UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

MAYTRONICS, LTD., Plaintiff, v. CHASING INNOVATION TECHNOLOGY CO., LTD. and CHASING TECHNOLOGY (USA), LLC, Defendants.	Case No. 2:23-cv-01406 COMPLAINT JURY TRIAL DEMANDED

Plaintiff Maytronics, Ltd. ("Maytronics" or "Plaintiff") hereby files this complaint against Defendants Chasing Innovation Technology Co., Ltd. ("Chasing-China") and Chasing Technology (USA), LLC ("Chasing-USA") (collectively "Chasing" or "Defendants"), and in support thereof, alleges and avers as follows:

PARTIES

1. Maytronics is a limited company organized under the laws of Israel having a principal place of business at Kibbutz Yizrael, Israel 19350.

2. Chasing-China is a limited company organized under the laws of the People's Republic of China with its principal place of business at 3105, Block A, Building 6, Shenzhen International Innovation Valley, Dashi First Road, Xil 1 Community, Xili Sub-District, Shenzhen,

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

Guangdong Province 518000, China. Exhibit 1. On information and belief, Chasing-China does business throughout the United States by selling robotic pool cleaners, including a robotic pool cleaner under the tradename Chasing CM600 ("Chasing CM600 pool cleaner"), in Washington.

3. Chasing-USA is a limited liability company organized under the laws of the state of Washington with a principal place of business and registered address of 506 2nd Avenue, Suite 1400, Seattle WA, 98104 and a registered agent address of 522 W Riverside Avenue Suite N, Spokane, WA, 99201. Exhibit 2. On information and belief, Chasing-USA does business throughout the United States by selling robotic pool cleaners, including the Chasing CM600 pool cleaner, in Washington.

4. Chasing-USA is a wholly owned subsidiary of Chasing-China. Exhibit 3.

5. Both Chasing-China and Chasing-USA are under the direction and management of at least one common individual, Changgen Zhou. Compare Exhibit 1, with Exhibit 2; *See also* https://www.chasing.com/jp/news-center/30.html; and https://opengovwa.com/corporation/604439140. On information and belief, Chasing-USA and its officers, acting on behalf of Chasing-China, have participated in and/or facilitated Chasing-China's efforts directed at making, using, selling, offering for sale and/or importing into the United States the Chasing CM600 pool cleaner. Chasing-China has publicly acknowledged that it has used Chasing-USA to distribute, sell, offer for sale, and/or import the Chasing CM600 pool cleaner into the United States, including the state of Washington.

NATURE OF THE ACTION

6. This is a civil action arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq*., including 35 U.S.C. § 271, based on Chasing's infringement of U.S. Patent No. 10,378,229 (the "'229 patent") (Exhibit 4) by virtue of its making, using, selling, offering for sale, and/or importing of the Chasing CM600 Robotic pool cleaner into the United States.

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

JURISDICTION AND VENUE

7. This Court has subject matter jurisdiction over Count I pursuant to 28 U.S.C. §§ 1331 and 1338(a) because the claim arises under the patent laws of the United States, 35 U.S.C. § 1 *et seq.*, including 35 U.S.C. § 271.

8. Venue is proper in this district as to Chasing-China pursuant to 28 U.S.C. § 1391.

9. Venue is proper in this district as to Chasing-USA pursuant to 28 U.S.C. § 1400(b).

10. This Court has personal jurisdiction over Chasing-China because on information and belief Chasing-China offers for sale, sells, and/or imports the accused product into the United States, including in the state of Washington, through an established distribution channel, Chasing-USA. *Beverly Hills Fan Co. v. Royal Sovereign Corp.*, 21 F.3d 1558, 1565 (Fed. Cir. 1994). As such, Chasing-China has sufficient minimum contacts with the forum state such that the maintenance of the suit does not offend traditional notions of fair play and substantial justice. Alternatively, if this Court finds that exercise of personal jurisdiction over Chasing-China is not proper based on its contacts with Washington specifically, then on information and belief, Chasing-China is not subject to any state's general jurisdiction and therefore personal jurisdiction over Chasing-China in this Court is proper pursuant to Fed. R. Civ. P. 4(k)(2).

11. This Court has personal jurisdiction over Chasing-USA because Chasing-USA is a limited liability company organized under the laws of the state of Washington and Chasing-USA has a principal place of business at 506 2nd Avenue, Suite 1400, Seattle WA, 98104.

BACKGROUND

12. Maytronics is a global leader in the swimming pool industry, specializing in pool water solutions and offering a wide variety of products such as robotic pool cleaners, pool safety products and water treatment systems. Maytronics was founded in 1983 and over the past 40 years, through innovative technology, design and reliability, Maytronics has built its pool cleaning robots into leading global brands, including the brand name Dolphin.

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

13. Among Maytronics innovative technologies is a filter bypass mechanism claimed and disclosed in the '229 patent. Prior to the development of the filter bypass mechanism, the effectiveness or even mere movement of cleaning robots in the market required a clean filtering unit. For example, some prior cleaning robots may stop moving all together when the filter is clogged. Further, prior cleaning robots were unable to climb vertical pool walls without sufficient fluid flow to create the suction necessary to attach the cleaning robot to a vertical pool wall. Maytronics' patented filter bypass mechanism feature provides continual fluid flow through the cleaning robot to maintain consistent motion and to create sufficient suction to enable vertical pool wall climbing.

14. The '229 patent, which issued on August 13, 2019, bares the title "Pool cleaning robot with bypass mechanism," and claim 1 reads as follows:

> A cleaning robot comprising: a housing comprising at least one inlet and an outlet; a filtering unit, located within the housing, for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to be directed towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one of the filtering unit and the bypass mechanism.

'229 Patent, 10:22-28.

15. Maytronics is the owner of the entire right, title, and interest in the '229 patent and possesses the right to sue for and obtain equitable relief and damages for infringement of the patent in suit.

16. The following images depict some of the Maytronics' products bearing the Dolphin brand that include the patented filter bypass feature:

Dolphin Active 60

Dolphin M600

Dolphin Nautilus CC Pro

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

17. Chasing-China was founded in 2016 and manufactures and sells underwater drones for industrial and consumer uses. Chasing drones are advertised for use in emergency rescue, hull inspection, aquaculture, water conservancy, scientific exploration, and environmental protection.

18. On information and belief, at least as early as July 2022, Chasing entered the robotic pool cleaning industry by making, using, selling, and offering for sale in the United States and/or importing into the United State the Chasing CM600 pool cleaner, depicted in the following image:

https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner.html. See also, Exhibit 5.

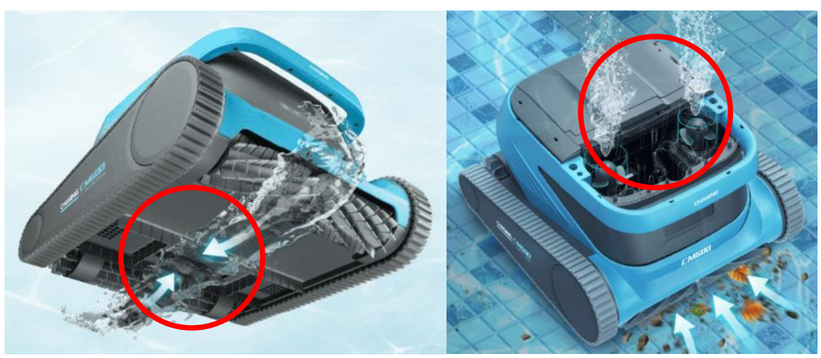
19. Upon information and belief, the accused product is "[a] cleaning robot comprising: a housing comprising at least one inlet and an outlet; a filtering unit, located within the housing, for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to be directed towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one of the filtering unit and the bypass mechanism." '229 patent, 10:22-28 (claim 1). A claim chart showing where each element of claim 1 of the '229 patent can be found in the Chasing CM600 pool cleaner is attached at Exhibit 6.

20. The Chasing CM600 pool cleaner is a cleaning robot.

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

See, *e.g.*, *Chasing CM600*, Chasing, https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner-overview.html (highlights added for emphasis).

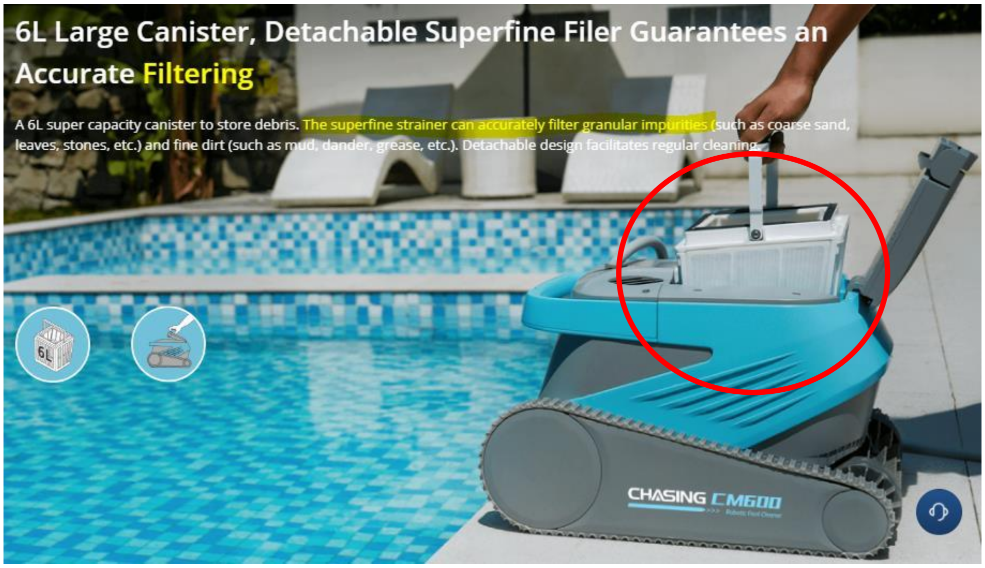
21. The Chasing CM600 pool cleaner includes a housing comprising at least one inlet and at least one outlet.



See, *e.g.*, *id.* (red circles indicating at least one inlet and at least one outlet; white arrows original).

22. The Chasing CM600 pool cleaner includes a filtering unit, located within the housing, for filtering fluid.

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022



See, *e.g.*, *id*. (highlights added for emphasis; red circle indicating filtering unit).

23. The Chasing CM600 pool cleaner includes a bypass mechanism for bypassing the filtering unit.

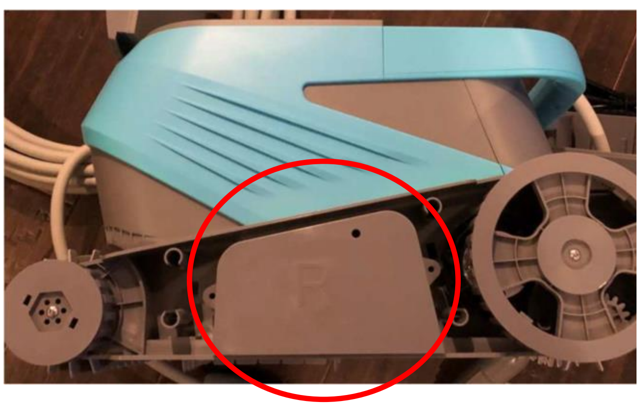


Image 1 of the Chasing CM600 pool cleaner with bypass mechanism circled in red

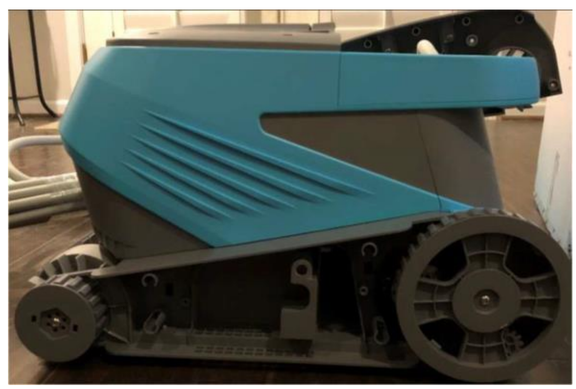


Image 2 of the Chasing CM600 pool cleaner with the bypass mechanism circled in red

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

Image 3 of the Chasing CM600 pool cleaner bypass mechanism circled in red

Image 4 of the Chasing CM600 pool cleaner bypass mechanism circled in red

24. The Chasing CM600 pool cleaner includes a fluid suction unit arranged to be directed towards the outlet.

See, *e.g.*, *Chasing CM600*, Chasing, https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner-overview.html (highlights added for emphasis); see, *e.g.*, *id.*

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

(red circle indicating fluid suction unit directed towards outlet; white arrows showing flow towards inlet in original).

25. The Chasing CM600 pool cleaner includes a fluid suction unit that directs fluid through an inlet.

See, *e.g.*, i*d.* (white arrows original to image indication flow into inlet).

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

26. The Chasing CM600 pool cleaner includes a fluid suction unit that also directs fluid through at least one of an outlet,

see, *e.g.*, *id.* (red arrows indicating fluid flow through at least one outlet; white arrows original to image), or a bypass mechanism.

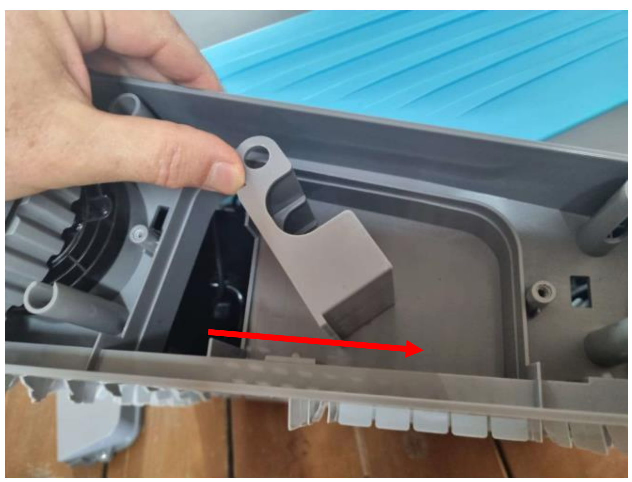


Image 5 of the Chasing CM600 pool cleaner (red arrow indicating fluid flow through bypass mechanism).

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

27. Images 3 and 4 of the Chasing CM600 pool cleaner as shown in Paragraph 23 and Image 5 of the Chasing CM600 pool cleaner as shown in in Paragraph 26 depict the operation of the filter bypass mechanism of the accused product with a moveable hinged door.

28. When the filter of the Chasing CM600 pool cleaner is clogged or when the Chasing CM600 pool cleaner tilts to climb a sloped pool section or wall, the moveable hinged door opens to allow fluid flow through the bypass mechanism. Compare Images 3 and 4 of the Chasing CM600 pool cleaner as shown in Paragraph 23 and Image 5 of the Chasing CM600 pool cleaner as shown and modified with an arrow in Paragraph 26, with the '229 patent Figures 2 and 3 and the description at 6:16-29 and 7:1-37.

29. Chasing's use of Maytronics' technology disclosed and claimed in the '229 patent in its CM600 pool cleaner is not licensed nor is it authorized by Maytronics. Therefore, Chasing's use of the technology disclosed and claimed in the '229 patent constitutes direct infringement for all CM600 pool cleaner's used, made, sold, imported or offered for sale in the United States pursuant to 35 U.S.C. § 271(a).

30. Maytronics sent Chasing-China a cease and desist letter, which was delivered on May 9, 2023. Exhibits 7 & 8. In the cease and desist letter, Maytronics informed Chasing-China that its Chasing CM600 pool cleaner infringed at least claim 1 of the '229 patent. Maytronics requested that Chasing-China cease and desist from infringing the '229 patent.

31. Maytronics also sent Chasing-USA a cease and desist letter, which was delivered on May 4, 2023. Exhibits 9 & 10. In the cease and desist letter, Maytronics informed Chasing-USA that its Chasing CM600 pool cleaner infringed at least claim 1 of the '229 patent. Maytronics requested that Chasing-USA cease and desist from infringing the '229 patent.

32. Neither Chasing-China nor Chasing-USA responded to Maytronics' cease and desist letter. On information and belief, Chasing-China and Chasing-USA continue to make, use, sell, offer to sell, and/or import the Chasing CM600 pool cleaner in the United States in willful

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

disregard of Maytronics '229 patent. *See* https://www.chasing.com/en/news-center/51.html; https://chasing.com/en/news-center/57.html; https://www.chasing.com/en/news-center/60.html.

COUNT I (AGAINST CHASING-CHINA AND CHASING-USA)
DIRECT INFRINGEMENT OF THE '229 PATENT (35 U.S.C. §271)

33. Plaintiff incorporates by reference the allegations in Paragraphs 1 through 32 above.

34. On information and belief, Chasing has launched an extensive campaign advertising and marketing the Chasing CM600 pool cleaner in the United States. See, e.g., *CHASING CM600 successfully appeared on the NASDAQ outdoor large screen in Times Square, New York*, https://www.chasing.com/en/news-center/39.html; *CHASING CM600 successfully appeared on the NASDAQ outdoor large screen in Times Square, New York*, https://www.chasing.com/en/news-center/44.html.

35. On information and belief, Chasing is selling the Chasing CM600 pool cleaner in the United States through at least (i) the Chasing website, *CHASING CM600,* https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner-overview.html and https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner.html?gclid=EAIaIQobChMI7fbJzM66f_gIVtSCtBh2WFQL2EAMYASAAEgLrsPD_Bw; (ii) third party retailer Amazon.com, https://www.amazon.com/Chasing-Different-Efficient-Cleaning-Waterline/dp/B0B5L71MSB?th=1 (Exhibit 5); and (iii) trade shows, e.g., the Western Pool and Spa Show in Long Beach, California on March 23-25, 2023, booth 729 https://westernshow.expocad.com/Events/23wpss/index.html and https://www.chasing.com/en/news-center/44.html.

36. As set forth in Paragraphs 18-32 and Exhibits 6, 7, and 9, pursuant to 35 U.S.C. § 271(a) Chasing has infringed and continues to infringe at least claim 1 of the '229 patent, either literally or under the doctrine of equivalents by making, using, selling, and offering for sale the

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

Chasing CM600 pool cleaner in the United State and/or importing the Chasing CM600 pool cleaner into the United States.

37. Maytronics has been damaged, is being damaged, and will continue to be damaged as a result of Chasing making, using, selling, offering for sale, and/or importing the Chasing CM600 pool cleaner in the United States.

38. Accordingly, Chasing is liable to Maytronics in an amount that compensates Maytronics for such infringement, which by law cannot be less than a reasonable royalty, together with interest and costs as fixed by the Court under 35 U.S.C. § 284.

39. On information and belief, Chasing has acted with full knowledge of the '229 patent and without a reasonable basis for believing that it was not or would not be liable for infringing the '229 patent. Chasing-USA has been specifically on notice of the '229 patent and Maytronics' claim of infringement of the '229 patent since at least since May 4, 2023. Exhibits 9 and 10. Chasing-China has been specifically on notice of the '229 patent and Maytronics' claim of infringement of the '229 patent since at least May 9, 2023. Exhibits 7 and 8. Chasing's infringement of the '229 patent has been deliberate and willful since at least May 4, 2023 and May 9, 2023, respectively, and this is therefore an exceptional case warranting an award of enhanced damages and attorneys' fees pursuant to 35 U.S.C. §§ 284-285.

40. As a result of Chasing's infringement of the '229 patent, Maytronics has suffered and will suffer irreparable harm which cannot be adequately compensated by money damages.

CONCLUSION AND PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests that:

A. The Court find that Chasing has directly infringed the '229 patent and hold Chasing liable for such infringement under 35 U.S.C.§ 271(a);

B. The Court issue and order pursuant to 35 U.S.C. § 284 for monetary damages in an amount no less than a reasonable royalty to adequately compensate Plaintiff for Chasing's infringement of the '229 patent;

K&L GATES LLP
925 FOURTH AVENUE
SUITE 2900
SEATTLE, WA 98104
TELEPHONE: +1 206 623 7580
FACSIMILE: +1 206 623 7022

C. The Court issue an order pursuant to 35 U.S.C. § 283 permanently enjoining Chasing, and anyone acting or participating by, through or in concert with Chasing from infringing the '229 patent;

D. The Court declare that Chasing's infringement has been willful entitling Plaintiff to an award of treble damages pursuant to 35 U.S.C. § 284;

E. The Court award Plaintiff treble damages pursuant to 35 U.S.C. § 284;

F. The Court declare that this is an exceptional case entitling Plaintiff to its reasonable attorneys' fees under 35 U.S.C.§ 285;

G. The Court award Plaintiff its costs and reasonable attorneys' fees pursuant to 35 U.S.C. §285; and

H. The Court award any other such relief as the Court may been just and proper.

DEMAND FOR JURY TRIAL

41. Plaintiff hereby demands a trial by jury on all issues so triable.

DATED this 11th day of September, 2023.

K&L GATES LLP

By: */s/ Christopher M. Wyant*
Christopher M. Wyant, WSBA # 35561

By: */s/ Shelby R. Stoner*
Shelby R. Stoner, WSBA # 52837

925 Fourth Avenue, Suite 2900
Seattle, Washington 98104-1158
Tel: +1 206 623 7580
Fax: +1 206 623 7022
Emails: chris.wyant@klgates.com
shelby.stoner@klgates.com

(Forthcoming *Pro Hac Vice*)
Jeffrey R. Gargano, Illinois Bar No. 6210852
J. Morgan Dixon, Louisiana Bar No. 38527
Jared Lund, Illinois Bar No. 6342370
K&L Gates LLP

70 W. Madison St., Suite 3100
Chicago, Illinois 60602
Tel: +1 312 372 1121
Fax: +1 312 827 8000
Emails: jeffrey.gargano@klgates.com
jmorgan.dixon@klgates.com
jared.lund@klgates.com

Attorneys for Plaintiff

EXHIBIT 1

ONESTOP REPORT

Chasing-Innovation Technology Co., LTD.

19-Apr-2023

D&B Hoovers

Table of Contents

Chasing-Innovation Technology Co., LTD.

Shenzhen, Guangdong, China

+86-75526407202 · www.chasing-innovation.com ·

Private Parent · Headquarters · Decision HQ

EMPLOYEES
40 (Total)

D&B LEGAL STATUS TYPE
Corporation

CORPORATE LINKAGE
9 Companies

INDUSTRY
Specialty Construction Trade Contractors

SALES
4.40M

REPORTING CURRENCY
CNY

D-U-N-S® NUMBER
54-092-7729

ADDRESS

3105, Block A, Building 6, Shenzhen International Innovation Valley, Dashi First Road, Xil I Community, Xili Sub-District, Nanshan District
Shenzhen, Guangdong, 518057 China

(Primary Address)

Latitude: 22.54554

Longitude: 114.0683

Company Summary

Business Description

Chasing-Innovation Technology Co., Ltd. is a special trade contractor primarily engaged in construction work, not elsewhere classified, such as construction of swimming pools and fences, erection and installation of ornamental metal work, house moving, shoring work, waterproofing, dampproofing, fireproofing, sandblasting, and steam cleaning of building exteriors.

Source: D&B

Industry

D&B HOOVERS INDUSTRIES
Specialty Construction Trade Contractors

ANZSIC 2006
3299 - Other Construction Services Not Elsewhere Classified

US 8-DIGIT SIC
17990000 - Special trade contractors, nec

ISIC REV 4
4390 - Other specialized construction activities

NACE REV 2
43 - Specialised construction activities

View All

NAICS 2022
238990 - All Other Specialty Trade Contractors

UK SIC 2003
4525 - Other construction work involving special trades

UK SIC 2007
4399 - Other specialised construction activities n.e.c.

US SIC 1987
1799 - Special Trade Contractors, Not Elsewhere Classified

Company Identifiers

D-U-N-S® NUMBER
540927729
LEI NUMBER

UNITED SOCIAL CREDIT CODE (CN)
91440300MA5DALMC8C

Corporate Highlights

TRADESTYLE
CHASING

YEAR FOUNDED
2016

PARENT D-U-N-S® NUMBER
540927729

GLOBAL ULTIMATE D-U-N-S® NUMBER
540927729

DOMESTIC ULTIMATE D-U-N-S® NUMBER
540927729

Spend Capacity

HIGHEST

99

Highest Spend (99) Lowest Spend (0)

Growth Trajectory

GROWING	STABLE	SHRINKING
Increasing demand	Needs unlikely to change	Decreasing demand

Contacts

Changgen Zhou	Director-General
Xun Zhang	Legal Representative
Bin Li	Director
Peng Li	Director
Jie Li	Director
Zhiping Yi	Director

View All 8 Contacts

Back to Table of Contents

Site Contacts

Changgen Zhou
Director-General at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Xun Zhang
Legal Representative at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Bin Li
Director at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Peng Li
Director at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Jie Li
Director at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Zhiping Yi
Director at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Yun You
Director at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Yingcan Li
Supervisor at Chasing-Innovation Technology Co., LTD.
Shenzhen, Guangdong, China • +86-75526407202
Specialty Construction Trade Contractors

Back to Table of Contents

Corporate Family

Chasing-Innovation Technology Co., LTD.
3105, Block A, Building 6, Shenzhen International Innovation Valley, Dashi First Road, Xil I Community, Xili Sub-District, N
Shenzhen, Guangdong, 518057, China
D-U-N-S® Number: 54-092-7729
Has Not Opted Out of Direct Marketing

S **Ganzhou Qianxing Technology Co., Ltd.**
Building A4, Huachang Kejiyuan, Ganzhou Economic Technology Development Zone, Ganzhou, Jiangxi, 341000, Ch
D-U-N-S® Number: 62-074-4072
Has Not Opted Out of Direct Marketing

S **Hainan Qianxing Innovation Technology Co., Ltd.**
Room 904D, Floor 9, Yazhounan Fanzhong Chuang Center, Yazhou District, Sanya, Hainan, 572000, China
D-U-N-S® Number: 61-946-0847
Has Not Opted Out of Direct Marketing

S **Qingdao Qianxing Innovation Technology Co., Ltd.**
Room 310, Comprehensive Building, No.385, Chaoyangshan Road, Huangdao District, Qingdao, Shandong, 26600(
D-U-N-S® Number: 61-720-2389
Has Not Opted Out of Direct Marketing

S **Shenzhen Qianxing Information Technology Co., Ltd.**
Room 10B, Building 11, Phase 2, Software Park, Yuehai Sub-District, Nanshan District, Shenzhen, Guangdong, 518(
D-U-N-S® Number: 69-837-9675
Has Not Opted Out of Direct Marketing

S **Shenzhen Qianxing Precision Manufacturing Co., Ltd.**
Floor 2, Building A, Tangtou Industrial Zone Liuweijian Industrial Park, Tangtou Community , Shiyan Sub-District, Ba
Shenzhen, Guangdong, 518000, China
D-U-N-S® Number: 69-836-9474
Has Not Opted Out of Direct Marketing

B **Chasing-Innovation Technology Co., Ltd. Beijing Branch**
Room 1928, Floor 10 Juli Service Station, Yuyuan Area, Building 1, No.2 Courtyard, Minsheng Road, Panggezhuang T
Beijing, Beijing, 100000, China
D-U-N-S® Number: 44-604-6838
Has Not Opted Out of Direct Marketing

S **Qianxing Innovation (Chengdu) Robotics Technology Co., Ltd.**
No.OI-02-202203032 Auxiliary, No.733, Hupan Road East Section, Xinglong Sub-District, Tian fu New District, China
Chengdu, Sichuan, 610000, China
D-U-N-S® Number: 84-795-8930
Has Not Opted Out of Direct Marketing

B **Chasing-Innovation Technology Co., Ltd. Kunming Branch**
No.101,201, Unit 101,201,2, Unit 1, Building 5, Electronic City Xunixianshi Technology Industrial Zone, Zhongguancu
Kunming, Yunnan, 650000, China
D-U-N-S® Number: 84-210-2598
Has Not Opted Out of Direct Marketing

Back to Table of Contents

Corporate Overview

Key ID SM Number: 299080491

Key Corporate Relationships

AUDITOR
NA

Industry Codes

ANZSIC 2006
3299 - Other Construction Services Not Elsewhere Classified (Primary)

ISIC REV 4
4390 - Other specialized construction activities (Primary)

NACE REV 2
43 - Specialised construction activities (Primary)

NAICS 2022
238990 - All Other Specialty Trade Contractors (Primary)

UK SIC 2003
4525 - Other construction work involving special trades (Primary)

UK SIC 2007
4399 - Other specialised construction activities n.e.c. (Primary)

US 8-DIGIT SIC
17990000 - Special trade contractors, nec (Primary)

US SIC 1987
1799 - Special Trade Contractors, Not Elsewhere Classified (Primary)

Business Description

Chasing-Innovation Technology Co., Ltd. is a special trade contractor primarily engaged in construction work, not elsewhere classified, such as construction of swimming pools and fences, erection and installation of ornamental metal work, house moving, shoring work, waterproofing, dampproofing, fireproofing, sandblasting, and steam cleaning of building exteriors.

Source: D&B

Financial Summary

Financials In	CNY(mil)	1 Year Growth
Sales	29.6	NA

Financial Summary

Financials In	CNY(mil)	1 Year Growth

Back to Table of Contents

Signals Report

100

Does Business in China

The value of this signal is set to 100 when a company does business in China, zero otherwise. Determined for all possible companies in the D&B Hoovers database. Updated at least quarterly.

Company does business in China

Back to Table of Contents

News

We're sorry, we couldn't find any information at this time

Back to Table of Contents

Triggers

We're sorry, we couldn't find any information at this time

Back to Table of Contents

Closest Industry Peers

Xutong (Shenzhen) Car Service Co., Ltd. Bantian Yayuan Branch

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Branch
D-U-N-S: 69-828-6050

0.00 Miles Away

Shenzhen Jiuceng Design Consulting Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 71-381-6779

Sales USD:	1.58M
Employees (Here):	5
Employees (Total):	5

0.00 Miles Away

Shenzhen Chuanxi Construction Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-074-0322

Sales USD:	3.53M
Employees (Here):	6
Employees (Total):	6

0.00 Miles Away

Jinbaili Technology (Shenzhen) Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Parent • Headquarters • DecisionHQ
D-U-N-S: 70-710-4293

Sales USD:	2.05M
Employees (Total):	28

0.00 Miles Away

Shenzhen Qianfang Design Consultant Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-545-0002

Sales USD:	1.45M
Employees (Here):	5
Employees (Total):	5

0.00 Miles Away

Shenzhen Qinsheng Decoration Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-651-2425

Sales USD: 2.24M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Shuntuo Architectural Decoration Waterproofing Works Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-064-1022

Sales USD: 3.77M
Employees (Here): 6
Employees (Total): 6

0.00 Miles Away

Shenzhen Xinyuhan Architecture Engineering Co., Ltd. Songgang Community Branch

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Branch
D-U-N-S: 70-431-6505

0.00 Miles Away

Shenzhen Gelin Shangpin Decoration Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-740-7861

Sales USD: 2.31M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Beijing Qingmei Daohe Landscape Design Co., Ltd. Shenzhen Branch

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Branch
D-U-N-S: 41-732-2145

0.00 Miles Away

Shenzhen Youxuan Decoration Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 40-281-3565

Sales USD: 3.36M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Chunxia Qiudong Decoration Design Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 41-735-1143

Sales USD: 2.83M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Santi Weisi Architectural Design Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 54-187-9577

Sales USD: 3.95M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Chuangya Decoration Design Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-728-1699

Sales USD: 1.40M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Kasi Telan Home Accessories Design Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-287-9782

Sales USD: 3.79M
Employees (Here): 5
Employees (Total): 5

0.00 Miles Away

Shenzhen Lintaida Engineering Construction Decoration Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 69-835-7978

Sales USD: **1.44M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Zhuopu Space Design Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 71-383-0850

Sales USD: **1.70M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Jingfengtai Industry Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-734-6749

Sales USD: **1.06M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Wangjia Decoration Design Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 54-262-3711

Sales USD: **3.70M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Jinhuali Decoration Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-065-1352

Sales USD: **4.12M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Jianding'an (Shenzhen) Construction Equipment Leasing Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 71-041-2640

Sales USD: **0.99M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Ruihong Inspection And Testing Equipment Leasing Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 71-053-8980

Sales USD: **0.99M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Shijue Impression Decoration Design Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-289-5434

Sales USD: **3.96M**
Employees (Here): **6**
Employees (Total): **6**

0.00 Miles Away

Shenzhen Jingyiwei Technology Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 55-108-1603

Sales USD: **4.06M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Hefu Architecture Engineering Co., Ltd.

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Independent
D-U-N-S: 70-257-8181

Sales USD: **1.35M**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Back to Table of Contents

Closest Companies

Shenzhen Zhaoxun Trading Co., Ltd.

Shenzhen, Guangdong, China
Miscellaneous Professional Services
Private • Independent
D-U-N-S: 70-954-4651

Sales USD: **0.96M**
Employees (Here): **6**
Employees (Total): **6**

0.00 Miles Away

Shenzhen Yutuo Design Consulting Office

Shenzhen, Guangdong, China
Consulting Services
Private • Independent
D-U-N-S: 71-380-6903

Sales USD: **447.68K**
Employees (Here): **5**
Employees (Total): **5**

0.00 Miles Away

Shenzhen Shengjing Catering Management Co., Ltd. Manhole Shop

Shenzhen, Guangdong, China
Restaurants and Bars
Private • Branch
D-U-N-S: 69-805-2572

0.00 Miles Away

Shenzhen Baoan District Xi Township Youtian Telecommunication Cell Phone Store

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-580-5375

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Shenzhen Shence Data Technology Co., Ltd.

Shenzhen, Guangdong, China
Computer Programming
Private • Independent
D-U-N-S: 70-969-0329

Sales USD: **0.99M**
Employees (Here): **6**
Employees (Total): **6**

0.00 Miles Away

Shenzhen Taoli Bread Co., Ltd. Longgang Distribution Department

Shenzhen, Guangdong, China
Grocery Wholesale
Private • Branch
D-U-N-S: 70-097-3987

0.00 Miles Away

Shenzhen Baoan District Manhole Meitai Computer Shop

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-438-5520

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Shenzhen Baoan District Manhole Keninglai Firm

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 61-023-7451

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Shenzhen Longgang District Bujihuang Sihai Tui Na Foot Massage Health Care Tang

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-448-2022

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Shenzhen Yinuochuang Electronic Science & Technology Co., Ltd. Huaqiangbei Branc h

Shenzhen, Guangdong, China
Electronics and Appliances Stores
Private • Branch
D-U-N-S: 72-466-0440

0.00 Miles Away

Shenzhen Xinghuo Yingxiang Culture Communication Co., Ltd.

Shenzhen, Guangdong, China • +86-75513424217821
Performing Arts
Private • Independent
D-U-N-S: 54-710-0566

Employees (Here): 6
Employees (Total): 6

0.00 Miles Away

Lilu Optoelectronic Science & Technology (Shenzhen) Co., Ltd. Shatou Branch

Shenzhen, Guangdong, China
Electronics Wholesale
Private • Branch
D-U-N-S: 72-246-3568

0.00 Miles Away

Shenzhen Baoan District Songgang Weixiangyu Security Products Business Departmen t

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-998-9903

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Shenzhen Futian District Meili Yuanyuan Beauty Studio

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-669-4884

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Shenzhen Haoyouduo Electronics Business Co., Ltd.

Shenzhen, Guangdong, China
Clothing and Apparel Stores
Private • Independent
D-U-N-S: 55-208-8268

Sales USD: 4.17M
Employees (Here): 3
Employees (Total): 3

0.00 Miles Away

Shenzhen Baoan District Manhole Jinpanchi Plastics & Rubber Electronics Business Department

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-976-1910

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Shenzhen Baoan District Fuyong Tengdaxin Hardware Mold Processing Department

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-970-7255

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Shenzhen Nanshan District Xinxueli Store

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-979-9484

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Shenzhen Futian District Daxing Stationery Store

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 61-085-2955

Employees (Here): 1
Employees (Total): 1

0.00 Miles Away

Xutong (Shenzhen) Car Service Co., Ltd. Bantian Yayuan Branch

Shenzhen, Guangdong, China
Specialty Construction Trade Contractors
Private • Branch
D-U-N-S: 69-828-6050

0.00 Miles Away

Zhongnong Suyuan (Shenzhen) Technology Co., Ltd.

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Parent • Headquarters • DecisionHQ
D-U-N-S: 70-058-6463

0.00 Miles Away

Shenzhen Defangxuan Information Consulting Co., Ltd.

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 70-963-0138

0.00 Miles Away

Shenzhen Tongyun Property Management Co., Ltd. Fengwei Keng Village Management O ffice

Shenzhen, Guangdong, China • +86-75584720616
Commercial Real Estate Leasing
Private • Branch
D-U-N-S: 55-012-6004

0.00 Miles Away

Shenzhen Baoan District Manhole Jiahe Auto Parts Store

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-396-1403

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Shenzhen Longhua New District Minzhiqianzise Apparel Wholesale Firm

Shenzhen, Guangdong, China
Nonclassifiable Establishments
Private • Independent
D-U-N-S: 60-981-3239

Employees (Here): **1**
Employees (Total): **1**

0.00 Miles Away

Back to Table of Contents

Industry Overview

Powered by First Research

Specialty Contractors

Fast Facts

Companies in this industry contract to perform construction work in a wide variety of trades, including site preparation, concrete, electrical, HVAC, plumbing, and painting. Major companies include APi Group, Comfort Systems USA, EMCOR Group, Performance Contracting, and Quanta Services (all based in the US), as well as Bilfinger (Germany) and Skanska (Sweden).

Global revenue for construction work, including specialty contracting, exceeds $7 trillion per year and is expected to reach about $15 trillion by 2030, according to Statista. The top employers in the construction industry include the US, Japan, Russia, and Mexico, according to NationMaster. Most specialty contractors focus on a single local or regional market, but some large companies operate internationally.

The US specialty contracting industry includes about 460,000 establishments (single-location firms and units of multi-location firms) with combined annual revenue of about $875 billion.

View A Glossary of Acronyms

Industry Growth Rating

LOW | MEDIUM | HIGH

Reflects snapshot of industry performance vs. industry risk over the next 12 to 24 months relative to other U.S. industries, along with short descriptions of vital demand and risk factors influencing the industry. Use to quickly determine the overall projected health of an industry.

- Demand: depends on construction activity
- Need: accurate project bids and efficient operations
- Risk: price competition

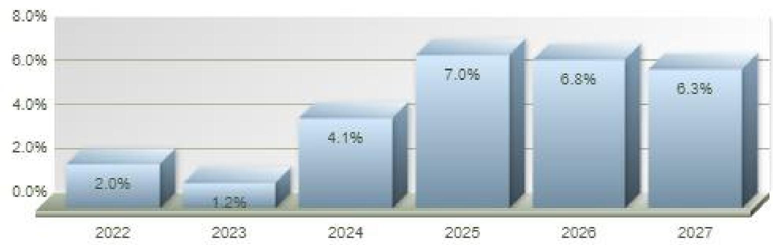
View Financial Information
View Challenges, Trends & Opportunities

Industry Indicators

The value of US nonresidential construction spending, a demand indicator for specialty contractors, rose 1.7% year-to-date in July 2022 compared to the same period in 2021.

Industry Forecast

The value of US new public and private construction spending, a major indicator for specialty contractor demand, is forecast to grow at an annual compounded rate of 5% between 2023 and 2027, based on changes in physical volume and unit prices.
Data Published: December 2022.



First Research forecasts are based on INFORUM forecasts that are licensed from the Interindustry Economic Research Fund, Inc. (IERF) in College Park, MD. INFORUM's "interindustry-macro" approach to modeling the economy captures the links between industries and the aggregate economy.

Top Challenges & Talking Points

Revenue Depends on Construction Activity

Specialty contractor firms typically rely on residential and nonresidential construction levels can vary sharply from year to year.

How does the company mitigate seasonal and cyclical changes in demand?

Competition

Specialty contractors operate in highly competitive markets, and many projects require substantial resources and capital investments.

How does the company set itself apart from competition?

Customer Concentration

Both large and small contractors may rely on one or a few customers for a significant portion of their revenue.

How diversified is the company's customer base?

View More Business Challenges

Top Opportunities & Talking Points

Energy Efficiency

Builders and home improvement contractors have benefited from a growing demand for energy-efficient homes and buildings.

How has the company taken advantage of demand for improved energy efficiency?

Acquisitions

Large specialty contracting companies can easily expand their geographic reach and service capabilities by acquiring smaller firms.

What role have acquisitions played in the company's growth strategy?

Remodeling Market

US consumers spend $400 billion yearly on home remodeling and repairs, according to the Joint Center of Housing Studies.

How much of the company's business comes from remodeling as opposed to new construction?

View More Industry Opportunities

Executive Talking Points

View More Talking Points & Executive Insight

Back to Table of Contents

Industry Description

Powered by First Research

Specialty Contractors

Industry Description

Companies in this industry contract to perform construction work in a wide variety of trades, including site preparation, concrete, electrical, HVAC, plumbing, and painting. Major companies include APi Group, Comfort Systems USA, EMCOR Group, Performance Contracting, and Quanta Services (all based in the US), as well as Bilfinger (Germany) and Skanska (Sweden).
Global revenue for construction work, including specialty contracting, exceeds $7 trillion per year and is expected to reach about $15 trillion by 2030, according to Statista. The top employers in the construction industry include the US, Japan, Russia, and Mexico, according to NationMaster. Most specialty contractors focus on a single local or regional market, but some large companies operate internationally.
The US specialty contracting industry includes about 460,000 establishments (single-location firms and units of multi-location firms) with combined annual revenue of about $875 billion.

Competitive Landscape

Demand is driven by new residential and nonresidential construction activity, as well as corporate profits and local government budgets. The profitability of individual companies depends on accurate project bids and efficient operations. Most specialty contractors earn revenues from fixed price contracts, and companies must estimate total costs for projects. If actual material prices or labor costs differ from the estimates and cannot be recovered through change orders, profitability could be reduced. Large companies have advantages in being able to offer a variety of services over a geographically diverse market at competitive prices. Small companies can compete effectively by offering niche services or by building relationships with customers in individual markets.
The specialty contractor industry is heavily fragmented, with the top 50 firms accounting for less than 10% of the industry's revenue. The industry is highly competitive, and a single project may attract bids from many contractors.

Products & Operation

Main revenue sources for specialty contractors include the construction of new single detached residential building, which accounts for about 30% of the industry revenue. This is followed by additions, renovations, and alterations (more than 15%) and new office buildings (more than 15%). Other services include the maintenance and repair of single detached buildings, and the construction of new nonresidential buildings.
Specialty contractors serve a broad range of commercial, industrial, utility, government, and institutional customers. Contractors often work on specific aspects of construction and are not responsible for the entire building project. Work is usually subcontracted by general contractors or builders. Work also is performed directly for homeowners or owners of commercial properties or industrial sites. Most work is performed onsite, however, some specialty contractors maintain facilities for prefabrication or other tasks.
Equipment and materials required varies by contractor type. For example, concrete and masonry contractors use portland cement, sand, gravel and water to create concrete. HVAC and plumbing contractors install bathroom and kitchen fixtures, pipes, furnaces, coolers, and air-conditioners. Smaller contractors buy materials from hardware stores, home improvement centers, or mass merchandisers. Larger firms buy directly from distributors. In addition to materials and equipment, labor is a major cost. Workers have varying degrees of skills and training. Some sectors, such as plumbing and electrical work, require employees to complete specific training and service programs before they can perform certain tasks. Apprenticeship programs also are used to train workers in the industry.
Technology
Construction contractors also utilize enterprise resource planning (ERP) software that supports project management and automates functions such as finance and accounting, customer relationship management (CRM), and supply orders. Software is used to make project bids, schedule projects, and invoice for work completed.
Larger firms may use mobile devices to help manage projects remotely. Contractors increasingly use mobile technology to access such software and communicate with clients and coworkers. Mobile devices also allow contractors to order equipment and materials and

estimate costs from the field.

Sales & Marketing

Typical customers are general contractors, builders, and residential and commercial property owners, as well as industrial, utility, and governmental clients. Large firms typically maintain a national sales force. Smaller companies rely on building long-term relationships with customers.
Major types of marketing include direct mail, print advertisements, and online ads or directory listings. Some companies are preferred vendors to many clients. They also establish strategic relationships with property owners, architects or builders that can result in future opportunities or long-term maintenance agreements.
Contract values vary widely, from hundreds of dollars for a home repair to millions for a larger-scale project at an industrial plant. Specialty contractors determine bids by estimating the cost of labor and materials needed for a project. Prices for materials such as lumber, paint, and steel can fluctuate and as a result, impact the cost of a project. In addition to competing with each other, specialty contractors also face competition from the in-house service organizations of customers who sometimes employ personnel that perform services similar to those that contractors provide.

Finance & Regulation

Specialty contracting can be a seasonal business, depending on the type of work, climate, and customer segment served. Adverse weather conditions, customer budgeting cycles, bidding seasons, and project timing all can impact construction activity. Cash flow typically is influenced by demand for services, operating margins, and the type of services companies provide. Uncollected receivables can negatively impact cash flow, especially for smaller companies. For the industry in the US, accounts receivables average about 60 days' sales.

Regulation

The construction industry is not directly regulated by government, but companies must comply with environmental, safety, and hiring standards. For example, some specialty contractors must follow Environmental Protection Agency (EPA) rules regarding the handling and disposal of asbestos and other hazardous waste. Construction projects also must meet local building codes. Worksite conditions and safety are monitored by the Occupational Safety & Health Administration (OSHA). Any violation of laws and regulations can result in fines, lawsuits, or project delays.

Working Capital Turnover by Company Size

The working capital turnover ratio, also known as working capital to sales, is a measure of how efficiently a company uses its capital to generate sales. Companies should be compared to others in their industry.

FINANCIAL INDUSTRY DATA PROVIDED BY MICROBILT CORPORATION COLLECTED FROM 32 DIFFERENT DATA SOURCES AND REPRESENTS FINANCIAL PERFORMANCE OF OVER 4.5 MILLION PRIVATELY HELD BUSINESSES AND DETAILED INDUSTRY FINANCIAL BENCHMARKS OF COMPANIES IN OVER 900 INDUSTRIES (SIC AND NAICS). MORE DATA AVAILABLE AT WWW.MICROBILT.COM.

Regional & International Issues

Global revenue for construction work, including specialty contracting, exceeds $7 trillion per year and is expected to reach about $15 trillion by 2030, according to Statista. Major specialty contractors based outside the US include Bilfinger Berger (Germany) and Skanska (Sweden). Most specialty contractors focus on a single local or regional market, but some large companies operate internationally.

Most specialty contractors focus on a single local or regional market, but some large companies operate internationally. Most cross-border operations involve contracts with governments or multinational corporations. Companies with a large scope and scale of services see opportunities for growth internationally.

The top employers in the construction industry include the US, Japan, Russia, and Mexico, according to NationMaster. Growth has been slower in developed markets such as Western Europe, especially as government spending on infrastructure has been constrained because of budget deficits.

In the US, specialty contractors are in highest demand in states with the most overall construction activity. States with the most specialty contractors, such as California, Florida, New York, Texas, and Illinois, typically have the most number of specialty contractor firms.

Services offered by specialty contractors also can vary depending on the region. For example, snow removal services are typically only needed in northern states. Meanwhile, demand for air-conditioning services tends to be higher in warmer climates.

Human Resources

Specialty contractors have varying levels of training and skills. Plumbers and electricians, for example, typically undergo special training and apprenticeship programs. Fewer skills are required for basic construction laborers. Average hourly pay for specialty contractors overall is moderately higher than the national average.

Construction workers often perform physically demanding jobs at large facilities or work sites where system failures can cause injury or death. Injury rates for specialty contractors in the US are almost the same as the national average. The leading causes of construction worker deaths are falls, electrocutions, being struck by heavy objects, and being caught in or between objects. Companies often carry workers' compensation insurance and general liability insurance to cover bodily injuries.

Industry Employment Growth - Bureau of Labor Statistics

Average Hourly Earnings & Annual Wage Increase - Bureau of Labor Statistics

Back to Table of Contents

Quarterly Industry Updates

Powered by First Research

Specialty Contractors

FEB 27 2023

Challenge: Reduced Demand from Weak Home Sales

The weak housing market and its declining performance due to higher housing costs resulting in low construction demand. According to the National Association of Realtors (NAR), although the pace of declining home sales slowed, US existing home sales in January were on lowest recorded level in more than 12 years. Higher mortgage rates and high prices were a huge factor in the slower housing sales. Although the market also saw the smallest increase in annual house prices since 2012, which makes housing more affordable, the market will still take time to recover, NAR added. As a result, specialty contractors are adversely affected as construction demand or renovations are also low, according to Building Online. Some companies such as LGI Homes are adjusting through 'rightsizing' their operations to correspond with the low demand.

Industry Impact

Specialty contractors may try to 'rightsize' their operations, recovery of the housing market and demand for construction to take more time.

NOV 21 2022

Opportunity: Solar Adoption in Residential Areas

Specialty contractors are shifting their attention towards the growing residential solar installation market, which is also getting support from the government. According to the Solar Energy Industries Association, residential solar power installations continue to rise year over year and having the second quarter of 2022 as its fifth consecutive quarterly growth. A part of the growth in residential installations is legislation implemented by the US government that offers a 30% solar tax credit, among other things. In states such as Mississippi, solar incentives were also recently approved. Specialty contractors are also being introduced to solar opportunities with industry events. The ongoing shift of consumers towards residential solar power and legislative support of the government are significant factors in the expected residential solar market growth by $6.67 billion in 2026, according to Report Linker.

Industry Impact

Specialty contractors may expect and prepare service offerings for the increased demand of residential power installation.

AUG 29 2022

Opportunity: Technology Integrations in Construction Equipment

Construction software will greatly benefit from updated digital integrations that make operations more seamless and efficient. According to ForConstructionPros.com, contractors are increasingly integrating useful construction software to existing and new construction equipment to enhance their portfolio offerings. An example of this integration is the relationship between Kojo, a leading provider of construction procurement management software, and Autodesk Construction Cloud. The partnership allows mutual customers to add a partner card into their Autodesk Construction Cloud dashboard, enabling them to access the Kojo environment directly from the Autodesk platform. Integrations between software products must be nurtured and tended to, in accordance with customer demand and mutual investments, to maintain and further advance a streamlined communication system between contractors and their customers.

Industry Impact

Specialty contractor firms may partner with software developers to equip their online systems and digital platforms with an efficient communication model that improves operating processes and eliminates miscommunication between teams.

MAY 30
2022

Challenge: Increasing Mortgage Rates on Housing Sales

The sales of existing homes as well as the construction of new homes have seen a downward trend in the past months. According to the National Associations of Realtors (NAR), sales of existing homes continued to decline for the third month in April. In addition, the organization stated that it is expected that the numbers will return back to pre-pandemic level after two years of a price and demand surge. Further, the construction of single-family housing, which accounts for a significant part of the industry's revenue, also seen a 7.3% decrease, according to the US Census Bureau. This was a result of the seen trend of decreasing permits month over month, largely due to the rapidly increasing mortgage rates and other inflationary factors, according to Zonda.

Industry Impact

Specialty contractor firms may expect slower demand and activity as sales and construction of residential homes continue to decrease.

Quarterly Update Question

How is the company affected by higher mortgage rates and housing costs?

The weak housing market and its declining performance due to higher housing costs resulting in low construction demand.

Back to Table of Contents

Executive Insight

Powered by First Research

Specialty Contractors

Chief Executive Officer - CEO

Planning for Demand Cycles

Residential and nonresidential construction activity can vary greatly from year to year and from region to region. Nonresidential construction depends on capital spending by businesses and government agencies. Demand for residential construction is sensitive to changes in economic conditions such as unemployment rates, household formations, consumer income, consumer confidence, availability of credit, and interest rates.

Dealing with Competition

Specialty contractors operate in highly competitive markets. One project may have dozens of competitive bids. Competition creates pricing pressures and as a result, lower profit margins for projects. Competitors on a bid will have the advantage if they have prior experience, technical capability, and financial strength. For some trades, there are few barriers to entry, which can lead to more price competition.

Chief Financial Officer - CFO

High Insurance Costs

Most contractors pay high insurance premiums due to the risky nature of the business. Types of insurance include workers' compensation, general liability, and surety bonding. Construction defects, safety, mold and moisture, and poor bookkeeping also are major insurance issues.

Managing Unpredictable Receivables

Specialty contractors that work as subcontractors can have unpredictable cash flow because payments can be withheld until after project completion even if that contractor's work is completed. Progress payments may also be delayed by a general contractor, and project schedules drawn out if local demand for commercial space drops. Most contractors try to cover themselves in the contracting process with terms specifying payment terms and conditions, but may draw down credit to cope in order to maintain relations with the general contractor.

Chief Information Officer - CIO

Using Mobile Technology

More specialty contractors are using mobile technology and cloud-based applications to help track assets, manage fleets, and improve communications with workers and clients while in the field.

Installation of More Advanced Systems

Specialty contractors are expected to install increasingly complex and technologically advanced systems such as voice and data communications, lighting, and environmental control. Regularly training may be needed to take advantage of opportunities to win major projects.

Human Resources - HR

Hiring Skilled Personnel

Companies often have difficulty hiring and retaining enough skilled workers, supervisors, and foremen for large projects, especially when demand in the industry is high. Because of the cyclical nature of demand, many companies can't afford to keep a full-time workforce and must hire new workers for each major project. Labor shortages can result in higher wages and labor costs.

Improving Safety Training

Because of the nature of working on construction sites, specialty contractors tend to have higher injury rates than the average US worker. Injuries may also be more severe, mainly because of electrical shock or falls.

VP Sales/Marketing - Sales

Improving Customer Relationships

Repeat business and long-term maintenance work depend heavily on good relations with customers, since the work can often be done as well by other contractors. Using customer relationship management (CRM) systems, contractors maintain more frequent and meaningful contact with customers. Because of frequent feast-or-famine cycles in construction, contractors must provide good service to existing customers during times of high demand, even at the cost of foregoing some new work.

Securing Job Bid Opportunities

Contractors can serve a large market and need information about a large number of possible bid opportunities. Public projects are open to all bidders, but owners or general contractors for private projects often invite bids from only a select group of contractors. Internet sites, and other web listings, detail a large number of construction projects.

Back to Table of Contents

Challenges, Trends & Opportunities

Powered by First Research

Specialty Contractors

Business Challenges

Revenue Depends on Construction Activity

Specialty contractor firms typically rely on residential and nonresidential construction levels can vary sharply from year to year. Nonresidential construction depends on capital spending by businesses and government agencies. Demand for residential construction is sensitive to changes in economic conditions such as unemployment rates, household formations, consumer income, consumer confidence, availability of credit, and interest rates.

Competition

Specialty contractors operate in highly competitive markets, and many projects require substantial resources and capital investments. These includes equipment, technology and skilled personnel. Competition creates pricing pressures and as a result, lower profit margins for projects. Competitors on a bid will have the advantage if they have prior experience, technical capability, and financial strength. For many trades, there are few barriers to entry, which can lead to more price competition.

Customer Concentration

Both large and small contractors may rely on one or a few customers for a significant portion of their revenue. While contractors work to establish long-standing relationships with their significant customers, any loss could hurt profitability. Reliance on just a few customers increases the risk of uneven cash flow and default.

High Insurance Costs

Most contractors usually pay higher-than-average insurance premiums due to the risky nature of the business. Types of insurance include workers' compensation, general liability, and surety bonding. Construction defects, safety, and poor bookkeeping are major insurance issues.

Dependence on Skilled Personnel

Companies often have difficulty hiring and retaining enough skilled workers, supervisors, and foremen for large projects. Because of the cyclical nature of demand, many companies can't afford to keep a full-time workforce and must hire new workers for each major project. Any labor shortages create competitive hiring markets, which can result in increased labor expenses or project delays.

Business Trends

Mobile Technology

More construction companies and contractors are using mobile technology and cloud-based applications to help track assets, manage fleets, and improve communications with workers and clients. Construction technology platforms provide real-time data to on-the-go contractors. These technologies can help speed up communications with workers in the field and help improve business efficiency and productivity.

Design-Build

Although specialty contractors are typically not responsible for entire large projects, many larger companies have in-house engineering teams capable of project design. On most projects specialty systems are either led by an integrated design-builder, a specialty contractor-led team, or an architect/engineer-led team with specialty contractors in a design assist role. Some specialty contractors prefer to be involved in design-build projects, which can take less time since the design and installation processes are integrated from the beginning.

Solar Energy Use

Demand for contracting work associated with solar energy installations is increasing. Employment in the US solar industry had a total of 230,000 workers as of 2020, according to the 11th annual National Solar Jobs Census. As costs associated with traditional energy sources rise and the cost of photovoltaic (PV) systems decreases, more Americans are installing solar at their homes and businesses. California, North Carolina, Arizona, Nevada, New Jersey, and Massachusetts are among the top states for solar panel installations. As the solar industry grows, more electrical contractors will receive special training to become certified installers of PV systems.

Industry Opportunities

Energy Efficiency

Builders and home improvement contractors have benefited from a growing demand for energy-efficient homes and buildings. Insulation and air sealing companies, as well as HVAC and electrical contractors, have the opportunity to sell more services and install high-performance technology. These enables them to better manage their energy use and create environmentally friendly buildings and home.

Acquisitions

Large specialty contracting companies can easily expand their geographic reach and service capabilities by acquiring smaller firms. Companies often make acquisitions that expand their reach into new markets, including other countries, such as Canada and the UK. While funding for acquisitions can at sometimes be tight, such deals are typically a major part of a company's growth strategy.

Remodeling Market

US consumers spend $400 billion yearly on home remodeling and repairs, according to the Joint Center of Housing Studies. This segment is almost entirely in the hands of small builders and specialty contractors who are often called on to remodel kitchens or make energy efficiency updates to homes. Although individual projects are smaller, the volume of such construction is much steadier than new home construction, and less financially risky.

Increased Automation

Advancements in machinery manufacturing and computer control software may enable robots and drones to perform some construction work. Robots adapted to construction sites could help reduce labor costs, make up for any labor shortages, and possibly improve safety and streamline production and quality. While fully autonomous job sites with dozens of robots working independently on various tasks is likely far in the future, some robots programed to do repetitive or dangerous work, such as brick laying or demolition, could be just around the corner.

Back to Table of Contents

Call Prep Questions

Powered by First Research

Specialty Contractors

Talking Points

How does the company mitigate seasonal and cyclical changes in demand?

Specialty contractor firms typically rely on residential and nonresidential construction levels can vary sharply from year to year.

How diversified is the company's customer base?

Both large and small contractors may rely on one or a few customers for a significant portion of their revenue.

What role have acquisitions played in the company's growth strategy?

Large specialty contracting companies can easily expand their geographic reach and service capabilities by acquiring smaller firms.

How does the company set itself apart from competition?

Specialty contractors operate in highly competitive markets, and many projects require substantial resources and capital investments.

How has the company taken advantage of demand for improved energy efficiency?

Builders and home improvement contractors have benefited from a growing demand for energy-efficient homes and buildings.

How much of the company's business comes from remodeling as opposed to new construction?

US consumers spend $400 billion yearly on home remodeling and repairs, according to the Joint Center of Housing Studies.

Back to Table of Contents

Financial Information

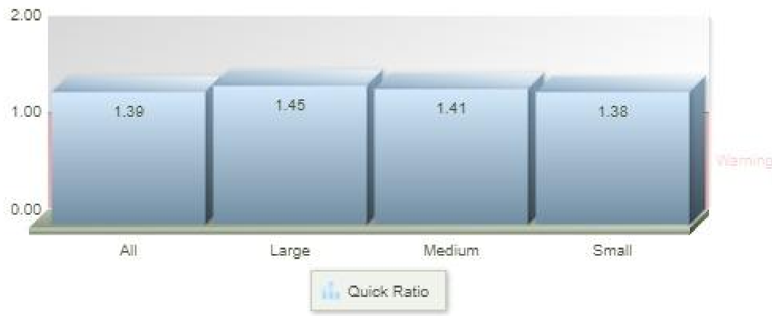
Powered by First Research

Specialty Contractors

Company Benchmark Trends

Quick Ratio by Company Size

The quick ratio, also known as the acid test ratio, measures a company's ability to meet short-term obligations with liquid assets. The higher the ratio, the better; a number below 1 signals financial distress. Use the quick ratio to determine if companies in an industry are typically able to pay off their current liabilities.



FINANCIAL INDUSTRY DATA PROVIDED BY MICROBILT CORPORATION COLLECTED FROM 32 DIFFERENT DATA SOURCES AND REPRESENTS FINANCIAL PERFORMANCE OF OVER 4.5 MILLION PRIVATELY HELD BUSINESSES AND DETAILED INDUSTRY FINANCIAL BENCHMARKS OF COMPANIES IN OVER 900 INDUSTRIES (SIC AND NAICS). MORE DATA AVAILABLE AT WWW.MICROBILT.COM.

Working Capital Turnover by Company Size

The working capital turnover ratio, also known as working capital to sales, is a measure of how efficiently a company uses its capital to generate sales. Companies should be compared to others in their industry.

FINANCIAL INDUSTRY DATA PROVIDED BY MICROBILT CORPORATION COLLECTED FROM 32 DIFFERENT DATA SOURCES AND REPRESENTS FINANCIAL PERFORMANCE OF OVER 4.5 MILLION PRIVATELY HELD BUSINESSES AND DETAILED INDUSTRY FINANCIAL BENCHMARKS OF COMPANIES IN OVER 900 INDUSTRIES (SIC AND NAICS). MORE DATA AVAILABLE AT WWW.MICROBILT.COM.

Current Liabilities to Net Worth by Company Size

The ratio of current liabilities to net worth, also called current liabilities to equity, indicates the amount due creditors within a year as a percentage of stockholders' equity in a company. A high ratio (above 80 percent) can indicate trouble.

FINANCIAL INDUSTRY DATA PROVIDED BY MICROBILT CORPORATION COLLECTED FROM 32 DIFFERENT DATA SOURCES AND REPRESENTS FINANCIAL PERFORMANCE OF OVER 4.5 MILLION PRIVATELY HELD BUSINESSES AND DETAILED INDUSTRY FINANCIAL BENCHMARKS OF COMPANIES IN OVER 900 INDUSTRIES (SIC AND NAICS). MORE DATA AVAILABLE AT WWW.MICROBILT.COM.

Company Benchmark Informations

Data Period: 2020	Last Update May 2022
Table Data Format	Mean

Company Size	All	Large	Medium	Small
Size by Revenue		Over $50M	$5M - $50M	Under $5M
Company Count	448596	220	9533	438843
Income Statement				
Net Sales	100%	100%	100%	100%
Gross Margin	23.7%	21.2%	22.8%	24.2%
Officer Compensation	3.3%	2.5%	2.6%	3.6%
Advertising & Sales	0.2%	0.2%	0.2%	0.2%
Other Operating Expenses	18.5%	17.2%	18.3%	18.7%
Operating Expenses	22.0%	19.9%	21.0%	22.6%
Operating Income	1.7%	1.2%	1.8%	1.6%
Net Income	0.7%	0.5%	0.9%	0.7%
Balance Sheet				
Cash	14.5%	14.9%	14.8%	14.4%
Accounts Receivable	42.8%	43.6%	44.6%	42.1%
Inventory	5.5%	5.3%	5.2%	5.7%
Total Current Assets	72.7%	73.6%	74.4%	71.9%
Property, Plant & Equipment	16.5%	16.1%	15.4%	17.0%
Other Non-Current Assets	10.8%	10.3%	10.3%	11.1%
Total Assets	100.0%	100.0%	100.0%	100.0%
Accounts Payable	16.7%	16.4%	17.1%	16.6%
Total Current Liabilities	41.6%	40.5%	42.5%	41.3%
Total Long Term Liabilities	17.1%	12.2%	16.0%	18.0%
Net Worth	41.3%	47.4%	41.4%	40.7%
Financial Ratios				

Quick Ratio	1.39	1.45	1.41	1.38
Current Ratio	1.75	1.82	1.75	1.74
Current Liabilities to Net Worth	100.7%	85.4%	102.7%	101.5%
Current Liabilities to Inventory	x7.51	x7.62	x8.20	x7.25
Total Debt to Net Worth	x1.42	x1.11	x1.41	x1.46
Fixed Assets to Net Worth	x0.40	x0.34	x0.37	x0.42
Days Accounts Receivable	60	61	63	59
Inventory Turnover	x35.70	x38.96	x38.25	x34.49
Total Assets to Sales	40.4%	39.9%	40.7%	40.3%
Working Capital to Sales	12.5%	13.2%	12.9%	12.3%
Accounts Payable to Sales	6.5%	6.3%	6.7%	6.4%
Pre-Tax Return on Sales	1.2%	0.9%	1.4%	1.1%
Pre-Tax Return on Assets	3.0%	2.2%	3.4%	2.8%
Pre-Tax Return on Net Worth	7.2%	4.7%	8.3%	7.0%
Interest Coverage	x3.61	x3.26	x4.19	x3.42
EBITDA to Sales	3.4%	2.7%	3.4%	3.5%
Capital Expenditures to Sales	2.5%	2.1%	2.2%	2.6%

FINANCIAL INDUSTRY DATA PROVIDED BY MICROBILT CORPORATION COLLECTED FROM 32 DIFFERENT DATA SOURCES AND REPRESENTS FINANCIAL PERFORMANCE OF OVER 4.5 MILLION PRIVATELY HELD BUSINESSES AND DETAILED INDUSTRY FINANCIAL BENCHMARKS OF COMPANIES IN OVER 900 INDUSTRIES (SIC AND NAICS). MORE DATA AVAILABLE AT WWW.MICROBILT.COM.

Economic Statistics And Information

Valuation Multiples

Specialty Contractors

Valuation Multiple	MVIC/Net Sales	MVIC/Gross Profit	MVIC/EBIT	MVIC/EBITDA
Median Value	N/A	N/A	N/A	N/A

MVIC (Market Value of Invested Capital) = Also known as the selling price, the MVIC is the total consideration paid to the seller and includes any cash, notes and/or securities that were used as a form of payment plus any interest-bearing liabilities assumed by the buyer.
Net Sales = Annual Gross Sales, net of returns and discounts allowed, if any.
Gross Profit = Net Sales - Cost of Goods Sold
EBIT = Operating Profit
EBITDA = Operating Profit + Noncash Charges

BVR
What It's Worth

Back to Table of Contents

Industry Websites & Acronyms

Powered by First Research

Specialty Contractors

Industry Websites

American Subcontractors Association (ASA)

Associated General Construction of America (AGC)

Builder

Canadian Construction Association (CCA)

Electrical Contractor Magazine

Engineering News-Record (ENR)

National Association of the Remodeling Industry (NARI)

Glossary of Acronyms

EPA Environmental Protection Agency

ERP enterprise resource planning

HVAC Heating, ventilation, and air-conditioning

OSHA Occupational Safety and Health Administration

Back to Table of Contents

Industry Codes

Powered by First Research

Specialty Contractors

Associated Industry Codes

NAICS CODES

238 - Terrazzo, tile, marble and mosaic work

SIC CODES

17 - Framing Contractors

Back to Table of Contents

EXHIBIT 2

WASHINGTON
Secretary of State
Corporations & Charities Division

Filed
Secretary of State
State of Washington
Date Filed: 02/14/2023
Effective Date: 02/14/2023
UBI #: 604 439 140

EXPRESS ANNUAL REPORT WITH CHANGES

BUSINESS INFORMATION

Business Name:
CHASING TECHNOLOGY (USA), LLC

UBI Number:
604 439 140

Business Type:
WA LIMITED LIABILITY COMPANY

Business Status:
ACTIVE

Principal Office Street Address:
506 2ND AVE, SUITE 1400, SEATTLE, WA, 98104-2307, UNITED STATES

Principal Office Mailing Address:
506 2ND AVE, SUITE 1400, SEATTLE, WA, 98104-2307, UNITED STATES

Expiration Date:
04/30/2024

Jurisdiction:
UNITED STATES, WASHINGTON

Formation/Registration Date:
04/03/2019

Period of Duration:
PERPETUAL

Inactive Date:

Nature of Business:
OTHER SERVICES, ANY LAWFUL PURPOSE, MARKETING, SALES, SERVICE AND FULFILLMENT OF MARINE DRONES

REGISTERED AGENT RCW 23.95.410

Registered Agent Name	Street Address	Mailing Address
NORTHWEST REGISTERED AGENT, LLC	522 W RIVERSIDE AVE STE N, SPOKANE, WA, 99201-0580, UNITED STATES	522 W RIVERSIDE AVE STE N, SPOKANE, WA, 99201-0580, UNITED STATES

PRINCIPAL OFFICE

Phone:

Email:
QINGLAN@CHASING-INNOVATION.COM

Street Address:
506 2ND AVE, SUITE 1400, SEATTLE, WA, 98104-2307, USA

Mailing Address:
506 2ND AVE, SUITE 1400, SEATTLE, WA, 98104-2307, USA

GOVERNORS

Title	Type	Entity Name	First Name	Last Name
GOVERNOR	INDIVIDUAL		CHANGGEN	ZHOU

NATURE OF BUSINESS

- OTHER SERVICES
- ANY LAWFUL PURPOSE
- MARKETING, SALES, SERVICE AND FULFILLMENT OF MARINE DRONES

EFFECTIVE DATE

Effective Date:
02/14/2023

CONTROLLING INTEREST

1. Does this entity own (hold title) real property in Washington, such as land or buildings, including leasehold improvements?
- No
2. In the **past 12 months**, has there been a transfer of at least 16-2/3 percent of the ownership, stock, or other financial interest in the entity?
- No
a. If "Yes", in the **past 36 months**, has there been a transfer of controlling interest (50 percent or greater) of the ownership, stock, or other financial interest in the entity?
- No
3. If you answered "Yes" to question 2a, has a controlling interest transfer return been filed with the Department of Revenue?
- No

You **must** submit a Controlling Interest Transfer Return form if you answered “yes” to questions 1 **and** 2a.

Failure to report a Controlling Interest Transfer is subject to penalty provisions of RCW 82.45.220.

For more information on **Controlling Interest**, visit www.dor.wa.gov/REET.

RETURN ADDRESS FOR THIS FILING

Attention:
Email:
Address:

EMAIL OPT-IN

☐ By checking this box, I hereby opt into receiving all notifications from the Secretary of State for this entity via email only. I acknowledge that I will no longer receive paper notifications.

AUTHORIZED PERSON

Person Type:
INDIVIDUAL

First Name:
NAT

Last Name:
SMITH

Title:

☑ This document is hereby executed under penalty of law and is to the best of my knowledge, true and correct.

EXHIBIT 3

CHASING

About Us

Company Profile

Chasing-Innovation Technology Co., LTD is a worl[illegible]ing company in R&D, production and sales of consumer-grade underwater drones, industrial-grade underwater robots and portable smart unmanned equipment. Chasing-Innovation is a national high-tech enterprise.

Founded in April 2016, Chasing is headquartered in Shenzhen, with domestic offices or subsidiaries in Beijing, Chengdu, Kunming and Qingdao, and a wholly-owned subsidiary in the United States. Chasing has 300 employees, including over 80 R&D personnel. The core team is from Huawei, BYD, CSIC, LG, Foxconn and other international first-class enterprises, and has reached the top level in the underwater field and many other technical domains. The R&D team has solid ability in underwater communication, general design of underwater vehicles, electric power and propulsion systems, navigation control, etc, and has reached the international first-class level in many technical fields. Until now, Chasing has obtained more than 100 invention patents and won over 100 kinds of awards at all levels in multiple countries.

Chasing has produced 7 generations of products which are characterized by low cost, high performance, easy operation and outstanding portability. They are widely used in underwater observation and photography, fishery and aquaculture, underwater emergency rescue inspection, scientific research and exploration, environmental protection detection, water conservancy and hydropower. CHASING products have been sold to more than 100 countries and regions around the world.

Chasing's vision is “Explore the Unexplored” and evoke the human spirit of exploration. Whether it's consumers discovering unimaginable underwater worlds, or industry experts finding new solutions to old problems - Chasing offers an exploratory spirit and solutions that drive people to desire more for their lives, to push boundaries, to discover the undiscovered, to constantly innovate and improve, and explore the unexplored.

Our Mission

Making underwater exploration easier.

Our Vision

To provide the smartest underwater products and deliver the greatest customer services.

Our Core Values

Customer focused, dedicated to succeed, be proactive, continualImprovement and commitment to excellence.

Milestone

2022

In May	CHASING M2 PRO MAX, the more professional, powerful and easy-to-use ROV,was officially launched globally.
In April	CHASING M2 won the iF Design Award.
In April	CHASING M2 won the 2022 red dot design award in Germany.

2022 2021 2020 2019

About Us +

Explore +

Where to Buy +

Become a Dealer +

Terms and Conditions +

中国大陆/English

EXHIBIT 4

US010378229B2

(12) **United States Patent**
Ben Dov et al.

(10) **Patent No.: US 10,378,229 B2**
(45) **Date of Patent: Aug. 13, 2019**

(54) **POOL CLEANING ROBOT WITH BYPASS MECHANISM**

(71) Applicant: **MAYTRONICS LTD.**, Kibutz Yizrael (IL)

(72) Inventors: **Boaz Ben Dov**, Ram On (IL); **Oded Golan**, Kefar Tavor (IL)

(73) Assignee: **.MAYTRONICS LTD**, Kibbutz Yizrael (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 956 days.

(21) Appl. No.: **14/445,082**

(22) Filed: **Jul. 29, 2014**

(65) **Prior Publication Data**

US 2015/0067974 A1 Mar. 12, 2015

Related U.S. Application Data

(60) Provisional application No. 61/875,066, filed on Sep. 8, 2013.

(51) **Int. Cl.**
E04H 4/16 (2006.01)

(52) **U.S. Cl.**
CPC ***E04H 4/1654*** (2013.01); ***E04H 4/1663*** (2013.01)

(58) **Field of Classification Search**
CPC E04H 4/1654; E04H 4/1663
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,828,626 A		5/1989	Meincke	
6,112,354 A	*	9/2000	Stoltz	E04H 4/1663 15/1.7
6,314,983 B1		11/2001	Hatch	
6,965,814 B2		11/2005	Hadari	
9,127,472 B2		9/2015	Borg	
2003/0201218 A1		10/2003	Henkin	
2004/0040581 A1	*	3/2004	Bruwer	E04H 4/1654 134/18
2011/0000035 A1		1/2011	Pichon	

FOREIGN PATENT DOCUMENTS

CA	1109209	9/1981
CN	201747089	2/2011
CN	202970016 U	6/2013

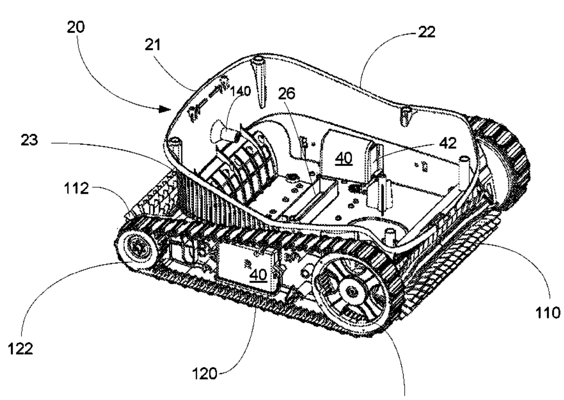
* cited by examiner

Primary Examiner — Randall E Chin
(74) *Attorney, Agent, or Firm* — Reches Patents

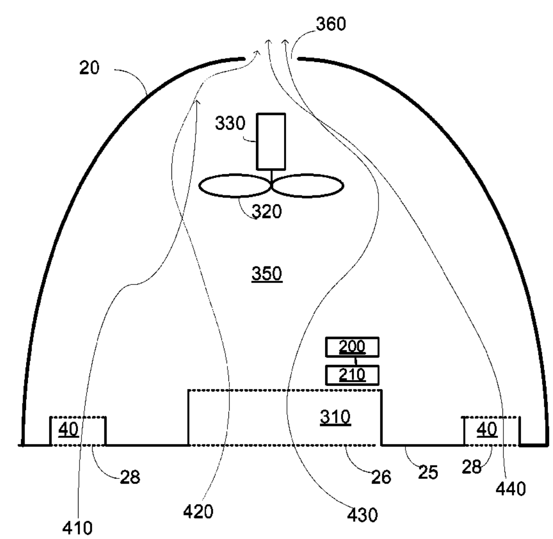
(57) **ABSTRACT**

A cleaning robot may be provided and may include a housing comprising at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit and the bypass mechanism.

