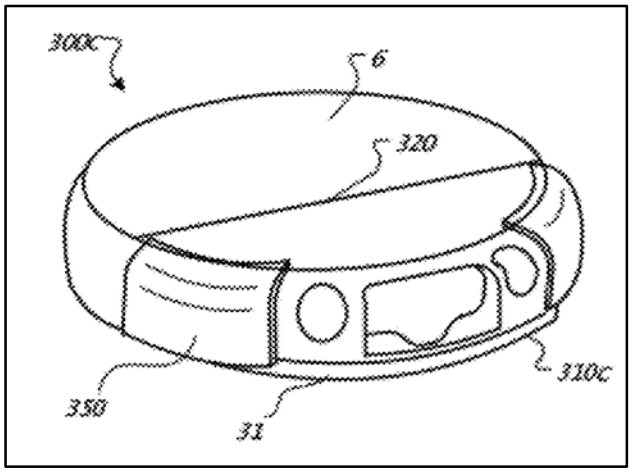
Claim 5 would have been obvious over Fu in view of Benzler, further in view of Hui. EX1010, ¶¶293-294.

F. Ground 2a: Claims 1, 2, And 4 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 system and onboard sensing for navigation and safety. *Id.*, Abstract, ¶¶[0002], [0004]-[0006].



Id., Fig. 3C (example cleaning robot). 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], [0216]-[0227].

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

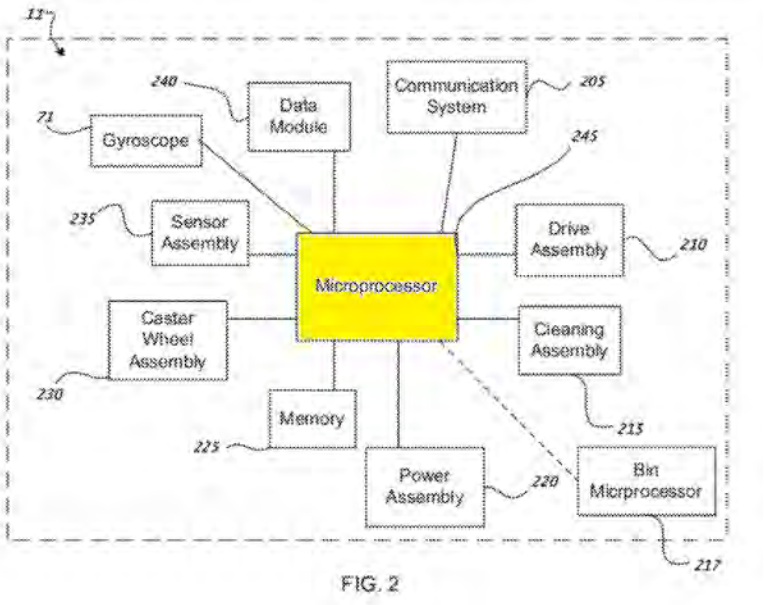


FIG. 2

Id., Fig. 2 (annotated). 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.*

Additionally, "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]):

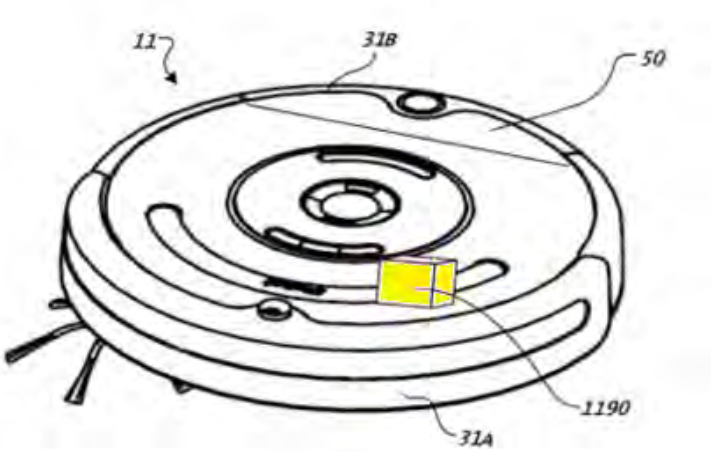


FIG. 11

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."). Camera 1190 is "in communication with the microprocessor 245," which controls the robot based on signals received from the camera. *Id.*, ¶[0204].

Schnittman is analogous art to the '766 Patent because (1) it is from the same field of endeavor as the '766 Patent, and (2) it is reasonably pertinent to the problem faced by the inventors of the '766 Patent. EX1010, ¶109; s*ee Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019).

First, the '766 Patent and Schnittman are in the same field of endeavor: autonomous cleaning robots. *Compare* EX1003, 1:24-29 (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 '766 Patent: ensuring "that all portions of … pool surfaces are satisfactorily cleaned." EX1003, 1:24-29. 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, thus ensuring 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 [POSA] was attempting to solve." *Airbus S.A.S*, 941 F.3d at 1382.

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

Schnittman is entitled to the December 30, 2010 priority date of the '808 Provisional because the provisional supports at least claim 1 of Schnittman. A later patent enjoys the priority date of the provisional so long as the provisional "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 below, 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 having a top portion and a bottom portion, the top portion above the bottom portion as debris is received into the receptacle;	"In one aspect, a debris monitoring system includes **a receptacle**, a first and a second emitter, and a first receiver. **The receptacle defines an opening to receive debris into the receptacle**." *Id.*, ¶[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** …." *Id.*, ¶[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**." *Id.*, ¶[0003].
1[d] a first receiver proximate to the first emitter to receive reflections of the signal emitted by the first emitter, the first	"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**

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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.	**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**." *Id.*, ¶[0003]. "In some implementations, the first receiver and the second emitter are disposed substantially opposite one another **across the largest dimension of the opening**." *Id.*, ¶[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**." *Id.*, ¶[0006]. "The debris monitoring system of claim 21 wherein 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." *Id.*, claim 24.

Additionally, the '808 provisional describes the subject matter of Schnittman that Petitioner relies upon as prior art. *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. Blue and

underlined text reflects material present in only Schnittman, while unmarked text reflects material common to both Schnittman and the provisional. Additionally, the Petition-cited Schnittman passages are highlighted in yellow. As EX1012 shows, none of the Petition-cited Schnittman passages appear as blue, underlined 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. Motivation To Combine

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, ¶¶295-304. 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. Section IV.D.1. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1.

At the time of the '766 Patent, POSAs working in the field of autonomous,

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image-based cleaning robots, whether for floors, lawns, or pools, were addressing the same problem: using an image to enable a robot to perceive its cleaning surface, and execute cleaning operations autonomously. EX1010, ¶299. Both Schnittman and Benzler address that problem, and offer complementary, overlapping teachings. *Id.* Importantly, Schnittman is not limited to any specific environment; its teachings apply generally to cleaning robots that analyze an image of the cleaning surface. As explained by Dr. Reinholtz, this image-based control represented a state-of-the-art approach to autonomous cleaning at the time, 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 as taught by Benzler. *Id.*, ¶¶295-304; EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203].

POSA would have understood that robotics principles underlying image-based cleaners, like those developed by leading manufacturers such as iRobot (assignee of Schnittman), are readily adaptable to different environments. EX1010, ¶300. Robotics, like any other technology, develops by building on existing technology and adapting existing technology to new contexts. *Id.* POSAs in the field of autonomous pool cleaners were not working in isolation; they routinely drew on technologies from the broader field of autonomous cleaning. *Id.* Indeed, Benzler itself confirms this: it describes the same image-driven framework as Schnittman, while applying this

framework to both land and water embodiments, such as a lawnmower, a snow cleaning vehicle, a pool cleaning vehicle, etc. Section IV.C.1; EX1013, ¶¶[0028], [0037], [0044]-[0046]. By describing the same image-based system across multiple domains, land and water alike, Benzler demonstrates that a POSA understood how to adapt the principles of image-based robotic navigation and cleaning across various environments

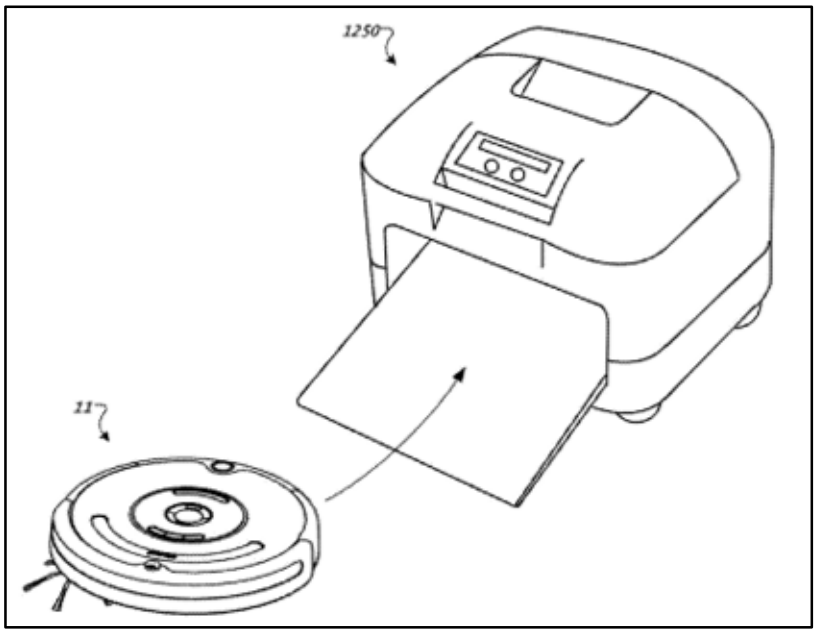
Benzler would have further reinforced a POSA's understanding that Schnittman's cleaning robot could be adapted for underwater use. For example, Benzler's teaching of a "moisture-sealed housing" for the internal logic unit (EX1013, ¶[0011]) contemplates operation in wet environments (*id.*, Fig. 3 (showing onboard logic unit 10 submerged in a pool)), providing a practical implementation detail that a POSA would have easily incorporated when adapting Schnittman's robot for underwater use. Likewise, 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 pool cleaner, would predictably yield an image-based underwater pool cleaner that is driven based on an image of the pool surface.

A POSA would have had a reasonable expectation of success in making this combination. EX1010, ¶303. By the time of the '766 Patent, the necessary adaptations to render a system water-ready were straightforward and within a POSA's skill, such as moisture-sealing or potting electronics, waterproofing, 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 well known. *See, e.g.*, EX1014 ("underwater sediment cleaning apparatus … wherein the controller … comprises: a camera unit"), EX1015 ("Robotic submersible cleaning system" including "use of an intelligent camera system 81 [to] assist in maintaining the positional accuracy … along an underwater surface"), EX1016 ("apparatus and method of … inspecting a submerged surface of a fluid reservoir" including a "navigation camera 6"). Researchers documented effective techniques to improve the effectiveness of underwater imaging. For example, literature from around that time described various normalization, filtering, and color-space methods that extract target information from underwater environments in real time. *See* EX1017, 7. These developments would have reinforced a POSA's motivation 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. Claim 1

(a) Preamble

To the extent limiting, claim 1's preamble would have been obvious over Schnittman in view of Benzler. EX1010, ¶¶305-308. Schnittman discloses autonomous robotic cleaners for removing debris from cleaning surfaces (*e.g.*, floors) (EX1008, ¶¶[0002], [0023], [0032]-[0033]):



Id., Fig. 14D (example robotic cleaner 11 and maintenance station 1250); ¶¶[0097], [0216]-[0217]). In embodiments, Schnittman's 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].

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 driven wheels 45"). In embodiments, power for moving Schnittman's robotic cleaner is provided via an onboard battery that is charged at a maintenance station 1250. *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.F.3. Therefore, Schnittman in view of Benzler renders obvious the preamble's "self-propelled pool cleaner [robotic cleaner 11] for cleaning debris from a submerged surface of a swimming pool." EX1010, ¶¶305-308.

(b) Element 1a

Schnittman discloses element 1a. *Id.*, ¶¶309-311. 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]):

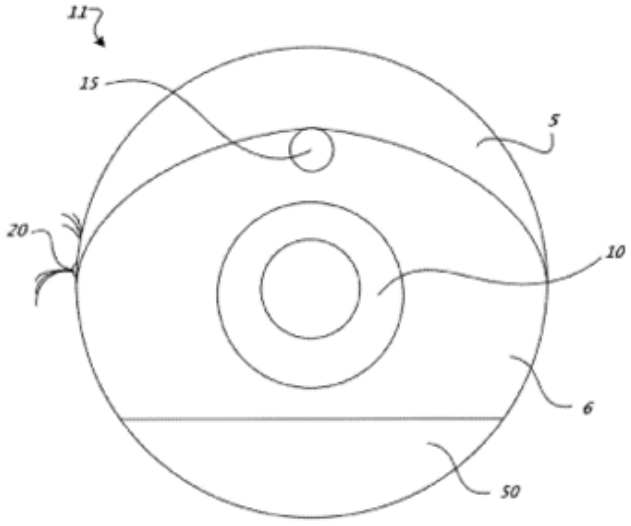


FIG. 1A

Id., Fig. 1A.

Thus, Schnittman discloses "a vehicle body [robot body 31]." EX1010, ¶¶309-311.

(c) Element 1b

Schnittman in view of Benzler would have rendered obvious element 1b. *Id.*, ¶¶312-315. The term "means for moving the vehicle body within the swimming pool" is an MPF term, and the corresponding structures in the '766 Patent include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like." EX1003, 3:31-43; Section II.C.1.

Schnittman's robotic cleaners include an onboard drive system (or "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]):

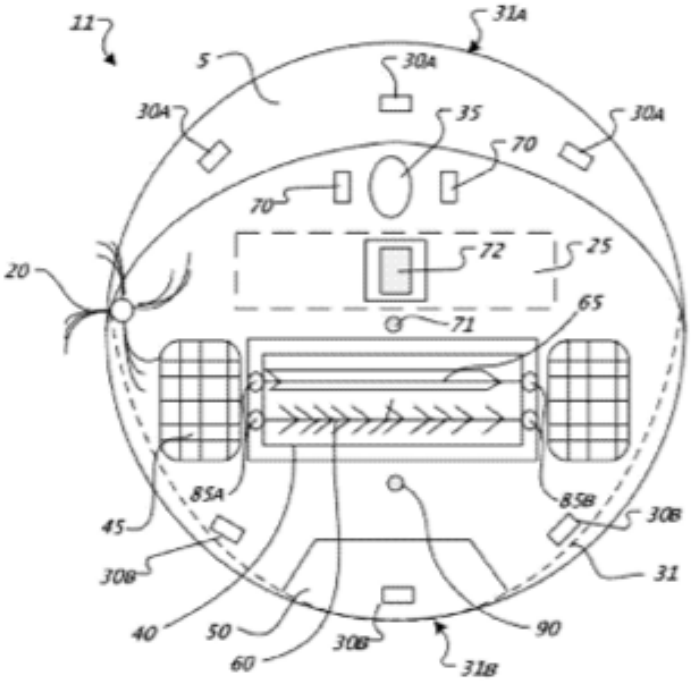


FIG. 1B

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 robot's movement. *Id.*, ¶¶[0119], [0177].

While Schnittman does not disclose moving "within [a] swimming pool" specifically, Benzler's teaching of "pool robotic vehicles [that] drive in particular on the bottom of a pool" using wheels powered by a drive motor provides a drive system similar to Schnittman's, reinforcing that Schnittman's similar motor-powered wheels

45 could be readily adapted for underwater use. Section IV.F.3.

Therefore, Schnittman in view of Benzler renders obvious "means for moving the vehicle body within the swimming pool [drive system with wheels 45]." EX1010, ¶¶312-315.

(d) Element 1c

Schnittman in view of Benzler would have rendered obvious element 1c. *Id.*, ¶¶316-317. Schnittman discloses that its robotic cleaners include an "internal filter 54" (EX1008, ¶[0117]):

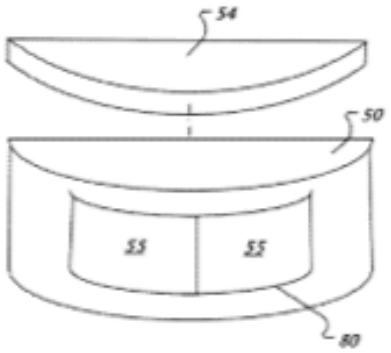


FIG. 1C

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

Internal filter 54 is part of the robot's cleaning bin 50, and it retains collected debris. *Id.*, ¶317; 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 in view of Benzler would include a filter like filter 54, with the filter retaining debris collected by the robot while passing filtered, clean water back into the swimming pool. EX1010, ¶317. Benzler

describes the use of debris-retaining filters in pool-cleaning robots. EX1013, ¶[0028] ("the robotic vehicle is construed as [a] pool-robotic vehicle, thus in particular as [a] filter vehicle and/or cleaning or purifying vehicle"), Claim 22 ("a working element of the [pool-cleaning] robotic vehicle, in particular the width of a filter unit"). 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. EX1010, ¶317; Section IV.F.3.

Therefore, Schnittman in view of Benzler renders obvious "a filter [internal filter 54] configured to retain debris collected from the submerged surface." *Id.*, ¶¶316-317.

(e) Element 1d

Schnittman in view of Benzler would have rendered obvious element 1d. *Id.*, ¶¶318-320. Schnittman discloses embodiments of its robotic cleaners including a camera 1190:

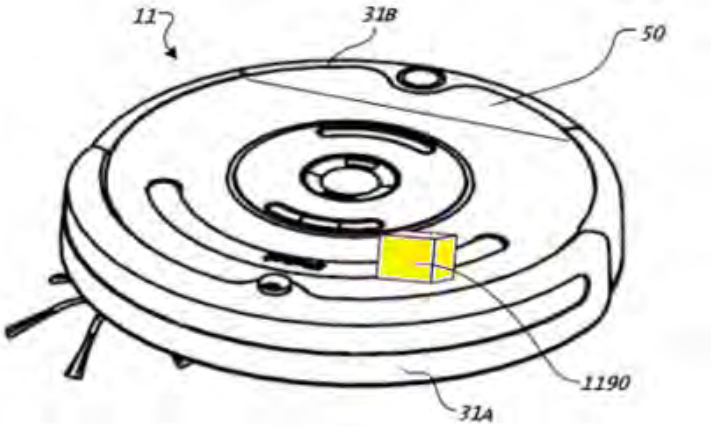


FIG. 11

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

Schnittman's camera is mounted 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 images of at least a first portion of a cleaning surface. EX1010, ¶319. Specifically, the camera "scan[s] an area substantially forward of the [robot]" as the "robot [moves] over the cleaning 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

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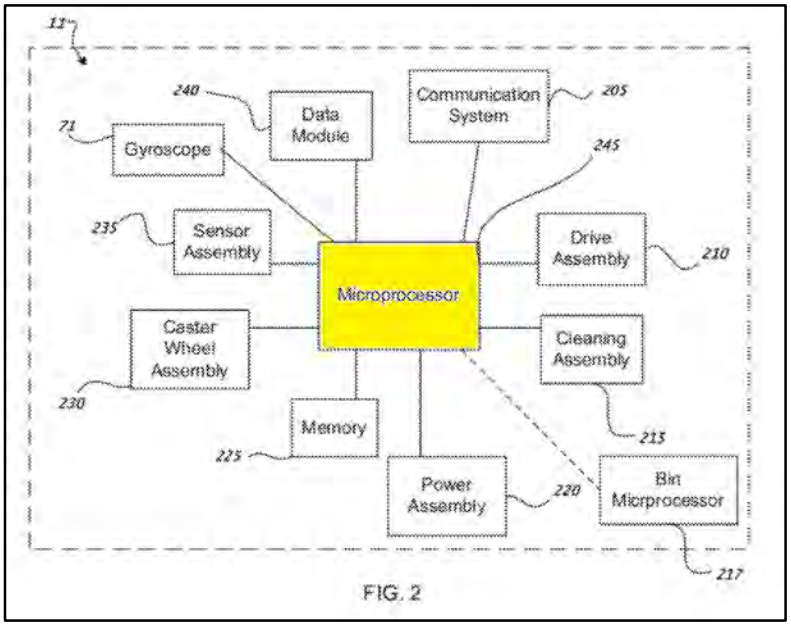
surface" absent an image of the cleaning surface captured by the camera. EX1010, ¶319.

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. Section IV.F.3; EX1010, ¶320.

Accordingly, Schnittman in view of Benzler renders obvious "at least one camera [camera 1190] mounted directly or indirectly to the body for capturing an image of at least a first portion of the submerged surface." *Id.*, ¶¶318-320.

(f) Element 1e:

Schnittman discloses element 1e. *Id.*, ¶¶321-323. Schnittman discloses embodiments of its robotic cleaners including a microprocessor 245 (EX1008, ¶[0118]):



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 Figure 2, the routines executed by microprocessor 245 are stored in memory 225, and data module 240 is configured to "upload new software routines or values to the robot 11." *Id.*, ¶[0118]. Schnittman's microprocessor thus discloses the "controller" because it controls operation of the cleaning robot and is similar to controllers described in the '766 Patent. EX1010, ¶322. For instance, the '766 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 such as generating control signals." EX1003, 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 EX1008, ¶¶[0118]-[0119], [0177].

Schnittman's microprocessor 245 is also positioned on or in the body of the robot. In Figure 2, microprocessor 245 is part of robot 11, and thus would be positioned on or in the robot's body. EX1008, ¶¶[0118] ("The robot 11 includes a

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microprocessor 245 ….”). Further, Schnittman states that the microprocessor is “included within the robot 11.” *Id.*

Therefore, Schnittman discloses “a controller [microprocessor 245]” that is “positioned on or in the body.”

(g) Element 1f

Schnittman discloses element 1f. EX1010, ¶¶324. 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 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 controller (microprocessor 245) “in electronic communication with the at least one camera [camera 1190].” EX1010, ¶324.

(h) Element 1g

Schnittman in view of Benzler would have rendered obvious element 1g. *Id.*, ¶¶325-329. 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 aby 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(*id.*, ¶¶[0177], [0191]-[0203]):

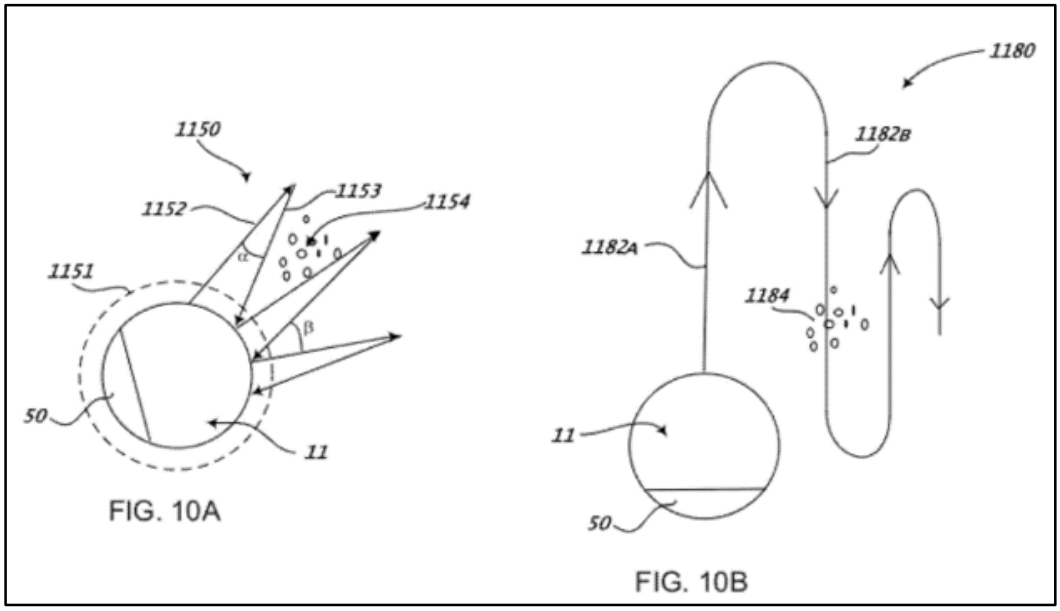


FIG. 10A FIG. 10B

Id., Figs. 10A, 10B (example cleaning patterns). Accordingly, Schnittman discloses the controller configured to generate control signals to cause movement of the robot's body. EX1010, ¶326.

Schnittman further discloses the generation of such control signals "in response to the captured image." Schnittman's 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]. Further, the microprocessor "can process the signal from the camera" and control movement of the robot accordingly. *Id.*, ¶¶[0204]-[0205]. Such control signals "cause movement of the [robot's] body … to, or away from, the first portion of the … surface":

> [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* Section IV.F.4.e), and the microprocessor processes the image to recognize debris in it. EX1010, ¶328. 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.*

While Schnittman does not disclose 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

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adapt Schnittman's robotic cleaners for use in this context and would have been motivated to do so for the reasons in Section IV.F.3. *Id.*, ¶329. 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.*, ¶¶325-329.

Schnittman in view of Benzler renders obvious claim 1. *Id.*, ¶¶305-330.

5. Claim 2

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

6. Claim 4

Claim 4 is unpatentable over Schnittman in view of Benzler for the reasons explained for claim 1. *See also* Section IV.A.5.

G. Ground 2b: Claim 3 Would Have Been Obvious Over Schnittman In View Of Benzler, In Further View Of Bailey

1. Summary Of Bailey

Bailey, EX1018, entitled "User-assisted Robot Navigation System," was filed on July 14, 2009 as U.S. Patent Application No. 12/502,699, and published on Jan. 29, 2013 as U.S. Patent No. 8,364,309 B1. EX1018, (10), (21), (22), (45), (54). Bailey is therefore prior art under at least pre-AIA 35 U.S.C. § 102(e).

Bailey describes a mobile robot 102, such as a room cleaning robot or a pool

cleaning robot, that autonomously navigates within a space to perform cleaning tasks, while also allowing user interaction and control through a remote management station 112. EX1018, 1:29-32, 3:46-49, 6:3-7:51, 17:26-29, claim 1. The robot 102 includes a control engine 300 that is an onboard processor implemented as "microprocessors, central processing units (CPUs), or programmable logic devices" "configured to execute computer code or instructions stored in a memory." *Id.*, 4:40-42, 5:31-39. The control engine 300 interfaces with the robot's "sensors, motors, communication facility, and other components of the robot, such that the robot control engine can receive data from the sensors, control the motors, and communicate with the management station 112." *Id.*, 5:19-24.

2. Independent Claim 3

As shown in Ground 1a (Section IV.A.4), claim 3's preamble and elements 3a-3d are substantially the same as claim 1's preamble and elements 1a-1d. Therefore, the preamble and elements 3a-3d are obvious over Schnittman in view of Benzler for the reasons explained in Ground 2a. Section IV.F.4.

(a) Element 3e:

Element 3e is obvious over Schnittman in view of Benzler for the reasons explained for element 1e. EX1010, ¶334; Section IV.F.4.f.

(b) Element 3f:

Element 3f is obvious over Schnittman in view of Benzler, in further view of

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Bailey. EX1010, ¶¶335-343.

For the reasons explained for element 1f, Schnittman makes obvious the controller (microprocessor 245) "in electronic communication with the at least one camera [camera 1190]." *Id.*; Section IV.F.4.g. Schnittman's remote indicator 1202 (EX1008, ¶[0214]) is a "portable electronic device" in "electronic communication with" the controller, as required by element 3f. EX1003, ¶336.

In addition, Bailey provides the complementary teaching of "a portable electronic device" "in electronic communication with" the controller. Bailey's management station 112, which may be implemented as "workstations, desktop computers, laptop computers or other personal computers," provides a user interface for remotely monitoring and interacting with robot 102. EX1018, 3:23-30, 7:23-51. Management station 112 is remote from robot 102, and it communicates with the onboard control engine 300 through standard technologies such as a "wireless network interface card (NIC), an Ethernet-based NIC, a Bluetooth interface or an infra red (IR) interface," or "a wireless data connection … 350." *Id.*, 3:37-40, 7:5-10, Fig. 1.

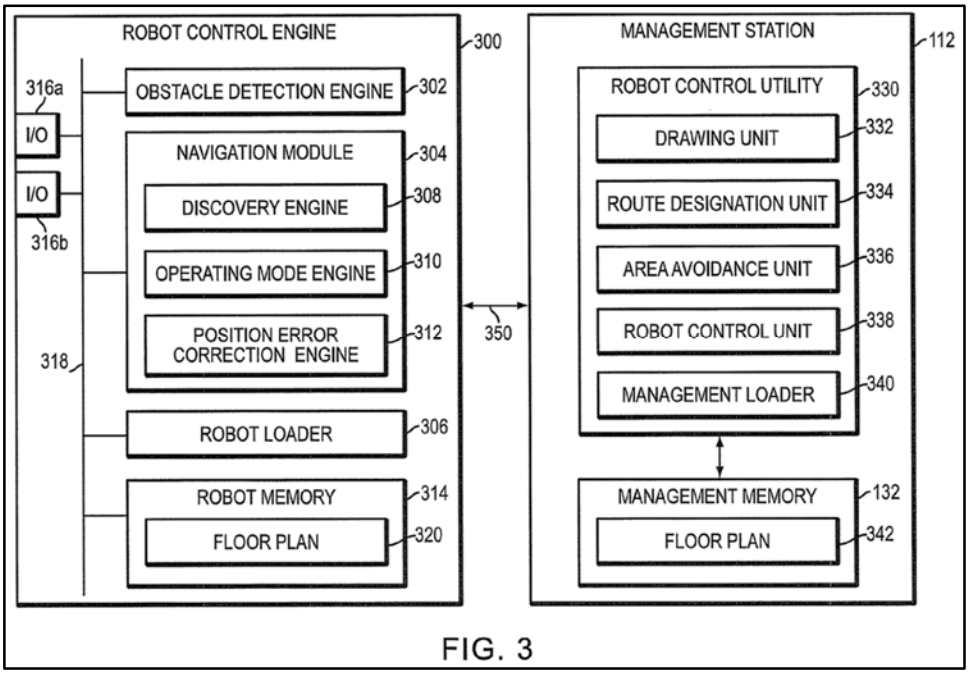


FIG. 3

EX1018, Fig. 3 (showing wireless data connection 350 between the control engine 300 and the management station 112). Bailey further explains that management station 112 may include "a central processing unit (CPU) 130, a memory 132, a display screen 134, one or more input devices, such as keyboard 136 and a mouse 138" that allow a user to interact with robot 102 via a GUI 1400. *Id*., 3:15-22, 7:23-51. "In an embodiment, the user may direct the motion of the robot 102 in real-time using the robot GUI 1400, as a remote control … from the management station 112." *Id*., 16:26-35. Management station 112 thus enables a user to remotely communicate with robot 102 regarding, for *e.g.*, floor plans, navigation commands, cleaning instructions, etc. *Id*., 7:3-12, 7:23-51. Bailey further teaches that "a hand-held remote control unit (not shown) may be operated by the user to direct the motion of the robot 102," emphasizing the portability and remote nature of management station 112. *Id*., 16:26-

35

Bailey's management station 112 thus discloses the "portable electronic device" that is "in electronic communication with" "a controller." A POSA would have been motivated to apply Bailey's management station 112 to the Schnittman/Benzler image-based underwater pool cleaner. Like Schnittman and Benzler, Bailey discloses an autonomous cleaning robot that navigates the cleaning space, such as a swimming pool, using sensor-based perception and an onboard control engine. EX1018, 1:29-32, 3:46-49, 3:51-4:25, 9:48-65, 17:26-29. Bailey's additional teaching of a portable, remote user interface provides a complementary feature that enables user interaction, monitoring, and real-time control—functionalities that would have been naturally desirable to extend to an autonomous pool cleaning robot. Combining Bailey with the Schnittman/Benzler pool cleaning robot would therefore have yielded a predictable and advantageous configuration: an image-guided, autonomous pool cleaning robot whose onboard controller communicates with a portable electronic device (Bailey's management station 112) for user monitoring and control.

As explained by Dr. Reinholtz, a POSA would have recognized the clear advantages of this combination. EX1010, ¶340. Bailey demonstrates that providing a remote management interface allows for convenient user input, remote monitoring, and real-time user control of the robot's navigation and cleaning. These advantages would have been particularly beneficial in the underwater pool cleaning context,

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where direct physical access to the robot or its onboard controls is impractical once the robot is submerged. For example, a user might wish to initiate or pause a cleaning cycle, redirect the robot to an uncleaned area, or retrieve diagnostic information if anything goes wrong, all of which are functions that could be conveniently performed through Bailey's management station 112.

Furthermore, Bailey explicitly references multiple iRobot cleaning platforms (*e.g.*, Roomba®, Home Base®, Create®) as suitable and known mobile robot implementations. EX1018, 1:11-16, 3:41-45, 4:53-58. Because iRobot is also the assignee of Schnittman, a POSA would have understood Bailey's and Schnittman's teachings as complementary and compatible technologies arising from the same field of autonomous cleaning robotics. This cross-reference would have reinforced a POSA's expectation that Bailey's management station 112 could be readily applied to Schnittman's image-based cleaning robot, including when adapted for a pool environment as taught by Benzler, particularly since Bailey itself states that the mobile robot 102 may be implemented as a pool cleaning robot. EX1018, 17:26-29.

As explained by Dr. Reinholtz, a POSA would have had a reasonable expectation of success in combining these references. EX1010, ¶342. By 2012, remote communication between a robot and a portable device was routine and well established, using mature technologies such as Bluetooth, wireless network, or infrared interfaces, all of which Bailey discloses. *Id.* Implementing Bailey's

management station 112 into the Schnittman/Benzler device would have required only conventional hardware and software integration, well within the skill of a POSA. *Id.* The necessary adaptations for underwater use, such as waterproofing and sealing, were likewise straightforward engineering tasks known to POSA. *Id.*

Accordingly, Schnittman in view of Benzler, in further view of Bailey makes obvious the controller (microprocessor 245) "in electronic communication with the at least one camera [camera 1190] and a portable electronic device [management station 112]." *Id.*, ¶¶335-343.

(c) Element 3g:

Element 3g is obvious over Schnittman in view of Benzler, in further view of Bailey. *Id.*, ¶¶344-348.

For the reasons explained for element 1g, Schnittman in view of Benzler makes obvious that the controller (microprocessor 245) is "configured to generate, in response to at least one of 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." Section IV.F.4.h.

As explained for element 3f, Bailey further teaches that its management station 112, which is in communication with the onboard control engine 300, allows a user to interact with and control the cleaning robot. EX1018, 7:5-10, 16:26-35 ("the user may direct the motion of the robot 102 in real-time using the robot GUI

1400 [on management station 112], as a remote control"), Figs. 1, 3. A user may direct the robot in real time through management station 112, *i.e.*, the portable electronic device, with those directions being transmitted to the control engine 300 wirelessly and being used to control the robot accordingly. *Id*., 3:37-40, 7:5-10, 7:23-51, 16:26-35.

Therefore, Schnittman in view of Benzler, in further view of Bailey, discloses that the controller (microprocessor 245) is "configured to generate, in response to at least one of the captured image [image captured by camera 1190] or information from the portable electronic device [management station 112], at least one control signal to cause movement of the body [robot body 31] within the swimming pool to, or away from, the first portion of the submerged surface."

Thus, claim 3 would have been obvious over Schnittman in view of Benzler, in further view of Bailey. EX1010, ¶¶333-348.

H. Ground 2c: Claim 5 Would Have Been Obvious Over Schnittman In View Of Benzler, In Further View Of Hui

1. Independent Claim 5

As shown in Ground 1d, claim 5's preamble, and elements 5a-5c and 5e-5f are substantially the same as claim 1's preamble, and elements 1a-1g. Section IV.D.2 Therefore, claim 5's preamble and elements 5a-5c and 5e-5f are obvious over Schnittman in view of Benzler for the reasons explained in Ground 2a. Section IV.F.4.

Claim 5 additionally recites element 5d, analyzed below.

(a) Element 5d:

Element 5d would have been obvious over Schnittman in view of Benzler, further in view of Hui. EX1010, ¶¶351-355.

Hui's pool cleaning vehicle discloses a chemical dispenser 30 that may be "on, in, or carried by" the vehicle body. Section IV.D.1. A POSA would have been motivated to combine Hui's chemical dispenser with the Schnittman/Benzler image-based underwater pool cleaner to provide an improved automated pool cleaning system capable of performing both mechanical filtration and chemical sanitization. EX1010, ¶352. Like the Schnittman/Benzler device, Hui is also directed to automated pool cleaning robots. EX1019, Abstract, ¶[0001]. When adapting Schnittman's cleaning robot for underwater operation as taught by Benzler, a POSA would know that adding a chemical-dispenser function, specifically for swimming pool environments, is a predictable step. EX1010, ¶352. A POSA would naturally incorporate a known chemical-dispensing element into the Schnittman/Benzler autonomous pool cleaning device because pool sanitation using chemicals, such as chlorine, has been widely known and implemented since before the '766 Patent. *Id.* A POSA would therefore recognize that Hui's chemical dispenser enhances the Schnittman/Benzler system by adding a known and desirable sanitization function through a straightforward modification.

As explained by Dr. Reinholtz, a POSA would have had a reasonable expectation of success in combining these references. EX1010, ¶353. Hui teaches that its chemical dispenser 30 may be mounted externally on the robot body, as illustrated in the embodiments of Figures 8 and 9. EX1019, Figs. 8-9. A POSA could therefore add Hui's chemical dispenser to the exterior of the Schnittman/Benzler device without altering the underlying architecture of the device. Simply mounting the chemical dispenser to the housing would expose the chemical dispenser to the pool water in the same manner as taught by Hui. EX1010, ¶353.

Alternatively, Hui also teaches that the chemical dispenser may be integrated within the robot body. Incorporating the chemical dispenser in this manner with the Schnittman/Benzler device would likewise have been a routine modification well within a POSA's skillset. *Id.*, ¶354. As explained above, at the time of the '766 Patent, pool cleaners incorporating chemical-dispensing components (*e.g.*, chlorine) were well-known and widely used. Thus, adding Hui's chemical dispenser, whether internally or externally, would require only a straightforward application of known methods.

Accordingly, Schnittman in view of Benzler, in further view of Hui renders obvious element 5d's "chemical dispenser [chemical dispenser 30] on, in, or carried by the vehicle body [robot body 31]."

Schnittman in view of Benzler, further in view of Hui renders obvious claim

5. *Id.*, ¶¶349-356.

V. CONCLUSION

Petitioner respectfully requests IPR of claims 1-5 of the ’766 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.

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 patent infringement lawsuit that involves the ’766 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 U.S. Patent Nos. the 11,003,191 and 11,880,207, which are related to the ’766 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:

Lead Counsel	Back-up Counsel
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PETITION FOR *INTER PARTES* REVIEW OF PATENT NO. 11,262,766

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,

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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. 11,262,766, 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. 11,262,766, including all exhibits, were served on litigation counsel for Patent Owner Zodiac Pool Systems LLC at the following addresses:

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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 13,914 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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EXHIBIT 6

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

Issued: May 11, 2021

Filed: July 2, 2020

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

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.

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

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.

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.

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:

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 ***wheels, rollers, tracks or other surface contacting members powered by a motor and the like***. … In one implementation vehicle 30 may also alternatively be propelled by means of the ***vacuum or liquid jets***. … 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.

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).

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:

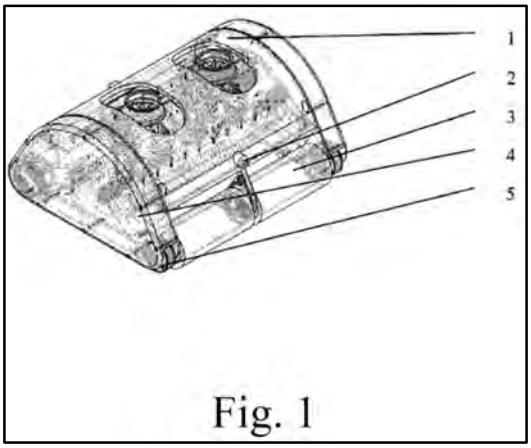
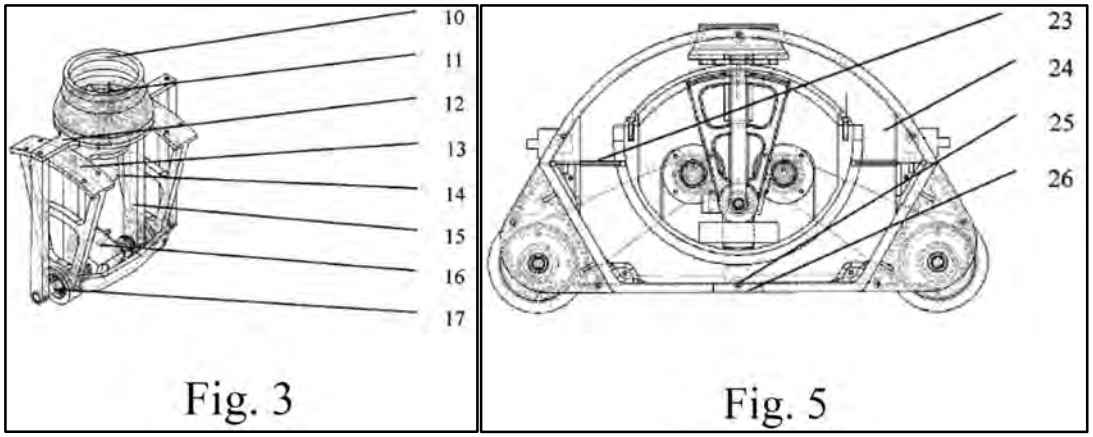


Fig. 1

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

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.*,

¶[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*.