42 Claims, 15 Drawing Sheets



10



10

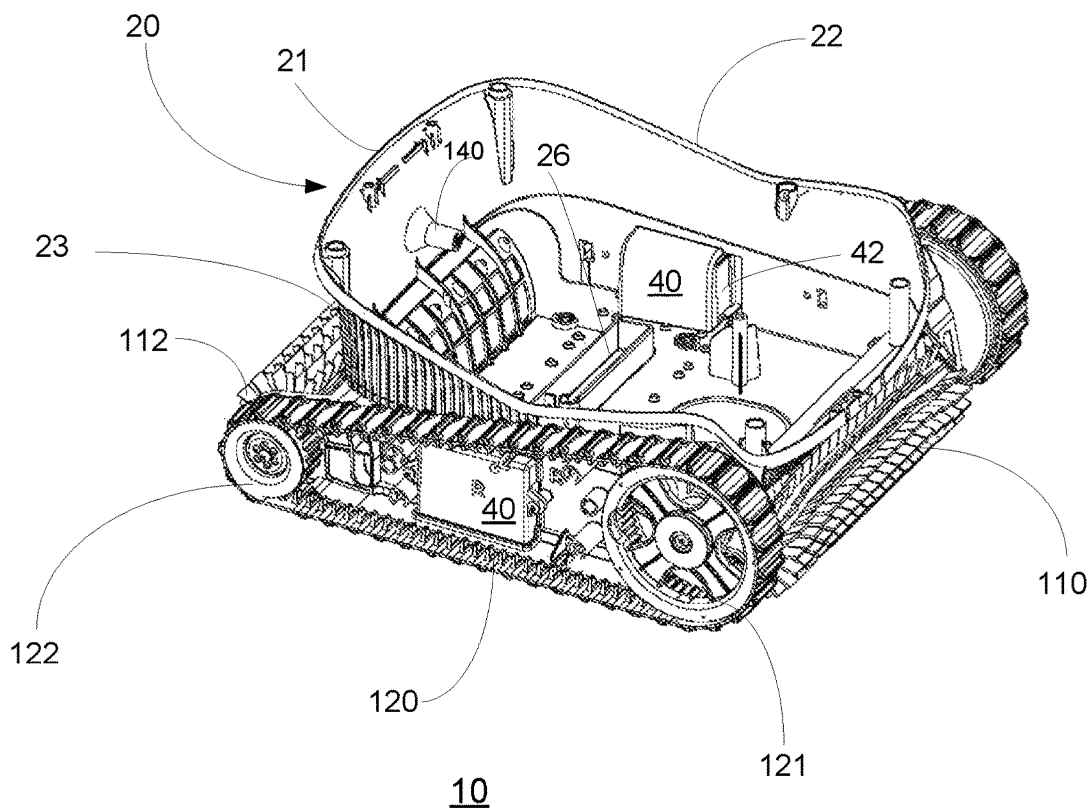


FIG. 1

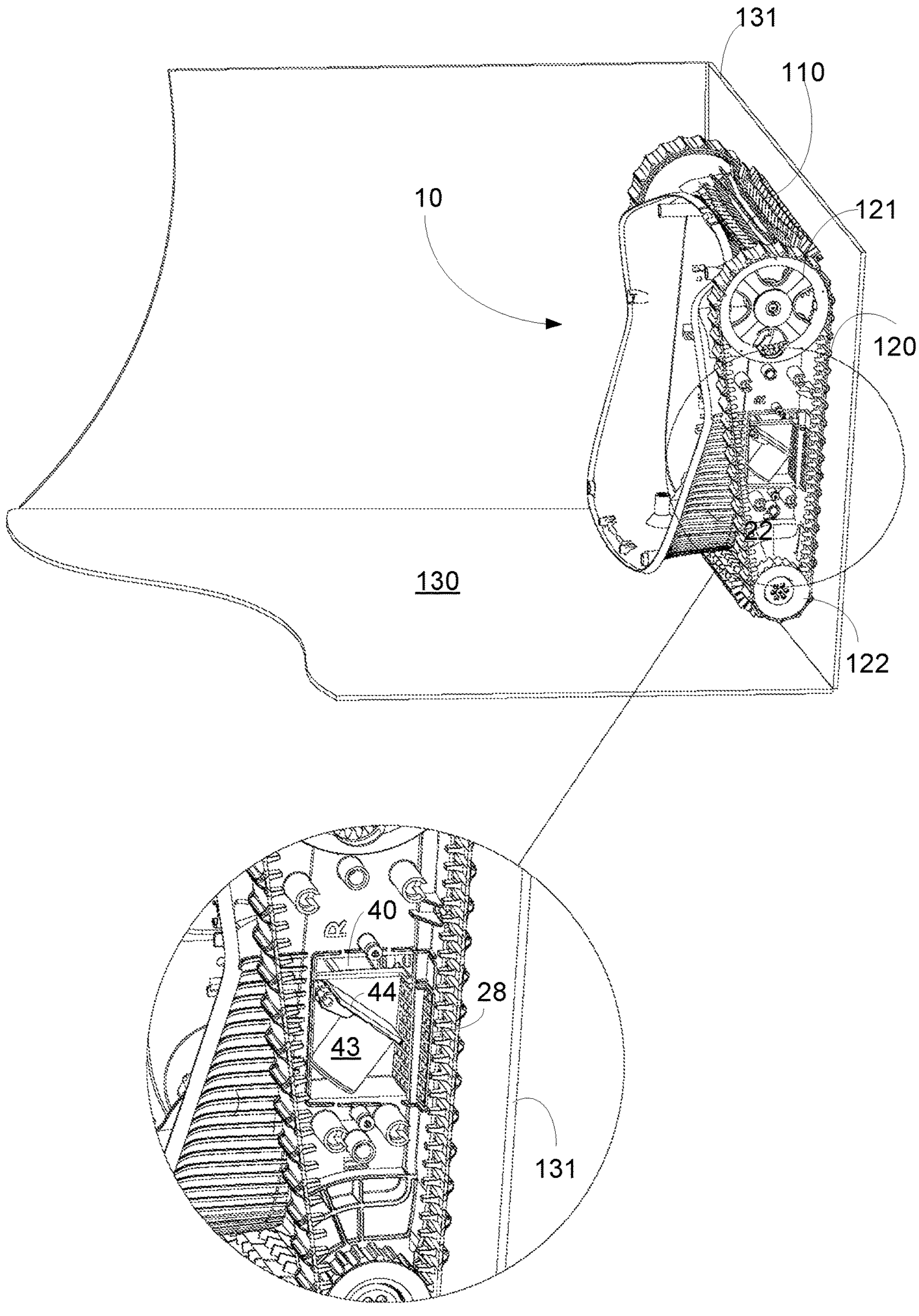


FIG. 2

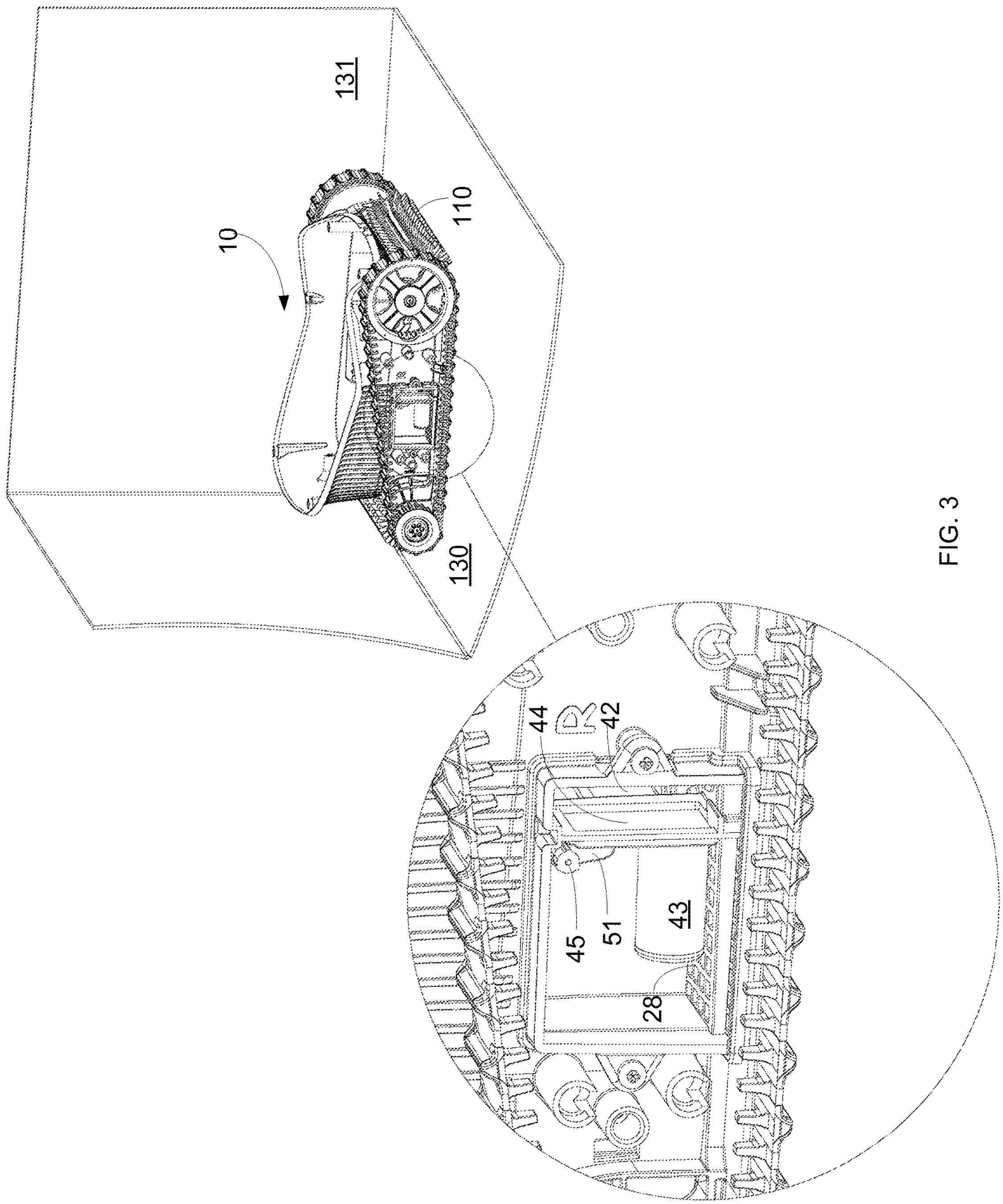


FIG. 3

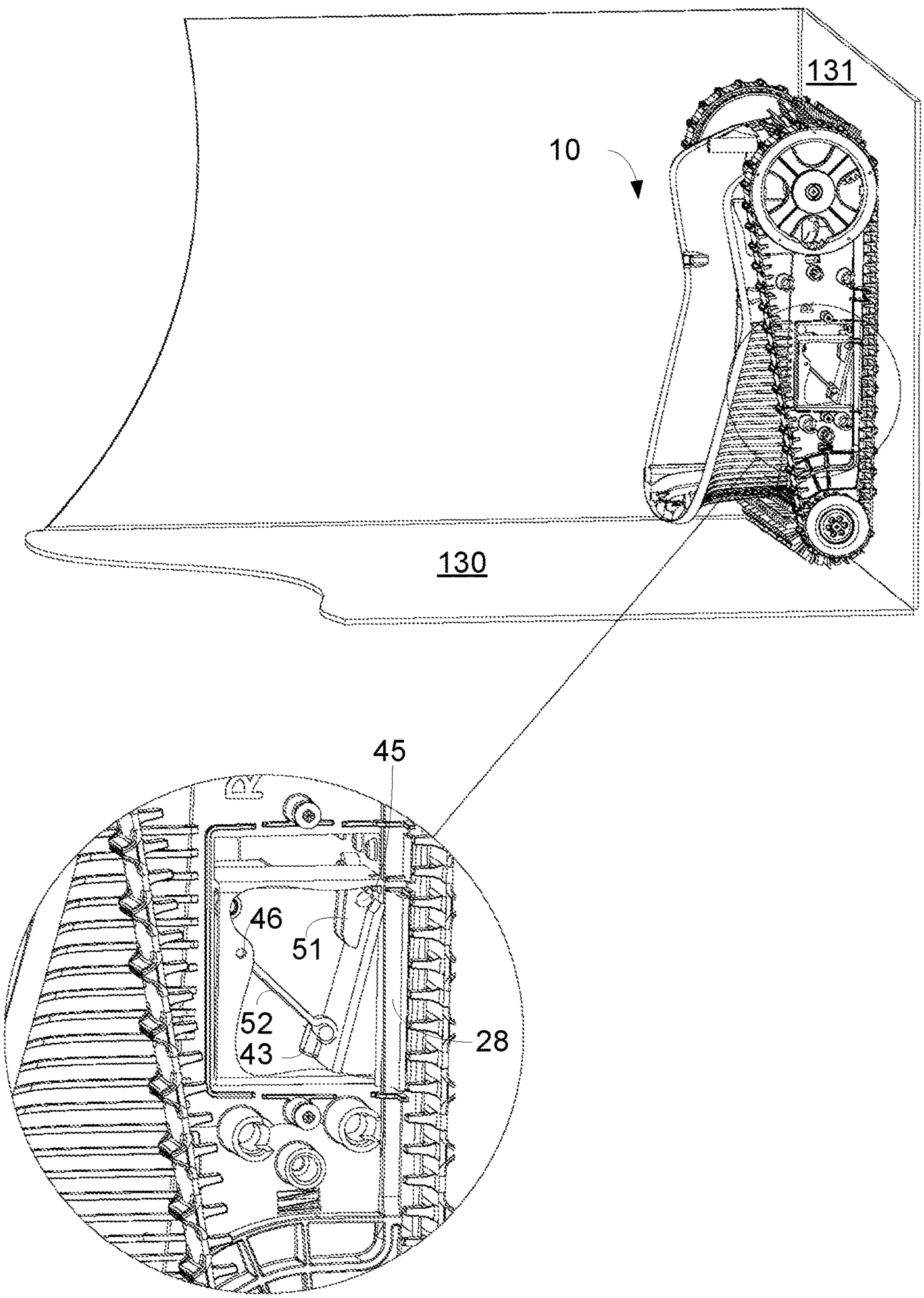


FIG. 4

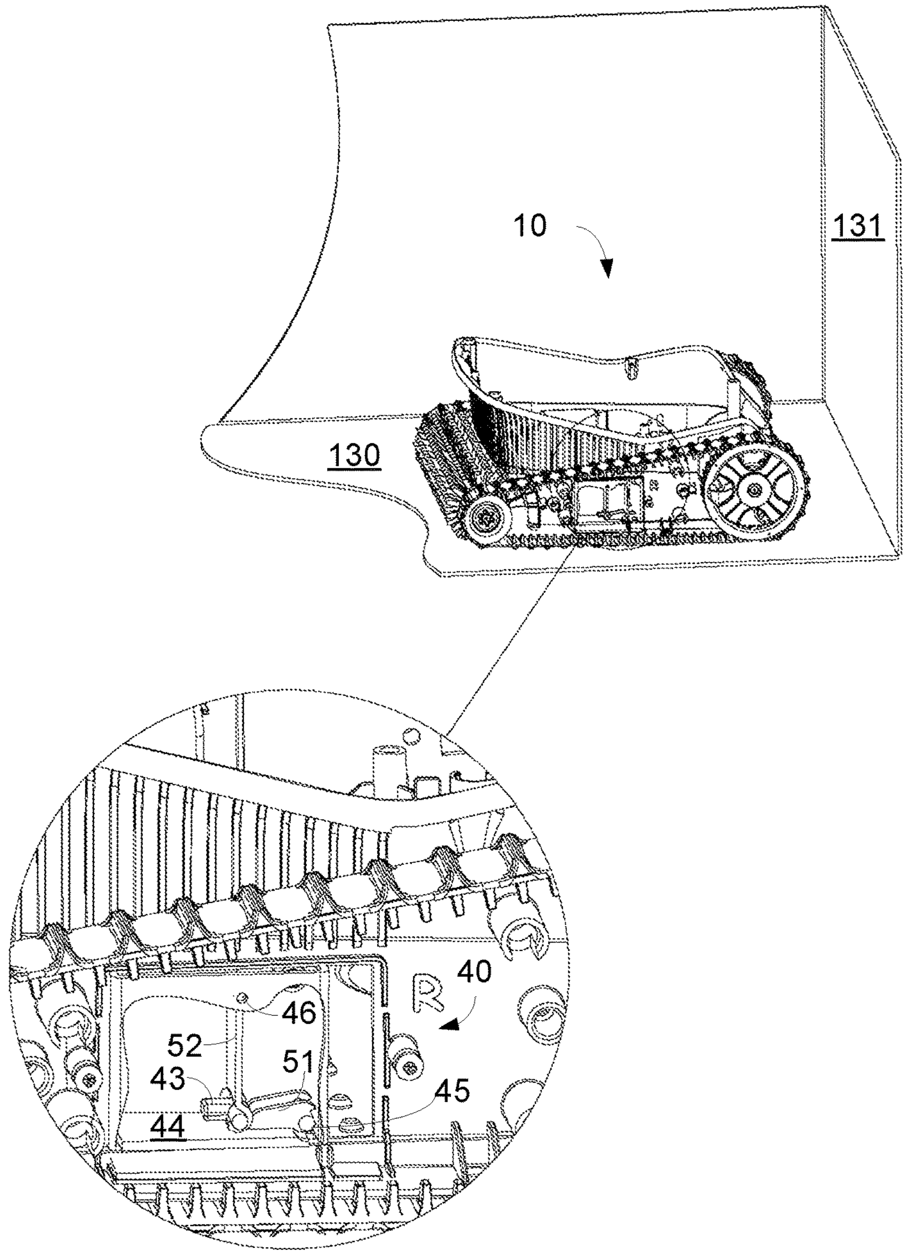


FIG. 5

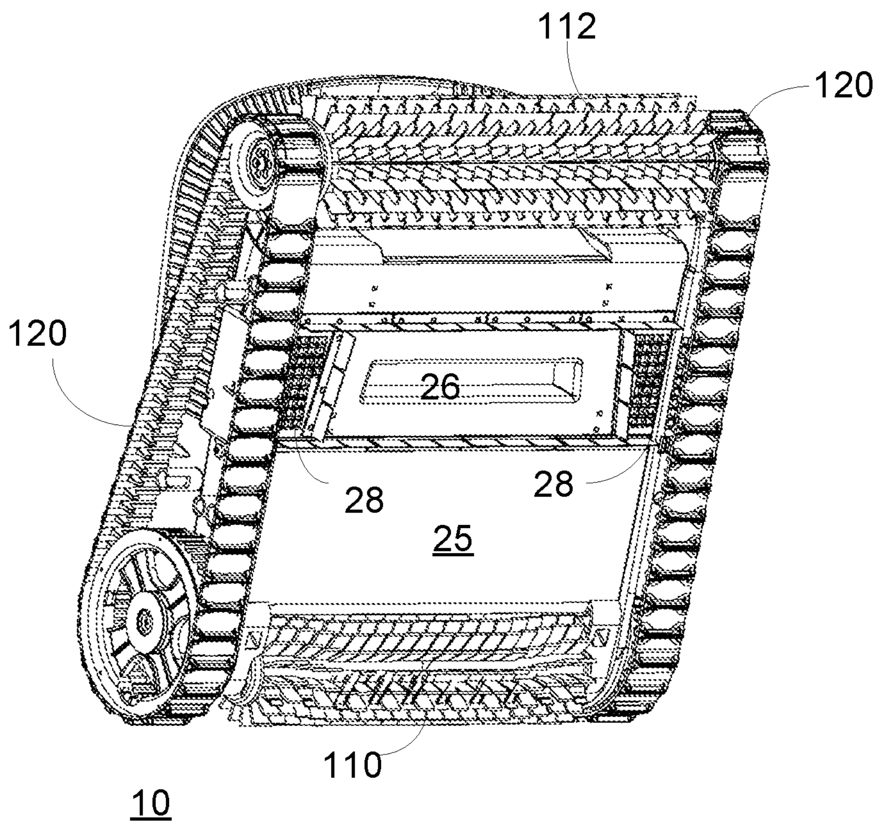


FIG. 6

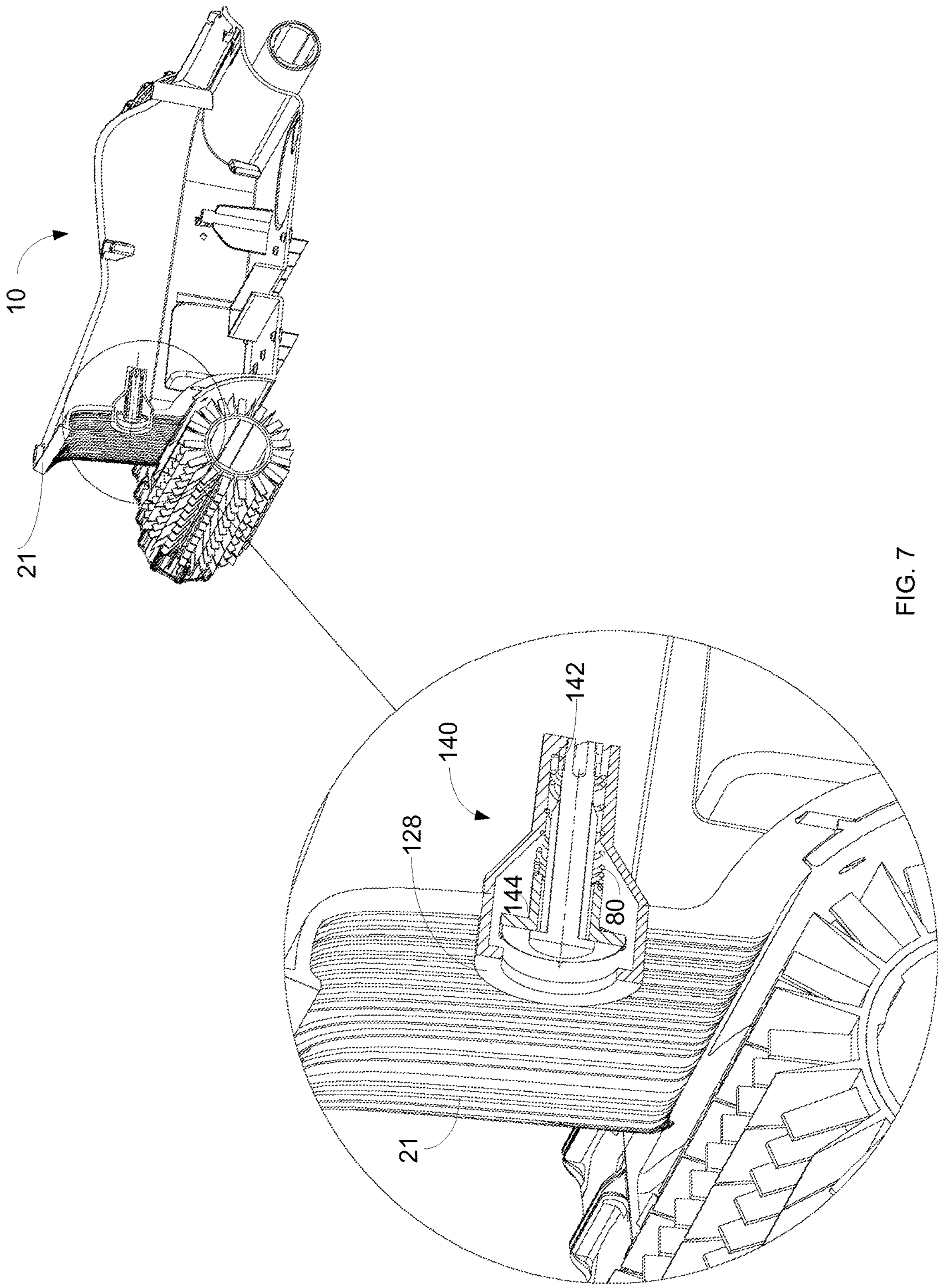


FIG. 7

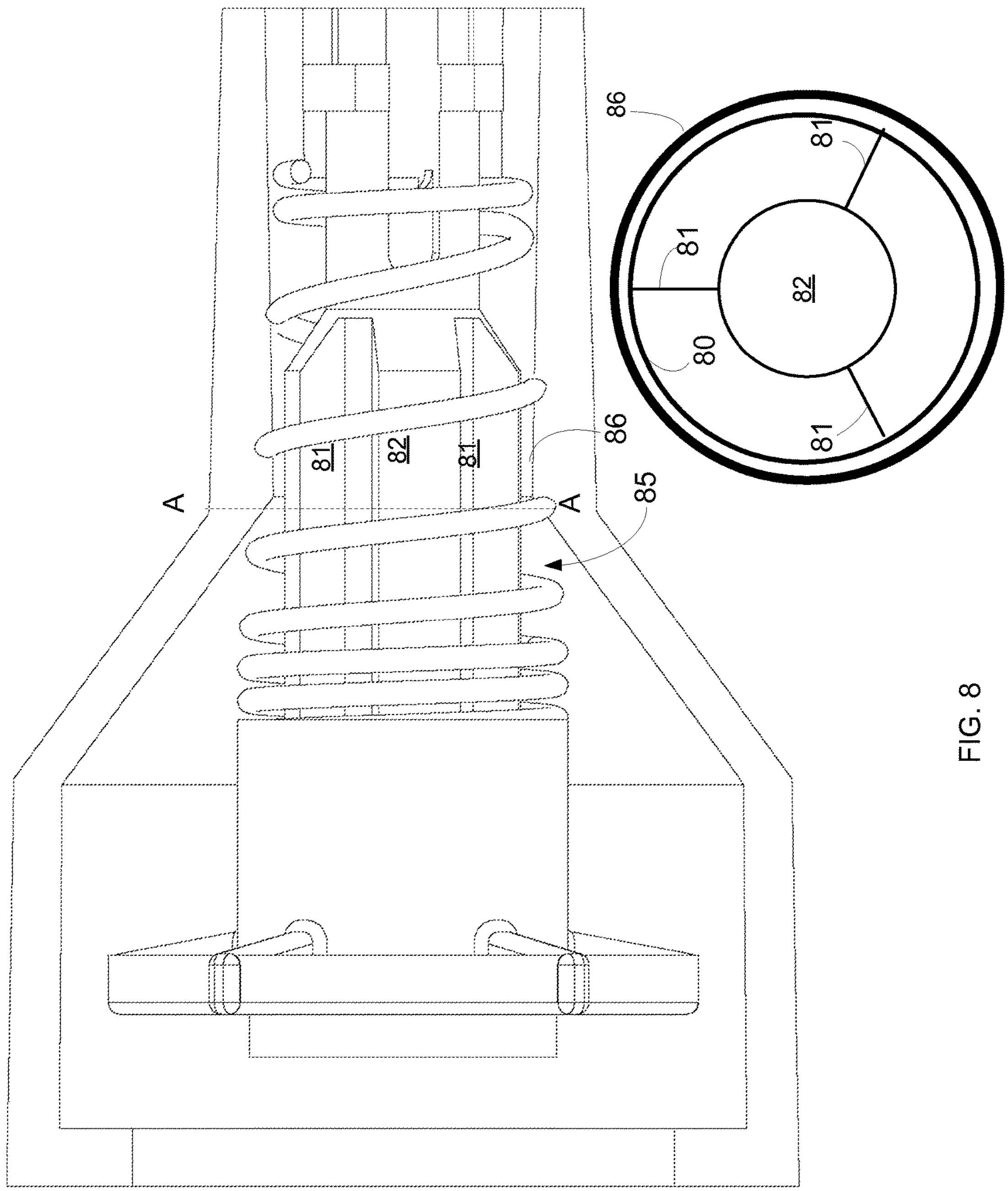


FIG. 8

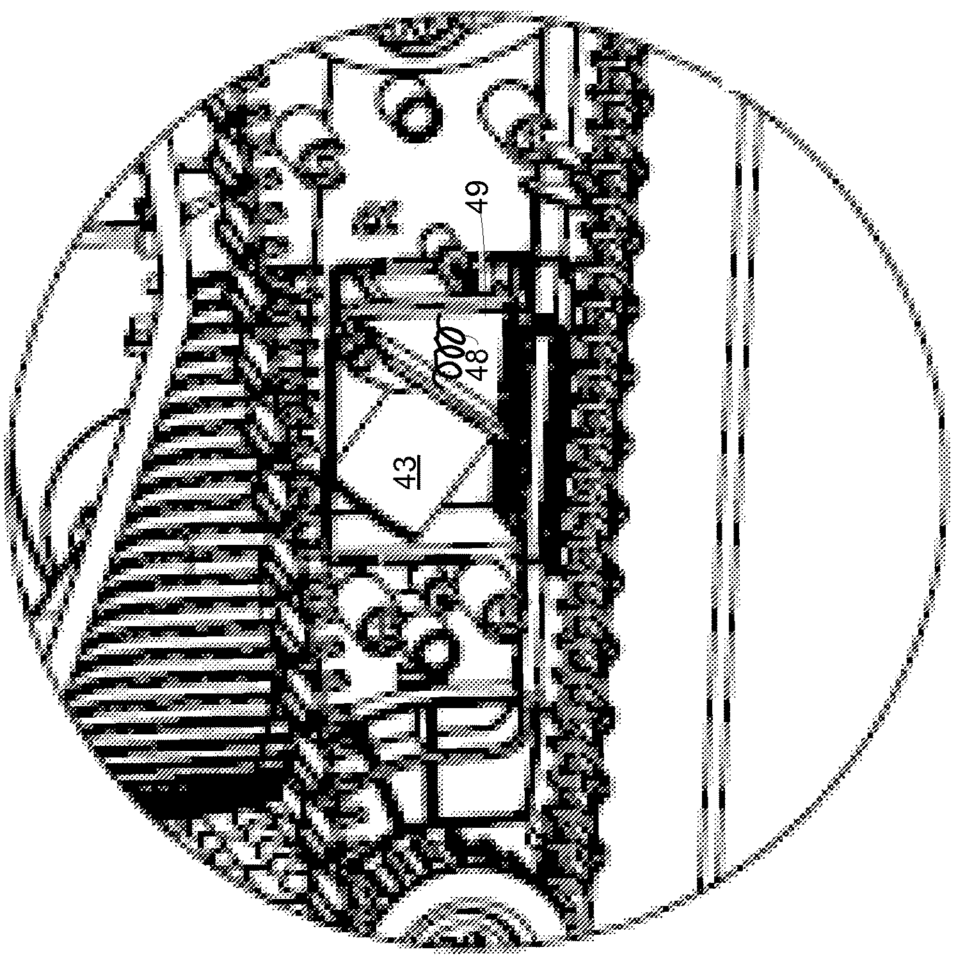


FIG. 9

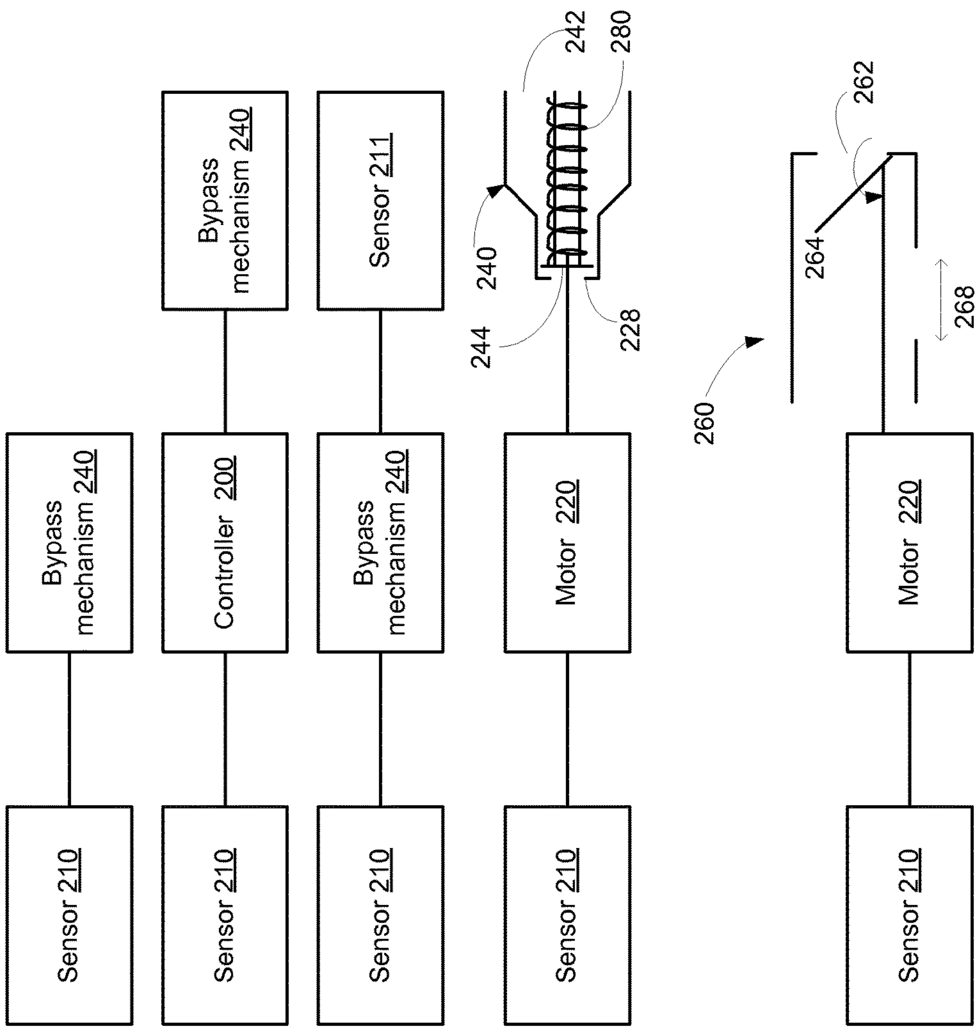

Bypass mechanism 240
Sensor 210
Controller 200
Bypass mechanism 240
Sensor 210
Sensor 211
Bypass mechanism 240
Sensor 210
242
280
240
244
228
Motor 220
Sensor 210
262
264
260
268
Motor 220
Sensor 210

FIG. 10

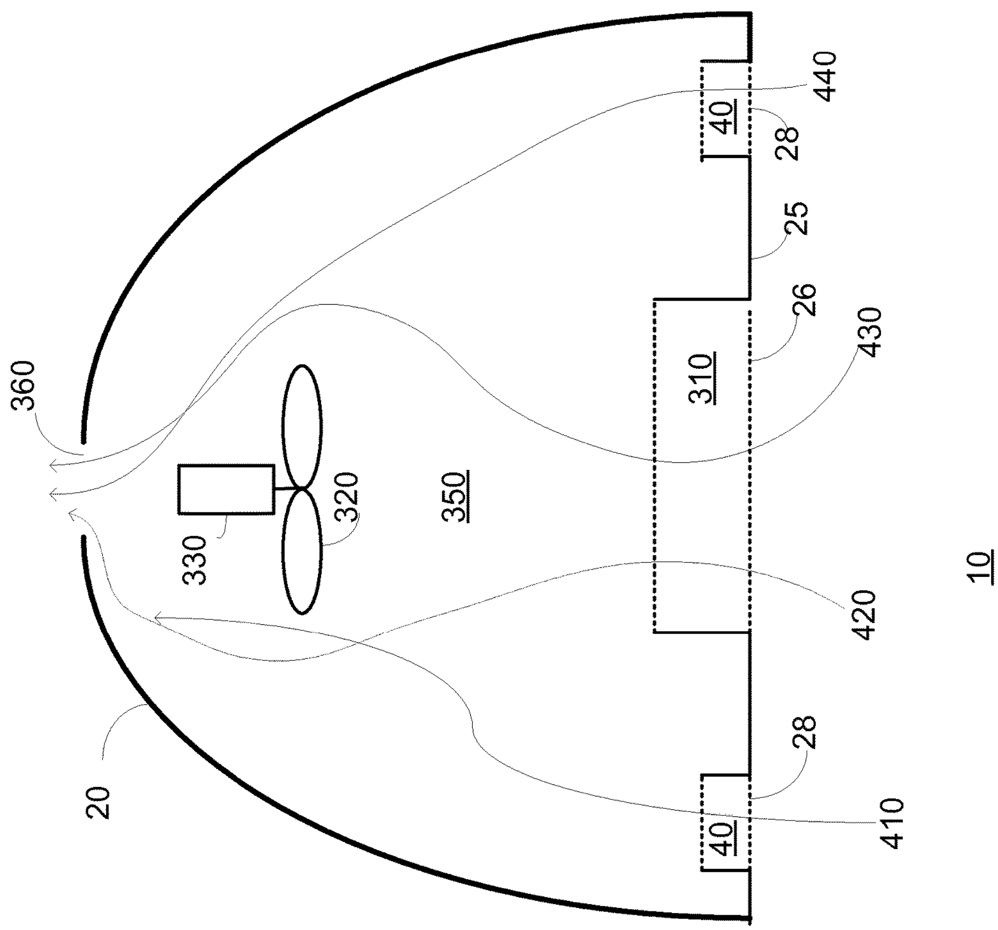
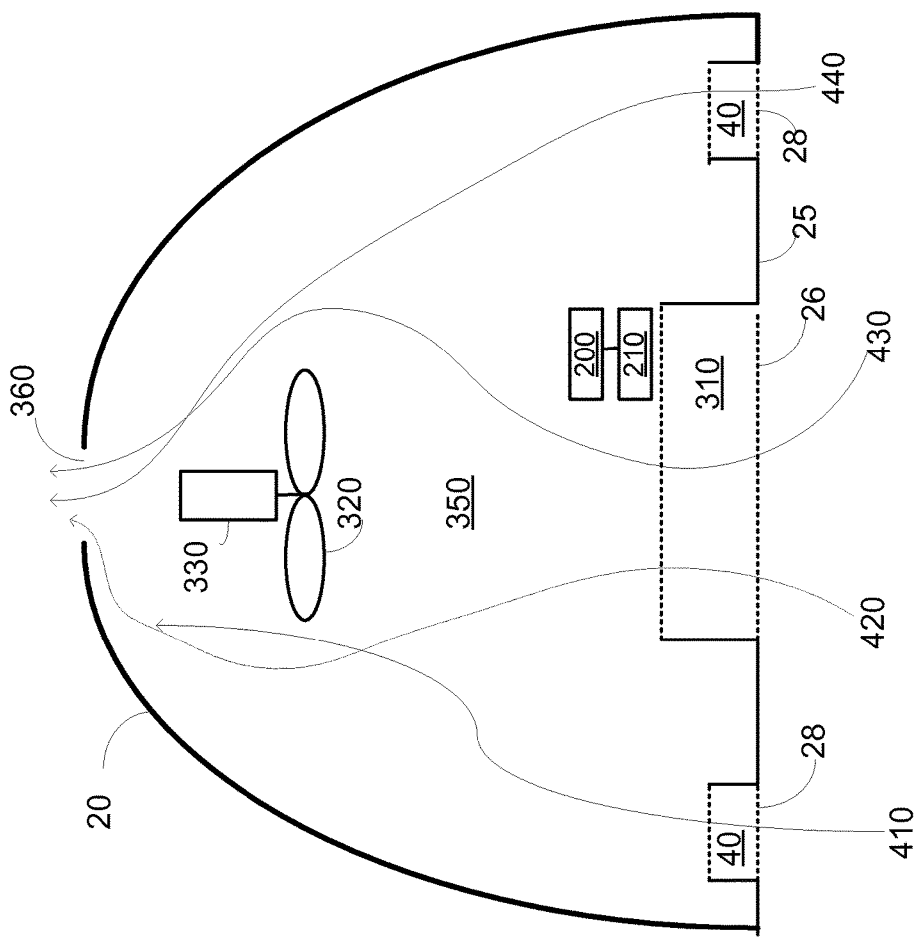


FIG. 11



10

FIG. 12

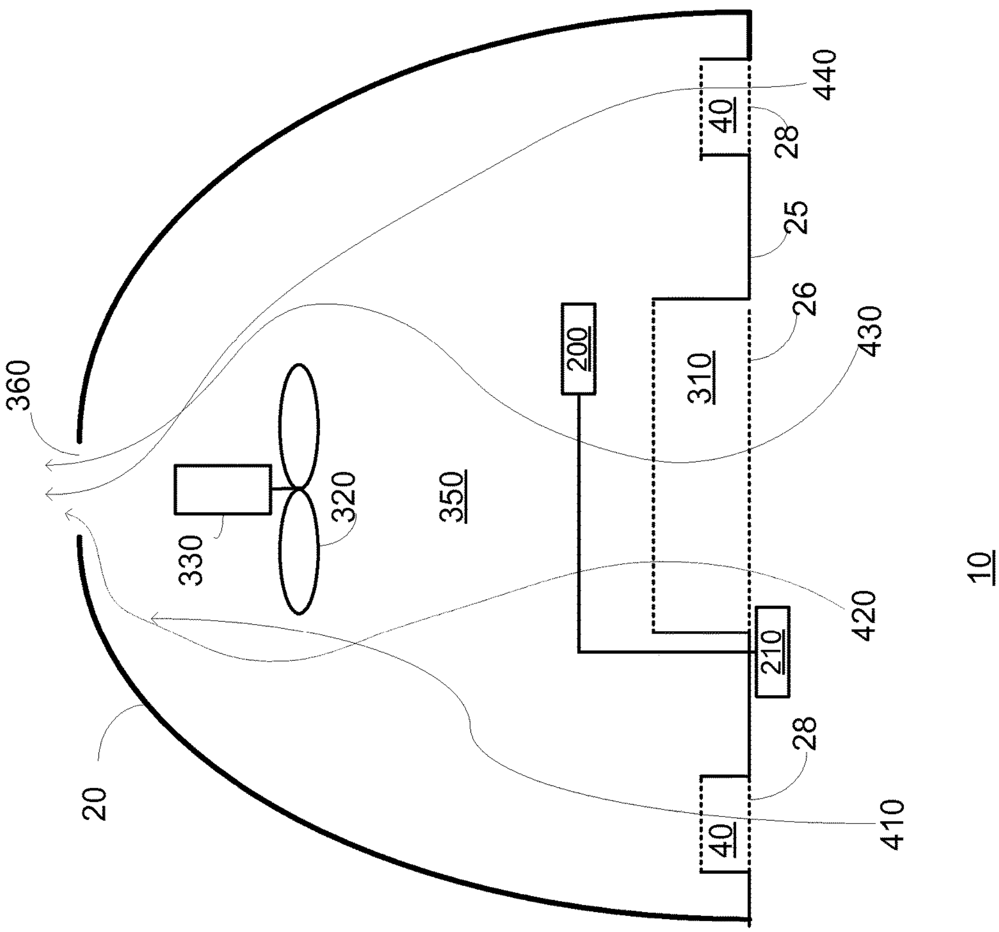
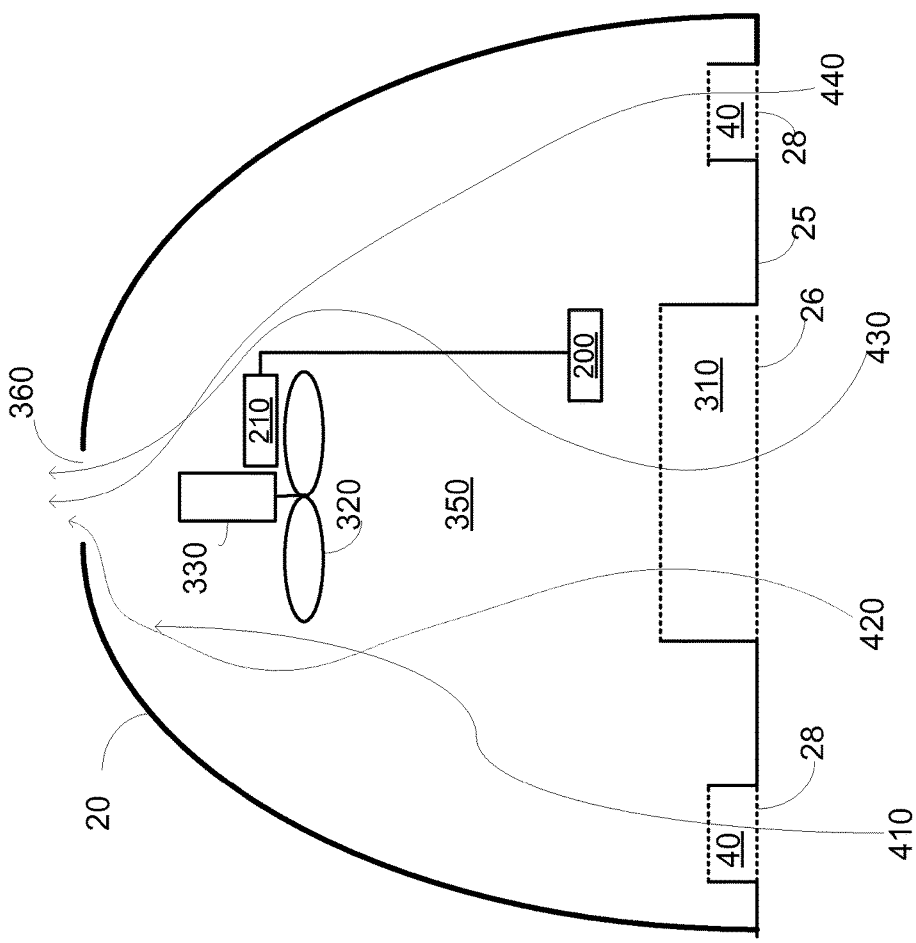


FIG. 13



10

FIG. 14

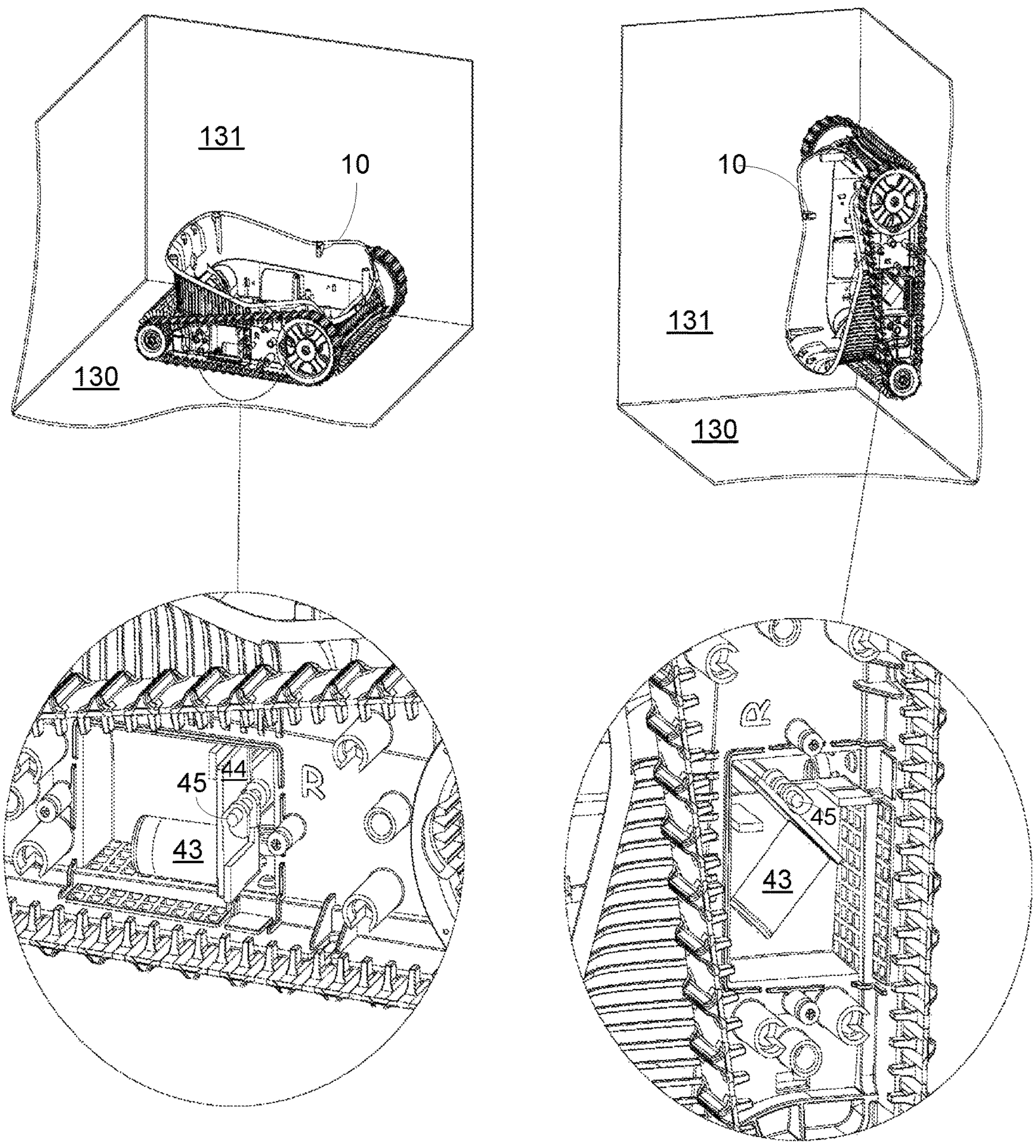


FIG. 15

POOL CLEANING ROBOT WITH BYPASS MECHANISM

RELATED APPLICATION

This application claims priority from U.S. provisional patent filing date Sep. 8, 2013 Ser. No. 61/875,066 which is incorporated herein by reference.

BACKGROUND

Cleaning robots contribute to the cleanliness of the fluid within a pool by moving within the pool and by filtering the fluid of the pool by means of a filter. The fluid of the pool enters the cleaning robot via one or more inlets, pass through the filter to be filtered and finally is outputted (after being filtered) as filtered fluid.

In some cleaning robots the effectiveness of the cleaning robot and even the mere movement of the cleaning robot require that the filtering unit to be clean. For example, some cleaning robots will stop moving if the filter is clogged. Yet other cleaning robots will not be able to climb the walls of the pool without a certain amount of fluid that is drawn-in by the cleaning robot and assist in attaching the cleaning robot to the walls of the pool.

There is a growing need to provide a cleaning robot that may be arranged to contribute to the cleanliness and sanitization of the pool surfaces and fluid even when its filters are partially or fully clogged.

SUMMARY

According to an embodiment of the invention there may be provided a cleaning robot with a bypass mechanism. The bypass mechanism can bypass one or more filters of a filtering unit.

According to an embodiment of the invention there may be provided a cleaning robot that may include a housing may include at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that may be arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit or the bypass mechanism.

The bypass mechanism may be arranged to allow fluid to pass through the bypass mechanism when the cleaning robot may be tilted by at least a predefined tilt angle.

The degree of openness of the bypass mechanism may be responsive to a tilt angle of the cleaning robot.

The bypass mechanism may include a door. The door may movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit. The position of the door may determine the openness level of the bypass mechanism.

The door may be pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

The door may be coupled to a weight.

The weight may be connected to a door. For example—near a lower end of the door. The rotation axis may be located near an upper end of the door.

The door may be connected to a lever that may be pivotally coupled to a rotation axis.

The door may be connected to a hinge that may be pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

The door may be coupled to a lever that may be pivotally coupled to a second rotation axis; wherein the lever may be arranged to limit a pivoting of the door about the first rotation axis.

The lever may be connected to a weight.

The weight may be arranged to slide across the door when the door moves between the close position and the open position.

The bypass mechanism may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

The bypass mechanism may include a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element may be arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

The bypass mechanism may include a spring that induces the sealing element to move towards the close position.

When the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element may be moved towards the open position.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be upstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be downstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

The cleaning robot further may include a sensor. The sensor may be arranged to detect an occurrence of a bypass related event and the bypass mechanism may be arranged to respond to the occurrence of the bypass related event.

The bypass mechanism may include a motor that may be arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

The sensor may be a robot tilt angle sensor.

The sensor may be a suction sensor.

The at least one inlet may include a bypass mechanism inlet and a filtering unit inlet.

The at least one inlet may include multiple bypass mechanism inlets and a filtering unit inlet.

The bypass mechanism may be closer to a sidewall of the housing than the filtering unit.

The bypass mechanism may be connected to a sidewall of the housing.

The bypass mechanism extends outside a sidewall of the housing.

The cleaning robot may include at least one additional bypass mechanism. The bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

At least two bypass mechanisms of the plurality of bypass mechanisms may differ from each other. For example—one bypass mechanism may be tilt angle triggered while another bypass mechanism may be pressure triggered.

At least two bypass mechanism of the plurality of bypass mechanisms may differ from each other by a triggering event that triggers an opening of the bypass mechanism.

At least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

A first bypass mechanism of the plurality of bypass mechanisms may be responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms. For example—when a pressure triggered bypass mechanism is opened it may ease the opening of a door of a tilt angle triggered bypass mechanism as the opening of the pressure triggered bypass mechanism may lower the suction within the housing and that reduction may ease an opening of a door of a tilt angle triggered bypass mechanism.

An opening of first bypass mechanism of the plurality of bypass mechanisms may ease an opening of another bypass mechanism of the plurality of bypass mechanisms.

An opening of first bypass mechanism of the plurality of bypass mechanisms may increase a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a clogging level of the filtering unit.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

A first bypass mechanism of the plurality of bypass mechanisms may have an opening located at a bottom of the housing and a second bypass mechanism of the plurality of bypass mechanisms may have an opening located at a sidewall of the housing.

A first bypass mechanism of the plurality of bypass mechanisms may include a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

A degree of openness of the bypass mechanism may be responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

There may be provided a cleaning robot that includes any combination of any components illustrated in the summary section of the application or in the specification.

There may be provided a cleaning robot that includes any combination of any components illustrated in any claims of the application.

If, for example, a cleaning robot include more than a single bypass mechanism then any of the bypass mechanism may have any structure illustrated in the summary, the specification or the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

FIG. **1** illustrates a portion of cleaning robot according to an embodiment of the invention;

FIG. **2** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **3** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **4** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **5** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **6** is a bottom view of a cleaning robot according to an embodiment of the invention;

FIG. **7** is a cross sectional view of a portion of cleaning robot taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention;

FIG. **8** is a cross sectional view of a bypass mechanism taken along a longitudinal axis of the bypass mechanism according to an embodiment of the invention;

FIG. **9** illustrates a portion of a cleaning robot according to an embodiment of the invention;

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention;

FIG. **11** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **12** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **13** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **14** is a cross sectional view of a cleaning robot according to an embodiment of the invention; and

FIG. **15** illustrates a portion of cleaning robot that climbs on a sidewall of a pool and a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

According to an embodiment of the invention there is provided a cleaning robot that may include one or more bypass mechanisms.

Various figures illustrate between one to three bypass mechanisms and it is noted that the number of bypassing mechanisms may be any positive integer (for example—one, two, three, four, five and more).

A bypass mechanism is a mechanical element that allows fluid to bypass a filtering unit. Thus, fluid that flows through a bypass mechanism does not flow through the filtering unit. It is noted that if the filtering unit has multiple filters than the bypass unit may be positioned to bypass one, some or all of the multiple filters of the filtering unit.

A bypass mechanism may include one or more mechanical components but may also include electrical components.

If a cleaning robot includes multiple bypass mechanisms then they all can be the same bypass mechanism, may all be different from each other or may include two or more bypass mechanisms that differ from each other.

Bypass mechanisms may differ from each other by their location, by mode of operation, by size, by shape, by the parameters that control their operation (such as a tilt angle of the cleaning robot or a suction level developed within an internal space of the cleaning robot), by including sensors, by excluding sensors, by including one or more motors, by excluding motors and the like.

Any bypass mechanism may be open or closed. An open bypass mechanism allows the fluid to flow through the bypass mechanism and to exit from the bypass mechanism thereby not flowing through one of more filters. A closed bypass mechanism prevents fluid from flowing through the bypass mechanism and exiting the bypass mechanism. It may prevent the fluid from entering the bypass mechanism, prevent fluid that enters the bypass mechanism to reach an outlet of the bypass mechanism and/or prevent fluid to flow through the outlet of the bypass mechanism.

Any bypass mechanism may have more than two openness levels—and may open at different degrees. Thus, a bypass mechanism may be partially open.

For simplicity of explanation the term “open” refers to a fully open or partially open.

According to an embodiment of the invention a bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filter is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid flow intensity and/or pressure level within the cleaning robot or when sensing that the flow intensity and/or pressure level of the filtered fluid is below a threshold.

The sensing may include sensing the flow and/or pressure of fluid before (downstream) and/or after (upstream) the filtering unit, in a path leading to the hydraulic movement mechanism and the like. The flow intensity and/or pressure level can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the filtering unit bypass may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall). This may be sensed by tracking the tilt angle of the cleaning robot, by using accelerometers and the like.

The opening may occur when sensing a reduction of the flow and/or pressure and climbing of the wall. Different thresholds for flow and/or suction levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the Flow and/or pressure of the filtered fluid is lower, and the like.

The movement of the cleaning robot even when the filtering unit is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving in the pool, detaching bacteria from the pool walls and floor by contact and assisting in pool filtering devices to filter the fluid by inducing fluid movements within the pool.

According to an embodiment of the invention the bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filtering unit is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of bypass related events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid and/or an increase in a suction level within the cleaning robot or both. The sensing may include sensing the flow and/or suction (pressure) of fluid before and/or after the filtering unit, in a path leading to a suction unit, to a hydraulic movement mechanism and the like. The flow and/or suction (pressure) can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the bypass mechanism may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall).

The opening may occur when sensing a reduction of the Flow and/or pressure and climbing of the wall. Different thresholds for Flow and/or pressure levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the flow and/or pressure of the filtered fluid is below a threshold, and the like.

By providing the bypass mechanism and allowing fluid to flow even when the filtering unit is clogged the cleaning robot may move in the pool. This movement of the cleaning robot even when the filter is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving the cleaning robot in the pool thereby detaching bacteria from the pool walls and floor by contact and assisting to pool filtering devices to filter the fluid by inducing fluid movements within the pool.

FIG. **1** illustrates a portion of cleaning robot **10** according to an embodiment of the invention.

FIG. **1** illustrates only a part of the cleaning robot as the upper part of the cleaning robot as well as multiple internal components of the cleaning robot (such as a filtering unit, a fluid suction unit, a driving motor and the like) are missing for clarity of explanation.

FIG. **1** illustrates the portion of the cleaning robot as including a housing **20**, front brush wheel **110**, rear brush wheel **112**, and tracks **120** movable by front wheel **121** and/or rear wheel **122**. It is noted that the cleaning robot may be moved by other movement elements (for example it may include wheels instead of tracks), may have other cleaning elements and the like.

The cleaning robot of FIG. **1** includes three bypass mechanisms—two bypass mechanisms **40** located at both sides of the housing (near sidewalls **22** and **23** of the housing **20**) and one bypass mechanism **140** located at the rear wall **21** of the housing **20**. FIG. **1** also shows a filtering unit inlet **26** formed at about the center of the bottom of the housing and positioned between bypass mechanisms **40**. FIG. **1** also shows a bypass outlet **42** of bypass mechanism **40**.

Each bypass mechanism allows fluid to bypass at least one filter of the filtering unit. The fluid propagates towards a fluid suction unit (such as an impeller) of the cleaning robot that is arranged to direct towards the outlet (of the housing) fluid that passes through the at least one inlet and through at least one of the filtering unit and the bypass mechanism.

FIG. **2** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **3** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **2** illustrates an open bypass mechanism **40** while FIG. **3** illustrates a closed bypass mechanism.

In FIGS. **2** and **3** the bypass mechanism **40** is illustrated as including door **44**. Door **44** is movable between (a) a closed position (FIG. **3**) in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position (FIG. **2**) in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

Door **44** is pivotally coupled to a first rotation axis **45** and rotates between the closed position and the open position.

FIGS. **2** and **3** also shows that the door **44** is coupled to a weight **43**. The weight **43** assists in opening the door **44** when the cleaning robot starts to tilt and closing the door **44** when the cleaning robot is horizontal. Alternatively, the door **44** may be heavy enough and does not require an additional weight **43**.

FIGS. **2** and **3** illustrate the weight **43** is being connected to a door **44** near a lower end of the door and illustrate the first rotation axis **45** is located near an upper end of the door **44**. The first rotation axis **45** may alternatively be located near the center of the door (as illustrated in FIG. **15**) in order to reduce the needed weight or mass of **43**. It is noted that the relative locations of the first rotation axis **45** and the weight **43** may differ from those illustrated in FIGS. **2** and **3**.

FIGS. **2** and **3** also show that the door **44** is not directly connected to the rotation axis but show a hinge **51** that is pivotally snapped-in or coupled to the first rotation axis **45** and interfaces with the door **44**. FIGS. **2** and **3** also illustrate a bypass path inlet **28** that is covered by a filtering mesh.

FIG. **4** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **5** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **4** illustrates an open bypass mechanism **40** while FIG. **5** illustrates a closed bypass mechanism.

FIGS. **4** and **5** illustrate a door **44** that is connected to a hinge **51** that is pivotally snapped-in or coupled to a first rotation axis **45** thereby allowing the door **44** to pivot about the first rotation axis **45**.

The door **44** of FIGS. **4** and **5** is coupled to a lever **52** that is pivotally coupled to a second rotation axis **46**. The second level **52** may be arranged to limit a pivoting of the door **44** about the first rotation axis **45**. The lever **52** may be oriented at about ninety degrees to the tilt angle of the cleaning robot but this is not necessarily so.

FIGS. **4** and **5** illustrate the lever **52**, connected or snapped-in to a weight **43** (or unify it by **43**), and interfaces with door **44**.

FIGS. **4** and **5** illustrate that the weight **43** is arranged to slide across the door **44** when the door moves between the close position and the open position.

FIGS. **2-6** illustrates bypass mechanisms **40** that their openness level depended upon the tilt angle of the cleaning robot. The tilt angle may be defined as the angle between the cleaning robot and the horizon.

It is noted that although FIGS. **2-6** do not show sensors for triggering the opening (and/or closing) of the bypass mechanisms—that the cleaning robot may include sensors that may sense the tilt angle of the cleaning robot and that the sensed tilt robot may be used to trigger (for example by using a motor) the opening and/or closing of a bypass mechanism.

Accordingly, there may be provided a cleaning robot wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle. This tilt angle may be measured by a sensor (such as sensor **210** of FIGS. **10**, **12** and **13**).

Yet for another embodiment of the invention the mechanical elements of the bypass mechanism may be arranged to allow opening the bypass mechanism only when the tilt angle exceeds a predetermined tilt angle. Referring to the example set forth in FIG. **9**, a spring **48** or other limiting element may be connected to door **44**, or to weight **43** and to a frame **49** of the bypass mechanism in order to counter the movement of the weight **43** or door **44** so that only at a predefined tilt angle the door **44** will move and at least partially open the bypass mechanism **40**. The predefined tilt angle may range between 70 and 110 degrees, may range between 50 and 90 degrees, between 20 and 80 degrees and the like.

FIG. **6** is a bottom view of a cleaning robot **10** according to an embodiment of the invention.

It shows a filtering unit inlet **26** located at about the center of the bottom **25** of the cleaning robot as well as two bypass path inlets **28** that are covered by a filtering mesh positioned at both sides of the filtering unit inlet **26**. This figure also shows front brush wheel **110**, rear brush wheel **112**, front wheel **121** and read wheel **122**.

FIG. **7** is a cross sectional view of a portion of cleaning robot **10** taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention.

FIG. **8** is a cross sectional view of a bypass mechanism **140** taken along a longitudinal axis of the bypass mechanism **140** according to an embodiment of the invention. FIG. **8** also provides a cross sectional view of the bypass mechanism **140** taken along axis A-A that is normal to the longitudinal axis of the bypass mechanism **140**.

Bypass mechanism **140** is installed in wall **21** of housing **20**. Bypass mechanism **140** may also be installed on other walls such as for example, sidewall **22** of the pool cleaner. Multiple bypass mechanisms may be used. It is pressure (suction) activated—it has a sealing element **144** that is forced by a spring **80** to move toward an exterior of the cleaning robot **10** thereby closing the inlet **128** of bypass mechanism **140**. On the other hand a pressure difference between the interior and the exterior of the cleaning robot **10** and/or suction applied by a fluid suction unit within an internal space of the cleaning robot (not shown) forces the sealing element **144** to move towards the interior of the cleaning robot **10** thereby opening the inlet **128** of bypass mechanism **140** and allowing fluid to pass through bypass mechanism and through outlet **142**. Accordingly—there is a suction (or pressure) thresholds that overcomes the spring and opens the bypass mechanism.

The sealing element **144** moves along an axis that is normal to the wall **21**. It includes a fluid conduit that has different cross sections at different location thus allowing a movement of the sealing element along the axis opens and closes the bypass mechanism **140**.

Accordingly—the sealing element **144** may move between (a) a closed position in which the sealing element **144** prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in

which the sealing element **144** allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

FIG. **8** illustrates that spring **80** is supported by and moves along a supporting element **86** that has a core **82** and three spaced apart wings **81** extending from the core **82**. Accordingly—the spaced apart wings **81** which contact the spring **80** define openings through which fluid may flow when the bypass mechanism **140** is open. The inner wall **86** of the bypass mechanism **140** may be larger than the exterior of spring **80**.

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention. FIG. **10** shows (from top to bottom) the following combinations:

a. A sensor **210** coupled to a bypass mechanism **240**. The sensor may sense pressure levels, tilt angles and may be used to control the bypass mechanism.

b. A controller **200** that is coupled to sensor **210** and to the bypass mechanism **240**. The sensor **210** may sense pressure levels, tilt angles and may send sensing signals to controller **200** that may control, in response to the sensing signals, the bypass mechanism.

c. Multiple (such as two) sensors **210** and **211** that are coupled to bypass mechanism **240** and their readings may be used for controlling the bypass mechanism **240**. Alternatively—the sensors may be coupled to controller **200** that in turn controls the bypass mechanism **240**.

d. Sensor **210** that controls motor **220** that in turn may manipulate (for example push and/or pull) sealing element **244** of bypass mechanism **240**. The bypass mechanism **240** may resemble (or may differ) the bypass mechanism **140** of FIG. **8**. The sealing element **244** can be forced by spring **280** to close the bypass mechanism **240**. The bypass mechanism **240** has an inlet **228** and an outlet **242** that is smaller than the inlet **228**.

e. Sensor **210** that controls motor **220** that in turn may manipulate (for example rotate) door **264** of bypass mechanism **260**. The bypass mechanism **260** may resemble (or may differ) the bypass mechanism **40** of FIGS. **2**-**4**. The door **264** can rotate about a rotation axis thereby close or open the bypass mechanism **260**. The bypass mechanism **260** has an inlet **268** and a filtering mesh and an outlet **262**.

FIG. **11** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **12** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **13** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **14** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention.

The cross section is taken along a transverse axis of the cleaning robot **10**.

FIGS. **11**, **12**, **13** and **14** differ by each other by:

a. The lack of a sensor and a controller **200** (FIG. **11**).

b. The inclusion of a controller **200** and the sensor **210** at a point that is upstream (after) the filtering unit **310**. (FIG. **12**)

c. The inclusion of the controller **200** upstream of the filtering unit **310** while the sensor **210** is located downstream the filtering unit **310**. (FIG. **13**)

d. The inclusion of a controller **200** within internal space **350** wherein the sensor **210** monitors the rotational speed of the suction unit (for example—of its impeller **320**). (FIG. **14**)

FIGS. **11**, **12**, **13** and **14** show the flow of fluid through bypass mechanism **40**—when the bypass mechanism **40** is open (see arrows **410** and **440**) or through filtering unit **310** (arrows **420** and **430**). FIG. **12** also illustrates a bypass path inlet **28** that is covered by a filtering mesh.

In FIG. **12** the sensor **210** may sense the flow of fluid at a point that is upstream to the filtering unit **310**. In FIG. **13** the sensor **210** may sense the flow of fluid at a point that is downstream to the filtering unit **310**.

The fluid that passes bypass mechanism **40** or filtering unit **310** enter an internal space **350** of the housing **20** and is drawn into a filtering unit **310** (illustrated as including impeller **320** and pump motor **330** for driving the impeller **320**) towards the outlet **360** of housing **20**.

While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

We claim:

1. A cleaning robot comprising: a housing comprising at least one inlet and an outlet; a filtering unit, located within the housing, for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one of the filtering unit and the bypass mechanism.

2. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle.

3. The cleaning robot according to claim **2** wherein predefined tilt angle ranges between 70 and 110 degrees.

4. The cleaning robot according to claim **2** wherein predefined tilt angle is 90 degrees.

5. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to a tilt angle of the cleaning robot.

6. The cleaning robot according to claim **1** wherein the bypass mechanism comprises a door; wherein the door is movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

7. The cleaning robot according to claim **6** wherein the door is pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

8. The cleaning robot according to claim **7** wherein the door is coupled to a weight.

9. The cleaning robot according to claim **8** wherein the weight is connected to a door at a location that is near a lower end of the door and wherein the rotation axis is located near an upper end of the door.

10. The cleaning robot according to claim **7** wherein the door is connected to a lever that is pivotally coupled to a rotation axis.

11. The cleaning robot according to claim **7** wherein the door is connected to a hinge that is pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

12. The cleaning robot according to claim **11** wherein the door is coupled to a lever that is pivotally coupled to a second rotation axis; wherein the lever is arranged to limit a pivoting of the door about the first rotation axis.

13. The cleaning robot according to claim **12** wherein the lever is connected to a weight.

14. The cleaning robot according to claim **12** wherein the weight is arranged to slide across the door when the door moves between the close position and the open position.

15. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

16. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element is arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

17. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a spring that induces the sealing element to move towards the close position.

18. The cleaning robot according to claim **17** wherein when the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element is moved towards the open position.

19. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is upstream to the filtering unit.

20. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is downstream to the filtering unit.

21. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

22. The cleaning robot according to claim **1** further comprising a sensor;

wherein the sensor is arranged to detect an occurrence of a bypass related event and wherein the bypass mechanism is arranged to respond to the occurrence of the bypass related event.

23. The cleaning robot according to claim **22** wherein the bypass mechanism comprises a motor that is arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

24. The cleaning robot according to claim **22** wherein the sensor is a robot tilt angle sensor.

25. The cleaning robot according to claim **22** wherein the sensor is a suction sensor.

26. The cleaning robot according to claim **1** wherein the at least one inlet comprises a bypass mechanism inlet and a filtering unit inlet.

27. The cleaning robot according to claim **1** wherein the at least one inlet comprises multiple bypass mechanism inlets and a filtering unit inlet.

28. The cleaning robot according to claim **1** wherein the bypass mechanism is closer to a sidewall of the housing than the filtering unit.

29. The cleaning robot according to claim **1** wherein the bypass mechanism is connected to a sidewall of the housing.

30. The cleaning robot according to claim **1** wherein the bypass mechanism extends outside a sidewall of the housing.

31. The cleaning robot according to claim **1** comprising at least one additional bypass mechanism; wherein the bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

32. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms differ from each other.

33. The cleaning robot according to claim **31** wherein at least two bypass mechanism of the plurality of bypass mechanisms differ from each other by a triggering event that triggers an opening of the bypass mechanism.

34. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

35. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms.

36. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms eases an opening of another bypass mechanism of the plurality of bypass mechanisms.

37. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms increases a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

38. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a clogging level of the filtering unit.

39. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

40. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms has an opening located at a bottom of the housing and wherein a second bypass mechanism of the plurality of bypass mechanisms has an opening located at a sidewall of the housing.

41. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms comprises a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

42. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

* * * * *

EXHIBIT 5

Delivering to Chicago 60641
Sign in to update
Garden & Outdoor
Search Amazon
EN
Hello, sign in
Account & Lists
Returns
& Orders
0

All Medical Care & Pharmacy Back to School Off to College Best Sellers Customer Service Amazon Basics Music Shop Black Business Month

Amazon Home Shop by Room Discover Shop by Style Home Décor Furniture Kitchen & Dining Bed & Bath Garden & Outdoor Home Improvement

12,926

Patio, Lawn & Garden › Pools, Hot Tubs & Supplies › Cleaning Tools & Chemicals › Automatic Pool Cleaners › Robotic Pool Cleaners

Sponsored

Roll over image to zoom in

6 VIDEOS

Chasing CM600 Robotic Pool Cleaner, Pool Vacuum Support Different Shape's Pool Up to 300m², App Control, Double Suction, Double Active Brush, Efficient Cleaning Waterline Dirt, Climb Wall, 6L Filter

Visit the Chasing Store

4.0 13 ratings

Deal

-34% $789.99

List Price: ~~$1,199.00~~

Get $50 off instantly: Pay $739.99 upon approval for Amazon Visa.

Delivery & Support

Select to learn more

Ships from Amazon

Eligible for Return, Refund or Replacement within 30 days of receipt

Customer Support

Color: **B-18M Anti-tangle Cable**

$789.99 $1,299.00

Brand	Chasing
Model Name	Robotic Pool Cleaner
Color	B-18M Anti-tangle Cable
Item Dimensions LxWxH	22.83 x 22.05 x 21.26 inches
Power Source	AC

About this item

- 【App Intelligent Control, Path Planning】The Robotic Pool Cleaner can be controlled remotely through the APP, and has functions such as scheduled cleaning (timed/delayed), unattended, and one-key recycling. You can easily enjoy the fun of high-tech at the touch of a button, and it also has a manual cleaning mode with strong controllability and no delay. Free your hands

prime

Enjoy fast, FREE delivery, exclusive deals and award-winning movies & TV shows with Prime

Try Prime and start saving today with **Fast, FREE Delivery**

$789.99

FREE delivery **Monday, August 14**. Order within 22 hrs 27 mins

Delivering to Chicago 60641. Sign in to update.

In Stock

Qty: 1

Add to Cart

Buy Now

Payment	Secure transaction
Ships from	Amazon
Sold by	Woot
Returns	Eligible for Return, Refund or Replacement within 30 days of receipt
Support	Free Amazon product support included

Add a gift receipt for easy returns

Add to List

New (2) from $789.99 & **FREE Shipping**.

Have one to sell?

Sell on Amazon

completely, allowing you to enjoy hassle-free cleaning and save time and worry. You will love this little robot!

- 【Chasing S-clean Technology, Efficient Cleaning】Pool cleaning robot, with CHASING S-Clean technology, is suitable for multi-shaped swimming pools, ensuring high coverage and time efficiency of the cleaning area, and also has the ability to automatically avoid obstacles and get out of trouble. You don't need to worry about the difficulty of cleaning at all, let it work efficiently for you and bring you a convenient swimming pool cleaning experience.
- 【Chasing S-climb Technology, Intelligent Wall Climbing】Automatic Robotic Pool Cleaner, with CHASING S-Climb technology, can automatically identify pool walls, steps, slopes, etc., easily achieve wall climbing function and continue cleaning work. In the waterline mode, it can better reflect its wall climbing ability and efficient cleaning ability in a vertical state. Smart and convenient, comprehensive cleaning, easy to solve your cleaning problems.
- 【Double Suction, Strong Decontamination】The pool robot adopts CHASING full brushless custom motor, and the power output is stable and reliable. Equipped with dual suction pumps with double suction, dual active brushes rotate at high speed and generate strong friction, which can easily pick up fine leaves, sand, stones, other debris, as well as dirt and sediment. It will also give you a clean, clear and impurity-free swimming pool, allowing you and your family to enjoy a happy swimming pool time.
- 【Removable Filter Screen, Precise Filtration】Detachable ultrafine filter screen design can not only filter coarse sand, leaves, stones and other granular impurities, but also filter mud, dander, grease and other finer impurities. 6L ultra-large volume filter pocket, no fear of being full. For the dirt stored in the filter bag, just open the cleaning compartment and clean the filter bag regularly. Pool cleaning has never been easier!
- 【Warranty Service And Customer Support】: It has been committed to the exploration of the underwater robot field and has achieved a series of significant results, providing satisfactory and continuously upgraded products and services to consumers in more than 80 countries and regions around the world. We promise 2 years warranty service and 24 hours friendly customer support. If you have any questions, please do not hesitate to contact us online immediately, we will be happy to help you!

Customer ratings by feature

Suction power	4.8
Durability	4.6
Longevity	4.0

See all reviews

Higher rated item to consider

Amazon's Choice

Dolphin Nautilus CC Plus Robotic Pool Vacuum Cleaner — Wall Climbing Capability — Top Load Filters for Easy Maintenance — Ideal for Above/In-Ground Pools up to 50 FT in Length

(20577)

$799.00

Buy it with

+

+

This item: Chasing CM600 Robotic Pool Cleaner, Pool Vacuum Support Different Shape's Pool …
$789.99

Pool Brush Head for Cleaning Pool Walls,Heavy Duty Inground/Above Ground Swimming Pool Scrub…
$20.20

EASYTEST 7-Way Pool Test Strips, 150 Strips Water Chemical Testing for Hot tub and Spa, Accurate T…
$11.87

Total price: $822.06

Add all three to Cart

These items are shipped from and sold by different sellers.
Show details

Deals on related products

Sponsored

Aiper Seagull Pro Cordless Robotic Pool Cleaner, Wall Climbing Pool Vacuum— Quad…
8,068
30% off Deal
$699.99
List: ~~$999.99~~ (30% off)

Sponsored

WYBOT Wall Climbing Robotic Pool Cleaner with APP Mode, Excellent Suction…
144
25% off Deal
$599.99
List: ~~$799.99~~ (25% off)

Sponsored

WYBOT Pool Vacuum for INGROUND Pools up to 60 FT in Length, Cordless Robotic…
78
18% off Deal
$509.99
List: ~~$619.99~~ (18% off)

Sponsored

WYBOT Cordless Robotic Pool Cleaner Vacuum, Ultra Strong Suction, Wall Climbing Fun...
194
27% off Deal
$479.99
List: ~~$659.99~~ (27% off)

Sponsored

Lydsto Cordless Robotic Pool Cleaner, Automatic Pool Vacuum, Dual-Motor, Stronger P...
41
35% off Deal
$129.00
List: ~~$199.00~~ (35% off)

Sponsored

WYBOT Ultimat Cordless Roboti Cleaner with Ap Setting, Lasts…
21
15% off Deal
$679.99
List: ~~$799.99~~ (15%

From the brand

INTELLIGENT AND CONVENIENT; COMPREHENSIVE CLEANING

Chasing CM600 is a robotic pool cleaner independently developed by CHASING INNOVATION for private, public, commercial, and other scenarios.

Product Description

INTELLIGENT AND CONVENIENT; COMPREHENSIVE CLEANING

Chasing CM600 is a robotic pool cleaner independently developed by CHASING INNOVATION for private, public, commercial, and other scenarios.

Controlling the cleaning process with an APP makes pool cleaning effort-free. Supported by CHASING S-Clean and S-Climb technologies, CM600 can easily handle various pool shapes and pool wall climbing. The brushless motor, ultra fine filter screen, and dual active brush can ensure thorough, effective, and reliable pool cleaning works. The multiple strainers can filter impurities accurately, and the filter bag is extra large.The anti-tangle cable can minimize possible troubles and risks happened during pool cleaning. The pick up mode allows you to remove CHASING CM600 quickly and easily from a pool.

Chasing CM600 gives you smart, thorough, and effort-free pool cleaning experiences, bringing limpidity back to your beloved pool.

Floors & Walls & Waterlines Take On An Altogether New Aspect！！！

- Chasing CM600 robotic pool cleaner has adopted dual active brush, allowing simultaneous moving and scrubbing.
- The active brushes have a relatively higher speed than tracks, generating higher friction force to clean pool floors, walls, and waterline stains effectively.
- CM600 Pool Cleaner Robotic's specially engineered hydrodynamic structure can avoid stirring up bottom debris and perform thorough pool cleaning.
- The dual water suction pump and axial flow pump impellers can generate doubled suction power and achieve highly efficient water filtering.

Brushless Motor, Reliable and Durable

CHASING CM600 robotic pool cleaner adopts CHASING brushless motors, which can reduce the interference of electric spark. The brushless motors can provide smooth, stable and reliable power, giving CM600 a long service life.

- Can reduce the interference of electric spark.
- Can provide smooth, stable and reliable power.
- Can extend CM600’s service life.

Dual Water Suction Pump

Ensure high coverage and time efficiency of the cleaning area.

You don't need to worry about the cleaning difficulty at all, let it work efficiently for you and bring you a convenient cleaning experience for the swimming pool.

Dual Active Brush, Eliminating Debris

Dual active brushes rotate at high speed and generate strong friction force, which can easily pick up fine leaves, sand, stones, other debris, as well as dirt and sediment.

It will also give you a clean, clear and impurity-free swimming pool, then you and your family can enjoy a happy swimming pool time.

APP Intelligently Control

Easily enjoy the fun brought by high-tech by one-key pressing. Free your hands completely, so you can enjoy efficient cleaning, and save time and free from worry. You will love this little cleaner!

Exclusive APP

Appointment cleaning

Unattended operation

One-key return

Using The Pick Up Mode

Pick up mode is available on the control box or CHASING GO3 APP. Using this function, your CM600 can travel to the nearest pool edge for easy removal.

CHASING CM600 will automatically stop working after being taken out of the water and will be in a stationary state.

Extra Large Filter Bag

The filter bag has an extra capacity of 6L.

It has adopted a multiple strainer design, the outer filter paper element has a higher precision and can filter finer impurities such as sludge, scurf and grease.

As to the impurities stored in the filter bag, you only need to press one key to open the canister and clean the filter bag on a regular basis.

CHASING S-Clean Technology & CHASING S-Climb Technology & Anti-Tangle Cable Minimizes the Risk of Tanglement

CHASING S-Clean Technology, Suitable for Various Pool Shapes!

- Chasing CM600 robotic pool cleaner has applied CHASING S-Clean Technology;
- Enabling it to efficiently and thoroughly clean pools of different shapes;
- CM600 can automatically avoid obstacles，It can also backtrack when it gets trapped.

CHASING S-Climb technology for climbing walls intelligently and cleaning waterlines easily!

- Chasing CM600 robotic pool cleaner has applied S-Climb Technology, allowing it to climb walls smart.
- CM600 can automatically climb walls, steps, and slopes once it senses them.
- In the waterline mode, it can better embody its ability of wall climbing and the ability of cleaning waterlines by parallel translation in a vertical state.

Anti-Tangle Cable Minimizes the Risk of Tanglement!

- CHASING CM600 adopts the anti-tangle cable, making the cleaner free to move during operations.

THE POOL AREA Is LARGE And DIFFICULT To CLEAN

CM600 can be used in large swimming pools

It can solve the problem of difficult cleaning of large swimming pools.

Easily cleans large pools

Pool walls and waterlines are easily cleaned

Save labor cost

Save water resources

Compare with similar items

	This item Chasing CM600 Robotic Pool Cleaner, Pool Vacuum Support Different Shape's Pool Up to 300m², App Control, Double Suction, Double Active Brush, Efficient Cleaning Waterline Dirt, Climb Wall, 6L Filter Add to Cart	WYBOT Cordless Wall Climbing Robotic Pool Cleaner with Intelligent Path Cleaning, APP Setting, Ultra Suction Power, Last 180 Mins, Automatic Pool Vacuum Robot Ideal for Inground Pools up to 1300sq.ft Add to Cart	WYBOT Wall Climbing Robotic Pool Cleaner with APP Mode, Excellent Suction Power, Smart Navigation Technology, 9200mAH Large Battery, LED Indicator, Automatic Pool Vacuum for Inground Pools-Black Add to Cart	(Eclipsing Wired) WYBOT Cordless Pool Robot Cleaner, 3X Suction Power, Full Pool Cleaning, Wall Climbing, Front & Rear Quadruple Brushes, Dual Filters, 120-Min, Suitable for Large In-Ground Pools Add to Cart
Customer Rating	(13)	(35)	(144)	(2)
Price	$789.99	$999.99	$599.99	$999.99
Shipping	FREE Shipping. Details	FREE Shipping. Details	FREE Shipping. Details	FREE Shipping. Details
Sold By	Woot	WYBOT U.S.	WYBOT U.S.	WYBOT U.S.

Product information

Product Dimensions	22.83 x 22.05 x 21.26 inches

Warranty & Support

Item Weight	50.9 pounds
Manufacturer	Chasing
ASIN	B0B5RBX4DS
Item model number	CM6-5-SU2
Customer Reviews	4.0 13 ratings 4.0 out of 5 stars
Best Sellers Rank	#184,738 in Patio, Lawn & Garden (See Top 100 in Patio, Lawn & Garden) #261 in Robotic Pool Cleaners

Product Warranty: For warranty information about this product, please click here

Feedback

Would you like to **tell us about a lower price?**

Videos

Videos for related products

1:47
Discover the Better WYBOT S1 Pool Robot with us
WYBOT U.S.

1:27
Should you get a rechargeable or corded vacuum?
Ty's Reviews

1:10
Well...Quick THOUGHTS + FACTS + a Forewarning...
D's Up Close THOUGHTS

Fu gr Jin

Upload your video

Important information

To report an issue with this product, click here.

Products related to this item

Sponsored

Dolphin Sigma Robotic Pool Cleaner (2023 Model) — Wi-Fi, App, Gyroscope, Weekly Tim...
883
$1,497.00

Aiper Seagull Pro Cordless Robotic Pool Cleaner, Wall Climbing Pool Vacuum— Quad...
8,068
30% off Deal
$699.99
Save $40.00 with coupon
List: ~~$999.99~~ (30% off)

(2023 Upgrade) AIPER Seagull Pro Cordless Robotic Pool Cleaner, Wall Climbing Pool ...
2,172
$799.00
Save $140.00 with coupon

(Eclipsing Wired) WYBOT Cordless Pool Robot Cleaner, 3X Suction Power, Full Pool Cl...
2
$999.99
Save $100.00 with coupon

WYBOT Wall Climbing Robotic Pool Cleaner with APP Mode, Excellent Suction...
144
25% off Deal
$599.99
Save 5% with coupon
List: ~~$799.99~~ (25% off)

WYBOT Cordles Pool Cleaner Va Ultra Strong Su Wall Climbing F
19
27% off Deal
$479.99
Save 5% with cou
List: ~~$659.99~~ (27%

Similar brands on Amazon

Looking for specific info?

Customer reviews

4 out of 5

13 global ratings

5 star		72%
4 star		0%
3 star		0%
2 star		15%
1 star		13%

How customer reviews and ratings work

Reviews with images

See all customer images

Top reviews

Top reviews from the United States

Elodily W. VINE VOICE

This pool cleaner helped me to keep the pool clean, safe, and enjoyable for everyone

Reviewed in the United States on May 12, 2023

Color: B-18M Anti-tangle Cable Verified Purchase

As a pool owner, there are a lot of tasks need to perform to ensure the proper maintenance and care of the pool. Like need to clean the pool regularly , maintain proper water balance , Filtration system maintenance, Chlorine or alternative sanitization, Monitoring water level etc. Proper and regular maintenance is essential

to keep the pool clean, safe, and enjoyable for everyone. The most difficult and time consuming part is the regular cleaning process. But as you know cleaning pool regularly is important for several reasons:
1. Water Quality

Read more

9 people found this helpful

Helpful Report

Heavy Duty VINE VOICE

Time saving and does an amazing job!

Reviewed in the United States on May 7, 2023

Color: A-25M Anti-tangle Cable **Verified Purchase**

I absolutely love summer and LOVE pool season, however I do not particularly love the constant cleaning of our pool! A clean and clear pool is a must but can be very time consuming especially when cleaning with just a hand vacuum and a pool net. With this Chasing robotic pool cleaner, the work is nearly all done for me! I can sit poolside, relax in my chair, with a cold drink while the pool cleaner gets ALL the mess - the dirt, sand, leaves, debris, insects and whatever else might be blown into the pool. It does a spectacular job! This cleaner does not just get the bottom of our pool clean, it will

Read more

9 people found this helpful

Helpful Report

Techsavvy69

Quit working after two cleanings.

Reviewed in the United States on May 27, 2023

Color: B-18M Anti-tangle Cable **Verified Purchase**

Cleaned my pool twice before the main control unit just gives a code of E00 on it and it won't do anything. Has trouble climbing the sides on an above ground pool. It tries to climb the side and it doesn't seem to adjust its speed down once it's vertical to let it stick better, then it could speed back up after it sticks to the side with vacuum. It just goes fast and keeps bouncing off the wall, and falling away from it. It probably does this because unlike an in ground pool, an above ground one has the liner stretched like fabric which can press in an rebound making it throw the cleaner off the wall. Once in awhile it climbs it. It seems that this could be fixed with a program change, maybe have an above ground pool setting choice and an in ground one. I really wanted to like this cleaner.

4 people found this helpful

Helpful Report

See more reviews ›

Back to top

Get to Know Us

- Careers
- Amazon Newsletter
- About Amazon
- Accessibility
- Sustainability
- Press Center
- Investor Relations
- Amazon Devices
- Amazon Science

Make Money with Us

- Sell more with Amazon
- Sell apps on Amazon
- Supply to Amazon
- Protect & Build Your Brand
- Become an Affiliate
- Become a Delivery Driver
- Start a Package Delivery Business
- Advertise Your Products
- Self-Publish with Us
- Host an Amazon Hub
- › See More Ways to Make Money

Amazon Payment Products

- Amazon Visa
- Amazon Store Card
- Amazon Secured Card
- Amazon Business Card
- Shop with Points
- Credit Card Marketplace
- Reload Your Balance
- Gift Cards
- Amazon Currency Converter

Let Us Help You

- Amazon and COVID-19
- Your Account
- Your Orders
- Shipping Rates & Policies
- Amazon Prime
- Returns & Replacements
- Manage Your Content and Devices
- Your Recalls and Product Safety Alerts
- Help

English United States

Amazon Music Stream millions of songs	Amazon Advertising Find, attract, and engage customers	6pm Score deals on fashion brands	AbeBooks Books, art & collectibles	ACX Audiobook Publishing Made Easy	Sell on Amazon Start a Selling Account
Amazon Business Everything For Your Business	Amazon Fresh Groceries & More Right To Your Door	AmazonGlobal Ship Orders Internationally	Home Services Experienced Pros Happiness Guarantee	Amazon Ignite Sell your original Digital Educational Resources	Amazon Web Services Scalable Cloud Computing Services
Audible Listen to Books & Original Audio Performances	Book Depository Books With Free Delivery Worldwide	Box Office Mojo Find Movie Box Office Data	ComiXology Thousands of Digital Comics	DPReview Digital Photography	Fabric Sewing, Quilting & Knitting
Goodreads Book reviews & recommendations	IMDb Movies, TV & Celebrities	IMDbPro Get Info Entertainment Professionals Need	Kindle Direct Publishing Indie Digital & Print Publishing Made Easy	Amazon Photos Unlimited Photo Storage Free With Prime	Prime Video Direct Video Distribution Made Easy
Shopbop Designer Fashion Brands	Amazon Warehouse Great Deals on Quality Used Products	Whole Foods Market America's Healthiest Grocery Store	Woot! Deals and Shenanigans	Zappos Shoes & Clothing	Ring Smart Home Security Systems
eero WiFi Stream 4K Video in Every Room	Blink Smart Security for Every Home	Neighbors App Real-Time Crime & Safety Alerts	Amazon Subscription Boxes Top subscription boxes – right to your door	PillPack Pharmacy Simplified	Amazon Renewed Like-new products you can trust

Conditions of Use Privacy Notice Your Ads Privacy Choices

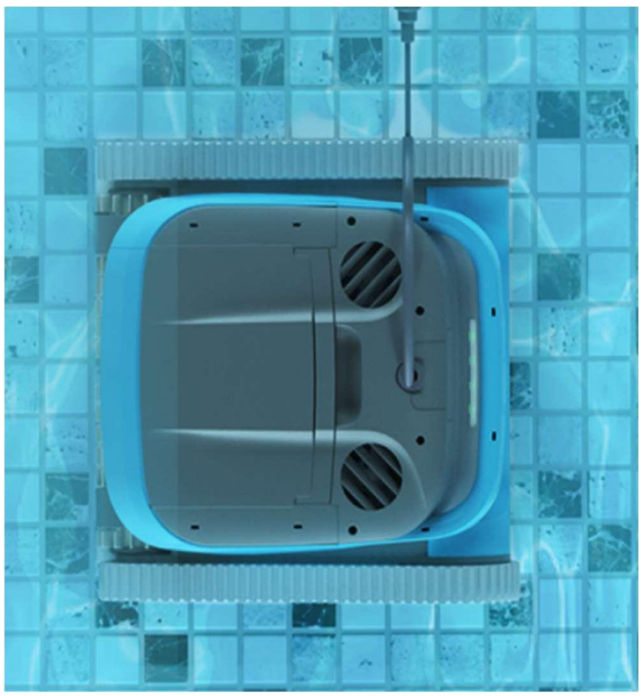
EXHIBIT 6

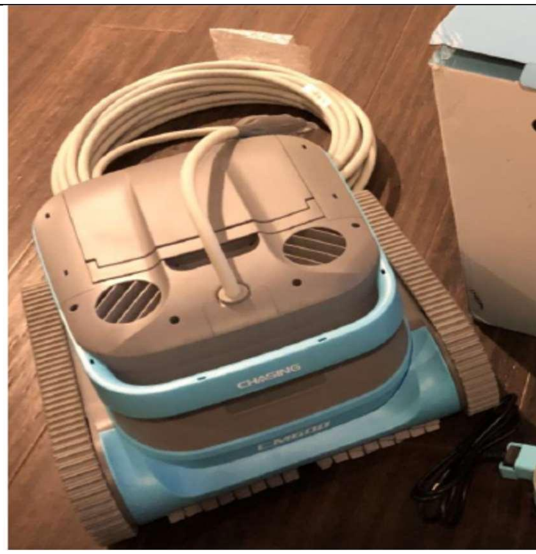
EXEMPLARY CLAIM CHART

Claim 1: Maytronics U.S. Patent No. 10,378,229	**Chasing Innovation CM600 Pool Robot**
A cleaning robot comprising:	The Chasing CM600 is an automatic robotic pool cleaner.  
a housing comprising at least one inlet and an outlet;	The CM600 has at least an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.

	 The inlet is in the bottom of the housing as shown below.  

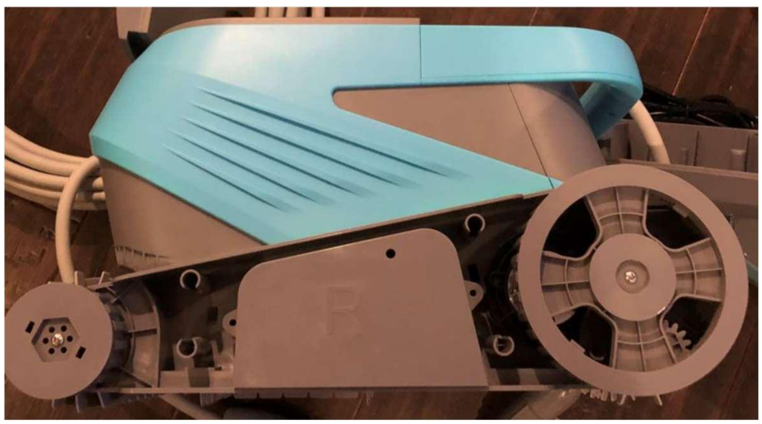
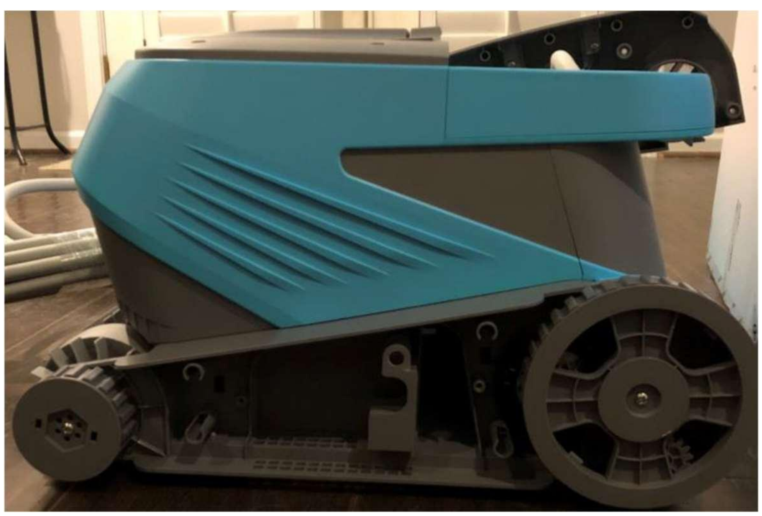
The top of the housing includes two outlets as shown below.



	
a filtering unit, located within the housing, for filtering fluid;	A filtering unit is located within the housing for filtering fluid directed into the inlet in the housing.  

<table>
<tr>
<td></td>
<td>

</td>
</tr>
</table>

	
a bypass mechanism for bypassing the filtering unit;	The Chasing CM600 includes a bypass mechanism for bypassing the filtering unit as shown below.  

<table>
<tr><td></td><td>
</td></tr>
<tr><td>and a fluid suction unit that is arranged to direct towards the outlet fluid that</td><td>The Chasing CM600 is equipped with dual suction pumps that takes in fluid from the inlet in the bottom of the housing and directs it towards the two outlets in the top of the housing.

</td></tr>
</table>

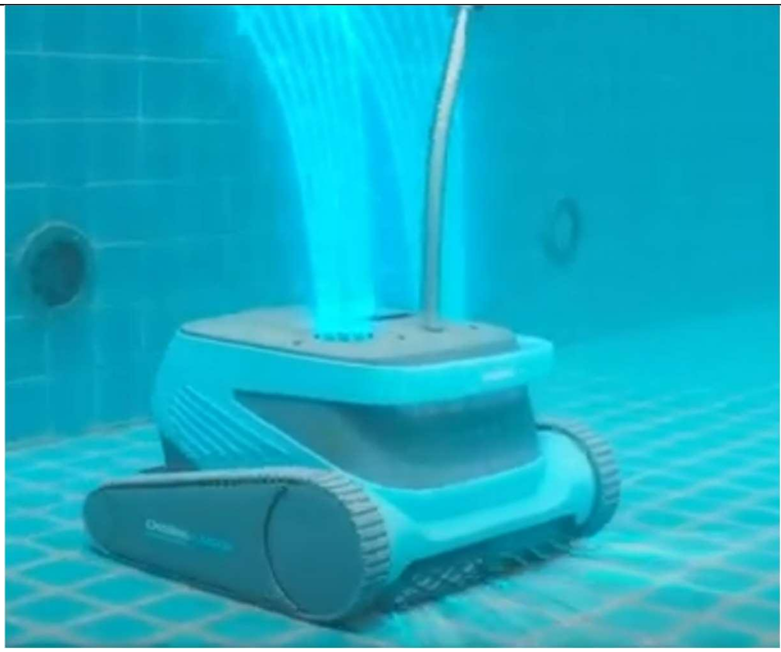
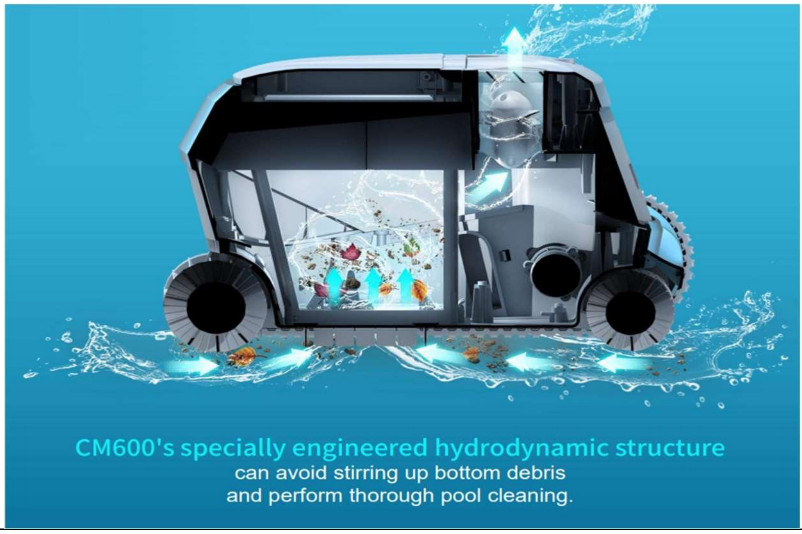
	
(a) passes through the at least one inlet and	As shown above and below, the fluid (here pool water) passes through the inlet in the bottom of the housing.
(b) passes through at least one of the filtering unit and the bypass mechanism.	The fluid passes through either the filtering unit or the bypass mechanism before exiting through one of the two outlets in the top of the housing. 

EXHIBIT 7

K&L GATES

VIA UPS

Jeffrey R. Gargano
jeffrey.gargano@klgates.com

T +1 312 807 4226
F +1 312 345 9068

May 3, 2023

Mr. Terry Xi, Co-Founder
Mr. Changgen Zhou, Director General
Mr. Xun Zhang, Legal Representative
Chasing Innovation Technology Co., Ltd.
Room 3105, Block A, Building 6, Shenzhen International Innovation Valley, Dashi 1st Road, Xili, Nanshan District, Shenzhen, Guangdong Province 518000, China

Re: Notice of Infringement of Maytronics U.S. and European Patent Rights

Dear Messrs. Xi, Zhou and Zhang:

We represent Maytronics in intellectual property matters. Maytronics is a global leader in the swimming pool industry, specializing in pool water solutions and offering a wide variety of products such as robotic pool cleaners, pool safety products and water treatment systems. Over the past 40 years, through innovative technology, design and reliability, Maytronics has built its Dolphin pool cleaning robots into a leading global brand. Innovation and creativity is core to Maytronics' mission and critical to Maytronics' leadership position and competitive advantage in the market. Consistent with Maytronics' commitment to leadership through innovation, Maytronics has invested substantial resources in research and development and protection of its proprietary innovative technology. Maytronics has developed a global patent portfolio that includes over 100 issued U.S. patents and published patent applications. In addition, Maytronics has numerous international patents protecting its industry-leading innovative technology for pool cleaning robots. Maytronics is fully committed to protecting and enforcing its intellectual property rights.

It has come to our attention that Chasing Innovation Technology Co., Ltd and Chasing Technology (USA), LLC (collectively "Chasing") introduced its first generation underwater pool cleaning robot, the Chasing CM600 Robotic Pool Cleaner, in July 2022. https://www.chasing.com/en/news-center/1.html It has also come to our attention that Chasing has recently launched an extensive campaign advertising and marketing the Chasing CM600 Robotic Pool Cleaner in the United States. https://www.chasing.com/en/news-center/39.html; https://www.chasing.com/en/news-center/44.html. Our research indicates that Chasing is selling its CM600 Robotic Pool Cleaner in the United States through: (i) Chasing's website (https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner-overview.html); https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner.html?gclid=EAIaIQobChMI7fbJzM6f_gIVtSCtBh2WFQL2EAMYASAAEgLrsPD_BwE; (ii) pool and spa distributors (e.g., https://bandrpools.com/shop/chasing-cm600-robotic-pool-cleaner/); and (iii) trade shows, e.g., the Western Pool and Spa Show in Long Beach, California on March 23-25, 2023 https://westernshow.expocad.com/Events/23wpss/index.html; https://www.chasing.com/en/news-center/44.html).

Maytronics recently purchased a Chasing CM600 Robotic Pool Cleaner in the United States. We have been charged with analyzing the CM600 Robotic Pool Cleaner to determine whether it utilizes any of Maytronics innovative technology and infringes on Maytronics intellectual property rights. We completed our analysis and have concluded that the Chasing CM600 Robotic Pool Cleaner infringes at least Maytronics' U.S. Patent No. 10,378,229 (the "'229 patent")(**Exhibit A**) and European Patent Nos. EP 2 845 969 B1 (the '969 patent")(**Exhibit B**) and EP 2 706 170 B1 (the "'170 patent")(**Exhibit C**).

An exemplary claim chart showing where each element of representative claim 1 of the '229 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit D**. An exemplary claim chart showing where each element of representative claim 1 of the '969 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit E**. Finally, an exemplary claim chart showing where each element of representative claim 1 of the '170 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit F**.

Chasing's use of Maytronics technology in its CM600 Robotic Pool Cleaner is not licensed nor is it authorized by Maytronics. Therefore, Chasing's use of this technology constitutes infringement of at least Maytronics' U.S. Patent No. 10,378,229 for all CM600 Robotic Pool Cleaner's used, made, sold, imported or offered for sale in the U.S. under 35 U.S.C. § 271.

Based on our preliminary research, Chasing is also selling the CM600 Robotic Pool Cleaner in Europe. See https://www.topomarket.gr/en/robotic-pool-cleaners/1052-chasing-cm600-robotic-pool-cleaner.html Chasing's use of this technology constitutes infringement of at least EP 2 845 969 B1 and EP 2 706 170 B1 for all CM600 Robotic Pool Cleaner's sold in Europe under the European Patent Convention, the Trade Related Aspects of Intellectual Property Rights and European national patent laws.

Maytronics demands that Chasing cease and desist from infringing its '229 patent in the United States and its '969 and '170 patents in Europe immediately. Accordingly, Maytronics demands that Chasing immediately cease and desist from selling or offering to sell its CM600 Robotic Pool Cleaner in the United States and Europe and that Chasing provide written confirmation to that effect by May 20, 2023. If Chasing does not comply with this request and provide written confirmation within the reasonable time provided, Maytronics reserves all rights afforded to it under the United States and European patent laws, including the right to bring a formal complaint against Chasing for patent infringement and enjoin Chasing's infringing activity and seek past damages.

Very truly yours,

/Jeffrey R. Gargano/

Jeffrey R. Gargano

EXHIBIT A

US010378229B2

(12) United States Patent
Ben Dov et al.

(10) Patent No.: US 10,378,229 B2
(45) Date of Patent: Aug. 13, 2019

(54) **POOL CLEANING ROBOT WITH BYPASS MECHANISM**

(71) Applicant: **MAYTRONICS LTD.**, Kibutz Yizrael (IL)

(72) Inventors: **Boaz Ben Dov**, Ram On (IL); **Oded Golan**, Kefar Tavor (IL)

(73) Assignee: **.MAYTRONICS LTD**, Kibbutz Yizrael (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 956 days.

(21) Appl. No.: **14/445,082**

(22) Filed: **Jul. 29, 2014**

(65) **Prior Publication Data**

US 2015/0067974 A1 Mar. 12, 2015

Related U.S. Application Data

(60) Provisional application No. 61/875,066, filed on Sep. 8, 2013.