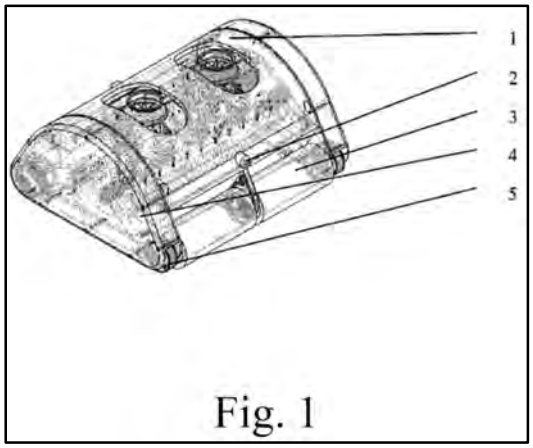


Fig. 1

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].

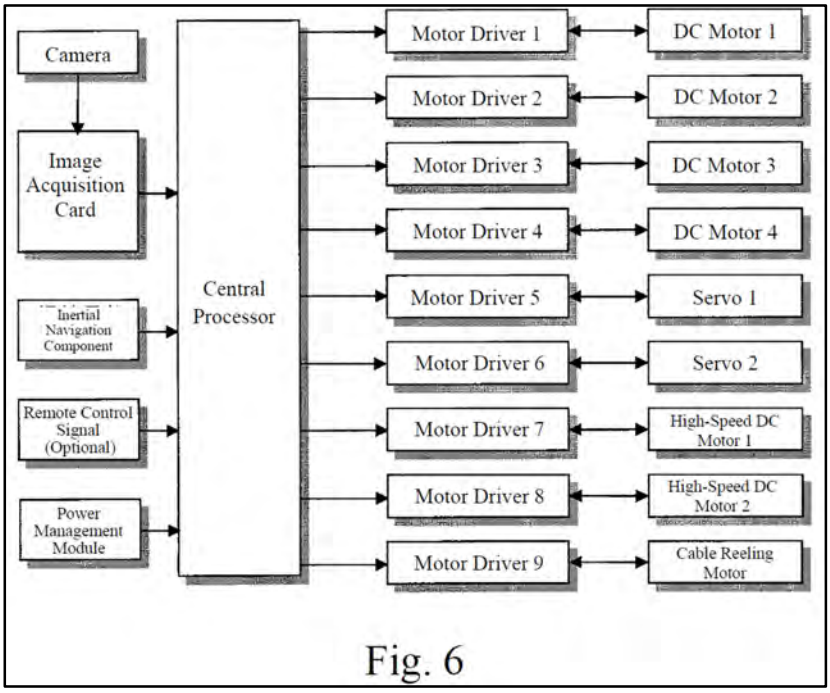


Fig. 6

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

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

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

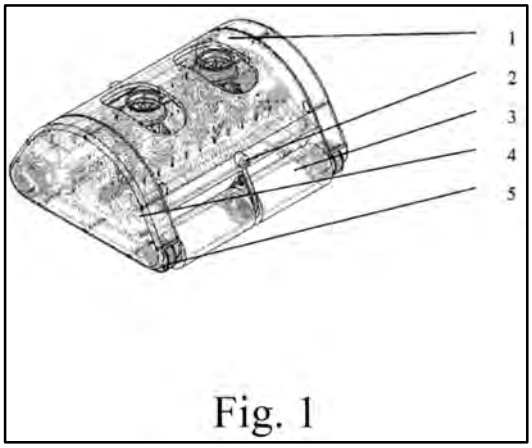


Fig. 1

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."

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]):

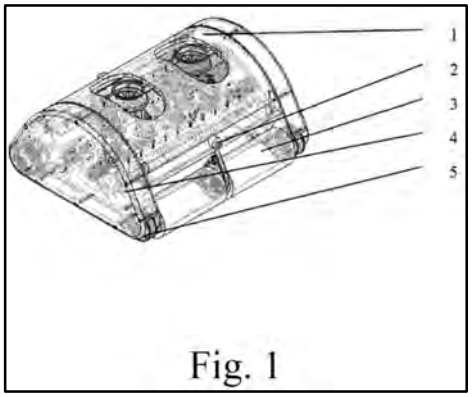


Fig. 1

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].

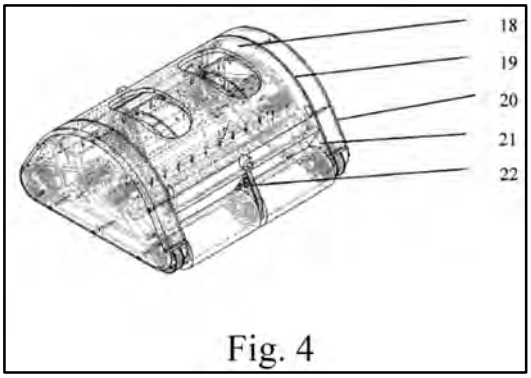


Fig. 4

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

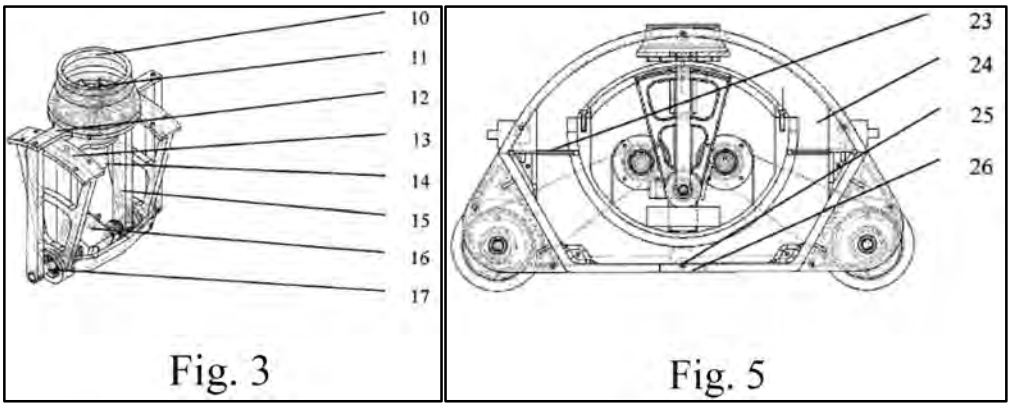
belt gears 5, and a driving synchronous belt 4." *Id.* A driving DC motor 7 drives the cleaning driving wheels 3 via the synchronous belt gears 5 and the driving synchronous belt 4. *Id*., ¶¶[0007],[0024] ("Said cleaning driving wheel DC motors [7] are equipped with reduction gearboxes and encoders. 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]."

(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

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):

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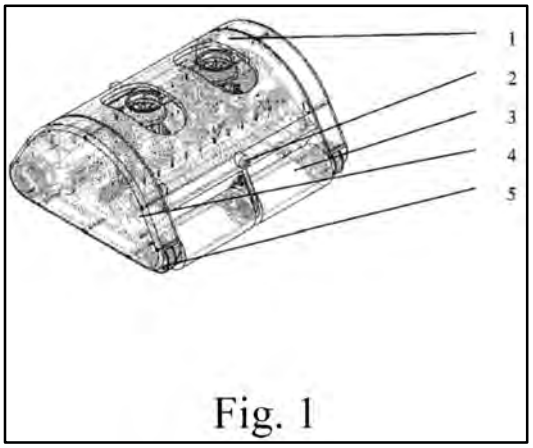


Fig. 1

"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.

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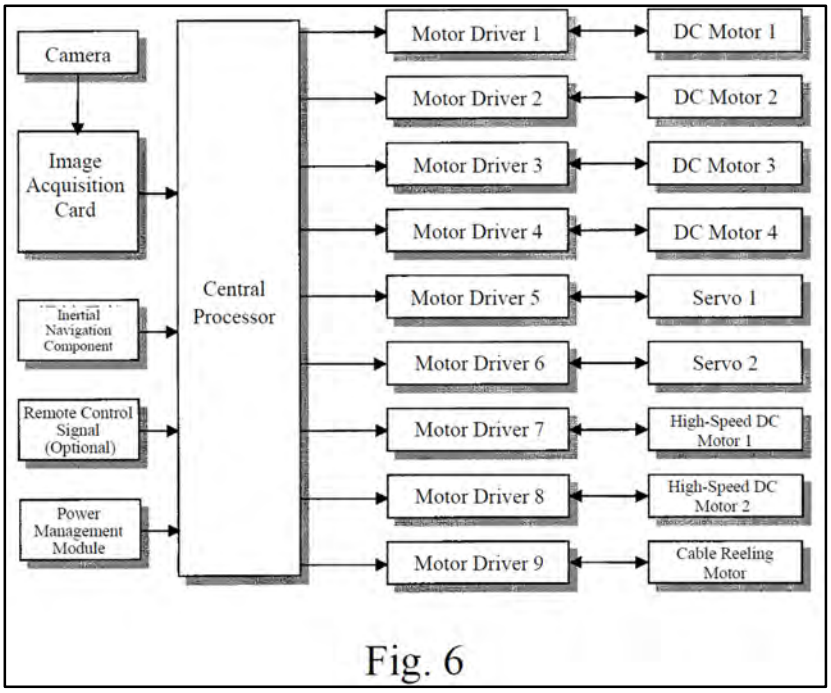


Fig. 6

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.

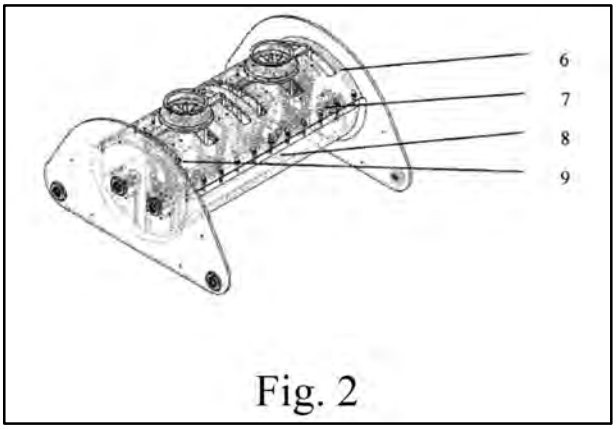


Fig. 2

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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].

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

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;

~~c~~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

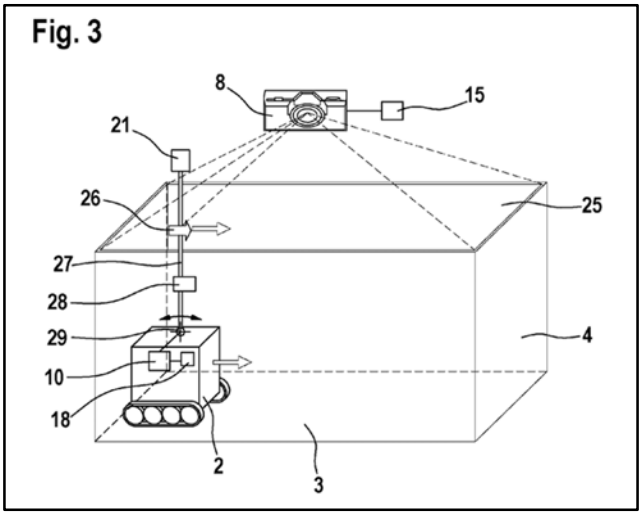
Benzler, EX1013, entitled "Activation System for a Robotic Vehicle," was filed on May 16, 2008 as PCT/EP08/56016, and published on Nov. 25, 2010 as US Patent Pub. No. 2010/0299016. EX1013, (10), (22), (43), (86). Benzler is therefore prior art under at least pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

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

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]):



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

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

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.

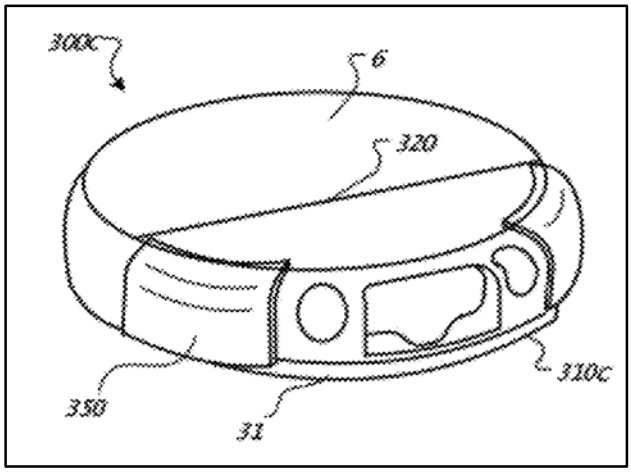
D. Ground 2: Claims 1-3 Would Have Been Obvious Over Schnittman In View Of Benzler

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

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]):

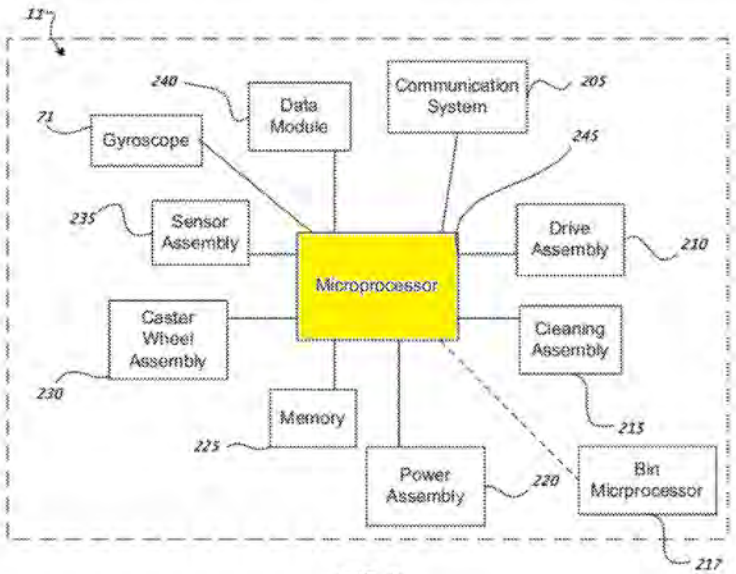


FIG. 2

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]):

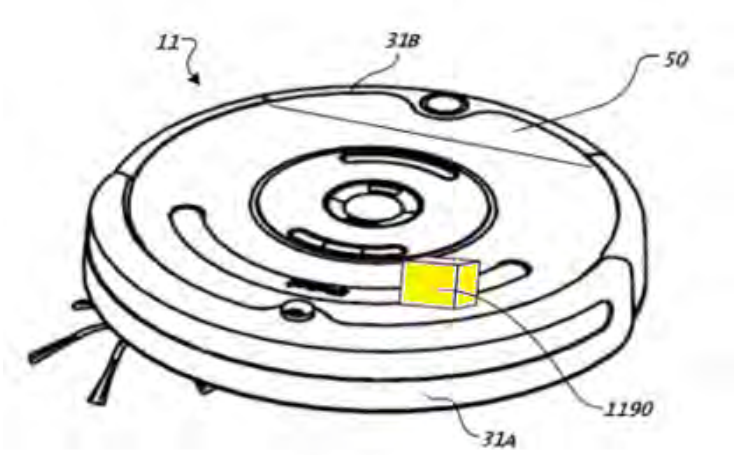


FIG. 11

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

faced by the inventors of the '191 Patent. EX1010, ¶109; s*ee 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.

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

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**." *Id.*, ¶[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** …." *Id.*, ¶[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**." *Id.*, ¶[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**." *Id.*, ¶[0003]. "In some implementations, the first receiver and the second emitter are disposed substantially opposite one another **across the largest dimension of the opening**." *Id.*, ¶[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**." *Id.*, ¶[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." *Id.*, claim 24.

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],

[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.

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

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

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

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.*

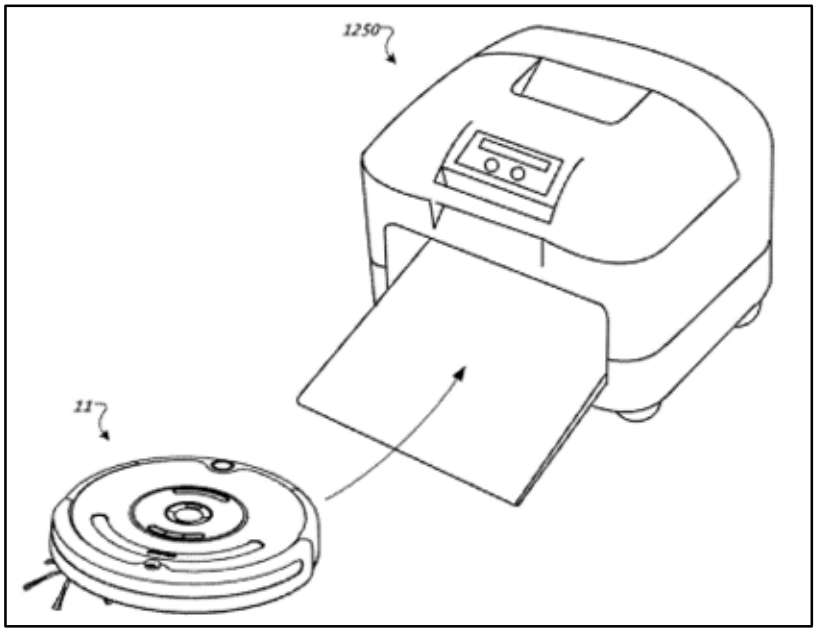
For example, in the same period, the use of cameras on underwater vehicles was known (*see, e.g.*, EX1014, WO 2012/0236676 ("underwater sediment cleaning apparatus … wherein the controller … comprises: a camera unit controlling an image captured by a camera … wherein the camera unit … [is] connected 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

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

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]):

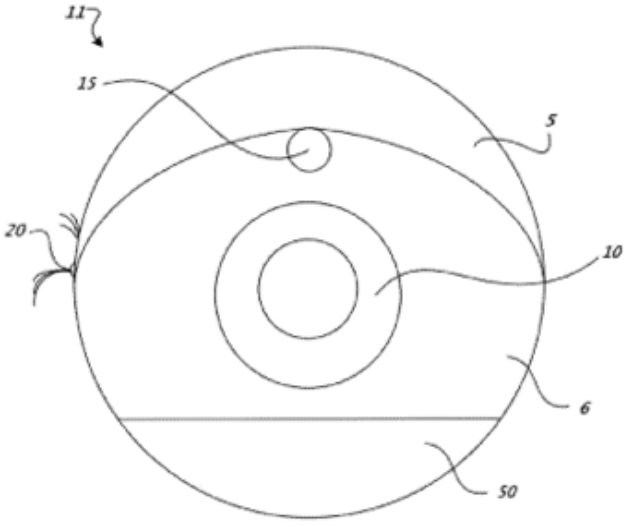


FIG. 1A

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,

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]):

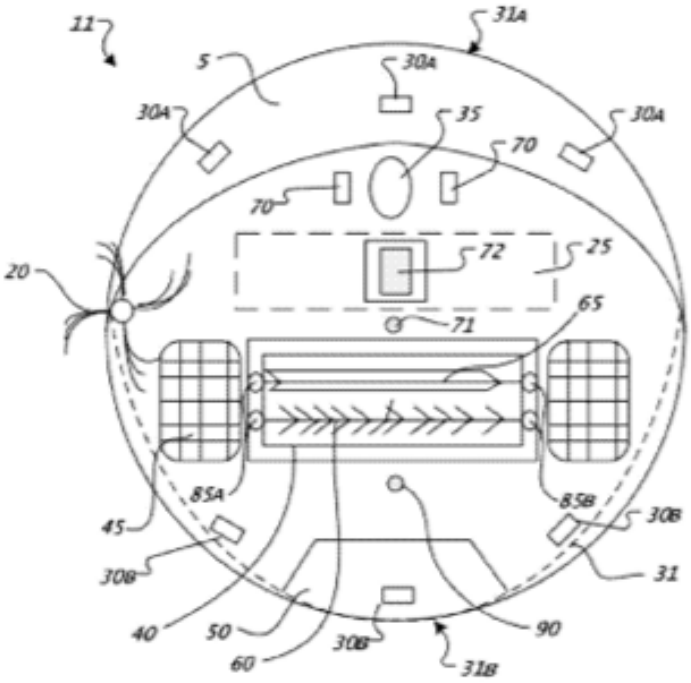


FIG. 1B

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

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]):