(51) **Int. Cl.**
E04H 4/16 (2006.01)

(52) **U.S. Cl.**
CPC ***E04H 4/1654*** (2013.01); ***E04H 4/1663*** (2013.01)

(58) **Field of Classification Search**
CPC E04H 4/1654; E04H 4/1663
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,828,626	A	5/1989	Meincke	
6,112,354	A *	9/2000	Stoltz	E04H 4/1663 15/1.7
6,314,983	B1	11/2001	Hatch	
6,965,814	B2	11/2005	Hadari	
9,127,472	B2	9/2015	Borg	
2003/0201218	A1	10/2003	Henkin	
2004/0040581	A1 *	3/2004	Bruwer	E04H 4/1654 134/18
2011/0000035	A1	1/2011	Pichon	

FOREIGN PATENT DOCUMENTS

CA	1109209	9/1981
CN	201747089	2/2011
CN	202970016 U	6/2013

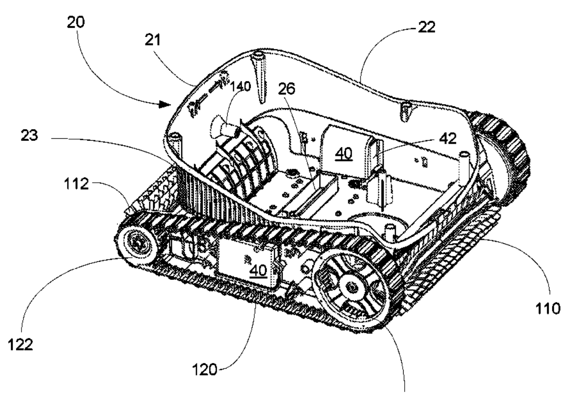
* cited by examiner

Primary Examiner — Randall E Chin
(74) *Attorney, Agent, or Firm* — Reches Patents

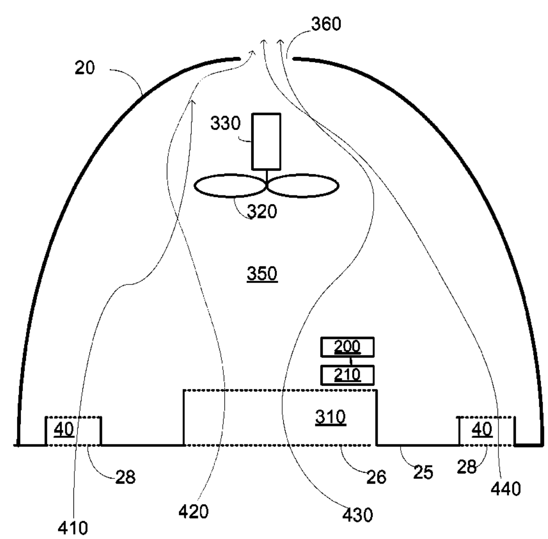
(57) **ABSTRACT**

A cleaning robot may be provided and may include a housing comprising at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit and the bypass mechanism.

42 Claims, 15 Drawing Sheets



10



10

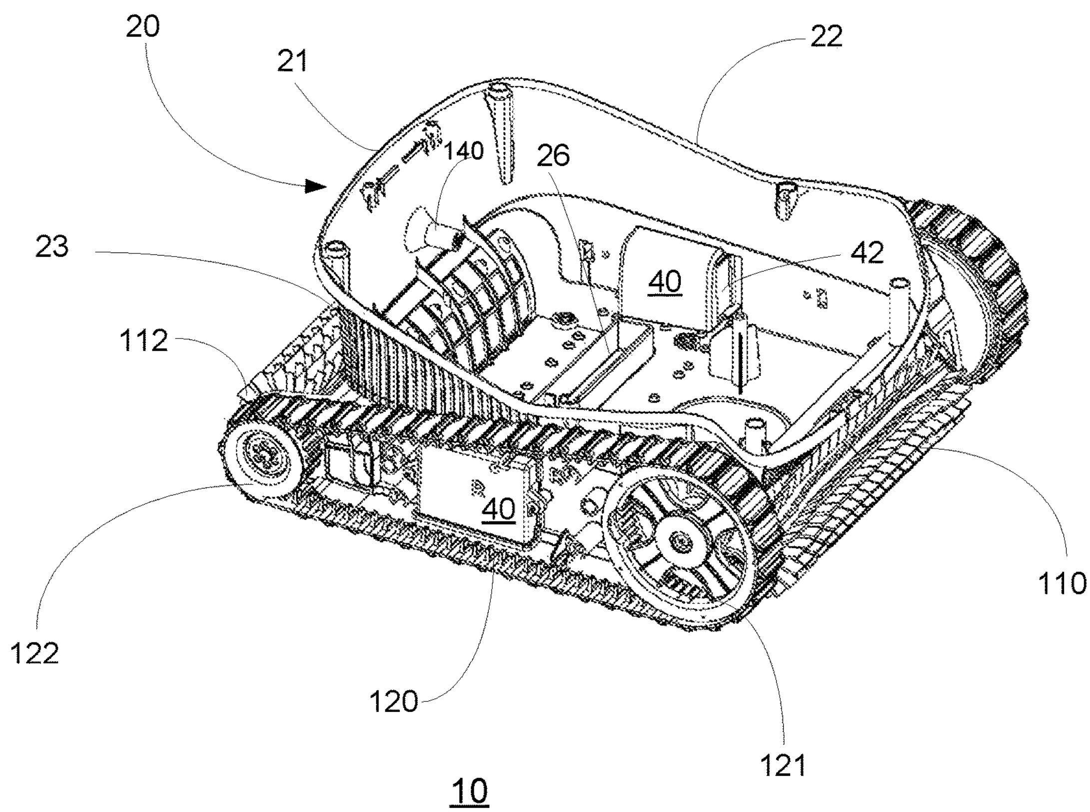


FIG. 1

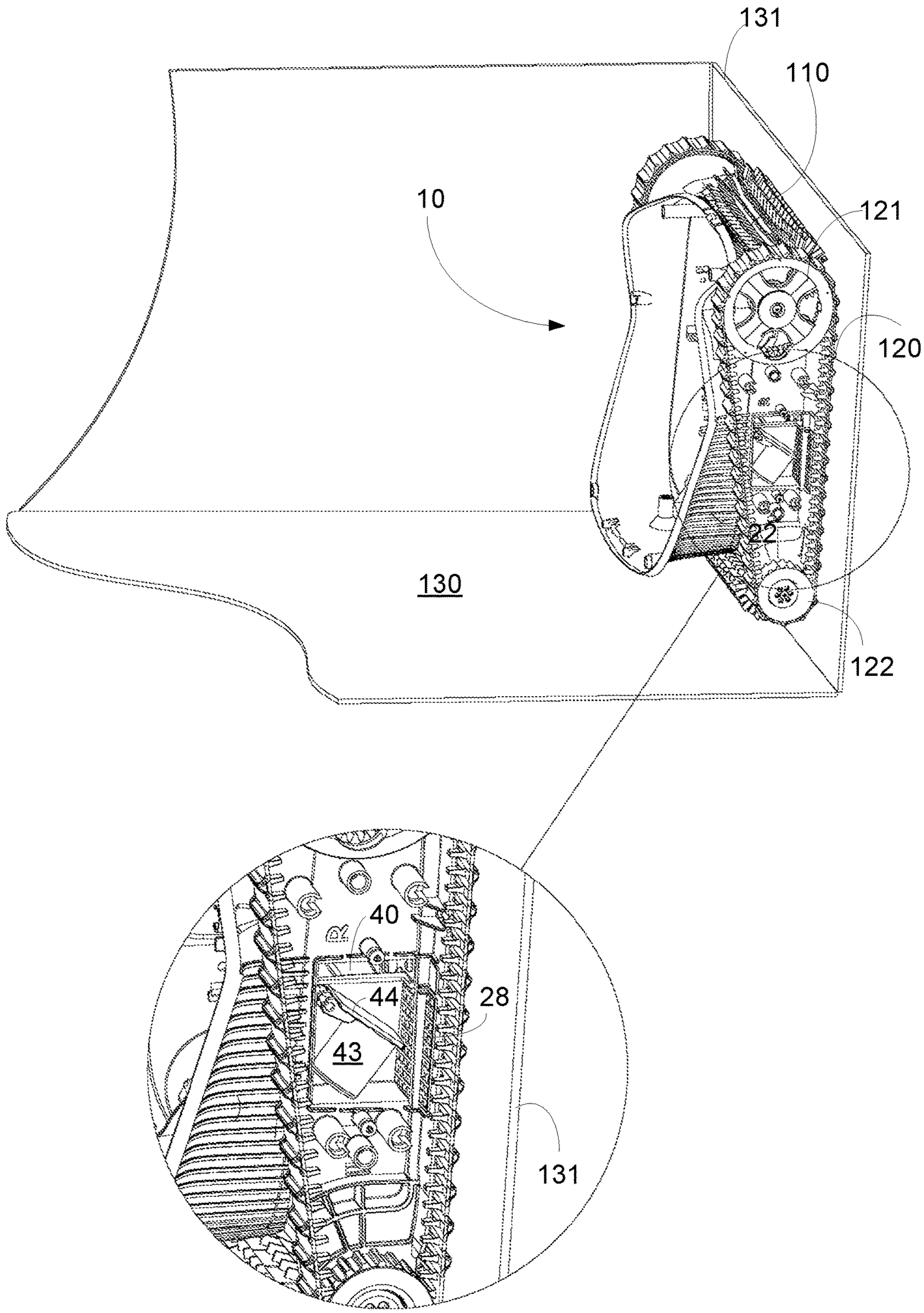


FIG. 2

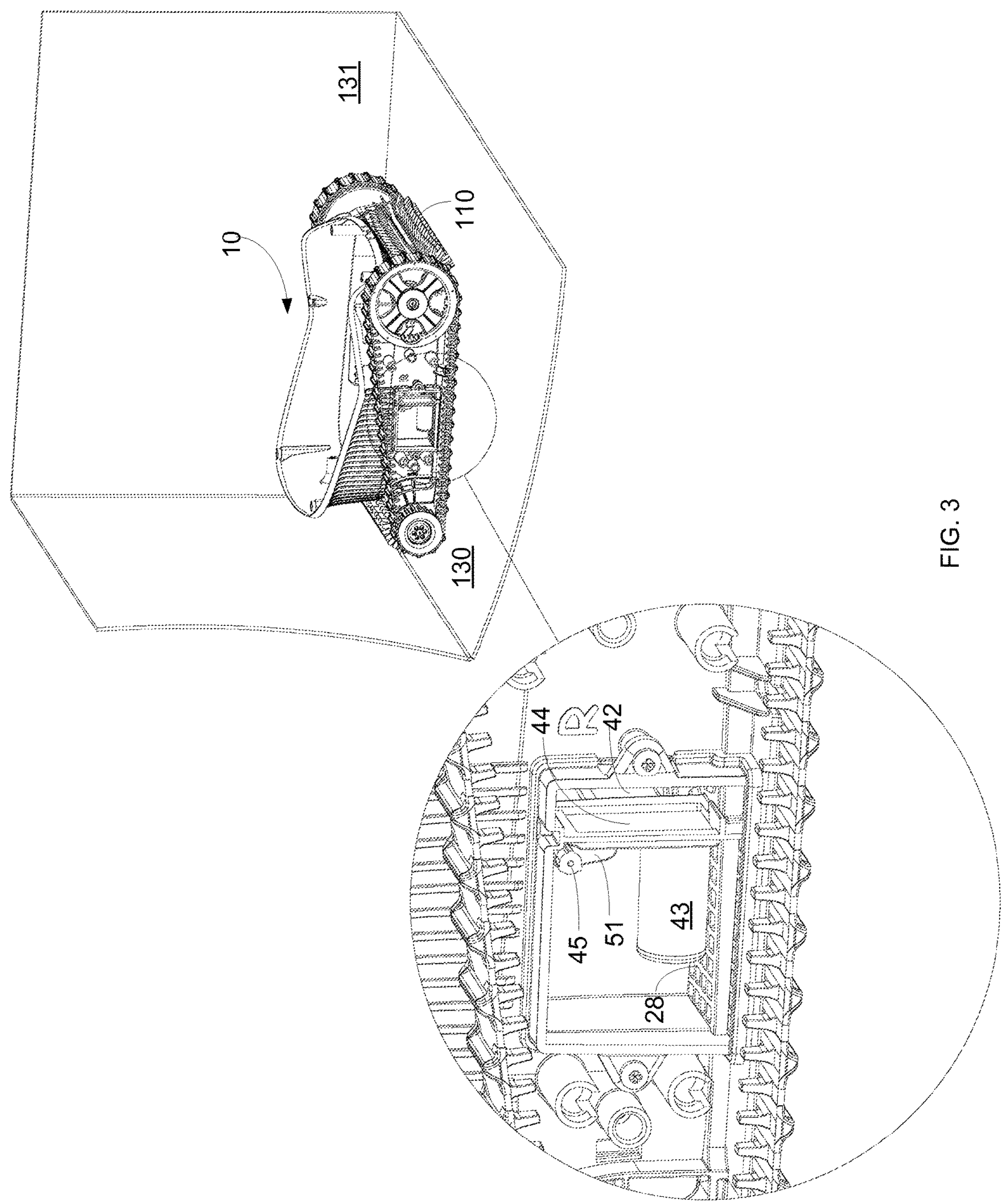


FIG. 3

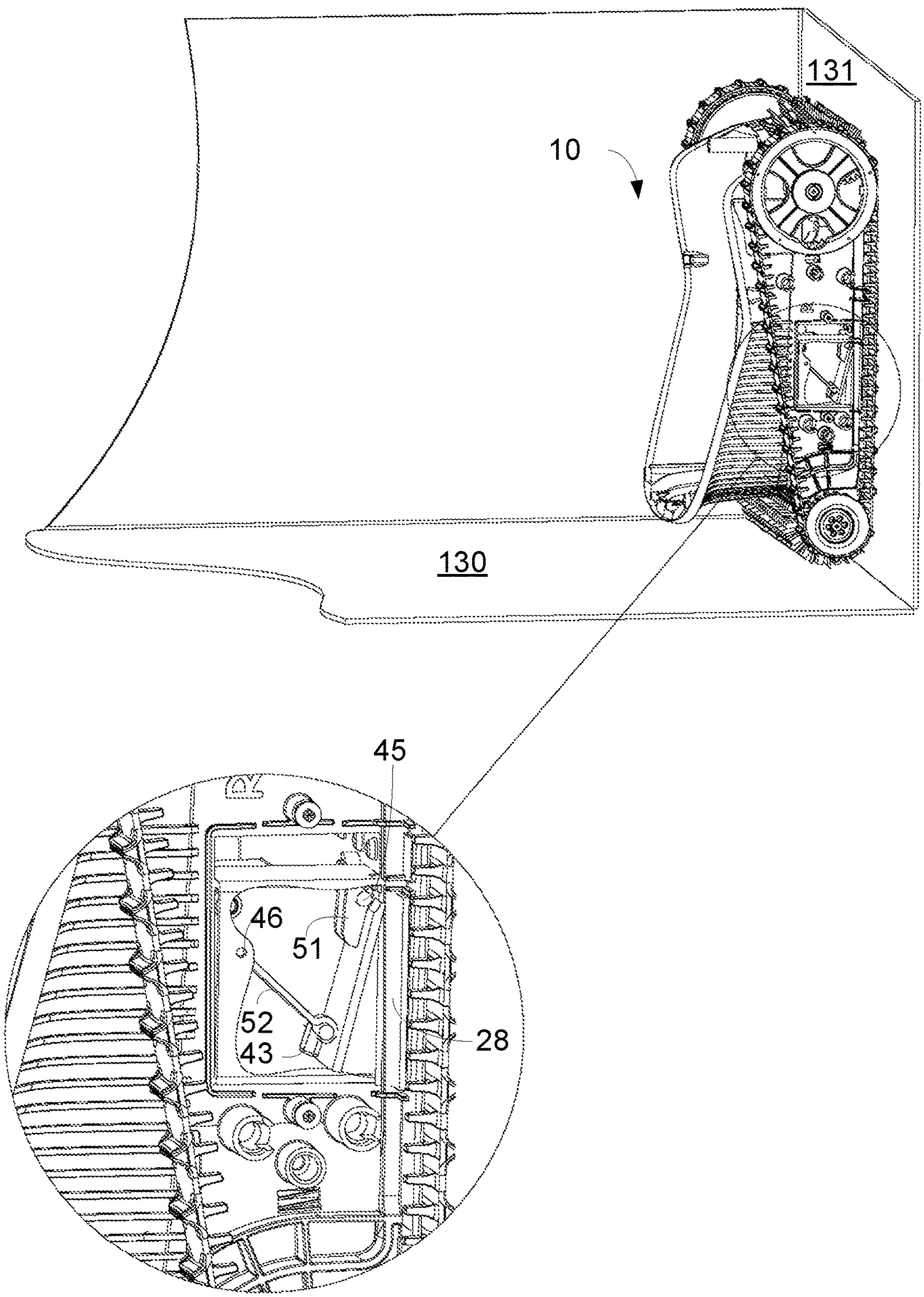


FIG. 4

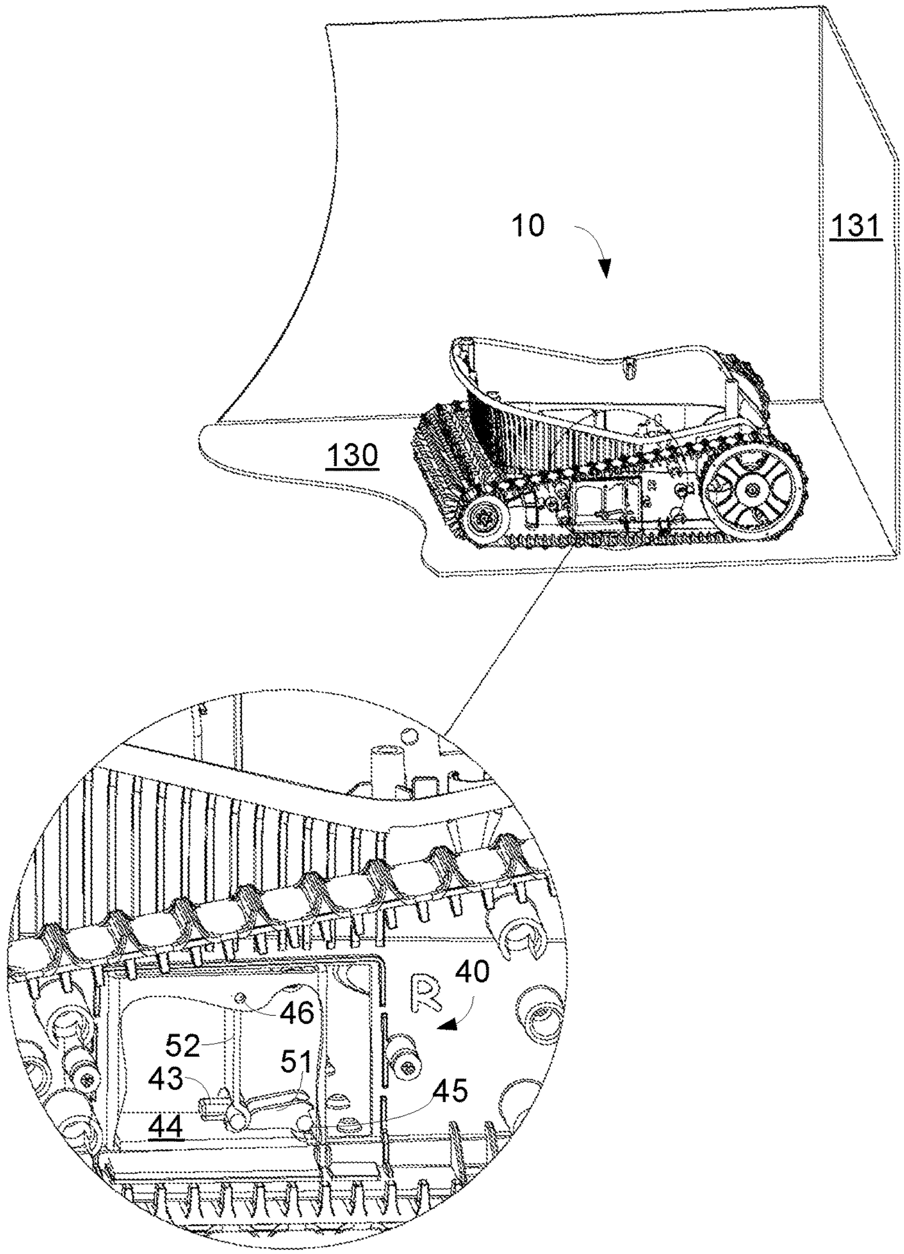


FIG. 5

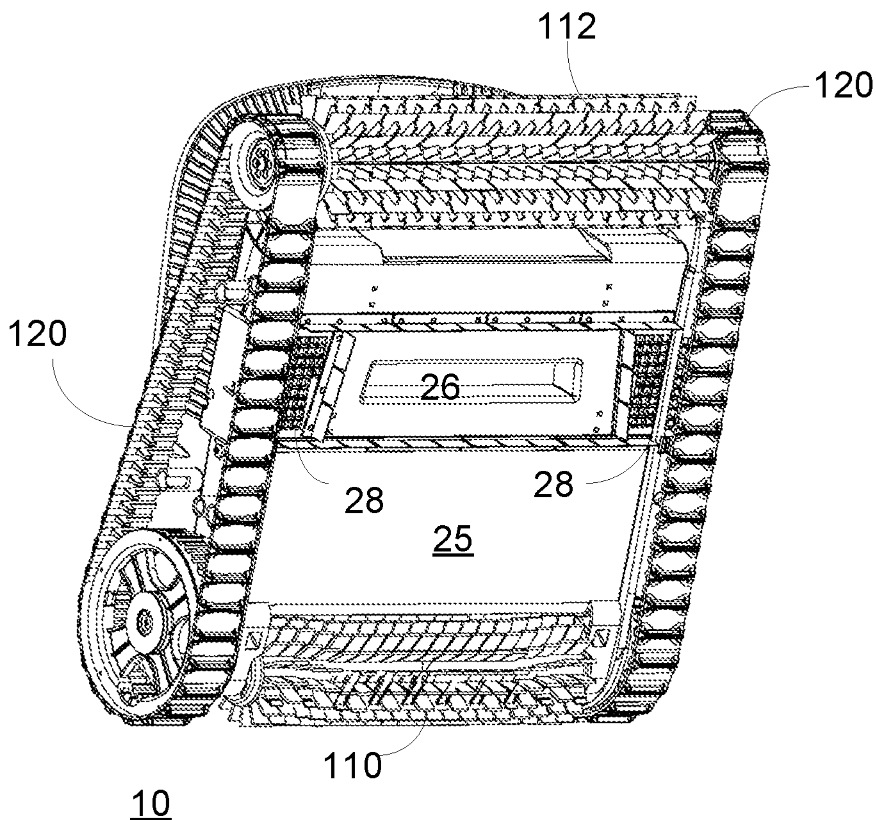


FIG. 6

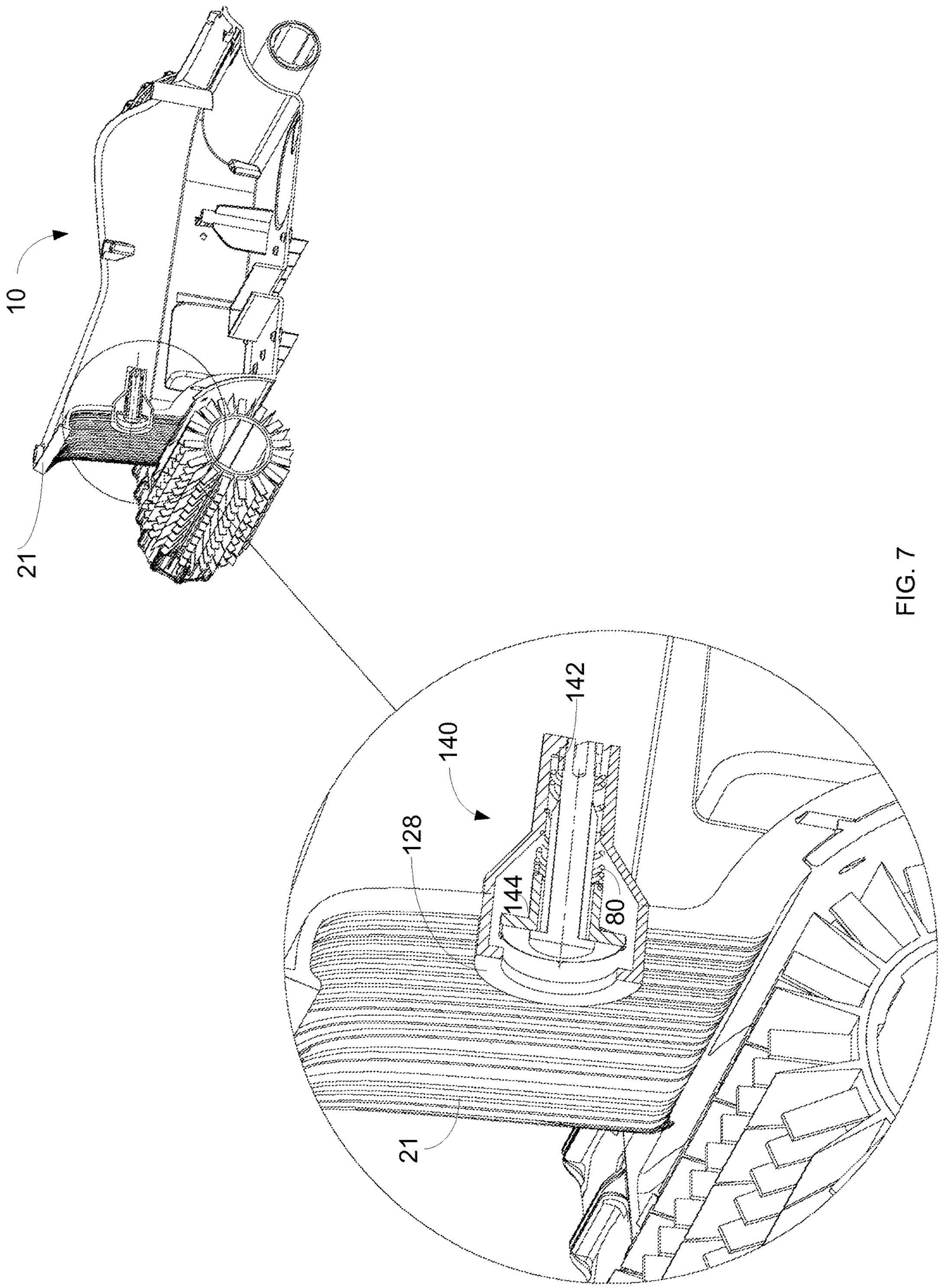


FIG. 7

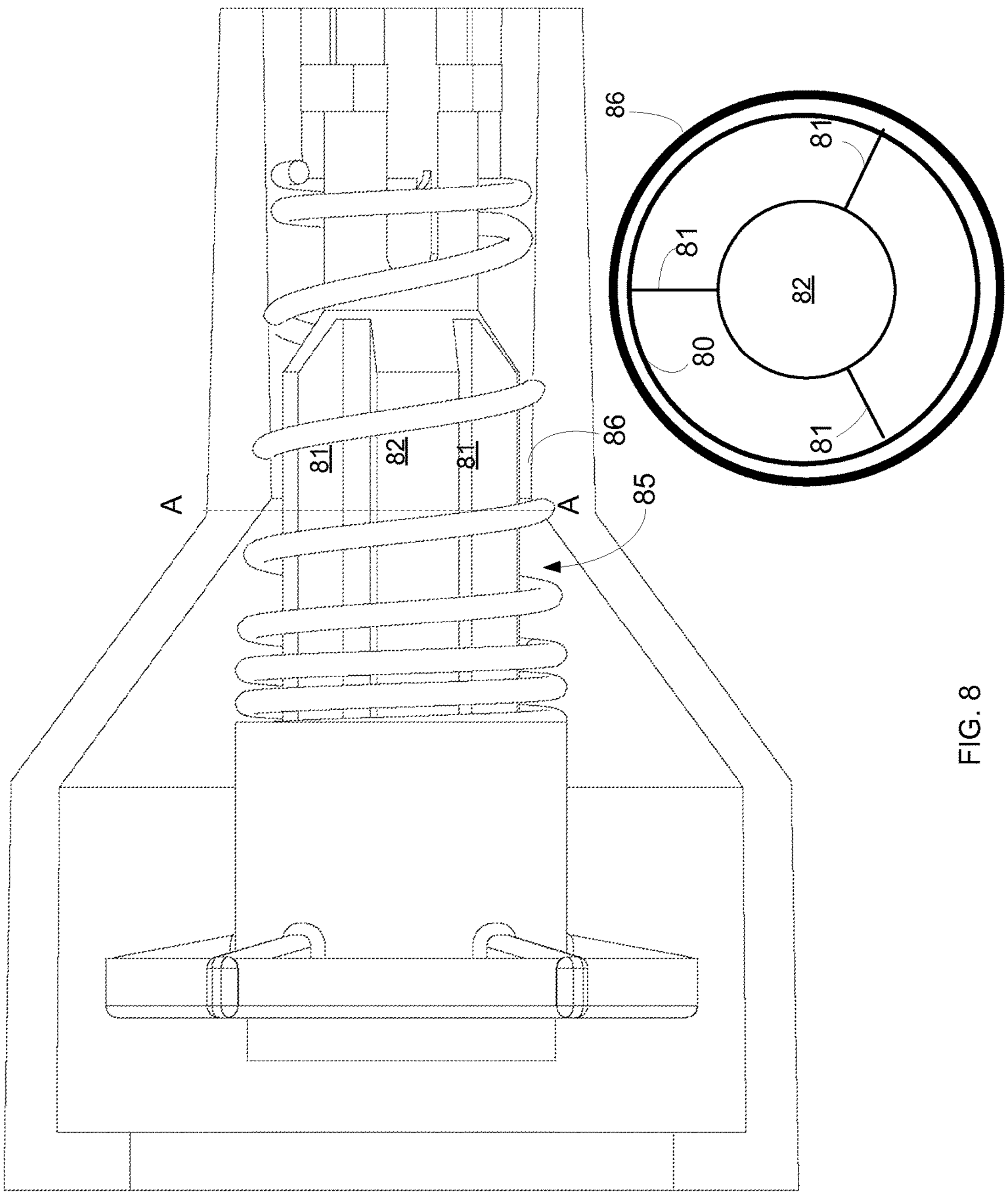


FIG. 8

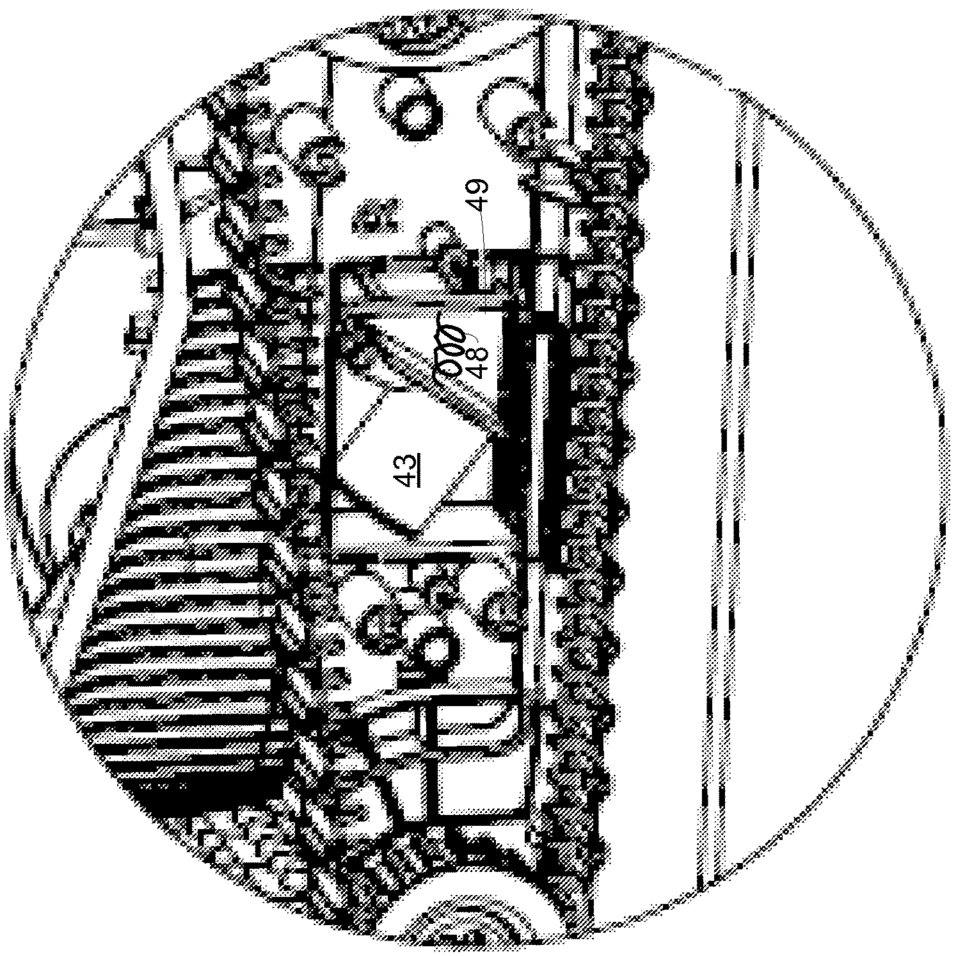


FIG. 9

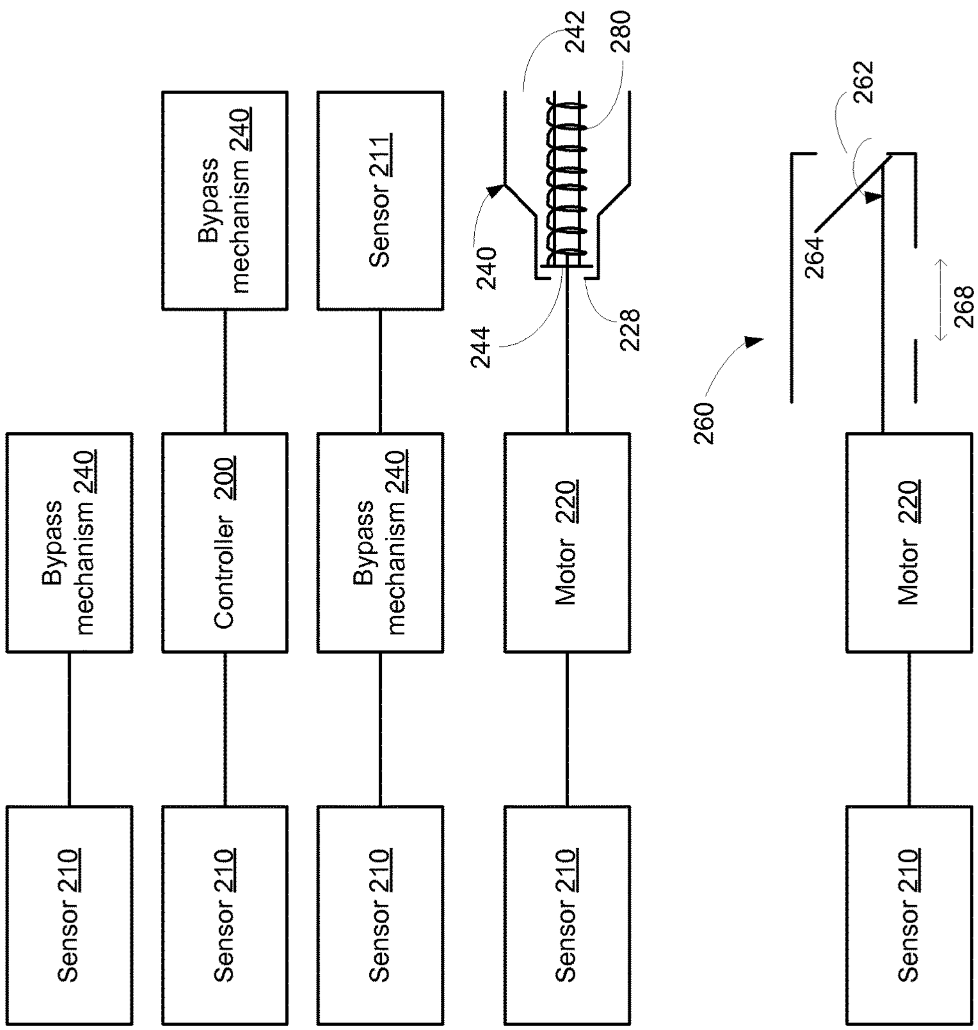

Sensor 210
Bypass mechanism 240
Controller 200
Bypass mechanism 240
Sensor 210
Bypass mechanism 240
Sensor 211
Sensor 210
Motor 220
242
280
240
244
228
Sensor 210
Motor 220
262
264
260
268

FIG. 10

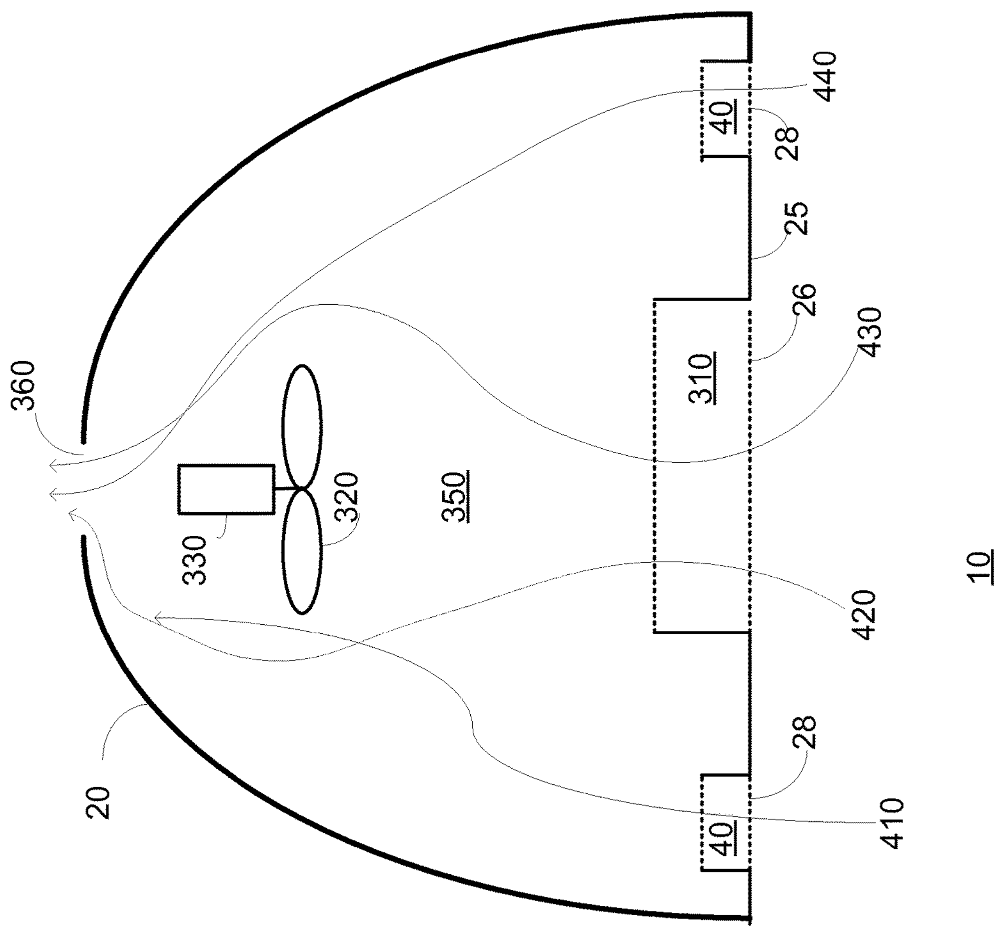


FIG. 11

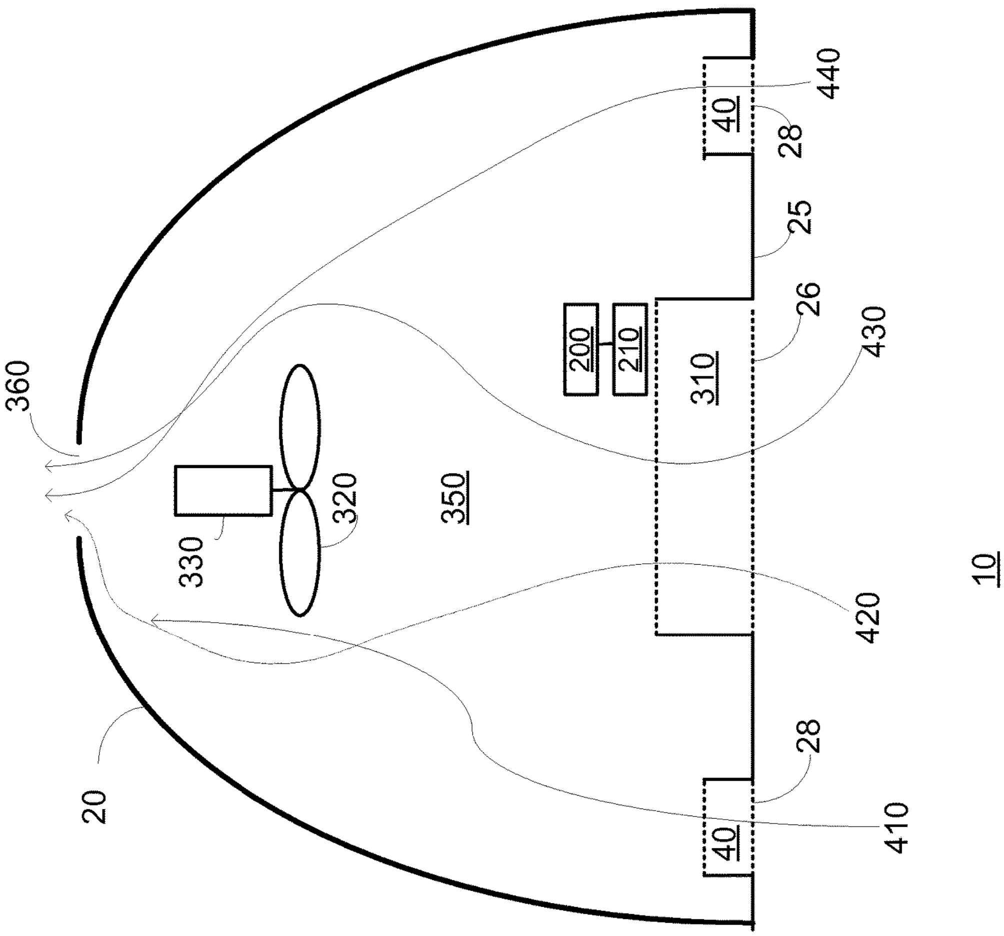
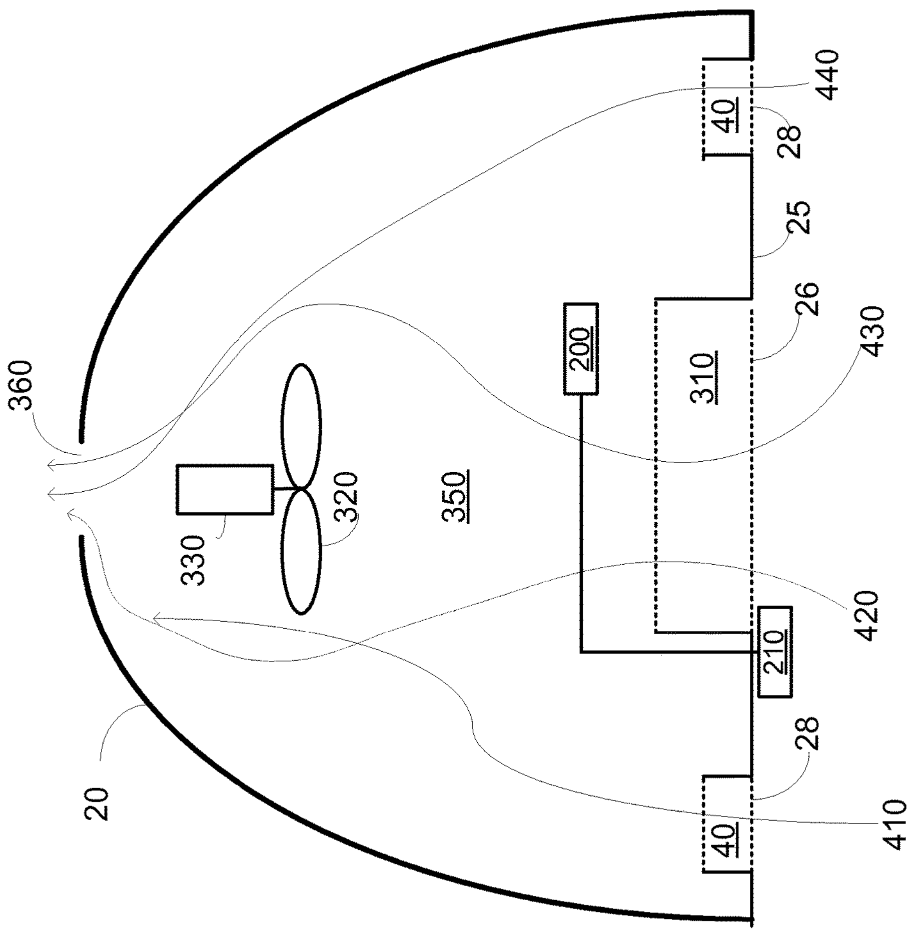
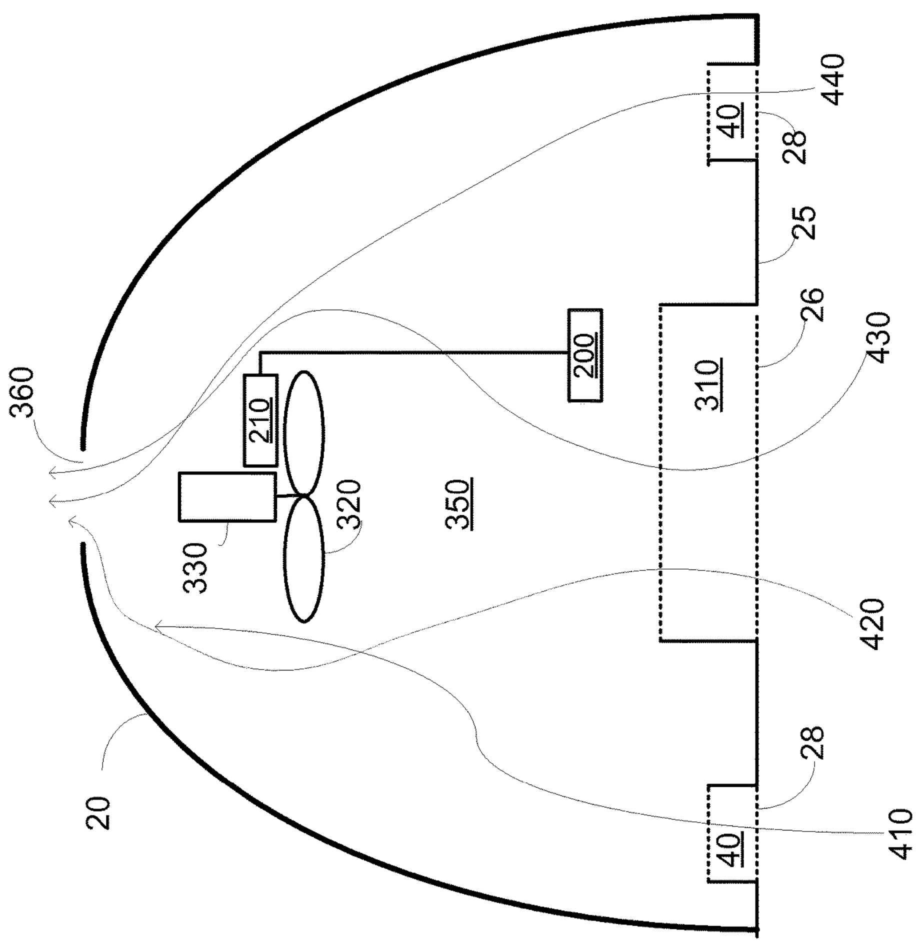


FIG. 12



10

FIG. 13



10

FIG. 14

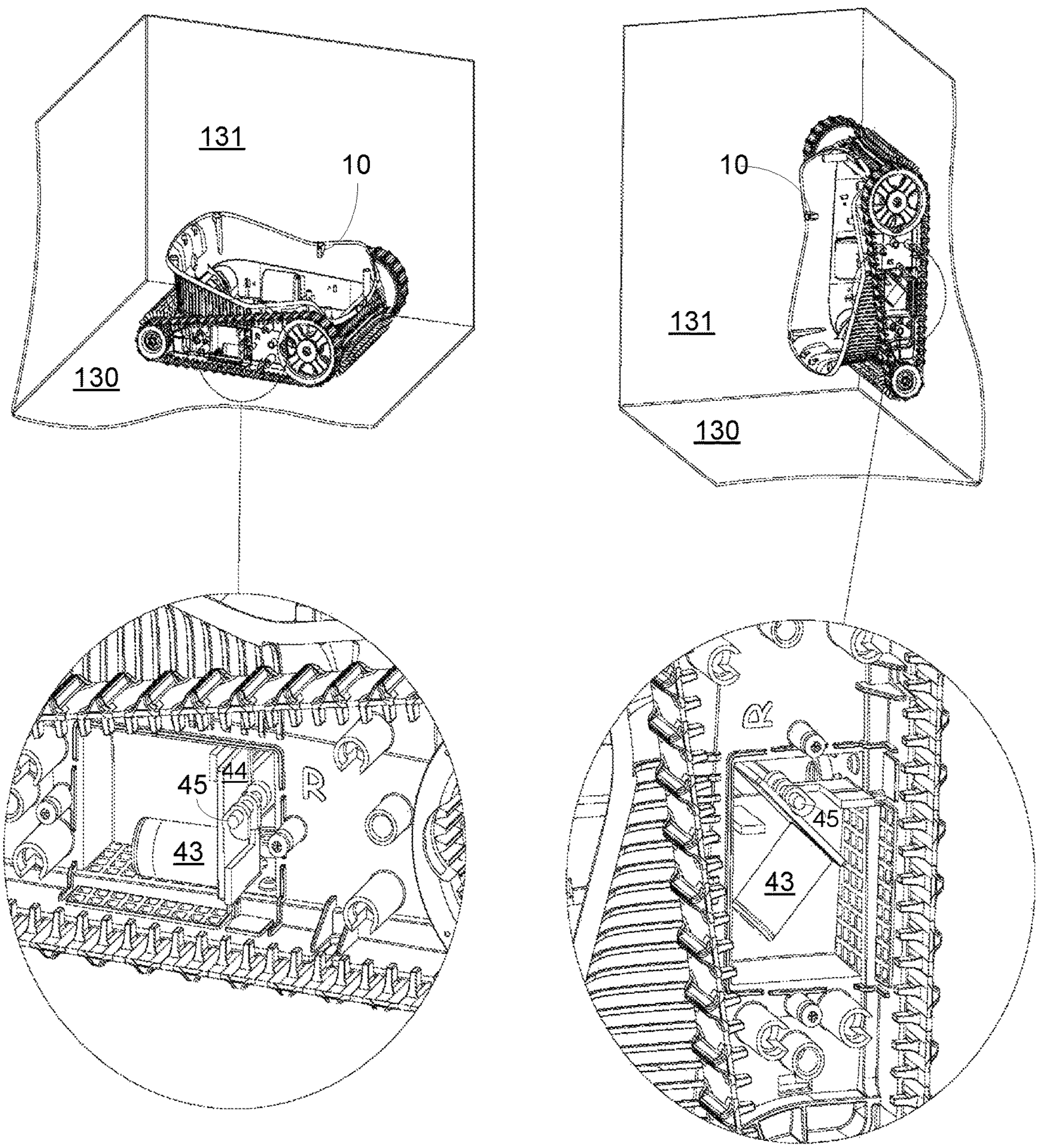


FIG. 15

POOL CLEANING ROBOT WITH BYPASS MECHANISM

RELATED APPLICATION

This application claims priority from U.S. provisional patent filing date Sep. 8, 2013 Ser. No. 61/875,066 which is incorporated herein by reference.

BACKGROUND

Cleaning robots contribute to the cleanliness of the fluid within a pool by moving within the pool and by filtering the fluid of the pool by means of a filter. The fluid of the pool enters the cleaning robot via one or more inlets, pass through the filter to be filtered and finally is outputted (after being filtered) as filtered fluid.

In some cleaning robots the effectiveness of the cleaning robot and even the mere movement of the cleaning robot require that the filtering unit to be clean. For example, some cleaning robots will stop moving if the filter is clogged. Yet other cleaning robots will not be able to climb the walls of the pool without a certain amount of fluid that is drawn-in by the cleaning robot and assist in attaching the cleaning robot to the walls of the pool.

There is a growing need to provide a cleaning robot that may be arranged to contribute to the cleanliness and sanitization of the pool surfaces and fluid even when its filters are partially or fully clogged.

SUMMARY

According to an embodiment of the invention there may be provided a cleaning robot with a bypass mechanism. The bypass mechanism can bypass one or more filters of a filtering unit.

According to an embodiment of the invention there may be provided a cleaning robot that may include a housing may include at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that may be arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit or the bypass mechanism.

The bypass mechanism may be arranged to allow fluid to pass through the bypass mechanism when the cleaning robot may be tilted by at least a predefined tilt angle.

The degree of openness of the bypass mechanism may be responsive to a tilt angle of the cleaning robot.

The bypass mechanism may include a door. The door may movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit. The position of the door may determine the openness level of the bypass mechanism.

The door may be pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

The door may be coupled to a weight.

The weight may be connected to a door. For example—near a lower end of the door. The rotation axis may be located near an upper end of the door.

The door may be connected to a lever that may be pivotally coupled to a rotation axis.

The door may be connected to a hinge that may be pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

The door may be coupled to a lever that may be pivotally coupled to a second rotation axis; wherein the lever may be arranged to limit a pivoting of the door about the first rotation axis.

The lever may be connected to a weight.

The weight may be arranged to slide across the door when the door moves between the close position and the open position.

The bypass mechanism may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

The bypass mechanism may include a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element may be arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

The bypass mechanism may include a spring that induces the sealing element to move towards the close position.

When the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element may be moved towards the open position.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be upstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be downstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

The cleaning robot further may include a sensor. The sensor may be arranged to detect an occurrence of a bypass related event and the bypass mechanism may be arranged to respond to the occurrence of the bypass related event.

The bypass mechanism may include a motor that may be arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

The sensor may be a robot tilt angle sensor.

The sensor may be a suction sensor.

The at least one inlet may include a bypass mechanism inlet and a filtering unit inlet.

The at least one inlet may include multiple bypass mechanism inlets and a filtering unit inlet.

The bypass mechanism may be closer to a sidewall of the housing than the filtering unit.

The bypass mechanism may be connected to a sidewall of the housing.

The bypass mechanism extends outside a sidewall of the housing.

The cleaning robot may include at least one additional bypass mechanism. The bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

At least two bypass mechanisms of the plurality of bypass mechanisms may differ from each other. For example—one bypass mechanism may be tilt angle triggered while another bypass mechanism may be pressure triggered.

At least two bypass mechanism of the plurality of bypass mechanisms may differ from each other by a triggering event that triggers an opening of the bypass mechanism.

At least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

A first bypass mechanism of the plurality of bypass mechanisms may be responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms. For example—when a pressure triggered bypass mechanism is opened it may ease the opening of a door of a tilt angle triggered bypass mechanism as the opening of the pressure triggered bypass mechanism may lower the suction within the housing and that reduction may ease an opening of a door of a tilt angle triggered bypass mechanism.

An opening of first bypass mechanism of the plurality of bypass mechanisms may ease an opening of another bypass mechanism of the plurality of bypass mechanisms.

An opening of first bypass mechanism of the plurality of bypass mechanisms may increase a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a clogging level of the filtering unit.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

A first bypass mechanism of the plurality of bypass mechanisms may have an opening located at a bottom of the housing and a second bypass mechanism of the plurality of bypass mechanisms may have an opening located at a sidewall of the housing.

A first bypass mechanism of the plurality of bypass mechanisms may include a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

A degree of openness of the bypass mechanism may be responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

There may be provided a cleaning robot that includes any combination of any components illustrated in the summary section of the application or in the specification.

There may be provided a cleaning robot that includes any combination of any components illustrated in any claims of the application.

If, for example, a cleaning robot include more than a single bypass mechanism then any of the bypass mechanism may have any structure illustrated in the summary, the specification or the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

FIG. **1** illustrates a portion of cleaning robot according to an embodiment of the invention;

FIG. **2** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **3** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **4** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **5** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **6** is a bottom view of a cleaning robot according to an embodiment of the invention;

FIG. **7** is a cross sectional view of a portion of cleaning robot taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention;

FIG. **8** is a cross sectional view of a bypass mechanism taken along a longitudinal axis of the bypass mechanism according to an embodiment of the invention;

FIG. **9** illustrates a portion of a cleaning robot according to an embodiment of the invention;

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention;

FIG. **11** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **12** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **13** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **14** is a cross sectional view of a cleaning robot according to an embodiment of the invention; and

FIG. **15** illustrates a portion of cleaning robot that climbs on a sidewall of a pool and a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

According to an embodiment of the invention there is provided a cleaning robot that may include one or more bypass mechanisms.

Various figures illustrate between one to three bypass mechanisms and it is noted that the number of bypassing mechanisms may be any positive integer (for example—one, two, three, four, five and more).

A bypass mechanism is a mechanical element that allows fluid to bypass a filtering unit. Thus, fluid that flows through a bypass mechanism does not flow through the filtering unit. It is noted that if the filtering unit has multiple filters than the bypass unit may be positioned to bypass one, some or all of the multiple filters of the filtering unit.

A bypass mechanism may include one or more mechanical components but may also include electrical components.

If a cleaning robot includes multiple bypass mechanisms then they all can be the same bypass mechanism, may all be different from each other or may include two or more bypass mechanisms that differ from each other.

Bypass mechanisms may differ from each other by their location, by mode of operation, by size, by shape, by the parameters that control their operation (such as a tilt angle of the cleaning robot or a suction level developed within an internal space of the cleaning robot), by including sensors, by excluding sensors, by including one or more motors, by excluding motors and the like.

Any bypass mechanism may be open or closed. An open bypass mechanism allows the fluid to flow through the bypass mechanism and to exit from the bypass mechanism thereby not flowing through one of more filters. A closed bypass mechanism prevents fluid from flowing through the bypass mechanism and exiting the bypass mechanism. It may prevent the fluid from entering the bypass mechanism, prevent fluid that enters the bypass mechanism to reach an outlet of the bypass mechanism and/or prevent fluid to flow through the outlet of the bypass mechanism.

Any bypass mechanism may have more than two openness levels—and may open at different degrees. Thus, a bypass mechanism may be partially open.

For simplicity of explanation the term “open” refers to a fully open or partially open.

According to an embodiment of the invention a bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filter is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid flow intensity and/or pressure level within the cleaning robot or when sensing that the flow intensity and/or pressure level of the filtered fluid is below a threshold.

The sensing may include sensing the flow and/or pressure of fluid before (downstream) and/or after (upstream) the filtering unit, in a path leading to the hydraulic movement mechanism and the like. The flow intensity and/or pressure level can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the filtering unit bypass may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall). This may be sensed by tracking the tilt angle of the cleaning robot, by using accelerometers and the like.

The opening may occur when sensing a reduction of the flow and/or pressure and climbing of the wall. Different thresholds for flow and/or suction levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the Flow and/or pressure of the filtered fluid is lower, and the like.

The movement of the cleaning robot even when the filtering unit is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving in the pool, detaching bacteria from the pool walls and floor by contact and assisting in pool filtering devices to filter the fluid by inducing fluid movements within the pool.

According to an embodiment of the invention the bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filtering unit is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of bypass related events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid and/or an increase in a suction level within the cleaning robot or both. The sensing may include sensing the flow and/or suction (pressure) of fluid before and/or after the filtering unit, in a path leading to a suction unit, to a hydraulic movement mechanism and the like. The flow and/or suction (pressure) can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the bypass mechanism may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall).

The opening may occur when sensing a reduction of the Flow and/or pressure and climbing of the wall. Different thresholds for Flow and/or pressure levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the flow and/or pressure of the filtered fluid is below a threshold, and the like.

By providing the bypass mechanism and allowing fluid to flow even when the filtering unit is clogged the cleaning robot may move in the pool. This movement of the cleaning robot even when the filter is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving the cleaning robot in the pool thereby detaching bacteria from the pool walls and floor by contact and assisting to pool filtering devices to filter the fluid by inducing fluid movements within the pool.

FIG. **1** illustrates a portion of cleaning robot **10** according to an embodiment of the invention.

FIG. **1** illustrates only a part of the cleaning robot as the upper part of the cleaning robot as well as multiple internal components of the cleaning robot (such as a filtering unit, a fluid suction unit, a driving motor and the like) are missing for clarity of explanation.

FIG. **1** illustrates the portion of the cleaning robot as including a housing **20**, front brush wheel **110**, rear brush wheel **112**, and tracks **120** movable by front wheel **121** and/or rear wheel **122**. It is noted that the cleaning robot may be moved by other movement elements (for example it may include wheels instead of tracks), may have other cleaning elements and the like.

The cleaning robot of FIG. **1** includes three bypass mechanisms—two bypass mechanisms **40** located at both sides of the housing (near sidewalls **22** and **23** of the housing **20**) and one bypass mechanism **140** located at the rear wall **21** of the housing **20**. FIG. **1** also shows a filtering unit inlet **26** formed at about the center of the bottom of the housing and positioned between bypass mechanisms **40**. FIG. **1** also shows a bypass outlet **42** of bypass mechanism **40**.

Each bypass mechanism allows fluid to bypass at least one filter of the filtering unit. The fluid propagates towards a fluid suction unit (such as an impeller) of the cleaning robot that is arranged to direct towards the outlet (of the housing) fluid that passes through the at least one inlet and through at least one of the filtering unit and the bypass mechanism.

FIG. **2** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **3** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **2** illustrates an open bypass mechanism **40** while FIG. **3** illustrates a closed bypass mechanism.

In FIGS. **2** and **3** the bypass mechanism **40** is illustrated as including door **44**. Door **44** is movable between (a) a closed position (FIG. **3**) in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position (FIG. **2**) in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

Door **44** is pivotally coupled to a first rotation axis **45** and rotates between the closed position and the open position.

FIGS. **2** and **3** also shows that the door **44** is coupled to a weight **43**. The weight **43** assists in opening the door **44** when the cleaning robot starts to tilt and closing the door **44** when the cleaning robot is horizontal. Alternatively, the door **44** may be heavy enough and does not require an additional weight **43**.

FIGS. **2** and **3** illustrate the weight **43** is being connected to a door **44** near a lower end of the door and illustrate the first rotation axis **45** is located near an upper end of the door **44**. The first rotation axis **45** may alternatively be located near the center of the door (as illustrated in FIG. **15**) in order to reduce the needed weight or mass of **43**. It is noted that the relative locations of the first rotation axis **45** and the weight **43** may differ from those illustrated in FIGS. **2** and **3**.

FIGS. **2** and **3** also show that the door **44** is not directly connected to the rotation axis but show a hinge **51** that is pivotally snapped-in or coupled to the first rotation axis **45** and interfaces with the door **44**. FIGS. **2** and **3** also illustrate a bypass path inlet **28** that is covered by a filtering mesh.

FIG. **4** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **5** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **4** illustrates an open bypass mechanism **40** while FIG. **5** illustrates a closed bypass mechanism.

FIGS. **4** and **5** illustrate a door **44** that is connected to a hinge **51** that is pivotally snapped-in or coupled to a first rotation axis **45** thereby allowing the door **44** to pivot about the first rotation axis **45**.

The door **44** of FIGS. **4** and **5** is coupled to a lever **52** that is pivotally coupled to a second rotation axis **46**. The second level **52** may be arranged to limit a pivoting of the door **44** about the first rotation axis **45**. The lever **52** may be oriented at about ninety degrees to the tilt angle of the cleaning robot but this is not necessarily so.

FIGS. **4** and **5** illustrate the lever **52**, connected or snapped-in to a weight **43** (or unify it by **43**), and interfaces with door **44**.

FIGS. **4** and **5** illustrate that the weight **43** is arranged to slide across the door **44** when the door moves between the close position and the open position.

FIGS. **2-6** illustrates bypass mechanisms **40** that their openness level depended upon the tilt angle of the cleaning robot. The tilt angle may be defined as the angle between the cleaning robot and the horizon.

It is noted that although FIGS. **2-6** do not show sensors for triggering the opening (and/or closing) of the bypass mechanisms—that the cleaning robot may include sensors that may sense the tilt angle of the cleaning robot and that the sensed tilt robot may be used to trigger (for example by using a motor) the opening and/or closing of a bypass mechanism.

Accordingly, there may be provided a cleaning robot wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle. This tilt angle may be measured by a sensor (such as sensor **210** of FIGS. **10**, **12** and **13**).

Yet for another embodiment of the invention the mechanical elements of the bypass mechanism may be arranged to allow opening the bypass mechanism only when the tilt angle exceeds a predetermined tilt angle. Referring to the example set forth in FIG. **9**, a spring **48** or other limiting element may be connected to door **44**, or to weight **43** and to a frame **49** of the bypass mechanism in order to counter the movement of the weight **43** or door **44** so that only at a predefined tilt angle the door **44** will move and at least partially open the bypass mechanism **40**. The predefined tilt angle may range between 70 and 110 degrees, may range between 50 and 90 degrees, between 20 and 80 degrees and the like.

FIG. **6** is a bottom view of a cleaning robot **10** according to an embodiment of the invention.

It shows a filtering unit inlet **26** located at about the center of the bottom **25** of the cleaning robot as well as two bypass path inlets **28** that are covered by a filtering mesh positioned at both sides of the filtering unit inlet **26**. This figure also shows front brush wheel **110**, rear brush wheel **112**, front wheel **121** and read wheel **122**.

FIG. **7** is a cross sectional view of a portion of cleaning robot **10** taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention.

FIG. **8** is a cross sectional view of a bypass mechanism **140** taken along a longitudinal axis of the bypass mechanism **140** according to an embodiment of the invention. FIG. **8** also provides a cross sectional view of the bypass mechanism **140** taken along axis A-A that is normal to the longitudinal axis of the bypass mechanism **140**.

Bypass mechanism **140** is installed in wall **21** of housing **20**. Bypass mechanism **140** may also be installed on other walls such as for example, sidewall **22** of the pool cleaner. Multiple bypass mechanisms may be used. It is pressure (suction) activated—it has a sealing element **144** that is forced by a spring **80** to move toward an exterior of the cleaning robot **10** thereby closing the inlet **128** of bypass mechanism **140**. On the other hand a pressure difference between the interior and the exterior of the cleaning robot **10** and/or suction applied by a fluid suction unit within an internal space of the cleaning robot (not shown) forces the sealing element **144** to move towards the interior of the cleaning robot **10** thereby opening the inlet **128** of bypass mechanism **140** and allowing fluid to pass through bypass mechanism and through outlet **142**. Accordingly—there is a suction (or pressure) thresholds that overcomes the spring and opens the bypass mechanism.

The sealing element **144** moves along an axis that is normal to the wall **21**. It includes a fluid conduit that has different cross sections at different location thus allowing a movement of the sealing element along the axis opens and closes the bypass mechanism **140**.

Accordingly—the sealing element **144** may move between (a) a closed position in which the sealing element **144** prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in

which the sealing element **144** allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

FIG. **8** illustrates that spring **80** is supported by and moves along a supporting element **86** that has a core **82** and three spaced apart wings **81** extending from the core **82**. Accordingly—the spaced apart wings **81** which contact the spring **80** define openings through which fluid may flow when the bypass mechanism **140** is open. The inner wall **86** of the bypass mechanism **140** may be larger than the exterior of spring **80**.

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention. FIG. **10** shows (from top to bottom) the following combinations:

a. A sensor **210** coupled to a bypass mechanism **240**. The sensor may sense pressure levels, tilt angles and may be used to control the bypass mechanism.

b. A controller **200** that is coupled to sensor **210** and to the bypass mechanism **240**. The sensor **210** may sense pressure levels, tilt angles and may send sensing signals to controller **200** that may control, in response to the sensing signals, the bypass mechanism.

c. Multiple (such as two) sensors **210** and **211** that are coupled to bypass mechanism **240** and their readings may be used for controlling the bypass mechanism **240**. Alternatively—the sensors may be coupled to controller **200** that in turn controls the bypass mechanism **240**.

d. Sensor **210** that controls motor **220** that in turn may manipulate (for example push and/or pull) sealing element **244** of bypass mechanism **240**. The bypass mechanism **240** may resemble (or may differ) the bypass mechanism **140** of FIG. **8**. The sealing element **244** can be forced by spring **280** to close the bypass mechanism **240**. The bypass mechanism **240** has an inlet **228** and an outlet **242** that is smaller than the inlet **228**.

e. Sensor **210** that controls motor **220** that in turn may manipulate (for example rotate) door **264** of bypass mechanism **260**. The bypass mechanism **260** may resemble (or may differ) the bypass mechanism **40** of FIGS. **2-4**. The door **264** can rotate about a rotation axis thereby close or open the bypass mechanism **260**. The bypass mechanism **260** has an inlet **268** and a filtering mesh and an outlet **262**.

FIG. **11** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **12** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **13** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **14** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention.

The cross section is taken along a transverse axis of the cleaning robot **10**.

FIGS. **11**, **12**, **13** and **14** differ by each other by:

a. The lack of a sensor and a controller **200** (FIG. **11**).

b. The inclusion of a controller **200** and the sensor **210** at a point that is upstream (after) the filtering unit **310**. (FIG. **12**)

c. The inclusion of the controller **200** upstream of the filtering unit **310** while the sensor **210** is located downstream the filtering unit **310**. (FIG. **13**)

d. The inclusion of a controller **200** within internal space **350** wherein the sensor **210** monitors the rotational speed of the suction unit (for example—of its impeller **320**). (FIG. **14**)

FIGS. **11**, **12**, **13** and **14** show the flow of fluid through bypass mechanism **40**—when the bypass mechanism **40** is open (see arrows **410** and **440**) or through filtering unit **310** (arrows **420** and **430**). FIG. **12** also illustrates a bypass path inlet **28** that is covered by a filtering mesh.

In FIG. **12** the sensor **210** may sense the flow of fluid at a point that is upstream to the filtering unit **310**. In FIG. **13** the sensor **210** may sense the flow of fluid at a point that is downstream to the filtering unit **310**.

The fluid that passes bypass mechanism **40** or filtering unit **310** enter an internal space **350** of the housing **20** and is drawn into a filtering unit **310** (illustrated as including impeller **320** and pump motor **330** for driving the impeller **320**) towards the outlet **360** of housing **20**.

While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

We claim:

1. A cleaning robot comprising: a housing comprising at least one inlet and an outlet; a filtering unit, located within the housing, for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one of the filtering unit and the bypass mechanism.

2. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle.

3. The cleaning robot according to claim **2** wherein predefined tilt angle ranges between 70 and 110 degrees.

4. The cleaning robot according to claim **2** wherein predefined tilt angle is 90 degrees.

5. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to a tilt angle of the cleaning robot.

6. The cleaning robot according to claim **1** wherein the bypass mechanism comprises a door; wherein the door is movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

7. The cleaning robot according to claim **6** wherein the door is pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

8. The cleaning robot according to claim **7** wherein the door is coupled to a weight.

9. The cleaning robot according to claim **8** wherein the weight is connected to a door at a location that is near a lower end of the door and wherein the rotation axis is located near an upper end of the door.

10. The cleaning robot according to claim **7** wherein the door is connected to a lever that is pivotally coupled to a rotation axis.

11. The cleaning robot according to claim **7** wherein the door is connected to a hinge that is pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

12. The cleaning robot according to claim **11** wherein the door is coupled to a lever that is pivotally coupled to a second rotation axis; wherein the lever is arranged to limit a pivoting of the door about the first rotation axis.

13. The cleaning robot according to claim **12** wherein the lever is connected to a weight.

14. The cleaning robot according to claim **12** wherein the weight is arranged to slide across the door when the door moves between the close position and the open position.

15. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

16. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element is arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

17. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a spring that induces the sealing element to move towards the close position.

18. The cleaning robot according to claim **17** wherein when the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element is moved towards the open position.

19. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is upstream to the filtering unit.

20. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is downstream to the filtering unit.

21. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

22. The cleaning robot according to claim **1** further comprising a sensor;

wherein the sensor is arranged to detect an occurrence of a bypass related event and wherein the bypass mechanism is arranged to respond to the occurrence of the bypass related event.

23. The cleaning robot according to claim **22** wherein the bypass mechanism comprises a motor that is arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

24. The cleaning robot according to claim **22** wherein the sensor is a robot tilt angle sensor.

25. The cleaning robot according to claim **22** wherein the sensor is a suction sensor.

26. The cleaning robot according to claim **1** wherein the at least one inlet comprises a bypass mechanism inlet and a filtering unit inlet.

27. The cleaning robot according to claim **1** wherein the at least one inlet comprises multiple bypass mechanism inlets and a filtering unit inlet.

28. The cleaning robot according to claim **1** wherein the bypass mechanism is closer to a sidewall of the housing than the filtering unit.

29. The cleaning robot according to claim **1** wherein the bypass mechanism is connected to a sidewall of the housing.

30. The cleaning robot according to claim **1** wherein the bypass mechanism extends outside a sidewall of the housing.

31. The cleaning robot according to claim **1** comprising at least one additional bypass mechanism; wherein the bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

32. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms differ from each other.

33. The cleaning robot according to claim **31** wherein at least two bypass mechanism of the plurality of bypass mechanisms differ from each other by a triggering event that triggers an opening of the bypass mechanism.

34. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

35. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms.

36. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms eases an opening of another bypass mechanism of the plurality of bypass mechanisms.

37. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms increases a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

38. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a clogging level of the filtering unit.

39. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

40. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms has an opening located at a bottom of the housing and wherein a second bypass mechanism of the plurality of bypass mechanisms has an opening located at a sidewall of the housing.

41. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms comprises a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

42. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

* * * * *

EXHIBIT B

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 845 969 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.09.2016 Bulletin 2016/38

(51) Int Cl.:
E04H 4/16 *(2006.01)*

(21) Application number: **14179190.5**

(22) Date of filing: **30.07.2014**

(54) **Pool cleaning robot with bypass mechanism**

Schwimmbeckenreinigungsroboter mit Bypassmechanismus

Robot de nettoyage de piscine avec mécanisme de dérivation

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **08.09.2013 US 201361875066 P**

(43) Date of publication of application:
11.03.2015 Bulletin 2015/11

(73) Proprietor: **Maytronics Ltd.**
1935000 Kibbutz Yizrael (IL)

(72) Inventors:
- **Ben Dov, Boaz**
  19205 Ram On (IL)
- **Golan, Oded**
  15241 Kefar Tavor (IL)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Thierschstrasse 11
80538 München (DE)

(56) References cited:
EP-A2- 1 489 249 **US-A1- 2011 000 035**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 75001 PARIS (FR)

Description

RELATED APPLICATION

[0001] This application claims priority from US provisional patent filing date September 8, 2013, serial number 61/875,066.

BACKGROUND

[0002] Cleaning robots contribute to the cleanliness of the fluid within a pool by moving within the pool and by filtering the fluid of the pool by means of a filter. The fluid of the pool enters the cleaning robot via one or more inlets, pass through the filter to be filtered and finally is outputted (after being filtered) as filtered fluid.

[0003] In some cleaning robots the effectiveness of the cleaning robot and even the mere movement of the cleaning robot require that the filtering unit to be clean. For example, some cleaning robots will stop moving if the filter is clogged. Yet other cleaning robots will not be able to climb the walls of the pool without a certain amount of fluid that is drawn-in by the cleaning robot and assist in attaching the cleaning robot to the walls of the pool.

[0004] There is a growing need to provide a cleaning robot that may be arranged to contribute to the cleanliness and sanitization of the pool surfaces and fluid even when its filters are partially or fully clogged.

SUMMARY

[0005] According to an embodiment of the invention there may be provided a cleaning robot with a bypass mechanism. The bypass mechanism can bypass one or more filters of a filtering unit.

[0006] According to an embodiment of the invention there may be provided a cleaning robot that may include a housing may include at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that may be arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit or the bypass mechanism.

[0007] The bypass mechanism may be arranged to allow fluid to pass through the bypass mechanism when the cleaning robot may be tilted by at least a predefined tilt angle.

[0008] The degree of openness of the bypass mechanism may be responsive to a tilt angle of the cleaning robot.

[0009] The bypass mechanism may include a door. The door may movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit. The position of the door may determine the openness level of the bypass mechanism.

[0010] The door may be pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

[0011] The door may be coupled to a weight.

[0012] The weight may be connected to a door. For example - near a lower end of the door. The rotation axis may be located near an upper end of the door.

[0013] The door may be connected to a lever that may be pivotally coupled to a rotation axis.

[0014] The door may be connected to a hinge that may be pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

[0015] The door may be coupled to a lever that may be pivotally coupled to a second rotation axis; wherein the lever may be arranged to limit a pivoting of the door about the first rotation axis.

[0016] The lever may be connected to a weight.

[0017] The weight may be arranged to slide across the door when the door moves between the close position and the open position.

[0018] The bypass mechanism may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

[0019] The bypass mechanism may include a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element may be arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0020] The bypass mechanism may include a spring that induces the sealing element to move towards the close position.

[0021] When the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element may be moved towards the open position.

[0022] The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be upstream to the filtering unit.

[0023] The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be downstream to the filtering unit.

[0024] The bypass mechanism may be arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

[0025] The cleaning robot further may include a sensor. The sensor may be arranged to detect an occurrence of a bypass related event and the bypass mechanism may be arranged to respond to the occurrence of the bypass related event.

[0026] The bypass mechanism may include a motor that may be arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

[0027] The sensor may be a robot tilt angle sensor.

[0028] The sensor may be a suction sensor.

[0029] The at least one inlet may include a bypass mechanism inlet and a filtering unit inlet.

[0030] The at least one inlet may include multiple bypass mechanism inlets and a filtering unit inlet.

[0031] The bypass mechanism may be closer to a sidewall of the housing than the filtering unit.

[0032] The bypass mechanism may be connected to a sidewall of the housing.

[0033] The bypass mechanism extends outside a sidewall of the housing.

[0034] The cleaning robot may include at least one additional bypass mechanism. The bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

[0035] At least two bypass mechanisms of the plurality of bypass mechanisms may differ from each other. For example- one bypass mechanism may be tilt angle triggered while another bypass mechanism may be pressure triggered.

[0036] At least two bypass mechanism of the plurality of bypass mechanisms may differ from each other by a triggering event that triggers an opening of the bypass mechanism.

[0037] At least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

[0038] A first bypass mechanism of the plurality of bypass mechanisms may be responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms. For example - when a pressure triggered bypass mechanism is opened it may ease the opening of a door of a tilt angle triggered bypass mechanism as the opening of the pressure triggered bypass mechanism may lower the suction within the housing and that reduction may ease an opening of a door of a tilt angle triggered bypass mechanism.

[0039] An opening of first bypass mechanism of the plurality of bypass mechanisms may ease an opening of another bypass mechanism of the plurality of bypass mechanisms.

[0040] An opening of first bypass mechanism of the plurality of bypass mechanisms may increase a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

[0041] A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a clogging level of the filtering unit.

[0042] A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

[0043] A first bypass mechanism of the plurality of bypass mechanisms may have an opening located at a bottom of the housing and a second bypass mechanism of the plurality of bypass mechanisms may have an opening located at a sidewall of the housing.

[0044] A first bypass mechanism of the plurality of bypass mechanisms may include a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

[0045] A degree of openness of the bypass mechanism may be responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

[0046] There may be provided a cleaning robot that includes any combination of any components illustrated in the summary section of the application or in the specification.

[0047] There may be provided a cleaning robot that includes any combination of any components illustrated in any claims of the application.

[0048] If, for example, a cleaning robot include more than a single bypass mechanism then any of the bypass mechanism may have any structure illustrated in the summary, the specification or the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

FIG. 1 illustrates a portion of cleaning robot according to an embodiment of the invention;

FIG. 2 illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. 3 illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. 4 illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. 5 illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. 6 is a bottom view of a cleaning robot according to an embodiment of the invention;

FIG. 7 is a cross sectional view of a portion of cleaning robot taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention;

FIG. 8 is a cross sectional view of a bypass mechanism taken along a longitudinal axis of the bypass mechanism according to an embodiment of the invention;

FIG. 9 illustrates a portion of a cleaning robot according to an embodiment of the invention;

FIG. 10 illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention;

FIG. 11 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 12 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 13 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 14 is a cross sectional view of a cleaning robot according to an embodiment of the invention; and

FIG. 15 illustrates a portion of cleaning robot that climbs on a sidewall of a pool and a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0050] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

[0051] According to an embodiment of the invention there is provided a cleaning robot that may include one or more bypass mechanisms.

[0052] Various figures illustrate between one to three bypass mechanisms and it is noted that the number of bypassing mechanisms may be any positive integer (for example - one, two, three, four, five and more).

[0053] A bypass mechanism is a mechanical element that allows fluid to bypass a filtering unit. Thus, fluid that flows through a bypass mechanism does not flow through the filtering unit. It is noted that if the filtering unit has multiple filters than the bypass unit may be positioned to bypass one, some or all of the multiple filters of the filtering unit.

[0054] A bypass mechanism may include one or more mechanical components but may also include electrical components.

[0055] If a cleaning robot includes multiple bypass mechanisms then they all can be the same bypass mechanism, may all be different from each other or may include two or more bypass mechanisms that differ from each other.

[0056] Bypass mechanisms may differ from each other by their location, by mode of operation, by size, by shape, by the parameters that control their operation (such as a tilt angle of the cleaning robot or a suction level developed within an internal space of the cleaning robot), by including sensors, by excluding sensors, by including one or more motors, by excluding motors and the like.

[0057] Any bypass mechanism may be open or closed. An open bypass mechanism allows the fluid to flow through the bypass mechanism and to exit from the bypass mechanism thereby not flowing through one of more filters. A closed bypass mechanism prevents fluid from flowing through the bypass mechanism and exiting the bypass mechanism. It may prevent the fluid from entering the bypass mechanism, prevent fluid that enters the bypass mechanism to reach an outlet of the bypass mechanism and/or prevent fluid to flow through the outlet of the bypass mechanism.

[0058] Any bypass mechanism may have more than two openness levels - and may open at different degrees. Thus, a bypass mechanism may be partially open.

[0059] For simplicity of explanation the term "open" refers to a fully open or partially open.

[0060] According to an embodiment of the invention a bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filter is clogged.

[0061] Because the bypass mechanism may allow unfiltered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of events.

[0062] For example - the bypass mechanism may be opened when sensing a reduction in the filtered fluid flow intensity and/or pressure level within the cleaning robot or when sensing that the flow intensity and/or pressure level of the filtered fluid is below a threshold.

[0063] The sensing may include sensing the flow and/or pressure of fluid before (downstream) and/or after (upstream) the filtering unit, in a path leading to the hydraulic movement mechanism and the like. The flow intensity and/or pressure level can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

[0064] Yet for another example - the filtering unit bypass may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall). This may be sensed by tracking the tilt angle of the cleaning robot, by using accelerometers and the like.

[0065] The opening may occur when sensing a reduction of the flow and/or pressure and climbing of the wall. Different thresholds for flow and/or suction levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

[0066] According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example- the bypass mechanism may be opened to a greater extent when climbing a wall, when the Flow and/or pressure of the filtered fluid is lower, and the like.

[0067] The movement of the cleaning robot even when the filtering unit is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving in the pool, detaching bacteria from the pool walls and floor by contact and assisting in pool filtering devices to filter the fluid by inducing fluid movements within the pool.

[0068] According to an embodiment of the invention the bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filtering unit is clogged.

[0069] Because the bypass mechanism may allow unfiltered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of bypass related events.

[0070] For example - the bypass mechanism may be opened when sensing a reduction in the filtered fluid and/or an increase in a suction level within the cleaning robot or both. The sensing may include sensing the flow and/or suction (pressure) of fluid before and/or after the filtering unit, in a path leading to a suction unit, to a hydraulic movement mechanism and the like. The flow and/or suction (pressure) can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

[0071] Yet for another example - the bypass mechanism may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall).

[0072] The opening may occur when sensing a reduction of the Flow and/or pressure and climbing of the wall. Different thresholds for Flow and/or pressure levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

[0073] According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example - the bypass mechanism may be opened to a greater extent when climbing a wall, when the flow and/or pressure of the filtered fluid is below a threshold, and the like.

[0074] By providing the bypass mechanism and allowing fluid to flow even when the filtering unit is clogged the cleaning robot may move in the pool. This movement of the cleaning robot even when the filter is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving the cleaning robot in the pool thereby detaching bacteria from the pool walls and floor by contact and assisting to pool filtering devices to filter the fluid by inducing fluid movements within the pool.

[0075] FIG. 1 illustrates a portion of cleaning robot 10 according to an embodiment of the invention.

[0076] Figure 1 illustrates only a part of the cleaning robot as the upper part of the cleaning robot as well as multiple internal components of the cleaning robot (such as a filtering unit, a fluid suction unit, a driving motor and the like) are missing for clarity of explanation.

[0077] Figure 1 illustrates the portion of the cleaning robot as including a housing 20, front brush wheel 110, rear brush wheel 112, tracks 120 movable by front wheel 121 and/or rear wheel 122. It is noted that the cleaning robot may be moved by other movement elements (for example it may include wheels instead of tracks), may have other cleaning elements and the like.

[0078] The cleaning robot of figure 1 includes three bypass mechanisms - two bypass mechanisms 40 located at both sides of the housing (near sidewalls 22 and 23 of the housing 20) and one bypass mechanism 140 located at the rear wall 21 of the housing 20. Figure 1 also shows a filtering unit inlet formed at about the center of the bottom of the housing and positioned between bypass mechanisms 40. Figure 1 also shows a bypass outlet 42 of bypass mechanism 40.

[0079] Each bypass mechanism allows fluid to bypass at least one filter of the filtering unit. The fluid propagates towards a fluid suction unit (such as an impeller) of the cleaning robot that is arranged to direct towards the outlet (of the housing) fluid that passes through the at least one inlet and through at least one out of the filtering unit and the bypass mechanism.

[0080] Figure 2 illustrates a portion of cleaning robot 10 that climbs on a sidewall 131 of a pool according to an embodiment of the invention. Figure 3 illustrates a portion of cleaning robot 10 that propagates along a bottom 130 of a pool according to an embodiment of the invention. Sidewall 131 is vertical and the bypass mechanism 40 is opened at its maximal extent. Figure 2 illustrates an open bypass mechanism 40 while figure 3 illustrates a closed bypass mechanism.

[0081] In figure 2 and 3 the bypass mechanism 40 is illustrated as including door 44. Door 44 is movable between (a) a closed position (figure 3) in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position (figure 2) in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0082] Door 44 is pivotally coupled to a first rotation axis 45 and rotates between the closed position and the open position.

[0083] Figure 2 and 3 also shows that the door 44 is coupled to a weight 43. The weight 43 assists in opening the door 44 when the cleaning robot starts to tilt and closing the door 44 when the cleaning robot is horizontal. Alternatively, the door 44 may be heavy enough and does not require an additional weight 43.

[0084] Figure 2 and 3 illustrate the weight 43 is being connected to a door 44 near a lower end of the door and illustrate the first rotation axis 45 is located near an upper end of the door 44. The first rotation axis 45 may alternatively be located near the center of the door (as illustrated in figure 15) in order to reduce the needed weight or mass of 43. It is noted that the relative locations of the first rotation axis 45 and the weight 43 may differ from those illustrated in figures 2 and 3.

[0085] Figures 2 and 3 also show that the door 44 is not directly connected to the rotation axis but show a hinge 51 that is pivotally snapped-in or coupled to the first rotation axis 45 and interfaces with the door 44.

[0086] Figure 4 illustrates a portion of cleaning robot 10 that climbs on a sidewall 131 of a pool according to an embodiment of the invention. Figure 5 illustrates a portion of cleaning robot 10 that propagates along a bottom 130 of a pool according to an embodiment of the invention. Sidewall 131 is vertical and the bypass mechanism 40 is opened at its maximal extent. Figure 4 illustrates an open bypass mechanism 40 while figure 5 illustrates a closed bypass mechanism.

[0087] Figure 4 and 5 illustrate a door 44 that is connected to a hinge 51 that is pivotally snapped-in or coupled to a first rotation axis 45 thereby allowing the door 44 to pivot about the first rotation axis 45.

[0088] The door 44 of figures 4 and 5 is coupled to a lever 52 that is pivotally coupled to a second rotation axis 46. The second level 52 may be arranged to limit a pivoting of the door 44 about the first rotation axis 45. The lever 52 may be oriented at about ninety degrees to the tilt angle of the cleaning robot but this is not necessarily so.

[0089] Figures 4 and 5 illustrate the lever 52, connected or snapped-in to a weight 43 (or unify it by 43), and interfaces with door 44.

[0090] Figure 4 and 5 illustrate that the weight 43 is arranged to slide across the door 44 when the door moves between the close position and the open position.

[0091] Figures 2-6 illustrates bypass mechanisms 40 that their openness level depended upon the tilt angle of the cleaning robot. The tilt angle may be defined as the angle between the cleaning robot and the horizon.

[0092] It is noted that although figures 2-6 do not show sensors for triggering the opening (and/or closing) of the bypass mechanisms - that the cleaning robot may include sensors that may sense the tilt angle of the cleaning robot and that the sensed tilt robot may be used to trigger (for example by using a motor) the opening and/or closing of a bypass mechanism.

[0093] Accordingly, there may be provided a cleaning robot wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle. This tilt angle may be measured by a sensor (such as sensor 210 of figures 10, 12 and 13).

[0094] Yet for another embodiment of the invention the mechanical elements of the bypass mechanism may be arranged to allow opening the bypass mechanism only when the tilt angle exceeds a predetermined tilt angle. Referring to the example set forth in figure 9, a spring 48 or other limiting element may be connected to door 44, or to weight 43 and to a frame 49 of the bypass mechanism in order to counter the movement of the weight 43 or door 44 so that only at a predefined tilt angle the door 44 will move and at least partially open the bypass mechanism 40. The predefined tilt angle may range between 70 and 110 degrees, may range between 50 and 90 degrees, between 20 and 80 degrees and the like.

[0095] Figure 6 is a bottom view of a cleaning robot 10 according to an embodiment of the invention.

[0096] It shows a filtering unit inlet 26 located at about the center of the bottom 25 of the cleaning robot as well as two bypass path inlets 28 that are covered by a filtering mesh positioned at both sides of the filtering unit inlet 26. This figure also shows front brush wheel 110, rear brush wheel 112, front wheel 121 and read wheel 122.

[0097] Figure 7 is a cross sectional view of a portion of cleaning robot 10 taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention.

[0098] Figure 8 is a cross sectional view of a bypass mechanism 140 taken along a longitudinal axis of the bypass mechanism 140 according to an embodiment of the invention. Figure 8 also provides a cross sectional view of the bypass mechanism 140 taken along axis A -A that is normal to the longitudinal axis of the bypass mechanism 140.

[0099] Bypass mechanism 140 is installed in wall 21 of housing 20. Bypass mechanism 140 may also be installed on other walls such as for example, sidewall 22 of the pool cleaner. Multiple bypass mechanisms may be used. It is pressure (suction) activated - it has a sealing element 144 that is forced by a spring 80 to move toward an exterior of the cleaning robot 10 thereby closing the inlet 128 of bypass mechanism 140. On the other hand a pressure difference between the interior and the exterior of the cleaning robot 10 and/or suction applied by a fluid suction unit within an internal space of the cleaning robot (not shown) forces the sealing element 144 to move towards the interior of the cleaning robot 10 thereby opening the inlet 128 of bypass mechanism 140 and allowing fluid to pass through bypass mechanism and through outlet 142. Accordingly- there is a suction (or pressure) thresholds that overcomes the spring and opens the bypass mechanism.

[0100] The sealing element 144 moves along an axis that is normal to the wall 21. It includes a fluid conduit that has different cross sections at different location thus allowing a movement of the sealing element along the axis opens and closes the bypass mechanism 140.