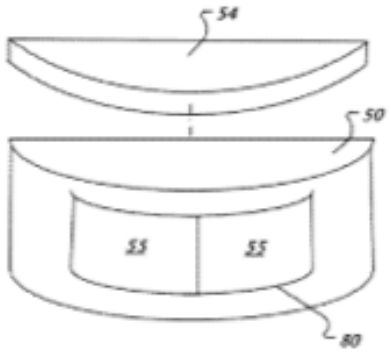


FIG. 1C

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

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:

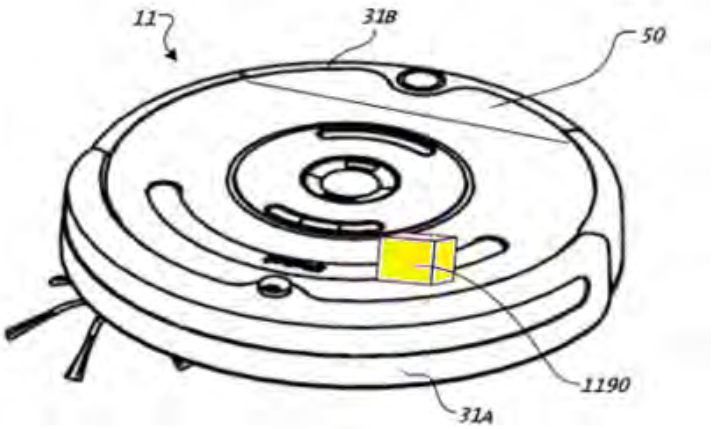


FIG. 11

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

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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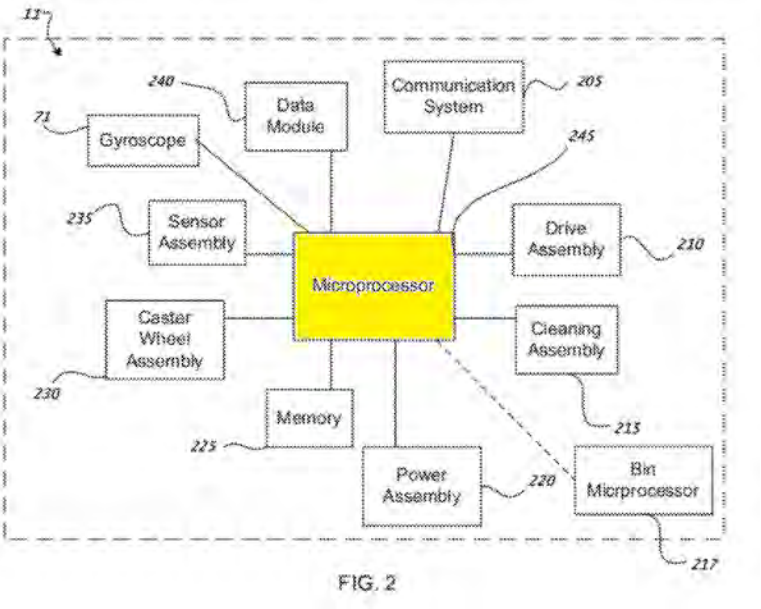


FIG. 2

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

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

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]):

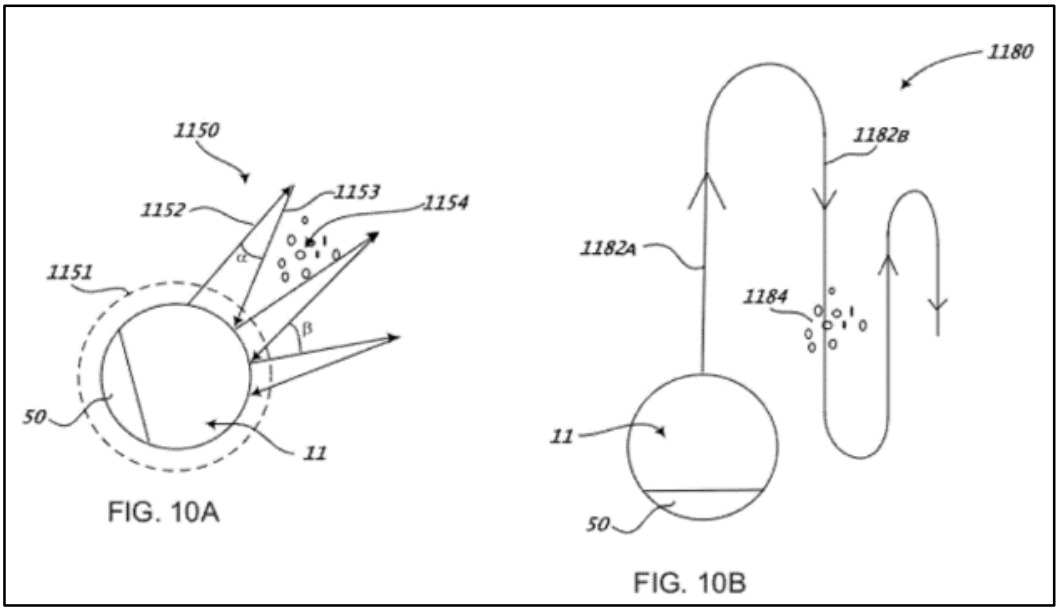


FIG. 10A FIG. 10B

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

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

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.

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:

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,

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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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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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EXHIBIT 7

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the *Inter Partes* Review of U.S. Patent No. 11,880,207

Trial No.: Not Yet Assigned

Issued: January 23, 2024

Filed: January 10, 2022

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 1-8, 11-14, and 19 of U.S. Patent No. 11,880,207 ("the '207 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
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EX1020	Merriam-Webster Dictionary, “object”, https://www.merriam-webster.com/dictionary/object (last visited Nov. 20, 2025)
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EX1031	U.S. Patent No. 5,351,355 (“Chiniara”), invented by Paul Chiniara, filed May 26, 1993

I. INTRODUCTION

This Petition presents a textbook case of why Congress created *inter partes* review to improve patent quality and provide a more efficient alternative to federal court litigation. The '207 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 a terminal disclaimer. As a result, the '207 Patent issued even though its alleged inventions are neither novel nor nonobvious. The Board should institute review and find these claims unpatentable.

The '207 Patent claims a self-propelled robotic pool cleaner that can detect debris and direct its motion 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 '207 Patent—a vehicle body, means for moving the vehicle body, and a filter—are common to all robotic pool cleaners and have been known for decades. In fact, according to the Examiner, the only purportedly novel feature of the '207 Patent is "a controller … configured to generate, in response to the captured image, at least one control signal to cause movement of the body … ." EX1006, 133-135. However, as this Petition shows below, that feature is not new, either.

For example, Chinese Patent Application No. 200710119800.5 to Fu (EX1007), entitled "Underwater Cleaning Robot" and filed almost five years before the application that resulted in the '207 Patent, discloses a "control system" comprised of "a central processor, monitoring cameras, an image acquisition card, inertial navigation components, … motor drivers … cleaning driving wheel DC motors 7," and other elements. EX1007, ¶[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 the cleaning driving wheel DC motors 7 constitute the cleaning driving ***execution layer*** of the control system." *Id.* (emphasis added). In the "autonomous mode, control signals are generated by the central processor, which autonomously plans paths and actions based on information from 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 '207 Patent—a controller that, based on an image of a location, generates at least one control signal to cause movement of the body to, or away from, that location—the only aspect of the Patent asserted as novel.

Additionally, as explained below, the claims are also obvious in light of Fu itself or in combination with U.S. Patent Pub. No. 2010/0299016 to Benzler, and over U.S. Patent Pub. No. 2012/0169497 to Schnittman, in combination with Benzler.

The Board should cancel claims 1-8, 11-14, and 19 of the '207 Patent.

II. THE '207 PATENT AND CLAIM CONSTRUCTION

A. Summary Of The '207 Patent

The '207 Patent, entitled "Pool Cleaning System and Method to Automatically Clean Surfaces of a Pool Using Images from a Camera," issued with 20 total claims, of which claims 1, 2, and 12 are independent. EX1005, (54), claims 1-20. The claims are directed broadly to systems and methods that use an image captured by a camera to control a pool system or equipment, such as a pool cleaner. *Id*., claims 1-20.

The '207 Patent generally relates to "a robotic pool cleaner" comprising a vehicle 30 with propulsion mechanisms, a filter, a camera, and a controller. *Id*., 2:67-3:3, 3:7-21, 3:31-43. Vehicle 30 uses propulsion mechanisms to move along submerged pool surfaces. *Id*., 3:33-45. Using its filter, the pool cleaner draws water from the pool and retains any debris present in the water. *Id*., 3:11-16. Cameras 32 capture an image of submerged pool surfaces, and Controller 42 "generate[s] control signals for steering vehicle 30 based upon signals received from cameras 32." *Id*., 3:46-55, 4:46-48.

B. Patent Family And File History

The '207 Patent was filed on Jan. 10, 2022 as U.S. Patent Application No. 17/572,388. *Id.*, (21), (22). The '207 Patent is seventh in a series of continuation applications claiming priority 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.

Originally filed claims 1-19 were copies of claims filed in a parent application, U.S. Patent Application No. 16/416,840 (the "'840 application"). *Compare* EX1006, 18-20 *with* EX1009, 17-19. Prior to examination, the applicant filed a preliminary amendment, canceling claims 1-19 and adding a new claim 20. EX1006, 41. The applicant characterized claim 20 as "similar in many respects to allowed claim 23 of the Allowed Parent Application" 17/143,624 (now U.S. Patent No. 11,262,766). *Id.*, 42.

No prior art rejections were issued against claim 20. The sole Office Action contained only a nonstatutory double patenting rejection that was overcome via a terminal disclaimer. *Id.*, 82-90. When responding to the Office Action, the applicant also added new claims 21-39. *Id.*, 99-105. No prior art rejections were issued against claims 21-39 either.

The Notice of Allowance indicated claims 20-39, now claims 1-19 of the '207 Patent, as allowed, identifying claim 1's "controller" limitations as allegedly

inventive. *Id*., 146-150 (also identifying claim 21's "controller" limitation as allegedly inventive). The Notice also identified claim 12 as allegedly inventive. *Id*.

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.

The term "means for moving the vehicle body within the swimming pool," of claim 1, is a means-plus-function (MPF) term governed by 35 U.S.C. § 112(f). Per 37 C.F.R. § 42.104(b)(3), Petitioner identifies specific portions of the specification that describe the structure and functions for this term:

Claim Limitation	**Structure**	**Function**
[1b] means for moving the vehicle	"In one implementation, vehicle 30 is propelled along the submerged pool surfaces using ***wheels, rollers, tracks or other surface contacting members***	Moving the vehicle body within

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body within the swimming pool	***powered by a motor and the like***. … In one implementation vehicle 30 may also alternatively be propelled by means of the ***vacuum or liquid jets***. … In other implementations, vehicle 30 may include other propulsion mechanisms." EX1005, 3:31-43.	the swimming pool EX1005, claim 1.

Thus, the corresponding structures disclosed in the specification for "means for moving" include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like" and "vacuum or liquid jets." EX1005, 3:34-45; *see also id.*, 10:11-30 (describing drive motor, "toothed track drive 900" and rollers 908 of Figs. 9 and 10).

2. POSA's Skill Level

A POSA 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, ¶¶30-32.

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 '207 Patent is eligible for IPR, and that Wybotics is not barred or estopped from requesting IPR of claims 1-8, 11-14, and 19 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, 5-8, 12-14, 19	Fu (EX1007, CN 101139007 B) anticipates under § 102
Ground 1b	1-3, 5-8, 12-14, 19	Fu renders obvious under § 103
Ground 1c	1-8, 11-14, 19	Fu in view of Benzler (EX1013, U.S. Patent Pub. No. 2010/0299016) renders obvious under § 103
Ground 2a	1-7, 11-14, 19	Schnittman (EX1008, U.S. Patent Pub. No. 2012/0169497) in view of Benzler renders obvious under § 103
Ground 2b	8	Schnittman in view of Benzler, in further view of Fu renders obvious under § 103

IV. CLAIMS 1-8, 11-14, AND 19 ARE UNPATENTABLE

A. Ground 1a: Fu Anticipates Claims 1-3, 5-8, 12-14, And 19

1. Summary Of Fu

Fu, entitled "Underwater Cleaning Robot," was filed on July 31, 2007 as Application No. 200710119800.5 in China. EX1007, (54), (21), (22). Fu issued as Grant Publication No. CN 101139007B, 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).

Fu describes a robot designed "for the underwater cleaning of swimming pool floors and walls." *Id.*, Abstract.

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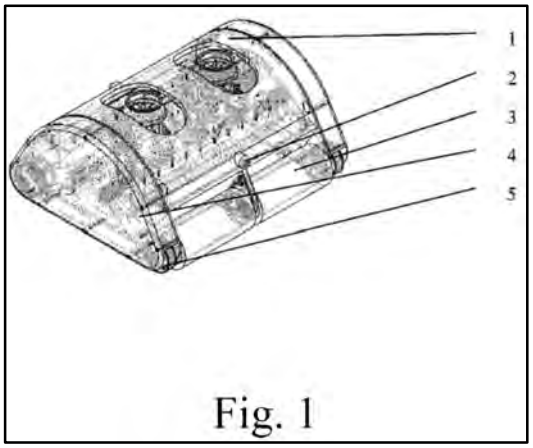


Fig. 1

Id., Fig. 1. The underwater cleaning robot has two operational modes: (i) manual mode, where a control keypad is used to send control signals to the robot; and (ii) autonomous mode, where the control system controls the robot's operations based on data received from cameras. *Id.*, ¶[0025].

The robot "comprises a drainage mechanism, a cleaning and mobility platform, and a control system." *Id.*, ¶[0024], Abstract.. These three units coordinate to "perform cleaning tasks autonomously or via remote control underwater on horizontal, vertical, and inclined surfaces." *Id.*, Abstract. The drainage mechanism filters pool water by drawing in water, filtering it to remove any debris, and discharging the filtered water into the pool. *Id.*, ¶¶[0024]-[0026]. The cleaning and mobility platform provides structural support and propulsion to the robot, while also performing "brush-cleaning" of pool surfaces via cleaning driving wheels 3. *Id.* The control system autonomously controls the robot's operations by generating control signals based on an image received from monitoring cameras 2,

that are installed on the robot's housing. *Id.*

2. Claim 1

(a) Preamble: "A self-propelled pool cleaning system for cleaning debris from a submerged surface of a swimming pool, comprising:"

To the extent limiting, claim 1's preamble is disclosed by Fu. EX1010, ¶¶359-363. Fu discloses "an underwater cleaning robot" designed "for the underwater cleaning of swimming pool floors and walls." EX1007, Abstract.

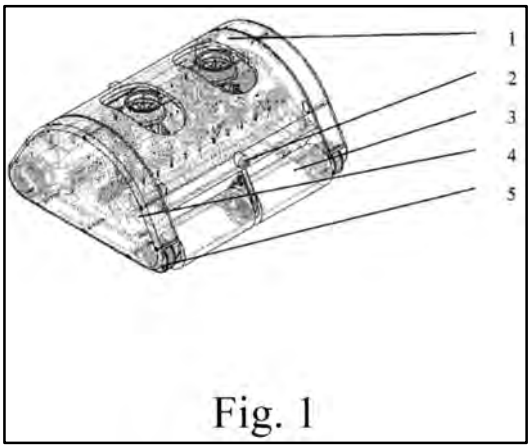


Fig. 1

Id., Fig. 1 (underwater cleaning robot). Fu's robot comprises "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 robot is a "pool

cleaning system for cleaning debris from a submerged surface of a swimming pool."

Fu's robot is also self-propelled. The robot's cleaning and mobility platform comprises "four independent cleaning driving wheels 3" that "are controlled by their respective motor drivers, allowing for independent movement." *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 motor drivers and cleaning driving wheel DC motors 7, which drive 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].

As detailed below for elements 1a-1f, Fu's robot discloses all the features of claim 1, thus, Fu discloses a "self-propelled pool cleaning system [underwater cleaning robot] for cleaning debris from a submerged surface of a swimming pool."

(b) Element 1a: "a vehicle body;"

Fu discloses element 1a. EX1010, ¶¶364-366. Figure 1 illustrates "[o]verall schematic diagram of the underwater cleaning robot," including "1 - robot housing body" (EX1007, ¶[0014]):

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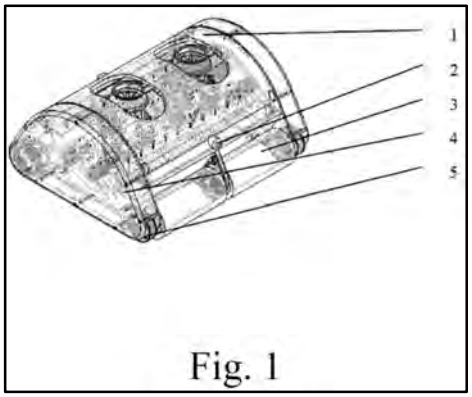


Fig. 1

Id., Fig. 1. The "housing body 1 comprises a robot top cover 18, robot side walls 20, and a robot main housing body 19." *Id*., ¶[0024].

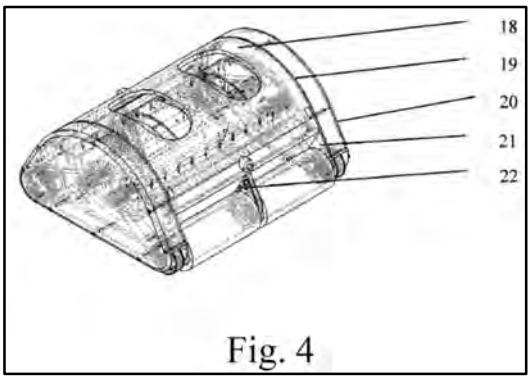


Fig. 4

Id., Fig. 4. Accordingly, Fu discloses "a vehicle body [robot housing body 1]."

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

Fu discloses element 1b. EX1010, ¶¶367-370. The term "means for moving the vehicle body within the swimming pool" is an MPF term, whose corresponding structures include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like." EX1005, 3:33-45; Section II.C.1.

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, comprises "a robot housing body 1, cleaning driving wheels 3, synchronous belt gears 5, and a driving synchronous belt 4." *Id.* A driving DC motor 7 drives wheels 3 via synchronous belt gears 5 and 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].").

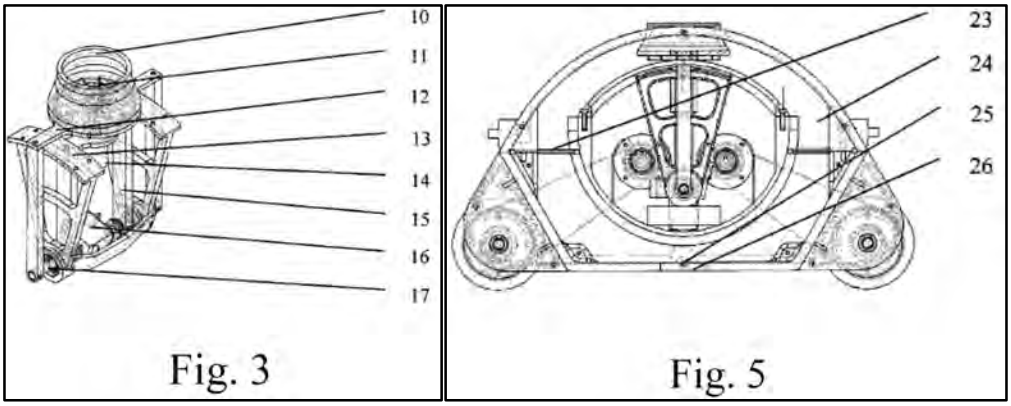
Further, cleaning driving wheels 3 "are controlled by their respective motor drivers, allowing for independent movement." *Id.*, ¶[0026]. "By using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, turning, and brush-cleaning." *Id*.

Thus, Fu teaches "means for moving the vehicle body within the swimming pool [driving wheels 3 powered by cleaning driving wheel DC motors 7]."

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

Fu discloses element 1c. EX1010, ¶¶371-374. Fu's robot includes a "drainage mechanism" designed to draw in pool water, filter out debris from the water, and discharge the filtered water while retaining the debris. EX1007,

¶¶[0024]-[0026]. Figures 3 and 5 illustrate an example schematic of the drainage mechanism :



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

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 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 also retains the debris that is filtered out from the 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, the debris is retained within water flow channel 24. Fu also describes that "[w]hen the debris [inside water flow channel 24] reaches a certain density, [the robot] issues a 'debris full' alarm," further confirming that the drainage mechanism retains the debris. *Id*.

Thus, Fu discloses "a filter [filter screen 23 of Fu's drainage mechanism] configured to retain debris collected from the submerged surface."

(e) Element 1d: "at least one camera for capturing an image of at least a first object within the swimming pool; and"

Fu discloses element 1d. EX1010, ¶¶375-378. Fu's robot comprises "2 – monitoring camera":

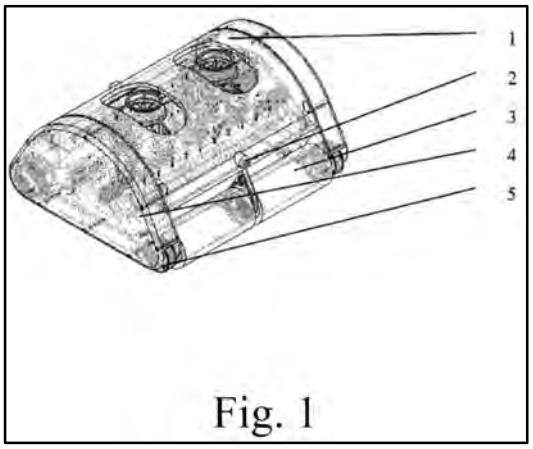


Fig. 1

EX1007, ¶[0014], Fig. 1. The robot "uses its monitoring cameras 2 to capture images of the pool floor and compares them with the [pool cleanliness image] threshold to determine the level of cleanliness." *Id.*, ¶¶[0010], [0026]. In doing so,

cameras 2 necessarily capture an image of "at least a first object within the swimming pool," *e.g.*, the pool surface itself, as well as debris, dirt, or any other visible particles present on or near the pictured surface. EX1010, ¶¶375-378. Because the captured image is evaluated to determine the cleanliness of the pool floor, the image necessarily include any debris or foreign matter that is present, along with the pool surface itself that is pictured.

The '207 Patent includes no lexicography or disclaimer for "object," so it is given its plain and ordinary meaning. *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). As explained by Dr. Reinholtz, the plain and ordinary meaning of "object" in the context of the '207 Patent is any material thing that can be perceived by the senses, which constitutes any debris, dirt, or the pool surface. EX1010, ¶377; EX1020.

Therefore, Fu discloses "at least one camera [monitoring cameras 2] for capturing an image of at least a first object within the swimming pool."

(f) Element 1e: "a controller (i) in electronic communication with the at least one camera and"

Fu discloses element 1e. EX1010, ¶¶379-381. Fu discloses a control system comprising "a central processor, monitoring cameras, an image acquisition card, … motor drivers, … [and] cleaning driving wheel DC motors 7." EX1007, ¶[0024].

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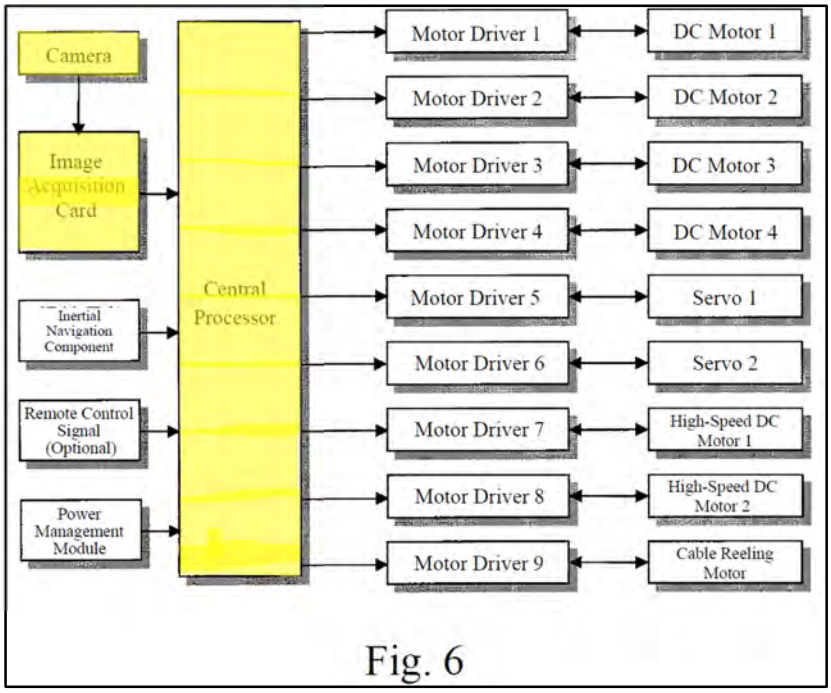


Fig. 6

Id., Fig. 6 (annotated). "The underwater cleaning robot controls its actions according to control commands issued by the central processor." *Id.*, ¶¶[0010], [0026]. Therefore, Fu's control system, comprising the central processor that generates control signals for controlling the robot, teaches the "controller." *Id.*

"[T]he monitoring cameras (2) are connected to the central processor via the image acquisition card." EX1007, claim 1, Fig. 6. The image acquisition card serves as an electronic interface that transmits an image from monitoring cameras 2 to the central processor for processing, such that the controller (control system with central processor) is "in electronic communication with the at least one camera [monitoring cameras 2]." EX1010, ¶¶379-381.

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(g) Element 1f: "[the controller] (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 object."

Fu discloses element 1f. *Id.*, ¶¶382-387. Fu explains that "[t]he monitoring cameras 2 and the image acquisition card constitute the environmental perception layer of the control system," which "constitutes the input part of the control system." EX1007, ¶[0024]. "[I]nformation from the environmental perception layer," *i.e.*, the image captured by monitoring cameras 2 is expressly identified as the basis upon which "control signals are generated by the central processor … to drive the robot[]." *Id.*, ¶[0025].

As shown in Figure 6, the central processor receives the image captured by cameras 2 via the image acquisition card . *Id.*, claim 1, Fig. 6. 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 [*i.e.*, motor drivers that drive wheels 3] and complete the underwater cleaning task." *Id.*, ¶[0025]. Fu further describes this process in detail:

> 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.

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> 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].

Fu also explains that "[b]y using different combinations of wheel speeds, the robot can perform tasks such as moving forward, backward, [and] turning," (*id*. [0010]) thus confirming that the generated signals cause the robot to move "to, or away from, the first object" based on the cleanliness determination of the pictured region. *Id.*

Thus, Fu's central processor receives the image captured by cameras 2, which includes visible dirt or debris constituting "a first object," to assess the "level of cleanliness" of the pictured region. *Id.*, ¶¶[0024]-[0026]. 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.*, ¶[0026]. A POSA would have recognized that any robot movement would necessarily be "to, or away from, the first object" captured by Fu's cameras 2. EX1010, ¶¶382-387.

Further, as Dr. Reinholtz explains, because the central processor generates control signals in response to the "level of cleanliness" of the captured image, and those signals drive movement in "forward, backward, [or] turning" directions, a POSA would have understood that the controller directs the robot toward the first

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object when it is located in a sub-threshold (*i.e.*, relatively dirty) region and away from the first object when it is located in an above-threshold (*i.e.*, relatively clean) region. *Id.*

Fu anticipates claim 1. *Id.*, ¶¶358-388.

3. Claim 2

(a) Preamble: "A pool system comprising:"

To the extent limiting, claim 2's preamble is disclosed by Fu. *Id.*, ¶389. Claim 2's preamble is broader than claim 1's because it merely recites a "pool system," imposing no requirements, as claim 1 does, that the pool system be "self-propelled" or dedicated to "cleaning debris from a submerged surface of a swimming pool." Because Fu anticipates the narrower preamble of claim 1, Fu likewise anticipates the broader preamble of claim 2. Thus, Fu discloses the "pool system [underwater cleaning robot]."

(b) Element 2a: "at least one piece of equipment for a swimming pool or spa;"

Fu discloses element 2a. *Id.*, ¶¶390-392. Fu discloses "an underwater cleaning robot" designed "for the underwater cleaning of swimming pool floors and walls." EX1007, Abstract. Figure 7 illustrates the robot performing "long-duration, global cleaning" of a swimming pool:

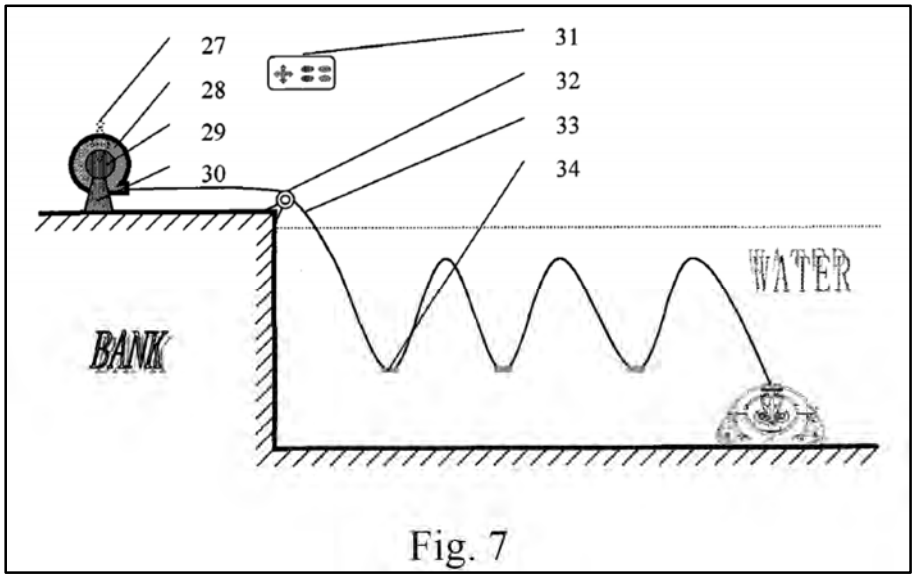


Fig. 7

Id., Fig. 7. Accordingly, Fu discloses "at least one piece of equipment [underwater cleaning robot] for a swimming pool or spa."

(c) Element 2b: "one or more cameras configured to capture video or images of at least a portion of a location including the swimming pool or spa; and"

Fu discloses element 2b. EX1010, ¶¶393-395. Fu's robot comprises "monitoring cameras 2 … installed on the two front panels of the robot main housing body 19":

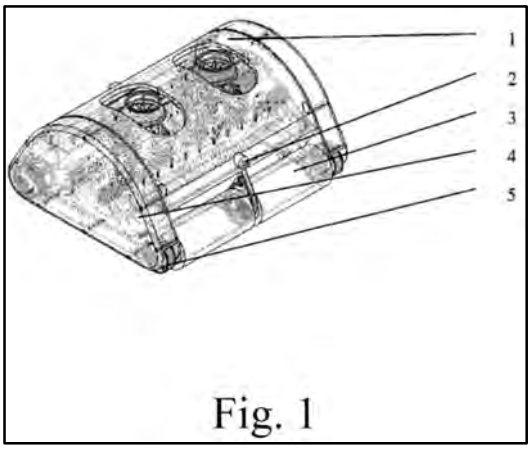


Fig. 1

EX1007, Fig. 1, ¶¶[0014], [0024]. The robot "uses its monitoring cameras 2 to capture images of the pool floor," which is a part of the swimming pool. *Id.*, ¶[0026].

Therefore, Fu discloses "one or more cameras [monitoring cameras 2] configured to capture video or images of at least a portion of a location including the swimming pool [images of the pool floor] or spa."

(d) Element 2c: "a controller in communication with the at least one piece of equipment and the one or more cameras, the controller configured to receive visual data from the one or more cameras and determine a control action for the at least one piece of equipment based on the received visual data."

Fu discloses element 2c. EX1010, ¶¶396-403. As explained for element 1e, Fu teaches a controller (control system with central processor) in communication with one or more cameras (monitoring cameras 2). Section IV.A.2.f.

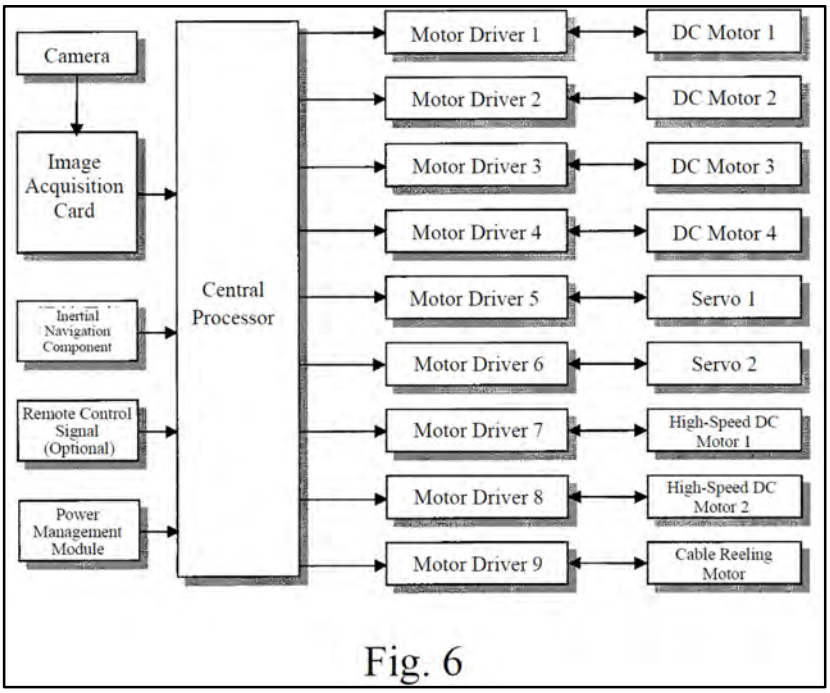


Fig. 6

EX1007, Fig. 6.

Additionally, "[t]he underwater cleaning robot controls its actions according to control commands issued by the central processor," which establishes communication between controller and the robot (*i.e.*, "piece of equipment") via control commands. *Id.*, ¶¶[0010], [0026]. As explained for element 1f, the central processor receives captured images (*i.e.*, "visual data") from monitoring cameras 2, and assesses the "level of cleanliness" of the pictured region by comparing the image with the "pool cleanliness image threshold." Section IV.A.2.g; EX1007, ¶¶[0024]-[0026]. Based on that assessment, the central processor generates control signals to drive the robot's "cleaning movements and adjusts the working state of the four cleaning driving wheels 3." Section IV.A.2.g; EX1007, ¶[0026].

Accordingly, Fu discloses "a controller [control system with central processor] in communication with the at least one piece of equipment [underwater cleaning robot] and the one or more cameras [monitoring cameras 2], the controller configured to receive visual data [images] from the one or more cameras and determine a control action [control signals regarding cleaning movements and wheel adjustments] for the at least one piece of equipment based on the received visual data."

Fu anticipates claim 2. *Id.*, ¶¶389-403.

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4. Claim 3

Fu discloses claim 3. *Id.*, ¶¶404-408. As explained for element 2a, Fu's robot teaches "at least one piece of equipment." Section IV.A.3.b. The robot is designed for cleaning a swimming pool by, for *e.g.*, filtering pool water and brush-cleaning pool surfaces, so it constitutes "a cleaning device." EX1007, Abstract, ¶¶[0010], [0024]-[0026]. As explained for element 1b, the robot includes "one or more propulsion mechanisms," *e.g.*, driving wheels 3 powered by cleaning driving wheel DC motors 7. Section IV.A.2.c.

Additionally, Fu's robot "possesses autonomous mobility and can be used for cleaning underwater horizontal, vertical, and inclined surfaces via remote or autonomous control, enabling it to autonomously complete underwater cleaning tasks in place of human labor." *Id.*, ¶[0001], Abstract. The robot "can adhere to the vertical walls of a swimming pool for cleaning, achieving vertical wall-climbing movement" because of "the high negative pressure within its water flow channel 24 and the force from the drainage mechanism." *Id.*, ¶¶[0011],[0026]. For vertical wall-climbing, the robot adjusts the position and discharge direction of water outlets 10 to generate a propulsive force for upward movement. *Id.*, claim 9, ¶¶[0012], [0026] ("The coordinated movement or positioning of multiple water outlets 10 along the water outlet sliding grooves 9 changes the discharge direction of the water outlets 10, generating different forces that affect the robot's movement. … Particularly when the

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robot is climbing a wall, factors such as pool steps may cause the chassis to be lifted, rendering the four cleaning driving wheels 3 ineffective. In this situation, the position of the water outlets must be adjusted to provide a propulsive force to the robot, returning it to a normal operating state."). Because Fu's robot travels underwater on the pool floor as well as vertical walls, it travels "adjacent to submerged or water containing surfaces of the swimming pool" just like the '207 Patent's pool cleaning system 20 with vehicle 30.

Thus, Fu anticipates claim 3: "the at least one piece of equipment comprises a cleaning device [underwater cleaning robot] with one or more propulsion mechanisms [driving wheels 3 powered by cleaning driving wheel DC motors 7], the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool floor and vertical pool walls] or spa and to perform a cleaning operation [filtering pool water and brush-cleaning pool surfaces]." EX1010, ¶¶404-408.

5. Claim 5

Fu discloses claim 5. *Id.*, ¶409. As explained for element 2b, Fu's monitoring cameras 2 are "installed on the two front panels of the robot main housing body." Section IV.A.3.c; EX1007, ¶[0024]. Thus, Fu anticipates claim 5: " the one or more cameras [monitoring cameras 2] are mounted on the at least one piece of equipment [underwater cleaning robot]."

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6. Claim 6

Fu discloses claim 6. EX1010, ¶¶410-411. As explained above, Fu's cameras 2 are installed on the robot body, and the robot is designed for underwater pool cleaning. Figure 7 shows the robot submerged in a swimming pool performing "long-duration, global cleaning":

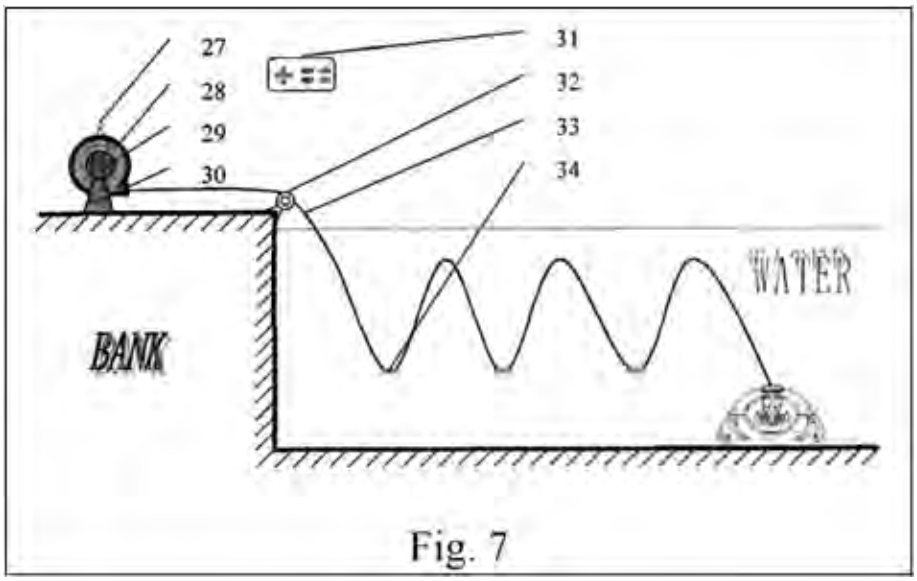


Fig. 7

EX1007, Fig. 7, ¶¶[0008], [0025]. Thus, Fu anticipates claim 6: "the one or more cameras [monitoring cameras 2] are submergible or submerged within the swimming pool or spa."

7. Claims 7-8

Fu discloses claims 7-8. EX1010, ¶¶412-415. As explained for element 2c, Fu's central processor receives captured images (*i.e.*, "visual data") from monitoring cameras 2, and assesses the "level of cleanliness" of the pictured region by comparing the image with the "pool cleanliness image threshold." Section IV.A.3.d. Based on

that cleanliness assessment, *i.e.*, determining whether the captured image falls above or below the pool cleanliness image threshold, the central processor generates control signals to drive the robot's "cleaning movements and adjusts the working state of the four cleaning driving wheels 3." *Id.*

Thus, Fu anticipates claim 7: "[t]he pool system of claim 2, wherein the controller is configured to detect a characteristic of the location [level of cleanliness of pictured region] based on the visual data and control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected characteristic." Fu also anticipates claim 8: "the characteristic comprises a cleanliness of a surface of the swimming pool [level of cleanliness of pictured region], and wherein the controller is configured to control the piece of equipment [adjust cleaning movements and wheel speeds of the underwater cleaning robot] based on the detected cleanliness being outside of a threshold [pool cleanliness image threshold]."