[0101] Accordingly - the sealing element 144 may move between (a) a closed position in which the sealing element 144 prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element 144 allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0102] Figure 8 illustrates that spring 80 is supported by and moves along a supporting element 86 that has a core 82 and three spaced apart wings 81 extending from the core 82. Accordingly - the spaced apart wings 81 which contact the spring 80 define openings through which fluid may flow when the bypass mechanism 140 is open. The inner wall 86 of the bypass mechanism 140 may be larger than the exterior of spring 80.

[0103] Figure 10 illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention. Figure 10 shows (from top to bottom) the following combinations:

a. A sensor 210 coupled to a bypass mechanism 240. The sensor may sense pressure levels, tilt angles and may be used to control the bypass mechanism.

b. A controller 200 that is coupled to sensor 210 and to the bypass mechanism 240. The sensor 210 may sense pressure levels, tilt angles and may send sensing signals to controller 200 that may control, in response to the sensing signals, the bypass mechanism.

c. Multiple (such as two) sensors 210 and 211 that are coupled to bypass mechanism 240 and their readings may be used for controlling the bypass mechanism 240. Alternatively - the sensors may be coupled to controller 200 that in turn controls the bypass mechanism 240.

d. Sensor 210 that controls motor 220 that in turn may manipulate (for example push and/or pull) sealing element 244 of bypass mechanism 240. The bypass mechanism 240 may resemble (or may differ) the bypass mechanism 140 of figure 8. The sealing element 244 can be forced by spring 280 to close the bypass mechanism 240. The bypass mechanism 240 has an inlet 228 and an outlet 242 that is smaller than the inlet 228.

e. Sensor 210 that controls motor 220 that in turn may manipulate (for example rotate) door 264 of bypass mechanism 260. The bypass mechanism 260 may resemble (or may differ) the bypass mechanism 40 of figures 2-4. The door 264 can rotate about a rotation axis thereby close or open the bypass mechanism 260. The bypass mechanism 260 has an inlet 268 and a filtering mesh and an outlet 262.

[0104] FIG. 11 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 12 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 13 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 14 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention.

[0105] The cross section is taken along a transverse axis of the cleaning robot 10.

[0106] Figures 11, 12, 13 and 14 differ by each other by:

a. The lack of a sensor and a controller 200 (figure 11).

b. The inclusion of a controller 200 and the sensor 210 at a point that is upstream (after) the filtering unit 310. (figure 12)

c. The inclusion of the controller 200 upstream of the filtering unit 310 while the sensor 210 is located downstream the filtering unit 310. (figure 13)

d. The inclusion of a controller 200 within internal space 350 wherein the sensor 210 monitors the rotational speed of the suction unit (for example- of its impeller 320). (figure 14)

[0107] Figures 11, 12, 13 and 14 show the flow of fluid through bypass mechanism 40 - when the bypass mechanism 40 is open (see arrows 410 and 440) or through filtering unit 310 (arrows 420 and 420).

[0108] In figure 12 the sensor 210 may sense the flow of fluid at a point that is upstream to the filtering unit 310. In figure 13 the sensor 210 may sense the flow of fluid at a point that is downstream to the filtering unit 310.

[0109] The fluid that passes bypass mechanism 40 or filtering unit 310 enter an internal space 350 of the housing 20 and is drawn into a filtering unit 310 (illustrated as including impeller 320 and pump motor 330 for driving the impeller motor 330) towards the outlet 360 of housing 20.

[0110] While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications.

Claims

1. A cleaning robot comprising:

a housing (20) comprising at least one inlet (26) and an outlet;
a filtering unit for filtering fluid;
a bypass mechanism (40, 140, 240) for bypassing the filtering unit; and
a fluid suction unit that is arranged to direct towards the outlet (142) fluid that (a) passes through the at least one inlet (26) and (b) passes through at least one out of the filtering unit and the bypass mechanism (40, 140, 240).

2. The cleaning robot according to claim 1 wherein the bypass mechanism (40) is arranged to allow fluid to pass through the bypass mechanism (40) when the cleaning robot is tilted by at least a predefined tilt angle.

3. The cleaning robot according to claim 1 wherein the bypass mechanism (40) comprises a door (44); wherein the door (44) is movable between (a) a closed position in which the door (44) prevents fluid to exit the bypass mechanism (40) and flow towards the fluid suction unit, and (b) an open position in which the door (44) allows fluid to exit from the bypass mechanism (40) and flow towards the fluid suction unit.

4. The cleaning robot according to claim 1 wherein the bypass mechanism (140) is arranged to be opened in response to a suction level developed within an internal space formed in the housing (20).

5. The cleaning robot according to claim 4 wherein the bypass mechanism (140) comprises a bypass mechanism inlet (28), a bypass mechanism outlet (142) and a sealing element (144); wherein the sealing element is arranged to be moved between (a) a closed position in which the sealing element (144) prevents fluid to exit the bypass mechanism (140) and flow towards the fluid suction unit, and (b) an open position in which the sealing element (144) allows fluid to exit from the bypass mechanism (140) and flow towards the fluid suction unit.

6. The cleaning robot according to claim 4 wherein the bypass mechanism (140) comprises a spring (80) that induces the sealing element (144) to move towards the close position.

7. The cleaning robot according to claim 6 wherein when the suction level developed within an internal space of the housing (20) exceeds a suction threshold the sealing element (144) is moved towards the open position.

8. The cleaning robot according to claim 1 further comprising a sensor (210); wherein the sensor (210) is arranged to detect an occurrence of a bypass related event and wherein the bypass mechanism (240) is arranged to respond to the occurrence of the bypass related event.

9. The cleaning robot according to claim 8 wherein the bypass mechanism (240) comprises a motor (220) that is arranged to affect an openness level of the bypass mechanism (240) in response to the occurrence of the bypass related event.

10. The cleaning robot according to claim 8 wherein the sensor (210) is a robot tilt angle sensor.

11. The cleaning robot according to claim 1 wherein the at least one inlet comprises multiple bypass mechanism inlets and a filtering unit inlet.

12. The cleaning robot according to claim 1 comprising at least one additional bypass mechanism; wherein the bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

13. The cleaning robot according to claim 12 wherein at least two bypass mechanism of the plurality of bypass mechanisms differ from each other by a triggering event that triggers an opening of the bypass mechanism.

14. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms is responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms.

15. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a clogging level of the filtering unit.

16. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms comprises a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

17. The cleaning robot according to claim 1 wherein a degree of openness of the bypass mechanism is responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

Patentansprüche

1. Ein Reinigungsroboter, der Folgendes umfasst:

   ein Gehäuse (20), das mindestens einen Einlass (26) und einen Auslass umfasst;
   eine Filtereinheit zum Filtern von Flüssigkeit;
   einen Bypass-Mechanismus (40, 140, 240) zum Umgehen der Filtereinheit und
   eine Flüssigkeits-Saugeinheit, die ausgebildet ist, um Flüssigkeit zum Auslass (142) hin zu lenken, die (a) durch den mindestens einen Einlass (26) strömt und (b) durch die Filtereinheit und/oder den Bypass-Mechanismus (40, 140, 240) strömt.

2. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (40) ausgebildet ist, um es zu ermöglichen, dass Flüssigkeit durch den Bypass-Mechanismus (40) strömt, wenn der Reinigungsroboter mindestens in einem vordefinierten Kippwinkel gekippt ist.

3. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (40) eine Tür (44) umfasst, wobei die Tür (44) beweglich ist zwischen (a) einer geschlossenen Position, in welcher die Tür (44)

Flüssigkeit daran hindert, aus dem Bypass-Mechanismus (40) auszutreten und zur Flüssigkeits-Saugeinheit hin zu strömen, und (b) einer offenen Position, in welcher die Tür (44) es ermöglicht, dass Flüssigkeit aus dem Bypass-Mechanismus (40) austritt und zur Flüssigkeits-Saugeinheit hin strömt.

4. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (140) ausgebildet ist, um als Reaktion auf ein Saugniveau geöffnet zu werden, das sich in einem im Gehäuse (20) gebildeten Innenraum entwickelt hat.

5. Der Reinigungsroboter gemäß Anspruch 4, wobei der Bypass-Mechanismus (140) einen Bypass-Mechanismus-Einlass (28), einen Bypass-Mechanismus-Auslass (142) und ein Abdichtungselement (144) umfasst, wobei das Abdichtungselement (144) angeordnet ist, um bewegt zu werden zwischen (a) einer geschlossenen Position, in welcher das Abdichtungselement (144) Flüssigkeit daran hindert, aus dem Bypass-Mechanismus (140) auszutreten und zur Flüssigkeits-Saugeinheit hin zu strömen, und (b) einer offenen Position, in welcher das Abdichtungselement (144) es ermöglicht, dass Flüssigkeit aus dem Bypass-Mechanismus (140) austritt und zur Flüssigkeits-Saugeinheit hin strömt.

6. Der Reinigungsroboter gemäß Anspruch 4, wobei der Bypass-Mechanismus (140) eine Feder (80) umfasst, die das Abdichtungselement (144) veranlasst, sich zur geschlossenen Position hin zu bewegen.

7. Der Reinigungsroboter gemäß Anspruch 6, wobei das Abdichtungselement (144) zur offenen Position hin bewegt wird, wenn das Saugniveau, das sich in einem Innenraum des Gehäuses (20) entwickelt hat, einen Saug-Schwellenwert überschreitet.

8. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen Sensor (210) umfasst, wobei der Sensor (210) ausgebildet ist, um ein Auftreten eines mit einer Umgehung zusammenhängenden Ereignisses zu erfassen, und wobei der Bypass-Mechanismus (240) ausgebildet ist, um auf das Auftreten des mit der Umgehung zusammenhängenden Ereignisses zu reagieren.

9. Der Reinigungsroboter gemäß Anspruch 8, wobei der Bypass-Mechanismus (240) einen Motor (220) umfasst, der ausgebildet ist, um als Reaktion auf das Auftreten des mit der Umgehung zusammenhängenden Ereignisses einen Öffnungsgrad des Bypass-Mechanismus (240) zu beeinflussen.

10. Der Reinigungsroboter gemäß Anspruch 8, wobei der Sensor (210) ein Roboter-Kippwinkel-Sensor ist.

11. Der Reinigungsroboter gemäß Anspruch 1, wobei der mindestens eine Einlass mehrere Bypass-Mechanismus-Einlässe und einen Filtereinheits-Einlass umfasst.

12. Der Reinigungsroboter gemäß Anspruch 1, der mindestens einen zusätzlichen Bypass-Mechanismus umfasst, wobei der Bypass-Mechanismus und der mindestens eine zusätzliche Bypass-Mechanismus eine Vielzahl von Bypass-Mechanismen bilden.

13. Der Reinigungsroboter gemäß Anspruch 12, wobei mindestens zwei Bypass-Mechanismen der Vielzahl von Bypass-Mechanismen sich voneinander in einem Auslöseereignis unterscheiden, das eine Öffnung des Bypass-Mechanismus auslöst.

14. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen auf einen Öffnungsgrad eines anderen Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen anspricht.

15. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen ausgebildet ist, um als Reaktion auf ein Kippniveau des Reinigungsroboters geöffnet zu werden, und ein zweiter Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen ausgebildet ist, um als Reaktion auf einen Verstopfungsgrad der Filtereinheit geöffnet zu werden.

16. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen einen Sensor und einen vom Sensor aktivierten Motor umfasst und wobei ein zweiter Bypass-Mechanismus der Vielzahl von Bypassmechanismen keinen Sensor oder einen vom Sensor aktivierten Motor einschließt.

17. Der Reinigungsroboter gemäß Anspruch 1, wobei ein erster Öffnungsgrad des Bypass-Mechanismus auf (a) einen Kippwinkel des Reinigungsroboters und (b) ein Saugniveau, das sich in einem im Gehäuse gebildeten Innenraum entwickelt hat, anspricht.

Revendications

1. Robot de nettoyage, comprenant:

un boîtier (20) comportant au moins une entrée (26) et une sortie;
une unité de filtrage pour filtrer du fluide;
un mécanisme de dérivation (40, 140, 240), pour contourner l'unité de filtrage; et
une unité d'aspiration de fluide qui est agencée

pour diriger vers la sortie (142) du fluide qui (a) passe à travers au moins une entrée (26) et (b) passe à travers au moins une parmi l'unité de filtrage et le mécanisme de dérivation (40, 140, 240).

2. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (40) est agencé pour permettre au fluide de passer à travers le mécanisme de dérivation (40) lorsque le robot de nettoyage est incliné selon au moins un angle d'inclinaison prédéfini.

3. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (40) comprend une porte (44); dans lequel la porte (44) est déplaçable entre (a) une position fermée dans laquelle la porte (44) empêche au fluide de sortir du mécanisme de dérivation (40) et de s'écouler vers l'unité d'aspiration de fluide, et (b) une position ouverte dans laquelle la porte (44) permet au fluide de sortir du mécanisme de dérivation (40) et de s'écouler vers l'unité d'aspiration de fluide.

4. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (140) est agencé pour être ouvert en réponse à un niveau d'aspiration développé dans un espace interne formé dans le boîtier (20).

5. Robot de nettoyage selon la revendication 4 dans lequel le mécanisme de dérivation (140) comprend une entrée (28) de mécanisme de dérivation, une sortie (142) de mécanisme de dérivation et un élément d'étanchéité (144); dans lequel l'élément d'étanchéité (144) est agencé pour être déplacé entre (a) une position fermée dans laquelle l'élément d'étanchéité (144) empêche au fluide de sortir du mécanisme de dérivation (140) et de s'écouler vers l'unité d'aspiration de fluide, et (b) une position ouverte dans laquelle l'élément d'étanchéité (144) permet au fluide de sortir du mécanisme de dérivation (140) et de s'écouler vers l'unité d'aspiration de fluide.

6. Robot de nettoyage selon la revendication 4 dans lequel le mécanisme de dérivation (140) comporte un ressort (80) qui entraîne le déplacement de l'élément d'étanchéité (144) vers la position fermée.

7. Robot de nettoyage selon la revendication 6 dans lequel, lorsque le niveau d'aspiration développé dans un espace interne du boîtier (20) dépasse un seuil d'aspiration, l'élément d'étanchéité (144) est déplacé vers la position ouverte.

8. Robot de nettoyage selon la revendication 1 comprenant en outre un capteur (210); dans lequel le capteur (210) est agencé pour détecter une survenance d'un événement lié à une dérivation et dans lequel le mécanisme de dérivation (240) est agencé de façon à répondre à la survenance de l'événement lié à une dérivation.

9. Robot de nettoyage selon la revendication 8 dans lequel le mécanisme de dérivation (240) comprend un moteur (220) qui est agencé pour affecter un niveau d'ouverture du mécanisme de dérivation (240) en réponse à la survenance de l'événement lié à une dérivation.

10. Robot de nettoyage selon la revendication 8 dans lequel le capteur (210) est un capteur d'angle d'inclinaison du robot.

11. Robot de nettoyage selon la revendication 1 dans lequel la au moins une entrée comprend de multiples entrées de mécanisme de dérivation et une entrée d'unité de filtration.

12. Robot de nettoyage selon la revendication 1 comprenant au moins un mécanisme de dérivation supplémentaire; dans lequel le mécanisme de dérivation et le au moins un mécanisme de dérivation supplémentaire forment une pluralité de mécanismes de dérivation.

13. Robot de nettoyage selon la revendication 12, dans lequel au moins deux mécanismes de dérivation de la pluralité de mécanismes de dérivation diffèrent l'un de l'autre par un événement déclencheur qui provoque une ouverture du mécanisme de dérivation.

14. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation est sensible à un niveau d'ouverture d'un autre mécanisme de dérivation de la pluralité de mécanismes de dérivation.

15. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation est agencé pour être ouvert en réponse à un niveau d'inclinaison du robot de nettoyage et un deuxième mécanisme de dérivation de la pluralité de mécanismes de dérivation est agencé pour être ouvert en réponse à un niveau d'obstruction de l'unité de filtrage.

16. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation comprend un capteur et un moteur actionné par le capteur et dans lequel un deuxième mécanisme de dérivation de la pluralité de mécanismes de dérivation ne comprend pas de capteur ou de moteur activé par le capteur.

17. Robot de nettoyage selon la revendication 1, dans lequel un degré d'ouverture du mécanisme de dérivation est sensible à (a) un angle d'inclinaison du robot de nettoyage et (b) à un niveau d'aspiration développé dans un espace interne formé dans le boîtier.

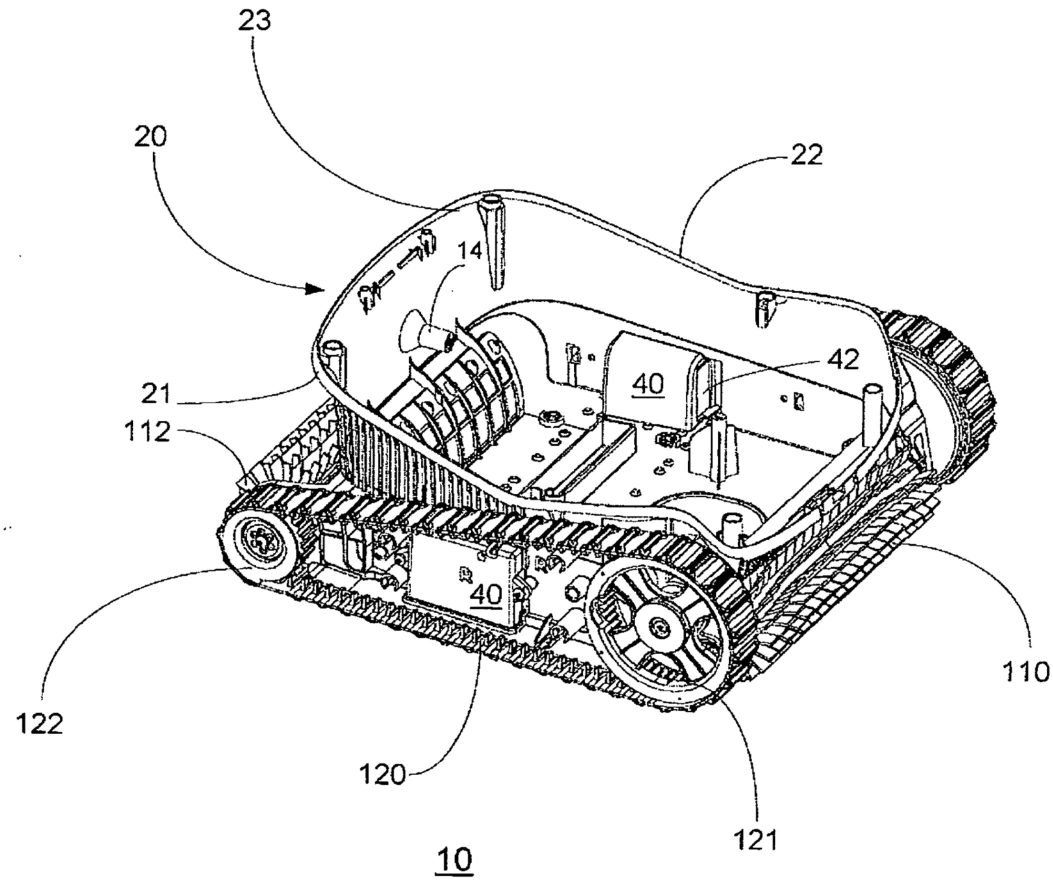


FIG. 1

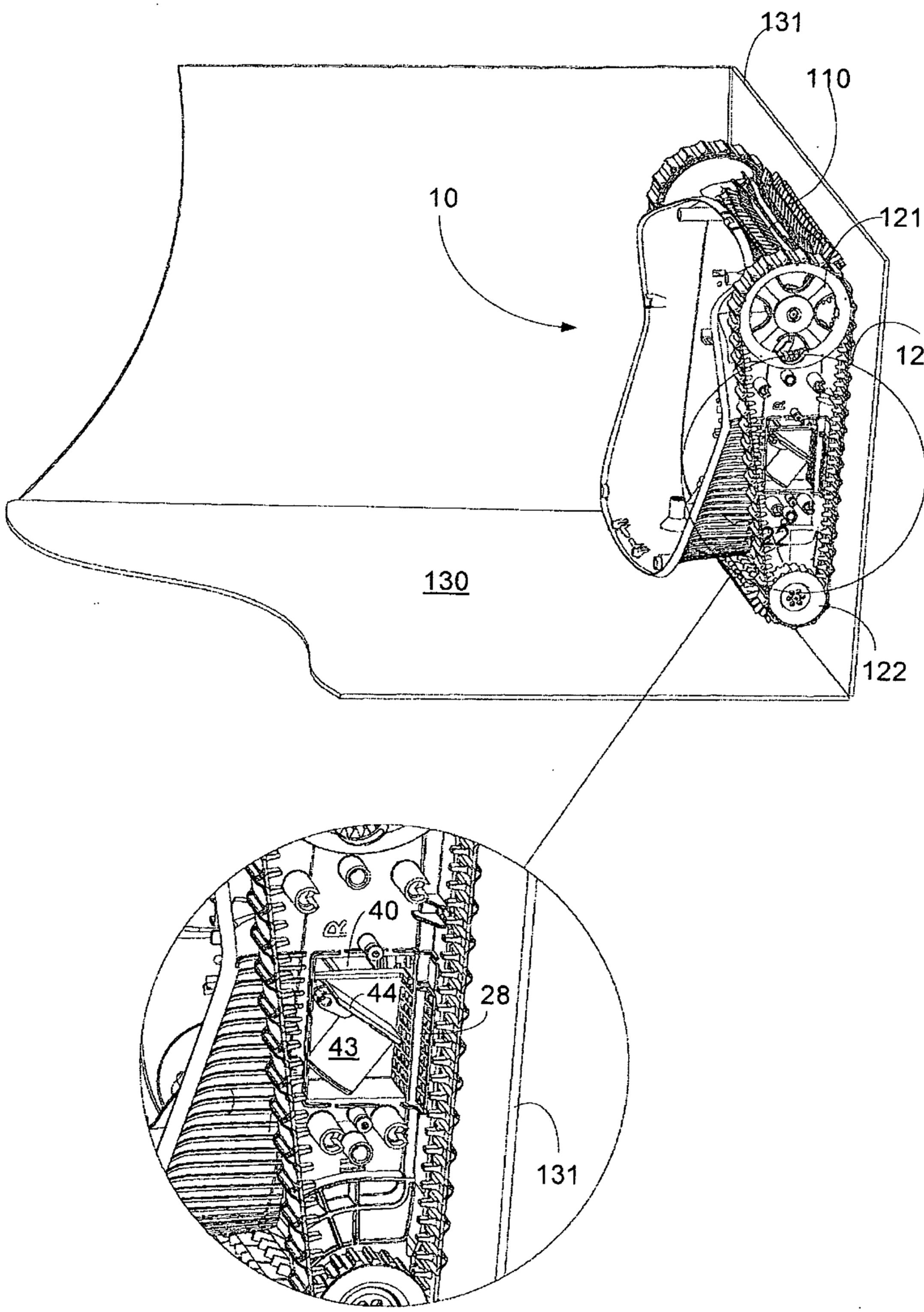


FIG. 2

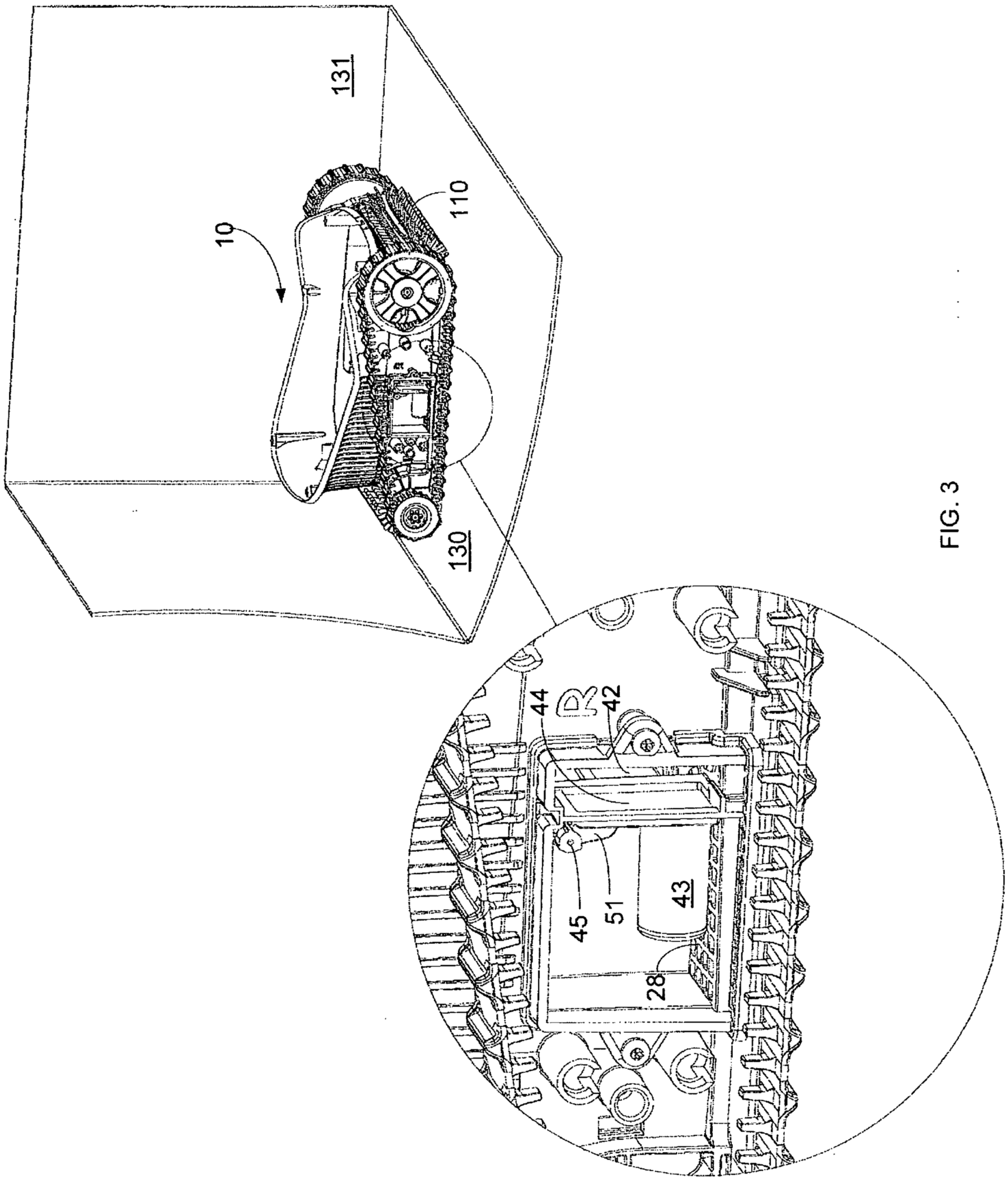


FIG. 3

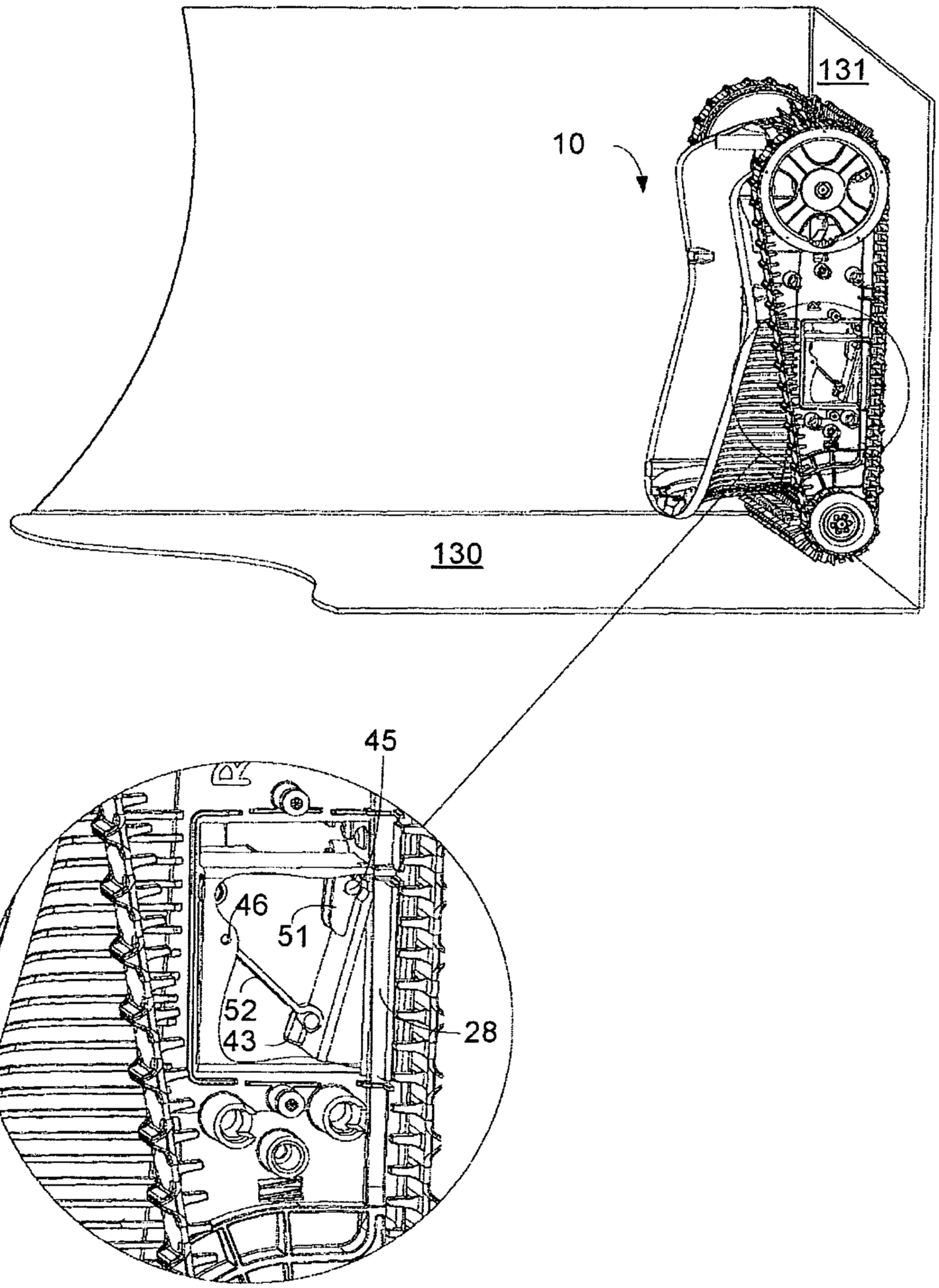


FIG. 4

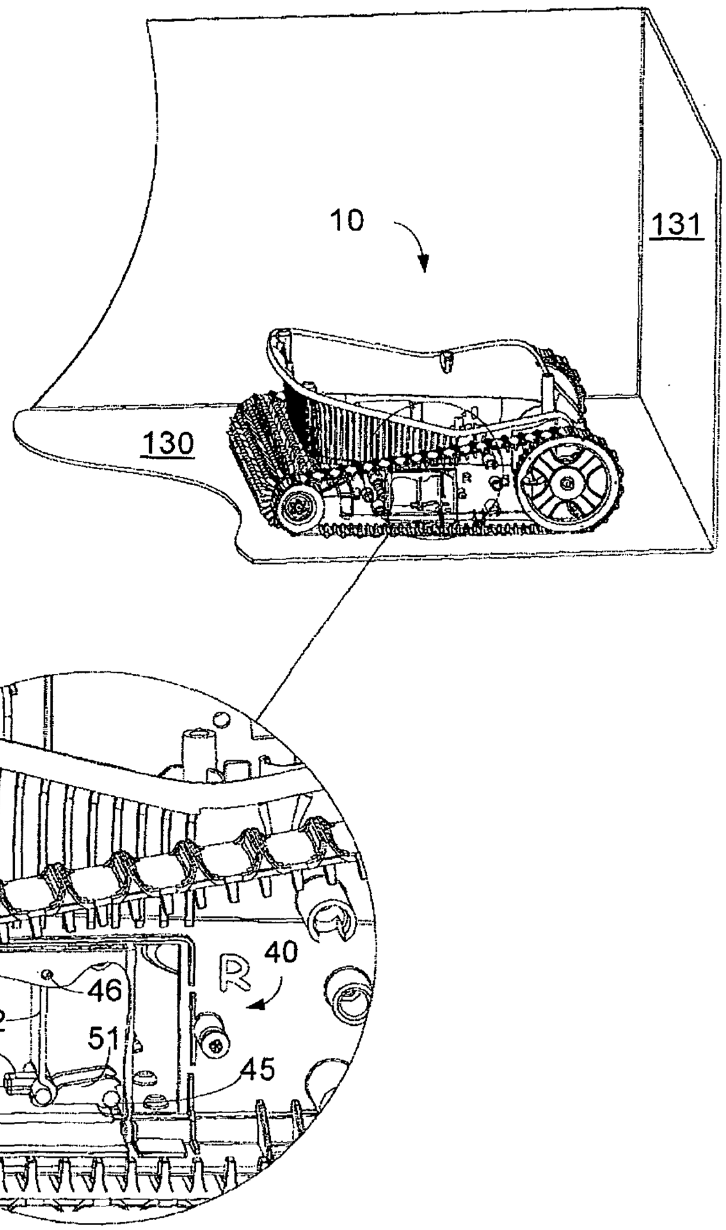


FIG. 5

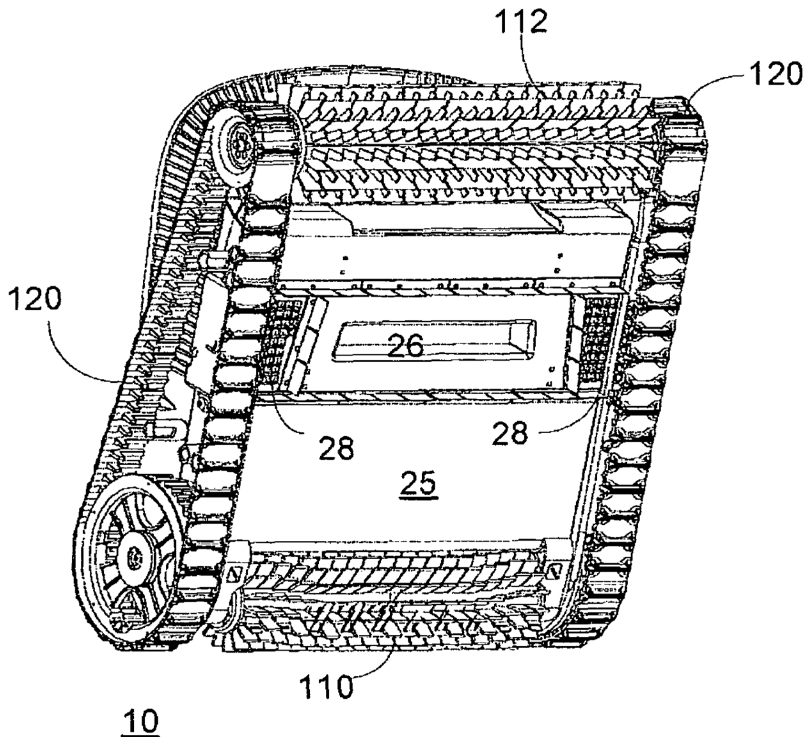


FIG. 6

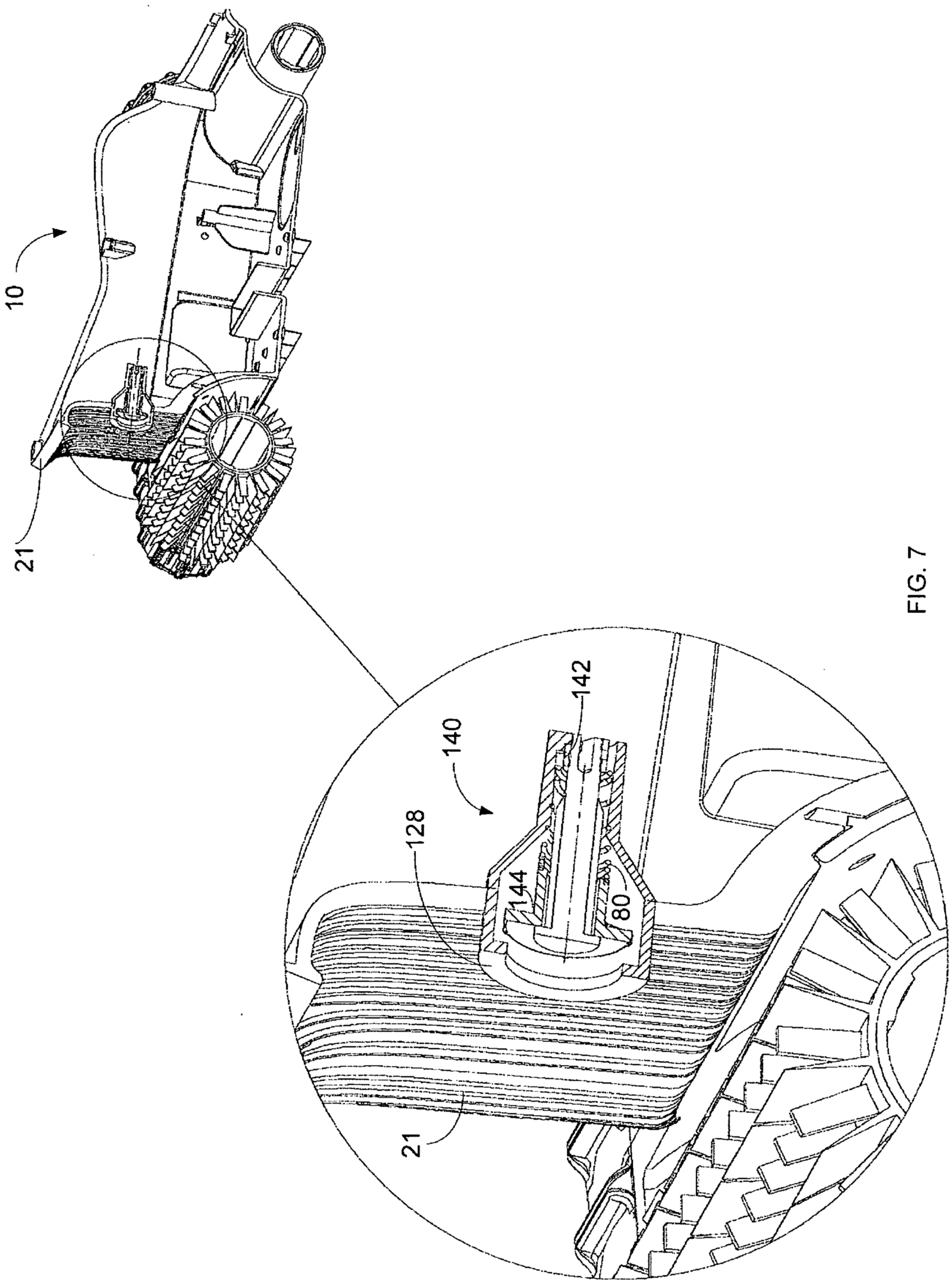


FIG. 7

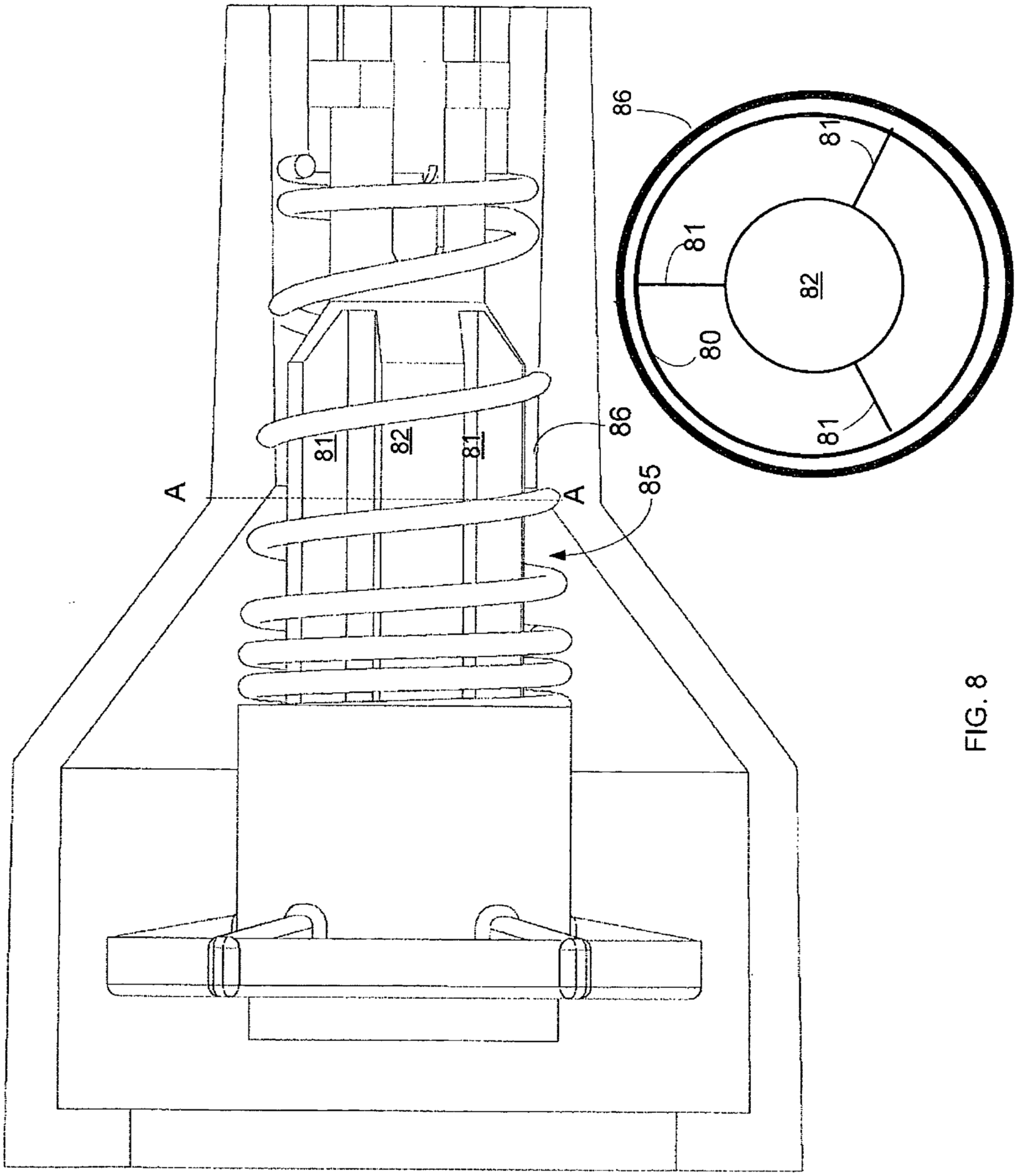


FIG. 8

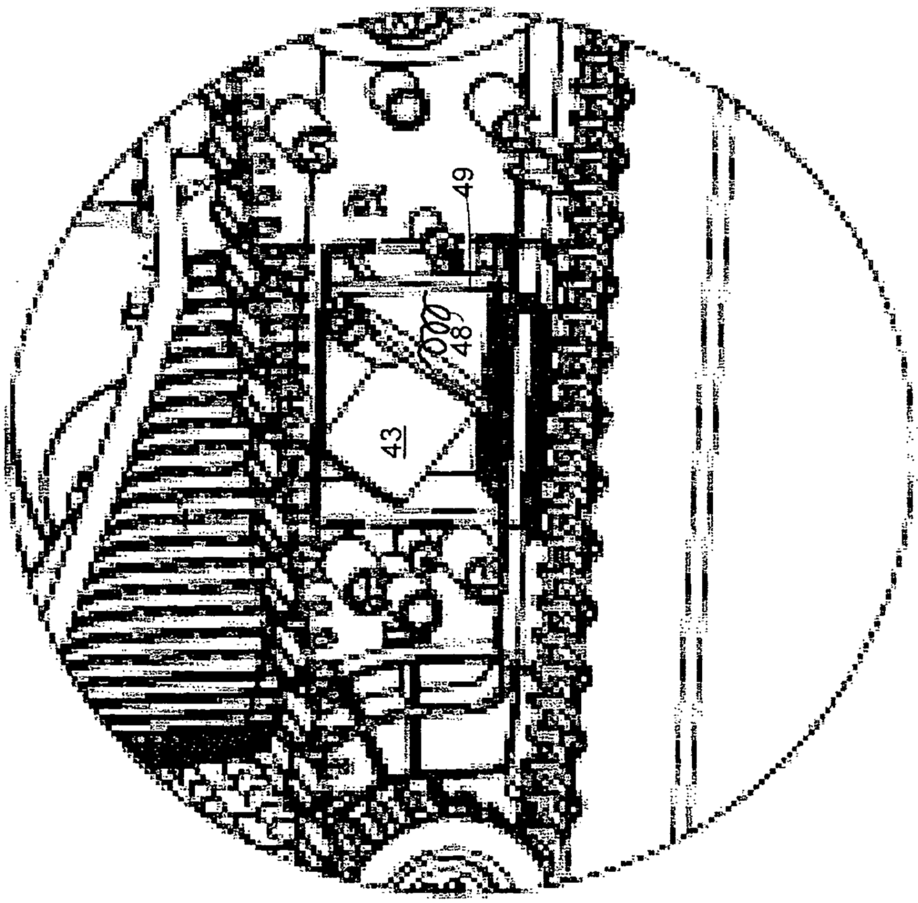


FIG. 9

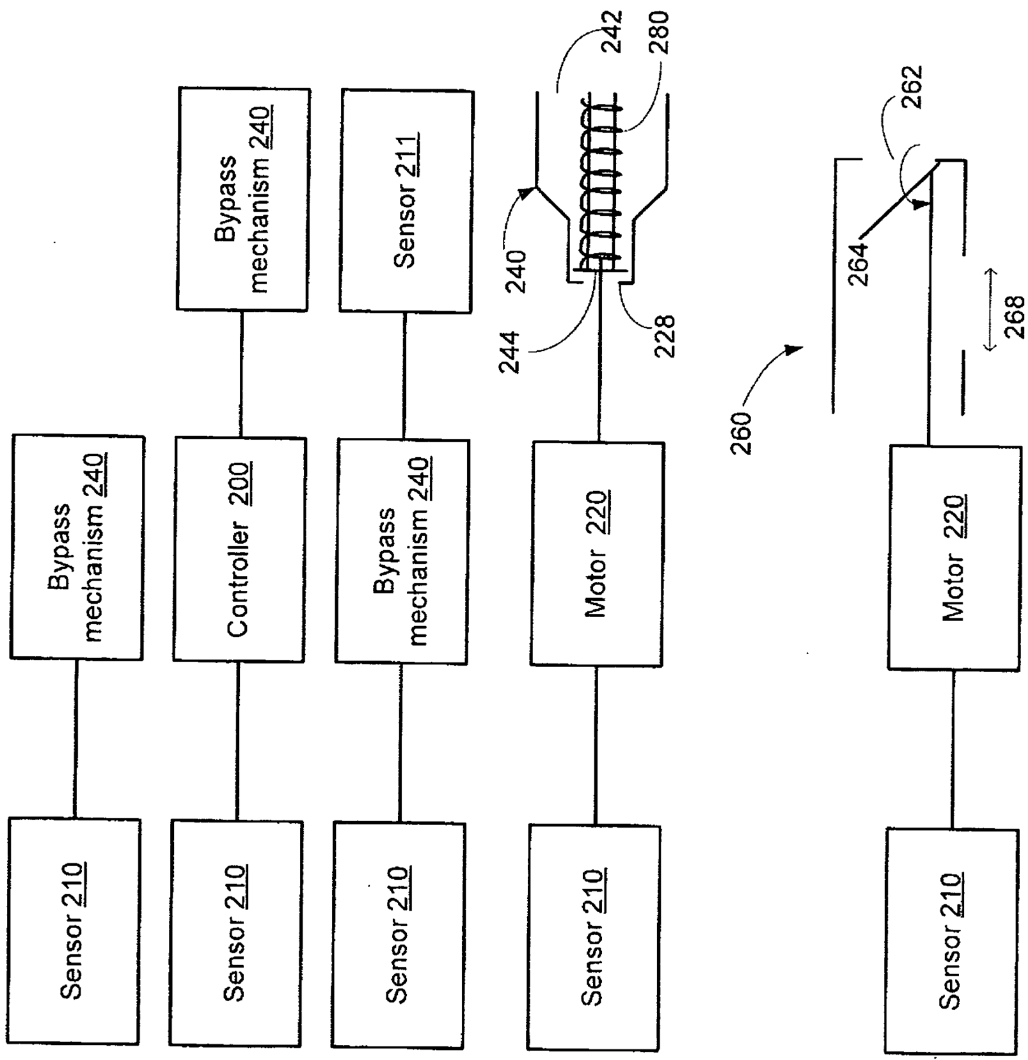

Sensor 210
Bypass mechanism 240
Sensor 210
Controller 200
Bypass mechanism 240
Sensor 211
Sensor 210
Bypass mechanism 240
Sensor 210
Motor 220
242
280
240
244
228
260
262
264
268
Sensor 210
Motor 220

FIG. 10

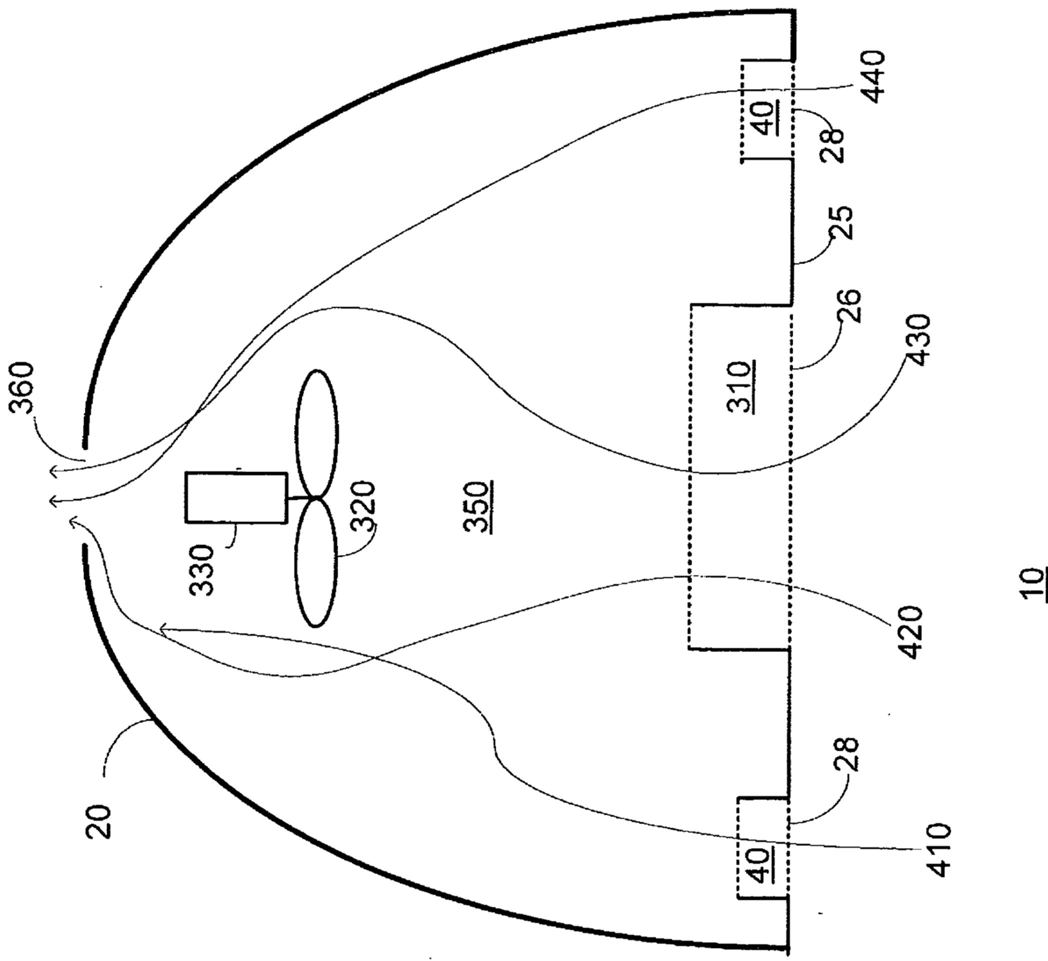


FIG. 11

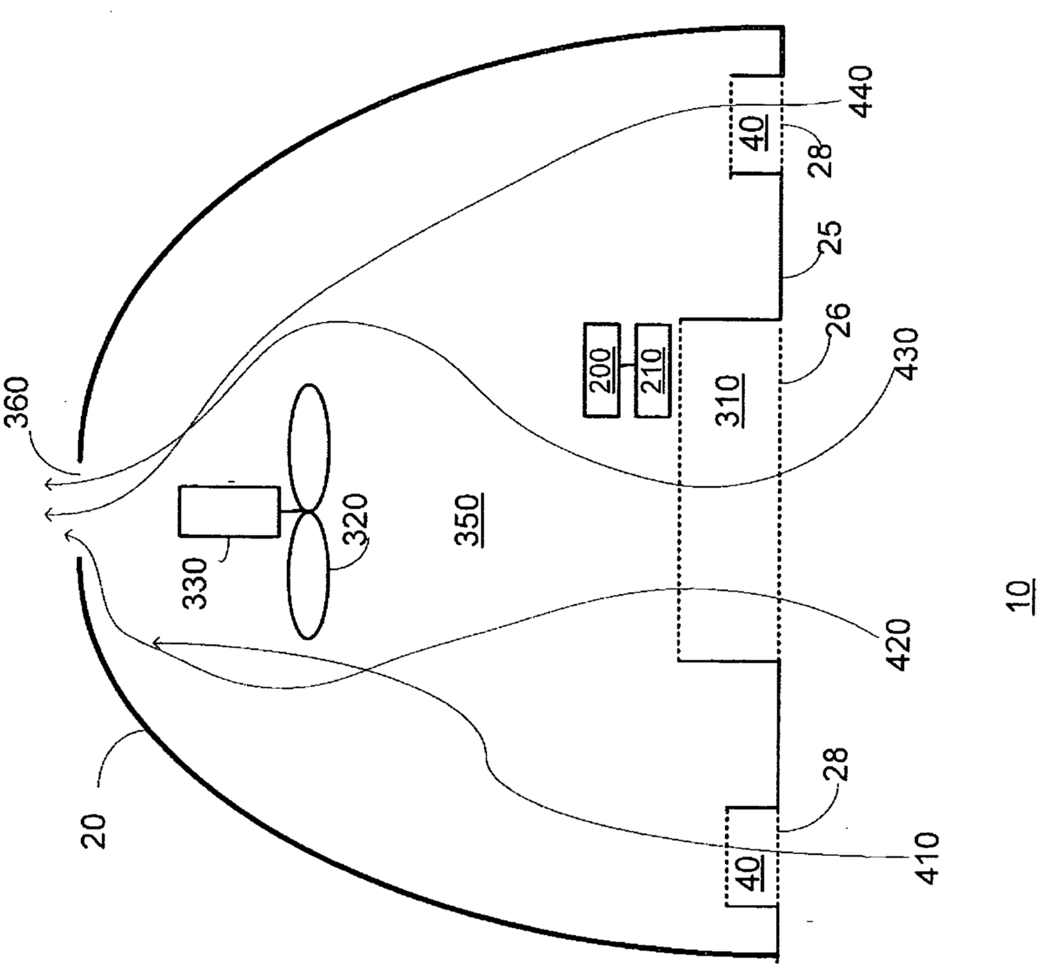


FIG. 12

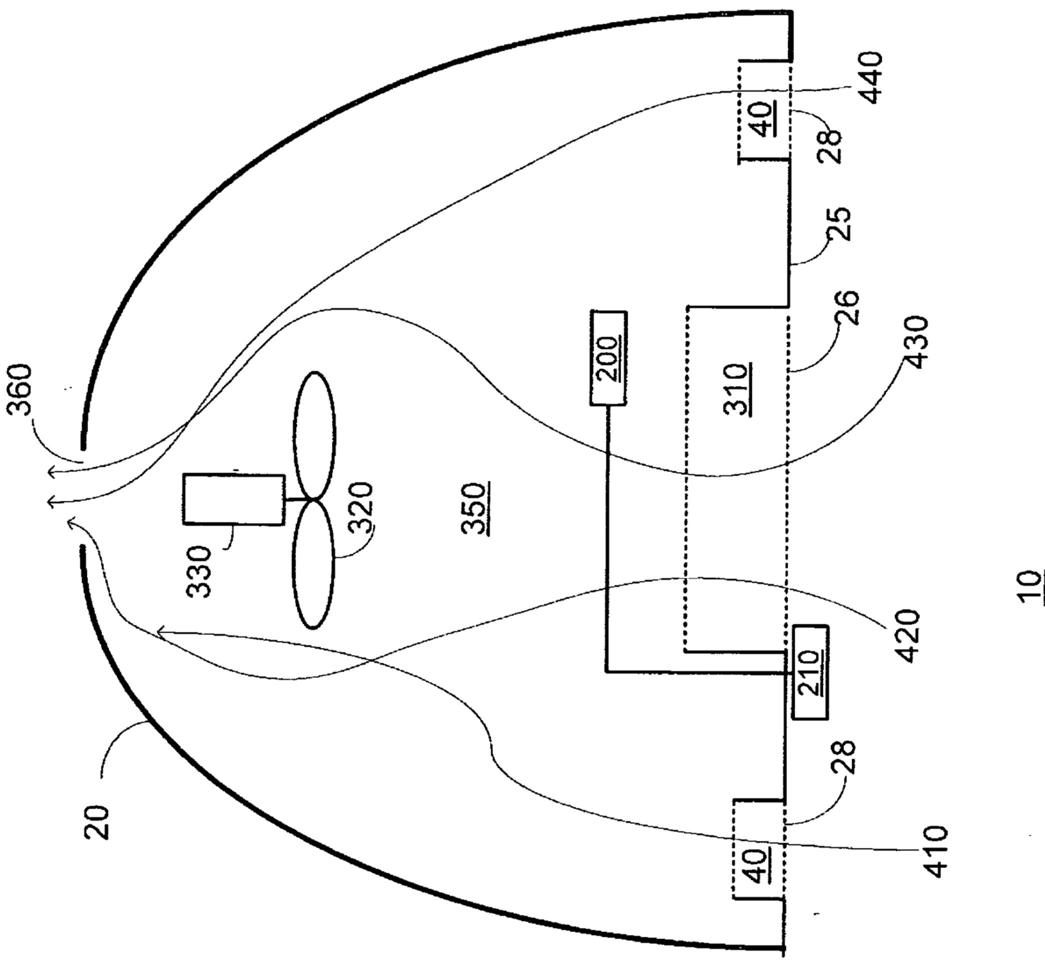


FIG. 13

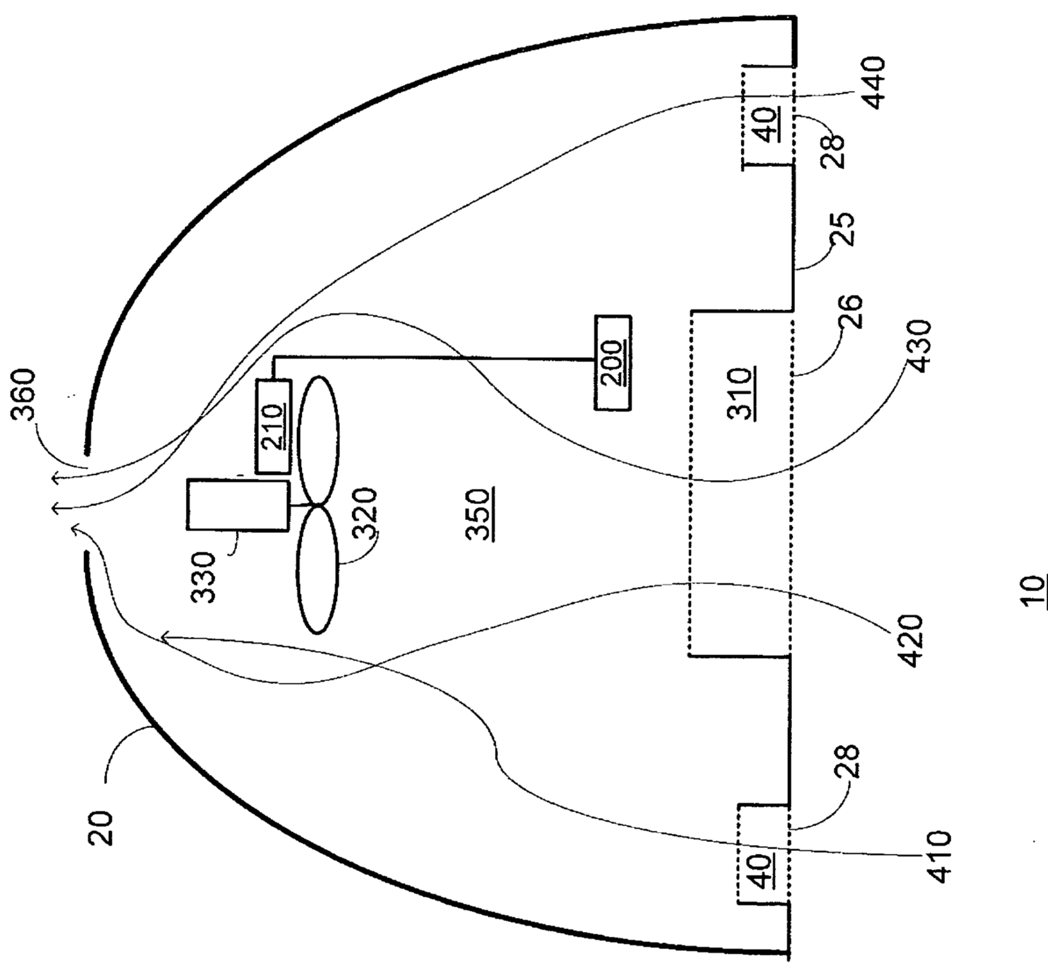


FIG. 14

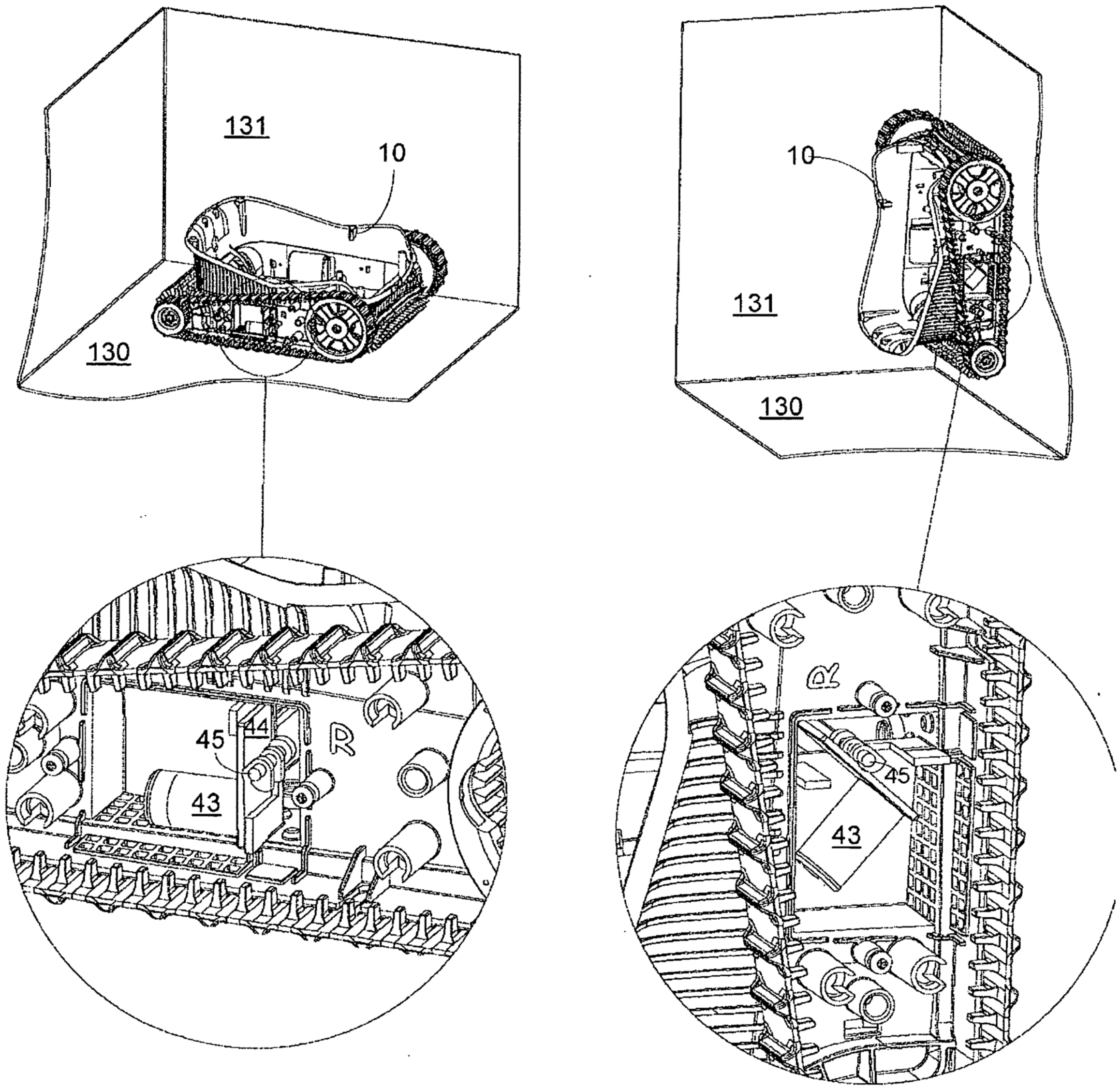


FIG. 15

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 61875066 B **[0001]**

EXHIBIT C

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 706 170 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.11.2020 Bulletin 2020/45

(51) Int Cl.:
E04H 4/16 *(2006.01)*

(21) Application number: **13183973.0**

(22) Date of filing: **11.09.2013**

(54) **Pool cleaning robot**

Schwimmbeckenreinigungsroboter

Robot de nettoyage de piscine

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **11.09.2012 IL 22187712**

(43) Date of publication of application:
12.03.2014 Bulletin 2014/11

(60) Divisional application:
19205736.2 / 3 623 545

(73) Proprietor: **Maytronics Ltd.**
19350 Kibbutz Yizrael (IL)

(72) Inventors:
- **Boaz, Ben-Dov**
  1935000 Kibbutz Yizrae (IL)
- **Yohanan, Maggeni**
  15255 Ilaniya (IL)
- **Jackov-Guy, Ben-Simon**
  20692 Yokneam (IL)
- **Yair, Hadari**
  12110, Kibbutz Hulata (IL)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Thierschstrasse 11
80538 München (DE)

(56) References cited:
EP-A2- 2 447 448
DE-A1- 2 801 394
US-A1- 2010 306 931
US-A1- 2011 000 032

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND

[0001] Cleaning robots are known in the art. Various cleaning robots are manufactured by Maytronics Ltd. of Israel and represent the state of the art of cleaning robots.

[0002] A cleaning robot is expected to clean the pool by brushing the surfaces of the pool and filtering the fluid of the pool by removing foreign particles from that fluid. The cleaning robot can be requested to move along various paths and change its direction when cleaning the pool.

[0003] There is a growing need to provide an efficient cleaning robot.

[0004] Document US2010306931 (A1) discloses a pool cleaning robot provided for cleaning a surface of a swimming pool. The robot comprises a main housing, a pair of main wheels disposed at opposite ends of a bottom panel of the housing spanning along a majority of its width and carrying a pair of continuous tracks spanning between edges thereof, the main wheels being configured for rotating at a first angular velocity, at least one inlet being formed in the bottom panel between the main wheels and being configured for intake of water and debris, and at least one auxiliary brushwheel disposed between the main wheels. The robot is configured for rotating the auxiliary brushwheel about an axis of rotation at a second angular velocity which is substantially greater than the first angular velocity.

SUMMARY

[0005] According to the invention, there is provided a cleaning robot defined by the technical features of claim 1. Advantageous embodiments thereof are defined in dependent claims 2-7.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 illustrates a cleaning robot.
Figs. 2-4A illustrate a front brushing unit and various interfaces.
Fig. 4B is a cross sectional view of a front brushing unit and various interfaces.
Fig. 5 illustrates a cleaning robot.
Figs. 6-12 are cross sectional views illustrating various portions of cleaning robots according to various embodiments of the invention;
Fig. 13 illustrates a rear panel of a cleaning robot according to an embodiment of the invention;
Figs. 14, 15 and 18 are cross sectional views illustrating various portions of cleaning robots according to various embodiments of the invention;
Fig. 16 illustrates a nozzle, a pump motor, and drive motor and a nozzle transmission according to a further embodiment of the invention;
Fig. 17 illustrates a cleaning robot according to an embodiment of the invention;
Fig. 18 illustrates a cleaning robot according to an embodiment of the invention;
Fig. 19 illustrates a portion of a cleaning robot according to an embodiment of the invention;
Fig. 20 illustrates a cleaning robot according to an embodiment of the invention;
Figures 21A and 21B illustrate a filtering unit according to an embodiment of the invention;
Figures 22 - 24 illustrate a cleaning robot according to various embodiments of the invention;
Figures 25-26 illustrate a portion of a cleaning robot according to various embodiment of the invention; and
Figure 27 illustrates a method.

[0007] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0008] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

[0009] The terms axis and axel are used in an interchanging manner. The term pool means any element that is capable of containing fluid.

[0010] Figure 1 illustrates a cleaning robot 10.

[0011] The cleaning robot 10 includes a housing 13 that includes a cover 11 that is pivotally connected to a main body 12 of the housing 13.

[0012] The cleaning robot 10 may interface a surface of a pool (to be cleaned by the robot) by two tracks - right track 310 and left track 312.

[0013] Right track 310 contacts rear right wheel 320 and a right side of a front brushing unit 200. Especially, inner teeth (not shown) of right track 310 match teeth of track receiving portion 220 that is positioned at the right side of the front brushing unit 200 and teeth (not shown) of a track receiving portion of the rear right wheel 320.

[0014] Left track 312 contacts rear left wheel 322 and a left side of front brushing unit 200. Especially, inner teeth of left track 312 match teeth of a track receiving portion (not shown) positioned at the left side of the front brushing unit 220 and teeth (not shown) of a track receiving portion of the rear left wheel 322.

[0015] The external teeth of each of tracks 310 and 312 may contact the surface of the pool.

[0016] Figure 1 also illustrates a right sidewall 15 of the housing 13 and a multiple-opening cover portion 450 that is positioned at a center of a rear panel 14 of the housing 13 and includes a right opening 452, a left opening 454 and a central opening 456 - the central opening 456 may include an array of narrow and elongated openings that have a curved cross section.

[0017] Figure 1 also illustrate a longitudinal axis 701 that is parallel to tracks 310 and 312 and a traverse axis 702 that is normal to the longitudinal axis 701, each of these axes is illustrates as being located at the center of the cleaning robot 10.

Reciprocation of cleaning element

[0018] A cleaning robot may include a drive motor; a housing that encloses the drive motor; a brushing element; and a transmission connected between the brushing element and the drive motor, the transmission may be arranged to convert a rotary movement induced by the drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) a reciprocal movement of the brushing element in parallel to the brushing element axis.

[0019] The brushing element axis may be parallel to a traverse axis of the housing.

[0020] The transmission may include a converter arranged to convert the rotary movement induced by the drive motor to the reciprocal movement. The rotary movement occurs within a rotary movement plane that is oriented in relation to the brushing element axis.

[0021] Referring to figure 2, the converter is illustrated as including (a) a first interface 202 that has a non-flat surface and may be arranged to be rotated by the rotary movement: (b) a second interface 201 that is positioned at fixed distance (distance of zero or more) from the rotary movement plane.

[0022] The second interface 201 may be arranged to contact the first interface 202 and to force the first interface 202 to reciprocate as a result of the rotary movement. The second interface 201 can have a cylindrical shape and (in order to reduce friction) may rotate about an axis that is parallel to the rotary movement plane.

[0023] The non-flat surface of the first interface 202 may have a sinusoidal cross section then when contacting the second interface 201 causes the front brushing element 211 to reciprocate.

[0024] Figure 2 illustrates one side (for example a left side) of the front brushing wheel and one side of the first interface 202.

[0025] The second side of the first interface 202 (that is proximate to the second side of the brushing unit 220) has a non-flat surface (for example a right side non-flat surface) that corresponds to the flat surface illustrated in figure 2 - so that at any orientation of the brushing wheel both non-flat surfaces induce a reciprocal movement to the same direction.

[0026] Thus, referring to the example set fourth in figure 2, the right non-flat surface of the first interface 202 has the same sinusoidal cross section wherein peaks of the sinusoidal cross section of the right non-flat surface are located at the same location (orientation wise) to corresponding minimal points of the sinusoidal cross section of the left non-flat surface.

[0027] Referring to figures 2 - 4A - the front brushing element 211 is connected to the first interface 202. The first interface 202 is connected to a rotating element 212 to facilitate a reciprocal movement of the first interface 202 and the front brushing element 211 in relation to the rotating element 212.

[0028] The rotating element 212 may include, for example, radially extending protrusions 212' that may be shaped as radially extending bars while the first interface 202 may have matching grooves (not shown) that allow reciprocal movement of the first interface 202 in relation to the rotating element 212. Alternatively - rotating element 212 may include grooves that match protrusions of the first interface 202. Alternatively - the rotating element 212 may have grooves and protrusions and the first interface 202 may include matching protrusions and grooves.

[0029] Although not shown there should be locking elements that prevent a detachment of the rotating element 212 from the first interface 202. These locking elements can be a part of the protrusions (for example - a protrusion that has a tip that is wider than the base of the protrusion). The protrusions may end by round shaped tips.

[0030] The rotating element 212 can be connected to the brushing element axel 214 via a cylindrical bearing 213.

[0031] A rotation of the rotating element 212 about a brushing element axis 214 may force the first interface 202 and the front brushing element 211 to rotate, in coordination with the rotating element 212, about the brushing element axis 214.

[0032] There is also provided a rim 220' that prevents a track 310 (that matches the teeth of track receiving portion 220 by size and gauge) from detaching from the track receiving portion 220 and does not show a rim and an annular groove that are shaped to fit a rounded notch of the housing. The track receiving portion 220 may be followed by the annular groove and the rim. Similar track receiving portions and rims are illustrated in US patent application 20090045110 of Garti.

[0033] The track receiving portion 220 is connected to the rotating element 212 and causes the latter to rotate. The rotation of the track receiving portion 220 is induced by track 310 that is rotated in response to an activation of a drive motor of the cleaning robot.

[0034] The rotation and reciprocal movements are obtained by having multiple brushing elements instead of a single one, allowing these brushing elements to move in relation to each other and one or more first interfaces that that have surfaces (that contact second interfaces) that not match each other such as to cause relative reciprocal movement of the brushing element in relation to each other. The different brushing elements (and additionally or alternatively the different first interfaces) can be connected to each other by elastic connectors such as springs.

[0035] Figure 4B is a horizontal cross sectional view of two brushing elements 240 and 250 and two interfacing elements 260 and 270 that share a rotating element 212.

[0036] Interfacing element 260 has an inner edge 261 that faces an inner edge 271 of interfacing element 270. Inner edges 261 and 271 may be connected to each other via elastic elements such as springs 280.

[0037] An outer edge 262 of interfacing element 260 may contact first interface 202 and an outer edge 272 of interfacing element 270 may contact another first interface 202

[0038] The first interfaces 202 and each one of outer edges 262 and 272 do not match each other - in order to induce relative lateral movement between interfacing elements 260 and 270 - and thus between brushing elements 240 and 250. For example, while outer edge 272 can have a sinusoidal cross section the outer edge 262 can have a planar cross section, a out of phase sinusoidal cross section, a ramped cross section and the like. Each of the brushing elements 240 and 250 is connected to a corresponding first interface out of first interfaces 260 and 270.

[0039] The interfacing elements 260 and 270 can be rotated by rotating element 212 while performing reciprocal movement in relation to rotating element 212. This can be achieved, for example, by using radially extending protrusions and matching curves in the rotating element 212 and each of the interfacing elements.

Change of direction of movement of the cleaning robot

[0040] The cleaning robot can be tilted in order to change the direction of movement of the cleaning robot. The change of direction can be induced in various manners.

[0041] According to a non claimed embodiment there is provided a cleaning robot 10 that may include (referring to figure 1) a housing 13 and multiple movable elements such a rear right wheel 320, rear left wheel 322 and a front brushing unit 200 that extends throughout the entire front panel of the housing 13. The cleaning robot is also equipped with a right track 310 and a left track 312.

[0042] When both tracks 310 and 312 contact the surface of the pool the cleaning robot 10 can move either forwards or backwards (depending upon the direction of rotation of tracks 310 and 312) - assuming that the movement of both tracks 310 and 312 are synchronized. Deviations from that direction of propagation can be achieved by jetting fluid from the cleaning robot 10 and especially by jetting fluid through openings of the multiple-opening cover portion 450.

[0043] If the different tracks do not contact the surface of the pool at the same manner (introduction of an imbalance between the tracks) and especially when one track contacts the surface while another does not contact the surface then the cleaning robot will turn towards the imbalance - towards the track that is in more contact with the surface. This imbalance can also be referred to as unevenness or asymmetry.

[0044] The pool leaning robot 10 may include an imbalance induction unit that may be arranged to introduce an imbalance between at least two movable elements that results in a change in a direction of propagation of the cleaning robot 10. The imbalance induction unit may be arranged to induce the imbalance as a result of a movement of a nozzle for outputting fluid from the cleaning robot (illustrated in figures 7-11), and, additionally or alternatively as a result of a movement of a diaphragm that is loosely connected to the housing (figures 5 and 6).

[0045] Figures 5 and 6 illustrates a cleaning robot 10 in which the imbalance induction unit may be arranged to induce the imbalance as a result of the movement of a diaphragm 300 that is loosely connected to the housing 13. The diaphragm 300, when positioned in a low position (figure 5 and 6) fits into an aperture 302 defined in the bottom panel 16 of the housing 13.

[0046] A change in the position of the diaphragm 300 may be responsive to a change in a status of an impeller 70 of the cleaning robot. When the impeller 70 draws fluid through input nozzle 410 (and through aperture 302) the diaphragm 300 is drawn upwards - towards the impeller 70.

[0047] The diaphragm transmission 330 may be arranged to convert a change in a location of the diaphragm 300 to a change in an elevation of the protrusion 350 that once located at a low position contacts the surface of the pool and induces the imbalance between the at least two movable elements.

[0048] The protrusion 350 may be illustrated as being distant from a longitudinal axis of symmetry of the cleaning robot 10. It should not be located along the longitudinal axis in order to induce an imbalance between tracks 312 and 310. Alternatively, the protrusion 350 can be located at the longitudinal axis but will have an asymmetrical tip (such as a sloped tip) that contacts the surface of the pool such as to introduce the imbalance.

[0049] Figure 6 illustrates the diaphragm transmission 330 as connected to the diaphragm 300 via handle 332 that vertically extends from the diaphragm 300 and (a) forces the diaphragm 300 to perform a rotational movement, and (b) translates the rotational movement to a linear movement so that protrusion 350 moves downwards (when the diaphragm 300 movers towards the impeller 71 and thereby tilts the cleaning robot towards the right (and even detaching left track 312 from the surface of the pool). It is noted that the diaphragm can follow other paths than the curved path forced by the diaphragm transmission 330 of figure 5.

[0050] After the impeller 71 stops drawing the fluid, the diaphragm 300 returns to its low diaphragm position and may seal the aperture 302.

[0051] Figure 6 illustrates an example of a diaphragm transmission 330. It includes a diaphragm axle 334 that is horizontal and is rotatably connected to a vertical inner wall 360 of the cleaning robot 10 via curved clips 336 that allow the diaphragm axle 334 to rotate about an axis.

[0052] The diaphragm axle 334 is connected to two radially extending elements - a first radially extending element 333 that is rotatably connected to handle 332 and a second radially extending element 338 that is rotatably connected to protrusion 350 such as to translate the rotational movement of the diaphragm axle 334 to (a) a curved movement of the diaphragm 300 and to (b) a linear movement of the protrusion 350 (the movement of the latter is further confined to linear movement by an aperture in the bottom panel 16 through which the protrusion 350 moves.

[0053] Figures 7-11 illustrate an imbalance induction unit that may be arranged to induce an imbalance between moving components of the cleaning robot as a result of a movement of a nozzle for outputting fluid from the cleaning robot 10.

[0054] The nozzle 410 can be moved along a predefined path and the movement of the nozzle 410 can be translated (by a nozzle transmission) to a linear movement of a protrusion that can tilt the cleaning robot and induce the imbalance.

[0055] Figures 7 - 11 illustrate a conversion of a rotary movement of the nozzle 410 to a linear movement of the protrusion 350. It is noted that there can be provided other types of movements (of either one of the nozzle and the protrusion). For example the protrusion can have a radially a-symmetrical cross section and can be rotated in order to introduce the imbalance. For example an X shaped cross section protrusion can be rotated in order to introduce the imbalance, an elliptical cross section protrusion can be rotated in order to induce the imbalance and the like. Yet for another example the nozzle can be moved along a linear path.

[0056] The protrusion 350 may be illustrated as being distant from a longitudinal axis of symmetry of the cleaning robot 10. It should not be located along the longitudinal axis in order to induce an imbalance between tracks 312 and 310. Alternatively, the protrusion 350 can be located at the longitudinal axis but will have an asymmetrical tip (such as a sloped tip) that contacts the surface of the pool such as to introduce the imbalance.

[0057] Figure 7 is a cross sectional view of the cleaning robot 10 that illustrates various internal components of the cleaning robot - such as filtering unit 20. Figures 21A and 21B illustrate the filtering unit 20 according to various embodiments of the invention.

[0058] The filtering unit 20 may include one or more filters of one or more filtering levels (a filter level defines the size of particles that may pass through the filter) such as a gross filter and a fine filter.

[0059] It is noted that the filtering unit 20 can include three or more filters. It may have at least one additional filter.

[0060] Any additional filter may have a filtering level that differs from the first and second filtering levels or equals one of the first and second filtering levels.

[0061] The cleaning robot can have a handle that is coupled to the filtering unit and extends outside an opening formed in the housing.

[0062] The handle can be connected to the filtering unit and extend outside an opening formed in the housing.

[0063] The fluid can enter the filtering unit 20 through an opening 380 that is formed in the bottom plate 16 of the housing this opening 380 allows fluid to enter an inner space surrounded by a first filter 21, to be filtered by the first filter 21 to provide a firstly filtered fluid that propagates towards the second filter 22 to be further filtered by the second filter to provide secondary filtered fluid (Also referred to as filtered fluid). According to the invention the second filter 22 may partially surround the first filter 21.

[0064] The first filtering level may exceeds the second filtering level - as the first filter 21 is arranged to perform a coarser filtering than the second filter 22.

[0065] Figure 7 illustrates the pump motor 80 that drives the impeller 70 as being oriented at about forty five degrees to the bottom panel 16 but other orientations can be provided.

[0066] The nozzle 410 can rotate about a nozzle axis that is parallel to a traverse axis of the cleaning robot 10, wherein the rotation can occur within a central plane that includes the longitudinal axis of the cleaning robot 10.

[0067] Figures 8-10 illustrate a spring 352 that is positioned between (a) disk 353 that is connected to protrusion 350 and (b) upper disk 354 that surrounds the opening through which protrusions 350 moves.

[0068] The spring 352 induces the protrusion 350 to be elevated to a higher protrusion position in which the lower end of protrusion 350 does not contact the surface of the pool - and does not introduce an imbalance between tracks 310 and 312.

[0069] The protrusion 350 may be moved downwards to a lower protrusion position and to induce the imbalance between the tracks by nozzle transmission 420 that converts a counterclockwise movement of the nozzle 410 to a downwards movement of the protrusion 350.

[0070] The nozzle transmission 420 includes: nozzle axle 442 that is connected to a vertical bevel gear 502 (used to rotate the nozzle 410) and is rotatably connected to second vertical inner wall 362 of the cleaning robot 10 via curved clip 441 that allows the nozzle axle 442 to rotate about an axis. The nozzle axle 442 is connected to a radially extending element 423 that interfaces with a first fin 425 that is fixed to a second fin 424. The second fin 424 is rotatably connected to sidewall of housing 13 and is parallel to the sidewall while first fin 425 is normal to that sidewall. A clockwise rotational movement of the nozzle axle 442 elevates radially extending element 423 that in turn elevates first fin 425 and causes the second fin to rotate counterclockwise and thereby lower projection 350 that is rotatably connected to the second fin 424 (via cylindrical interfacing element 426).

Multiple directional fluid jetting arrangement

[0071] Fluid can be jetted from the cleaning robot in multiple different directions, wherein the directions are determined by a rotational movement of the nozzle and by the state of the impeller 70 - static, rotational movement along a first direction and rotational movement along a second rotational direction.

[0072] Referring to figures 1 and 12-15 the cleaning robot 10 is illustrated as including a housing 13 that includes a multiple-opening cover portion 450. The multiple- opening cover portion 450 is positioned at a center of a rear panel 14 of the housing 13 and includes a right opening 452, a left opening 454 and a central opening 456 that includes an array of narrow and elongated openings that have a curved cross section.

[0073] The right opening 452 faces the right of the cleaning robot 10.

[0074] The left opening 454 faces the left of the cleaning robot 10 and both openings (452 and 454) can be parallel to the left or right sidewalls of the housing 13.

[0075] The multiple-opening cover portion 450 is positioned at the center of the cleaning robot 10 and its right and left openings 452 and 454 are positioned in a symmetrical manner in relation to the longitudinal axis 701 of the cleaning robot 10. They have the same shape (rectangular) and size but may differ from each other by shape size, and location.

[0076] The right opening 452 is preceded by a right fluid conduit 462 that is substantially horizontal. The right fluid conduit 462 may be arranged to direct fluid from the nozzle 410 to the right of the housing (through the right opening 452).

[0077] The left opening 454 is preceded by a left fluid conduit 464 that is substantially horizontal. The left fluid conduit 464 may be arranged to direct fluid from the nozzle 410 to the left of the housing (through the left opening 454).

[0078] Figures 12, 14 and 15 illustrate the right and left fluid conduits 462 and 464 as sharing a sidewall.

[0079] The central opening 456 is preceded by a central conduit 466 that faces the nozzle 410.

[0080] The nozzle 410 can be rotated and thus follow a curved path that changes its orientation, for example from being vertical to being horizontal. Other ranges of orientations can be obtained.

[0081] Figure 16 illustrates the nozzle 410, a pump motor 80, a drive motor 82, , a removable cover 506 of a sealed housing (not shown) that encloses the drive motor 82 and the pump motor 80), a horizontal bevel gear 504 that mashes with a vertical bevel gear 502, the horizontal bevel gear 504 rotates about an vertical axis by a motor (not shown) and this rotation is translated by the pair of horizontal and vertical bevel gears 504 and 506 to a vertical rotation of the nozzle 410 that changes the orientation of the nozzle.

[0082] The nozzle 410 can be rotatably connected to a support element (not shown) that may support the nozzle 410 and facilitate the rotational movement of the nozzle 410. The nozzle 410 can interface with a curved cover 560 that prevents fluid from exiting a path defined by the nozzle 410 and any of the conduits (462, 464 and 466) during the entire rotational movement of the nozzle 410.

[0083] The horizontal and vertical bevel gears 502 and 504 and the motor that drives the horizontal bevel gear 502 may form a nozzle manipulator that may be arranged to rotate the nozzle 410 about a nozzle axis such as to alter an orientation of the nozzle 410 in relation to the longitudinal axis 701.

[0084] The right, left and central conduits 462, 464 and 466 may belong to a fluid interfacing unit that may be arranged to direct fluid from the nozzle 410 (a) towards the central fluid conduit 466 when the nozzle 410 is at a first orientation, (b) towards the right fluid conduit 462 when the nozzle 410 is at a second orientation, and (c) towards the left fluid conduit 464 when the nozzle 410 is at a third orientation. The first orientation differs from the second and third orientations.

[0085] The second orientation may substantially differ from the third orientation - but this is not illustrated in figures 12, 14 and 15.

[0086] These figures (figures 12, 14 and 15) illustrate an embodiment in which the second orientation substantially equals the third orientation (for example - a forty five degree orientation) and wherein a selection between the left fluid conduit 464 and the right fluid conduit 462 may be made by rotating the nozzle 410 and, additionally or alternatively, by changing an operational mode of the impeller 70 - static, rotation at a first rotational direction or rotation at a second rotational direction.

[0087] Figures 12, 14 and 15 illustrate a shutter 550 that is pivotally connected to a shared sidewall 552 of the left and right fluid conduits 462 and 464. The shutter 550 is pivotally connected to the shared sidewall 552 via a spring (not shown) that tends to force the shutter 550 towards an initial shutter position in which the shutter 550 is slightly oriented towards an opening 464' formed in the left fluid conduit 464.

[0088] The nozzle 410 can be moved from a first or fourth orientation to a second orientation while the impeller 70 pushes fluid to exit the nozzle 410 during this movement so that the flow of fluid will cause the shutter 550 to complete an upward (clockwise) movement (and be out of the reach of the nozzle 410) and to shut the opening 464' formed in the left fluid conduit 464 so that the fluid can enter opening 462' formed in the right fluid conduit 462 and exit through the right opening 452.

[0089] If the same movement of the nozzle 410 is done without pushing fluid towards the shutter 550 then the nozzle 410 can move the shutter 550 downwards to close the opening of the 462' formed in the right fluid conduit 462 so that the fluid can enter opening 464' formed in the left fluid conduit 464 and to exit through the left opening 454.

[0090] The nozzle manipulator unit may be arranged to position the nozzle 410 at a fourth orientation that may also face the center opening 466.

[0091] Figure 17 illustrates a robot 11. The robot 10 has a multiple opening structure 720 that has a right aperture 724, a left aperture 723, a upper aperture 722 and a rear aperture 721 that face the right, left, upper and rear directions and are preceded by fluid conduits that facilitate a flow of fluid from an inner space in which the nozzle is allowed to move such as to face one or more of these fluid conduits and allow the fluid to exit via one of the apertures and assist in directing the robot to move along a desired direction. The nozzle can perform a movement along to degrees of freedom so that it can face the different openings.

Asymmetrical position of components

[0092] Figure 18 illustrates a cleaning robot that includes a drive motor 610 that is arranged to rotate multiple rotating elements such as any of the wheels and tracks mentioned in any of the previous figures), at least some of which are arranged to contact a surface of the pool, an impeller 70, a pump motor 80 that is arranged to rotate the impeller 70; a housing 13 that encloses a drive motor (not shown), the pump motor 80 and the impeller 70; a filtering unit 20; and front and rear brushing units 200 and 200'.

[0093] The pump motor 80, the drive motor and the impeller 70 are substantially closer to a front edge 601 of the housing than to a rear edge 604 of the housing. Their center of gravity is located between a traverse axis 701 and the front edge 601.

[0094] The proximity of these components to the front edge (and the placing of these components outside the center 630 of the housing) may assist in reducing the aggregation of air bubbles in the cleaning robot - as bubbles that enter the pool cleaning robot via apertures located at the housing are not forced to pass through the filtering unit 20 (positioned near the rear edge of the housing) and are also (if entering the front edge that may surface above the fluid of the pool) may be quickly ejected by the impeller that is also located near the front edge.

[0095] A distance of each one of the pump motor, drive motor and the impeller from the front edge of the housing is at least 10%, 15%, 20%, 25%, 30% smaller than a corresponding distance to the rear edge of the housing.