8. Claim 12

(a) Preamble: "A method for monitoring a pool system, the method comprising:"

To the extent limiting, claim 12's preamble is disclosed by Fu. EX1010, ¶¶416-417. In the autonomous mode, Fu's robot uses monitoring cameras 2 to monitor pool conditions and operate accordingly. *Id.*, Abstract, ¶¶[0024]-[0025]. The robot uses cameras 2 to capture images of the pool floor, and compares them with the pool cleanliness image threshold to determine the level of cleanliness of the

pictured region. *Id*. Based on this assessment, the robot autonomously adjusts its cleaning operations. *Id*. This continuous image capture and analysis of cleanliness comprises a "method for monitoring a pool system."

Thus, Fu discloses a "method for monitoring a pool system."

(b) Element 12a: "receiving images of at least a portion of a location including a swimming pool or spa from one or more cameras;"

Fu discloses element 12a. EX1010, ¶¶418-421. As explained for elements 1d-e, Fu's control system receives, via the image acquisition card, images captured by monitoring cameras 2 of the pool floor. Section IV.A.2.e-f.

Thus, Fu discloses "receiving images of at least a portion of a location including a swimming pool [images of the pool floor] or spa from one or more cameras [monitoring cameras 2]."

(c) Element 12b: "determining a target area and detecting a characteristic of the target area based on the images; and"

Fu discloses element 12b. EX1010, ¶¶422-424. Fu's robot "uses its monitoring cameras 2 to capture images of the pool floor and compares them with the [pool cleanliness image] threshold to determine the level of cleanliness." EX1007, ¶[0026]. The robot analyzes the specific region of the pool captured in the images to determine whether that region meets the cleanliness threshold. *Id.* That

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region corresponds to the "target area" because it is the specific area identified, *i.e.*, "determine[ed]" for assessing the level of cleanliness. *Id*.

Thus, Fu discloses "determining a target area [pictured region of the pool floor that is assessed for cleanliness] and detecting a characteristic of the target area [level of cleanliness] based on the images."

(d) Element 12c: "generating a control response based on the detected characteristic of the target area."

Fu discloses element 12c. EX1010, ¶¶425-428. As explained for element 1f, based on the determined level of cleanliness, the central processor generates control signals to drive the robot's "cleaning movements and adjusts the working state of the four cleaning driving wheels 3." Section IV.A.2.g.

Thus, Fu discloses "generating a control response [control signals to adjust the robot's cleaning movements and working state of the wheels] based on the detected characteristic [level of cleanliness] of the target area [pictured region of the pool floor that is assessed for cleanliness]."

Fu anticipates claim 12. EX1010, ¶¶416-428.

9. Claim 13

Fu discloses claim 13. *Id.*, ¶¶429-431. As explained for element 12b, the "target area" comprises the pool area captured in the images of the pool floor, whose "level of cleanliness" is assessed in comparison to a threshold. Section IV.A.8.c; EX1007, ¶[0026].

Thus, Fu anticipates claim 13: "the target area comprises a portion of a surface of the swimming pool [pictured region of the pool floor that is assessed for cleanliness] or spa, and wherein the characteristic comprises a cleanliness characteristic [level of cleanliness] of the portion of the surface of the swimming pool or spa." EX1010, ¶¶429-431.

10. Claim 14

Fu discloses claim 14. *Id.*, ¶¶432-433. As explained for element 12c, based on the "level of cleanliness" of the pictured region of the pool, Fu's central processor generates control signals that autonomously adjust the robot's cleaning movements and working state of the wheels. Section IV.A.8.d; EX1007, ¶[0026].

Thus, Fu anticipates claim 14: "generating the control response comprises controlling an operation of a piece of equipment of the swimming pool [control signals to adjust the robot's cleaning movements and working state of the wheels] or spa." EX1010, ¶¶432-433.

11. Claim 19

Fu discloses dependent claim 19. *Id.*, ¶¶434-436. As explained for claim 3, Fu's robot teaches a "cleaning device" "configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation." Section IV.A.4. Fu further teaches that, based on the determined level of cleanliness, its central processor generates control signals that autonomously adjust

the robot's working state of the wheels 3. EX1007, ¶[0026]. "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." *Id*., (emphasis added)).

Thus, Fu anticipates claim 19: "generating the control response [control signals to adjust the robot's cleaning movements and working state of the wheels] comprises controlling operation of a cleaning device [underwater cleaning robot] configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool floor and vertical pool walls] or spa and to perform a cleaning operation [filtering pool water and brush-cleaning pool surfaces], wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device [controlling the direction of the robot], an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning [cleaning actions of varying intensity], or a speed of the cleaning device [controlling the speed of cleaning wheels 3]." EX1010, ¶¶434-436.

B. Ground 1b: Claims 1-3, 5-8, 12-14, And 19 Would Have Been Obvious Over Fu

1. Claim 1

Fu anticipates claim 1. Section IV.A.2. However, to the extent the Board finds that Fu does not anticipate claim 1 for allegedly lacking at least one control signal that

causes movement of the body "to, or away from, the first object,"[1] Fu nevertheless would have rendered obvious this claim. EX1010, ¶¶437-440.

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]. A POSA would have found it obvious to implement motion control in Fu to direct the cleaning robot toward (i) pictured regions containing a first object falling below the cleanliness threshold, and (ii) away from pictured regions containing the first object falling above the cleanliness threshold. EX1010, ¶¶437-440.

Given Fu's use of image-based cleanliness determination to adjust wheel speeds and movement paths, it would have been a routine and predictable application for a POSA to configure Fu's central processor to generate control signals directing the robot toward the first object when it is in a subthreshold (*i.e.*, relatively dirty)

[1] As explained in Section IV.A.2.g, such a finding would be erroneous because claim 1 encompasses any control signal generated in response to the captured image that causes movement of the body: Once the camera captures an image of at least a first object within the pool, the vehicle occupies some finite position relative to that first object. *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 first object, *i.e.*, it will be movement "to, or away from" that first object. EX1010, ¶437 n.15.

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area. *Id*. A POSA would have been motivated to do so because moving the robot toward dirtier areas improves cleaning efficiency and task completion time. *Id*. Likewise, it would have been a routine and predictable application to configure Fu's central processor to generate control signals directing the robot away from the first object when it is present in an above-threshold (*i.e.*, relatively clean) area. *Id*. As explained by Dr. Reinholtz, implementing such control behaviors in Fu would have required no more than routine software configuration within a POSA's skill. *Id*. Such implementation would reflect 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 "at least one control signal to cause movement of the body within the swimming pool to, or away from, the object." *Id*.

Accordingly, Fu would have rendered obvious claim 1. *Id*.

2. Claims 2, 3, 5-8, 12-14, And 19

Independent claims 2 and 12 recite limitations similar to claim 1's, and are obvious over Fu for the reasons explained for claim 1. Fu also discloses the limitations added in dependent claims 3, 5-8, 13, 14, and 19 (*see* Ground 1a in Section IV.A), such that these dependent claims are likewise obvious over Fu. EX1010, ¶441.

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C. Ground 1c: Claims 1-8, 11-14, And 19 Would Have Been Obvious Over Fu In View Of Benzler

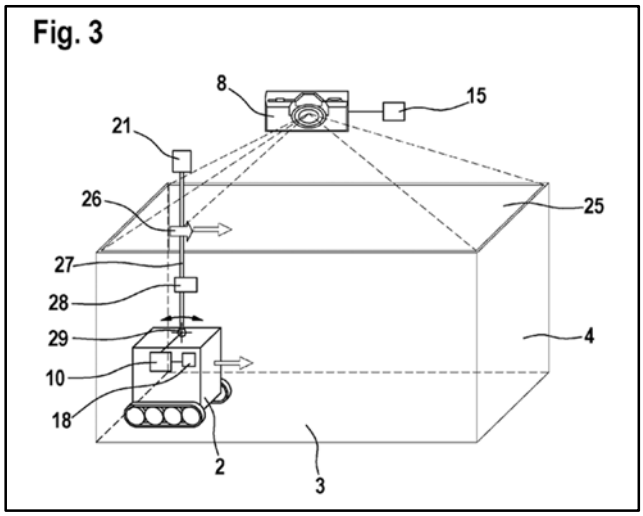
1. Summary Of Benzler

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 U.S. 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 vehicle (2) within a work area 3. *Id*., ¶[0037], Abstract. 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 robotic vehicle 2 for execution. *Id.*, ¶¶[0044]-[0046].

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 pool embodiment, "[t]he external border 4 of the work area 3 is created by the surrounding pool walls." Figure 3 illustrates the activation system as pool robotic vehicle 2 (*id.*, ¶¶[0036], [0051]-[0056]):



Id., Fig. 3.

Camera 8 transmits data via logic unit 10 to "control unit 18, which controls the not shown drive means" for driving robotic vehicle 2. *Id.*, ¶[0054].

2. Motivation To Combine

The similar disclosures of Fu and Benzler would have motivated a POSA to consider them together. EX1010, ¶¶442-443. Fu discloses capturing an image of the pool floor, comparing it to a cleanliness threshold to determine a level of cleanliness, and then adjusting the robot's operations accordingly. EX1007, ¶[0026]. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning

embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1; EX1013, Abstract, ¶¶[0016], [0018], [0028], [0037], [0044]-[0046], [0053]. Thus, Benzler, like Fu, is directed to an autonomous robotic cleaner that uses an image to guide its operations, particularly in a pool-cleaning embodiment.

A POSA's motivation for combining Fu and Benzler and further described below with respect to the claims.

3. Claim 1

To the extent the Board determines that Fu alone does not anticipate or render obvious the "at least one control signal to cause movement of the body within the swimming pool to, or away from, the first object," claim 1 is nonetheless obvious over Fu in combination with Benzler. EX1010, ¶¶444-448.

Benzler describes various embodiments of its robotic vehicle, such as an autonomous lawnmower. In this embodiment, "the logic unit … is … [constructed] 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." EX1013, ¶¶[0018], [0023], [0045]. 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 image-based 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, ¶¶444-448. Applying Benzler's classification-driven motion to Fu's thresholded cleanliness determinations would have yielded the control signal for causing movement "to, or away from" a portion of the submerged surface captured by the 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 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.*

Thus, Fu in view of Benzler renders obvious claim 1's "to, or away from"

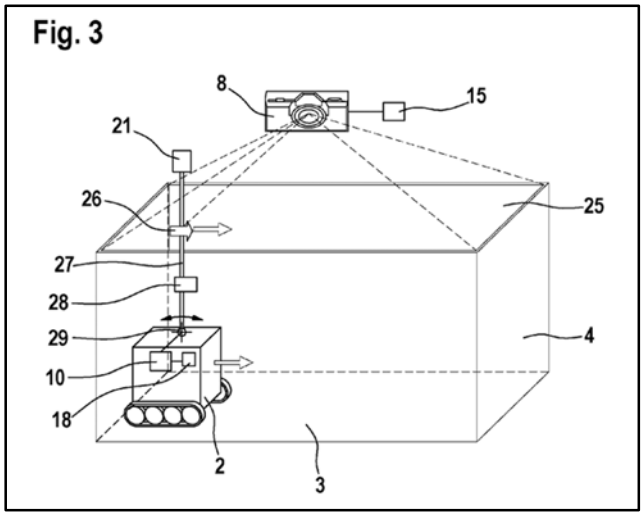
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control-signal limitation by teaching and motivating use of image-based region classification to control motion toward target (dirtier) regions and away from non-target (cleaner) regions. *Id*.

Claim 1 would have been obvious over Fu in view of Benzler. *Id.*, ¶¶442-448.

4. Claim 4

Claim 4 would have been obvious over Fu in view of Benzler. *Id.*, ¶¶449-453. While Fu's robot comprises onboard cameras that are submerged in the pool, Benzler's pool robotic vehicle 2 uses external camera 8. Sections IV.A.5-6, IV.C.1. A POSA would have recognized the advantages of implementing Fu with Benzler's external camera 8. Benzler emphasizes that external camera 8 is positioned above the work area, *i.e.*, pool, so it can capture a broad, global view of the entire pool. Ex. 1013, ¶[0010] ("The camera is preferably arranged above the work area, so that a section of the work area can be detected that is as big as possible with the camera ... It is furthermore possible to arrange the at least one camera … in such a way that it follows the movement of the robotic vehicle.").



EX1013, Fig. 3. A POSA would understand that this overhead perspective provides additional information that Fu's submerged, onboard cameras cannot capture; while Fu's onboard cameras observe only a partial, local region within the pool, Benzler's external camera provides a complete, unobstructed view of the entire pool along with the robot's exact location, orientation, and trajectory. EX1010, ¶¶449-453.

A POSA would have had a reasonable expectation of success in making this combination because Fu already provides an existing communication infrastructure for easily integrating Benzler's external camera 8 into Fu. Figure 7 illustrates a "control and power management system" that is external to the pool, including components such as signal relay and cable manager 28, and signal and power cable 33:

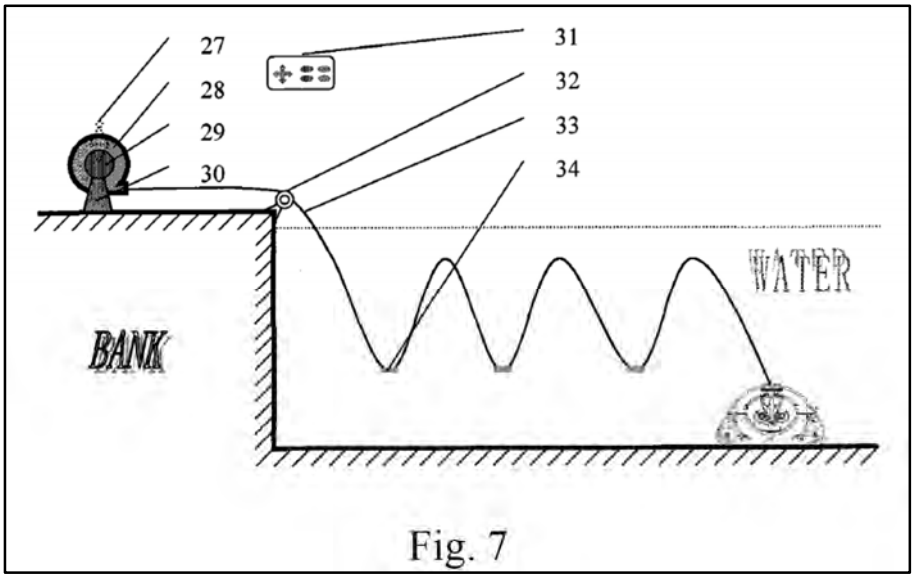


Fig. 7

Id., Fig. 7. This system establishes a communication path for transmiting controls signals and power between external hardware and the underwater robot. EX1007, ¶[0024] (*e.g.*, floating antenna 27 relays signals from keypad 31 to the robot via cable 33). A POSA would understand that this same communication path could be used to transmit data from Benzler's camera 8, and/or control signals derived from images captured by camera 8, to the robot. As explained by Dr. Reinholtz, this would be a straightforward integration well within a POSA's skill. EX1010, ¶¶449-453.

Thus, Fu in view of Benzler renders obvious claim 4: "the one or more cameras [Benzler's camera 8] are mounted external to the swimming pool or spa." *Id.*

5. Claim 11

Claim 11 would have been obvious over Fu in view of Benzler. *Id.*, ¶¶454-455. Fu discloses an onboard controller (control system with central processor) in communication with the camera. EX1007, ¶¶[0024]-[0026]. A POSA would have

recognized the advantages of implementing Benzler's external camera 8 with Fu's onboard controller (Section IV.C.4), making "the controller [onboard control system with central processor] [] remote from the camera [Benzler's camera 8]" in Fu's robot.

Thus, Fu in view of Benzler renders obvious claim 11. EX1010, ¶¶454-455.

6. Claims 2, 3, 5-8, 12-14, And 19

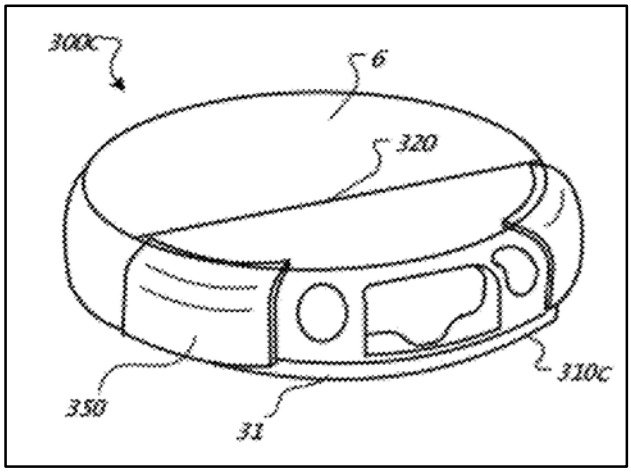
Independent claims 2 and 12 recite limitations similar to claim 1's, and are obvious over Fu in view of Benzler for the reasons explained in Sections IV.C.2-3 for claim 1. Fu also discloses the limitations added in dependent claims 3, 5-8, 13, 14, and 19 (*see* Section IV.A for Ground 1a), such that these dependent claims are likewise obvious over Fu in view of Benzler. EX1010, ¶456.

D. Ground 2a: Claims 1-7, 11-14, And 19 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 system and onboard sensing for navigation and safety. *Id.*, Abstract, ¶¶[0002], [0004]-[0006].



Id., Fig. 3C (example cleaning robot). 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], [0216]-[0227].

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

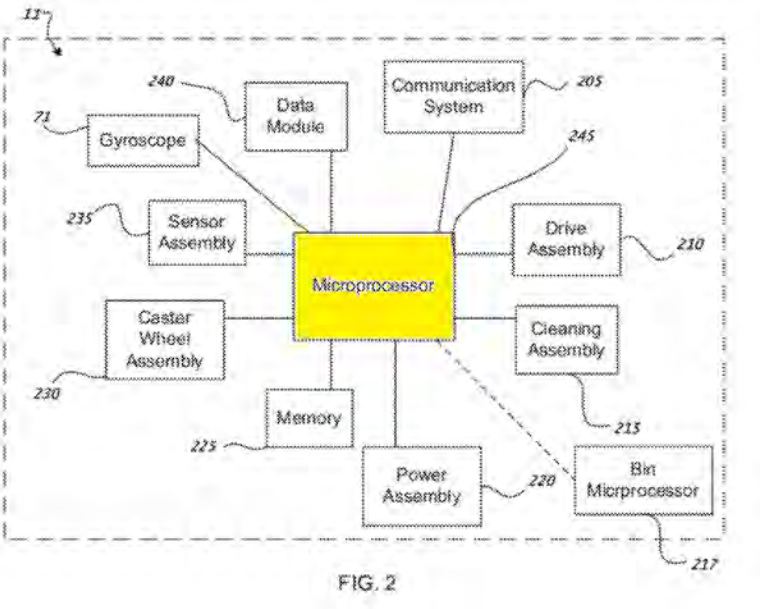


FIG. 2

Id., Fig. 2 (annotated). 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.*

Additionally, "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]):

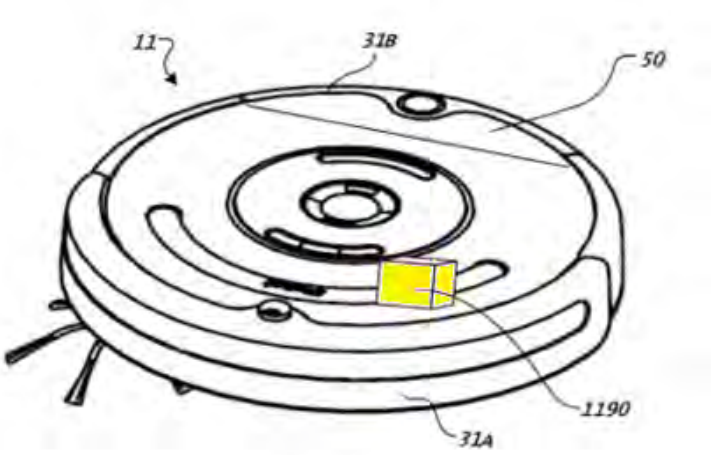


FIG. 11

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."). Camera 1190 is "in communication with the microprocessor 245," which controls the robot based on signals received from the camera. *Id.*, ¶[0204].

Schnittman is analogous art to the '207 Patent because (1) it is from the same field of endeavor as the '207 Patent, and (2) it is reasonably pertinent to the problem faced by the inventors of the '207 Patent. EX1010, ¶109; s*ee Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019).

First, the '207 Patent and Schnittman are in the same field of endeavor: autonomous cleaning robots. *Compare* EX1005, 1:26-2:36 (automated, robotic cleaners for cleaning surfaces) *with* EX1008, ¶¶[0002]-[0003] ("This application

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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 '207 Patent: ensuring "that all portions of … pool surfaces are satisfactorily cleaned." EX1005, 1:26-31. 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, thus ensuring 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 [POSA] was attempting to solve." *Airbus S.A.S*, 941 F.3d at 1382.

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

Schnittman is entitled to the December 30, 2010 priority date of the '808 Provisional because the Provisional supports at least claim 1 of Schnittman. A later patent enjoys the priority date of the provisional so long as the provisional "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).

As shown below, 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 having a top portion and a bottom portion, the top portion above the bottom portion as debris is received into the receptacle;	"In one aspect, a debris monitoring system includes **a receptacle**, a first and a second emitter, and a first receiver. **The receptacle defines an opening to receive debris into the receptacle**." *Id.*, ¶[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** …." *Id.*, ¶[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**." *Id.*, ¶[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**." *Id.*, ¶[0003]. "In some implementations, the first receiver and the

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	second emitter are disposed substantially opposite one another **across the largest dimension of the opening**." *Id.*, ¶[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**." *Id.*, ¶[0006]. "The debris monitoring system of claim 21 wherein 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." *Id.*, claim 24.

Additionally, the '808 provisional describes the subject matter of Schnittman that Petitioner relies upon as prior art. *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. Blue and underlined text reflects material present in only Schnittman, while unmarked text reflects material common to both Schnittman and the provisional. Additionally, the Petition-cited Schnittman passages are highlighted in yellow. As EX1012 shows, none of the Petition-cited Schnittman passages appear as blue, underlined text, demonstrating that every portion of Schnittman relied upon in the Petition is present

verbatim or in substance in the '808 provisional. Additionally, all 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. Motivation To Combine

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, ¶¶457-466. 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. Section IV.D.1. Likewise, Benzler describes an autonomous robotic cleaning system, with a pool cleaning embodiment, that makes movement and cleaning decisions based on an image of the work area. Section IV.C.1.

At the time of the '207 Patent, POSAs working in the field of autonomous, image-based cleaning robots, whether for floors, lawns, or pools, were addressing the same problem: using an image to enable a robot to perceive its cleaning surface, and execute cleaning operations autonomously. EX1010, ¶¶457-466. Both Schnittman and Benzler address that problem, and offer complementary, overlapping teachings. *Id*. Importantly, Schnittman is not limited to any specific environment; its teachings

apply generally to cleaning robots that analyze an image of the cleaning surface. As explained by Dr. Reinholtz, this image-based control represented a state-of-the-art approach to autonomous cleaning at the time, 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 as taught by Benzler. *Id.*; EX1008, Figs. 10A-10B; ¶¶[0024], [0191]-[0203].

POSA would have understood that robotics principles underlying image-based cleaners, like those developed by leading manufacturers such as iRobot (assignee of Schnittman), are readily adaptable to different environments. EX1010, ¶¶457-466. Robotics, like any other technology, develops by building on existing technology and adapting existing technology to new contexts. *Id*. POSAs in the field of autonomous pool cleaners were not working in isolation; they routinely drew on technologies from the broader field of autonomous cleaning. *Id*. Indeed, Benzler itself confirms this: it describes the same image-driven framework as Schnittman, while applying this framework to both land and water embodiments, such as a lawnmower, a snow cleaning vehicle, a pool cleaning vehicle, etc. Section IV.C.1; EX1013, ¶¶[0028], [0037], [0044]-[0046]. By describing the same image-based system across multiple domains, land and water alike, Benzler demonstrates that a POSA understood how to adapt the principles of image-based robotic navigation and cleaning across various

environments.

Benzler would have further reinforced a POSA's understanding that Schnittman's cleaning robot could be adapted for underwater use. For example, Benzler's teaching of a "moisture-sealed housing" for the internal logic unit (EX1013, ¶[0011]) contemplates operation in wet environments (*id*., Fig. 3 (showing onboard logic unit 10 submerged in a pool)), providing a practical implementation detail that a POSA would have easily incorporated when adapting Schnittman's robot for underwater use. Likewise, 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 pool cleaner, would predictably yield an image-based underwater pool cleaner that is driven based on an image of the pool surface.

A POSA would have had a reasonable expectation of success in making this combination. EX1010, ¶¶457-466. By the time of the '207 Patent, the necessary adaptations to render a system water-ready were straightforward and within a POSA's skill, such as moisture-sealing or potting electronics, waterproofing, ensuring stable mobility and traction along submerged pool surfaces to counter buoyancy and

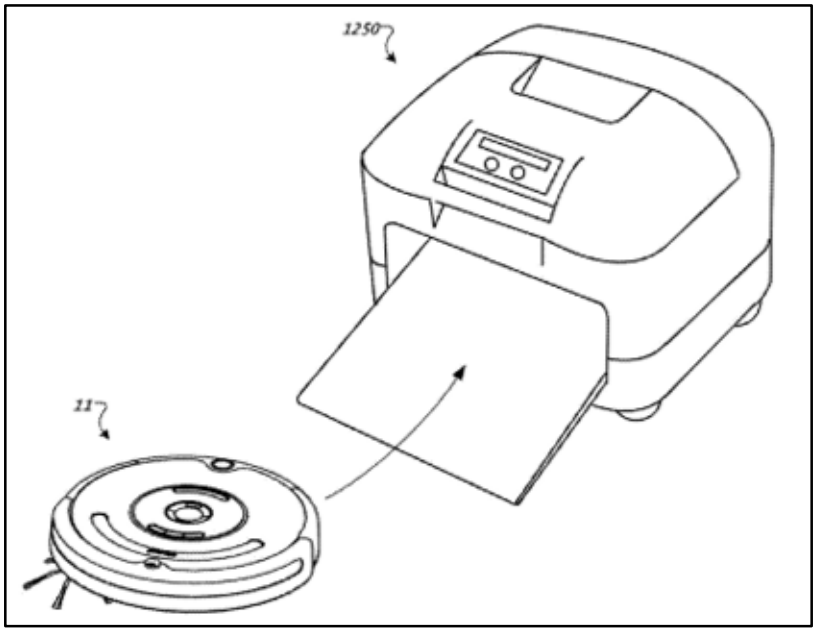
slippage, and applying known image-processing techniques to extract useful information from underwater camera imagery. *Id*. For example, in the same period, the use of cameras on underwater cleaning vehicles was well known. *See, e.g.*, EX1014 ("underwater sediment cleaning apparatus … wherein the controller … comprises: a camera unit"), EX1015 ("Robotic submersible cleaning system" including "use of an intelligent camera system 81 [to] assist in maintaining the positional accuracy … along an underwater surface"), EX1016 ("apparatus and method of … inspecting a submerged surface of a fluid reservoir" including a "navigation camera 6"). Researchers documented effective techniques to improve the effectiveness of underwater imaging. For *e.g*., literature from around that time described various normalization, filtering, and color-space methods that extract target information from underwater environments in real time. *See* EX1017, 7. These developments would have reinforced a POSA's motivation 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. Claim 1

(a) Preamble

To the extent limiting, claim 1's preamble would have been obvious over Schnittman in view of Benzler. EX1010, ¶¶467-471. Schnittman discloses

autonomous robotic cleaners for removing debris from cleaning surfaces (*e.g.*, floors) (EX1008, ¶¶[0002], [0023], [0032], [0033]):



Id., Fig. 14D (example robotic cleaner 11 and maintenance station 1250); ¶¶[0097], [0216]-[0217]. In embodiments, Schnittman's 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].

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 driven wheels 45"). In embodiments, power for moving Schnittman's robotic cleaner is provided via an onboard battery that is charged at a maintenance station 1250. *Id.*, ¶¶[0048], [0050], [0054], [0115], [0118], [0216]-[0217], [0221], [0227], [0230].

As detailed below for elements 1a-1f, Schnittman's cleaning robot discloses all the features recited in claim 1, thus it discloses the preamble's "pool cleaning system." Additionally, 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 preamble's "self-propelled pool cleaning system [robotic cleaner 11] for cleaning debris from a submerged surface of a swimming pool." EX1010, ¶¶467-471.

(b) Element 1a

Schnittman discloses element 1a. *Id.*, ¶¶472-474. Embodiments of Schnittman's 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]):

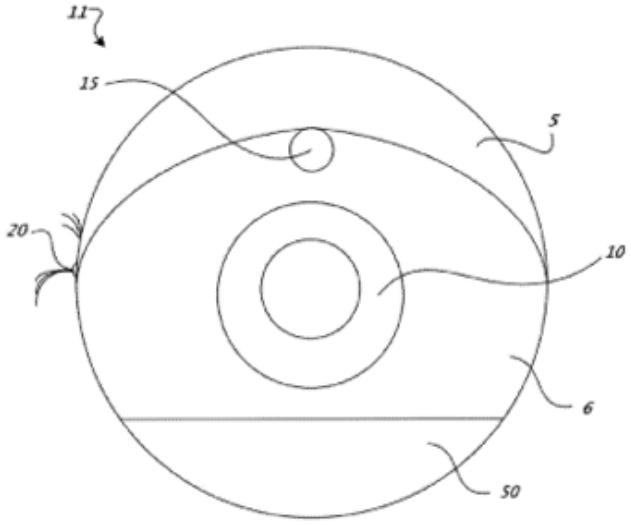


FIG. 1A

Id., Fig. 1A.

Thus, Schnittman's discloses "a vehicle body [robot body 31]." EX1010, ¶¶472-474.

(c) Element 1b

Schnittman in view of Benzler would have rendered obvious element 1b. *Id.*, ¶¶475-478. The term "means for moving the vehicle body within the swimming pool" is an MPF term, and the corresponding structures in the '207 Patent include "wheels, rollers, tracks or other surface contacting members powered by a motor and the like." EX1005, 3:33-45; Section II.C.1.

Schnittman's robotic cleaners include an onboard drive system (or "drive assembly") for moving the robot. 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]):

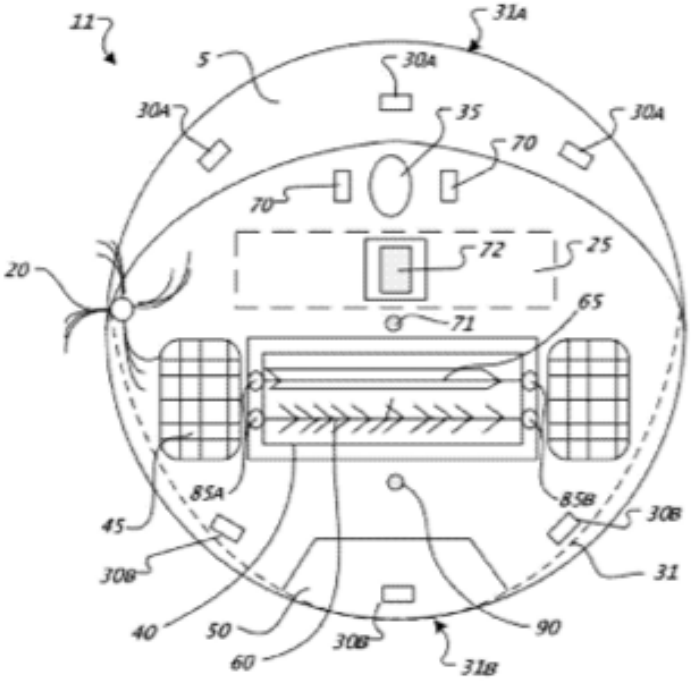


FIG. 1B

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 robot's movement. *Id.*, ¶¶[0119], [0177].

While Schnittman does not disclose moving "within [a] swimming pool" specifically, Benzler's teaching of "pool robotic vehicles [that] drive in particular on the bottom of a pool" using wheels powered by a drive motor provides a drive system similar to Schnittman's, reinforcing that Schnittman's similar motor-powered wheels 45 could be readily adapted for underwater use. Section IV.D.3.

Therefore, Schnittman in view of Benzler renders obvious "means for moving

the vehicle body within the swimming pool [drive system with wheels 45]." EX1010, ¶¶475-478.

(d) Element 1c

Schnittman in view of Benzler would have rendered obvious element 1c. *Id.*, ¶¶479-480. Schnittman discloses that its robotic cleaners include an "internal filter 54" (EX1008, ¶[0117]):

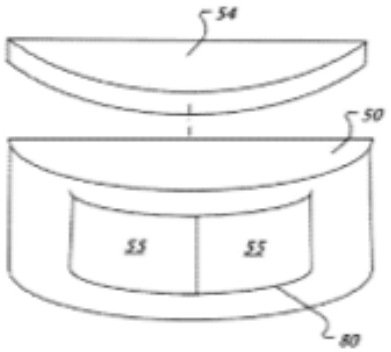


FIG. 1C

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

Internal filter 54 is part of the robot's cleaning bin 50, and it retains collected debris. *Id.*, ¶¶[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 in view of Benzler would include a filter like filter 54, with the filter retaining debris collected by the robot while passing filtered, clean water back into the swimming pool. EX1010, ¶¶479-480. Benzler describes use of debris-retaining filters in pool-cleaning robots. EX1013, ¶[0028] ("the robotic vehicle is construed as [a] pool-robotic vehicle, thus in particular as [a] filter vehicle

and/or cleaning or purifying vehicle"), Claim 22 ("a working element of the [pool-cleaning] robotic vehicle, in particular the width of a filter unit"). 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 a pool-cleaning context. EX1010, ¶¶479-480; Section IV.D.3.

Therefore, Schnittman in view of Benzler renders obvious "a filter [internal filter 54] configured to retain debris collected from the submerged surface." *Id.*, ¶¶479-480.

(e) Element 1d

Schnittman in view of Benzler would have rendered obvious element 1d. *Id.*, ¶¶481-484. Schnittman discloses embodiments of its robotic cleaners including a camera 1190:

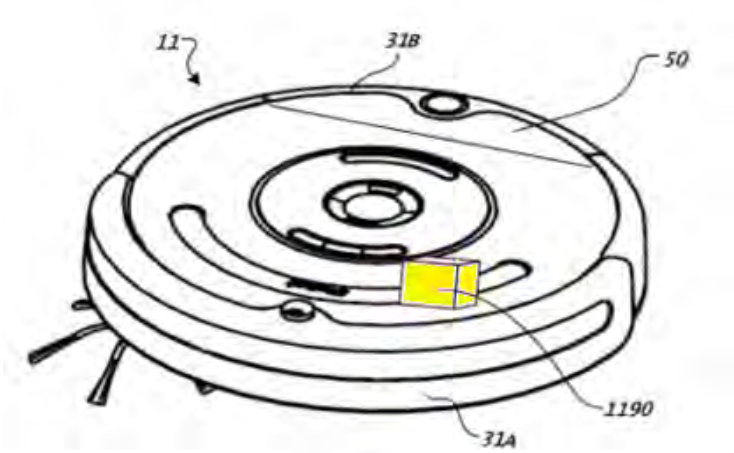


FIG. 11

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

The camera "scan[s] an area substantially forward of the [robot]" as the "robot [moves] over the cleaning surface." EX1008, ¶¶[0045], [0204]. The camera is "in communication with [a] microprocessor 245," and "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]. Additionally, "the microprocessor 245 can process the signal from the camera 1190 to recognize obstacles . . . in the vicinity of the robot 11 and maneuver the robot 11 to avoid obstacles . . . larger than a specific size threshold[.]" *Id.*, ¶[0205].

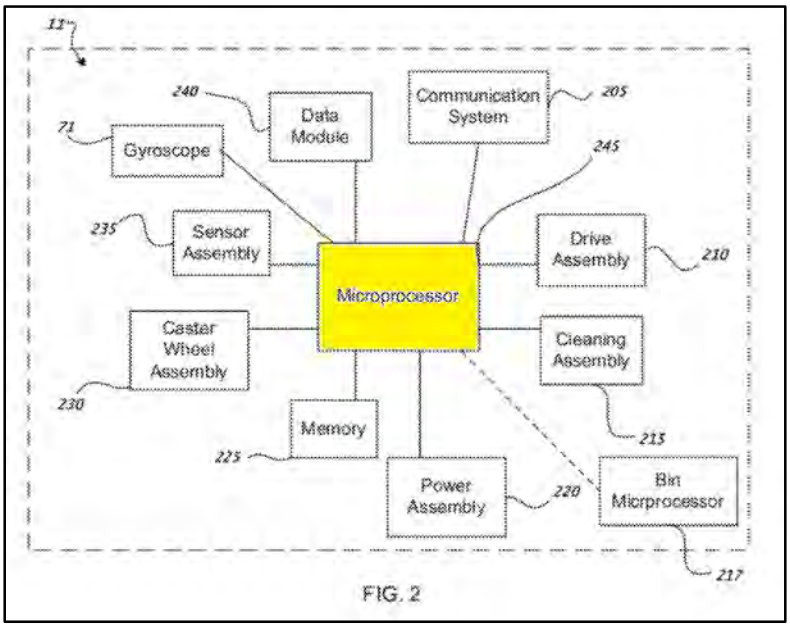
The debris, obstacles, and cleaning surface itself captured by Schnittman's camera and recognized by its microprocessor are examples of a first object. *See* Section IV.A.2.e. As explained by Dr. Reinholtz, a POSA would have thus understood that Schnittman's camera captures an image of at least a first object: The microprocessor could not "recognize debris on the cleaning surface" absent an image of these objects captured by the camera. EX1010, ¶¶481-484.

While Schnittman does not disclose capturing an image "within the swimming pool" specifically, a pool-cleaner implementation of Schnittman in view of Benzler would capture such an image. Section IV.D.3.

Accordingly, Schnittman in view of Benzler renders obvious "at least one camera [camera 1190] for capturing an image of at least a first object within the swimming pool." EX1010, ¶¶481-484.

(f) Element 1e

Schnittman discloses element 1e. *Id.*, ¶¶485-487. Schnittman discloses embodiments of its robotic cleaners including a microprocessor 245 (EX1008, ¶[0118]):



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 Figure 2, the routines executed by microprocessor 245 are stored in memory 225, and data module 240 is configured to "upload new software routines or values to the robot 11." *Id.*, ¶[0118]. Schnittman's microprocessor thus discloses the "controller" because it controls operation of the cleaning robot and is similar to controllers described in the '207

Patent. EX1010, ¶¶485-487. For instance, the '207 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 such as generating control signals." EX1005, 4:18-28 ("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. EX1008, ¶¶[0118]-[0119], [0177].

Schnittman further discloses that "camera 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 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].

Thus, Schnittman discloses "a controller [microprocessor 245]" "in electronic communication with the at least one camera [camera 1190]." EX1010, ¶¶485-487.

(g) Element 1f

Schnittman in view of Benzler would have rendered obvious element 1f. *Id.*, ¶¶488-492. Schnittman's microprocessor ("controller") generates commands ("control signals") to cause movement of the robot: "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 (*id.*, ¶¶[0177], [0191]-[0203]):

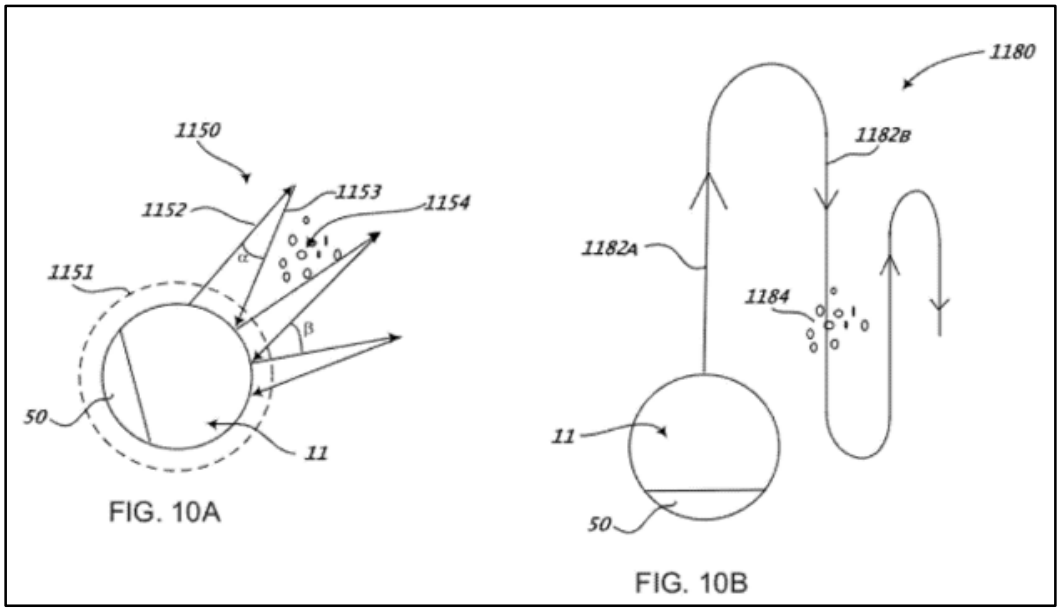


FIG. 10A FIG. 10B

Id., Figs. 10A, 10B (example cleaning patterns). Accordingly, Schnittman discloses the controller configured to generate control signals to cause movement of the robot's body. EX1010, ¶¶488-492.