Optical sensor and compass

[0096] The robot can have an optical sensor 800 that may be arranged to detect motion. The detection signals of the optical sensor can be processed by a controller that may in turn control the movement of the robot according to a desired path and motion detection. The optical sensor 800 can be located at the bottom of the robot or in any other location. Figure 19 illustrates a robot that is equipped with an optical sensor 800 that is positioned at the center of the robot (along its longitudinal axis) and at the bottom panel of the robot. It is noted that the optical sensor 800 can be located elsewhere. The optical sensor 800 can include a radiation source 801, a detector 802, optics 803 and a detection signal processor 804. The detector 802 and the detection signal processor 804 can be equivalent to those that are being used in a computer mouse.

[0097] The radiation source 801 can include one or multiple light sources such as an array of light emitting diodes. The radiation source 801 can generate radiation at various wavelengths - such as between 630 to 618 nm. The optics 803 may include an objective lens that is expected to focus reflected radiation from the surface of the pool onto the detector 802, while the detector is more distant (for example - 20 mm) from the surface of the pool in comparison to the distance (about 6 mm) from the detector of a computer mouse to a surface. The depth of view of the objective lens should be about 4 mm and the radiation can be impinging on the surface at an angle of about 45 degrees.

[0098] Additionally or alternatively, the robot may include a pair of compasses that may provide directional information that may be processed in order to determine the location of the robot.

[0099] Figure 20 illustrates a robot that is equipped with a first compass 810 and a second compass 820.

[0100] The first and second compasses 810 and 820 are either positioned or configured so that they are expected to react in a different manner to magnetic field interferences that result from metal elements such as metal infrastructure that belongs to the pool, supports the pool or otherwise is proximate to the pool. The first and second compasses 810 and 820 can be positioned in different locations - for example the first compass 810 can be positioned above the second compass 820 so that the first compass will be more sensitive to magnetic interferences resulting, from example, from the bottom of the pool. The compasses can be magnetically shielded in a different manner than the other compass.

[0101] It is expected that at the absence of magnetic interferences both compasses will provide substantially the same directional information. Usually small deviations between the directional information provided by different compasses are allowed.

[0102] A threshold can be defined and it should exceed the small deviation by a safety margin.

[0103] If the differences between first directional information provided by the first compass 810 and second directional information provided by the second compass 820 exceeds the threshold it may be concluded that at least one of the compasses is magnetically interfered. In this case at least one or both of the first or second directional information can be ignored of or given lower weight.

[0104] It is noted that the processor 830 can compare between the first and second directional information by applying multiple thresholds or by applying non-threshold based comparisons.

[0105] The first compass 810 and the second compass 820 provide their directional information to a processor 830 that is arranged to receive directional information from the first and second compasses and to determine a direction parameter of the cleaning robot based upon the first and second directional information.

[0106] The processor 830 may be arranged to compare the first and second directional information to provide a comparison result; and to determine a validity of at least one of the first and second directional information based upon the comparison result.

[0107] The processor 830 may be arranged to declare the first directional information as invalid if a difference between the first and second results exceeds the threshold.

[0108] The processor 830 may be arranged to declare the first directional information and the second directional information as invalid if a difference between the first and second results exceeds a threshold.

[0109] Figure 20 illustrates the first compass 810 as being positioned above the second compass 820.

[0110] The cleaning robot can also include a non-magnetic sensor arranged to generate output signals indicative of a location of the cleaning robot. The non-magnetic sensor can be a counter that counts rotations of a wheel of the cleaning robot, a gyroscope, an accelerometer, an optical sensor or any other non-magnetic sensor that can obtain information without relying on magnetic fields and that may output location information or information that can be processed to obtain the location of the cleaning robot.

[0111] Figure 20 also illustrates the non-magnetic sensor 840. It is coupled to the processor 830.

[0112] The processor 830 may be arranged to assign more weight to output signals of the non-magnetic sensor 840 than to the first and second directional information if it is determined that a difference between the first and second results exceeds a threshold.

[0113] The robot can have both compass 810 and 820 as well as optical sensor 800 or only one of these components.

[0114] Figures 22 - 24 illustrate a cleaning robot 900. Figure 25-26 illustrate a portion of the cleaning robot 900. Figures 22-25 illustrate a door 908 of the cleaning robot 900 at a closed position while figure 26 illustrates the door 908 at an opened position. Figure 22 is a cross sectional view of the cleaning robot 900 taken about the center of the cleaning robot 900 while figure 23 is a cross sectional view taken along an virtual axis that is proximate to a left edge of the housing 902 of the cleaning robot 900. Figure 24 illustrates the flow (via arrows 950) of fluid through the cleaning robot 900. Figures 25-26 illustrates parts of a housing 902 and the door 908.

[0115] These figures illustrate a mechanism that allows draining fluid through a rear opening of a cleaning robot once the robot is pulled out from the fluid - and also allows the rear opening to be sealed when the robot is submerged in fluid. The selective sealing of the rear opening can be obtained by rotational movement of a door. The opening and sealing can be obtained by using a floating element and without mechanical means (such as springs or other elastic elements) to force the door to seal the rear opening. This is expected to increase the life span of the cleaning robot and simplify its maintenance as springs tend to malfunction. Another advantage, in relation to a spring mechanism, is that the normal rear door position, when out of water with cleaner in a horizontal position e.g.: for storage or hibernation, will always remain open. This reduces the risk of a rear door becoming stuck or glued to the opening 920 as the gravity acts the opposite to flotation 914

[0116] Cleaning robot 900 can include any combination of any of the components listed in any of the previous figures.

[0117] The cleaning robot 900 may include: a housing 902 having a front portion 904, a rear portion 906, a door 908 and a hinge 910.

[0118] Figures 22-24 also show other elements of the cleaning robot 900 such as filtering unit 20, impeller 70, pump motor 80, drive motor (denoted 82 of figure 23), aperture 380, front and rea brushing units 200 and 200' and right track 310.

[0119] The door 908 is pivotally connected to the rear portion 906 of the housing 902 via the hinge 910. The upper edge of the door 908 can be connected to the hinge 910 in a manner that allows a rotational movement of the door 908 in relation to the hinge 910.

[0120] The rear portion 906 of the housing 902 may include a rear opening 920.

[0121] The door 908 is arranged to move between (a) a closed position in which the door 908 substantially closes the rear opening 920 and (b) an open position in which the door 908 does not close the rear opening 920.

[0122] The door 908 may include a floating element (for example - it may be in itself the floating element) or may be coupled to a floating element.

[0123] The floating element 912 is positioned to induce the door 908 to move to the closed position when the cleaning robot is submerged in fluid.

[0124] Assuming that a rotational movement of the door in a counterclockwise manner will induce the door to be at a closed position then the floating element is positioned to induce a counterclockwise movement. When looking from top of the cleaning robot 900 - when the door is at the closed position the floating element 912 may be positioned between the hinge 910 and the front portion 904 of the housing 902.

[0125] Accordingly - at least a portion of the floating element 912 may be closer to the front portion of the housing than the hinge.

[0126] If the door 908 includes the floating element 910 then a center of flotation of the door 908 may be closer to the front portion 904 of the housing 902 than the hinge 910.

[0127] If the door 908 is coupled to the floating element 912 then a center of flotation 914 of a combination of the door 908 and the floating element 912 is closer to the front portion 904 of the housing 902 than the hinge 910.

[0128] The door 908 can be made of a floating material.

[0129] The door 908 may be induced to move to an open position when the cleaning robot is pulled out from the fluid and the front portion 904 of the housing 900 is positioned above the rear portion 906 of the housing 902.

[0130] The cleaning robot 900 may include a limiting element for limiting an extent of movement of the door between the open and closed positions.

[0131] The limiting element may be the rear brushing unit 200'.

[0132] The limiting element (not shown) may be arranged to limit a movement of the hinge 910.The range of movement of the door 908 between the open and closed positions may not exceed ten centimeters. Alternatively, it may exceed ten centimeters. The door movement can be limited so when immersed in the water at horizontal position the door center of flotation will be between the hinge and the front (904).

[0133] The center of floating 914 can be positioned between hinge 910 and front portion 904 and not on the opposite side.

[0134] The range of movement of the door 908 between the open and closed positions may not exceed one, two or three centimeters.

[0135] The door 908 may have a curved cross section.

[0136] The width of the door 908 may exceed a predetermined portion of a width of the cleaning robot 900. The predetermined portion may be any percentage. Both widths are measured along a horizontal axis when the cleaning robot 900 is placed at a horizontal position.

[0137] The cleaning robot 900 may also include handle 930 that is connected to the front portion 904 of the housing 900.

[0138] Figure 27 illustrates a method 2700. Method 2700 includes stage 2710 of inserting a cleaning robot into a pool that is at least partially filled with fluid. The cleaning robot can be any of the cleaning robots illustrate din any one of figures 1-26.

[0139] Stage 2710 is followed by stage 2720 of activating the cleaning robot. The activating may include, for example, allowing the cleaning robot to move and to clean the pool in any manner mentioned in any one of figures 1-26.

[0140] Stage 2720 may include, for example:

i. Converting a rotary movement induced by a drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) a reciprocal movement of the brushing element in parallel to the brushing element axis.

ii. Converting the rotary movement induced by the drive motor to the reciprocal movement.

iii. Allowing the rotary movement to occurs within a rotary movement plane that is oriented in relation to the brushing element axis; wherein the converting is executed by a converter that may include: (a) a first interface that has a non-flat surface and is arranged to be rotated by the rotary movement: (b) a second interface that is positioned at fixed distance from the rotary movement plane; wherein the second interface is arranged to contact the second interface and force the first interface to reciprocate as a result of the rotary movement.

iv. Facilitating a reciprocal movement of the first interface and the brushing element in relation to the rotating element; whereas a rotation of the rotating element about the brushing element axis forces the first interface and the brushing element to rotate, in coordination with the rotating element, about the brushing element axis.

v. Introducing an imbalance between at least two movable elements of the cleaning robot, the imbalance results in a change in a direction of propagation of the cleaning robot, the imbalance may be induced as a result of at least one out of (a) a movement of a nozzle that is arranged to output fluid from the cleaning robot, and (b) a movement of a diaphragm that is coupled to the housing.

vi. Changing the position of the diaphragm in response to a change in an operational mode of an impeller of the cleaning robot.

vii. Allowing the diaphragm to be drawn towards the impeller when the impeller is rotated at a first rotational direction.

viii. Converting by a diaphragm transmission a change in a location of the diaphragm to a change in an elevation of a protrusion that once located at a low protrusion position extends below any of the multiple movable elements and induces the imbalance between the at least two movable elements.

ix. Inducing imbalance due to a movement of a nozzle that is arranged to rotate about an axis and thereby change a direction of fluid being outputted from the cleaning robot.

x. Converting a change in a location of the nozzle to a change in an elevation of a protrusion that once located at a low position contacts the surface of the pool and induces the imbalance between the at least two movable elements.

xi. Introducing an imbalance between at least two movable elements by detaching at least one of the at least two movable elements from the surface of the pool.

xii. Introducing the imbalance by a protrusion that is arranged to introduce the imbalance by moving to a position in which it contacts a surface of the pool and causes at least one of the movable elements to be spaced apart from the surface of the pool.

xiii. Rotating a nozzle about an nozzle axis such as to alter an orientation of the nozzle in relation to an imaginary longitudinal axis of the housing.

xiv. Directing fluid from the nozzle (a) towards the central fluid conduit when the nozzle is at a first orientation, (b) towards the right fluid conduit when the nozzle is at a second orientation, and (c) towards the left fluid conduit when the nozzle is at a third orientation; wherein the first orientation differs from the second and third orientations.

xv. Directing the fluid wherein the second orientation differs from the third orientation.

xvi. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein a selection between the left fluid conduit and the right fluid conduit is responsive to a rotation of the nozzle towards the second orientation.

xvii. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein a selection between the left fluid conduit and the right fluid conduit is responsive to an operational mode of the impeller.

xviii. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein the fluid interfacing unit comprises a shutter that is arranged to prevent fluid from entering the right fluid conduit when positioned at a first position and is arranged to prevent fluid from entering the left fluid conduit from entering the right fluid conduit when positioned at a second position.

xix. Moving the nozzle towards the second orientation in order to move the shutter between the first and second positions.

xx. Positioning the nozzle at a fourth orientation; wherein when in either one of the first and fourth orientations the nozzle faces the center opening.

xxi. Moving the cleaning robot wherein the pump motor, the drive motor and the impeller are substantially closer to a front edge of the housing than to a rear edge of the housing.

xxii. Moving the cleaning robot while determining a motion characteristic or a location characteristic of the cleaning robot in response to an outcome of (a) illuminating, by at least one light source an area of a surface of the pool being cleaned by the cleaning robot through optical lens at a non vertical angle, (b) and generating, by a detector, based upon light from the area of the surface of the pool, detection signals indicative of a motion of the cleaning robot; (c) receiving the detection signals and determining the motion characteristic or the location characteristic of the cleaning robot.

xxiii. Generating, by a first compass first directional information; generating by a second compass second directional information; wherein the first and second compasses are spaced apart from each other; receiving directional information from the first and second compasses, and determining at least one of a location parameter and a directional parameter of the cleaning robot based upon at least the first and second directional information.

xxiv. The generating may include comparing the first and second directional information to provide a comparison result; and determining a validity of at least one of the first and second directional information based upon the comparison result.

xxv. Declaring the first directional information as valid if a difference between the first and second results is below a threshold.

xxvi. Declaring the first directional information and the second directional information as invalid if a difference between the first and second results exceeds a threshold.

xxvii. Generating output signals indicative of a direction of the cleaning robot by a non-magnetic sensor and assigning more weight to output signals of the non-magnetic sensor than to the first and second directional information if it is determined that a difference between the first and second results exceeds a threshold.

xxviii. Converting a rotary movement induced by the drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) vibrations of the brushing element, the vibrations differ from the rotary movement.

xxix. Filtering fluid by a first filter of a filtering unit that and the filtering fluid filtered by the first filter by a second filter of the filtering unit, wherein the filtering unit comprises a first filter that has a first filtering level and a second filter that has a second filtering level that differs from the first filtering level.

xxx. Allowing a door (that is pivotally connected to a rear portion of a housing of a cleaning robot, the housing has a rear opening), to move between a closed position in which the door substantially closes the rear opening and an open position in which the door does not close the rear opening; wherein the door comprises a floating element or is coupled to a floating element, wherein the floating element is positioned and shaped to induce the door to move to the closed position when the cleaning robot is submerged in fluid and to remain in an open position when out of water in a horizontal position.

xxxi. Allowing the door to move between a closed position in which the door substantially closes the rear opening and an open position in which the door does not close the rear opening; wherein the door comprises a floating element or is coupled to a floating element, wherein the floating element is positioned and shaped to induce the door to move to the closed position when the cleaning robot is submerged in fluid.

[0141] Stage 2720 may be followed by stage 2730 of taking the cleaning robot from the pool.

List of elements

[0142]

a. Cleaning robot 10.
b. Cover 11
c. Main body 12.
d. Housing 13.
e. Rear panel 14
f. Right sidewall 15
g. Bottom panel 16.
h. Filtering unit 20.
i. First filter 21.
j. Second filter 22.
k. Impeller 70.
l. Pump motor 80.
m. Drive motor 82.
n. Spur 84.
o. Fluid surface 90
p. Front brushing unit 200.
q. Rear brushing unit 200'.
r. First interface 202.
s. Second interface 201.
t. Brushing element 211.
u. Rotating element 212.
v. Radially extending protrusions 212'.
w. Cylindrical bearing 213.
x. Brushing element axel 214.
y. Track receiving portion 220.
z. Brushing element 240.
aa. Brushing element 250.
bb. Interfacing elements 260, 270.
cc. Inner edges of interfacing elements 261, 271
dd. Outer edges of interfacing elements 262, 272
ee. Springs 280.
ff. Diaphragm 300.
gg. Aperture 302.
hh. Right track 310.
ii. Left track 312.
jj. Rear right wheel 320.
kk. Rear left wheel 322.
ll. Diaphragm transmission 330.
mm. Handle 332.
nn. First radially extending element 333.
oo. Diaphragm axle 334.
pp. Curved clips 336.
qq. Second radially extending element 338.
rr. Protrusion 350.
ss. Spring 352.
tt. Disk 353.
uu. Disk 354.
vv. First vertical inner wall 360.
ww. Second vertical inner wall 362.
xx. Nozzle 410.
yy. Nozzle transmission 420.
zz. Radially extending element 423.
aaa. First fin 425.
bbb. Second fin 424.
ccc. Cylindrical interfacing element 426.
ddd. Nozzle axle 442.
eee. Curved clip 441.
fff. Nozzle axle 442.
ggg. Multiple opening cover portion 450.
hhh. Right opening 452.
iii. Left opening 454.
jjj. Central opening 456.
kkk. Right fluid conduit 462.
lll. Opening 462' formed in the right fluid conduit 462.
mmm. Left fluid conduit 464.
nnn. Opening 464' formed in the left fluid conduit 464.
ooo. Central fluid conduit 466.
ppp. Vertical bevel gear 502.
qqq. Horizontal bevel gear 504
rrr. Removable cover 506 of a sealed housing.
sss. Shutter 550.
ttt. Curved cover 560.
uuu. Front edge 601 of the housing.
vvv. Rear edge 604 of the housing.
www. Spur 610.
xxx. Longitudinal axis 701.
yyy. Traverse axis 702.
zzz. Multiple opening structures 720.
aaaa. Right aperture 724.
bbbb. Left aperture 723.
cccc. Upper aperture 722.
dddd. Rear aperture 721.
eeee. Optical detector 800.
ffff. Radiation source 801
gggg. Detector 802
hhhh. Optics 803
iiii. Detection signal processor 804.
jjjj. First compass 810.
kkkk. Second compass 820.
llll. Processor 830.
mmmm. Non-magnetic sensor 840.
nnnn. Cleaning robot 900.
oooo. Housing 902.
pppp. Front portion 904.
qqqq. Rear portion 906.
rrrr. Door 908.
ssss. Hinge 910.
tttt. Floating element 912.
uuuu. Center of floatation 914
vvvv. Rear opening 920.

Claims

1. A cleaning robot (10, 900) comprising:

a housing (13, 902) that comprises an inlet (380) and an outlet (450, 410);
a filtering unit (20) that is arranged to filter fluid that enters through the inlet to provide filtered fluid that flows through the outlet;
wherein the filtering unit (20) comprises a first

filter (21) that has a first filtering level and a second filter (22) that has a second filtering level that differs from the first filtering level; the first filter (21) being arranged to perform a coarser filtering than the second filter (22), **characterized in that** the second filter (22) at least partially surrounds the first filter (21).

2. The cleaning robot according to claim 1 further comprising at least one additional filter.

3. The cleaning robot according to claim 1 further comprising an additional filter that has a filtering level that differ from the first and second filtering levels.

4. The cleaning robot according to claim 1 further comprising an additional filter that has a filtering level that equals one of the first and second filtering levels.

5. The cleaning robot according to claim 1 further comprising a handle that is coupled to the filtering unit (20) and extends outside an opening formed in the housing.

6. The cleaning robot according to claim 1 wherein the second filter (22) surrounds the first filter (21).

7. The cleaning robot according to claim 1 wherein the first filtering level exceeds the second filtering level and wherein the first filter (21) is arranged to provide firstly filtered fluid to the second filter (22).

Patentansprüche

1. Ein Reinigungsroboter (10, 900), der Folgendes umfasst:

   ein Gehäuse (13, 902), das einen Einlass (380) und einen Auslass (450, 410) umfasst;
   eine Filtereinheit (20), die angeordnet ist, um Flüssigkeit zu filtern, die durch den Einlass eintritt, um gefilterte Flüssigkeit bereitzustellen, die durch den Auslass strömt;
   wobei die Filtereinheit (20) einen ersten Filter (21) umfasst, der eine erste Filtrierstufe hat, und einen zweiten Filter (22), der eine zweite Filtrierstufe hat, die sich von der ersten Filtrierstufe unterscheidet; wobei der erste Filter (21) angeordnet ist, um eine gröbere Filtration durchzuführen als der zweite Filter (22); **dadurch gekennzeichnet, dass** der zweite Filter (22) den ersten Filter (21) zumindest teilweise umgibt.

2. Der Reinigungsroboter gemäß Anspruch 1, der weiter mindestens einen zusätzlichen Filter umfasst.

3. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen zusätzlichen Filter mit einer Filtrierstufe umfasst, die sich von der ersten und der zweiten Filtrierstufe unterscheidet.

4. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen zusätzlichen Filter mit einer Filtrierstufe umfasst, die gleich entweder der ersten oder der zweiten Filtrierstufe ist.

5. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen Griff umfasst, welcher mit der Filtereinheit (20) gekoppelt ist und sich außerhalb einer im Gehäuse geformten Öffnung erstreckt.

6. Der Reinigungsroboter gemäß Anspruch 1, wobei der zweite Filter (22) den ersten Filter (21) umgibt.

7. Der Reinigungsroboter gemäß Anspruch 1, wobei die erste Filtrierstufe die zweite Filtrierstufe übersteigt und wobei der erste Filter (21) angeordnet ist, um dem zweiten Filter (22) primär gefilterte Flüssigkeit zuzuführen.

Revendications

1. Robot nettoyeur (10, 900) comprenant :

   une coque (13, 902) qui comprend un orifice d'entrée (380) et un orifice de sortie (450, 410) ;
   une unité de filtration (20) qui est conçue pour filtrer du liquide qui pénètre par l'orifice d'entrée afin de fournir du liquide filtré qui s'écoule par l'orifice de sortie ;
   dans lequel l'unité de filtration (20) comprend un premier filtre (21) qui a un premier niveau de filtration et un deuxième filtre (22) qui a un deuxième niveau de filtration qui est différent du premier niveau de filtration ; le premier filtre (21) étant conçu pour effectuer une filtration plus grossière que le deuxième filtre (22),
   caractérisé en ce que le deuxième filtre (22) entoure au moins partiellement le premier filtre (21).

2. Robot nettoyeur selon la revendication 1, comprenant en outre au moins un filtre supplémentaire.

3. Robot nettoyeur selon la revendication 1, comprenant en outre un filtre supplémentaire qui a un niveau de filtration qui est différent des premier et deuxième niveaux de filtration.

4. Robot nettoyeur selon la revendication 1, comprenant en outre un filtre supplémentaire qui a un niveau de filtration qui est égal à l'un des premier et deuxième niveaux de filtration.

5. Robot nettoyeur selon la revendication 1, comprenant en outre une poignée qui est couplée à l'unité de filtration (20) et s'étend à l'extérieur d'une ouverture formée dans la coque.

6. Robot nettoyeur selon la revendication 1, dans lequel le deuxième filtre (22) entoure le premier filtre (21).

7. Robot nettoyeur selon la revendication 1, dans lequel le premier niveau de filtration dépasse le deuxième niveau de filtration et dans lequel le premier filtre (21) est conçu pour fournir du liquide filtré une première fois au deuxième filtre (22).