Schnittman further discloses the generation of such control signals "in response to the captured image." Schnittman's 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]. Further, the microprocessor "can process the signal from the camera" and control movement of the robot accordingly. *Id.*, ¶¶[0204]-[0205]. Such control signals "cause movement of the [robot's] body … to, or away from, the first object":

> [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 an object, such as debris, obstacles, and cleaning surfaces (*see* Section IV.A.2.e), and the microprocessor processes the image to recognize debris or obstacles in it. EX1010, ¶¶488-492. Based on the recognized objects in the image,

the microprocessor generates control signals for moving the robot toward or away from the objects. *Id.*

While Schnittman does not disclose control signals for causing movement "within the swimming pool" specifically, a POSA would have understood, in view of Benzler, how to adapt Schnittman's robotic cleaners for use in this context. Section IV.D.3; EX1010, ¶¶488-492. Therefore, Schnittman discloses "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 object." EX1010, ¶¶488-492.

Schnittman in view of Benzler renders obvious claim 1. *Id.*, ¶¶467-493.

5. Claim 2

(a) Preamble

To the extent limiting, claim 2's preamble would have been obvious Schnittman in view of Benzler . *Id.*, ¶494. Claim 2's preamble is broader than claim 1's because it merely recites a "pool system," imposing no requirements, as claim 1 does, that the pool system be "self-propelled" or dedicated to "cleaning debris from a submerged surface of a swimming pool." Because Schnittman in view of Benzler would have rendered obvious the narrower preamble of claim 1, they likewise would have rendered obvious the broader preamble of claim 2. Thus, Schnittman in view of Benzler renders obvious the "pool system [robotic cleaner 11]." *Id.*, ¶494.

(b) Element 2a

Schnittman in view of Benzler would have rendered obvious element 2a. *Id.*, ¶¶495-497. Schnittman describes a robotic cleaner 11 for removing debris by, for *e.g.*, using "debris agitators," from cleaning surfaces (*e.g.*, floors). Section IV.D.4.a. 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 "at least one piece of equipment [robotic cleaner 11] for a swimming pool or spa." EX1010, ¶¶495-497.

(c) Element 2b

Schnittman in view of Benzler would have rendered obvious element 2b. *Id.*, ¶¶498-500. Schnittman discloses a camera 1190 that captures images of the cleaning surface. Section IV.D.4.e. While Schnittman does not disclose that the images capture a swimming pool specifically, in a pool-cleaner implementation of Schnittman in view of Benzler, the cleaning surface would comprise a pool. Hence, camera 1190 would capture images of submerged pool surfaces. Section IV.D.3; EX1010, ¶¶498-500. Accordingly, Schnittman in view of Benzler renders obvious "one or more cameras [camera 1190] configured to capture video or images of at least a portion of a location including the swimming pool or spa." *Id.*

(d) Element 2c

Schnittman discloses element 2c. EX1010, ¶¶501-505. As explained for element 1e, Schnittman teaches a controller (microprocessor 245) in communication with one or more cameras (camera 1190). Section IV.D.4.f. Additionally, microprocessor 245 is "capable of executing routines and generating and sending control signals" for "controlling [the robot's] drive assembly" and other components, which establishes communication between microprocessor 245 and robot 11 (*i.e.*, "piece of equipment") via control signals. EX1008, ¶¶[0118]-[0119], [0177]. As explained for element 1f, microprocessor 245 processes signals receives from camera 1190 (*i.e.*, visual data), and controls robot 11 accordingly. Section IV.D.4.g. For example, microprocessor 245 can "maneuver the robot 11 towards the debris" detected by camera 1190, or it can "maneuver the robot 11 to avoid obstacles and/or debris larger than a specific size." EX1008, ¶¶[0204]-[0205].

Therefore, Schnittman discloses "a controller [microprocessor 245] in communication with the at least one piece of equipment [robotic cleaner 11] and the one or more cameras [camera 1190], the controller configured to receive visual data from the one or more cameras and determine a control action [maneuver the robot 11 toward debris, or away from obstacles/debris] for the at least one piece of equipment based on the received visual data." EX1010, ¶¶501-505.

Schnittman in view of Benzler renders obvious claim 2. *Id.*, ¶¶494-505.

6. Claim 3

Schnittman in view of Benzler would have rendered obvious claim 3. *Id.*, ¶¶506-510. As explained for element 2a, Schnittman's robotic cleaner 11 in view of Benzler teaches "at least one piece of equipment. Section IV.D.5.b. Robotic cleaner 11 removes debris from cleaning surfaces, so it comprises "a cleaning device." *Id*. As explained for element 1b, robot 11 includes "one or more propulsion mechanisms," *e.g.*, right and left differentially driven wheels 45, right and left wheel motors, and wheel encoders. Section IV.D.4.c.

Additionally, Schnittman's "drive system is coupled to the [robot's] housing and configured to maneuver the robot across a cleaning surface." EX1008, ¶[0005]. In a pool-cleaner implementation of Schnittman in view of Benzler, the cleaning surface would comprise a pool. Thus, robot 11 would travel along underwater pool surfaces.

Thus, Schnittman in view of Benzler renders obvious claim 3: "the at least one piece of equipment [robotic cleaner 11] comprises a cleaning device with one or more propulsion mechanisms [drive system with wheels 45], the cleaning device configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool surfaces] or spa and to perform a cleaning operation [removing debris]." EX1010, ¶¶506-510.

7. Claim 4

Schnittman in view of Benzler would have rendered obvious claim 4. *Id.*, ¶¶511-513. A POSA would have recognized the advantages of implementing the Schnittman/Benzler pool cleaning robot 11 with Benzler's external camera 8 for similar reasons as explained in Section IV.C.4. For example, the combination would yield an advantageous arrangement for more accurate monitoring and control of the robot 11 due to the external camera's ability to provide an overhead, unobstructed view of the entire pool along with the robot's exact location, orientation, and trajectory. *Id.*

A POSA would have had a reasonable expectation of success in making this combination using routine, well-known techniques for connecting a robot to an external device. *Id.*, ¶¶511-513. In fact, Schnittman itself describes well-known wireless communication methods between the robot's bin 50 and a remote indicator 1202, such as "IEEE 801.11/WiFi, BlueTooth, Zigbee, wireless USB, a frequency modulated signal, an amplitude modulated signal, or the like." EX1008, [0213]. A POSA could have easily integrated external camera 8 with robot 11 using known communication methods.

Thus, Schnittman in view of Benzler renders obvious claim 4: "the one or more cameras [Benzler's camera 8] are mounted external to the swimming pool or spa." EX1010, ¶¶511-513.

8. Claim 5

Schnittman in view of Benzler would have rendered obvious claim 5. *Id.*, ¶514. Schnittman's "camera 1190 [is] disposed toward the forward portion of the robot 11":

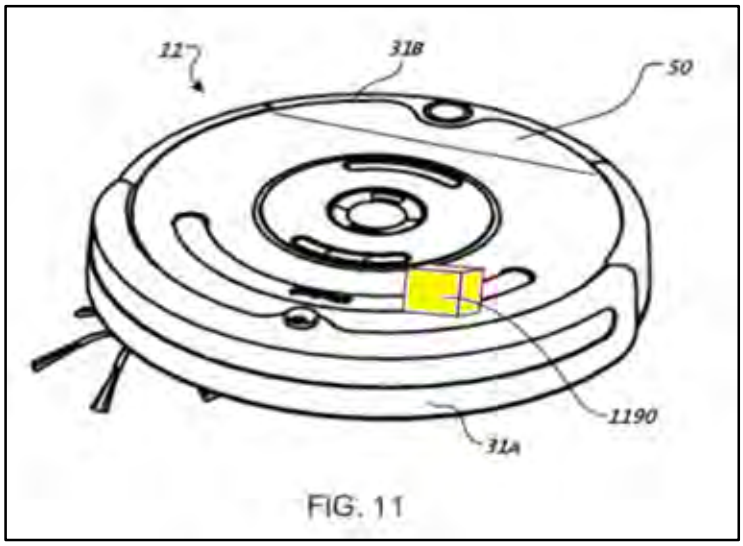


FIG. 11

EX1008, Fig. 11, ¶[0204]. Thus, Schnittman in view of Benzler renders obvious claim 5: "the one or more cameras [camera 1190] are mounted on the at least one piece of equipment [robotic cleaner 11]." EX1010, ¶514.

9. Claim 6

Schnittman in view of Benzler would have rendered obvious claim 6. *Id.*, ¶¶515-516. In a pool-cleaning embodiment of Schnittman in view of Benzler, the robotic cleaner 11 would operate underwater, so its onboard camera 1190 would be submerged. Section IV.D.3.

Thus, Schnittman in view of Benzler renders obvious claim 6: "the one or more cameras [camera 1190] are submergible or submerged within the swimming pool or

spa." EX1010, ¶¶515-516.

10. Claim 7

Schnittman in view of Benzler would have rendered obvious claim 7. *Id.*, ¶¶517-519. As explained for element 2c, Schnittman's microprocessor 245 "can process the signal from the camera 1190 [*i.e.*, "visual data"] to recognize obstacles and/or debris in the vicinity of the robot 11," and maneuver the robot accordingly, for *e.g.*, drive toward the debris, or drive to avoid obstacles or debris larger than a threshold. Section IV.D.5.d.

Thus, Schnittman in view of Benlzer renders obvious "the controller is configured to detect a characteristic [presence of debris/obstacle] of the location based on the visual data and control the piece of equipment [maneuver the robotic cleaner 11 toward debris and to avoid obstacles or larger debris] based on the detected characteristic." EX1010, ¶¶517-519.

11. Claim 11

Schnittman in view of Benzler would have rendered obvious claim 11. *Id.*, ¶¶520-521. Schnittman discloses an onboard controller (microprocessor 245) in communication with the camera. Section IV.D.4.f-g. A POSA would have recognized the advantages of implementing the Schnittman/Benzler robot 11 with Benzler's external camera 8 (Section IV.D.7), making "the controller [onboard microprocessor 245] [] remote from the camera [Benzler's camera 8]" in the

Schnittman/Benzler robot 11.

Thus, Schnittman in view of Benzler renders obvious claim 11. EX1010, ¶¶520-521.

12. Claim 12

(a) Preamble

To the extent limiting, claim 12's preamble would have been obvious over Schnittman in view of Benzler. *Id.*, ¶¶522-524. A POSA would have been motivated to implement Schnittman's robotic cleaner 11, comprising an onboard camera 1190, as an underwater pool cleaner in view of Benzler. Section IV.D.3. Schnittman's microprocessor 245 processes signals received from camera 1190, *i.e.*, images, to recognize obstacles and/or debris, and maneuvers the robot accordingly. Section IV.D.5.d. This continuous processing of images to recognize debris/obstacles comprises a "method for monitoring a pool system."

Thus, Schnittman in view of Benzler renders obvious claim 12's preamble. EX1010, ¶¶522-524.

(b) Element 12a

Schnittman in view of Benzler would have rendered obvious element 12a. *Id.*, ¶¶525-526. Schnittman's microprocessor 245 receives signals from camera 1190, *i.e.*, images of the cleaning surface. Section IV.D.5.d. In a pool-cleaner implementation of Schnittman in view of Benzler, the cleaning surface would comprise a pool.

Section IV.D.3. Hence, camera 1190 would capture images of submerged pool surfaces.

Thus, Schnittman in view of Benzler renders obvious "receiving images of at least a portion of a location including a swimming pool [images of pool surfaces] or spa from one or more cameras [camera 1190]." EX1010, ¶¶525-526.

(c) Element 12b

Schnittman discloses element 12b. *Id.*, ¶¶527-528. Schnittman's robot 11 processes signals from camera 1190, *i.e.*, images of the cleaning surface, to "recognize obstacle and/or debris." EX1008 ¶¶[0204]-[0205]. The specific region of the cleaning surface captured in the images and assessed for obstacles/debris corresponds to the "target area." *See* Section IV.A.8.c.

Thus, Schnittman discloses "determining a target area [pictured region of the cleaning surface assessed for obstacles/debris] and detecting a characteristic [presence of obstacles/debris] of the target area based on the images." EX1010, ¶¶527-528.

(d) Element 12c

Schnittman discloses element 12c. *Id.*, ¶¶529-530. As explained for element 2c, based on the recognized obstacles/debris on the cleaning surface, microprocessor 245 maneuvers robot 11 toward debris, or away from obstacles or larger debris. Section IV.D.5.d.

Thus, Schnittman discloses "generating a control response [maneuver robot 11

toward debris, or away from obstacles/debris] based on the detected characteristic [presence of obstacles/debris] of the target area [pictured region of the cleaning surface assessed for obstacles/debris]." EX1010, ¶¶529-530.

Thus, Schnittman in view of Benzler renders obvious claim 12. *Id.*, ¶¶522-530.

13. Claim 13

Schnittman in view of Benzler would have rendered obvious claim 13. *Id.*, ¶¶531-532. In a pool-cleaner implementation of Schnittman in view of Benzler, the target area would comprise a portion of a pool surface. Section IV.D.3. As explained for element 12b, the target area is assessed for presence of debris. Section IV.D.12.c.

Thus, Schnittman in view of Benzler renders obvious claim 13: "the target area [pictured region of a pool surface assessed for obstacles/debris] comprises a portion of a surface of the swimming pool or spa, and wherein the characteristic [presence of debris] comprises a cleanliness characteristic of the portion of the surface of the swimming pool or spa." EX1010, ¶¶531-532.

14. Claim 14

Schnittman in view of Benzler would have rendered obvious claim 14. *Id.*, ¶533. As explained for element 12c, based on the recognized debris on the cleaning surface, microprocessor 245 maneuvers robot 11 toward debris, or away from debris larger than a threshold. Section IV.D.12.d.

Thus, Schnittman in view of Benzler renders obvious claim 14: "generating the

control response comprises controlling an operation of a piece of equipment of the swimming pool [maneuver robot 11 toward debris, or away from large debris] or spa." EX1010, ¶533.

15. Claim 19

Schnittman in view of Benzler would have rendered obvious claim 19. *Id.*, ¶¶534-536. As explained for claim 3, implementation of Schnittman's robotic cleaner 11 in view of Benzler renders obvious a "cleaning device" "configured to travel adjacent to submerged or water-containing surfaces of the swimming pool or spa and to perform a cleaning operation." Section IV.D.6. Further, microprocessor 245 causes robot 11 to move based on detected debris and/or in different cleaning patterns (*id.*, ¶¶[0177], [0191]-[0203]):

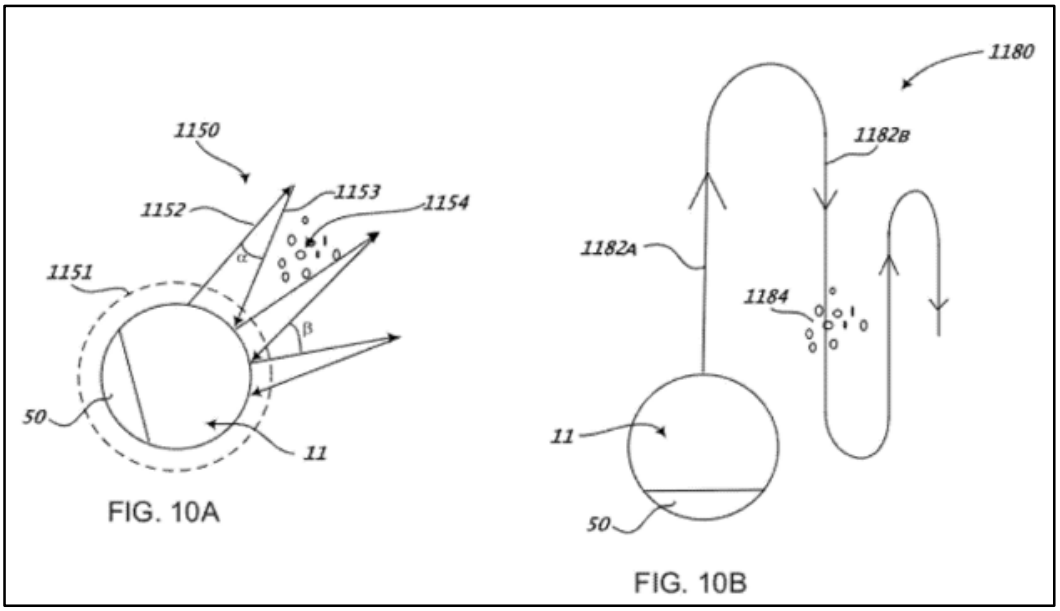


FIG. 10A FIG. 10B

Id., Figs. 10A, 10B.

Accordingly, Schnittman in view of Benzler renders obvious claim 19: "generating the control response comprises controlling operation of a cleaning device [robotic cleaner 11] configured to travel adjacent to submerged or water-containing surfaces of the swimming pool [pool surfaces] or spa and to perform a cleaning operation, wherein controlling operation of the cleaning device comprises one or more of controlling a path or route of the cleaning device [maneuvering robot 11 based on detected debris or cleaning patterns], an aggressiveness of cleaning chemicals deployed, an aggressiveness of mechanical cleaning, or a speed of the cleaning device." EX1010, ¶¶534-536.

E. Ground 2b: Claim 8 Would Have Been Obvious Over Schnittman In View Of Benzler, In Further View Of Fu

Schnittman in view of Benzler further in view of Fu would have rendered obvious claim 8. *Id.*, ¶¶537-541. Schnittman in view of Benzler renders obvious the limitations added in claim 8 (*id.*, ¶538), but should the Board disagree, this limitation is nonetheless obvious over Schnittman and Benzler, in further view of Fu. A POSA would have been motivated to combine Fu with the Schnittman/Benzler pool-cleaning robot because Fu is also directed to an autonomous pool cleaner that uses images to guide its operations. Fu additionally compares images of the pool floor with a "pool cleanliness image threshold" to determine the "level of cleanliness" of the pictured area, and guides its robot accordingly. EX1007, ¶[0026]; Section IV.A.7. A POSA would have understood that implementing Fu's threshold-based cleanliness

assessment in the Schnittman/Benzler combination would yield a pool cleaner capable of focusing cleaning efforts on dirty areas (*i.e.*, sub-threshold areas), while avoiding unnecessary cleaning of already-clean areas (*i.e.*, above-threshold areas), thus improving cleaning efficiency. EX1010, ¶¶537-541. As explained by Dr. Reinholtz, threshold-based cleaning was conventional at the time, and implementing Fu's threshold-based assessment in the Schnittman/Benzler combination would have required no more than routine software configurations to microprocessor 245, which already processes images from a camera to recognize debris and maneuver the robot accordingly. *See* Section IV.D.4.g. Thus, this combination would have been well within a POSA's skill. *Id*.

Thus, Schnittman in view of Benzler further in view of Fu renders obvious claim 8: "the characteristic comprises a cleanliness of a surface of the swimming pool [presence of debris], and wherein the controller is configured to control the piece of equipment based on the detected cleanliness being outside of a threshold [pool cleanliness image threshold]." *Id*.

V. CONCLUSION

Petitioner respectfully requests IPR of claims 1-8, 11-14, and 19 of the '207 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.

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 patent infringement lawsuit that involves the '207 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 U.S. Patent Nos. 11,003,191 and 11,262,766, which are related to the '207 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:

Lead Counsel	Back-up Counsel
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PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT 11,880,207

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,

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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. 11,880,207, 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. 11,880,207, including all exhibits, was served on litigation counsel for patent owner Zodiac Pool Systems LLC at the following address:

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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 13,970 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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