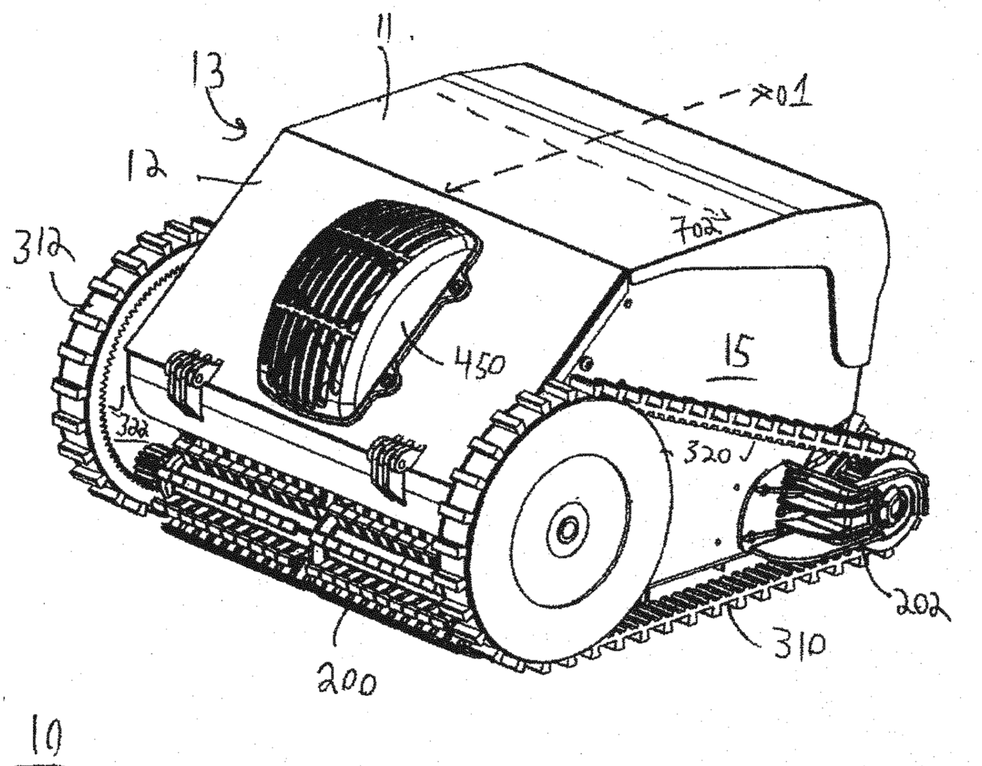


FIG. 1

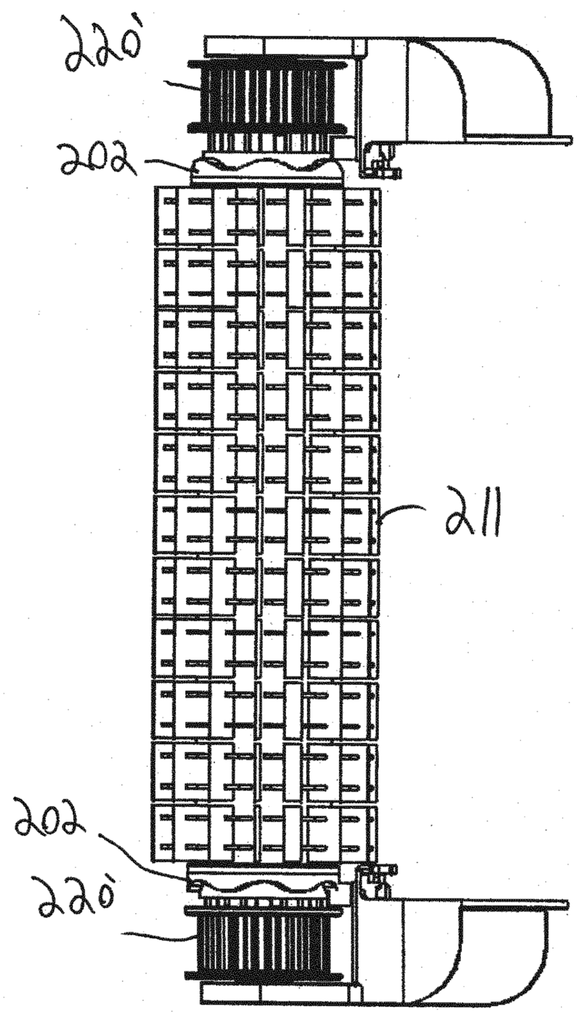


FIG.2

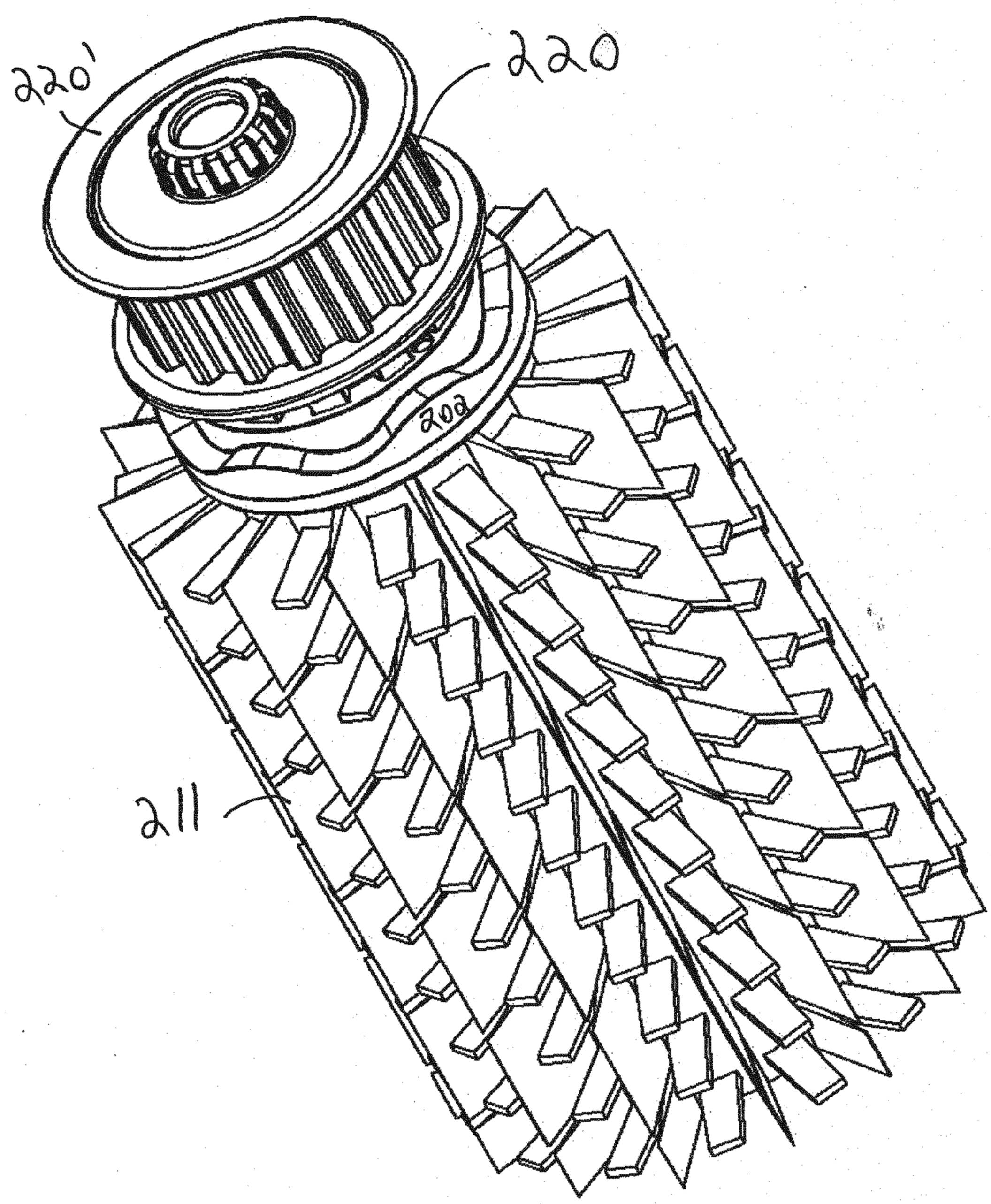


FIG. 3

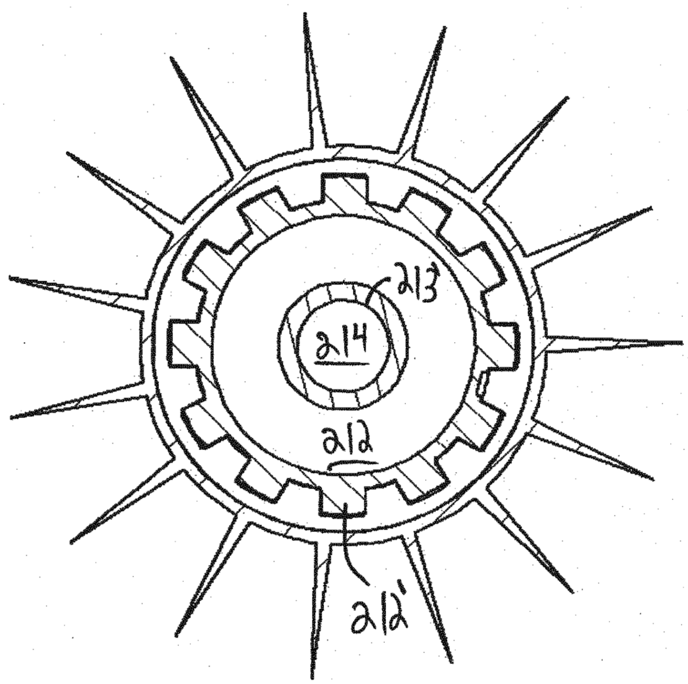


FIG. 4A

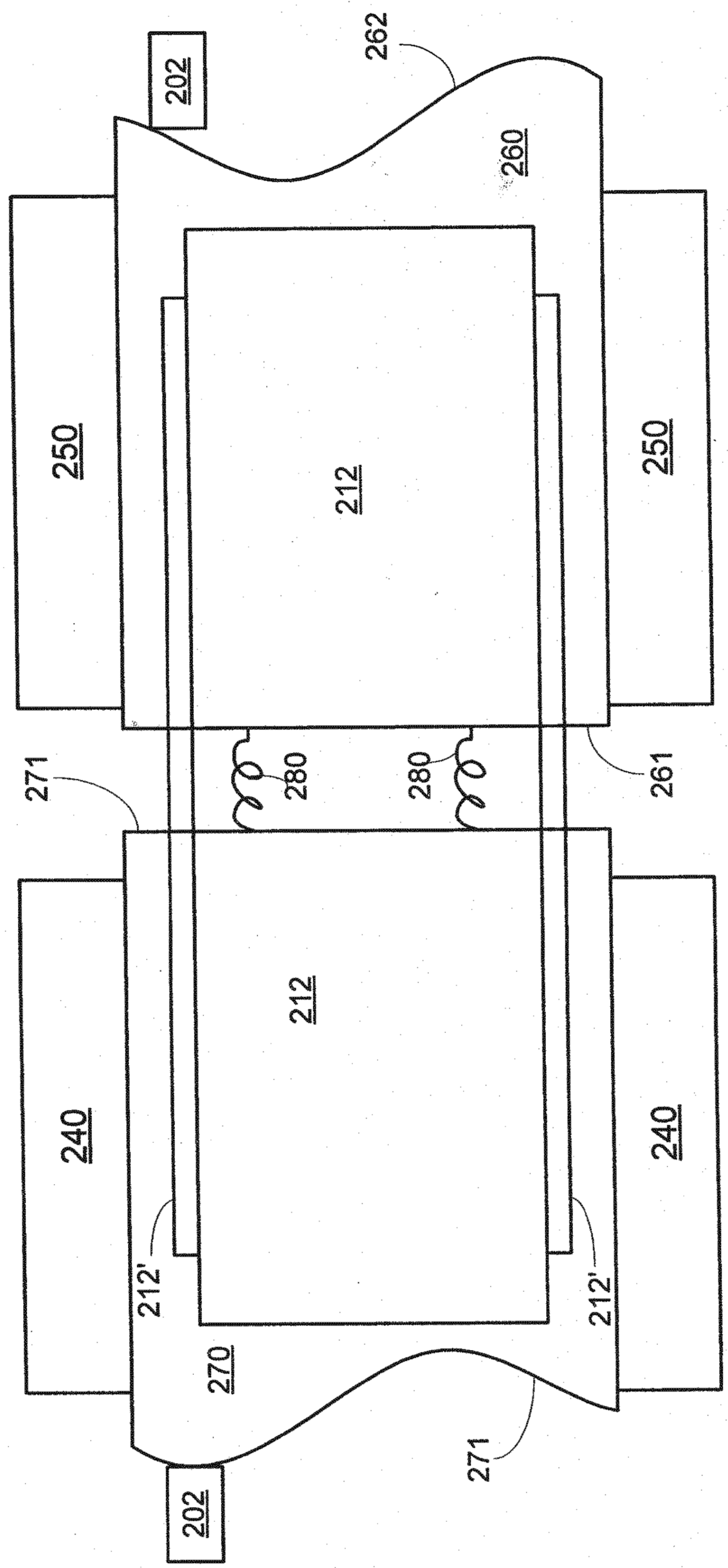

202
262
260
250
250
212
212
271
280
280
261
240
240
212'
212'
270
271
202

FIG. 4B

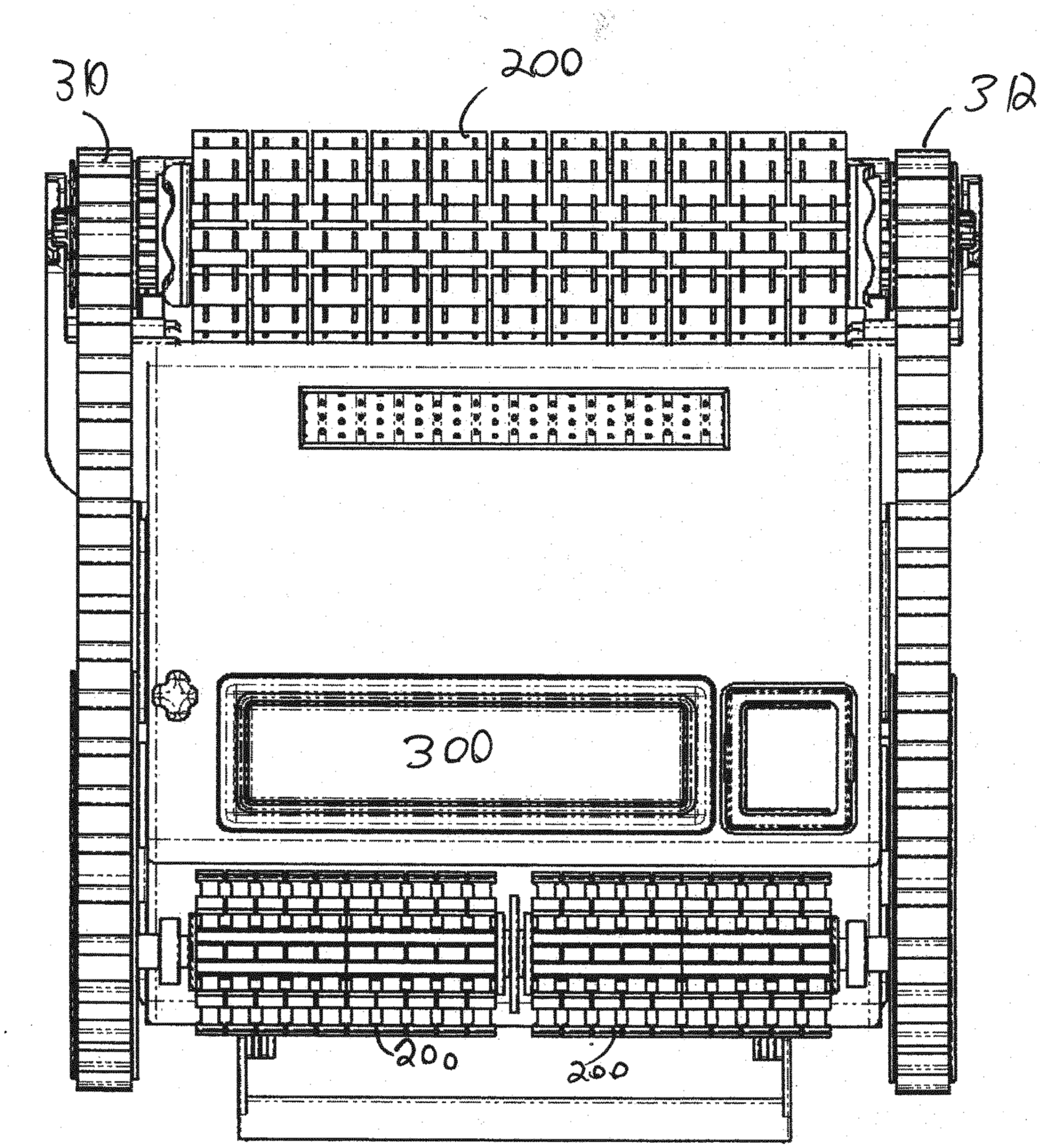


FIG.5

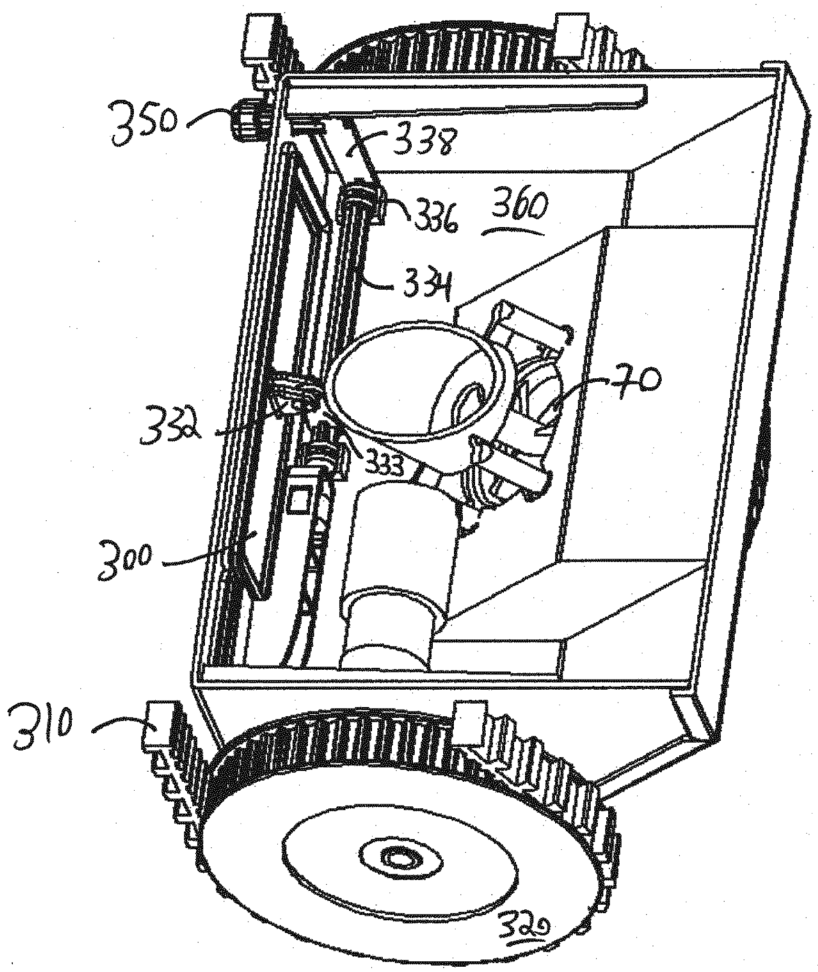


FIG. 6

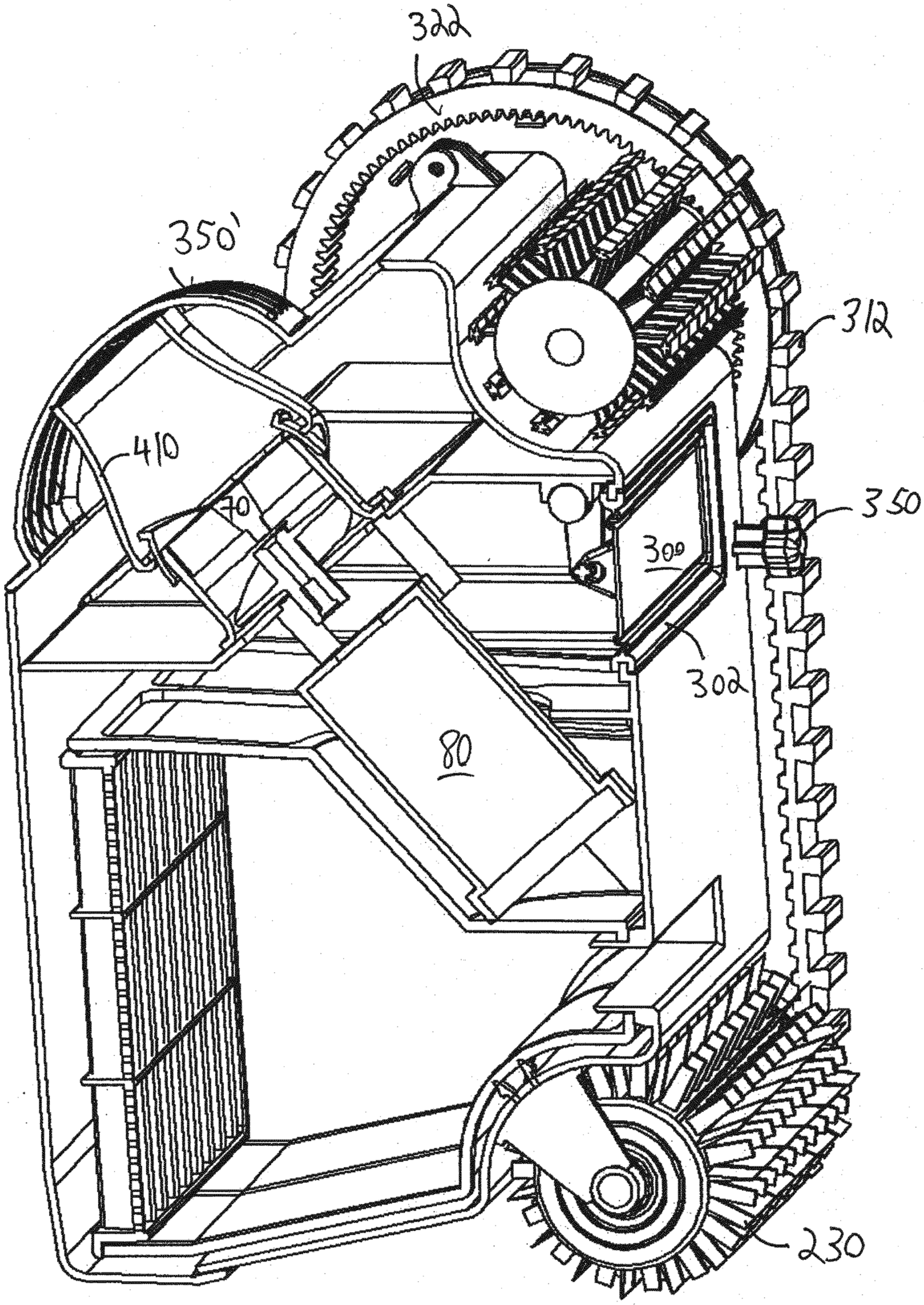


FIG. 7

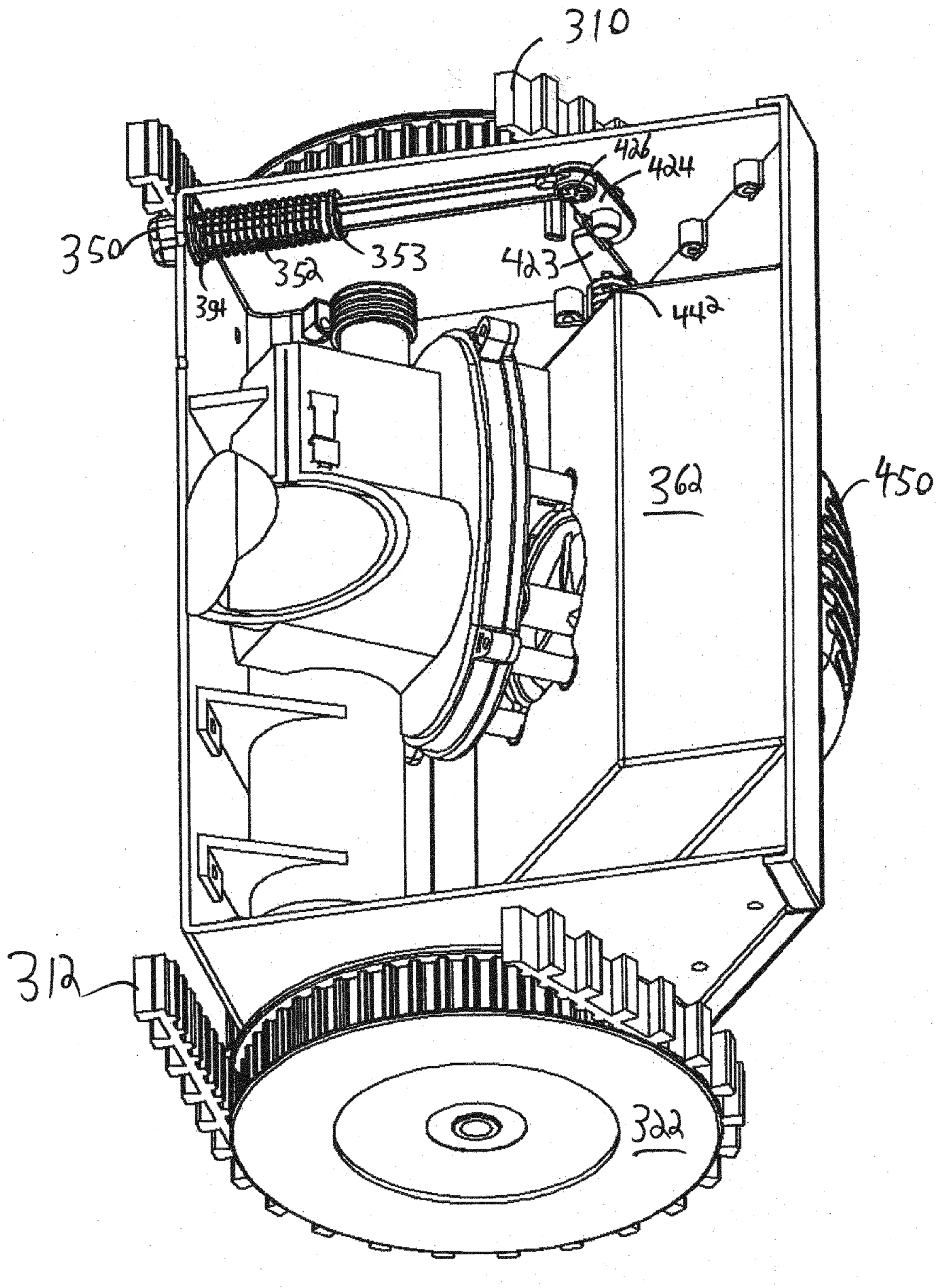


FIG.8

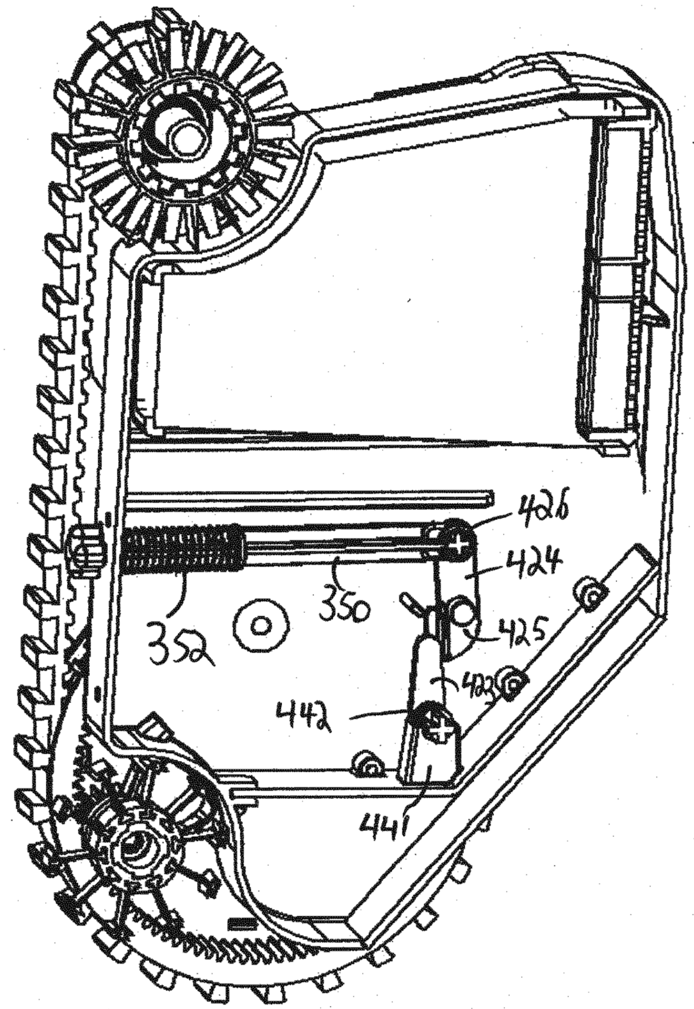


FIG. 9

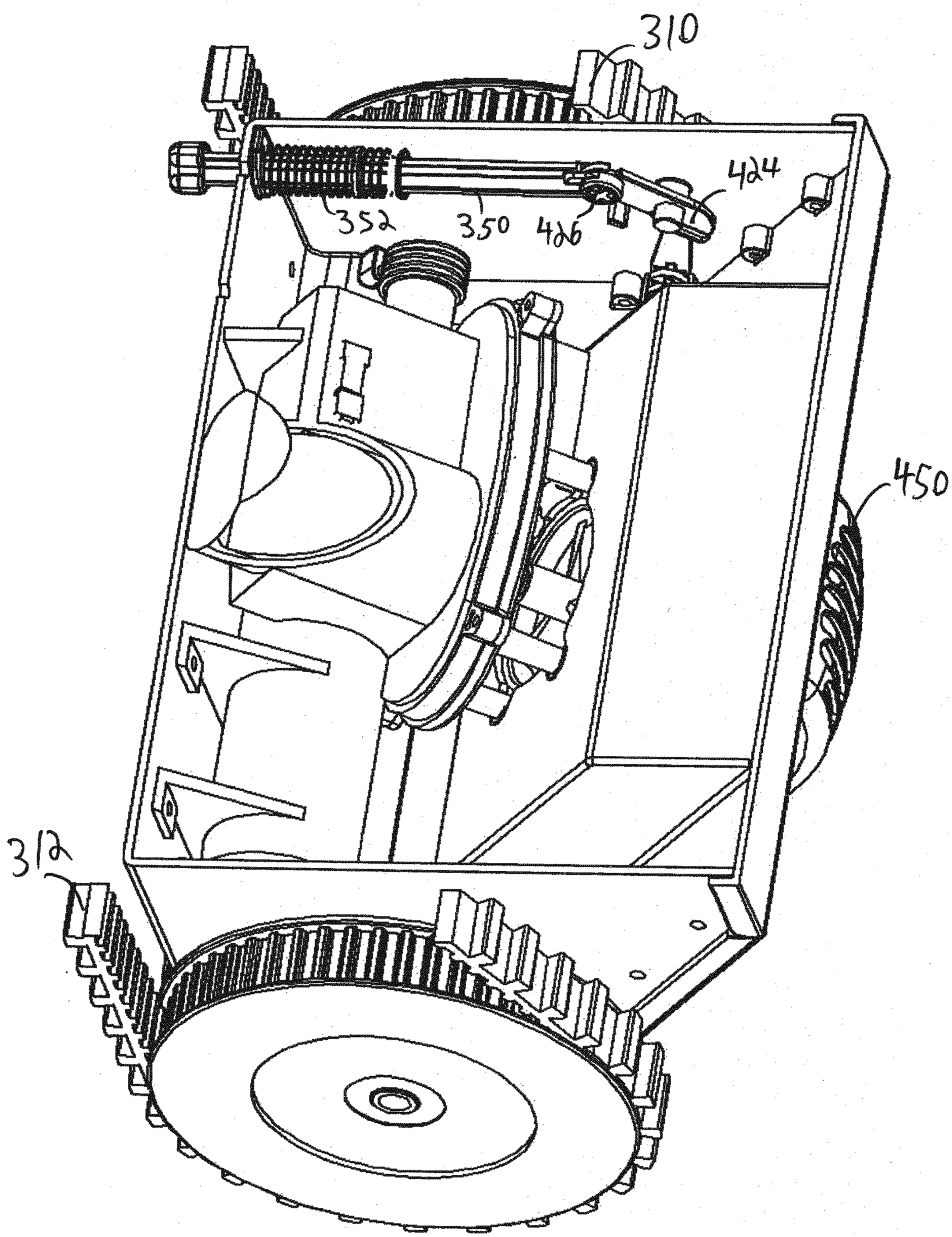


FIG. 10

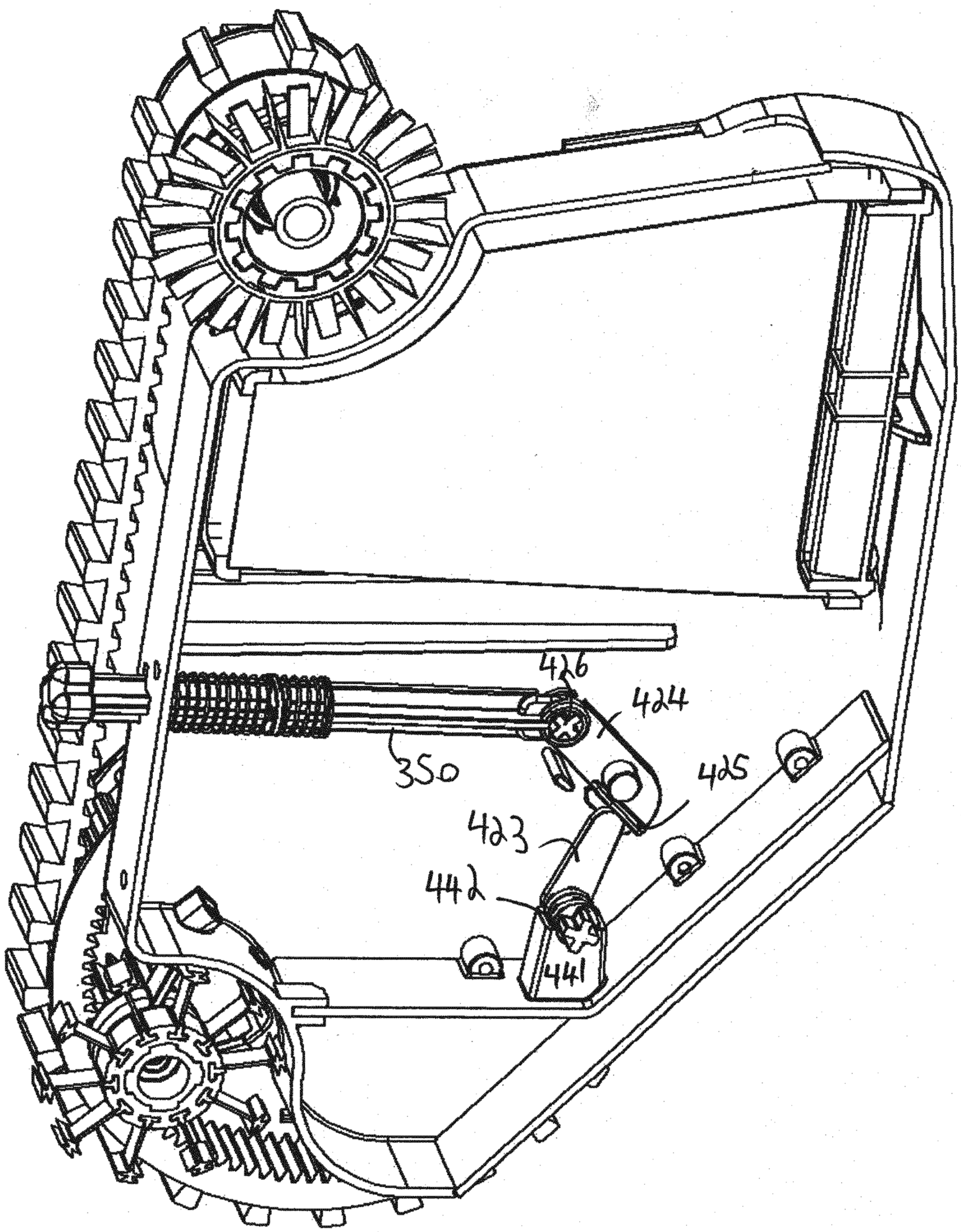


FIG. 11

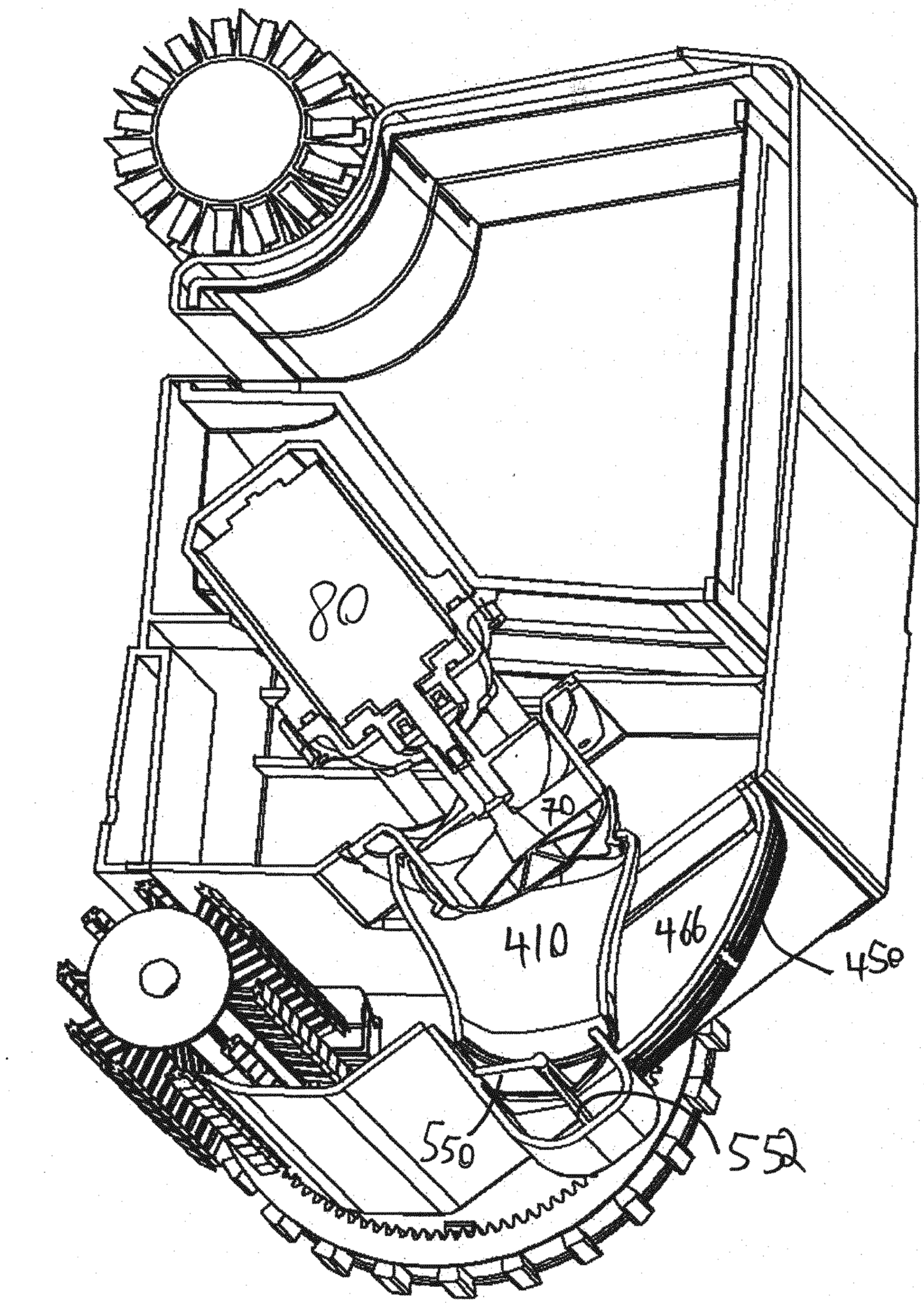


FIG. 12

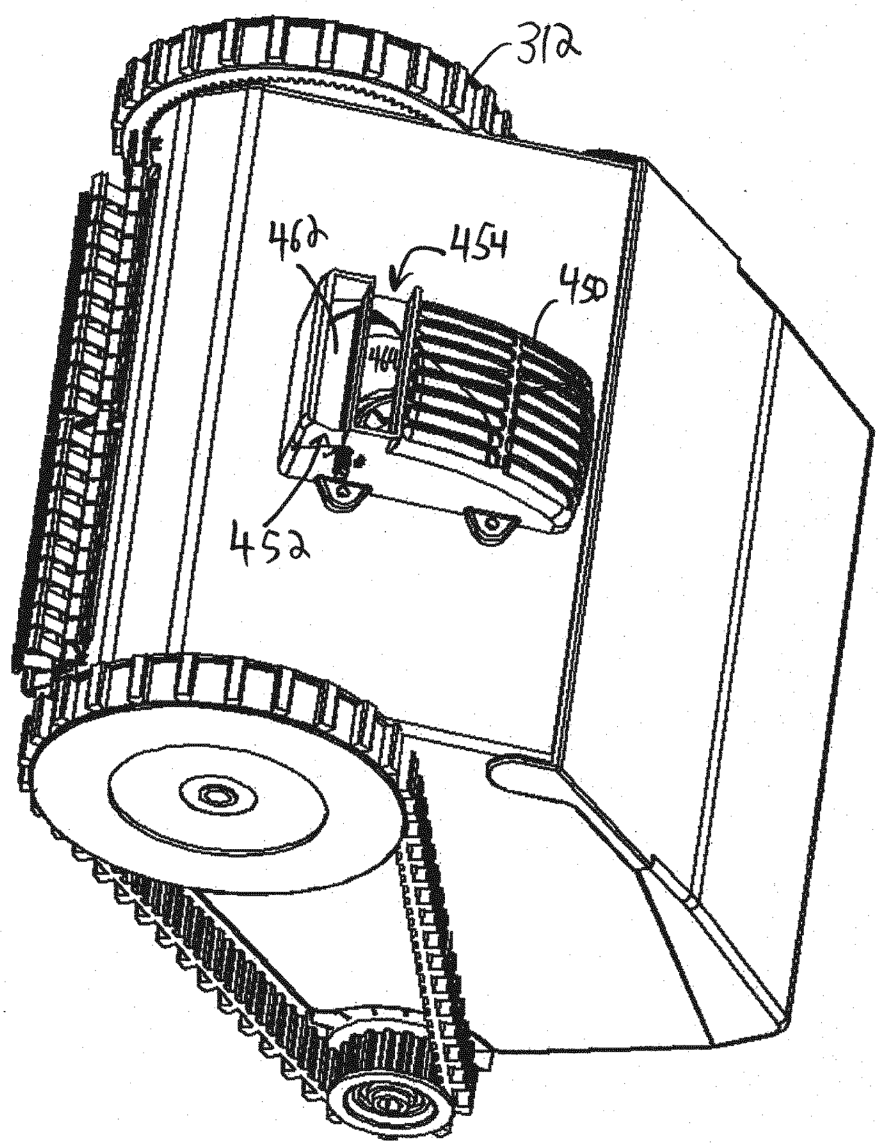


FIG.13

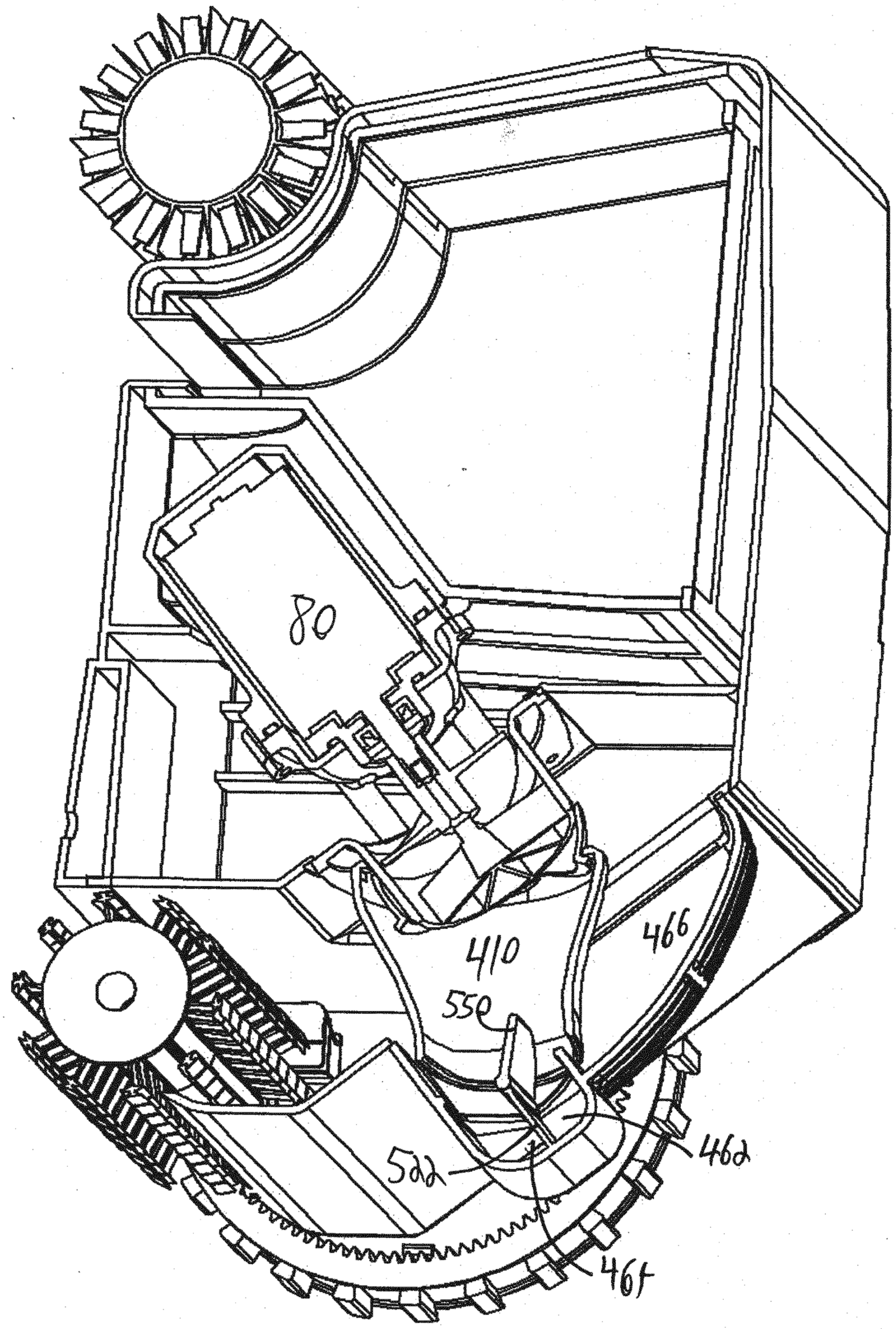


FIG. 14

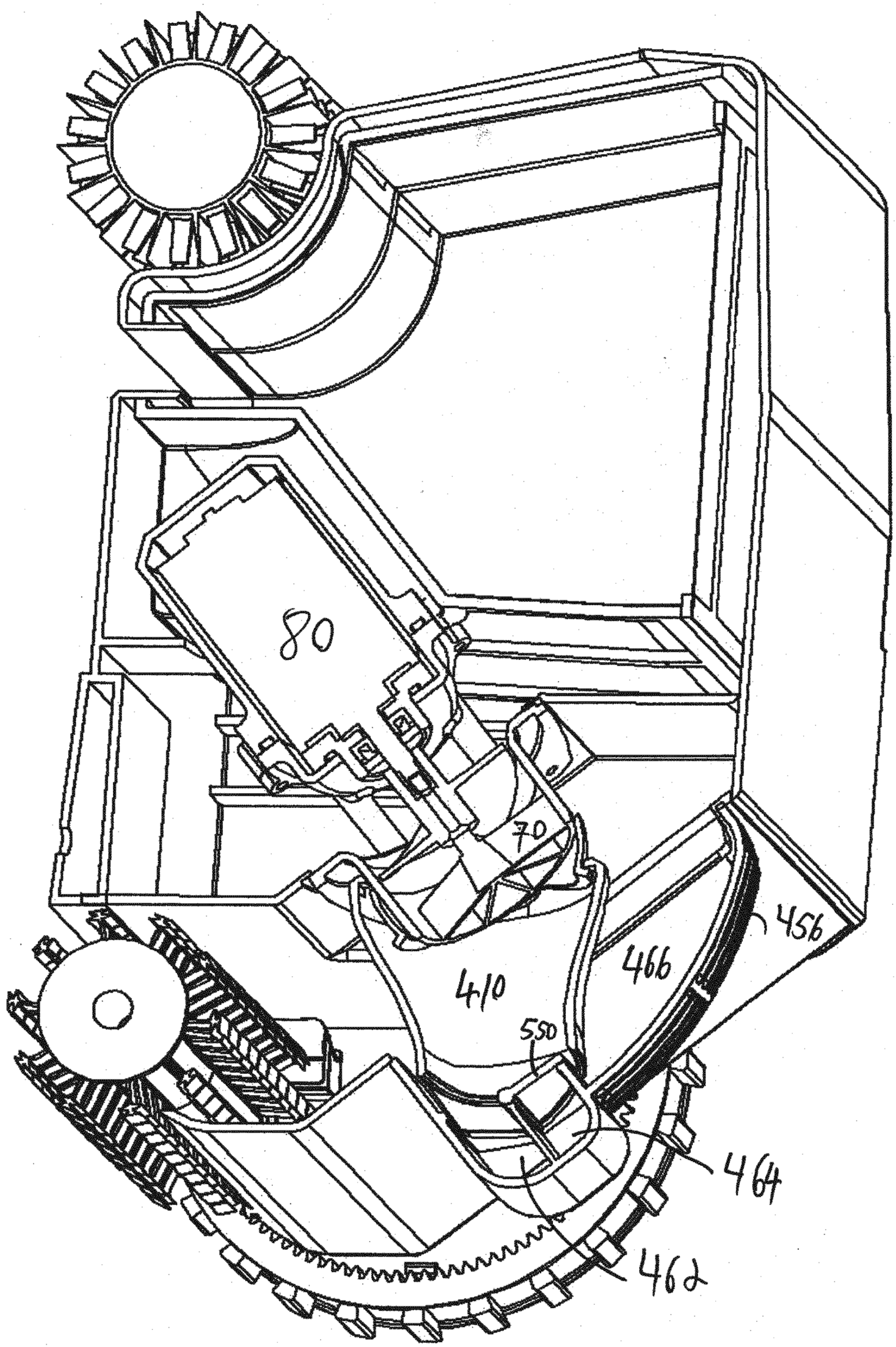


FIG.15

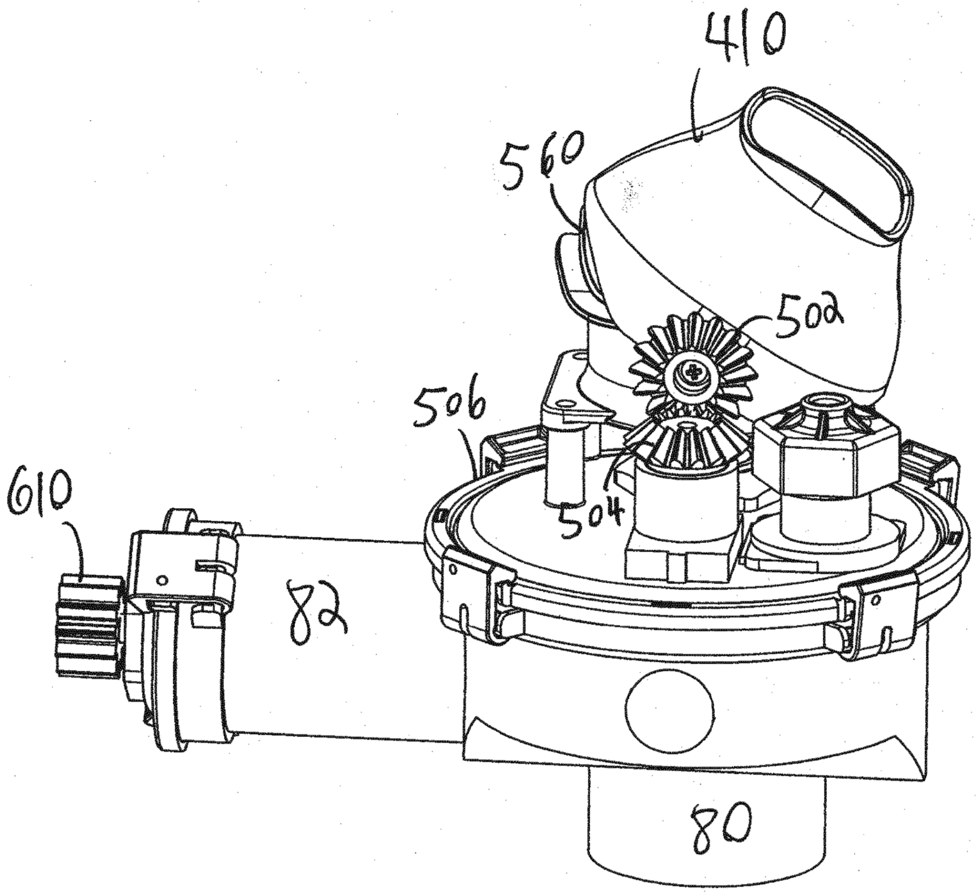


FIG. 16

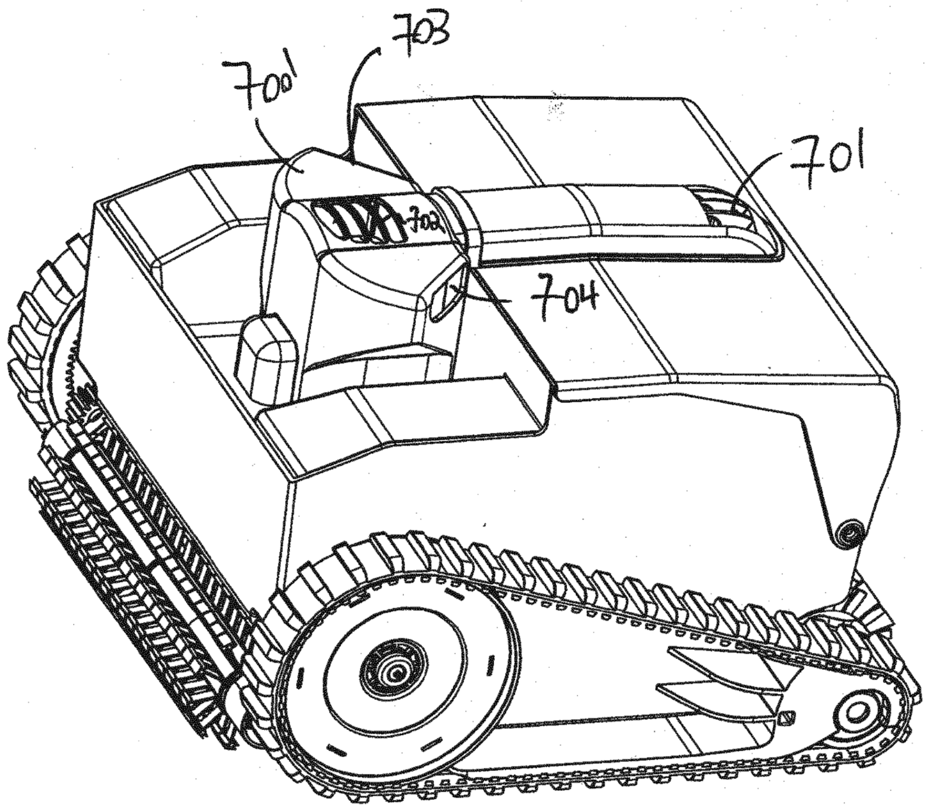


FIG. 17

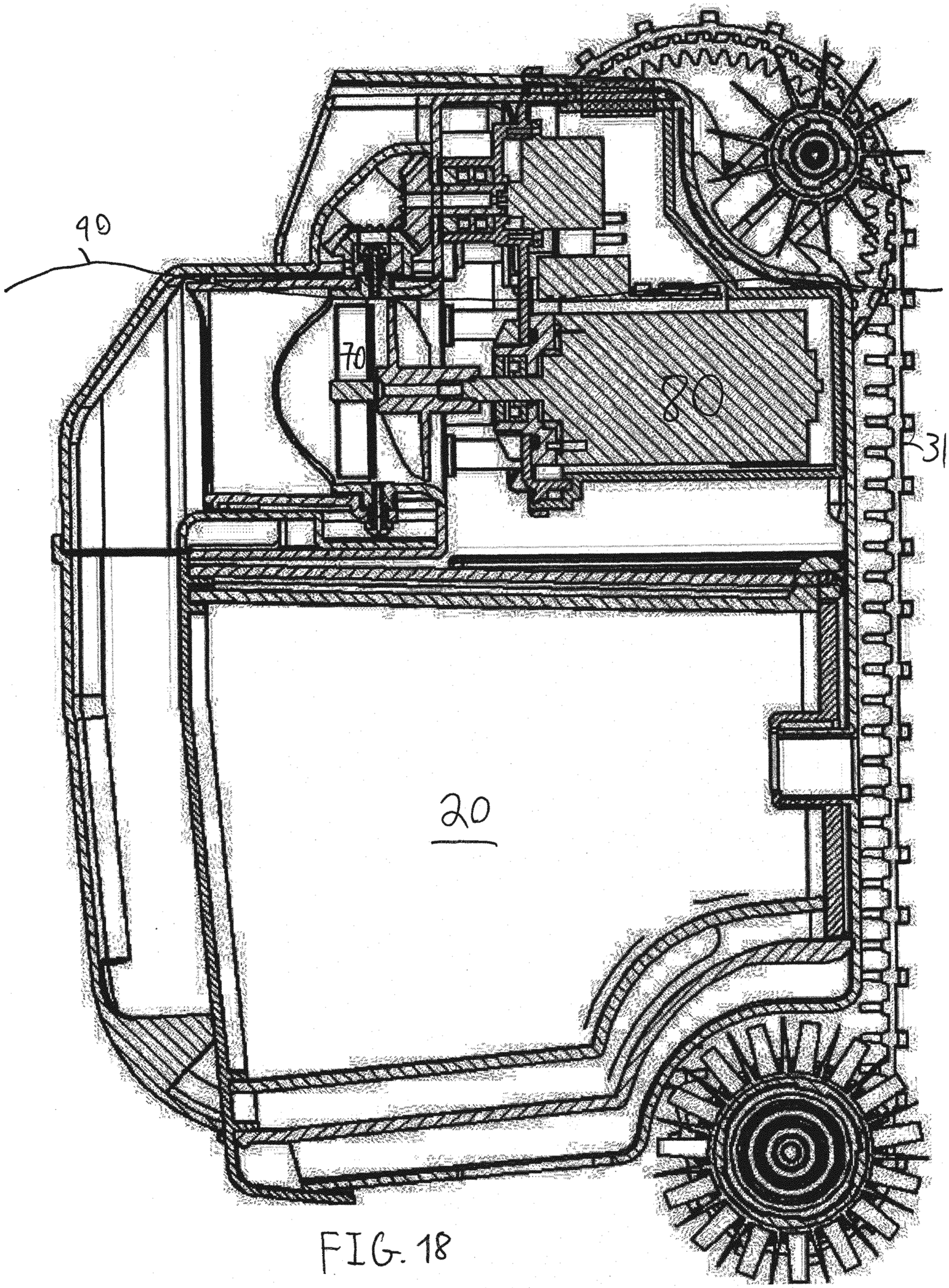


FIG. 18

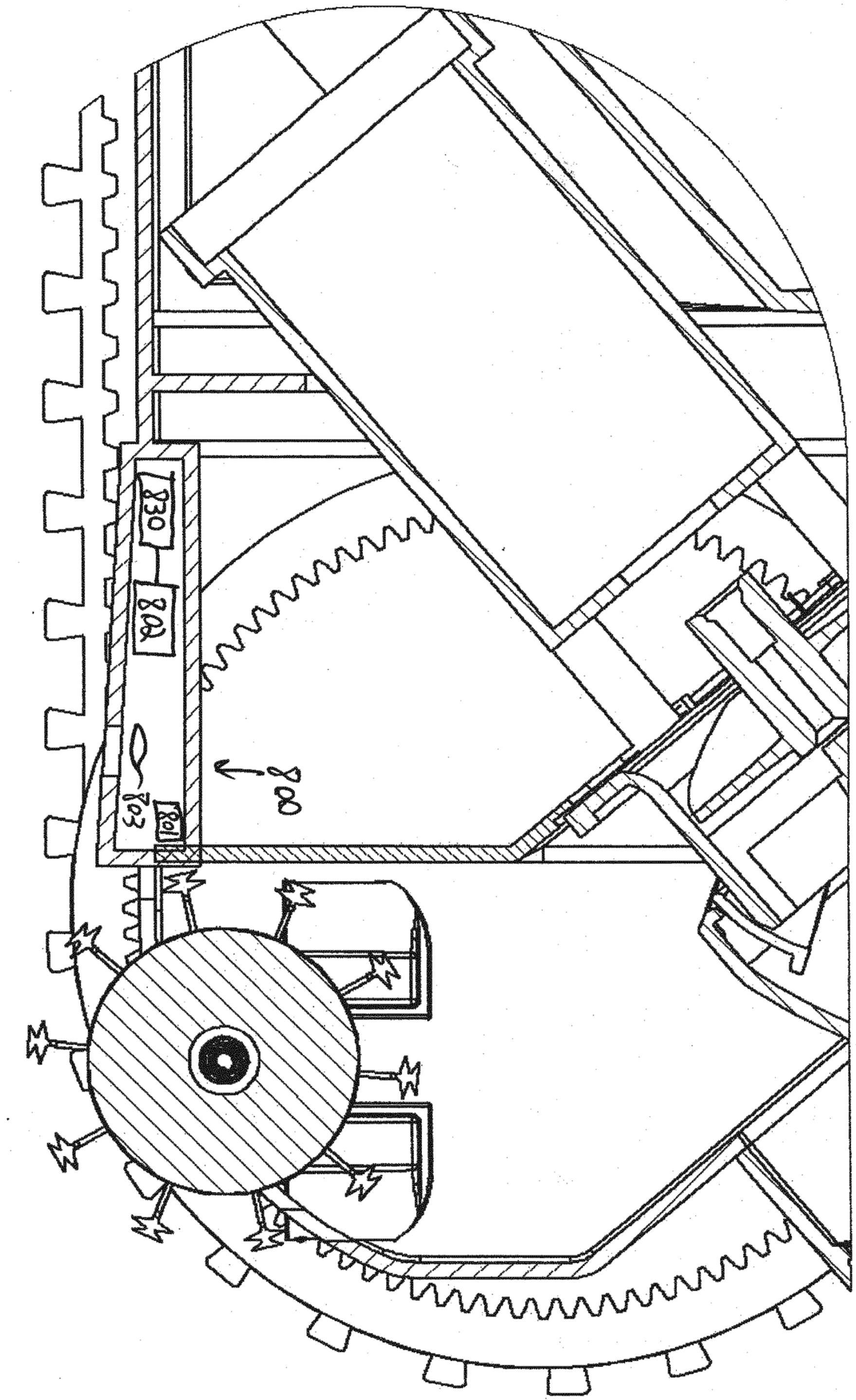


FIG. 19

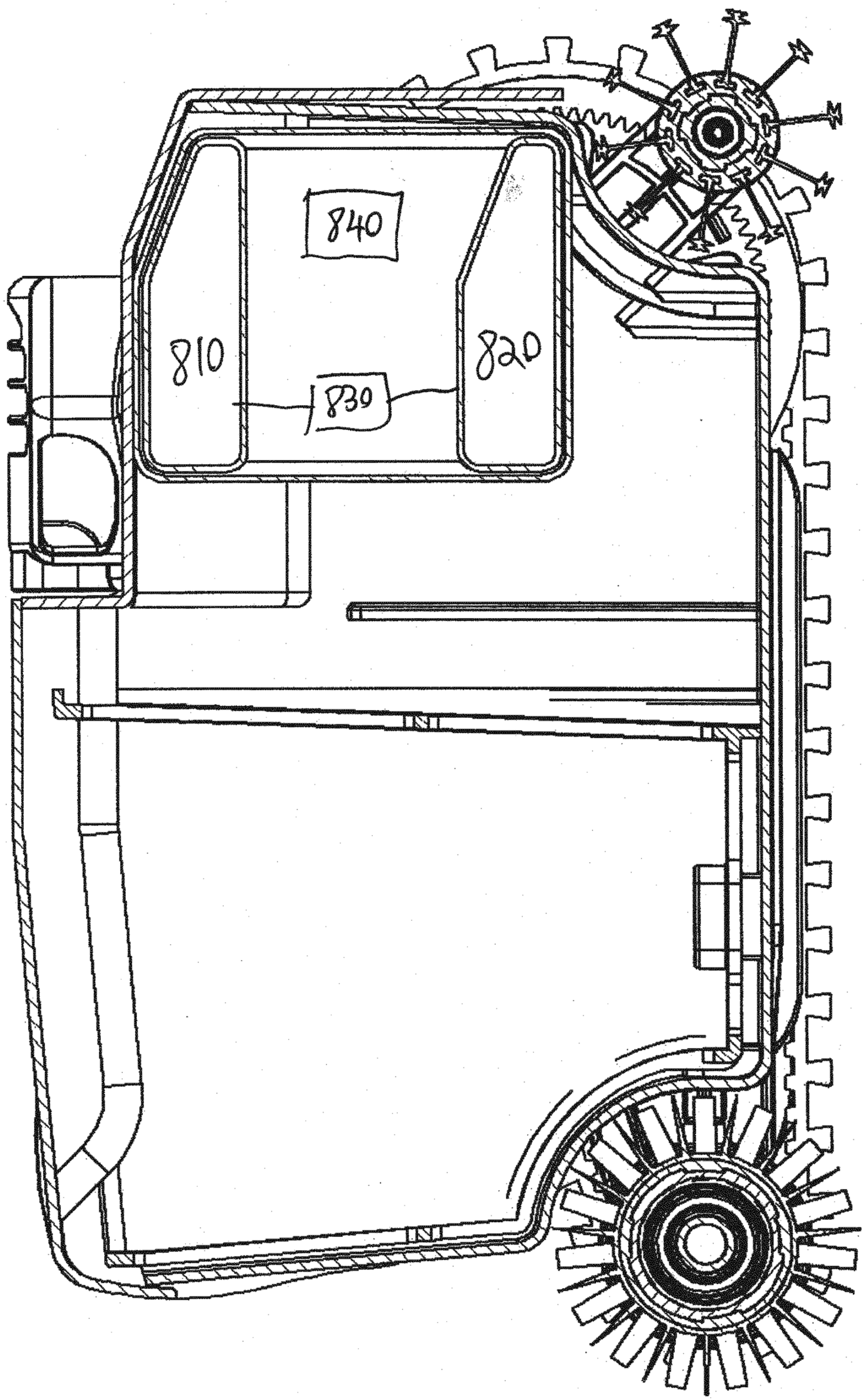


FIG. 20

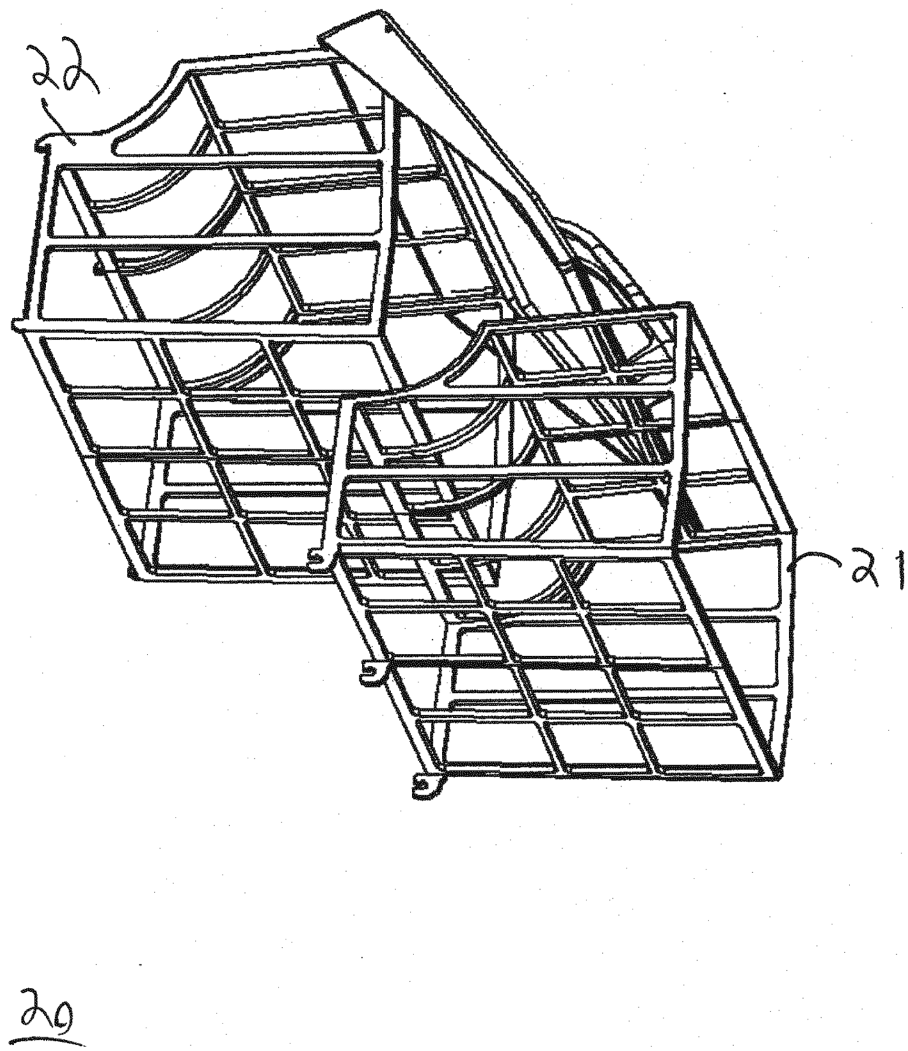


FIG. 21A

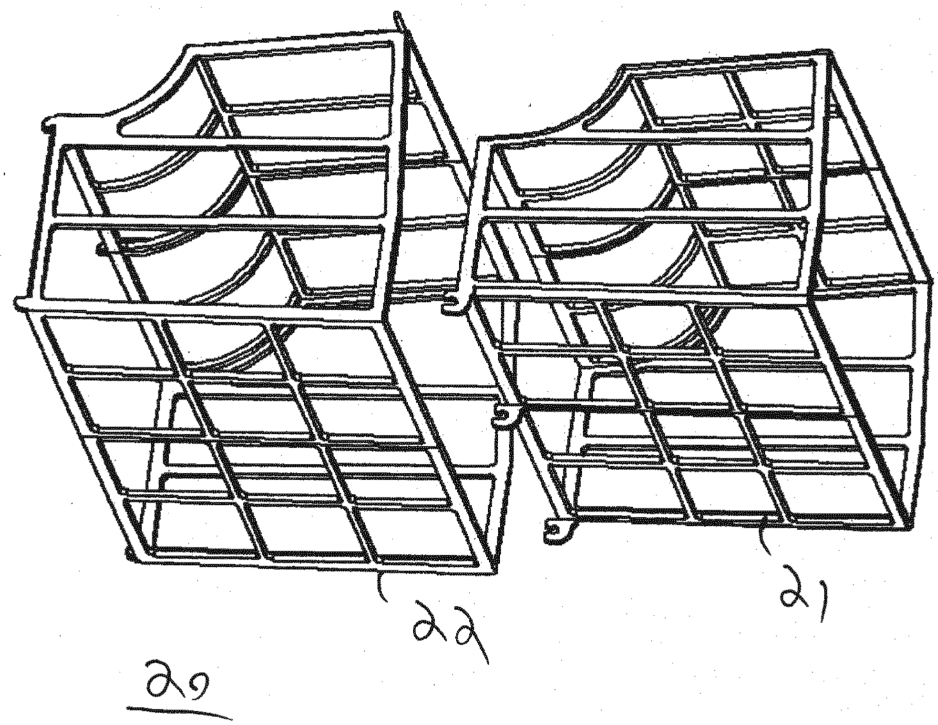


FIG. 21B

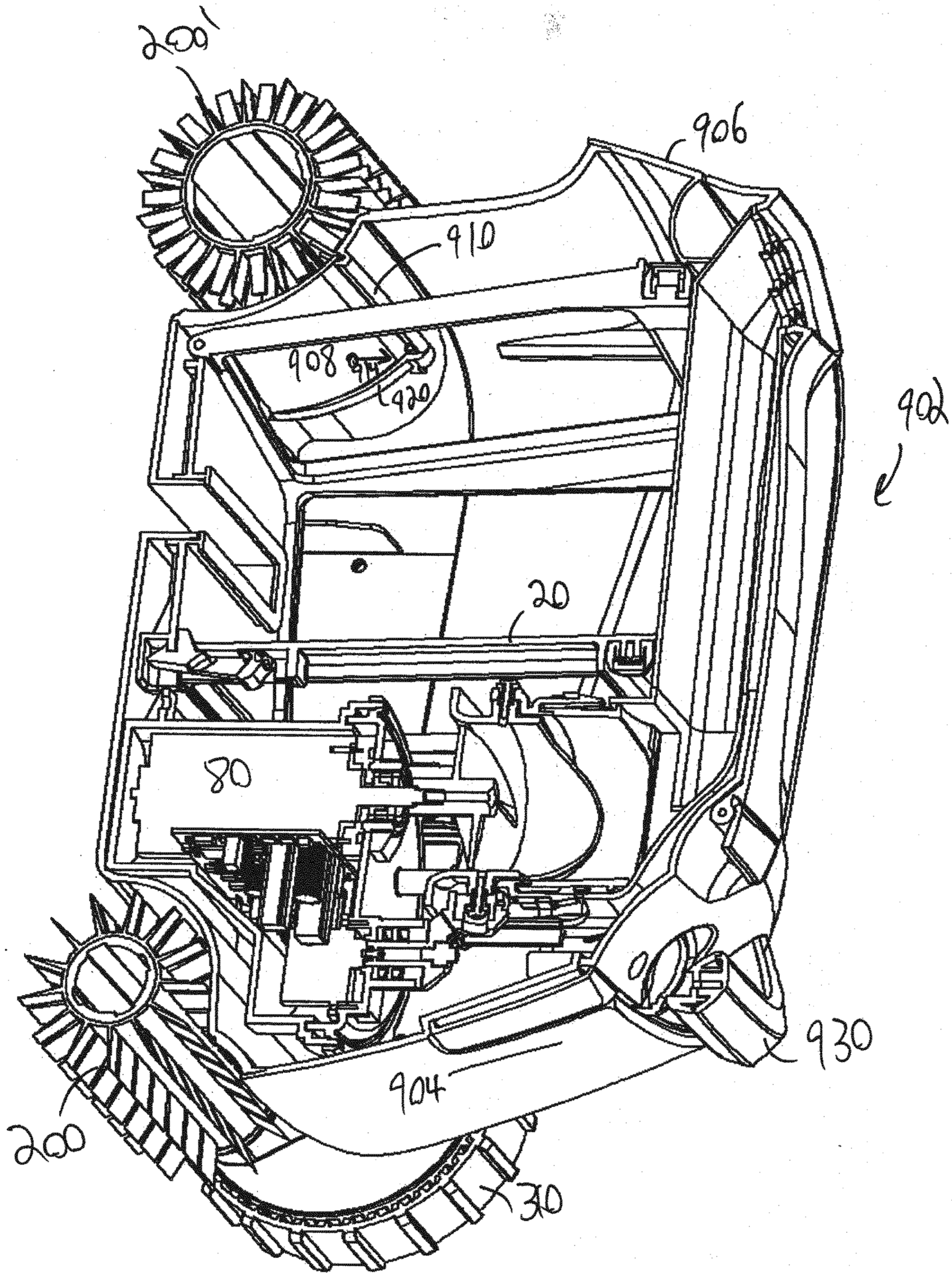


FIG. 22

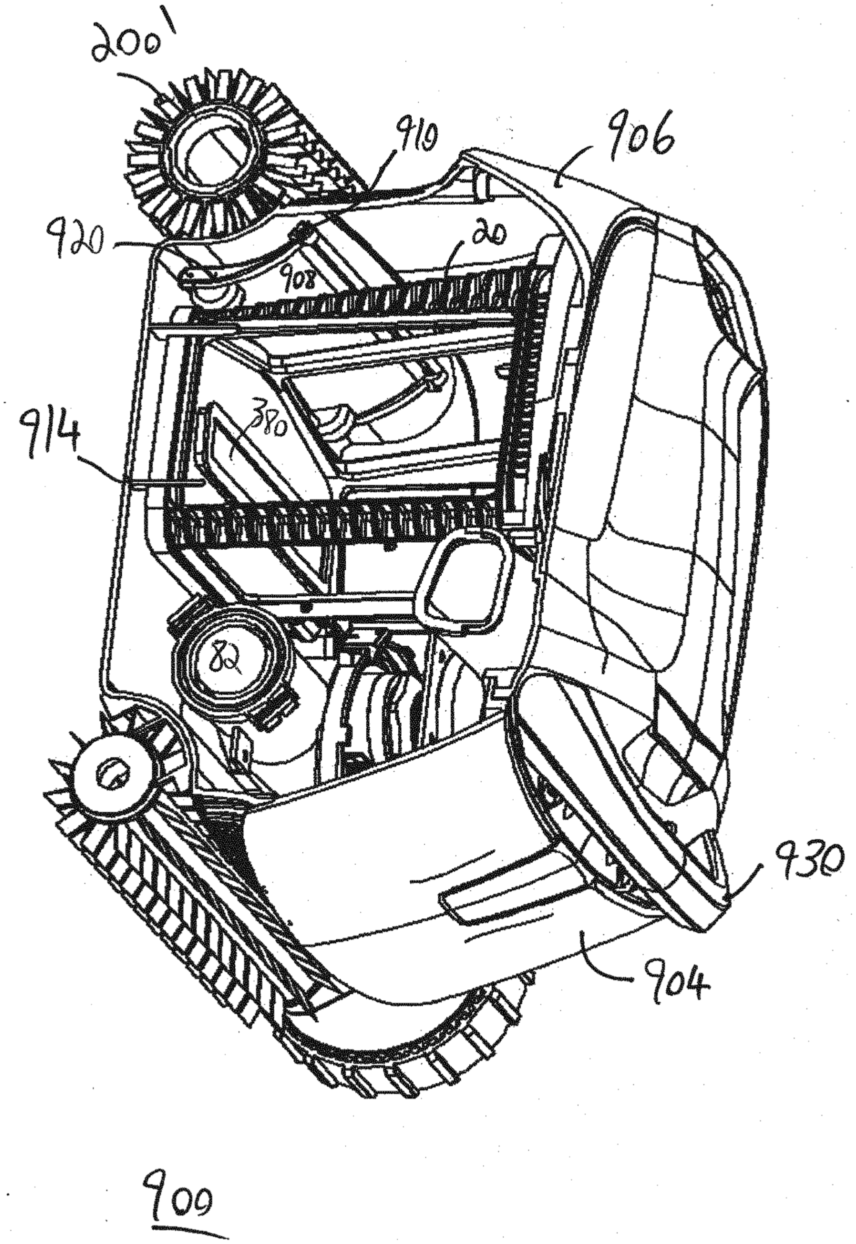


FIG. 23

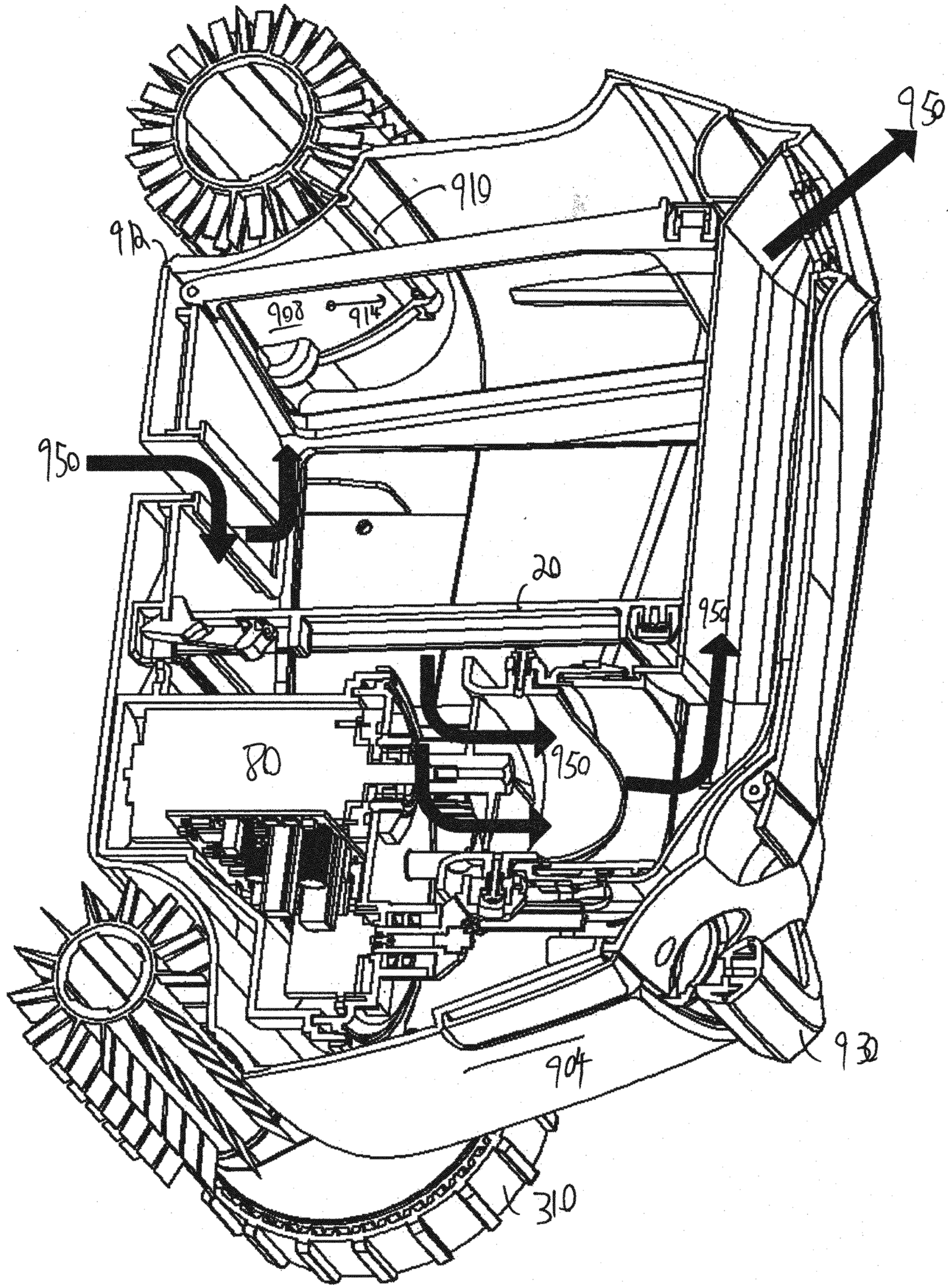


FIG.24

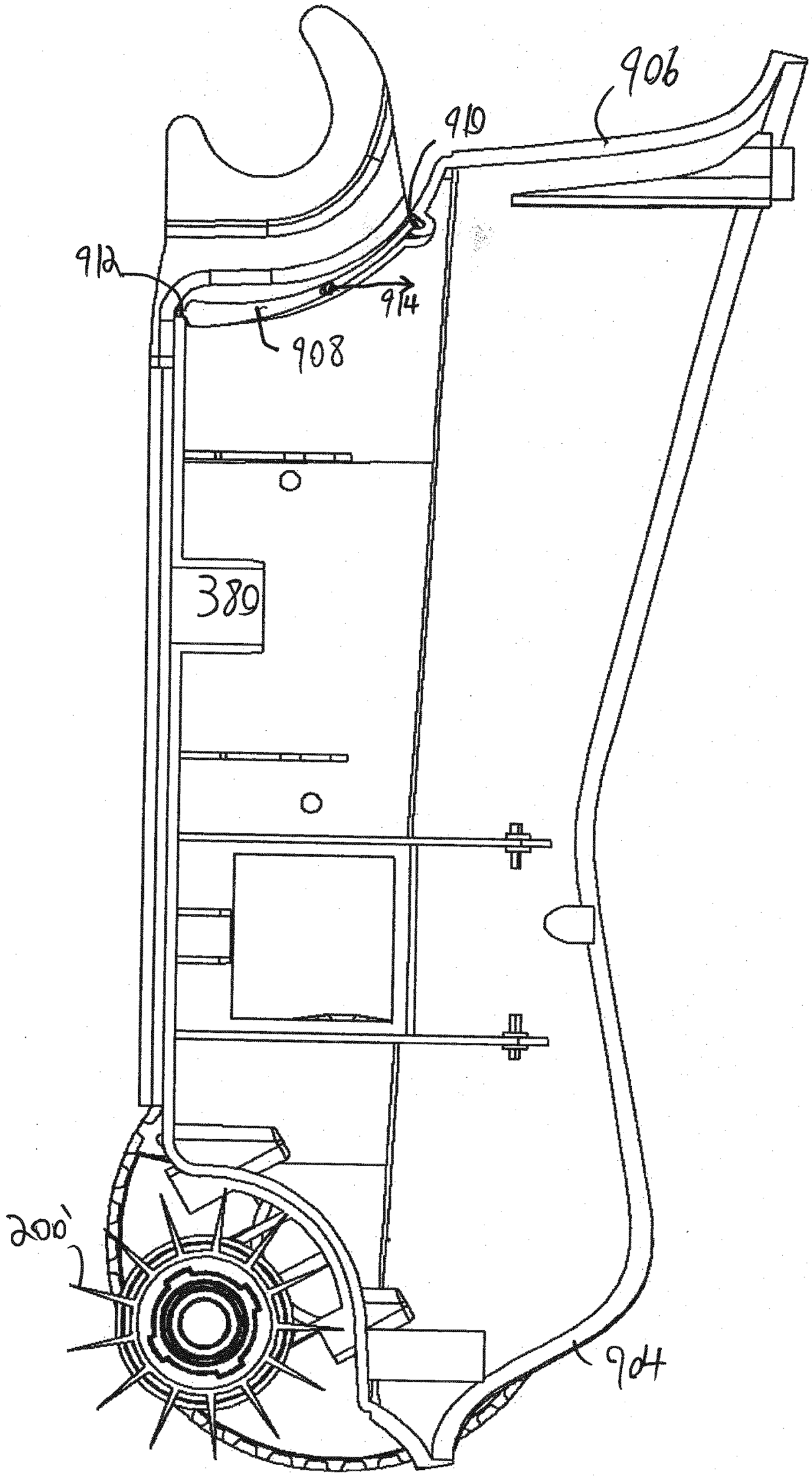


FIG. 25

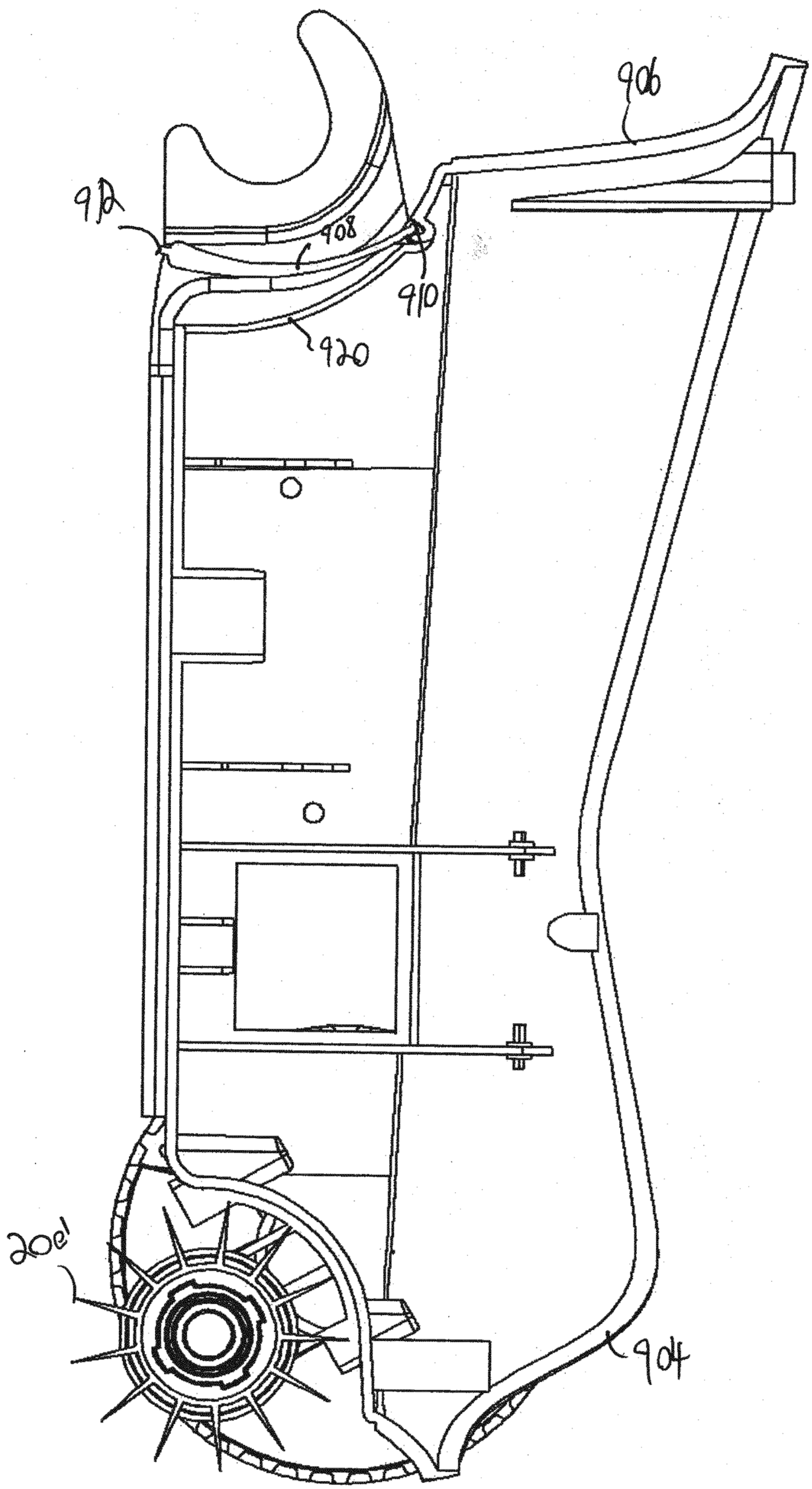


FIG. 26

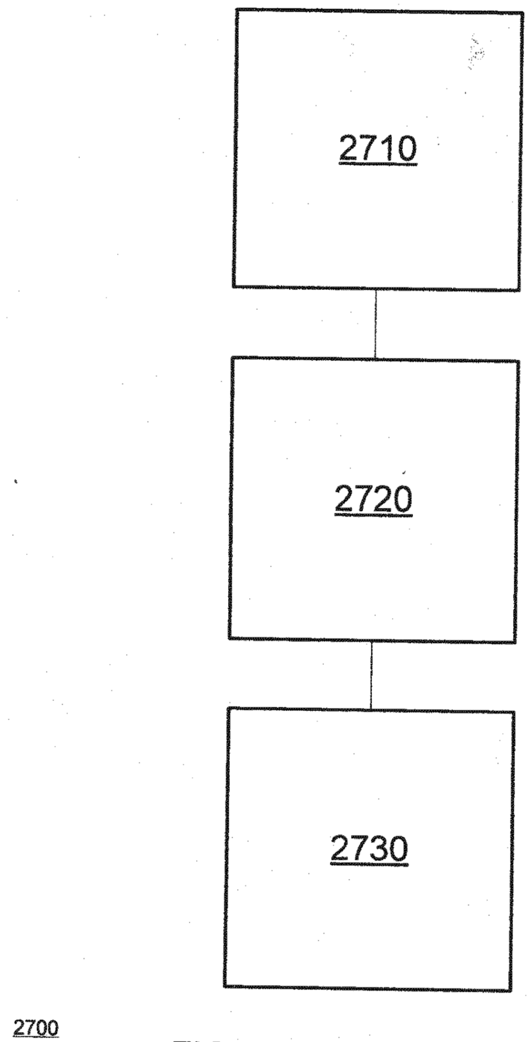


FIG. 27

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2010306931 A1 **[0004]**
- US 20090045110 A, Garti **[0032]**

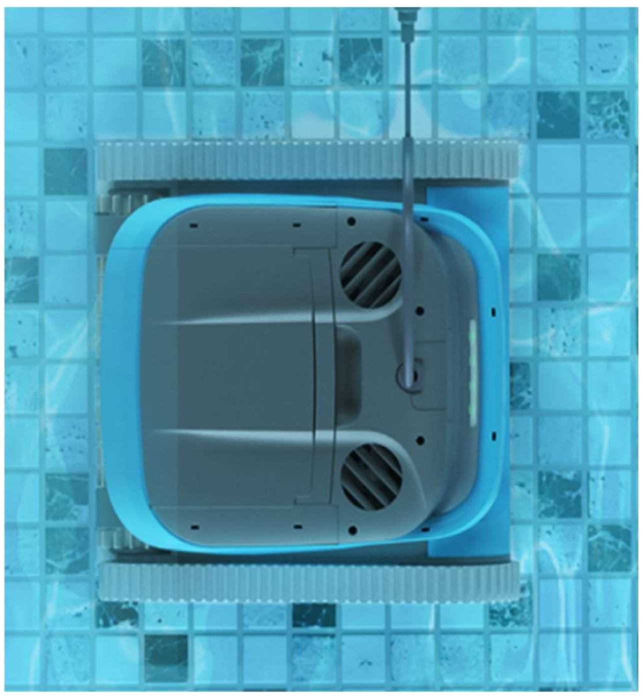
EXHIBIT D

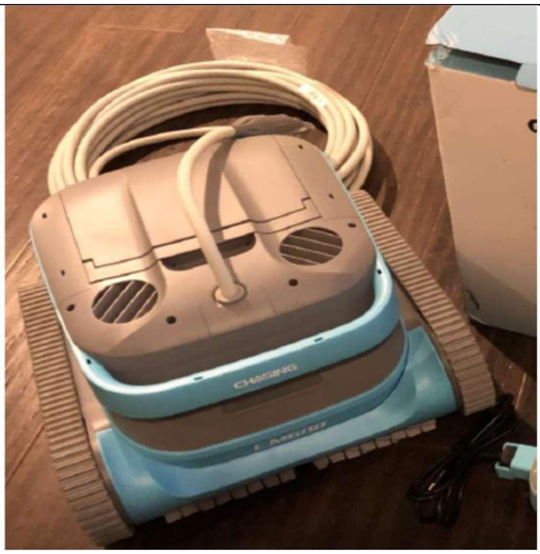
EXHIBIT D: EXEMPLARY CLAIM CHART

<table>
<tr><th>Claim 1: Maytronics U.S. Patent No. 10,378,229</th><th>Chasing Innovation CM600 Pool Robot</th></tr>
<tr><td>A cleaning robot comprising:</td><td>The Chasing CM600 is an automatic robotic pool cleaner.

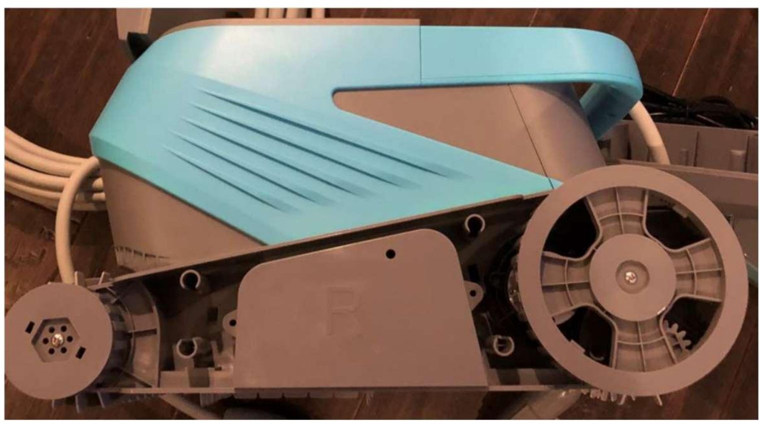
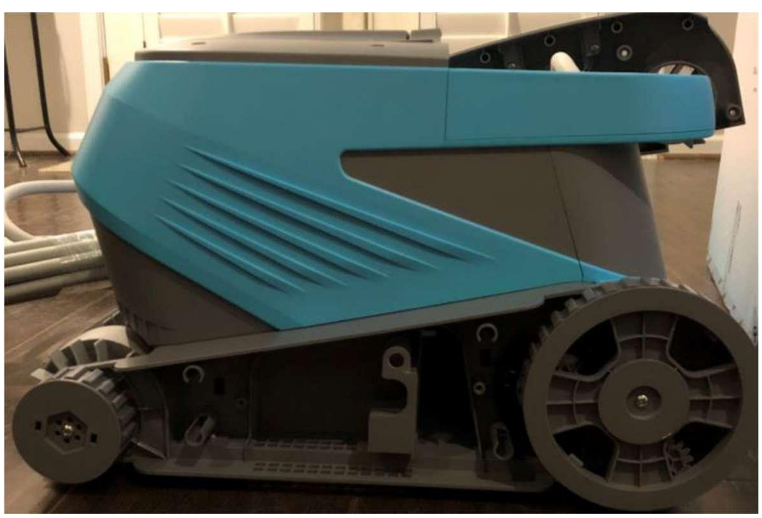
</td></tr>
<tr><td>a housing comprising at least one inlet and an outlet;</td><td>The CM600 has at least an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.</td></tr>
</table>

The inlet is in the bottom of the housing as shown below.

	 The top of the housing includes two outlets as shown below. 

	
a filtering unit, located within the housing, for filtering fluid;	A filtering unit is located within the housing for filtering fluid directed into the inlet in the housing.  

<table>
<tr><td></td><td>
</td></tr>
<tr><td>a bypass mechanism for bypassing the filtering unit;</td><td>The Chasing CM600 includes a bypass mechanism for bypassing the filtering unit as shown below.

</td></tr>
</table>

<table>
<tr><td></td><td>
</td></tr>
<tr><td>and a fluid suction unit that is arranged to direct towards the outlet fluid that</td><td>The Chasing CM600 is equipped with dual suction pumps that takes in fluid from the inlet in the bottom of the housing and directs it towards the two outlets in the top of the housing.

</td></tr>
</table>


CHASING
CM600


CHASING CM600

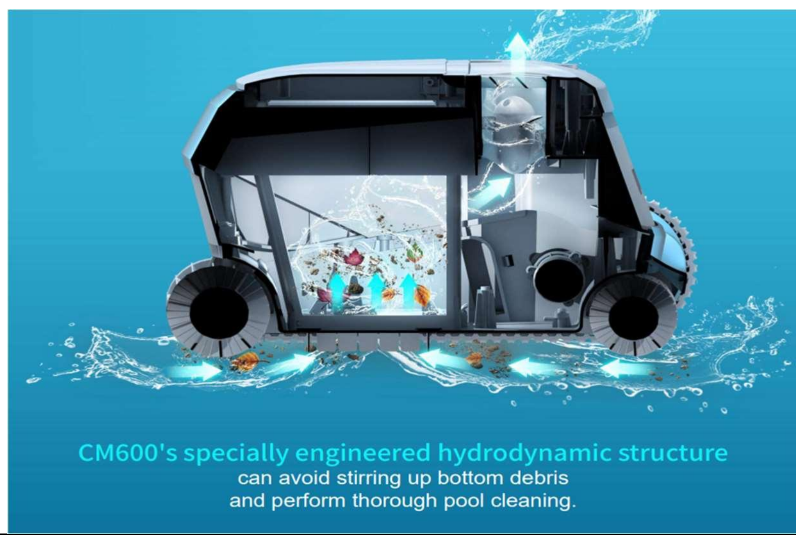
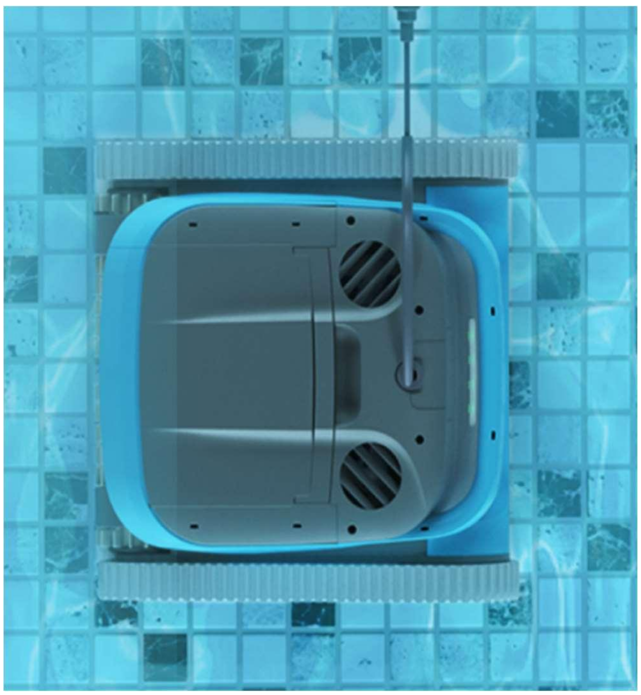
	
(a) passes through the at least one inlet and	As shown above and below, the fluid (here pool water) passes through the inlet in the bottom of the housing.
(b) passes through at least one of the filtering unit and the bypass mechanism.	The fluid passes through either the filtering unit or the bypass mechanism before exiting through one of the two outlets in the top of the housing. 

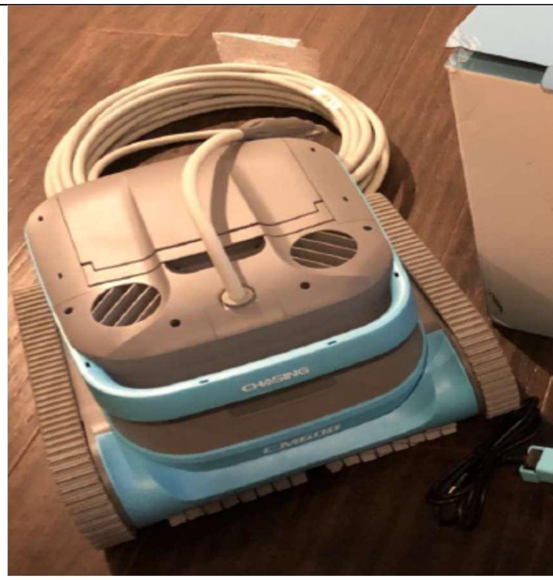
EXHIBIT E

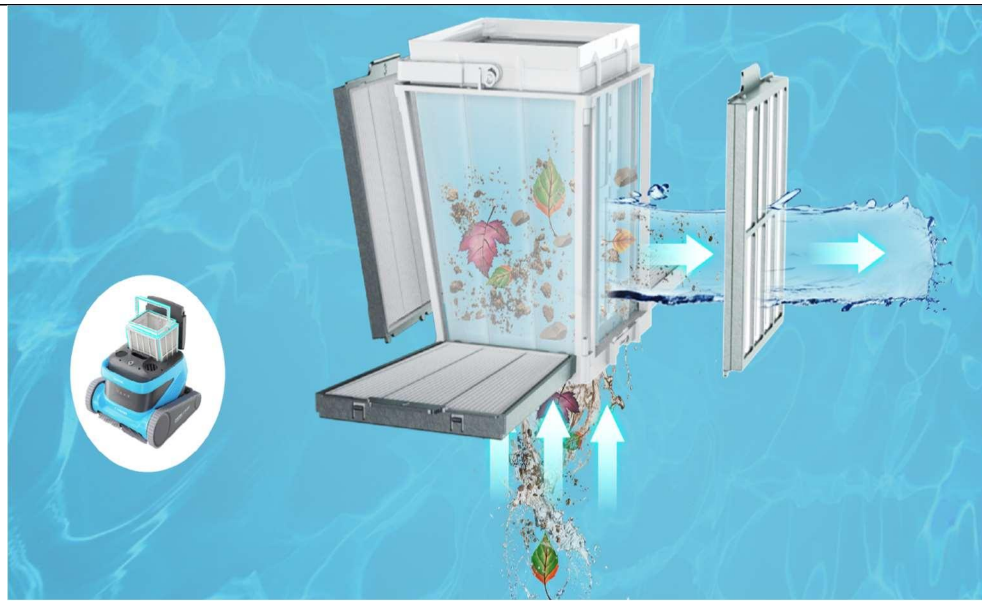
EXHIBIT E: EXEMPLARY CLAIM CHART

Claim 1: Maytronics EP 2 845 969 B1	Chasing Innovation CM600 Pool Robot
A cleaning robot comprising:	The Chasing CM600 is an automatic robotic pool cleaner.  
a housing (20) comprising at least one inlet	The CM600 has at least an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.

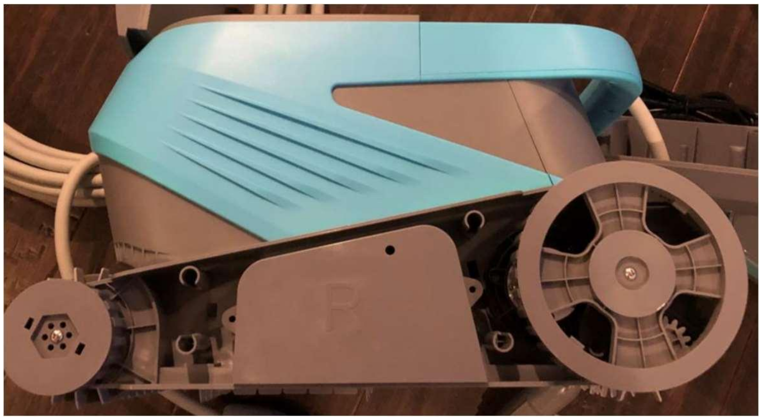
(26) and an outlet;	 The inlet is in the bottom of the housing as shown below.  

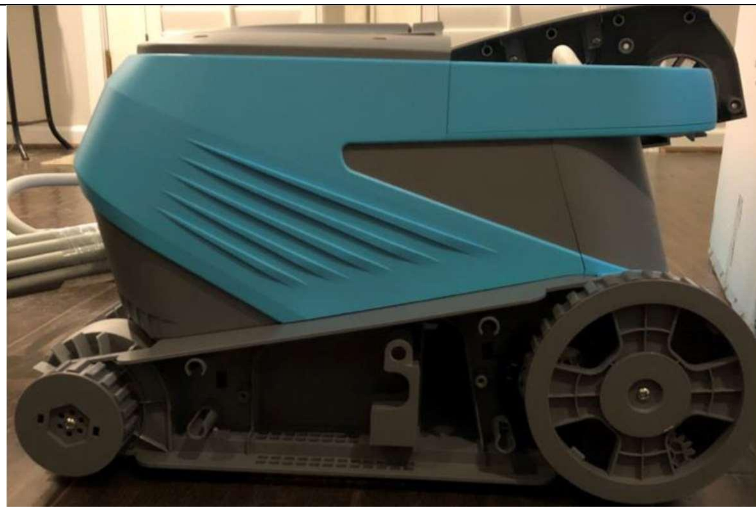
	 The top of the housing includes two outlets as shown below. 

	
a filtering unit for filtering fluid;	A filtering unit is located within the housing for filtering fluid directed into the inlet in the housing.  **Double-layer Filter for Precise Filtration of Dirt** CHASING CM600 Robotic Pool Cleaner is designed with a double-layer filter. The inner filter bag filters coarse sand, leaves, stones, and other types of impurities in large particles. The outer filter sheet filters sludge, dander, grease, and other smaller debris. Double-layer filtration offers better cleaning performance.




CHASING

	
a bypass mechanism (40, 140, 240) for bypassing the filtering unit; and	The Chasing CM600 includes a bypass mechanism for bypassing the filtering unit as shown below. 

<table>
<tr>
<td>a fluid suction unit that is arranged to direct towards the outlet (142) fluid that</td>
<td>The Chasing CM600 is equipped with dual suction pumps (i.e., a fluid suction unit) that takes in fluid from the inlet in the bottom of the housing and directs it towards the two outlets in the top of the housing.

</td>
</tr>
</table>

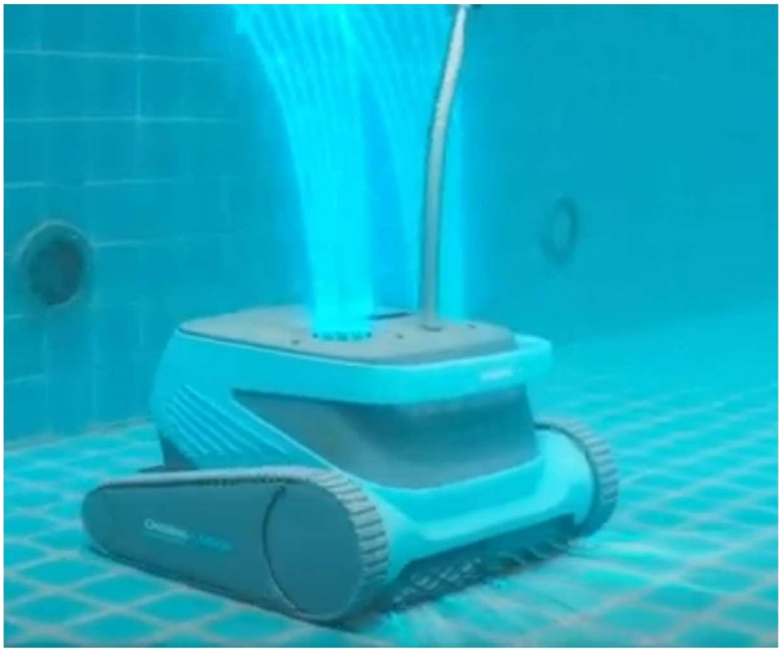
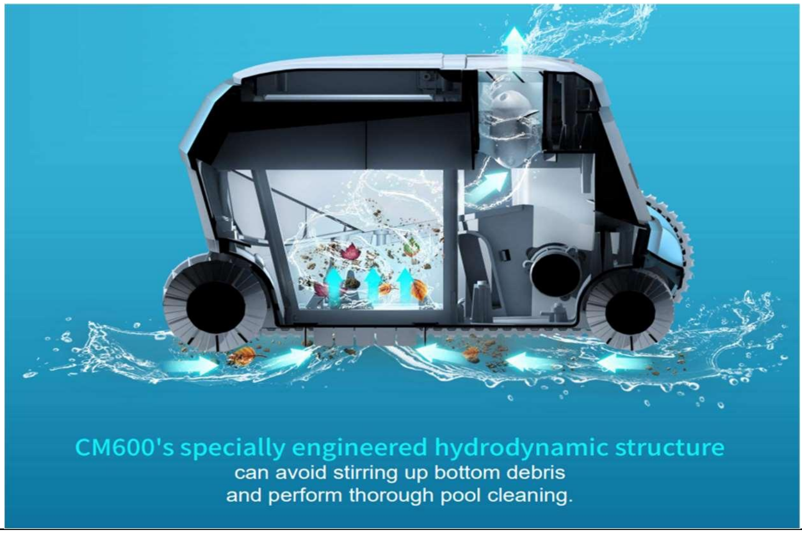
	
(a) passes through the at least one inlet (26) and	As shown above and below, the fluid (here pool water) passes through the inlet in the bottom of the housing.
(b) passes through at least one out of the filtering unit and the bypass mechanism (40, 140, 240).	The fluid passes through either the filtering unit or the bypass mechanism before exiting through one of the two outlets in the top of the housing. 

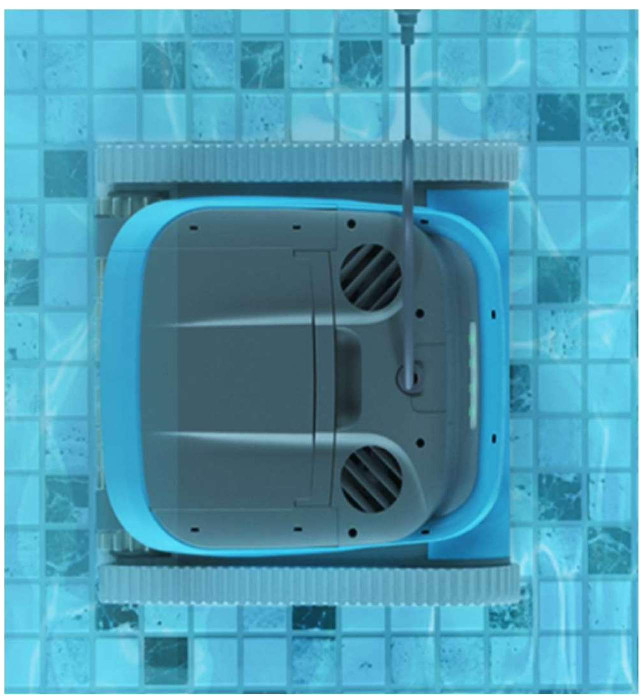
EXHIBIT F

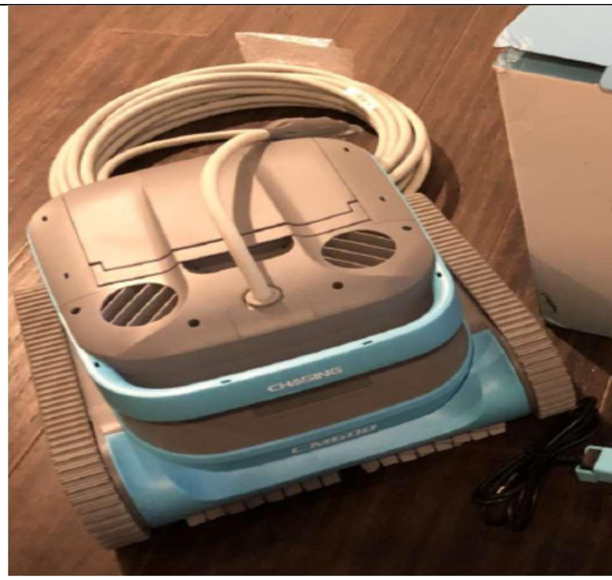
EXHIBIT F: EXEMPLARY CLAIM CHART

<table>
<tr><th>Claim 1: Maytronics EP 2 706 170 B1</th><th>Chasing Innovation CM600 Pool Robot</th></tr>
<tr><td>A cleaning robot (10, 900) comprising:</td><td>The Chasing CM600 is an automatic robotic pool cleaner.

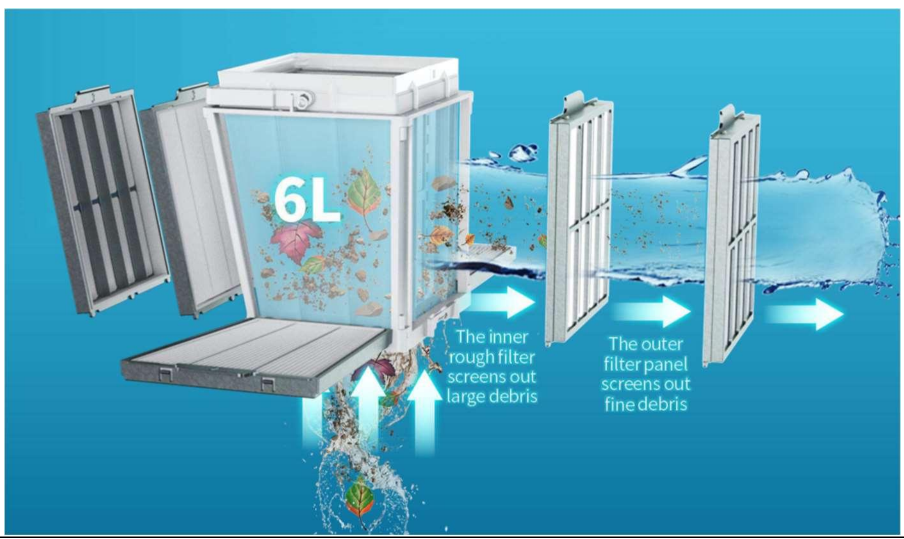

</td></tr>
<tr><td>a housing (13, 902) that comprises an inlet (380)</td><td>The CM600 has an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.</td></tr>
</table>

and an outlet (450, 410);	 The inlet is in the bottom of the housing as shown below.  

	 The top of the housing includes two outlets as shown below. 

	
a filtering unit (20) that is arranged to filter fluid that enters through the inlet to provide filtered fluid that flows through the outlet;	The Chasing CM600 has a filtering unit that is arranged to filter fluid that enters through the inlet and direct the filtered fluid out through the two outlets at the top of the housing.  

	
wherein the filtering unit (20) comprises a first filter (21) that has a first filtering level and	The filtering unit has an inner filter bag (i.e., first filter) that filters coarse sand, leaves and other large particles. Thus, the inner filter bag has a first filtering level. 
a second filter (22) that has a second filtering level that differs from the first filtering level;	The filtering unit has an outer filter sheets (i.e., second filter) that filters sludge, grease and other smaller debris. Thus, the outer filter sheets have a second filtering level that is different from the inner filter bag.

	CHASING CM600 has double-layer filter screens. The inner rough filter can screen out tinny stones, gravels, and twigs, while the outer filter panels have more excellent fineness and can filter soil, debris and lipid.
the first filter (21) being arranged to perform a coarser filtering than the second filter (22),	The inner filter bag (first filter) performs a coarser filtering than the outer filter sheets (second filter). CHASING CM600 has double-layer filter screens. The inner rough filter can screen out tinny stones, gravels, and twigs, while the outer filter panels have more excellent fineness and can filter soil, debris and lipid. 
characterized in that the second filter (22) at least partially surrounds the first filter (21).	The outer filter sheets (second filter) at least partially surrounds the inner filter bag (first filter).

	 CHASING  CHASING

	CHASING	

EXHIBIT 8

From: UPS
To: Haffron, Laurie
Subject: UPS 递送通知,追踪号码 1Z3580680496562241
Date: Tuesday, May 9, 2023 7:42:24 AM

External Sender:

您好, 您的包裹已递送
递送日期: 2023/05/09, 星期二
递送时间: 9:03 AM
签字人: SF1685656912202

追踪包裹状态 | 管理首选项 | 查看递送计划表

K & L GATES

追踪号码:	1Z3580680496562241
运输至:	CHASING INNOVATION TECHNOLOGY CO., SHENZHEN INTL INNOVATION VALLEY 3105, BLDG 6, DASHI 1ST RD. XILI NANSHAN DIST. GUANGDONG, 518000 CN
包裹数:	1
UPS 服务:	UPS Worldwide Saver®
包裹重量:	0.0 LBS
参考编号:	0528113.00045

Hello, your parcel has been delivered.
Delivery Date: 2023/05/09, Tuesday
Delivery Time: 9:03 AM
Signed by: SF1685656912202

Track Package Status | Manage Preferences | View Delivery Planner

K & L GATES

Tracking Number:	1Z35806804965622 41
Ship To:	CHASING INNOVATION TECHNOLOGY CO., SHENZHEN INTL INNOVATION VALLEY 3105, BLDG 6, DASHI 1ST RD. XILI NANSHAN DIST. GUANGDONG, 518000 CN
Number of parcels:	1
UPS Service:	UPS Worldwide Saver®
Parcel Weight:	0.0 LBS
Reference Number:	0528113.00045

EXHIBIT 9

K&L GATES

VIA FEDERAL EXPRESS

May 3, 2023

Jeffrey R. Gargano
jeffrey.gargano@klgates.com

T +1 312 807 4226
F +1 312 345 9068

Mr. Terry Xi, Co-Founder
Mr. Changgen Zhou, Director General
Mr. Xun Zhang, Legal Representative
Chasing Innovation Technology Co., Ltd.
506 2nd Ave, Suite 1400
Seattle, WA 98104-2307

Re: Notice of Infringement of Maytronics U.S. and European Patent Rights

Dear Messrs. Xi, Zhou and Zhang:

We represent Maytronics in intellectual property matters. Maytronics is a global leader in the swimming pool industry, specializing in pool water solutions and offering a wide variety of products such as robotic pool cleaners, pool safety products and water treatment systems. Over the past 40 years, through innovative technology, design and reliability, Maytronics has built its Dolphin pool cleaning robots into a leading global brand. Innovation and creativity is core to Maytronics' mission and critical to Maytronics' leadership position and competitive advantage in the market. Consistent with Maytronics' commitment to leadership through innovation, Maytronics has invested substantial resources in research and development and protection of its proprietary innovative technology. Maytronics has developed a global patent portfolio that includes over 100 issued U.S. patents and published patent applications. In addition, Maytronics has numerous international patents protecting its industry-leading innovative technology for pool cleaning robots. Maytronics is fully committed to protecting and enforcing its intellectual property rights.

It has come to our attention that Chasing Innovation Technology Co., Ltd and Chasing Technology (USA), LLC (collectively "Chasing") introduced its first generation underwater pool cleaning robot, the Chasing CM600 Robotic Pool Cleaner, in July 2022. https://www.chasing.com/en/news-center/1.html It has also come to our attention that Chasing has recently launched an extensive campaign advertising and marketing the Chasing CM600 Robotic Pool Cleaner in the United States. https://www.chasing.com/en/news-center/39.html; https://www.chasing.com/en/news-center/44.html. Our research indicates that Chasing is selling its CM600 Robotic Pool Cleaner in the United States through: (i) Chasing's website (https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner-overview.html); https://www.chasing.com/en/chasing-cm600-robotic-pool-cleaner.html?gclid=EAIaIQobChMI7fbJzM6f_gIVtSCtBh2WFQL2EAMYASAAEgLrsPD_BwE; (ii) pool and spa distributors (e.g., https://bandrpools.com/shop/chasing-cm600-robotic-pool-cleaner/); and (iii) trade shows, e.g., the Western Pool and Spa Show in Long Beach, California on March 23-25, 2023 https://westernshow.expocad.com/Events/23wpss/index.html; https://www.chasing.com/en/news-center/44.html).

Maytronics recently purchased a Chasing CM600 Robotic Pool Cleaner in the United States. We have been charged with analyzing the CM600 Robotic Pool Cleaner to determine whether it utilizes any of Maytronics innovative technology and infringes on Maytronics intellectual property rights. We completed our analysis and have concluded that the Chasing CM600 Robotic Pool Cleaner infringes at least Maytronics' U.S. Patent No. 10,378,229 (the "'229 patent")(**Exhibit A**) and European Patent Nos. EP 2 845 969 B1 (the '969 patent")(**Exhibit B**) and EP 2 706 170 B1 (the "'170 patent")(**Exhibit C**).

An exemplary claim chart showing where each element of representative claim 1 of the '229 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit D**. An exemplary claim chart showing where each element of representative claim 1 of the '969 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit E**. Finally, an exemplary claim chart showing where each element of representative claim 1 of the '170 patent can be found in the CM600 Robotic Pool Cleaner is attached as **Exhibit F**.

Chasing's use of Maytronics technology in its CM600 Robotic Pool Cleaner is not licensed nor is it authorized by Maytronics. Therefore, Chasing's use of this technology constitutes infringement of at least Maytronics' U.S. Patent No. 10,378,229 for all CM600 Robotic Pool Cleaner's used, made, sold, imported or offered for sale in the U.S. under 35 U.S.C. § 271.

Based on our preliminary research, Chasing is also selling the CM600 Robotic Pool Cleaner in Europe. See https://www.topomarket.gr/en/robotic-pool-cleaners/1052-chasing-cm600-robotic-pool-cleaner.html Chasing's use of this technology constitutes infringement of at least EP 2 845 969 B1 and EP 2 706 170 B1 for all CM600 Robotic Pool Cleaner's sold in Europe under the European Patent Convention, the Trade Related Aspects of Intellectual Property Rights and European national patent laws.

Maytronics demands that Chasing cease and desist from infringing its '229 patent in the United States and its '969 and '170 patents in Europe immediately. Accordingly, Maytronics demands that Chasing immediately cease and desist from selling or offering to sell its CM600 Robotic Pool Cleaner in the United States and Europe and that Chasing provide written confirmation to that effect by May 20, 2023. If Chasing does not comply with this request and provide written confirmation within the reasonable time provided, Maytronics reserves all rights afforded to it under the United States and European patent laws, including the right to bring a formal complaint against Chasing for patent infringement and enjoin Chasing's infringing activity and seek past damages.

Very truly yours,

/Jeffrey R. Gargano/

Jeffrey R. Gargano

EXHIBIT A

US010378229B2

(12) **United States Patent**
Ben Dov et al.

(10) **Patent No.: US 10,378,229 B2**
(45) **Date of Patent: Aug. 13, 2019**

(54) **POOL CLEANING ROBOT WITH BYPASS MECHANISM**

(71) Applicant: **MAYTRONICS LTD.**, Kibutz Yizrael (IL)

(72) Inventors: **Boaz Ben Dov**, Ram On (IL); **Oded Golan**, Kefar Tavor (IL)

(73) Assignee: **.MAYTRONICS LTD**, Kibbutz Yizrael (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 956 days.

(21) Appl. No.: **14/445,082**

(22) Filed: **Jul. 29, 2014**

(65) **Prior Publication Data**

US 2015/0067974 A1 Mar. 12, 2015

Related U.S. Application Data

(60) Provisional application No. 61/875,066, filed on Sep. 8, 2013.

(51) **Int. Cl.**
E04H 4/16 (2006.01)

(52) **U.S. Cl.**
CPC ***E04H 4/1654*** (2013.01); ***E04H 4/1663*** (2013.01)

(58) **Field of Classification Search**
CPC E04H 4/1654; E04H 4/1663
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,828,626	A	5/1989	Meincke	
6,112,354	A *	9/2000	Stoltz	E04H 4/1663 15/1.7
6,314,983	B1	11/2001	Hatch	
6,965,814	B2	11/2005	Hadari	
9,127,472	B2	9/2015	Borg	
2003/0201218	A1	10/2003	Henkin	
2004/0040581	A1 *	3/2004	Bruwer	E04H 4/1654 134/18
2011/0000035	A1	1/2011	Pichon	

FOREIGN PATENT DOCUMENTS

CA	1109209	9/1981
CN	201747089	2/2011
CN	202970016 U	6/2013

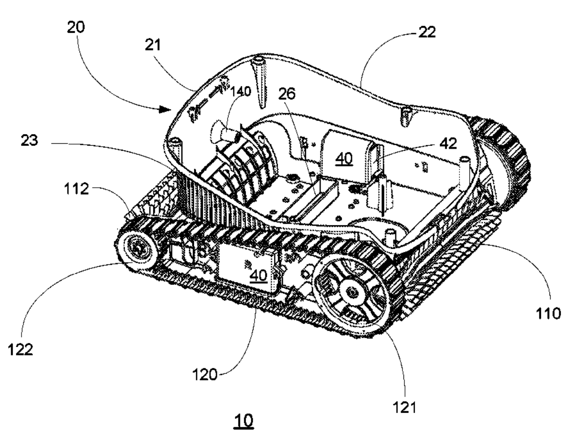
* cited by examiner

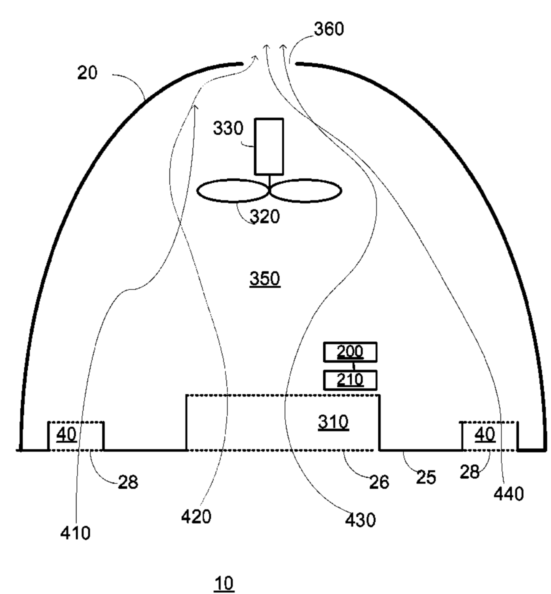
Primary Examiner — Randall E Chin
(74) *Attorney, Agent, or Firm* — Reches Patents

(57) **ABSTRACT**

A cleaning robot may be provided and may include a housing comprising at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit and the bypass mechanism.

42 Claims, 15 Drawing Sheets





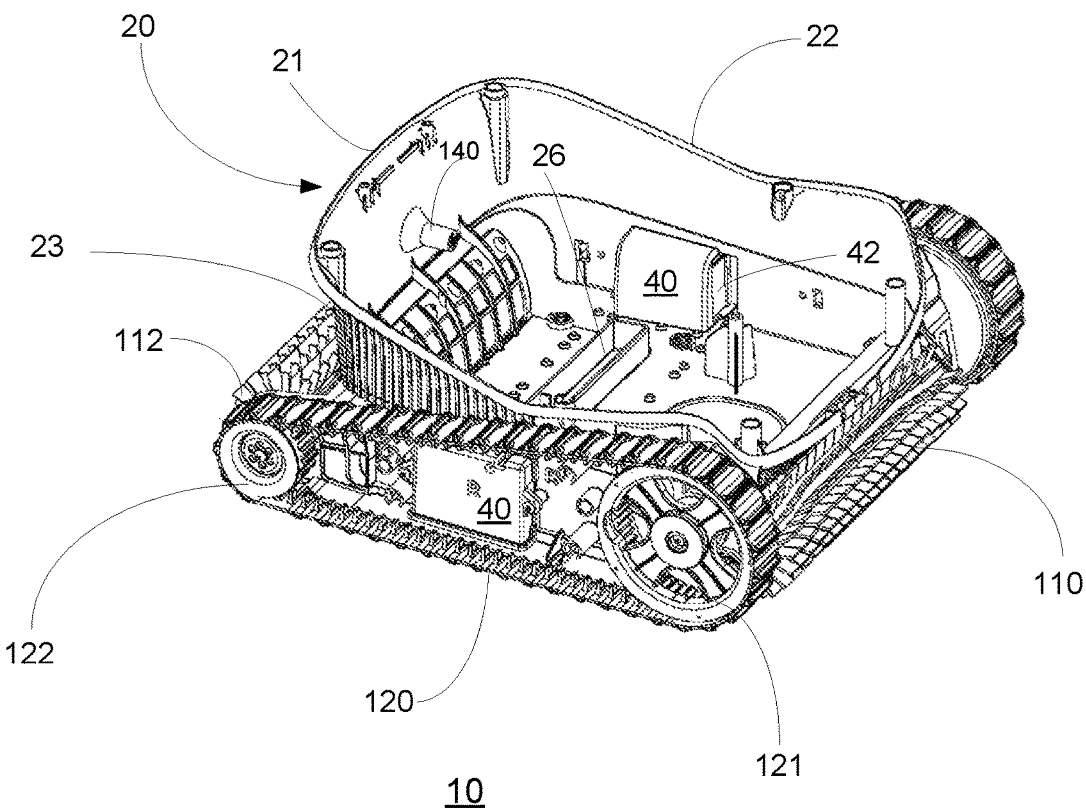


FIG. 1

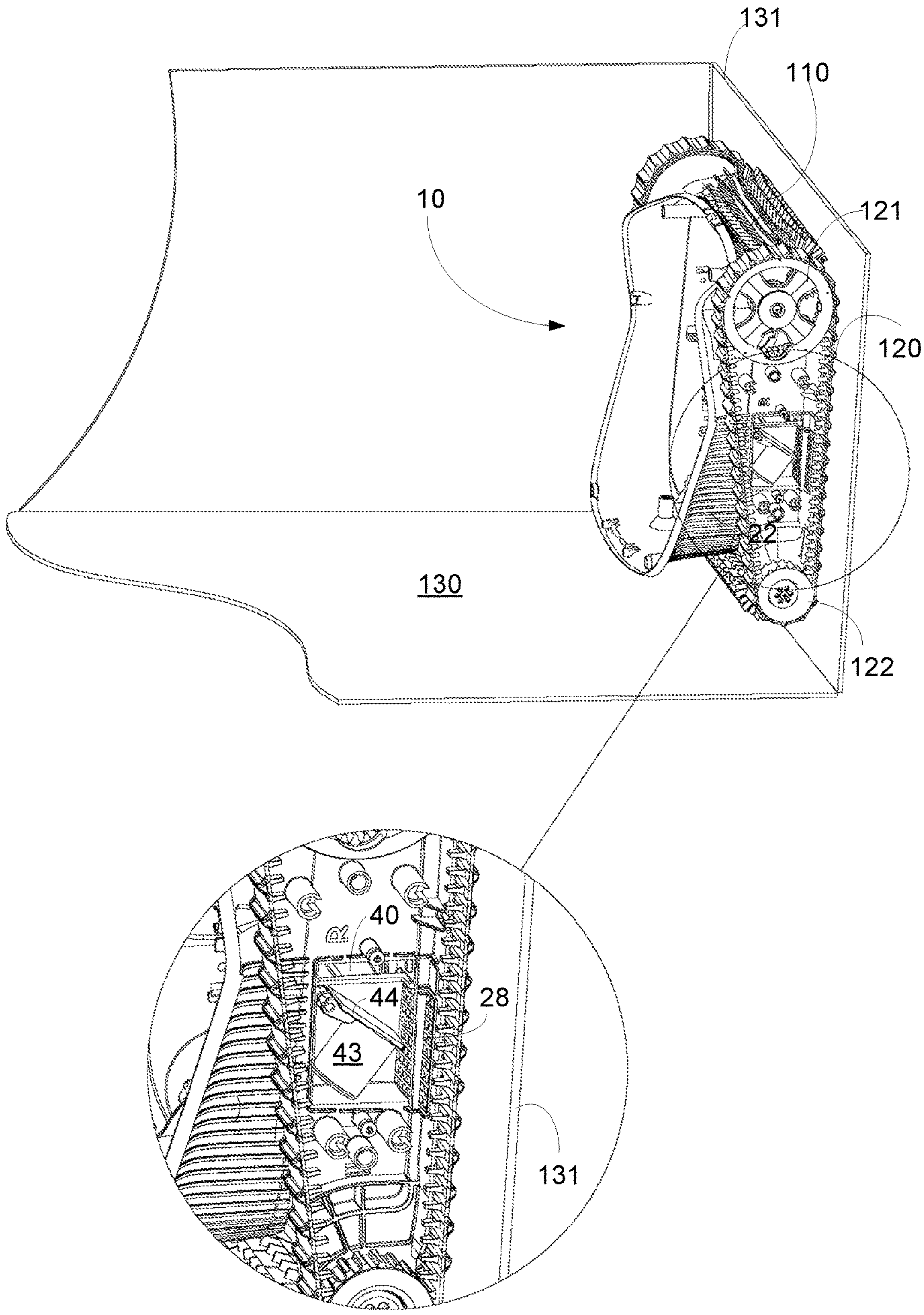


FIG. 2

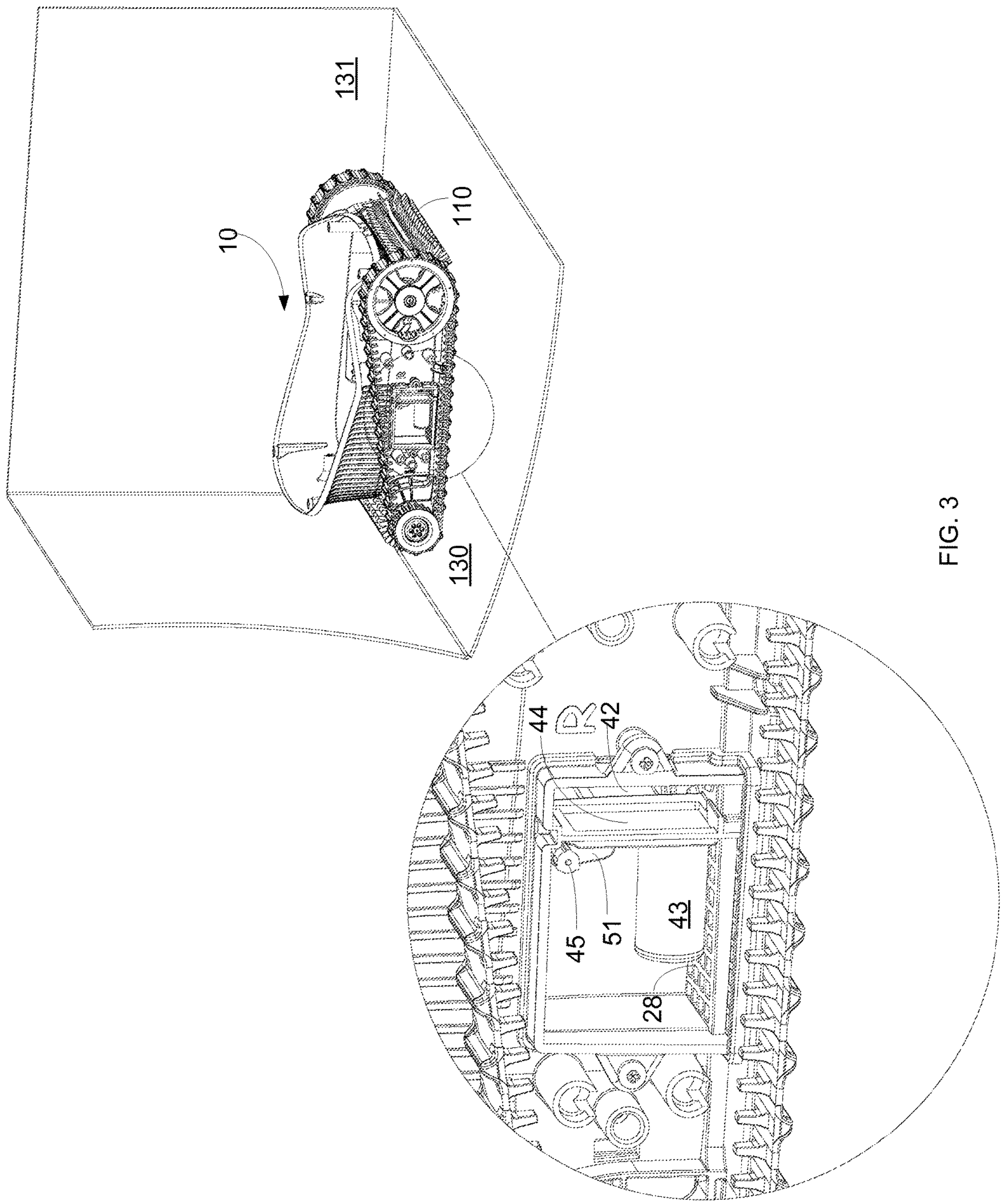


FIG. 3

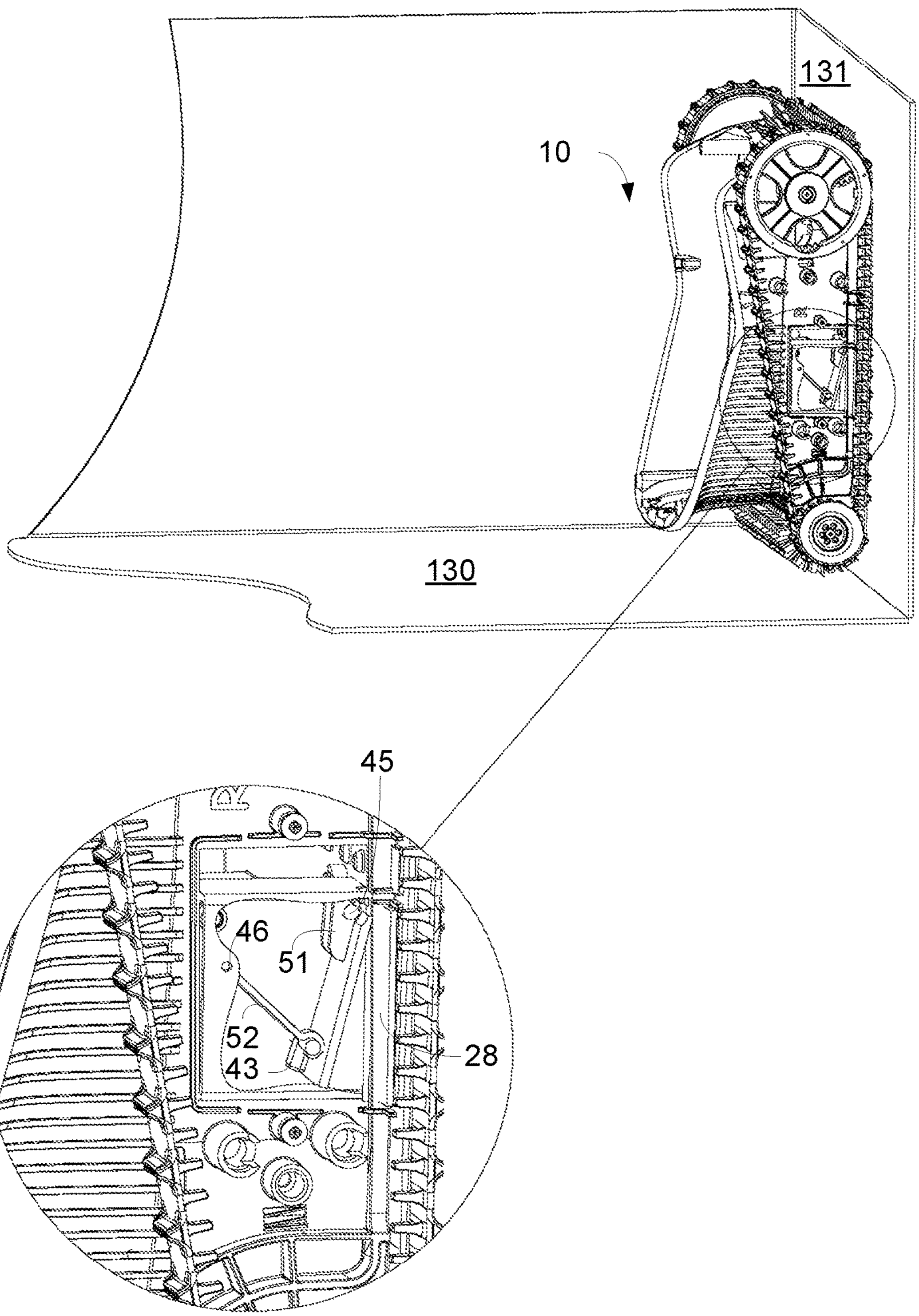


FIG. 4

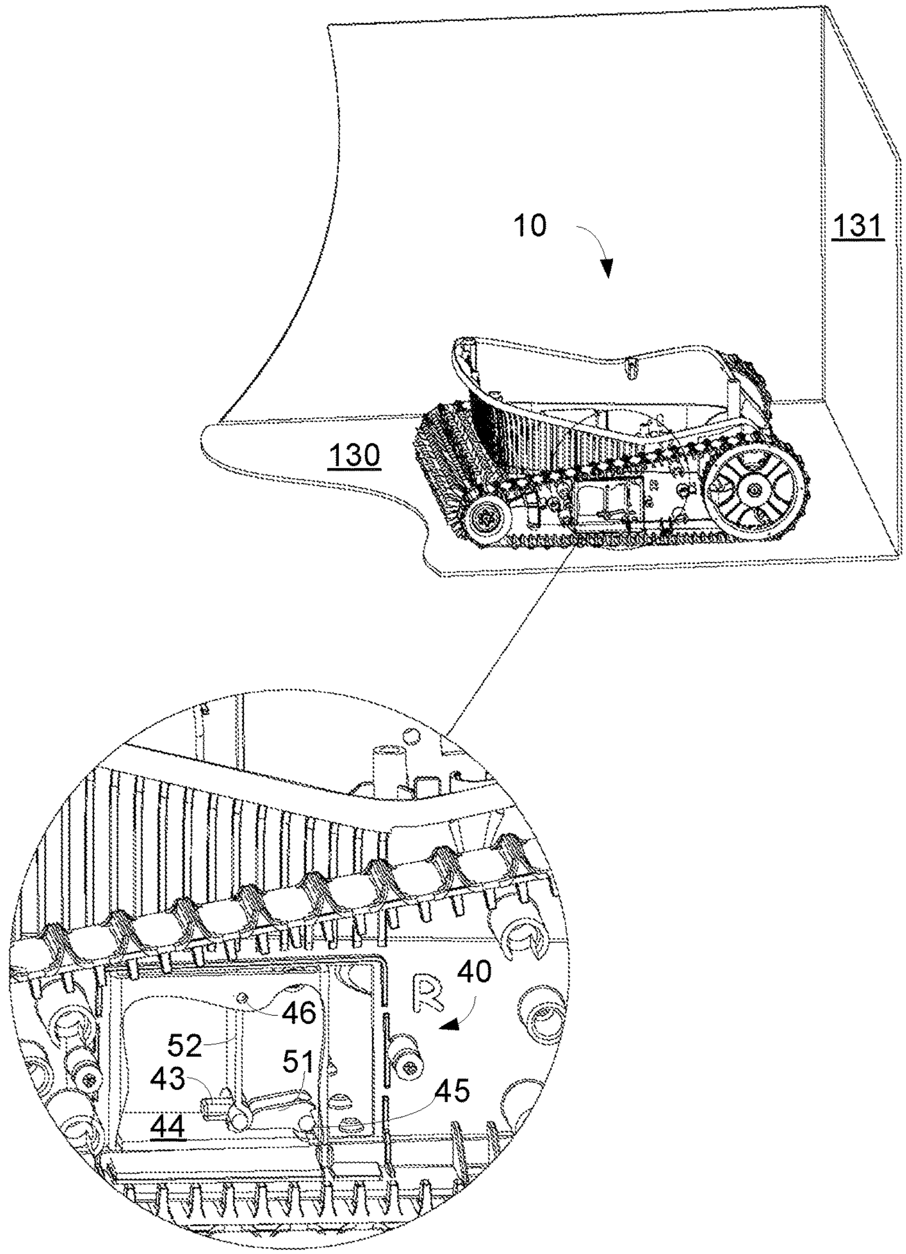


FIG. 5

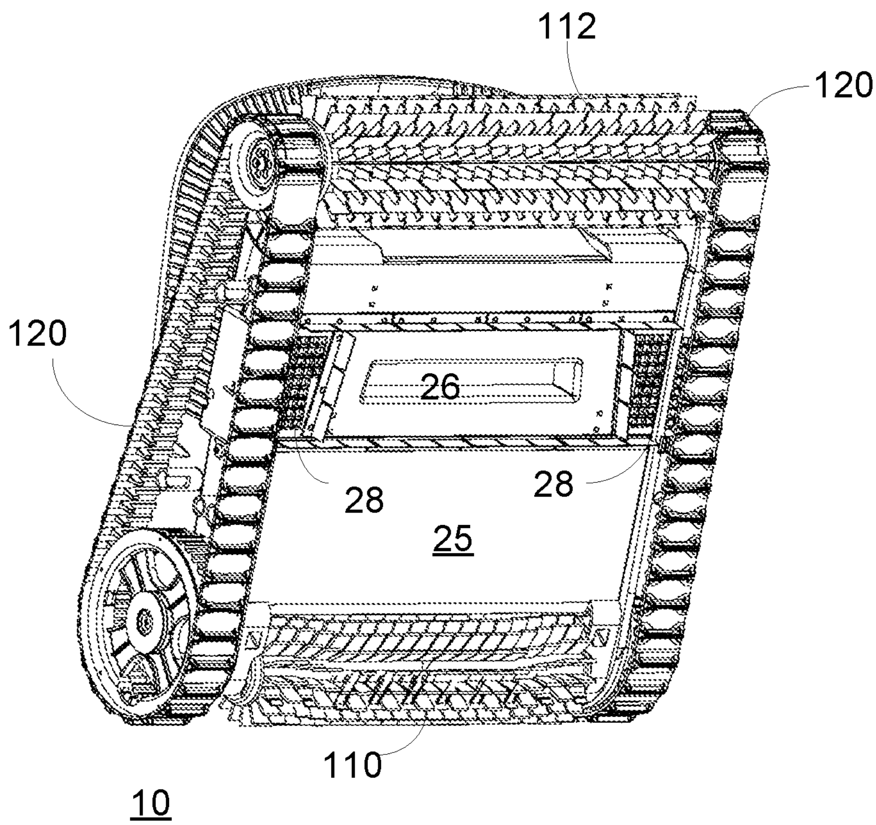


FIG. 6

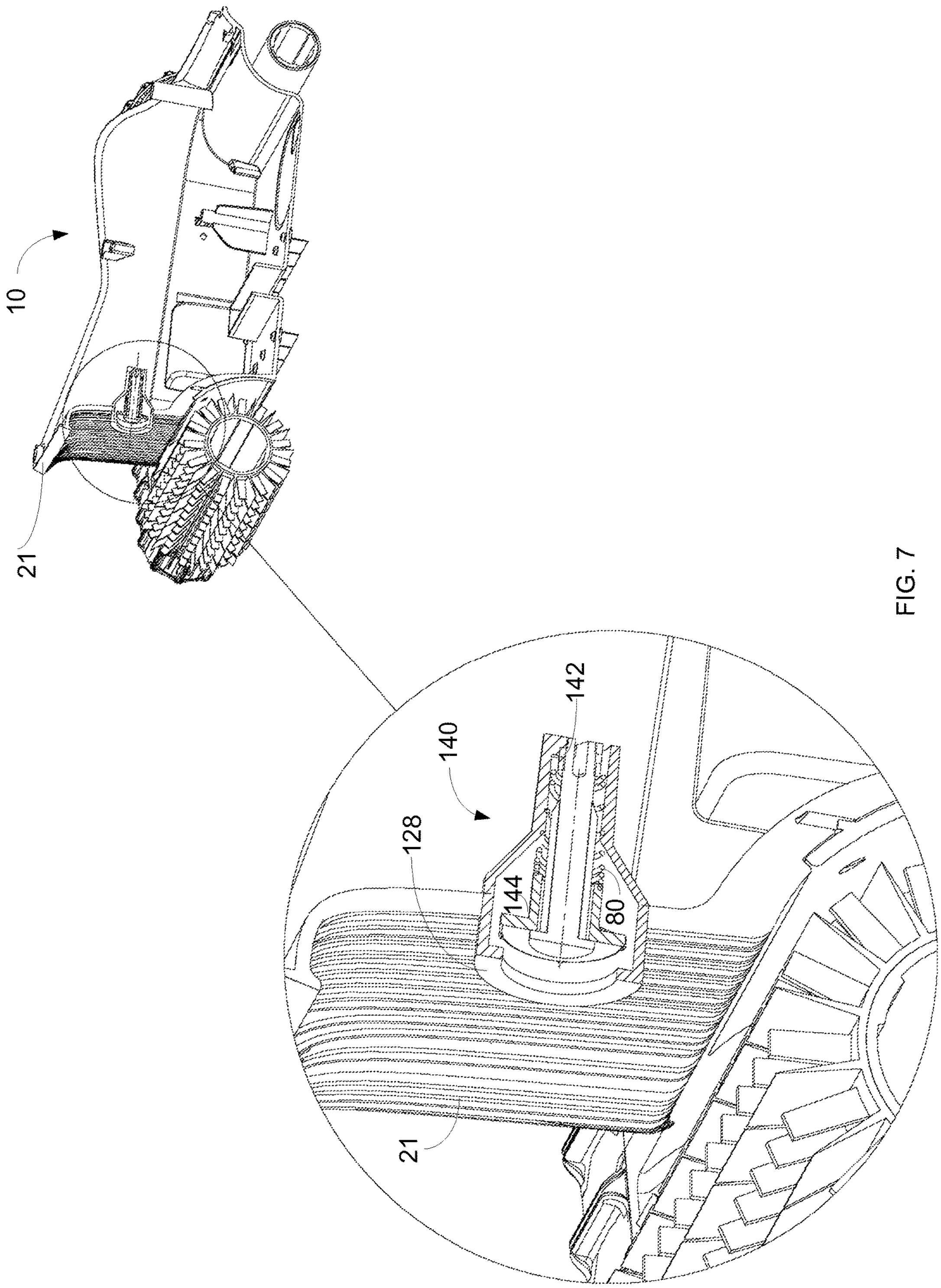


FIG. 7

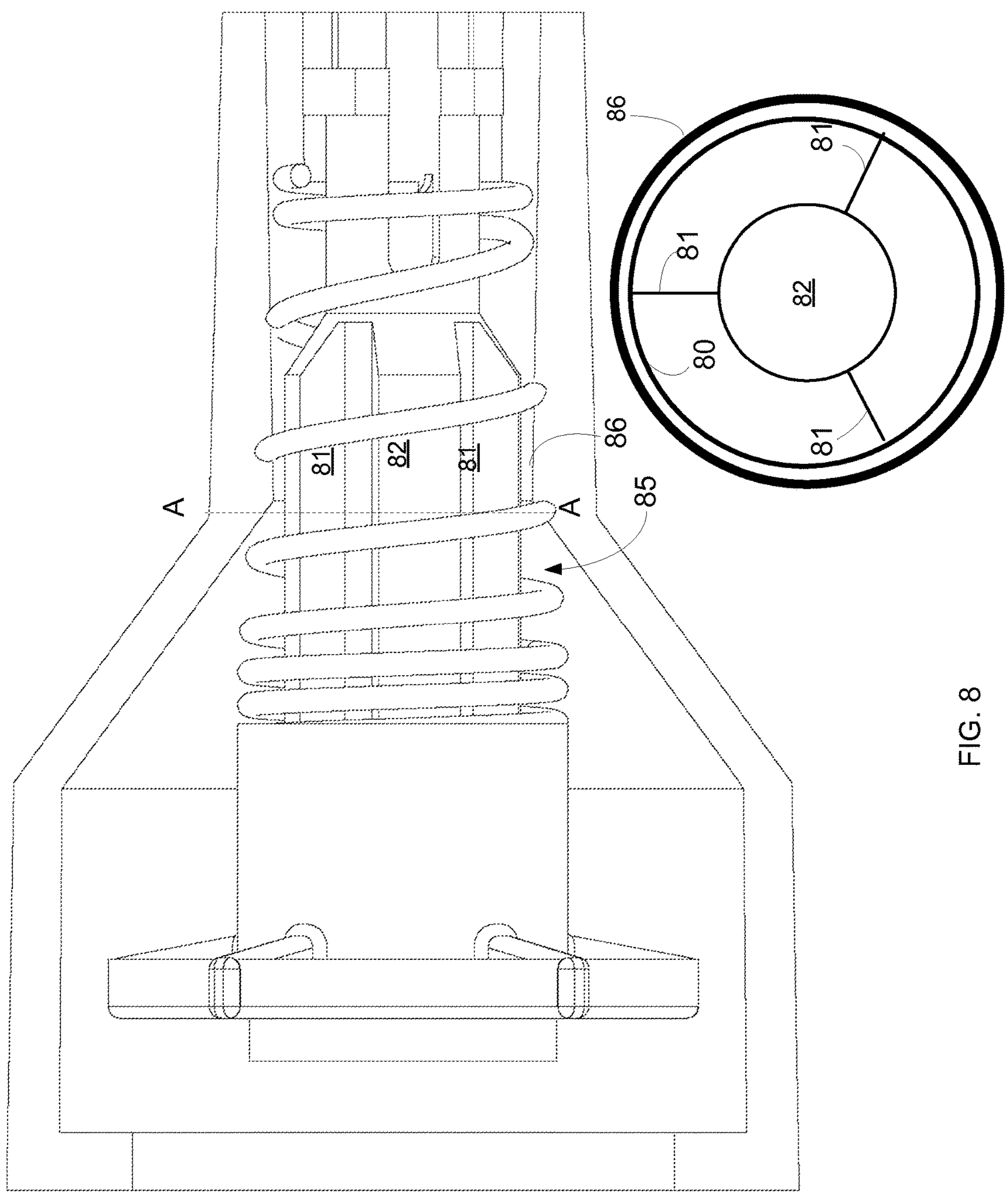


FIG. 8

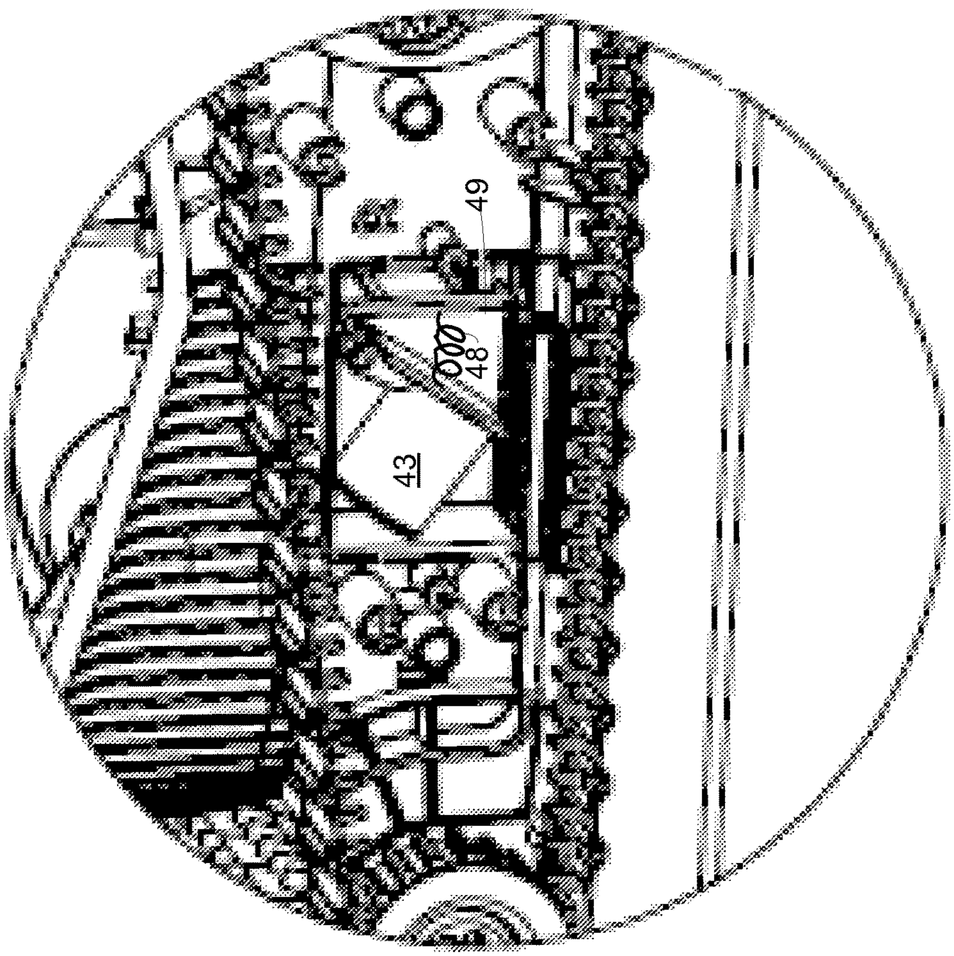


FIG. 9

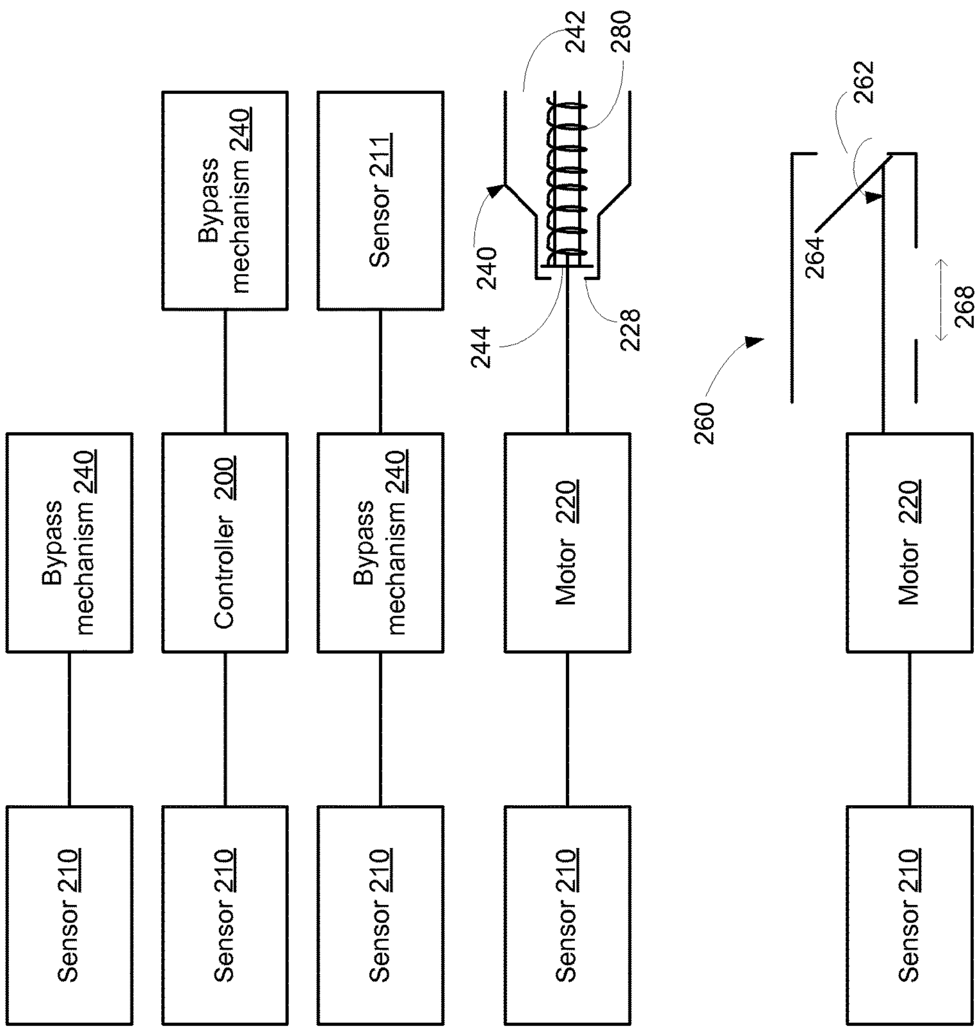

Sensor 210
Bypass mechanism 240
Sensor 210
Controller 200
Bypass mechanism 240
Sensor 210
Bypass mechanism 240
Sensor 211
Sensor 210
Motor 220
240
242
280
244
228
260
Sensor 210
Motor 220
262
264
268

FIG. 10

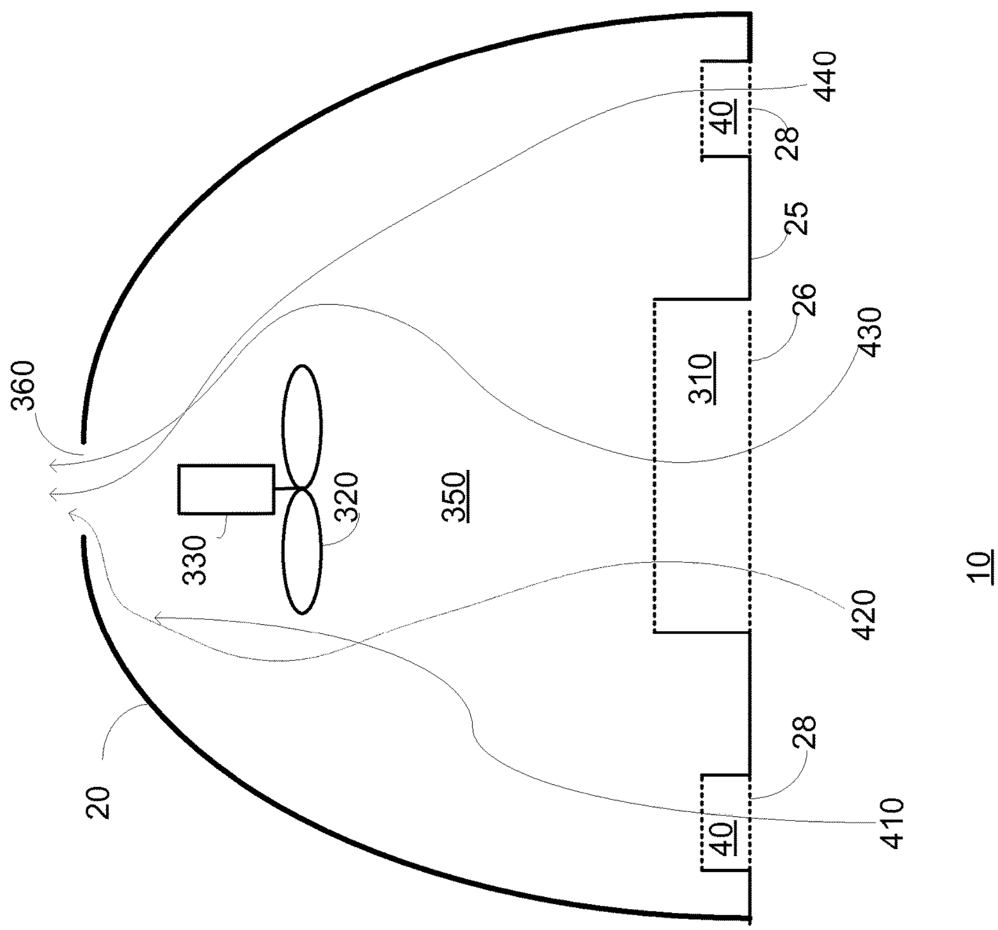


FIG. 11

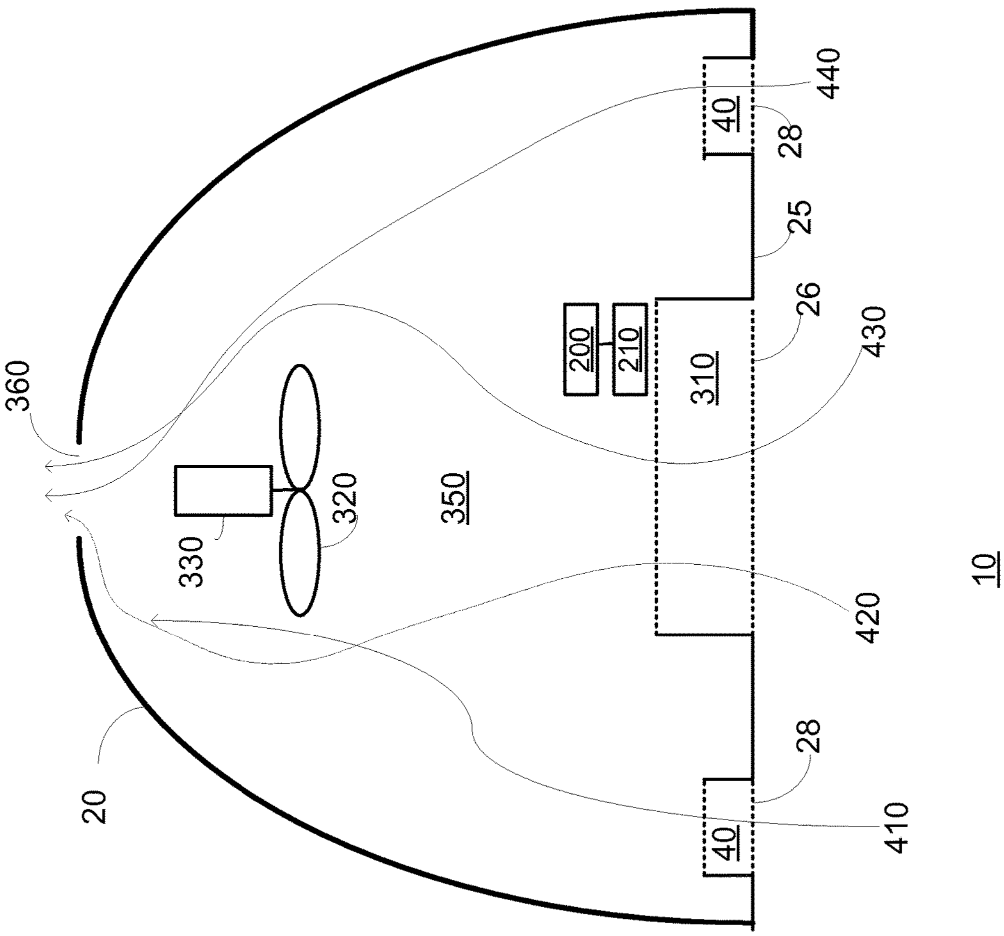


FIG. 12

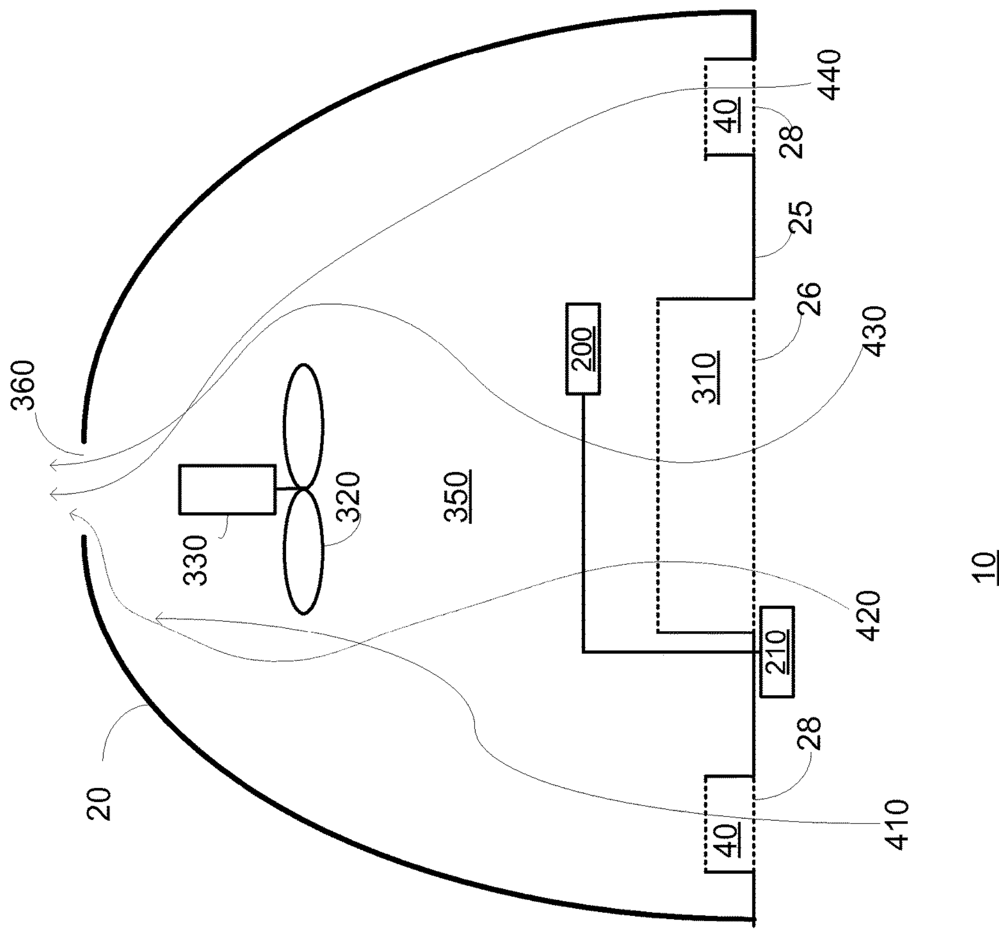


FIG. 13

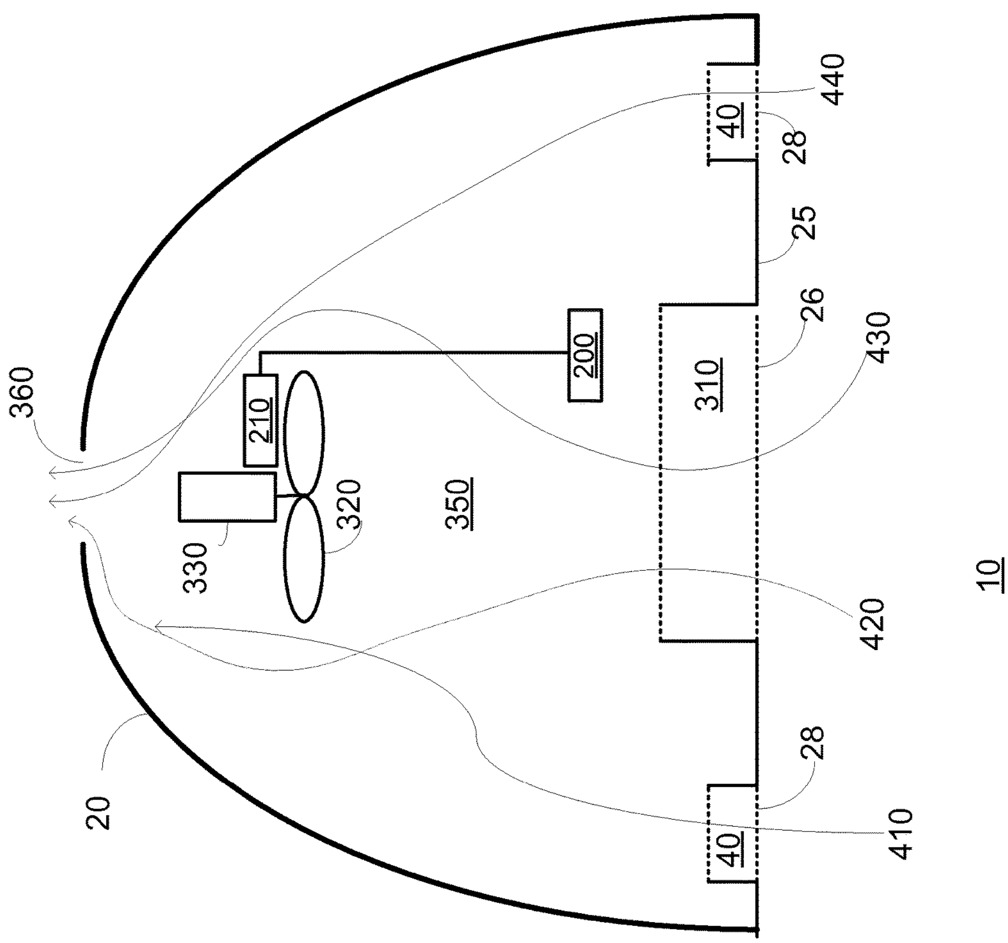


FIG. 14

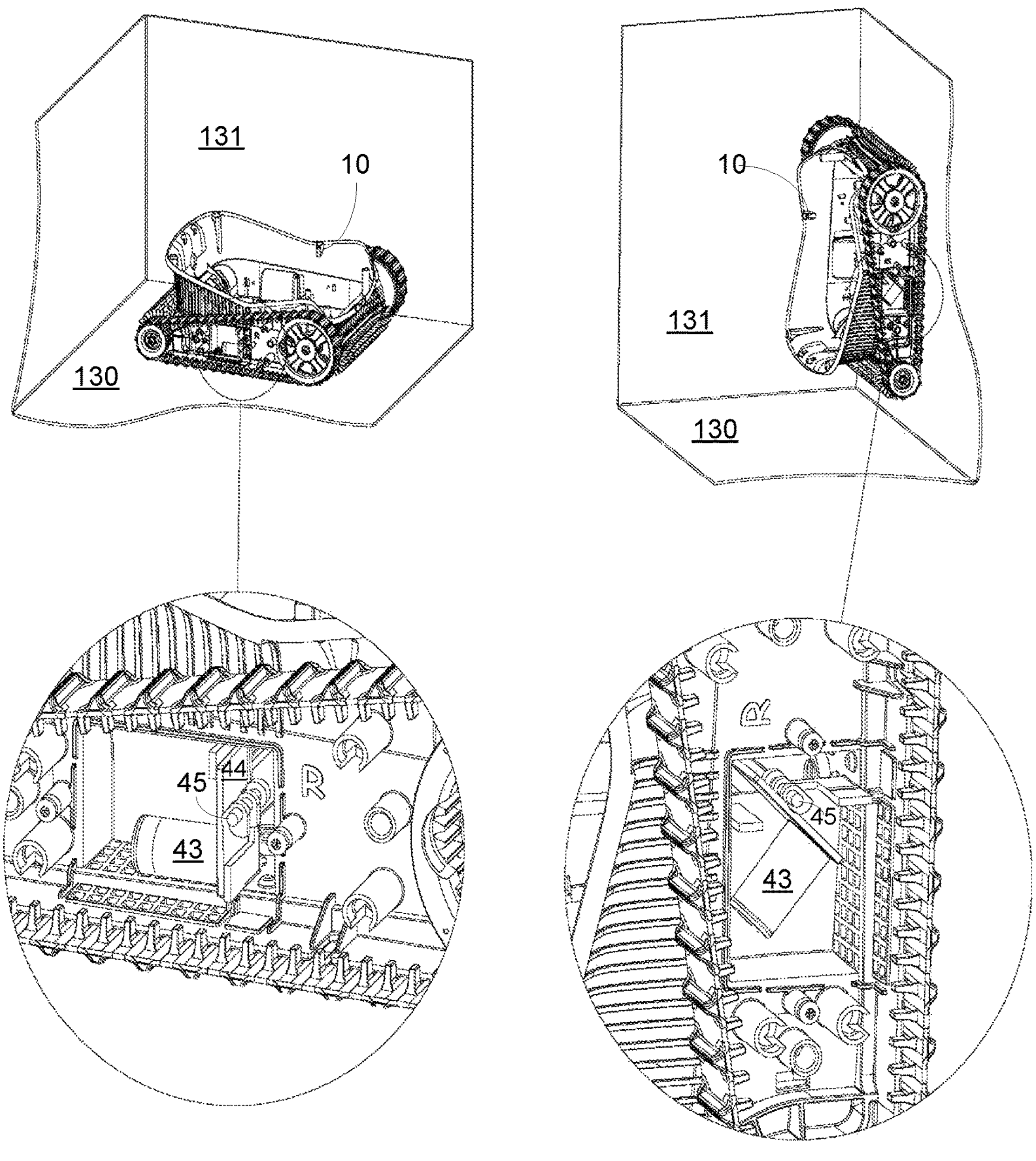


FIG. 15

POOL CLEANING ROBOT WITH BYPASS MECHANISM

RELATED APPLICATION

This application claims priority from U.S. provisional patent filing date Sep. 8, 2013 Ser. No. 61/875,066 which is incorporated herein by reference.

BACKGROUND

Cleaning robots contribute to the cleanliness of the fluid within a pool by moving within the pool and by filtering the fluid of the pool by means of a filter. The fluid of the pool enters the cleaning robot via one or more inlets, pass through the filter to be filtered and finally is outputted (after being filtered) as filtered fluid.

In some cleaning robots the effectiveness of the cleaning robot and even the mere movement of the cleaning robot require that the filtering unit to be clean. For example, some cleaning robots will stop moving if the filter is clogged. Yet other cleaning robots will not be able to climb the walls of the pool without a certain amount of fluid that is drawn-in by the cleaning robot and assist in attaching the cleaning robot to the walls of the pool.

There is a growing need to provide a cleaning robot that may be arranged to contribute to the cleanliness and sanitization of the pool surfaces and fluid even when its filters are partially or fully clogged.

SUMMARY

According to an embodiment of the invention there may be provided a cleaning robot with a bypass mechanism. The bypass mechanism can bypass one or more filters of a filtering unit.

According to an embodiment of the invention there may be provided a cleaning robot that may include a housing may include at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that may be arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit or the bypass mechanism.

The bypass mechanism may be arranged to allow fluid to pass through the bypass mechanism when the cleaning robot may be tilted by at least a predefined tilt angle.

The degree of openness of the bypass mechanism may be responsive to a tilt angle of the cleaning robot.

The bypass mechanism may include a door. The door may movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit. The position of the door may determine the openness level of the bypass mechanism.

The door may be pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

The door may be coupled to a weight.

The weight may be connected to a door. For example—near a lower end of the door. The rotation axis may be located near an upper end of the door.

The door may be connected to a lever that may be pivotally coupled to a rotation axis.

The door may be connected to a hinge that may be pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

The door may be coupled to a lever that may be pivotally coupled to a second rotation axis; wherein the lever may be arranged to limit a pivoting of the door about the first rotation axis.

The lever may be connected to a weight.

The weight may be arranged to slide across the door when the door moves between the close position and the open position.

The bypass mechanism may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

The bypass mechanism may include a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element may be arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

The bypass mechanism may include a spring that induces the sealing element to move towards the close position.

When the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element may be moved towards the open position.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be upstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be downstream to the filtering unit.

The bypass mechanism may be arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

The cleaning robot further may include a sensor. The sensor may be arranged to detect an occurrence of a bypass related event and the bypass mechanism may be arranged to respond to the occurrence of the bypass related event.

The bypass mechanism may include a motor that may be arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

The sensor may be a robot tilt angle sensor.

The sensor may be a suction sensor.

The at least one inlet may include a bypass mechanism inlet and a filtering unit inlet.

The at least one inlet may include multiple bypass mechanism inlets and a filtering unit inlet.

The bypass mechanism may be closer to a sidewall of the housing than the filtering unit.

The bypass mechanism may be connected to a sidewall of the housing.

The bypass mechanism extends outside a sidewall of the housing.

The cleaning robot may include at least one additional bypass mechanism. The bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

At least two bypass mechanisms of the plurality of bypass mechanisms may differ from each other. For example—one bypass mechanism may be tilt angle triggered while another bypass mechanism may be pressure triggered.

At least two bypass mechanism of the plurality of bypass mechanisms may differ from each other by a triggering event that triggers an opening of the bypass mechanism.

At least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

A first bypass mechanism of the plurality of bypass mechanisms may be responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms. For example—when a pressure triggered bypass mechanism is opened it may ease the opening of a door of a tilt angle triggered bypass mechanism as the opening of the pressure triggered bypass mechanism may lower the suction within the housing and that reduction may ease an opening of a door of a tilt angle triggered bypass mechanism.

An opening of first bypass mechanism of the plurality of bypass mechanisms may ease an opening of another bypass mechanism of the plurality of bypass mechanisms.

An opening of first bypass mechanism of the plurality of bypass mechanisms may increase a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a clogging level of the filtering unit.

A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

A first bypass mechanism of the plurality of bypass mechanisms may have an opening located at a bottom of the housing and a second bypass mechanism of the plurality of bypass mechanisms may have an opening located at a sidewall of the housing.

A first bypass mechanism of the plurality of bypass mechanisms may include a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

A degree of openness of the bypass mechanism may be responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

There may be provided a cleaning robot that includes any combination of any components illustrated in the summary section of the application or in the specification.

There may be provided a cleaning robot that includes any combination of any components illustrated in any claims of the application.

If, for example, a cleaning robot include more than a single bypass mechanism then any of the bypass mechanism may have any structure illustrated in the summary, the specification or the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

FIG. **1** illustrates a portion of cleaning robot according to an embodiment of the invention;

FIG. **2** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **3** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **4** illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. **5** illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. **6** is a bottom view of a cleaning robot according to an embodiment of the invention;

FIG. **7** is a cross sectional view of a portion of cleaning robot taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention;

FIG. **8** is a cross sectional view of a bypass mechanism taken along a longitudinal axis of the bypass mechanism according to an embodiment of the invention;

FIG. **9** illustrates a portion of a cleaning robot according to an embodiment of the invention;

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention;

FIG. **11** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **12** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **13** is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. **14** is a cross sectional view of a cleaning robot according to an embodiment of the invention; and

FIG. **15** illustrates a portion of cleaning robot that climbs on a sidewall of a pool and a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

According to an embodiment of the invention there is provided a cleaning robot that may include one or more bypass mechanisms.

Various figures illustrate between one to three bypass mechanisms and it is noted that the number of bypassing mechanisms may be any positive integer (for example—one, two, three, four, five and more).

A bypass mechanism is a mechanical element that allows fluid to bypass a filtering unit. Thus, fluid that flows through a bypass mechanism does not flow through the filtering unit. It is noted that if the filtering unit has multiple filters than the bypass unit may be positioned to bypass one, some or all of the multiple filters of the filtering unit.

A bypass mechanism may include one or more mechanical components but may also include electrical components.

If a cleaning robot includes multiple bypass mechanisms then they all can be the same bypass mechanism, may all be different from each other or may include two or more bypass mechanisms that differ from each other.

Bypass mechanisms may differ from each other by their location, by mode of operation, by size, by shape, by the parameters that control their operation (such as a tilt angle of the cleaning robot or a suction level developed within an internal space of the cleaning robot), by including sensors, by excluding sensors, by including one or more motors, by excluding motors and the like.

Any bypass mechanism may be open or closed. An open bypass mechanism allows the fluid to flow through the bypass mechanism and to exit from the bypass mechanism thereby not flowing through one of more filters. A closed bypass mechanism prevents fluid from flowing through the bypass mechanism and exiting the bypass mechanism. It may prevent the fluid from entering the bypass mechanism, prevent fluid that enters the bypass mechanism to reach an outlet of the bypass mechanism and/or prevent fluid to flow through the outlet of the bypass mechanism.

Any bypass mechanism may have more than two openness levels—and may open at different degrees. Thus, a bypass mechanism may be partially open.

For simplicity of explanation the term "open" refers to a fully open or partially open.

According to an embodiment of the invention a bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filter is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid flow intensity and/or pressure level within the cleaning robot or when sensing that the flow intensity and/or pressure level of the filtered fluid is below a threshold.

The sensing may include sensing the flow and/or pressure of fluid before (downstream) and/or after (upstream) the filtering unit, in a path leading to the hydraulic movement mechanism and the like. The flow intensity and/or pressure level can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the filtering unit bypass may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall). This may be sensed by tracking the tilt angle of the cleaning robot, by using accelerometers and the like.

The opening may occur when sensing a reduction of the flow and/or pressure and climbing of the wall. Different thresholds for flow and/or suction levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the Flow and/or pressure of the filtered fluid is lower, and the like.

The movement of the cleaning robot even when the filtering unit is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving in the pool, detaching bacteria from the pool walls and floor by contact and assisting in pool filtering devices to filter the fluid by inducing fluid movements within the pool.

According to an embodiment of the invention the bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filtering unit is clogged.

Because the bypass mechanism may allow un-filtered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of bypass related events.

For example—the bypass mechanism may be opened when sensing a reduction in the filtered fluid and/or an increase in a suction level within the cleaning robot or both. The sensing may include sensing the flow and/or suction (pressure) of fluid before and/or after the filtering unit, in a path leading to a suction unit, to a hydraulic movement mechanism and the like. The flow and/or suction (pressure) can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

Yet for another example—the bypass mechanism may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall).

The opening may occur when sensing a reduction of the Flow and/or pressure and climbing of the wall. Different thresholds for Flow and/or pressure levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example—the bypass mechanism may be opened to a greater extent when climbing a wall, when the flow and/or pressure of the filtered fluid is below a threshold, and the like.

By providing the bypass mechanism and allowing fluid to flow even when the filtering unit is clogged the cleaning robot may move in the pool. This movement of the cleaning robot even when the filter is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving the cleaning robot in the pool thereby detaching bacteria from the pool walls and floor by contact and assisting to pool filtering devices to filter the fluid by inducing fluid movements within the pool.

FIG. **1** illustrates a portion of cleaning robot **10** according to an embodiment of the invention.

FIG. **1** illustrates only a part of the cleaning robot as the upper part of the cleaning robot as well as multiple internal components of the cleaning robot (such as a filtering unit, a fluid suction unit, a driving motor and the like) are missing for clarity of explanation.

FIG. **1** illustrates the portion of the cleaning robot as including a housing **20**, front brush wheel **110**, rear brush wheel **112**, and tracks **120** movable by front wheel **121** and/or rear wheel **122**. It is noted that the cleaning robot may be moved by other movement elements (for example it may include wheels instead of tracks), may have other cleaning elements and the like.

The cleaning robot of FIG. **1** includes three bypass mechanisms—two bypass mechanisms **40** located at both sides of the housing (near sidewalls **22** and **23** of the housing **20**) and one bypass mechanism **140** located at the rear wall **21** of the housing **20**. FIG. **1** also shows a filtering unit inlet **26** formed at about the center of the bottom of the housing and positioned between bypass mechanisms **40**. FIG. **1** also shows a bypass outlet **42** of bypass mechanism **40**.

Each bypass mechanism allows fluid to bypass at least one filter of the filtering unit. The fluid propagates towards a fluid suction unit (such as an impeller) of the cleaning robot that is arranged to direct towards the outlet (of the housing) fluid that passes through the at least one inlet and through at least one of the filtering unit and the bypass mechanism.

FIG. **2** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **3** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **2** illustrates an open bypass mechanism **40** while FIG. **3** illustrates a closed bypass mechanism.

In FIGS. **2** and **3** the bypass mechanism **40** is illustrated as including door **44**. Door **44** is movable between (a) a closed position (FIG. **3**) in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position (FIG. **2**) in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

Door **44** is pivotally coupled to a first rotation axis **45** and rotates between the closed position and the open position.

FIGS. **2** and **3** also shows that the door **44** is coupled to a weight **43**. The weight **43** assists in opening the door **44** when the cleaning robot starts to tilt and closing the door **44** when the cleaning robot is horizontal. Alternatively, the door **44** may be heavy enough and does not require an additional weight **43**.

FIGS. **2** and **3** illustrate the weight **43** is being connected to a door **44** near a lower end of the door and illustrate the first rotation axis **45** is located near an upper end of the door **44**. The first rotation axis **45** may alternatively be located near the center of the door (as illustrated in FIG. **15**) in order to reduce the needed weight or mass of **43**. It is noted that the relative locations of the first rotation axis **45** and the weight **43** may differ from those illustrated in FIGS. **2** and **3**.

FIGS. **2** and **3** also show that the door **44** is not directly connected to the rotation axis but show a hinge **51** that is pivotally snapped-in or coupled to the first rotation axis **45** and interfaces with the door **44**. FIGS. **2** and **3** also illustrate a bypass path inlet **28** that is covered by a filtering mesh.

FIG. **4** illustrates a portion of cleaning robot **10** that climbs on a sidewall **131** of a pool according to an embodiment of the invention. FIG. **5** illustrates a portion of cleaning robot **10** that propagates along a bottom **130** of a pool according to an embodiment of the invention. Sidewall **131** is vertical and the bypass mechanism **40** is opened at its maximal extent. FIG. **4** illustrates an open bypass mechanism **40** while FIG. **5** illustrates a closed bypass mechanism.

FIGS. **4** and **5** illustrate a door **44** that is connected to a hinge **51** that is pivotally snapped-in or coupled to a first rotation axis **45** thereby allowing the door **44** to pivot about the first rotation axis **45**.

The door **44** of FIGS. **4** and **5** is coupled to a lever **52** that is pivotally coupled to a second rotation axis **46**. The second level **52** may be arranged to limit a pivoting of the door **44** about the first rotation axis **45**. The lever **52** may be oriented at about ninety degrees to the tilt angle of the cleaning robot but this is not necessarily so.

FIGS. **4** and **5** illustrate the lever **52**, connected or snapped-in to a weight **43** (or unify it by **43**), and interfaces with door **44**.

FIGS. **4** and **5** illustrate that the weight **43** is arranged to slide across the door **44** when the door moves between the close position and the open position.

FIGS. **2-6** illustrates bypass mechanisms **40** that their openness level depended upon the tilt angle of the cleaning robot. The tilt angle may be defined as the angle between the cleaning robot and the horizon.

It is noted that although FIGS. **2-6** do not show sensors for triggering the opening (and/or closing) of the bypass mechanisms—that the cleaning robot may include sensors that may sense the tilt angle of the cleaning robot and that the sensed tilt robot may be used to trigger (for example by using a motor) the opening and/or closing of a bypass mechanism.

Accordingly, there may be provided a cleaning robot wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle. This tilt angle may be measured by a sensor (such as sensor **210** of FIGS. **10**, **12** and **13**).

Yet for another embodiment of the invention the mechanical elements of the bypass mechanism may be arranged to allow opening the bypass mechanism only when the tilt angle exceeds a predetermined tilt angle. Referring to the example set forth in FIG. **9**, a spring **48** or other limiting element may be connected to door **44**, or to weight **43** and to a frame **49** of the bypass mechanism in order to counter the movement of the weight **43** or door **44** so that only at a predefined tilt angle the door **44** will move and at least partially open the bypass mechanism **40**. The predefined tilt angle may range between 70 and 110 degrees, may range between 50 and 90 degrees, between 20 and 80 degrees and the like.

FIG. **6** is a bottom view of a cleaning robot **10** according to an embodiment of the invention.

It shows a filtering unit inlet **26** located at about the center of the bottom **25** of the cleaning robot as well as two bypass path inlets **28** that are covered by a filtering mesh positioned at both sides of the filtering unit inlet **26**. This figure also shows front brush wheel **110**, rear brush wheel **112**, front wheel **121** and read wheel **122**.

FIG. **7** is a cross sectional view of a portion of cleaning robot **10** taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention.

FIG. **8** is a cross sectional view of a bypass mechanism **140** taken along a longitudinal axis of the bypass mechanism **140** according to an embodiment of the invention. FIG. **8** also provides a cross sectional view of the bypass mechanism **140** taken along axis A-A that is normal to the longitudinal axis of the bypass mechanism **140**.

Bypass mechanism **140** is installed in wall **21** of housing **20**. Bypass mechanism **140** may also be installed on other walls such as for example, sidewall **22** of the pool cleaner. Multiple bypass mechanisms may be used. It is pressure (suction) activated—it has a sealing element **144** that is forced by a spring **80** to move toward an exterior of the cleaning robot **10** thereby closing the inlet **128** of bypass mechanism **140**. On the other hand a pressure difference between the interior and the exterior of the cleaning robot **10** and/or suction applied by a fluid suction unit within an internal space of the cleaning robot (not shown) forces the sealing element **144** to move towards the interior of the cleaning robot **10** thereby opening the inlet **128** of bypass mechanism **140** and allowing fluid to pass through bypass mechanism and through outlet **142**. Accordingly—there is a suction (or pressure) thresholds that overcomes the spring and opens the bypass mechanism.

The sealing element **144** moves along an axis that is normal to the wall **21**. It includes a fluid conduit that has different cross sections at different location thus allowing a movement of the sealing element along the axis opens and closes the bypass mechanism **140**.

Accordingly—the sealing element **144** may move between (a) a closed position in which the sealing element **144** prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in

which the sealing element **144** allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

FIG. **8** illustrates that spring **80** is supported by and moves along a supporting element **86** that has a core **82** and three spaced apart wings **81** extending from the core **82**. Accordingly—the spaced apart wings **81** which contact the spring **80** define openings through which fluid may flow when the bypass mechanism **140** is open. The inner wall **86** of the bypass mechanism **140** may be larger than the exterior of spring **80**.

FIG. **10** illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention. FIG. **10** shows (from top to bottom) the following combinations:

a. A sensor **210** coupled to a bypass mechanism **240**. The sensor may sense pressure levels, tilt angles and may be used to control the bypass mechanism.

b. A controller **200** that is coupled to sensor **210** and to the bypass mechanism **240**. The sensor **210** may sense pressure levels, tilt angles and may send sensing signals to controller **200** that may control, in response to the sensing signals, the bypass mechanism.

c. Multiple (such as two) sensors **210** and **211** that are coupled to bypass mechanism **240** and their readings may be used for controlling the bypass mechanism **240**. Alternatively—the sensors may be coupled to controller **200** that in turn controls the bypass mechanism **240**.

d. Sensor **210** that controls motor **220** that in turn may manipulate (for example push and/or pull) sealing element **244** of bypass mechanism **240**. The bypass mechanism **240** may resemble (or may differ) the bypass mechanism **140** of FIG. **8**. The sealing element **244** can be forced by spring **280** to close the bypass mechanism **240**. The bypass mechanism **240** has an inlet **228** and an outlet **242** that is smaller than the inlet **228**.

e. Sensor **210** that controls motor **220** that in turn may manipulate (for example rotate) door **264** of bypass mechanism **260**. The bypass mechanism **260** may resemble (or may differ) the bypass mechanism **40** of FIGS. **2**-**4**. The door **264** can rotate about a rotation axis thereby close or open the bypass mechanism **260**. The bypass mechanism **260** has an inlet **268** and a filtering mesh and an outlet **262**.

FIG. **11** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **12** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **13** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention. FIG. **14** is a cross sectional view of a cleaning robot **10** according to an embodiment of the invention.

The cross section is taken along a transverse axis of the cleaning robot **10**.

FIGS. **11**, **12**, **13** and **14** differ by each other by:

a. The lack of a sensor and a controller **200** (FIG. **11**).

b. The inclusion of a controller **200** and the sensor **210** at a point that is upstream (after) the filtering unit **310**. (FIG. **12**)

c. The inclusion of the controller **200** upstream of the filtering unit **310** while the sensor **210** is located downstream the filtering unit **310**. (FIG. **13**)

d. The inclusion of a controller **200** within internal space **350** wherein the sensor **210** monitors the rotational speed of the suction unit (for example—of its impeller **320**). (FIG. **14**)

FIGS. **11**, **12**, **13** and **14** show the flow of fluid through bypass mechanism **40**—when the bypass mechanism **40** is open (see arrows **410** and **440**) or through filtering unit **310** (arrows **420** and **430**). FIG. **12** also illustrates a bypass path inlet **28** that is covered by a filtering mesh.

In FIG. **12** the sensor **210** may sense the flow of fluid at a point that is upstream to the filtering unit **310**. In FIG. **13** the sensor **210** may sense the flow of fluid at a point that is downstream to the filtering unit **310**.

The fluid that passes bypass mechanism **40** or filtering unit **310** enter an internal space **350** of the housing **20** and is drawn into a filtering unit **310** (illustrated as including impeller **320** and pump motor **330** for driving the impeller **320**) towards the outlet **360** of housing **20**.

While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

We claim:

1. A cleaning robot comprising: a housing comprising at least one inlet and an outlet; a filtering unit, located within the housing, for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that is arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one of the filtering unit and the bypass mechanism.

2. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle.

3. The cleaning robot according to claim **2** wherein predefined tilt angle ranges between 70 and 110 degrees.

4. The cleaning robot according to claim **2** wherein predefined tilt angle is 90 degrees.

5. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to a tilt angle of the cleaning robot.

6. The cleaning robot according to claim **1** wherein the bypass mechanism comprises a door; wherein the door is movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

7. The cleaning robot according to claim **6** wherein the door is pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

8. The cleaning robot according to claim **7** wherein the door is coupled to a weight.

9. The cleaning robot according to claim **8** wherein the weight is connected to a door at a location that is near a lower end of the door and wherein the rotation axis is located near an upper end of the door.

10. The cleaning robot according to claim **7** wherein the door is connected to a lever that is pivotally coupled to a rotation axis.

11. The cleaning robot according to claim **7** wherein the door is connected to a hinge that is pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

12. The cleaning robot according to claim **11** wherein the door is coupled to a lever that is pivotally coupled to a second rotation axis; wherein the lever is arranged to limit a pivoting of the door about the first rotation axis.

13. The cleaning robot according to claim **12** wherein the lever is connected to a weight.

14. The cleaning robot according to claim **12** wherein the weight is arranged to slide across the door when the door moves between the close position and the open position.

15. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

16. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element is arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

17. The cleaning robot according to claim **15** wherein the bypass mechanism comprises a spring that induces the sealing element to move towards the close position.

18. The cleaning robot according to claim **17** wherein when the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element is moved towards the open position.

19. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is upstream to the filtering unit.

20. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to an intensity of flow of fluid at a point that is downstream to the filtering unit.

21. The cleaning robot according to claim **1** wherein the bypass mechanism is arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

22. The cleaning robot according to claim **1** further comprising a sensor;

wherein the sensor is arranged to detect an occurrence of a bypass related event and wherein the bypass mechanism is arranged to respond to the occurrence of the bypass related event.

23. The cleaning robot according to claim **22** wherein the bypass mechanism comprises a motor that is arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

24. The cleaning robot according to claim **22** wherein the sensor is a robot tilt angle sensor.

25. The cleaning robot according to claim **22** wherein the sensor is a suction sensor.

26. The cleaning robot according to claim **1** wherein the at least one inlet comprises a bypass mechanism inlet and a filtering unit inlet.

27. The cleaning robot according to claim **1** wherein the at least one inlet comprises multiple bypass mechanism inlets and a filtering unit inlet.

28. The cleaning robot according to claim **1** wherein the bypass mechanism is closer to a sidewall of the housing than the filtering unit.

29. The cleaning robot according to claim **1** wherein the bypass mechanism is connected to a sidewall of the housing.

30. The cleaning robot according to claim **1** wherein the bypass mechanism extends outside a sidewall of the housing.

31. The cleaning robot according to claim **1** comprising at least one additional bypass mechanism; wherein the bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

32. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms differ from each other.

33. The cleaning robot according to claim **31** wherein at least two bypass mechanism of the plurality of bypass mechanisms differ from each other by a triggering event that triggers an opening of the bypass mechanism.

34. The cleaning robot according to claim **31** wherein at least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

35. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms.

36. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms eases an opening of another bypass mechanism of the plurality of bypass mechanisms.

37. The cleaning robot according to claim **31** wherein an opening of first bypass mechanism of the plurality of bypass mechanisms increases a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

38. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a clogging level of the filtering unit.

39. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a suction level developed within an internal space formed in the housing.

40. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms has an opening located at a bottom of the housing and wherein a second bypass mechanism of the plurality of bypass mechanisms has an opening located at a sidewall of the housing.

41. The cleaning robot according to claim **31** wherein a first bypass mechanism of the plurality of bypass mechanisms comprises a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

42. The cleaning robot according to claim **1** wherein a degree of openness of the bypass mechanism is responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

* * * * *

EXHIBIT B

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 845 969 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.09.2016 Bulletin 2016/38

(51) Int Cl.:
E04H 4/16 *(2006.01)*

(21) Application number: **14179190.5**

(22) Date of filing: **30.07.2014**

(54) **Pool cleaning robot with bypass mechanism**

Schwimmbeckenreinigungsroboter mit Bypassmechanismus

Robot de nettoyage de piscine avec mécanisme de dérivation

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **08.09.2013 US 201361875066 P**

(43) Date of publication of application:
11.03.2015 Bulletin 2015/11

(73) Proprietor: **Maytronics Ltd.**
1935000 Kibbutz Yizrael (IL)

(72) Inventors:
- **Ben Dov, Boaz**
  19205 Ram On (IL)
- **Golan, Oded**
  15241 Kefar Tavor (IL)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Thierschstrasse 11
80538 München (DE)

(56) References cited:
EP-A2- 1 489 249 **US-A1- 2011 000 035**

Printed by Jouve, 75001 PARIS (FR)

Description

RELATED APPLICATION

[0001] This application claims priority from US provisional patent filing date September 8, 2013, serial number 61/875,066.

BACKGROUND

[0002] Cleaning robots contribute to the cleanliness of the fluid within a pool by moving within the pool and by filtering the fluid of the pool by means of a filter. The fluid of the pool enters the cleaning robot via one or more inlets, pass through the filter to be filtered and finally is outputted (after being filtered) as filtered fluid.

[0003] In some cleaning robots the effectiveness of the cleaning robot and even the mere movement of the cleaning robot require that the filtering unit to be clean. For example, some cleaning robots will stop moving if the filter is clogged. Yet other cleaning robots will not be able to climb the walls of the pool without a certain amount of fluid that is drawn-in by the cleaning robot and assist in attaching the cleaning robot to the walls of the pool.

[0004] There is a growing need to provide a cleaning robot that may be arranged to contribute to the cleanliness and sanitization of the pool surfaces and fluid even when its filters are partially or fully clogged.

SUMMARY

[0005] According to an embodiment of the invention there may be provided a cleaning robot with a bypass mechanism. The bypass mechanism can bypass one or more filters of a filtering unit.

[0006] According to an embodiment of the invention there may be provided a cleaning robot that may include a housing may include at least one inlet and an outlet; a filtering unit for filtering fluid; a bypass mechanism for bypassing the filtering unit; and a fluid suction unit that may be arranged to direct towards the outlet fluid that (a) passes through the at least one inlet and (b) passes through at least one out of the filtering unit or the bypass mechanism.

[0007] The bypass mechanism may be arranged to allow fluid to pass through the bypass mechanism when the cleaning robot may be tilted by at least a predefined tilt angle.

[0008] The degree of openness of the bypass mechanism may be responsive to a tilt angle of the cleaning robot.

[0009] The bypass mechanism may include a door. The door may movable between (a) a closed position in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit. The position of the door may determine the openness level of the bypass mechanism.

[0010] The door may be pivotally coupled to a rotation axis and wherein the door rotates between the closed position and the open position.

[0011] The door may be coupled to a weight.

[0012] The weight may be connected to a door. For example - near a lower end of the door. The rotation axis may be located near an upper end of the door.

[0013] The door may be connected to a lever that may be pivotally coupled to a rotation axis.

[0014] The door may be connected to a hinge that may be pivotally coupled to a first rotation axis thereby allowing the door to pivot about the first rotation axis.

[0015] The door may be coupled to a lever that may be pivotally coupled to a second rotation axis; wherein the lever may be arranged to limit a pivoting of the door about the first rotation axis.

[0016] The lever may be connected to a weight.

[0017] The weight may be arranged to slide across the door when the door moves between the close position and the open position.

[0018] The bypass mechanism may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

[0019] The bypass mechanism may include a bypass mechanism inlet, a bypass mechanism outlet and a sealing element; wherein the sealing element may be arranged to be moved between (a) a closed position in which the sealing element prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0020] The bypass mechanism may include a spring that induces the sealing element to move towards the close position.

[0021] When the suction level developed within an internal space of the housing exceeds a suction threshold the sealing element may be moved towards the open position.

[0022] The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be upstream to the filtering unit.

[0023] The bypass mechanism may be arranged to be opened in response to an intensity of flow of fluid at a point that may be downstream to the filtering unit.

[0024] The bypass mechanism may be arranged to be opened in response to a rotational speed of a hydraulic movement mechanism of the cleaning robot.

[0025] The cleaning robot further may include a sensor. The sensor may be arranged to detect an occurrence of a bypass related event and the bypass mechanism may be arranged to respond to the occurrence of the bypass related event.

[0026] The bypass mechanism may include a motor that may be arranged to affect an openness level of the bypass mechanism in response to the occurrence of the bypass related event.

[0027] The sensor may be a robot tilt angle sensor.

[0028] The sensor may be a suction sensor.

[0029] The at least one inlet may include a bypass mechanism inlet and a filtering unit inlet.

[0030] The at least one inlet may include multiple bypass mechanism inlets and a filtering unit inlet.

[0031] The bypass mechanism may be closer to a sidewall of the housing than the filtering unit.

[0032] The bypass mechanism may be connected to a sidewall of the housing.

[0033] The bypass mechanism extends outside a sidewall of the housing.

[0034] The cleaning robot may include at least one additional bypass mechanism. The bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

[0035] At least two bypass mechanisms of the plurality of bypass mechanisms may differ from each other. For example- one bypass mechanism may be tilt angle triggered while another bypass mechanism may be pressure triggered.

[0036] At least two bypass mechanism of the plurality of bypass mechanisms may differ from each other by a triggering event that triggers an opening of the bypass mechanism.

[0037] At least two bypass mechanisms of the plurality of bypass mechanisms operate independently from each other.

[0038] A first bypass mechanism of the plurality of bypass mechanisms may be responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms. For example - when a pressure triggered bypass mechanism is opened it may ease the opening of a door of a tilt angle triggered bypass mechanism as the opening of the pressure triggered bypass mechanism may lower the suction within the housing and that reduction may ease an opening of a door of a tilt angle triggered bypass mechanism.

[0039] An opening of first bypass mechanism of the plurality of bypass mechanisms may ease an opening of another bypass mechanism of the plurality of bypass mechanisms.

[0040] An opening of first bypass mechanism of the plurality of bypass mechanisms may increase a difficulty of an opening of another bypass mechanism of the plurality of bypass mechanisms.

[0041] A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a clogging level of the filtering unit.

[0042] A first bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms may be arranged to be opened in response to a suction level developed within an internal space formed in the housing.

[0043] A first bypass mechanism of the plurality of bypass mechanisms may have an opening located at a bottom of the housing and a second bypass mechanism of the plurality of bypass mechanisms may have an opening located at a sidewall of the housing.

[0044] A first bypass mechanism of the plurality of bypass mechanisms may include a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

[0045] A degree of openness of the bypass mechanism may be responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

[0046] There may be provided a cleaning robot that includes any combination of any components illustrated in the summary section of the application or in the specification.

[0047] There may be provided a cleaning robot that includes any combination of any components illustrated in any claims of the application.

[0048] If, for example, a cleaning robot include more than a single bypass mechanism then any of the bypass mechanism may have any structure illustrated in the summary, the specification or the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

FIG. 1 illustrates a portion of cleaning robot according to an embodiment of the invention;

FIG. 2 illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. 3 illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. 4 illustrates a portion of cleaning robot that climbs on a sidewall of a pool according to an embodiment of the invention;

FIG. 5 illustrates a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention;

FIG. 6 is a bottom view of a cleaning robot according to an embodiment of the invention;

FIG. 7 is a cross sectional view of a portion of cleaning robot taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention;

FIG. 8 is a cross sectional view of a bypass mechanism taken along a longitudinal axis of the bypass mechanism according to an embodiment of the invention;

FIG. 9 illustrates a portion of a cleaning robot according to an embodiment of the invention;

FIG. 10 illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention;

FIG. 11 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 12 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 13 is a cross sectional view of a cleaning robot according to an embodiment of the invention;

FIG. 14 is a cross sectional view of a cleaning robot according to an embodiment of the invention; and

FIG. 15 illustrates a portion of cleaning robot that climbs on a sidewall of a pool and a portion of cleaning robot that propagates along a bottom of a pool according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0050] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

[0051] According to an embodiment of the invention there is provided a cleaning robot that may include one or more bypass mechanisms.

[0052] Various figures illustrate between one to three bypass mechanisms and it is noted that the number of bypassing mechanisms may be any positive integer (for example - one, two, three, four, five and more).

[0053] A bypass mechanism is a mechanical element that allows fluid to bypass a filtering unit. Thus, fluid that flows through a bypass mechanism does not flow through the filtering unit. It is noted that if the filtering unit has multiple filters than the bypass unit may be positioned to bypass one, some or all of the multiple filters of the filtering unit.

[0054] A bypass mechanism may include one or more mechanical components but may also include electrical components.

[0055] If a cleaning robot includes multiple bypass mechanisms then they all can be the same bypass mechanism, may all be different from each other or may include two or more bypass mechanisms that differ from each other.

[0056] Bypass mechanisms may differ from each other by their location, by mode of operation, by size, by shape, by the parameters that control their operation (such as a tilt angle of the cleaning robot or a suction level developed within an internal space of the cleaning robot), by including sensors, by excluding sensors, by including one or more motors, by excluding motors and the like.

[0057] Any bypass mechanism may be open or closed. An open bypass mechanism allows the fluid to flow through the bypass mechanism and to exit from the bypass mechanism thereby not flowing through one of more filters. A closed bypass mechanism prevents fluid from flowing through the bypass mechanism and exiting the bypass mechanism. It may prevent the fluid from entering the bypass mechanism, prevent fluid that enters the bypass mechanism to reach an outlet of the bypass mechanism and/or prevent fluid to flow through the outlet of the bypass mechanism.

[0058] Any bypass mechanism may have more than two openness levels - and may open at different degrees. Thus, a bypass mechanism may be partially open.

[0059] For simplicity of explanation the term "open" refers to a fully open or partially open.

[0060] According to an embodiment of the invention a bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filter is clogged.

[0061] Because the bypass mechanism may allow unfiltered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of events.

[0062] For example - the bypass mechanism may be opened when sensing a reduction in the filtered fluid flow intensity and/or pressure level within the cleaning robot or when sensing that the flow intensity and/or pressure level of the filtered fluid is below a threshold.

[0063] The sensing may include sensing the flow and/or pressure of fluid before (downstream) and/or after (upstream) the filtering unit, in a path leading to the hydraulic movement mechanism and the like. The flow intensity and/or pressure level can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

[0064] Yet for another example - the filtering unit bypass may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall). This may be sensed by tracking the tilt angle of the cleaning robot, by using accelerometers and the like.

[0065] The opening may occur when sensing a reduction of the flow and/or pressure and climbing of the wall. Different thresholds for flow and/or suction levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

[0066] According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example- the bypass mechanism may be opened to a greater extent when climbing a wall, when the Flow and/or pressure of the filtered fluid is lower, and the like.

[0067] The movement of the cleaning robot even when the filtering unit is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving in the pool, detaching bacteria from the pool walls and floor by contact and assisting in pool filtering devices to filter the fluid by inducing fluid movements within the pool.

[0068] According to an embodiment of the invention the bypass mechanism may provide fluid to a hydraulic movement mechanism even when the filtering unit is clogged.

[0069] Because the bypass mechanism may allow unfiltered fluid to propagate within the cleaning robot and to be ejected out of the cleaning robot it may be selectively opened and closed due to an occurrence of bypass related events.

[0070] For example - the bypass mechanism may be opened when sensing a reduction in the filtered fluid and/or an increase in a suction level within the cleaning robot or both. The sensing may include sensing the flow and/or suction (pressure) of fluid before and/or after the filtering unit, in a path leading to a suction unit, to a hydraulic movement mechanism and the like. The flow and/or suction (pressure) can be directly (flow and/or pressure sensing) sensed, indirectly sensed (sensing movements of the hydraulic movement mechanism) or a combination thereof.

[0071] Yet for another example - the bypass mechanism may be opened when sensing that the cleaning robot is about to climb a wall (or is in the progress of climbing a wall).

[0072] The opening may occur when sensing a reduction of the Flow and/or pressure and climbing of the wall. Different thresholds for Flow and/or pressure levels may be provided as a function of the activity of the cleaning robot (climbing a wall or horizontal movement).

[0073] According to an embodiment of the invention the amount of fluid that may pass through the bypass mechanism may be altered as a function of sensed parameters. For example - the bypass mechanism may be opened to a greater extent when climbing a wall, when the flow and/or pressure of the filtered fluid is below a threshold, and the like.

[0074] By providing the bypass mechanism and allowing fluid to flow even when the filtering unit is clogged the cleaning robot may move in the pool. This movement of the cleaning robot even when the filter is clogged or almost clogged can assist in the cleanliness of the fluid in the pool by merely moving the cleaning robot in the pool thereby detaching bacteria from the pool walls and floor by contact and assisting to pool filtering devices to filter the fluid by inducing fluid movements within the pool.

[0075] FIG. 1 illustrates a portion of cleaning robot 10 according to an embodiment of the invention.

[0076] Figure 1 illustrates only a part of the cleaning robot as the upper part of the cleaning robot as well as multiple internal components of the cleaning robot (such as a filtering unit, a fluid suction unit, a driving motor and the like) are missing for clarity of explanation.

[0077] Figure 1 illustrates the portion of the cleaning robot as including a housing 20, front brush wheel 110, rear brush wheel 112, tracks 120 movable by front wheel 121 and/or rear wheel 122. It is noted that the cleaning robot may be moved by other movement elements (for example it may include wheels instead of tracks), may have other cleaning elements and the like.

[0078] The cleaning robot of figure 1 includes three bypass mechanisms - two bypass mechanisms 40 located at both sides of the housing (near sidewalls 22 and 23 of the housing 20) and one bypass mechanism 140 located at the rear wall 21 of the housing 20. Figure 1 also shows a filtering unit inlet formed at about the center of the bottom of the housing and positioned between bypass mechanisms 40. Figure 1 also shows a bypass outlet 42 of bypass mechanism 40.

[0079] Each bypass mechanism allows fluid to bypass at least one filter of the filtering unit. The fluid propagates towards a fluid suction unit (such as an impeller) of the cleaning robot that is arranged to direct towards the outlet (of the housing) fluid that passes through the at least one inlet and through at least one out of the filtering unit and the bypass mechanism.

[0080] Figure 2 illustrates a portion of cleaning robot 10 that climbs on a sidewall 131 of a pool according to an embodiment of the invention. Figure 3 illustrates a portion of cleaning robot 10 that propagates along a bottom 130 of a pool according to an embodiment of the invention. Sidewall 131 is vertical and the bypass mechanism 40 is opened at its maximal extent. Figure 2 illustrates an open bypass mechanism 40 while figure 3 illustrates a closed bypass mechanism.

[0081] In figure 2 and 3 the bypass mechanism 40 is illustrated as including door 44. Door 44 is movable between (a) a closed position (figure 3) in which the door prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position (figure 2) in which the door allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0082] Door 44 is pivotally coupled to a first rotation axis 45 and rotates between the closed position and the open position.

[0083] Figure 2 and 3 also shows that the door 44 is coupled to a weight 43. The weight 43 assists in opening the door 44 when the cleaning robot starts to tilt and closing the door 44 when the cleaning robot is horizontal. Alternatively, the door 44 may be heavy enough and does not require an additional weight 43.

[0084] Figure 2 and 3 illustrate the weight 43 is being connected to a door 44 near a lower end of the door and illustrate the first rotation axis 45 is located near an upper end of the door 44. The first rotation axis 45 may alternatively be located near the center of the door (as illustrated in figure 15) in order to reduce the needed weight or mass of 43. It is noted that the relative locations of the first rotation axis 45 and the weight 43 may differ from those illustrated in figures 2 and 3.

[0085] Figures 2 and 3 also show that the door 44 is not directly connected to the rotation axis but show a hinge 51 that is pivotally snapped-in or coupled to the first rotation axis 45 and interfaces with the door 44.

[0086] Figure 4 illustrates a portion of cleaning robot 10 that climbs on a sidewall 131 of a pool according to an embodiment of the invention. Figure 5 illustrates a portion of cleaning robot 10 that propagates along a bottom 130 of a pool according to an embodiment of the invention. Sidewall 131 is vertical and the bypass mechanism 40 is opened at its maximal extent. Figure 4 illustrates an open bypass mechanism 40 while figure 5 illustrates a closed bypass mechanism.

[0087] Figure 4 and 5 illustrate a door 44 that is connected to a hinge 51 that is pivotally snapped-in or coupled to a first rotation axis 45 thereby allowing the door 44 to pivot about the first rotation axis 45.

[0088] The door 44 of figures 4 and 5 is coupled to a lever 52 that is pivotally coupled to a second rotation axis 46. The second level 52 may be arranged to limit a pivoting of the door 44 about the first rotation axis 45. The lever 52 may be oriented at about ninety degrees to the tilt angle of the cleaning robot but this is not necessarily so.

[0089] Figures 4 and 5 illustrate the lever 52, connected or snapped-in to a weight 43 (or unify it by 43), and interfaces with door 44.

[0090] Figure 4 and 5 illustrate that the weight 43 is arranged to slide across the door 44 when the door moves between the close position and the open position.

[0091] Figures 2-6 illustrates bypass mechanisms 40 that their openness level depended upon the tilt angle of the cleaning robot. The tilt angle may be defined as the angle between the cleaning robot and the horizon.

[0092] It is noted that although figures 2-6 do not show sensors for triggering the opening (and/or closing) of the bypass mechanisms - that the cleaning robot may include sensors that may sense the tilt angle of the cleaning robot and that the sensed tilt robot may be used to trigger (for example by using a motor) the opening and/or closing of a bypass mechanism.

[0093] Accordingly, there may be provided a cleaning robot wherein the bypass mechanism is arranged to allow fluid to pass through the bypass mechanism when the cleaning robot is tilted by at least a predefined tilt angle. This tilt angle may be measured by a sensor (such as sensor 210 of figures 10, 12 and 13).

[0094] Yet for another embodiment of the invention the mechanical elements of the bypass mechanism may be arranged to allow opening the bypass mechanism only when the tilt angle exceeds a predetermined tilt angle. Referring to the example set forth in figure 9, a spring 48 or other limiting element may be connected to door 44, or to weight 43 and to a frame 49 of the bypass mechanism in order to counter the movement of the weight 43 or door 44 so that only at a predefined tilt angle the door 44 will move and at least partially open the bypass mechanism 40. The predefined tilt angle may range between 70 and 110 degrees, may range between 50 and 90 degrees, between 20 and 80 degrees and the like.

[0095] Figure 6 is a bottom view of a cleaning robot 10 according to an embodiment of the invention.

[0096] It shows a filtering unit inlet 26 located at about the center of the bottom 25 of the cleaning robot as well as two bypass path inlets 28 that are covered by a filtering mesh positioned at both sides of the filtering unit inlet 26. This figure also shows front brush wheel 110, rear brush wheel 112, front wheel 121 and read wheel 122.

[0097] Figure 7 is a cross sectional view of a portion of cleaning robot 10 taken along a longitudinal axis of the cleaning robot according to an embodiment of the invention.

[0098] Figure 8 is a cross sectional view of a bypass mechanism 140 taken along a longitudinal axis of the bypass mechanism 140 according to an embodiment of the invention. Figure 8 also provides a cross sectional view of the bypass mechanism 140 taken along axis A -A that is normal to the longitudinal axis of the bypass mechanism 140.

[0099] Bypass mechanism 140 is installed in wall 21 of housing 20. Bypass mechanism 140 may also be installed on other walls such as for example, sidewall 22 of the pool cleaner. Multiple bypass mechanisms may be used. It is pressure (suction) activated - it has a sealing element 144 that is forced by a spring 80 to move toward an exterior of the cleaning robot 10 thereby closing the inlet 128 of bypass mechanism 140. On the other hand a pressure difference between the interior and the exterior of the cleaning robot 10 and/or suction applied by a fluid suction unit within an internal space of the cleaning robot (not shown) forces the sealing element 144 to move towards the interior of the cleaning robot 10 thereby opening the inlet 128 of bypass mechanism 140 and allowing fluid to pass through bypass mechanism and through outlet 142. Accordingly- there is a suction (or pressure) thresholds that overcomes the spring and opens the bypass mechanism.

[0100] The sealing element 144 moves along an axis that is normal to the wall 21. It includes a fluid conduit that has different cross sections at different location thus allowing a movement of the sealing element along the axis opens and closes the bypass mechanism 140.

[0101] Accordingly - the sealing element 144 may move between (a) a closed position in which the sealing element 144 prevents fluid to exit the bypass mechanism and flow towards the fluid suction unit, and (b) an open position in which the sealing element 144 allows fluid to exit from the bypass mechanism and flow towards the fluid suction unit.

[0102] Figure 8 illustrates that spring 80 is supported by and moves along a supporting element 86 that has a core 82 and three spaced apart wings 81 extending from the core 82. Accordingly - the spaced apart wings 81 which contact the spring 80 define openings through which fluid may flow when the bypass mechanism 140 is open. The inner wall 86 of the bypass mechanism 140 may be larger than the exterior of spring 80.

[0103] Figure 10 illustrates various combinations of sensors and bypass mechanisms according to an embodiment of the invention. Figure 10 shows (from top to bottom) the following combinations:

a. A sensor 210 coupled to a bypass mechanism 240. The sensor may sense pressure levels, tilt angles and may be used to control the bypass mechanism.

b. A controller 200 that is coupled to sensor 210 and to the bypass mechanism 240. The sensor 210 may sense pressure levels, tilt angles and may send sensing signals to controller 200 that may control, in response to the sensing signals, the bypass mechanism.

c. Multiple (such as two) sensors 210 and 211 that are coupled to bypass mechanism 240 and their readings may be used for controlling the bypass mechanism 240. Alternatively - the sensors may be coupled to controller 200 that in turn controls the bypass mechanism 240.

d. Sensor 210 that controls motor 220 that in turn may manipulate (for example push and/or pull) sealing element 244 of bypass mechanism 240. The bypass mechanism 240 may resemble (or may differ) the bypass mechanism 140 of figure 8. The sealing element 244 can be forced by spring 280 to close the bypass mechanism 240. The bypass mechanism 240 has an inlet 228 and an outlet 242 that is smaller than the inlet 228.

e. Sensor 210 that controls motor 220 that in turn may manipulate (for example rotate) door 264 of bypass mechanism 260. The bypass mechanism 260 may resemble (or may differ) the bypass mechanism 40 of figures 2-4. The door 264 can rotate about a rotation axis thereby close or open the bypass mechanism 260. The bypass mechanism 260 has an inlet 268 and a filtering mesh and an outlet 262.

[0104] FIG. 11 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 12 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 13 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention. FIG. 14 is a cross sectional view of a cleaning robot 10 according to an embodiment of the invention.

[0105] The cross section is taken along a transverse axis of the cleaning robot 10.

[0106] Figures 11, 12, 13 and 14 differ by each other by:

a. The lack of a sensor and a controller 200 (figure 11).

b. The inclusion of a controller 200 and the sensor 210 at a point that is upstream (after) the filtering unit 310. (figure 12)

c. The inclusion of the controller 200 upstream of the filtering unit 310 while the sensor 210 is located downstream the filtering unit 310. (figure 13)

d. The inclusion of a controller 200 within internal space 350 wherein the sensor 210 monitors the rotational speed of the suction unit (for example- of its impeller 320). (figure 14)

[0107] Figures 11, 12, 13 and 14 show the flow of fluid through bypass mechanism 40 - when the bypass mechanism 40 is open (see arrows 410 and 440) or through filtering unit 310 (arrows 420 and 420).

[0108] In figure 12 the sensor 210 may sense the flow of fluid at a point that is upstream to the filtering unit 310. In figure 13 the sensor 210 may sense the flow of fluid at a point that is downstream to the filtering unit 310.

[0109] The fluid that passes bypass mechanism 40 or filtering unit 310 enter an internal space 350 of the housing 20 and is drawn into a filtering unit 310 (illustrated as including impeller 320 and pump motor 330 for driving the impeller motor 330) towards the outlet 360 of housing 20.

[0110] While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications.

Claims

1. A cleaning robot comprising:

a housing (20) comprising at least one inlet (26) and an outlet;
a filtering unit for filtering fluid;
a bypass mechanism (40, 140, 240) for bypassing the filtering unit; and
a fluid suction unit that is arranged to direct towards the outlet (142) fluid that (a) passes through the at least one inlet (26) and (b) passes through at least one out of the filtering unit and the bypass mechanism (40, 140, 240).

2. The cleaning robot according to claim 1 wherein the bypass mechanism (40) is arranged to allow fluid to pass through the bypass mechanism (40) when the cleaning robot is tilted by at least a predefined tilt angle.

3. The cleaning robot according to claim 1 wherein the bypass mechanism (40) comprises a door (44); wherein the door (44) is movable between (a) a closed position in which the door (44) prevents fluid to exit the bypass mechanism (40) and flow towards the fluid suction unit, and (b) an open position in which the door (44) allows fluid to exit from the bypass mechanism (40) and flow towards the fluid suction unit.

4. The cleaning robot according to claim 1 wherein the bypass mechanism (140) is arranged to be opened in response to a suction level developed within an internal space formed in the housing (20).

5. The cleaning robot according to claim 4 wherein the bypass mechanism (140) comprises a bypass mechanism inlet (28), a bypass mechanism outlet (142) and a sealing element (144); wherein the sealing element is arranged to be moved between (a) a closed position in which the sealing element (144) prevents fluid to exit the bypass mechanism (140) and flow towards the fluid suction unit, and (b) an open position in which the sealing element (144) allows fluid to exit from the bypass mechanism (140) and flow towards the fluid suction unit.

6. The cleaning robot according to claim 4 wherein the bypass mechanism (140) comprises a spring (80) that induces the sealing element (144) to move towards the close position.

7. The cleaning robot according to claim 6 wherein when the suction level developed within an internal space of the housing (20) exceeds a suction threshold the sealing element (144) is moved towards the open position.

8. The cleaning robot according to claim 1 further comprising a sensor (210); wherein the sensor (210) is arranged to detect an occurrence of a bypass related event and wherein the bypass mechanism (240) is arranged to respond to the occurrence of the bypass related event.

9. The cleaning robot according to claim 8 wherein the bypass mechanism (240) comprises a motor (220) that is arranged to affect an openness level of the bypass mechanism (240) in response to the occurrence of the bypass related event.

10. The cleaning robot according to claim 8 wherein the sensor (210) is a robot tilt angle sensor.

11. The cleaning robot according to claim 1 wherein the at least one inlet comprises multiple bypass mechanism inlets and a filtering unit inlet.

12. The cleaning robot according to claim 1 comprising at least one additional bypass mechanism; wherein the bypass mechanism and the at least one additional bypass mechanism form a plurality of bypass mechanisms.

13. The cleaning robot according to claim 12 wherein at least two bypass mechanism of the plurality of bypass mechanisms differ from each other by a triggering event that triggers an opening of the bypass mechanism.

14. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms is responsive to an openness level of another bypass mechanism of the plurality of bypass mechanisms.

15. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a tilt level of the cleaning robot and a second bypass mechanism of the plurality of bypass mechanisms is arranged to be opened in response to a clogging level of the filtering unit.

16. The cleaning robot according to claim 12 wherein a first bypass mechanism of the plurality of bypass mechanisms comprises a sensor and a motor activated by the sensor and wherein a second bypass mechanism of the plurality of bypass mechanisms does not include a sensor or a motor activated by the sensor.

17. The cleaning robot according to claim 1 wherein a degree of openness of the bypass mechanism is responsive to (a) a tilt angle of the cleaning robot and to (b) a suction level developed within an internal space formed in the housing.

Patentansprüche

1. Ein Reinigungsroboter, der Folgendes umfasst:

ein Gehäuse (20), das mindestens einen Einlass (26) und einen Auslass umfasst;
eine Filtereinheit zum Filtern von Flüssigkeit;
einen Bypass-Mechanismus (40, 140, 240) zum Umgehen der Filtereinheit und
eine Flüssigkeits-Saugeinheit, die ausgebildet ist, um Flüssigkeit zum Auslass (142) hin zu lenken, die (a) durch den mindestens einen Einlass (26) strömt und (b) durch die Filtereinheit und/oder den Bypass-Mechanismus (40, 140, 240) strömt.

2. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (40) ausgebildet ist, um es zu ermöglichen, dass Flüssigkeit durch den Bypass-Mechanismus (40) strömt, wenn der Reinigungsroboter mindestens in einem vordefinierten Kippwinkel gekippt ist.

3. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (40) eine Tür (44) umfasst, wobei die Tür (44) beweglich ist zwischen (a) einer geschlossenen Position, in welcher die Tür (44)

Flüssigkeit daran hindert, aus dem Bypass-Mechanismus (40) auszutreten und zur Flüssigkeits-Saugeinheit hin zu strömen, und (b) einer offenen Position, in welcher die Tür (44) es ermöglicht, dass Flüssigkeit aus dem Bypass-Mechanismus (40) austritt und zur Flüssigkeits-Saugeinheit hin strömt.

4. Der Reinigungsroboter gemäß Anspruch 1, wobei der Bypass-Mechanismus (140) ausgebildet ist, um als Reaktion auf ein Saugniveau geöffnet zu werden, das sich in einem im Gehäuse (20) gebildeten Innenraum entwickelt hat.

5. Der Reinigungsroboter gemäß Anspruch 4, wobei der Bypass-Mechanismus (140) einen Bypass-Mechanismus-Einlass (28), einen Bypass-Mechanismus-Auslass (142) und ein Abdichtungselement (144) umfasst, wobei das Abdichtungselement (144) angeordnet ist, um bewegt zu werden zwischen (a) einer geschlossenen Position, in welcher das Abdichtungselement (144) Flüssigkeit daran hindert, aus dem Bypass-Mechanismus (140) auszutreten und zur Flüssigkeits-Saugeinheit hin zu strömen, und (b) einer offenen Position, in welcher das Abdichtungselement (144) es ermöglicht, dass Flüssigkeit aus dem Bypass-Mechanismus (140) austritt und zur Flüssigkeits-Saugeinheit hin strömt.

6. Der Reinigungsroboter gemäß Anspruch 4, wobei der Bypass-Mechanismus (140) eine Feder (80) umfasst, die das Abdichtungselement (144) veranlasst, sich zur geschlossenen Position hin zu bewegen.

7. Der Reinigungsroboter gemäß Anspruch 6, wobei das Abdichtungselement (144) zur offenen Position hin bewegt wird, wenn das Saugniveau, das sich in einem Innenraum des Gehäuses (20) entwickelt hat, einen Saug-Schwellenwert überschreitet.

8. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen Sensor (210) umfasst, wobei der Sensor (210) ausgebildet ist, um ein Auftreten eines mit einer Umgehung zusammenhängenden Ereignisses zu erfassen, und wobei der Bypass-Mechanismus (240) ausgebildet ist, um auf das Auftreten des mit der Umgehung zusammenhängenden Ereignisses zu reagieren.

9. Der Reinigungsroboter gemäß Anspruch 8, wobei der Bypass-Mechanismus (240) einen Motor (220) umfasst, der ausgebildet ist, um als Reaktion auf das Auftreten des mit der Umgehung zusammenhängenden Ereignisses einen Öffnungsgrad des Bypass-Mechanismus (240) zu beeinflussen.

10. Der Reinigungsroboter gemäß Anspruch 8, wobei der Sensor (210) ein Roboter-Kippwinkel-Sensor ist.

11. Der Reinigungsroboter gemäß Anspruch 1, wobei der mindestens eine Einlass mehrere Bypass-Mechanismus-Einlässe und einen Filtereinheits-Einlass umfasst.

12. Der Reinigungsroboter gemäß Anspruch 1, der mindestens einen zusätzlichen Bypass-Mechanismus umfasst, wobei der Bypass-Mechanismus und der mindestens eine zusätzliche Bypass-Mechanismus eine Vielzahl von Bypass-Mechanismen bilden.

13. Der Reinigungsroboter gemäß Anspruch 12, wobei mindestens zwei Bypass-Mechanismen der Vielzahl von Bypass-Mechanismen sich voneinander in einem Auslöseereignis unterscheiden, das eine Öffnung des Bypass-Mechanismus auslöst.

14. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen auf einen Öffnungsgrad eines anderen Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen anspricht.

15. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen ausgebildet ist, um als Reaktion auf ein Kippniveau des Reinigungsroboters geöffnet zu werden, und ein zweiter Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen ausgebildet ist, um als Reaktion auf einen Verstopfungsgrad der Filtereinheit geöffnet zu werden.

16. Der Reinigungsroboter gemäß Anspruch 12, wobei ein erster Bypass-Mechanismus der Vielzahl von Bypass-Mechanismen einen Sensor und einen vom Sensor aktivierten Motor umfasst und wobei ein zweiter Bypass-Mechanismus der Vielzahl von Bypassmechanismen keinen Sensor oder einen vom Sensor aktivierten Motor einschließt.

17. Der Reinigungsroboter gemäß Anspruch 1, wobei ein erster Öffnungsgrad des Bypass-Mechanismus auf (a) einen Kippwinkel des Reinigungsroboters und (b) ein Saugniveau, das sich in einem im Gehäuse gebildeten Innenraum entwickelt hat, anspricht.

Revendications

1. Robot de nettoyage, comprenant:

un boîtier (20) comportant au moins une entrée (26) et une sortie;
une unité de filtrage pour filtrer du fluide;
un mécanisme de dérivation (40, 140, 240), pour contourner l'unité de filtrage; et
une unité d'aspiration de fluide qui est agencée

pour diriger vers la sortie (142) du fluide qui (a) passe à travers au moins une entrée (26) et (b) passe à travers au moins une parmi l'unité de filtrage et le mécanisme de dérivation (40, 140, 240).

2. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (40) est agencé pour permettre au fluide de passer à travers le mécanisme de dérivation (40) lorsque le robot de nettoyage est incliné selon au moins un angle d'inclinaison prédéfini.

3. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (40) comprend une porte (44); dans lequel la porte (44) est déplaçable entre (a) une position fermée dans laquelle la porte (44) empêche au fluide de sortir du mécanisme de dérivation (40) et de s'écouler vers l'unité d'aspiration de fluide, et (b) une position ouverte dans laquelle la porte (44) permet au fluide de sortir du mécanisme de dérivation (40) et de s'écouler vers l'unité d'aspiration de fluide.

4. Robot de nettoyage selon la revendication 1 dans lequel le mécanisme de dérivation (140) est agencé pour être ouvert en réponse à un niveau d'aspiration développé dans un espace interne formé dans le boîtier (20).

5. Robot de nettoyage selon la revendication 4 dans lequel le mécanisme de dérivation (140) comprend une entrée (28) de mécanisme de dérivation, une sortie (142) de mécanisme de dérivation et un élément d'étanchéité (144); dans lequel l'élément d'étanchéité (144) est agencé pour être déplacé entre (a) une position fermée dans laquelle l'élément d'étanchéité (144) empêche au fluide de sortir du mécanisme de dérivation (140) et de s'écouler vers l'unité d'aspiration de fluide, et (b) une position ouverte dans laquelle l'élément d'étanchéité (144) permet au fluide de sortir du mécanisme de dérivation (140) et de s'écouler vers l'unité d'aspiration de fluide.

6. Robot de nettoyage selon la revendication 4 dans lequel le mécanisme de dérivation (140) comporte un ressort (80) qui entraîne le déplacement de l'élément d'étanchéité (144) vers la position fermée.

7. Robot de nettoyage selon la revendication 6 dans lequel, lorsque le niveau d'aspiration développé dans un espace interne du boîtier (20) dépasse un seuil d'aspiration, l'élément d'étanchéité (144) est déplacé vers la position ouverte.

8. Robot de nettoyage selon la revendication 1 comprenant en outre un capteur (210); dans lequel le capteur (210) est agencé pour détecter une survenance d'un événement lié à une dérivation et dans lequel le mécanisme de dérivation (240) est agencé de façon à répondre à la survenance de l'événement lié à une dérivation.

9. Robot de nettoyage selon la revendication 8 dans lequel le mécanisme de dérivation (240) comprend un moteur (220) qui est agencé pour affecter un niveau d'ouverture du mécanisme de dérivation (240) en réponse à la survenance de l'événement lié à une dérivation.

10. Robot de nettoyage selon la revendication 8 dans lequel le capteur (210) est un capteur d'angle d'inclinaison du robot.

11. Robot de nettoyage selon la revendication 1 dans lequel la au moins une entrée comprend de multiples entrées de mécanisme de dérivation et une entrée d'unité de filtration.

12. Robot de nettoyage selon la revendication 1 comprenant au moins un mécanisme de dérivation supplémentaire; dans lequel le mécanisme de dérivation et le au moins un mécanisme de dérivation supplémentaire forment une pluralité de mécanismes de dérivation.

13. Robot de nettoyage selon la revendication 12, dans lequel au moins deux mécanismes de dérivation de la pluralité de mécanismes de dérivation diffèrent l'un de l'autre par un événement déclencheur qui provoque une ouverture du mécanisme de dérivation.

14. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation est sensible à un niveau d'ouverture d'un autre mécanisme de dérivation de la pluralité de mécanismes de dérivation.

15. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation est agencé pour être ouvert en réponse à un niveau d'inclinaison du robot de nettoyage et un deuxième mécanisme de dérivation de la pluralité de mécanismes de dérivation est agencé pour être ouvert en réponse à un niveau d'obstruction de l'unité de filtrage.

16. Robot de nettoyage selon la revendication 12 dans lequel un premier mécanisme de dérivation de la pluralité de mécanismes de dérivation comprend un capteur et un moteur actionné par le capteur et dans lequel un deuxième mécanisme de dérivation de la pluralité de mécanismes de dérivation ne comprend pas de capteur ou de moteur activé par le capteur.

17. Robot de nettoyage selon la revendication 1, dans lequel un degré d'ouverture du mécanisme de dérivation est sensible à (a) un angle d'inclinaison du robot de nettoyage et (b) à un niveau d'aspiration développé dans un espace interne formé dans le boîtier.

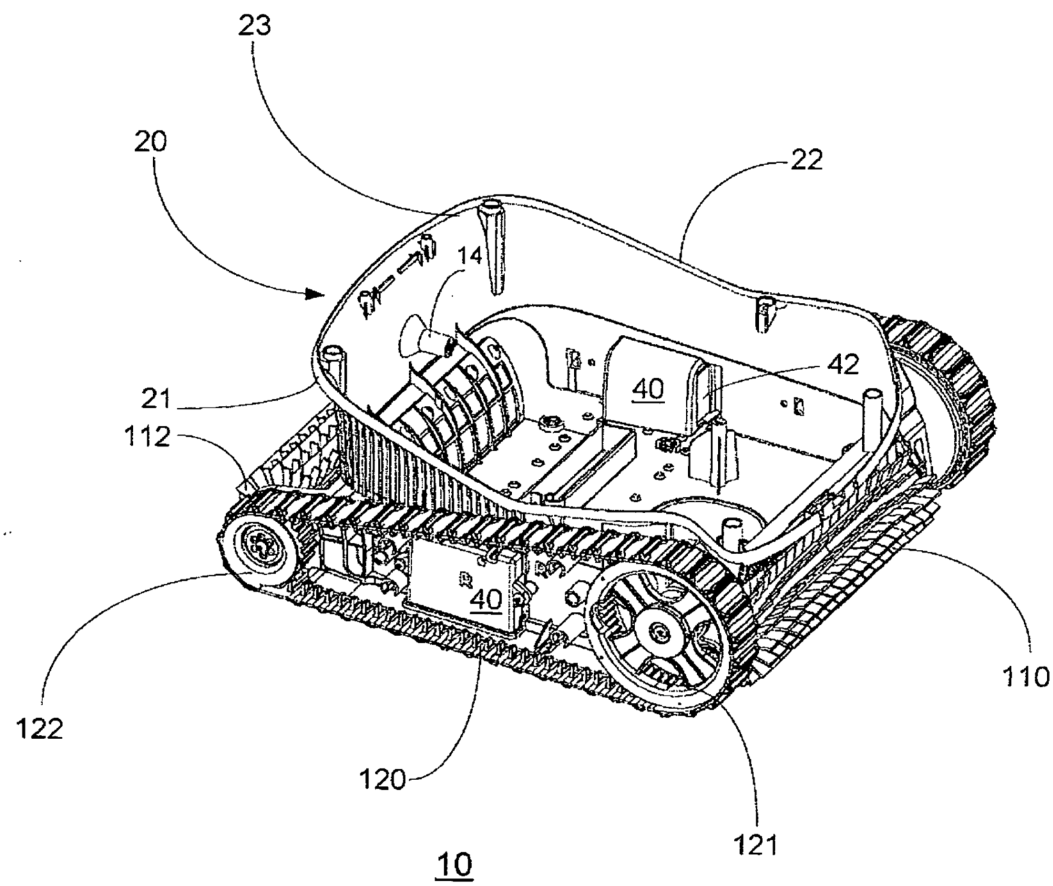


FIG. 1

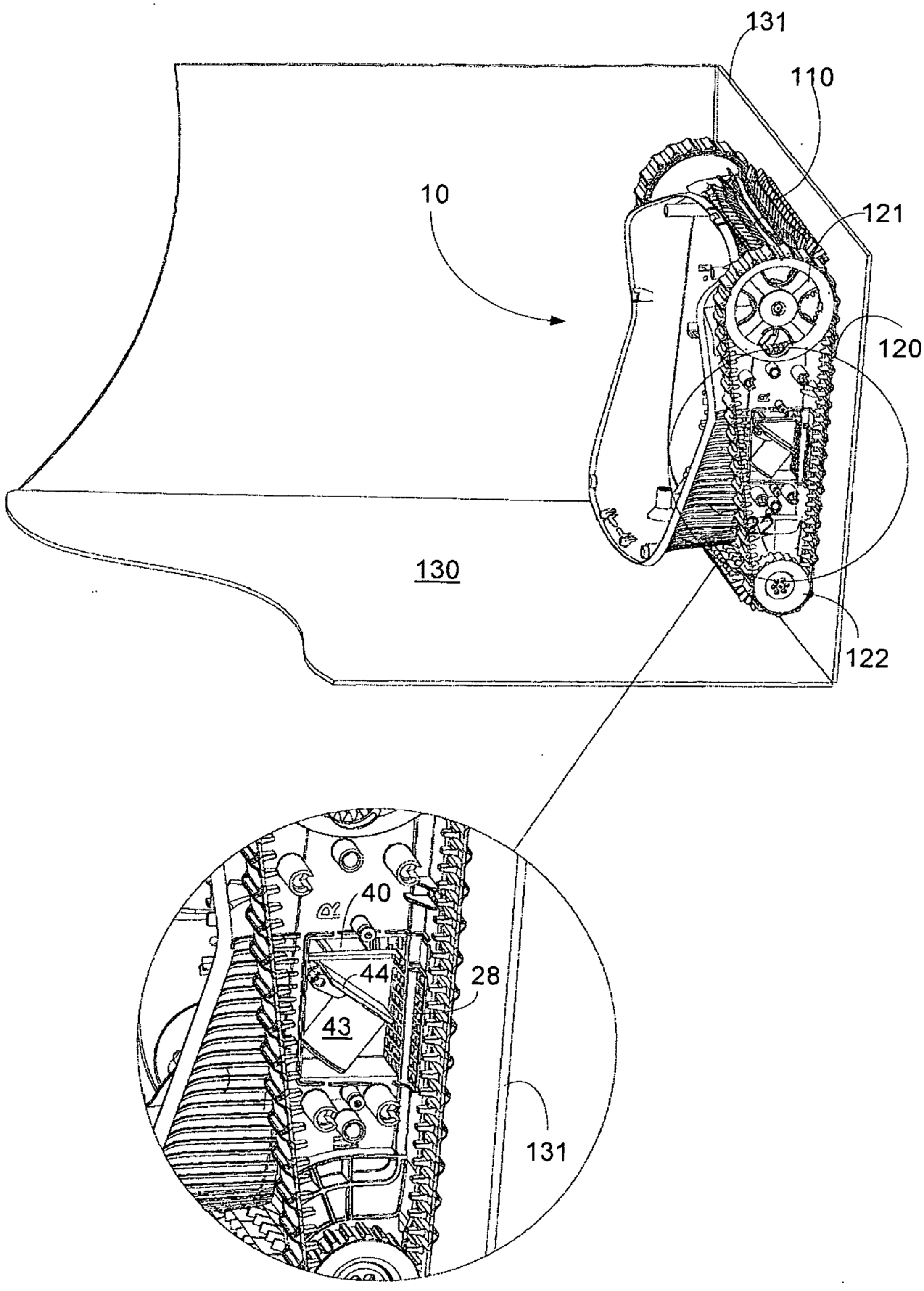


FIG. 2

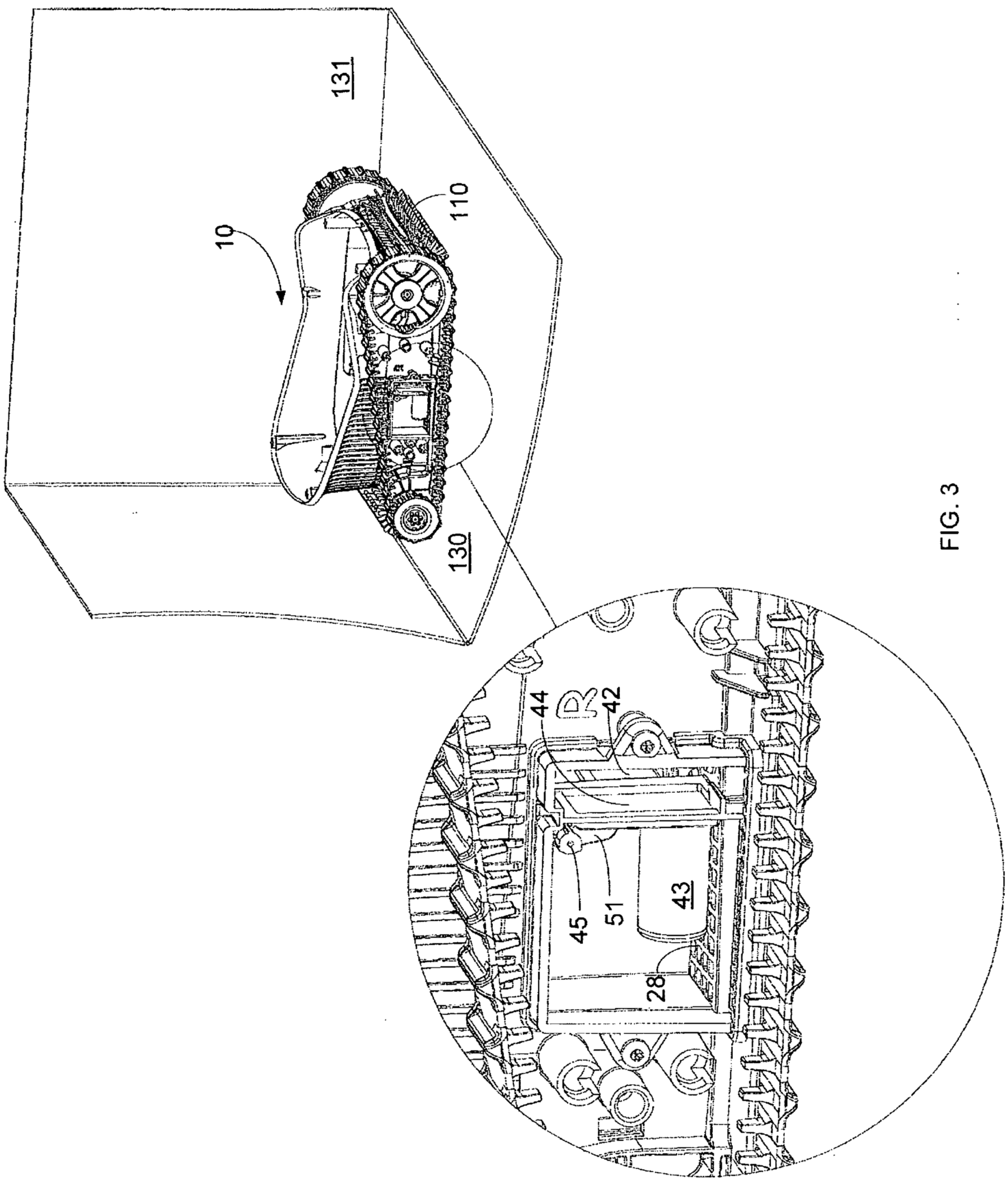


FIG. 3

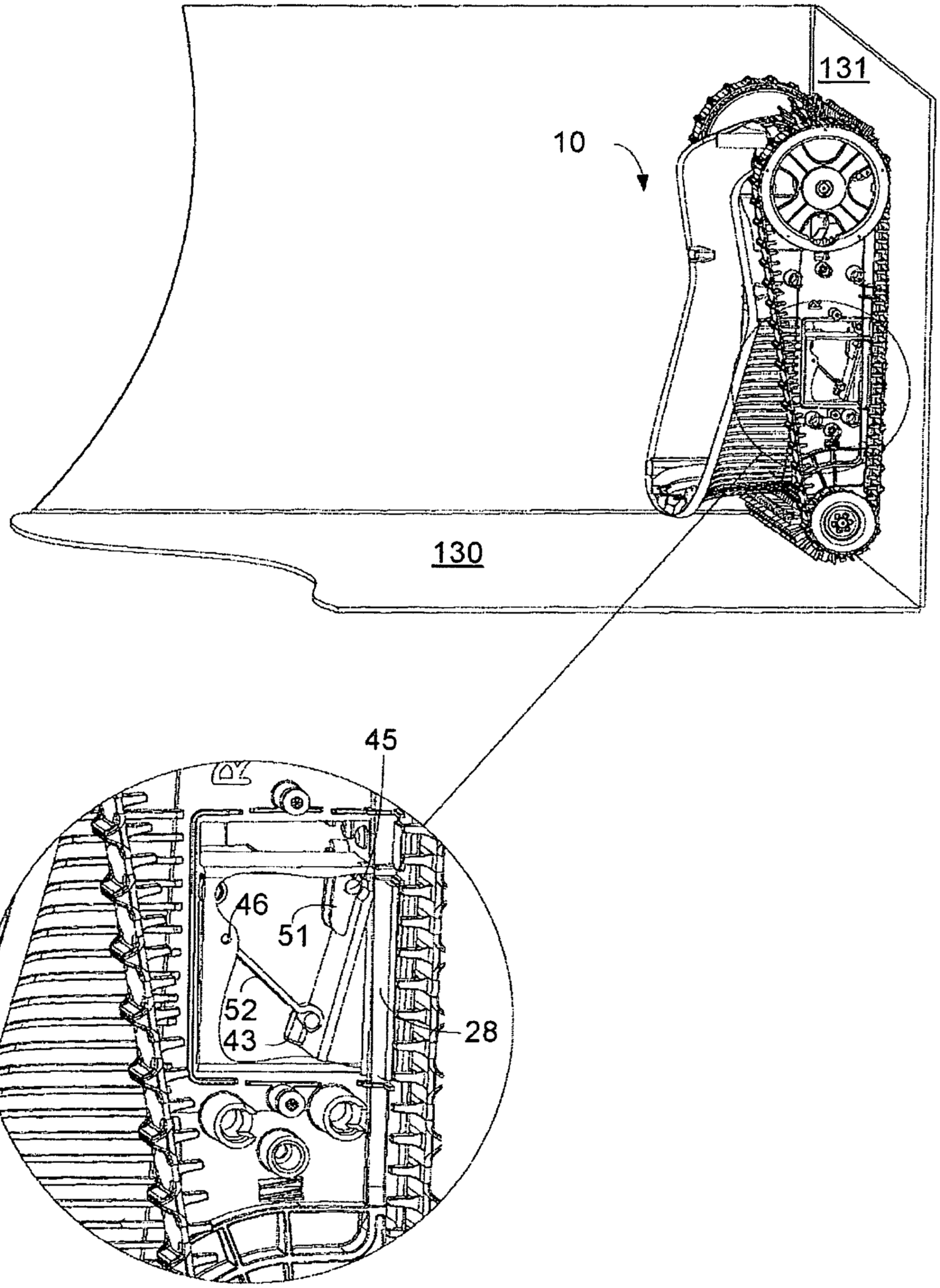


FIG. 4

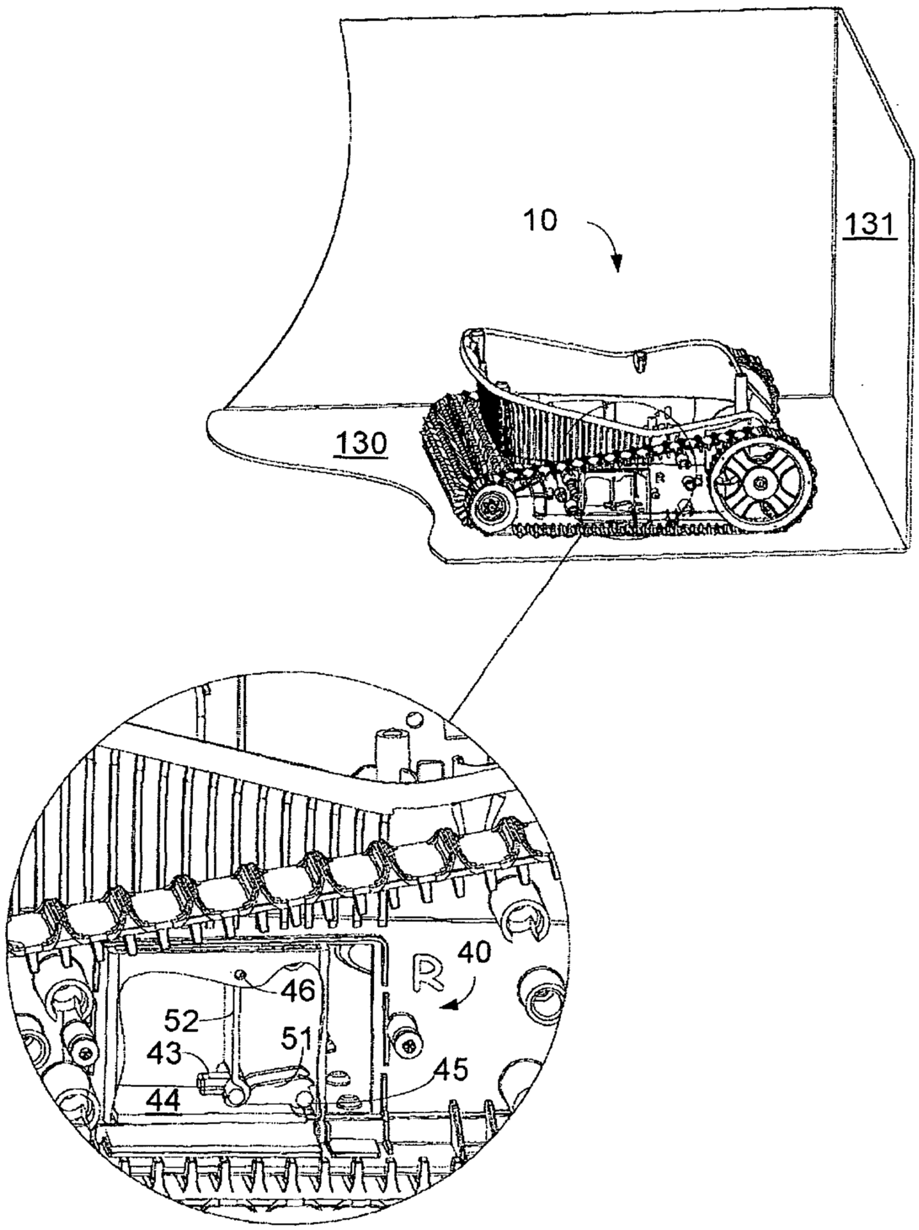


FIG. 5

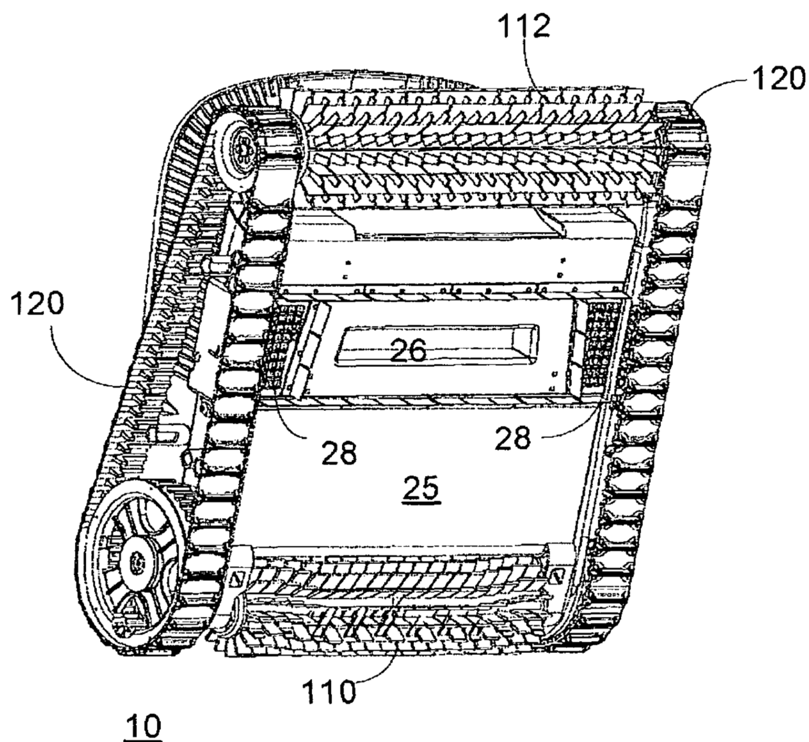


FIG. 6

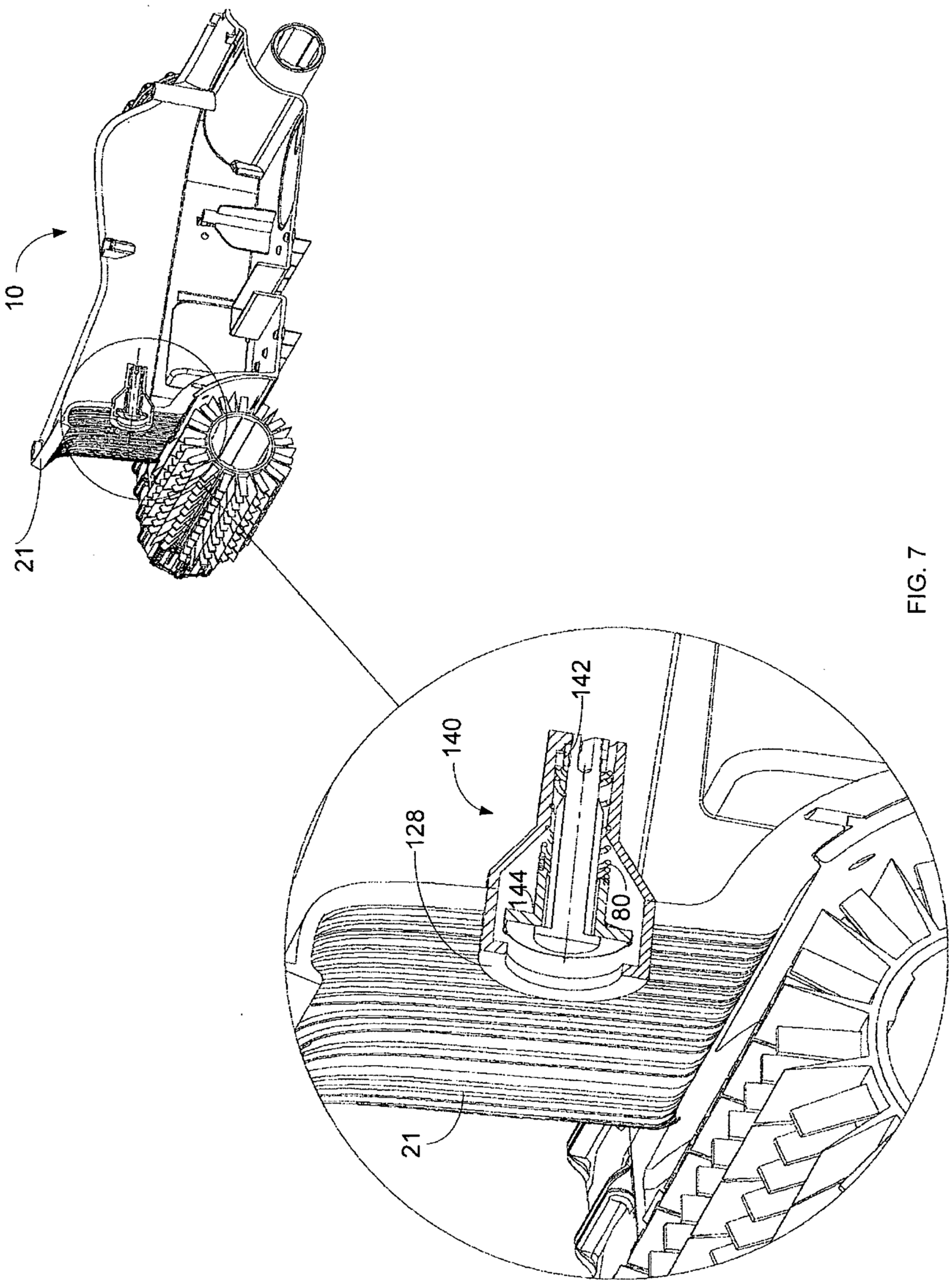


FIG. 7

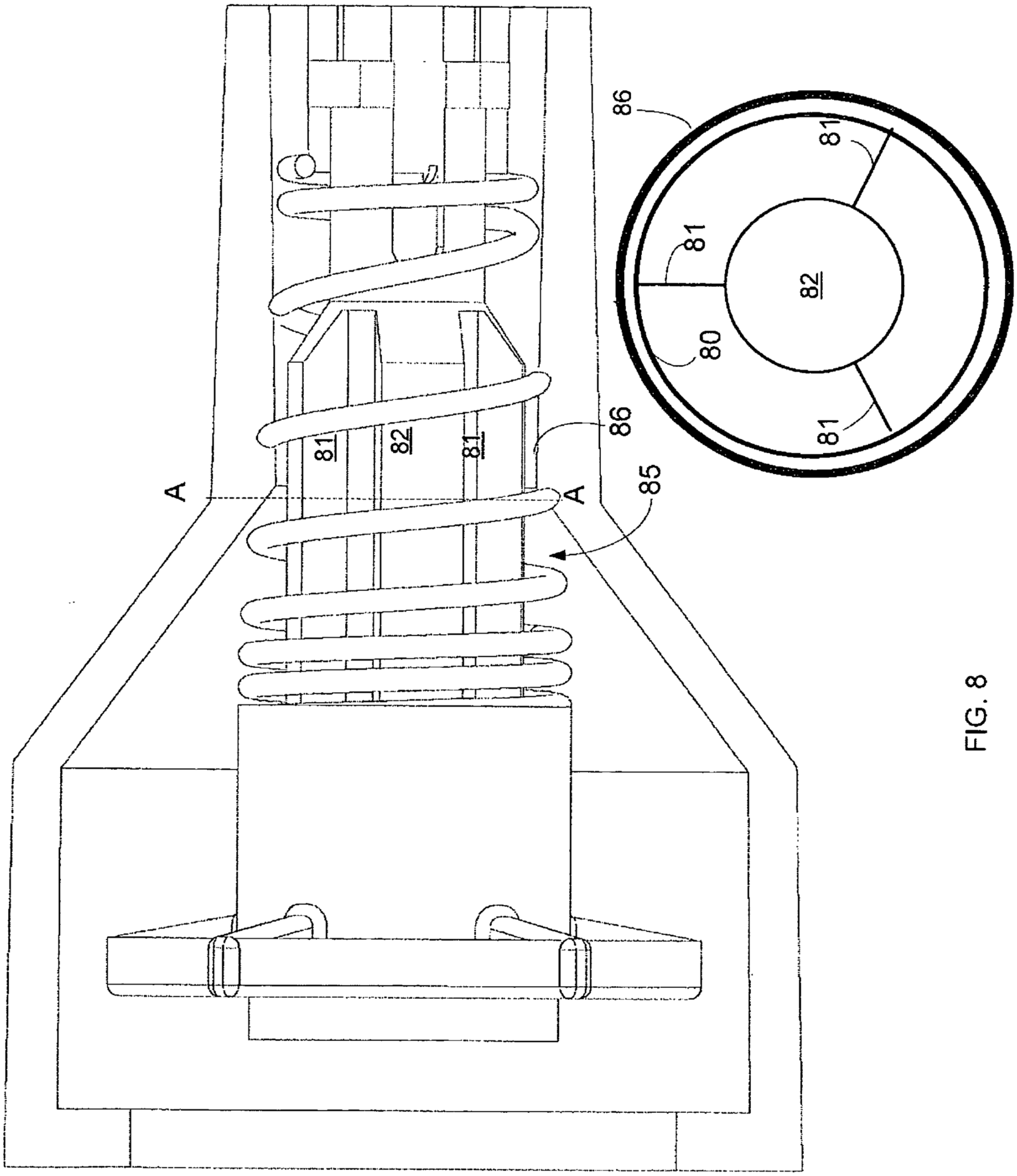


FIG. 8

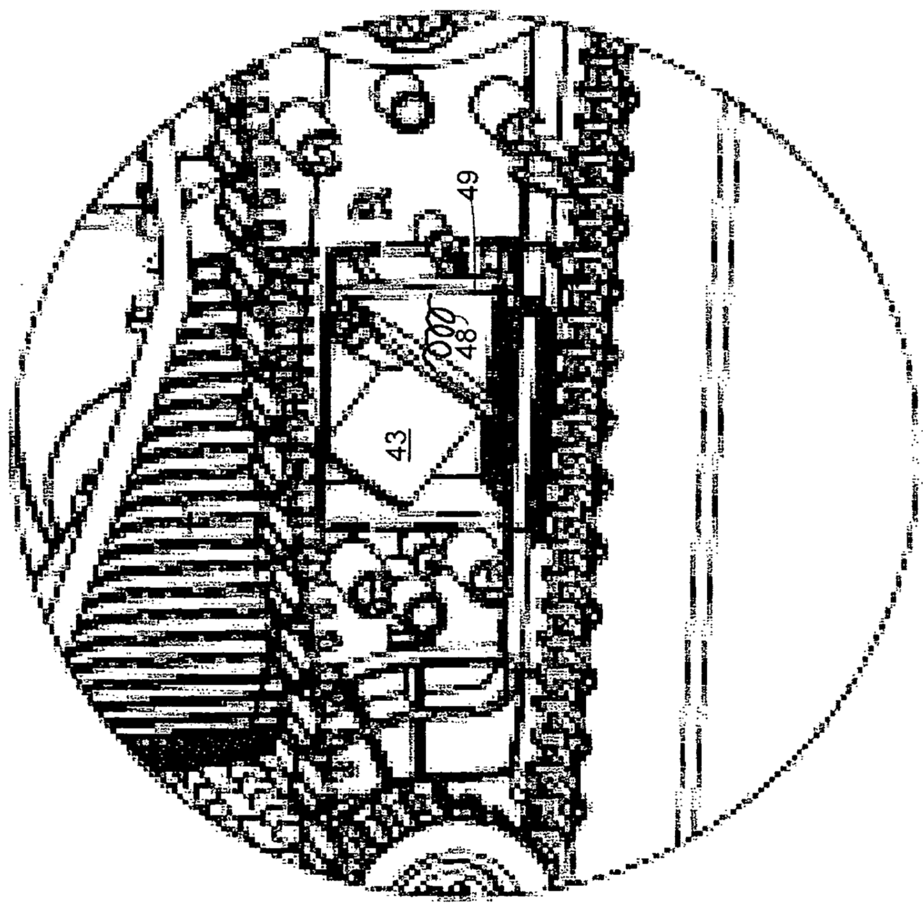


FIG. 9

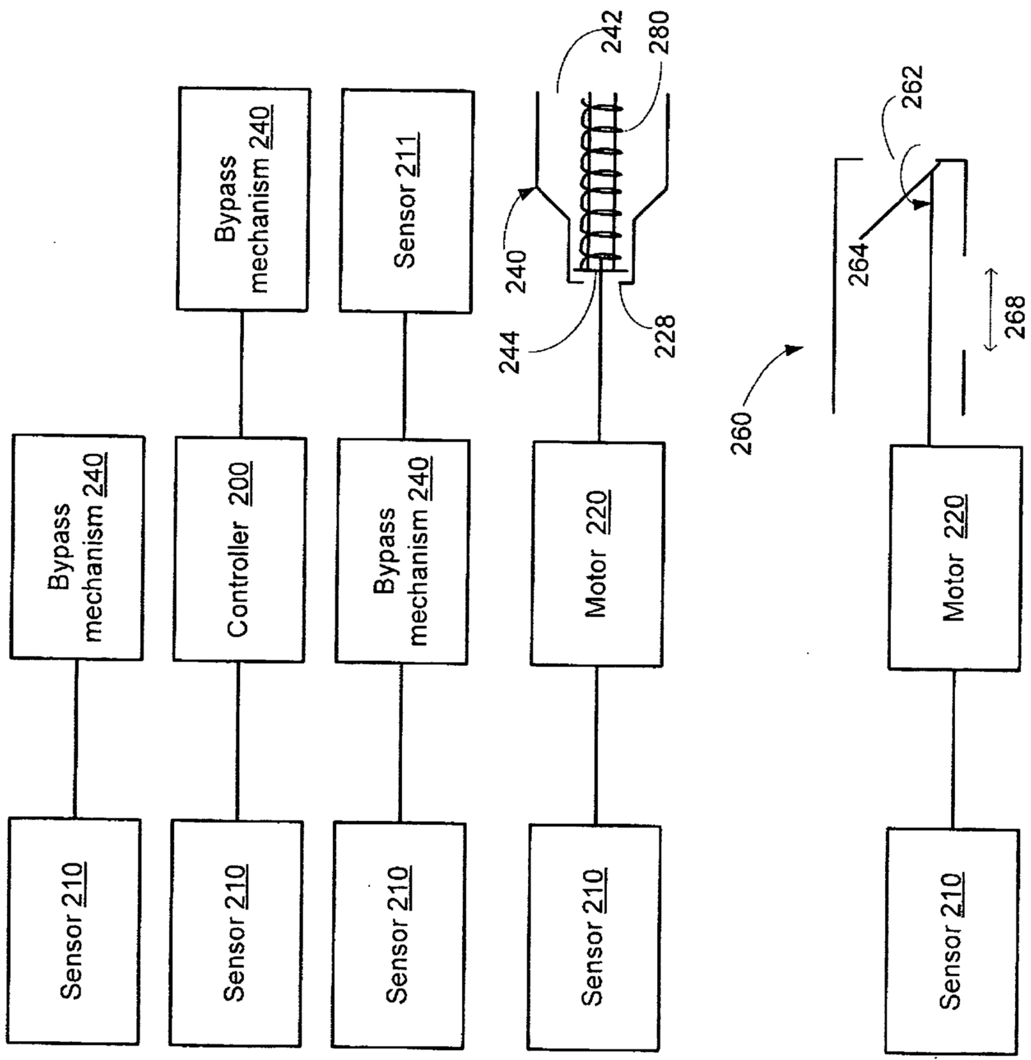

Sensor 210
Bypass mechanism 240
Sensor 210
Controller 200
Bypass mechanism 240
Sensor 210
Bypass mechanism 240
Sensor 211
Sensor 210
Motor 220
244
240
228
242
280
260
Sensor 210
Motor 220
264
262
268

FIG. 10

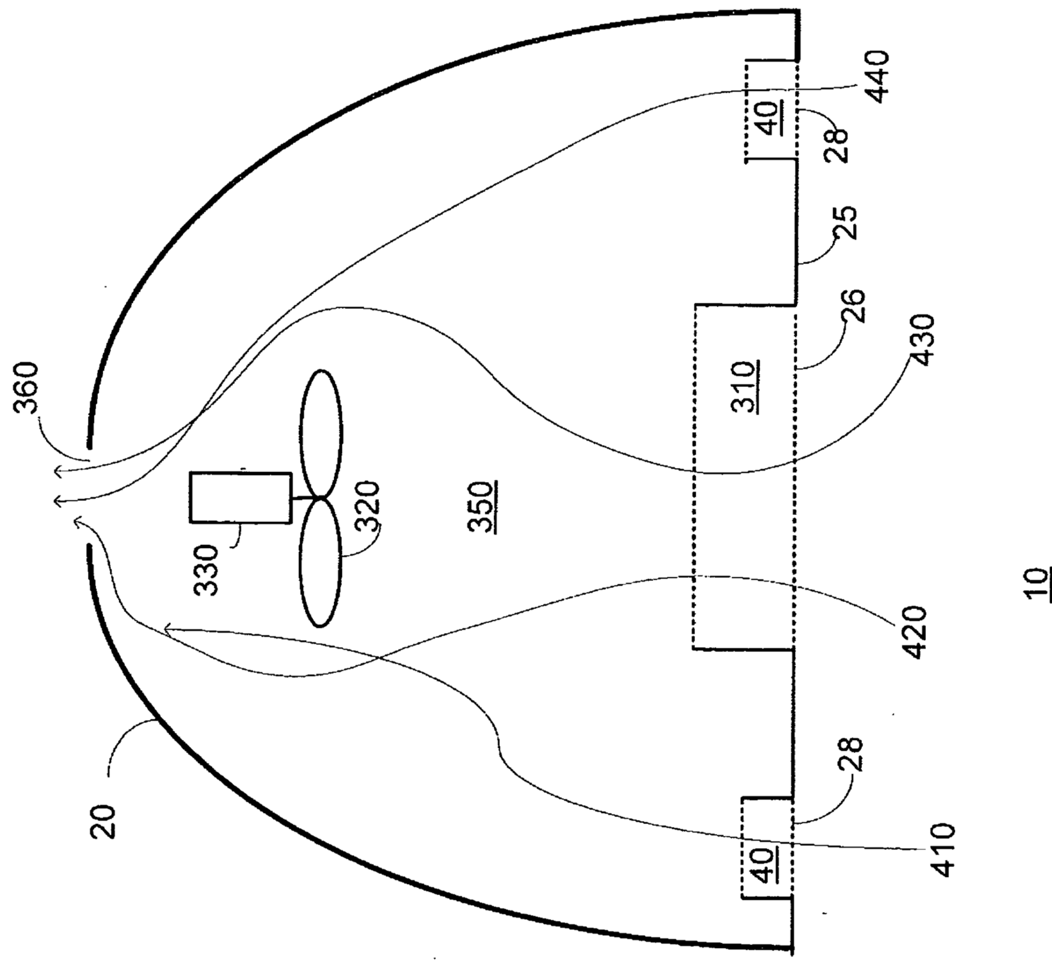


FIG. 11

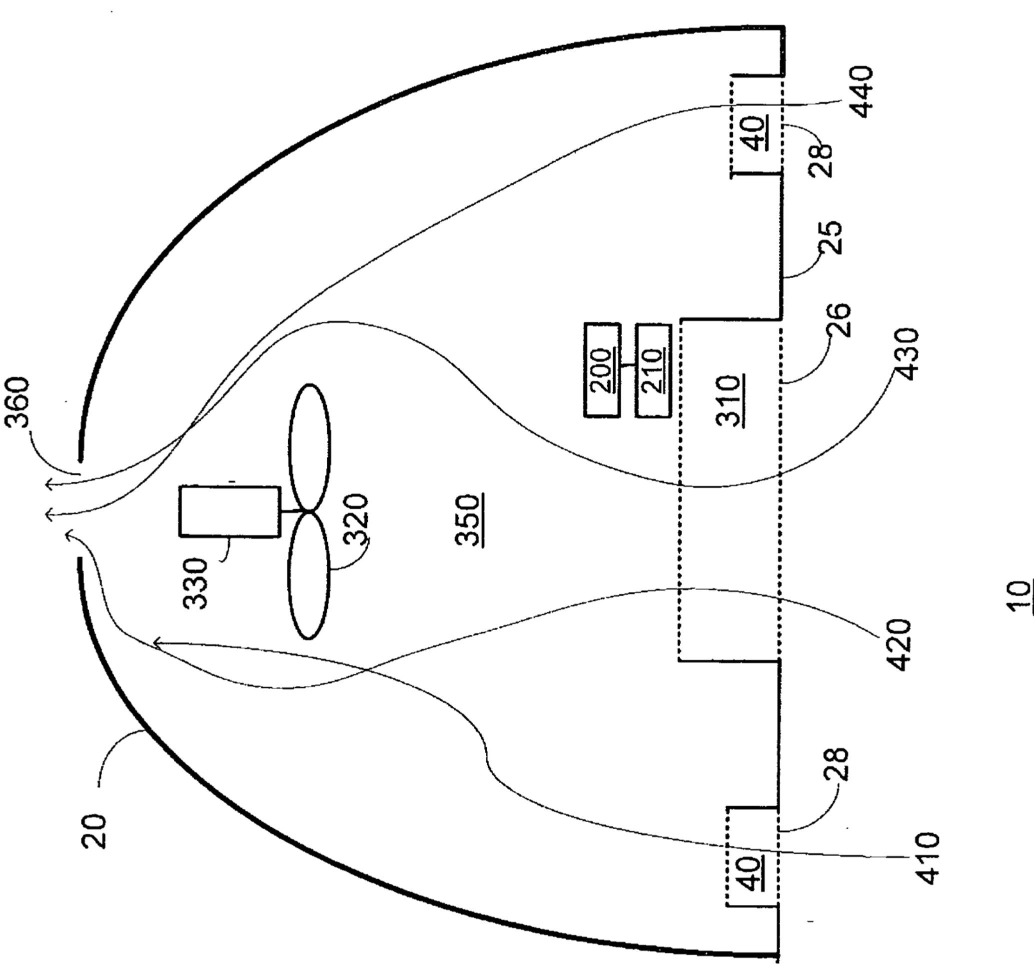


FIG. 12

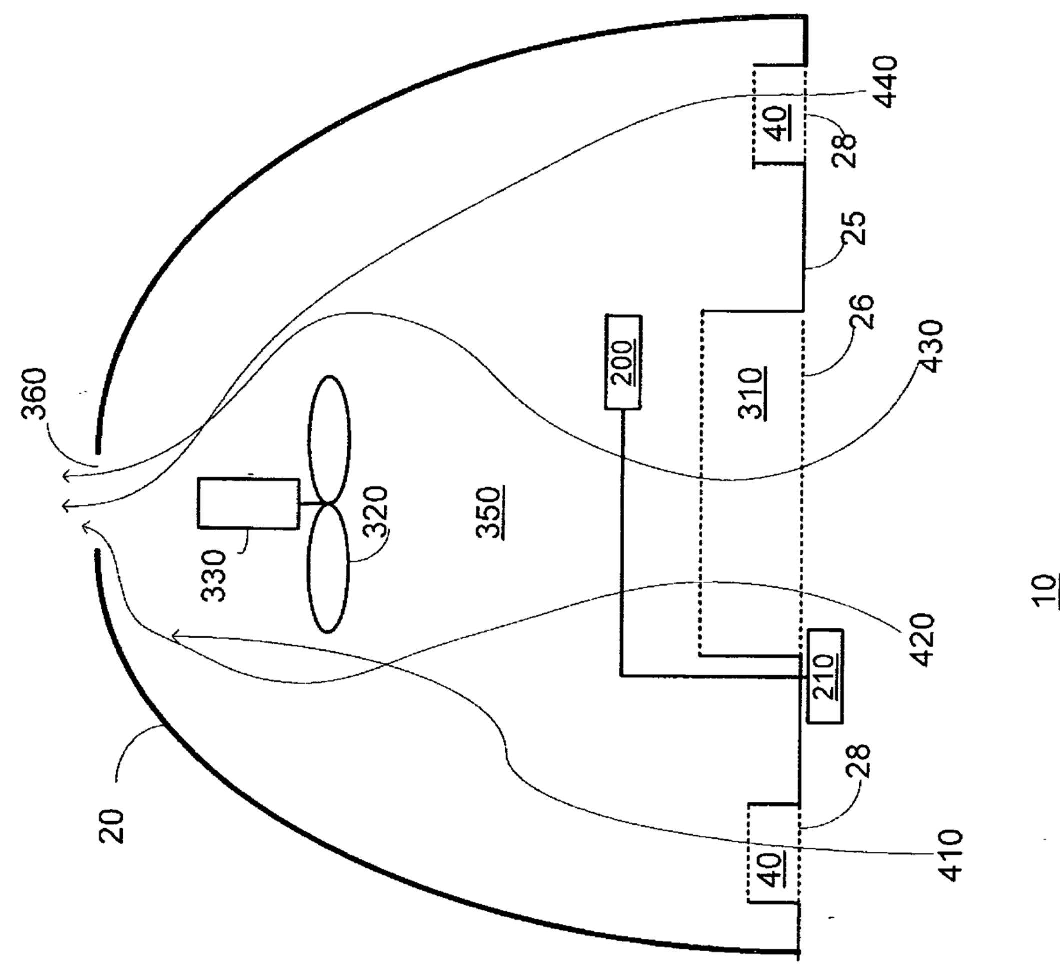


FIG. 13

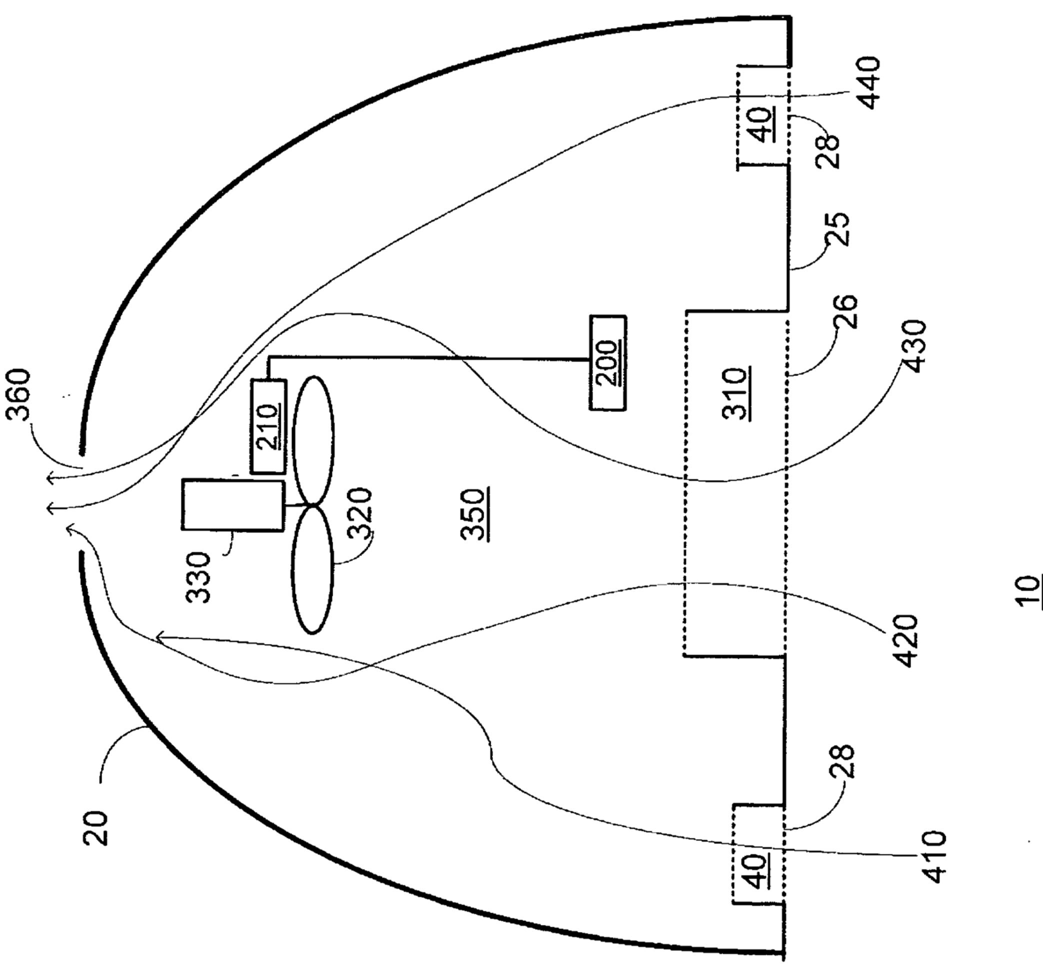


FIG. 14

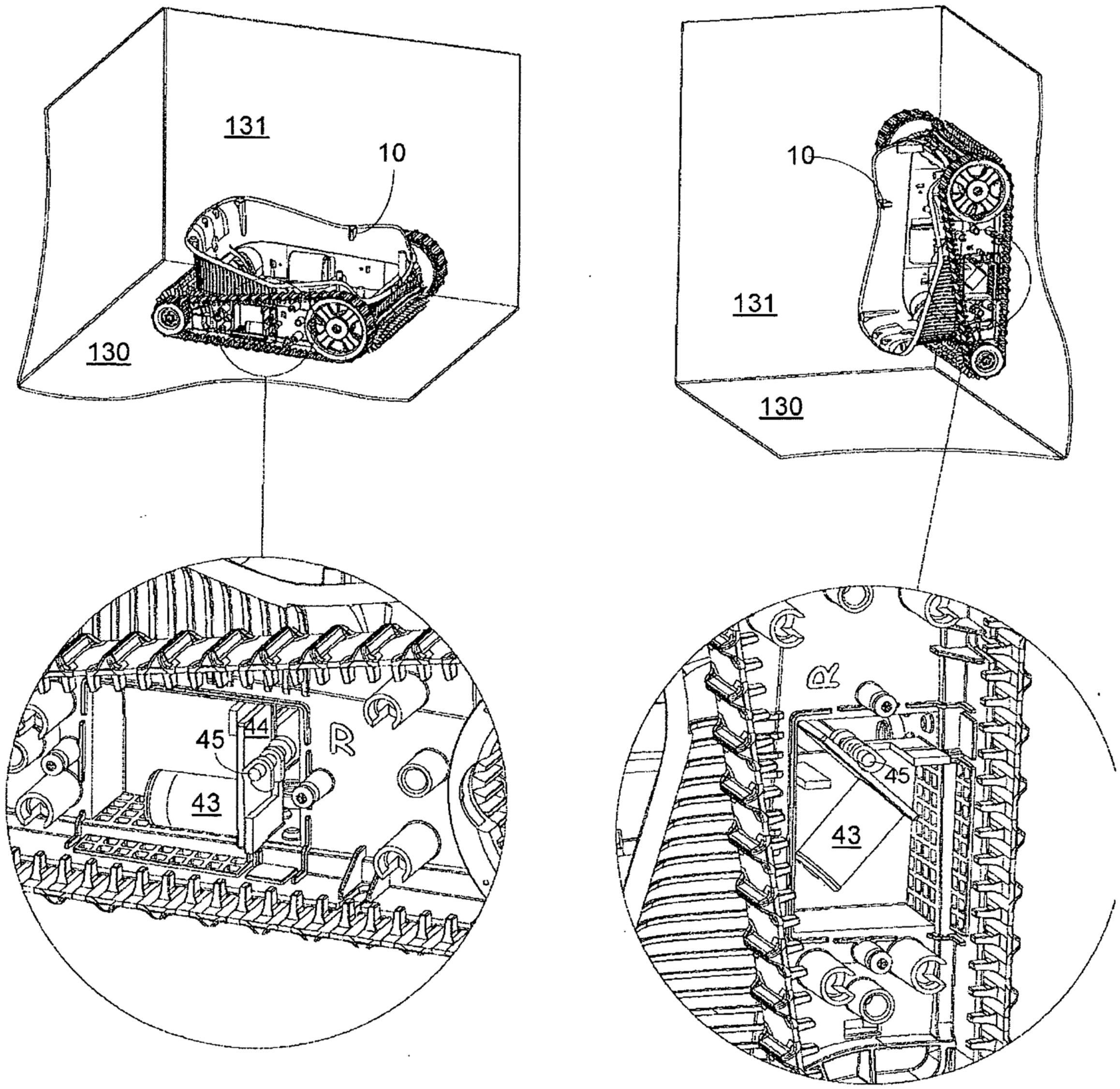


FIG. 15

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 61875066 B **[0001]**

EXHIBIT C

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 706 170 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.11.2020 Bulletin 2020/45

(51) Int Cl.:
E04H 4/16 *(2006.01)*

(21) Application number: **13183973.0**

(22) Date of filing: **11.09.2013**

(54) **Pool cleaning robot**

Schwimmbeckenreinigungsroboter

Robot de nettoyage de piscine

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **11.09.2012 IL 22187712**

(43) Date of publication of application:
12.03.2014 Bulletin 2014/11

(60) Divisional application:
19205736.2 / 3 623 545

(73) Proprietor: **Maytronics Ltd.**
19350 Kibbutz Yizrael (IL)

(72) Inventors:
- **Boaz, Ben-Dov**
  1935000 Kibbutz Yizrae (IL)
- **Yohanan, Maggeni**
  15255 Ilaniya (IL)
- **Jackov-Guy, Ben-Simon**
  20692 Yokneam (IL)
- **Yair, Hadari**
  12110, Kibbutz Hulata (IL)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Thierschstrasse 11
80538 München (DE)

(56) References cited:
EP-A2- 2 447 448
DE-A1- 2 801 394
US-A1- 2010 306 931
US-A1- 2011 000 032

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND

[0001] Cleaning robots are known in the art. Various cleaning robots are manufactured by Maytronics Ltd. of Israel and represent the state of the art of cleaning robots.

[0002] A cleaning robot is expected to clean the pool by brushing the surfaces of the pool and filtering the fluid of the pool by removing foreign particles from that fluid. The cleaning robot can be requested to move along various paths and change its direction when cleaning the pool.

[0003] There is a growing need to provide an efficient cleaning robot.

[0004] Document US2010306931 (A1) discloses a pool cleaning robot provided for cleaning a surface of a swimming pool. The robot comprises a main housing, a pair of main wheels disposed at opposite ends of a bottom panel of the housing spanning along a majority of its width and carrying a pair of continuous tracks spanning between edges thereof, the main wheels being configured for rotating at a first angular velocity, at least one inlet being formed in the bottom panel between the main wheels and being configured for intake of water and debris, and at least one auxiliary brushwheel disposed between the main wheels. The robot is configured for rotating the auxiliary brushwheel about an axis of rotation at a second angular velocity which is substantially greater than the first angular velocity.

SUMMARY

[0005] According to the invention, there is provided a cleaning robot defined by the technical features of claim 1. Advantageous embodiments thereof are defined in dependent claims 2-7.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 illustrates a cleaning robot.
Figs. 2-4A illustrate a front brushing unit and various interfaces.
Fig. 4B is a cross sectional view of a front brushing unit and various interfaces.
Fig. 5 illustrates a cleaning robot.
Figs. 6-12 are cross sectional views illustrating various portions of cleaning robots according to various embodiments of the invention;
Fig. 13 illustrates a rear panel of a cleaning robot according to an embodiment of the invention;
Figs. 14, 15 and 18 are cross sectional views illustrating various portions of cleaning robots according to various embodiments of the invention;
Fig. 16 illustrates a nozzle, a pump motor, and drive motor and a nozzle transmission according to a further embodiment of the invention;
Fig. 17 illustrates a cleaning robot according to an embodiment of the invention;
Fig. 18 illustrates a cleaning robot according to an embodiment of the invention;
Fig. 19 illustrates a portion of a cleaning robot according to an embodiment of the invention;
Fig. 20 illustrates a cleaning robot according to an embodiment of the invention;
Figures 21A and 21B illustrate a filtering unit according to an embodiment of the invention;
Figures 22 - 24 illustrate a cleaning robot according to various embodiments of the invention;
Figures 25-26 illustrate a portion of a cleaning robot according to various embodiment of the invention; and
Figure 27 illustrates a method.

[0007] It will be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity. Further, where considered appropriate, reference numerals may be repeated among the figures to indicate corresponding or analogous elements.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0008] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, and components have not been described in detail so as not to obscure the present invention.

[0009] The terms axis and axel are used in an interchanging manner. The term pool means any element that is capable of containing fluid.

[0010] Figure 1 illustrates a cleaning robot 10.

[0011] The cleaning robot 10 includes a housing 13 that includes a cover 11 that is pivotally connected to a main body 12 of the housing 13.

[0012] The cleaning robot 10 may interface a surface of a pool (to be cleaned by the robot) by two tracks - right track 310 and left track 312.

[0013] Right track 310 contacts rear right wheel 320 and a right side of a front brushing unit 200. Especially, inner teeth (not shown) of right track 310 match teeth of track receiving portion 220 that is positioned at the right side of the front brushing unit 200 and teeth (not shown) of a track receiving portion of the rear right wheel 320.

[0014] Left track 312 contacts rear left wheel 322 and a left side of front brushing unit 200. Especially, inner teeth of left track 312 match teeth of a track receiving portion (not shown) positioned at the left side of the front brushing unit 220 and teeth (not shown) of a track receiving portion of the rear left wheel 322.

[0015] The external teeth of each of tracks 310 and 312 may contact the surface of the pool.

[0016] Figure 1 also illustrates a right sidewall 15 of the housing 13 and a multiple-opening cover portion 450 that is positioned at a center of a rear panel 14 of the housing 13 and includes a right opening 452, a left opening 454 and a central opening 456 - the central opening 456 may include an array of narrow and elongated openings that have a curved cross section.

[0017] Figure 1 also illustrate a longitudinal axis 701 that is parallel to tracks 310 and 312 and a traverse axis 702 that is normal to the longitudinal axis 701, each of these axes is illustrates as being located at the center of the cleaning robot 10.

Reciprocation of cleaning element

[0018] A cleaning robot may include a drive motor; a housing that encloses the drive motor; a brushing element; and a transmission connected between the brushing element and the drive motor, the transmission may be arranged to convert a rotary movement induced by the drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) a reciprocal movement of the brushing element in parallel to the brushing element axis.

[0019] The brushing element axis may be parallel to a traverse axis of the housing.

[0020] The transmission may include a converter arranged to convert the rotary movement induced by the drive motor to the reciprocal movement. The rotary movement occurs within a rotary movement plane that is oriented in relation to the brushing element axis.

[0021] Referring to figure 2, the converter is illustrated as including (a) a first interface 202 that has a non-flat surface and may be arranged to be rotated by the rotary movement: (b) a second interface 201 that is positioned at fixed distance (distance of zero or more) from the rotary movement plane.

[0022] The second interface 201 may be arranged to contact the first interface 202 and to force the first interface 202 to reciprocate as a result of the rotary movement. The second interface 201 can have a cylindrical shape and (in order to reduce friction) may rotate about an axis that is parallel to the rotary movement plane.

[0023] The non-flat surface of the first interface 202 may have a sinusoidal cross section then when contacting the second interface 201 causes the front brushing element 211 to reciprocate.

[0024] Figure 2 illustrates one side (for example a left side) of the front brushing wheel and one side of the first interface 202.

[0025] The second side of the first interface 202 (that is proximate to the second side of the brushing unit 220) has a non-flat surface (for example a right side non-flat surface) that corresponds to the flat surface illustrated in figure 2 - so that at any orientation of the brushing wheel both non-flat surfaces induce a reciprocal movement to the same direction.

[0026] Thus, referring to the example set fourth in figure 2, the right non-flat surface of the first interface 202 has the same sinusoidal cross section wherein peaks of the sinusoidal cross section of the right non-flat surface are located at the same location (orientation wise) to corresponding minimal points of the sinusoidal cross section of the left non-flat surface.

[0027] Referring to figures 2 - 4A - the front brushing element 211 is connected to the first interface 202. The first interface 202 is connected to a rotating element 212 to facilitate a reciprocal movement of the first interface 202 and the front brushing element 211 in relation to the rotating element 212.

[0028] The rotating element 212 may include, for example, radially extending protrusions 212' that may be shaped as radially extending bars while the first interface 202 may have matching grooves (not shown) that allow reciprocal movement of the first interface 202 in relation to the rotating element 212. Alternatively - rotating element 212 may include grooves that match protrusions of the first interface 202. Alternatively - the rotating element 212 may have grooves and protrusions and the first interface 202 may include matching protrusions and grooves.

[0029] Although not shown there should be locking elements that prevent a detachment of the rotating element 212 from the first interface 202. These locking elements can be a part of the protrusions (for example - a protrusion that has a tip that is wider than the base of the protrusion). The protrusions may end by round shaped tips.

[0030] The rotating element 212 can be connected to the brushing element axel 214 via a cylindrical bearing 213.

[0031] A rotation of the rotating element 212 about a brushing element axis 214 may force the first interface 202 and the front brushing element 211 to rotate, in coordination with the rotating element 212, about the brushing element axis 214.

[0032] There is also provided a rim 220' that prevents a track 310 (that matches the teeth of track receiving portion 220 by size and gauge) from detaching from the track receiving portion 220 and does not show a rim and an annular groove that are shaped to fit a rounded notch of the housing. The track receiving portion 220 may be followed by the annular groove and the rim. Similar track receiving portions and rims are illustrated in US patent application 20090045110 of Garti.

[0033] The track receiving portion 220 is connected to the rotating element 212 and causes the latter to rotate. The rotation of the track receiving portion 220 is induced by track 310 that is rotated in response to an activation of a drive motor of the cleaning robot.

[0034] The rotation and reciprocal movements are obtained by having multiple brushing elements instead of a single one, allowing these brushing elements to move in relation to each other and one or more first interfaces that that have surfaces (that contact second interfaces) that not match each other such as to cause relative reciprocal movement of the brushing element in relation to each other. The different brushing elements (and additionally or alternatively the different first interfaces) can be connected to each other by elastic connectors such as springs.

[0035] Figure 4B is a horizontal cross sectional view of two brushing elements 240 and 250 and two interfacing elements 260 and 270 that share a rotating element 212.

[0036] Interfacing element 260 has an inner edge 261 that faces an inner edge 271 of interfacing element 270. Inner edges 261 and 271 may be connected to each other via elastic elements such as springs 280.

[0037] An outer edge 262 of interfacing element 260 may contact first interface 202 and an outer edge 272 of interfacing element 270 may contact another first interface 202

[0038] The first interfaces 202 and each one of outer edges 262 and 272 do not match each other - in order to induce relative lateral movement between interfacing elements 260 and 270 - and thus between brushing elements 240 and 250. For example, while outer edge 272 can have a sinusoidal cross section the outer edge 262 can have a planar cross section, a out of phase sinusoidal cross section, a ramped cross section and the like. Each of the brushing elements 240 and 250 is connected to a corresponding first interface out of first interfaces 260 and 270.

[0039] The interfacing elements 260 and 270 can be rotated by rotating element 212 while performing reciprocal movement in relation to rotating element 212. This can be achieved, for example, by using radially extending protrusions and matching curves in the rotating element 212 and each of the interfacing elements.

Change of direction of movement of the cleaning robot

[0040] The cleaning robot can be tilted in order to change the direction of movement of the cleaning robot. The change of direction can be induced in various manners.

[0041] According to a non claimed embodiment there is provided a cleaning robot 10 that may include (referring to figure 1) a housing 13 and multiple movable elements such a rear right wheel 320, rear left wheel 322 and a front brushing unit 200 that extends throughout the entire front panel of the housing 13. The cleaning robot is also equipped with a right track 310 and a left track 312.

[0042] When both tracks 310 and 312 contact the surface of the pool the cleaning robot 10 can move either forwards or backwards (depending upon the direction of rotation of tracks 310 and 312) - assuming that the movement of both tracks 310 and 312 are synchronized. Deviations from that direction of propagation can be achieved by jetting fluid from the cleaning robot 10 and especially by jetting fluid through openings of the multiple-opening cover portion 450.

[0043] If the different tracks do not contact the surface of the pool at the same manner (introduction of an imbalance between the tracks) and especially when one track contacts the surface while another does not contact the surface then the cleaning robot will turn towards the imbalance - towards the track that is in more contact with the surface. This imbalance can also be referred to as unevenness or asymmetry.

[0044] The pool leaning robot 10 may include an imbalance induction unit that may be arranged to introduce an imbalance between at least two movable elements that results in a change in a direction of propagation of the cleaning robot 10. The imbalance induction unit may be arranged to induce the imbalance as a result of a movement of a nozzle for outputting fluid from the cleaning robot (illustrated in figures 7-11), and, additionally or alternatively as a result of a movement of a diaphragm that is loosely connected to the housing (figures 5 and 6).

[0045] Figures 5 and 6 illustrates a cleaning robot 10 in which the imbalance induction unit may be arranged to induce the imbalance as a result of the movement of a diaphragm 300 that is loosely connected to the housing 13. The diaphragm 300, when positioned in a low position (figure 5 and 6) fits into an aperture 302 defined in the bottom panel 16 of the housing 13.

[0046] A change in the position of the diaphragm 300 may be responsive to a change in a status of an impeller 70 of the cleaning robot. When the impeller 70 draws fluid through input nozzle 410 (and through aperture 302) the diaphragm 300 is drawn upwards - towards the impeller 70.

[0047] The diaphragm transmission 330 may be arranged to convert a change in a location of the diaphragm 300 to a change in an elevation of the protrusion 350 that once located at a low position contacts the surface of the pool and induces the imbalance between the at least two movable elements.

[0048] The protrusion 350 may be illustrated as being distant from a longitudinal axis of symmetry of the cleaning robot 10. It should not be located along the longitudinal axis in order to induce an imbalance between tracks 312 and 310. Alternatively, the protrusion 350 can be located at the longitudinal axis but will have an asymmetrical tip (such as a sloped tip) that contacts the surface of the pool such as to introduce the imbalance.

[0049] Figure 6 illustrates the diaphragm transmission 330 as connected to the diaphragm 300 via handle 332 that vertically extends from the diaphragm 300 and (a) forces the diaphragm 300 to perform a rotational movement, and (b) translates the rotational movement to a linear movement so that protrusion 350 moves downwards (when the diaphragm 300 movers towards the impeller 71 and thereby tilts the cleaning robot towards the right (and even detaching left track 312 from the surface of the pool). It is noted that the diaphragm can follow other paths than the curved path forced by the diaphragm transmission 330 of figure 5.

[0050] After the impeller 71 stops drawing the fluid, the diaphragm 300 returns to its low diaphragm position and may seal the aperture 302.

[0051] Figure 6 illustrates an example of a diaphragm transmission 330. It includes a diaphragm axle 334 that is horizontal and is rotatably connected to a vertical inner wall 360 of the cleaning robot 10 via curved clips 336 that allow the diaphragm axle 334 to rotate about an axis.

[0052] The diaphragm axle 334 is connected to two radially extending elements - a first radially extending element 333 that is rotatably connected to handle 332 and a second radially extending element 338 that is rotatably connected to protrusion 350 such as to translate the rotational movement of the diaphragm axle 334 to (a) a curved movement of the diaphragm 300 and to (b) a linear movement of the protrusion 350 (the movement of the latter is further confined to linear movement by an aperture in the bottom panel 16 through which the protrusion 350 moves.

[0053] Figures 7-11 illustrate an imbalance induction unit that may be arranged to induce an imbalance between moving components of the cleaning robot as a result of a movement of a nozzle for outputting fluid from the cleaning robot 10.

[0054] The nozzle 410 can be moved along a predefined path and the movement of the nozzle 410 can be translated (by a nozzle transmission) to a linear movement of a protrusion that can tilt the cleaning robot and induce the imbalance.

[0055] Figures 7 - 11 illustrate a conversion of a rotary movement of the nozzle 410 to a linear movement of the protrusion 350. It is noted that there can be provided other types of movements (of either one of the nozzle and the protrusion). For example the protrusion can have a radially a-symmetrical cross section and can be rotated in order to introduce the imbalance. For example an X shaped cross section protrusion can be rotated in order to introduce the imbalance, an elliptical cross section protrusion can be rotated in order to induce the imbalance and the like. Yet for another example the nozzle can be moved along a linear path.

[0056] The protrusion 350 may be illustrated as being distant from a longitudinal axis of symmetry of the cleaning robot 10. It should not be located along the longitudinal axis in order to induce an imbalance between tracks 312 and 310. Alternatively, the protrusion 350 can be located at the longitudinal axis but will have an asymmetrical tip (such as a sloped tip) that contacts the surface of the pool such as to introduce the imbalance.

[0057] Figure 7 is a cross sectional view of the cleaning robot 10 that illustrates various internal components of the cleaning robot - such as filtering unit 20. Figures 21A and 21B illustrate the filtering unit 20 according to various embodiments of the invention.

[0058] The filtering unit 20 may include one or more filters of one or more filtering levels (a filter level defines the size of particles that may pass through the filter) such as a gross filter and a fine filter.

[0059] It is noted that the filtering unit 20 can include three or more filters. It may have at least one additional filter.

[0060] Any additional filter may have a filtering level that differs from the first and second filtering levels or equals one of the first and second filtering levels.

[0061] The cleaning robot can have a handle that is coupled to the filtering unit and extends outside an opening formed in the housing.

[0062] The handle can be connected to the filtering unit and extend outside an opening formed in the housing.

[0063] The fluid can enter the filtering unit 20 through an opening 380 that is formed in the bottom plate 16 of the housing this opening 380 allows fluid to enter an inner space surrounded by a first filter 21, to be filtered by the first filter 21 to provide a firstly filtered fluid that propagates towards the second filter 22 to be further filtered by the second filter to provide secondary filtered fluid (Also referred to as filtered fluid). According to the invention the second filter 22 may partially surround the first filter 21.

[0064] The first filtering level may exceeds the second filtering level - as the first filter 21 is arranged to perform a coarser filtering than the second filter 22.

[0065] Figure 7 illustrates the pump motor 80 that drives the impeller 70 as being oriented at about forty five degrees to the bottom panel 16 but other orientations can be provided.

[0066] The nozzle 410 can rotate about a nozzle axis that is parallel to a traverse axis of the cleaning robot 10, wherein the rotation can occur within a central plane that includes the longitudinal axis of the cleaning robot 10.

[0067] Figures 8-10 illustrate a spring 352 that is positioned between (a) disk 353 that is connected to protrusion 350 and (b) upper disk 354 that surrounds the opening through which protrusions 350 moves.

[0068] The spring 352 induces the protrusion 350 to be elevated to a higher protrusion position in which the lower end of protrusion 350 does not contact the surface of the pool - and does not introduce an imbalance between tracks 310 and 312.

[0069] The protrusion 350 may be moved downwards to a lower protrusion position and to induce the imbalance between the tracks by nozzle transmission 420 that converts a counterclockwise movement of the nozzle 410 to a downwards movement of the protrusion 350.

[0070] The nozzle transmission 420 includes: nozzle axle 442 that is connected to a vertical bevel gear 502 (used to rotate the nozzle 410) and is rotatably connected to second vertical inner wall 362 of the cleaning robot 10 via curved clip 441 that allows the nozzle axle 442 to rotate about an axis. The nozzle axle 442 is connected to a radially extending element 423 that interfaces with a first fin 425 that is fixed to a second fin 424. The second fin 424 is rotatably connected to sidewall of housing 13 and is parallel to the sidewall while first fin 425 is normal to that sidewall. A clockwise rotational movement of the nozzle axle 442 elevates radially extending element 423 that in turn elevates first fin 425 and causes the second fin to rotate counterclockwise and thereby lower projection 350 that is rotatably connected to the second fin 424 (via cylindrical interfacing element 426).

Multiple directional fluid jetting arrangement

[0071] Fluid can be jetted from the cleaning robot in multiple different directions, wherein the directions are determined by a rotational movement of the nozzle and by the state of the impeller 70 - static, rotational movement along a first direction and rotational movement along a second rotational direction.

[0072] Referring to figures 1 and 12-15 the cleaning robot 10 is illustrated as including a housing 13 that includes a multiple-opening cover portion 450. The multiple- opening cover portion 450 is positioned at a center of a rear panel 14 of the housing 13 and includes a right opening 452, a left opening 454 and a central opening 456 that includes an array of narrow and elongated openings that have a curved cross section.

[0073] The right opening 452 faces the right of the cleaning robot 10.

[0074] The left opening 454 faces the left of the cleaning robot 10 and both openings (452 and 454) can be parallel to the left or right sidewalls of the housing 13.

[0075] The multiple-opening cover portion 450 is positioned at the center of the cleaning robot 10 and its right and left openings 452 and 454 are positioned in a symmetrical manner in relation to the longitudinal axis 701 of the cleaning robot 10. They have the same shape (rectangular) and size but may differ from each other by shape size, and location.

[0076] The right opening 452 is preceded by a right fluid conduit 462 that is substantially horizontal. The right fluid conduit 462 may be arranged to direct fluid from the nozzle 410 to the right of the housing (through the right opening 452).

[0077] The left opening 454 is preceded by a left fluid conduit 464 that is substantially horizontal. The left fluid conduit 464 may be arranged to direct fluid from the nozzle 410 to the left of the housing (through the left opening 454).

[0078] Figures 12, 14 and 15 illustrate the right and left fluid conduits 462 and 464 as sharing a sidewall.

[0079] The central opening 456 is preceded by a central conduit 466 that faces the nozzle 410.

[0080] The nozzle 410 can be rotated and thus follow a curved path that changes its orientation, for example from being vertical to being horizontal. Other ranges of orientations can be obtained.

[0081] Figure 16 illustrates the nozzle 410, a pump motor 80, a drive motor 82, , a removable cover 506 of a sealed housing (not shown) that encloses the drive motor 82 and the pump motor 80), a horizontal bevel gear 504 that mashes with a vertical bevel gear 502, the horizontal bevel gear 504 rotates about an vertical axis by a motor (not shown) and this rotation is translated by the pair of horizontal and vertical bevel gears 504 and 506 to a vertical rotation of the nozzle 410 that changes the orientation of the nozzle.

[0082] The nozzle 410 can be rotatably connected to a support element (not shown) that may support the nozzle 410 and facilitate the rotational movement of the nozzle 410. The nozzle 410 can interface with a curved cover 560 that prevents fluid from exiting a path defined by the nozzle 410 and any of the conduits (462, 464 and 466) during the entire rotational movement of the nozzle 410.

[0083] The horizontal and vertical bevel gears 502 and 504 and the motor that drives the horizontal bevel gear 502 may form a nozzle manipulator that may be arranged to rotate the nozzle 410 about a nozzle axis such as to alter an orientation of the nozzle 410 in relation to the longitudinal axis 701.

[0084] The right, left and central conduits 462, 464 and 466 may belong to a fluid interfacing unit that may be arranged to direct fluid from the nozzle 410 (a) towards the central fluid conduit 466 when the nozzle 410 is at a first orientation, (b) towards the right fluid conduit 462 when the nozzle 410 is at a second orientation, and (c) towards the left fluid conduit 464 when the nozzle 410 is at a third orientation. The first orientation differs from the second and third orientations.

[0085] The second orientation may substantially differ from the third orientation - but this is not illustrated in figures 12, 14 and 15.

[0086] These figures (figures 12, 14 and 15) illustrate an embodiment in which the second orientation substantially equals the third orientation (for example - a forty five degree orientation) and wherein a selection between the left fluid conduit 464 and the right fluid conduit 462 may be made by rotating the nozzle 410 and, additionally or alternatively, by changing an operational mode of the impeller 70 - static, rotation at a first rotational direction or rotation at a second rotational direction.

[0087] Figures 12, 14 and 15 illustrate a shutter 550 that is pivotally connected to a shared sidewall 552 of the left and right fluid conduits 462 and 464. The shutter 550 is pivotally connected to the shared sidewall 552 via a spring (not shown) that tends to force the shutter 550 towards an initial shutter position in which the shutter 550 is slightly oriented towards an opening 464' formed in the left fluid conduit 464.

[0088] The nozzle 410 can be moved from a first or fourth orientation to a second orientation while the impeller 70 pushes fluid to exit the nozzle 410 during this movement so that the flow of fluid will cause the shutter 550 to complete an upward (clockwise) movement (and be out of the reach of the nozzle 410) and to shut the opening 464' formed in the left fluid conduit 464 so that the fluid can enter opening 462' formed in the right fluid conduit 462 and exit through the right opening 452.

[0089] If the same movement of the nozzle 410 is done without pushing fluid towards the shutter 550 then the nozzle 410 can move the shutter 550 downwards to close the opening of the 462' formed in the right fluid conduit 462 so that the fluid can enter opening 464' formed in the left fluid conduit 464 and to exit through the left opening 454.

[0090] The nozzle manipulator unit may be arranged to position the nozzle 410 at a fourth orientation that may also face the center opening 466.

[0091] Figure 17 illustrates a robot 11. The robot 10 has a multiple opening structure 720 that has a right aperture 724, a left aperture 723, a upper aperture 722 and a rear aperture 721 that face the right, left, upper and rear directions and are preceded by fluid conduits that facilitate a flow of fluid from an inner space in which the nozzle is allowed to move such as to face one or more of these fluid conduits and allow the fluid to exit via one of the apertures and assist in directing the robot to move along a desired direction. The nozzle can perform a movement along to degrees of freedom so that it can face the different openings.

Asymmetrical position of components

[0092] Figure 18 illustrates a cleaning robot that includes a drive motor 610 that is arranged to rotate multiple rotating elements such as any of the wheels and tracks mentioned in any of the previous figures), at least some of which are arranged to contact a surface of the pool, an impeller 70, a pump motor 80 that is arranged to rotate the impeller 70; a housing 13 that encloses a drive motor (not shown), the pump motor 80 and the impeller 70; a filtering unit 20; and front and rear brushing units 200 and 200'.

[0093] The pump motor 80, the drive motor and the impeller 70 are substantially closer to a front edge 601 of the housing than to a rear edge 604 of the housing. Their center of gravity is located between a traverse axis 701 and the front edge 601.

[0094] The proximity of these components to the front edge (and the placing of these components outside the center 630 of the housing) may assist in reducing the aggregation of air bubbles in the cleaning robot - as bubbles that enter the pool cleaning robot via apertures located at the housing are not forced to pass through the filtering unit 20 (positioned near the rear edge of the housing) and are also (if entering the front edge that may surface above the fluid of the pool) may be quickly ejected by the impeller that is also located near the front edge.

[0095] A distance of each one of the pump motor, drive motor and the impeller from the front edge of the housing is at least 10%, 15%, 20%, 25%, 30% smaller than a corresponding distance to the rear edge of the housing.

Optical sensor and compass

[0096] The robot can have an optical sensor 800 that may be arranged to detect motion. The detection signals of the optical sensor can be processed by a controller that may in turn control the movement of the robot according to a desired path and motion detection. The optical sensor 800 can be located at the bottom of the robot or in any other location. Figure 19 illustrates a robot that is equipped with an optical sensor 800 that is positioned at the center of the robot (along its longitudinal axis) and at the bottom panel of the robot. It is noted that the optical sensor 800 can be located elsewhere. The optical sensor 800 can include a radiation source 801, a detector 802, optics 803 and a detection signal processor 804. The detector 802 and the detection signal processor 804 can be equivalent to those that are being used in a computer mouse.

[0097] The radiation source 801 can include one or multiple light sources such as an array of light emitting diodes. The radiation source 801 can generate radiation at various wavelengths - such as between 630 to 618 nm. The optics 803 may include an objective lens that is expected to focus reflected radiation from the surface of the pool onto the detector 802, while the detector is more distant (for example - 20 mm) from the surface of the pool in comparison to the distance (about 6 mm) from the detector of a computer mouse to a surface. The depth of view of the objective lens should be about 4 mm and the radiation can be impinging on the surface at an angle of about 45 degrees.

[0098] Additionally or alternatively, the robot may include a pair of compasses that may provide directional information that may be processed in order to determine the location of the robot.

[0099] Figure 20 illustrates a robot that is equipped with a first compass 810 and a second compass 820.

[0100] The first and second compasses 810 and 820 are either positioned or configured so that they are expected to react in a different manner to magnetic field interferences that result from metal elements such as metal infrastructure that belongs to the pool, supports the pool or otherwise is proximate to the pool. The first and second compasses 810 and 820 can be positioned in different locations - for example the first compass 810 can be positioned above the second compass 820 so that the first compass will be more sensitive to magnetic interferences resulting, from example, from the bottom of the pool. The compasses can be magnetically shielded in a different manner than the other compass.

[0101] It is expected that at the absence of magnetic interferences both compasses will provide substantially the same directional information. Usually small deviations between the directional information provided by different compasses are allowed.

[0102] A threshold can be defined and it should exceed the small deviation by a safety margin.

[0103] If the differences between first directional information provided by the first compass 810 and second directional information provided by the second compass 820 exceeds the threshold it may be concluded that at least one of the compasses is magnetically interfered. In this case at least one or both of the first or second directional information can be ignored of or given lower weight.

[0104] It is noted that the processor 830 can compare between the first and second directional information by applying multiple thresholds or by applying non-threshold based comparisons.

[0105] The first compass 810 and the second compass 820 provide their directional information to a processor 830 that is arranged to receive directional information from the first and second compasses and to determine a direction parameter of the cleaning robot based upon the first and second directional information.

[0106] The processor 830 may be arranged to compare the first and second directional information to provide a comparison result; and to determine a validity of at least one of the first and second directional information based upon the comparison result.

[0107] The processor 830 may be arranged to declare the first directional information as invalid if a difference between the first and second results exceeds the threshold.

[0108] The processor 830 may be arranged to declare the first directional information and the second directional information as invalid if a difference between the first and second results exceeds a threshold.

[0109] Figure 20 illustrates the first compass 810 as being positioned above the second compass 820.

[0110] The cleaning robot can also include a non-magnetic sensor arranged to generate output signals indicative of a location of the cleaning robot. The non-magnetic sensor can be a counter that counts rotations of a wheel of the cleaning robot, a gyroscope, an accelerometer, an optical sensor or any other non-magnetic sensor that can obtain information without relying on magnetic fields and that may output location information or information that can be processed to obtain the location of the cleaning robot.

[0111] Figure 20 also illustrates the non-magnetic sensor 840. It is coupled to the processor 830.

[0112] The processor 830 may be arranged to assign more weight to output signals of the non-magnetic sensor 840 than to the first and second directional information if it is determined that a difference between the first and second results exceeds a threshold.

[0113] The robot can have both compass 810 and 820 as well as optical sensor 800 or only one of these components.

[0114] Figures 22 - 24 illustrate a cleaning robot 900. Figure 25-26 illustrate a portion of the cleaning robot 900. Figures 22-25 illustrate a door 908 of the cleaning robot 900 at a closed position while figure 26 illustrates the door 908 at an opened position. Figure 22 is a cross sectional view of the cleaning robot 900 taken about the center of the cleaning robot 900 while figure 23 is a cross sectional view taken along an virtual axis that is proximate to a left edge of the housing 902 of the cleaning robot 900. Figure 24 illustrates the flow (via arrows 950) of fluid through the cleaning robot 900. Figures 25-26 illustrates parts of a housing 902 and the door 908.

[0115] These figures illustrate a mechanism that allows draining fluid through a rear opening of a cleaning robot once the robot is pulled out from the fluid - and also allows the rear opening to be sealed when the robot is submerged in fluid. The selective sealing of the rear opening can be obtained by rotational movement of a door. The opening and sealing can be obtained by using a floating element and without mechanical means (such as springs or other elastic elements) to force the door to seal the rear opening. This is expected to increase the life span of the cleaning robot and simplify its maintenance as springs tend to malfunction. Another advantage, in relation to a spring mechanism, is that the normal rear door position, when out of water with cleaner in a horizontal position e.g.: for storage or hibernation, will always remain open. This reduces the risk of a rear door becoming stuck or glued to the opening 920 as the gravity acts the opposite to flotation 914

[0116] Cleaning robot 900 can include any combination of any of the components listed in any of the previous figures.

[0117] The cleaning robot 900 may include: a housing 902 having a front portion 904, a rear portion 906, a door 908 and a hinge 910.

[0118] Figures 22-24 also show other elements of the cleaning robot 900 such as filtering unit 20, impeller 70, pump motor 80, drive motor (denoted 82 of figure 23), aperture 380, front and rea brushing units 200 and 200' and right track 310.

[0119] The door 908 is pivotally connected to the rear portion 906 of the housing 902 via the hinge 910. The upper edge of the door 908 can be connected to the hinge 910 in a manner that allows a rotational movement of the door 908 in relation to the hinge 910.

[0120] The rear portion 906 of the housing 902 may include a rear opening 920.

[0121] The door 908 is arranged to move between (a) a closed position in which the door 908 substantially closes the rear opening 920 and (b) an open position in which the door 908 does not close the rear opening 920.

[0122] The door 908 may include a floating element (for example - it may be in itself the floating element) or may be coupled to a floating element.

[0123] The floating element 912 is positioned to induce the door 908 to move to the closed position when the cleaning robot is submerged in fluid.

[0124] Assuming that a rotational movement of the door in a counterclockwise manner will induce the door to be at a closed position then the floating element is positioned to induce a counterclockwise movement. When looking from top of the cleaning robot 900 - when the door is at the closed position the floating element 912 may be positioned between the hinge 910 and the front portion 904 of the housing 902.

[0125] Accordingly - at least a portion of the floating element 912 may be closer to the front portion of the housing than the hinge.

[0126] If the door 908 includes the floating element 910 then a center of flotation of the door 908 may be closer to the front portion 904 of the housing 902 than the hinge 910.

[0127] If the door 908 is coupled to the floating element 912 then a center of flotation 914 of a combination of the door 908 and the floating element 912 is closer to the front portion 904 of the housing 902 than the hinge 910.

[0128] The door 908 can be made of a floating material.

[0129] The door 908 may be induced to move to an open position when the cleaning robot is pulled out from the fluid and the front portion 904 of the housing 900 is positioned above the rear portion 906 of the housing 902.

[0130] The cleaning robot 900 may include a limiting element for limiting an extent of movement of the door between the open and closed positions.

[0131] The limiting element may be the rear brushing unit 200'.

[0132] The limiting element (not shown) may be arranged to limit a movement of the hinge 910.The range of movement of the door 908 between the open and closed positions may not exceed ten centimeters. Alternatively, it may exceed ten centimeters. The door movement can be limited so when immersed in the water at horizontal position the door center of flotation will be between the hinge and the front (904).

[0133] The center of floating 914 can be positioned between hinge 910 and front portion 904 and not on the opposite side.

[0134] The range of movement of the door 908 between the open and closed positions may not exceed one, two or three centimeters.

[0135] The door 908 may have a curved cross section.

[0136] The width of the door 908 may exceed a predetermined portion of a width of the cleaning robot 900. The predetermined portion may be any percentage. Both widths are measured along a horizontal axis when the cleaning robot 900 is placed at a horizontal position.

[0137] The cleaning robot 900 may also include handle 930 that is connected to the front portion 904 of the housing 900.

[0138] Figure 27 illustrates a method 2700. Method 2700 includes stage 2710 of inserting a cleaning robot into a pool that is at least partially filled with fluid. The cleaning robot can be any of the cleaning robots illustrate din any one of figures 1-26.

[0139] Stage 2710 is followed by stage 2720 of activating the cleaning robot. The activating may include, for example, allowing the cleaning robot to move and to clean the pool in any manner mentioned in any one of figures 1-26.

[0140] Stage 2720 may include, for example:

i. Converting a rotary movement induced by a drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) a reciprocal movement of the brushing element in parallel to the brushing element axis.

ii. Converting the rotary movement induced by the drive motor to the reciprocal movement.

iii. Allowing the rotary movement to occurs within a rotary movement plane that is oriented in relation to the brushing element axis; wherein the converting is executed by a converter that may include: (a) a first interface that has a non-flat surface and is arranged to be rotated by the rotary movement: (b) a second interface that is positioned at fixed distance from the rotary movement plane; wherein the second interface is arranged to contact the second interface and force the first interface to reciprocate as a result of the rotary movement.

iv. Facilitating a reciprocal movement of the first interface and the brushing element in relation to the rotating element; whereas a rotation of the rotating element about the brushing element axis forces the first interface and the brushing element to rotate, in coordination with the rotating element, about the brushing element axis.

v. Introducing an imbalance between at least two movable elements of the cleaning robot, the imbalance results in a change in a direction of propagation of the cleaning robot, the imbalance may be induced as a result of at least one out of (a) a movement of a nozzle that is arranged to output fluid from the cleaning robot, and (b) a movement of a diaphragm that is coupled to the housing.

vi. Changing the position of the diaphragm in response to a change in an operational mode of an impeller of the cleaning robot.

vii. Allowing the diaphragm to be drawn towards the impeller when the impeller is rotated at a first rotational direction.

viii. Converting by a diaphragm transmission a change in a location of the diaphragm to a change in an elevation of a protrusion that once located at a low protrusion position extends below any of the multiple movable elements and induces the imbalance between the at least two movable elements.

ix. Inducing imbalance due to a movement of a nozzle that is arranged to rotate about an axis and thereby change a direction of fluid being outputted from the cleaning robot.

x. Converting a change in a location of the nozzle to a change in an elevation of a protrusion that once located at a low position contacts the surface of the pool and induces the imbalance between the at least two movable elements.

xi. Introducing an imbalance between at least two movable elements by detaching at least one of the at least two movable elements from the surface of the pool.

xii. Introducing the imbalance by a protrusion that is arranged to introduce the imbalance by moving to a position in which it contacts a surface of the pool and causes at least one of the movable elements to be spaced apart from the surface of the pool.

xiii. Rotating a nozzle about an nozzle axis such as to alter an orientation of the nozzle in relation to an imaginary longitudinal axis of the housing.

xiv. Directing fluid from the nozzle (a) towards the central fluid conduit when the nozzle is at a first orientation, (b) towards the right fluid conduit when the nozzle is at a second orientation, and (c) towards the left fluid conduit when the nozzle is at a third orientation; wherein the first orientation differs from the second and third orientations.

xv. Directing the fluid wherein the second orientation differs from the third orientation.

xvi. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein a selection between the left fluid conduit and the right fluid conduit is responsive to a rotation of the nozzle towards the second orientation.

xvii. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein a selection between the left fluid conduit and the right fluid conduit is responsive to an operational mode of the impeller.

xviii. Directing the fluid wherein the second orientation substantially equals the third orientation and wherein the fluid interfacing unit comprises a shutter that is arranged to prevent fluid from entering the right fluid conduit when positioned at a first position and is arranged to prevent fluid from entering the left fluid conduit from entering the right fluid conduit when positioned at a second position.

xix. Moving the nozzle towards the second orientation in order to move the shutter between the first and second positions.

xx. Positioning the nozzle at a fourth orientation; wherein when in either one of the first and fourth orientations the nozzle faces the center opening.

xxi. Moving the cleaning robot wherein the pump motor, the drive motor and the impeller are substantially closer to a front edge of the housing than to a rear edge of the housing.

xxii. Moving the cleaning robot while determining a motion characteristic or a location characteristic of the cleaning robot in response to an outcome of (a) illuminating, by at least one light source an area of a surface of the pool being cleaned by the cleaning robot through optical lens at a non vertical angle, (b) and generating, by a detector, based upon light from the area of the surface of the pool, detection signals indicative of a motion of the cleaning robot; (c) receiving the detection signals and determining the motion characteristic or the location characteristic of the cleaning robot.

xxiii. Generating, by a first compass first directional information; generating by a second compass second directional information; wherein the first and second compasses are spaced apart from each other; receiving directional information from the first and second compasses, and determining at least one of a location parameter and a directional parameter of the cleaning robot based upon at least the first and second directional information.

xxiv. The generating may include comparing the first and second directional information to provide a comparison result; and determining a validity of at least one of the first and second directional information based upon the comparison result.

xxv. Declaring the first directional information as valid if a difference between the first and second results is below a threshold.

xxvi. Declaring the first directional information and the second directional information as invalid if a difference between the first and second results exceeds a threshold.

xxvii. Generating output signals indicative of a direction of the cleaning robot by a non-magnetic sensor and assigning more weight to output signals of the non-magnetic sensor than to the first and second directional information if it is determined that a difference between the first and second results exceeds a threshold.

xxviii. Converting a rotary movement induced by the drive motor to a combination of (a) a rotary movement of the brushing element about a brushing element axis, and (b) vibrations of the brushing element, the vibrations differ from the rotary movement.

xxix. Filtering fluid by a first filter of a filtering unit that and the filtering fluid filtered by the first filter by a second filter of the filtering unit, wherein the filtering unit comprises a first filter that has a first filtering level and a second filter that has a second filtering level that differs from the first filtering level.

xxx. Allowing a door (that is pivotally connected to a rear portion of a housing of a cleaning robot, the housing has a rear opening), to move between a closed position in which the door substantially closes the rear opening and an open position in which the door does not close the rear opening; wherein the door comprises a floating element or is coupled to a floating element, wherein the floating element is positioned and shaped to induce the door to move to the closed position when the cleaning robot is submerged in fluid and to remain in an open position when out of water in a horizontal position.

xxxi. Allowing the door to move between a closed position in which the door substantially closes the rear opening and an open position in which the door does not close the rear opening; wherein the door comprises a floating element or is coupled to a floating element, wherein the floating element is positioned and shaped to induce the door to move to the closed position when the cleaning robot is submerged in fluid.

[0141] Stage 2720 may be followed by stage 2730 of taking the cleaning robot from the pool.

List of elements

[0142]

a. Cleaning robot 10.
b. Cover 11
c. Main body 12.
d. Housing 13.
e. Rear panel 14
f. Right sidewall 15
g. Bottom panel 16.
h. Filtering unit 20.
i. First filter 21.
j. Second filter 22.
k. Impeller 70.
l. Pump motor 80.
m. Drive motor 82.
n. Spur 84.
o. Fluid surface 90
p. Front brushing unit 200.
q. Rear brushing unit 200'.
r. First interface 202.
s. Second interface 201.
t. Brushing element 211.
u. Rotating element 212.
v. Radially extending protrusions 212'.
w. Cylindrical bearing 213.
x. Brushing element axel 214.
y. Track receiving portion 220.
z. Brushing element 240.
aa. Brushing element 250.
bb. Interfacing elements 260, 270.
cc. Inner edges of interfacing elements 261, 271
dd. Outer edges of interfacing elements 262, 272
ee. Springs 280.
ff. Diaphragm 300.
gg. Aperture 302.
hh. Right track 310.
ii. Left track 312.
jj. Rear right wheel 320.
kk. Rear left wheel 322.
ll. Diaphragm transmission 330.
mm. Handle 332.
nn. First radially extending element 333.
oo. Diaphragm axle 334.
pp. Curved clips 336.
qq. Second radially extending element 338.
rr. Protrusion 350.
ss. Spring 352.
tt. Disk 353.
uu. Disk 354.
vv. First vertical inner wall 360.
ww. Second vertical inner wall 362.
xx. Nozzle 410.
yy. Nozzle transmission 420.
zz. Radially extending element 423.
aaa. First fin 425.
bbb. Second fin 424.
ccc. Cylindrical interfacing element 426.
ddd. Nozzle axle 442.
eee. Curved clip 441.
fff. Nozzle axle 442.
ggg. Multiple opening cover portion 450.
hhh. Right opening 452.
iii. Left opening 454.
jjj. Central opening 456.
kkk. Right fluid conduit 462.
lll. Opening 462' formed in the right fluid conduit 462.
mmm. Left fluid conduit 464.
nnn. Opening 464' formed in the left fluid conduit 464.
ooo. Central fluid conduit 466.
ppp. Vertical bevel gear 502.
qqq. Horizontal bevel gear 504
rrr. Removable cover 506 of a sealed housing.
sss. Shutter 550.
ttt. Curved cover 560.
uuu. Front edge 601 of the housing.
vvv. Rear edge 604 of the housing.
www. Spur 610.
xxx. Longitudinal axis 701.
yyy. Traverse axis 702.
zzz. Multiple opening structures 720.
aaaa. Right aperture 724.
bbbb. Left aperture 723.
cccc. Upper aperture 722.
dddd. Rear aperture 721.
eeee. Optical detector 800.
ffff. Radiation source 801
gggg. Detector 802
hhhh. Optics 803
iiii. Detection signal processor 804.
jjjj. First compass 810.
kkkk. Second compass 820.
llll. Processor 830.
mmmm. Non-magnetic sensor 840.
nnnn. Cleaning robot 900.
oooo. Housing 902.
pppp. Front portion 904.
qqqq. Rear portion 906.
rrrr. Door 908.
ssss. Hinge 910.
tttt. Floating element 912.
uuuu. Center of floatation 914
vvvv. Rear opening 920.

Claims

1. A cleaning robot (10, 900) comprising:

a housing (13, 902) that comprises an inlet (380) and an outlet (450, 410);
a filtering unit (20) that is arranged to filter fluid that enters through the inlet to provide filtered fluid that flows through the outlet;
wherein the filtering unit (20) comprises a first

filter (21) that has a first filtering level and a second filter (22) that has a second filtering level that differs from the first filtering level; the first filter (21) being arranged to perform a coarser filtering than the second filter (22), **characterized in that** the second filter (22) at least partially surrounds the first filter (21).

2. The cleaning robot according to claim 1 further comprising at least one additional filter.

3. The cleaning robot according to claim 1 further comprising an additional filter that has a filtering level that differ from the first and second filtering levels.

4. The cleaning robot according to claim 1 further comprising an additional filter that has a filtering level that equals one of the first and second filtering levels.

5. The cleaning robot according to claim 1 further comprising a handle that is coupled to the filtering unit (20) and extends outside an opening formed in the housing.

6. The cleaning robot according to claim 1 wherein the second filter (22) surrounds the first filter (21).

7. The cleaning robot according to claim 1 wherein the first filtering level exceeds the second filtering level and wherein the first filter (21) is arranged to provide firstly filtered fluid to the second filter (22).

Patentansprüche

1. Ein Reinigungsroboter (10, 900), der Folgendes umfasst:

   ein Gehäuse (13, 902), das einen Einlass (380) und einen Auslass (450, 410) umfasst;
   eine Filtereinheit (20), die angeordnet ist, um Flüssigkeit zu filtern, die durch den Einlass eintritt, um gefilterte Flüssigkeit bereitzustellen, die durch den Auslass strömt;
   wobei die Filtereinheit (20) einen ersten Filter (21) umfasst, der eine erste Filtrierstufe hat, und einen zweiten Filter (22), der eine zweite Filtrierstufe hat, die sich von der ersten Filtrierstufe unterscheidet; wobei der erste Filter (21) angeordnet ist, um eine gröbere Filtration durchzuführen als der zweite Filter (22); **dadurch gekennzeichnet, dass** der zweite Filter (22) den ersten Filter (21) zumindest teilweise umgibt.

2. Der Reinigungsroboter gemäß Anspruch 1, der weiter mindestens einen zusätzlichen Filter umfasst.

3. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen zusätzlichen Filter mit einer Filtrierstufe umfasst, die sich von der ersten und der zweiten Filtrierstufe unterscheidet.

4. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen zusätzlichen Filter mit einer Filtrierstufe umfasst, die gleich entweder der ersten oder der zweiten Filtrierstufe ist.

5. Der Reinigungsroboter gemäß Anspruch 1, der weiter einen Griff umfasst, welcher mit der Filtereinheit (20) gekoppelt ist und sich außerhalb einer im Gehäuse geformten Öffnung erstreckt.

6. Der Reinigungsroboter gemäß Anspruch 1, wobei der zweite Filter (22) den ersten Filter (21) umgibt.

7. Der Reinigungsroboter gemäß Anspruch 1, wobei die erste Filtrierstufe die zweite Filtrierstufe übersteigt und wobei der erste Filter (21) angeordnet ist, um dem zweiten Filter (22) primär gefilterte Flüssigkeit zuzuführen.

Revendications

1. Robot nettoyeur (10, 900) comprenant :

   une coque (13, 902) qui comprend un orifice d'entrée (380) et un orifice de sortie (450, 410) ;
   une unité de filtration (20) qui est conçue pour filtrer du liquide qui pénètre par l'orifice d'entrée afin de fournir du liquide filtré qui s'écoule par l'orifice de sortie ;
   dans lequel l'unité de filtration (20) comprend un premier filtre (21) qui a un premier niveau de filtration et un deuxième filtre (22) qui a un deuxième niveau de filtration qui est différent du premier niveau de filtration ; le premier filtre (21) étant conçu pour effectuer une filtration plus grossière que le deuxième filtre (22),
   caractérisé en ce que le deuxième filtre (22) entoure au moins partiellement le premier filtre (21).

2. Robot nettoyeur selon la revendication 1, comprenant en outre au moins un filtre supplémentaire.

3. Robot nettoyeur selon la revendication 1, comprenant en outre un filtre supplémentaire qui a un niveau de filtration qui est différent des premier et deuxième niveaux de filtration.

4. Robot nettoyeur selon la revendication 1, comprenant en outre un filtre supplémentaire qui a un niveau de filtration qui est égal à l'un des premier et deuxième niveaux de filtration.

5. Robot nettoyeur selon la revendication 1, comprenant en outre une poignée qui est couplée à l'unité de filtration (20) et s'étend à l'extérieur d'une ouverture formée dans la coque.

6. Robot nettoyeur selon la revendication 1, dans lequel le deuxième filtre (22) entoure le premier filtre (21).

7. Robot nettoyeur selon la revendication 1, dans lequel le premier niveau de filtration dépasse le deuxième niveau de filtration et dans lequel le premier filtre (21) est conçu pour fournir du liquide filtré une première fois au deuxième filtre (22).

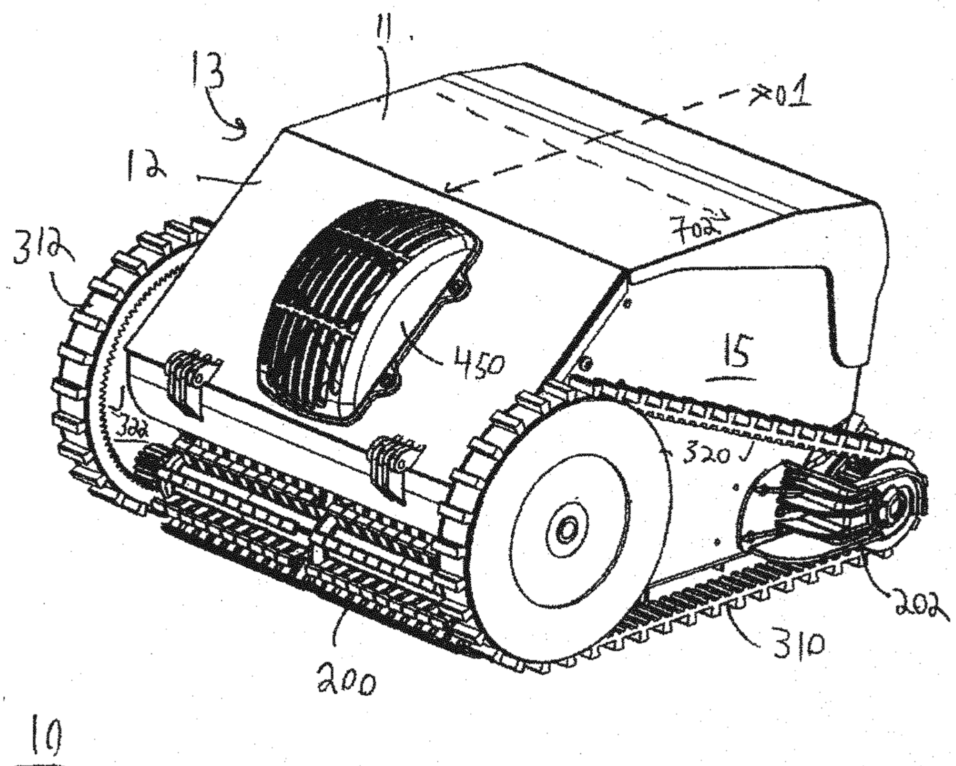


FIG. 1

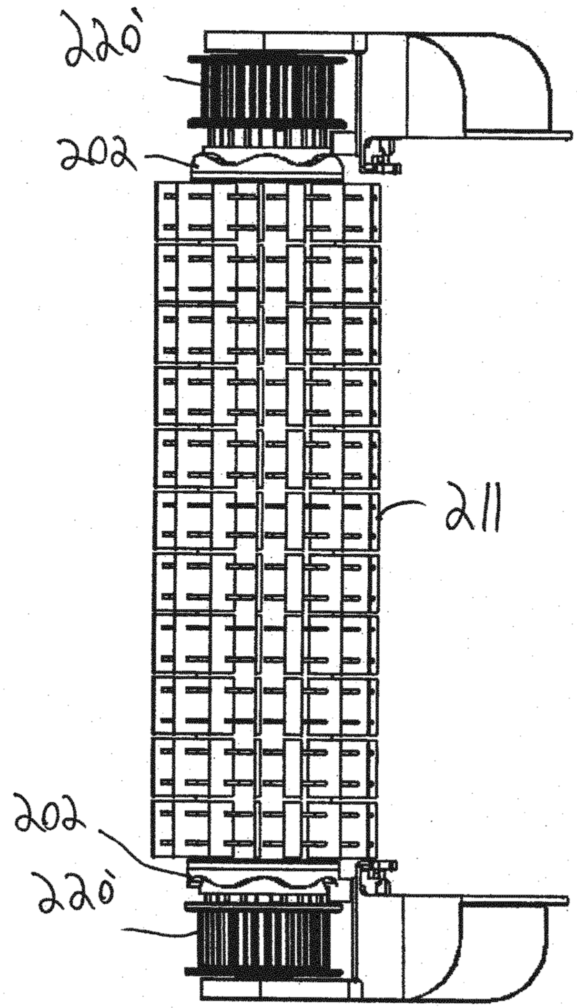


FIG. 2

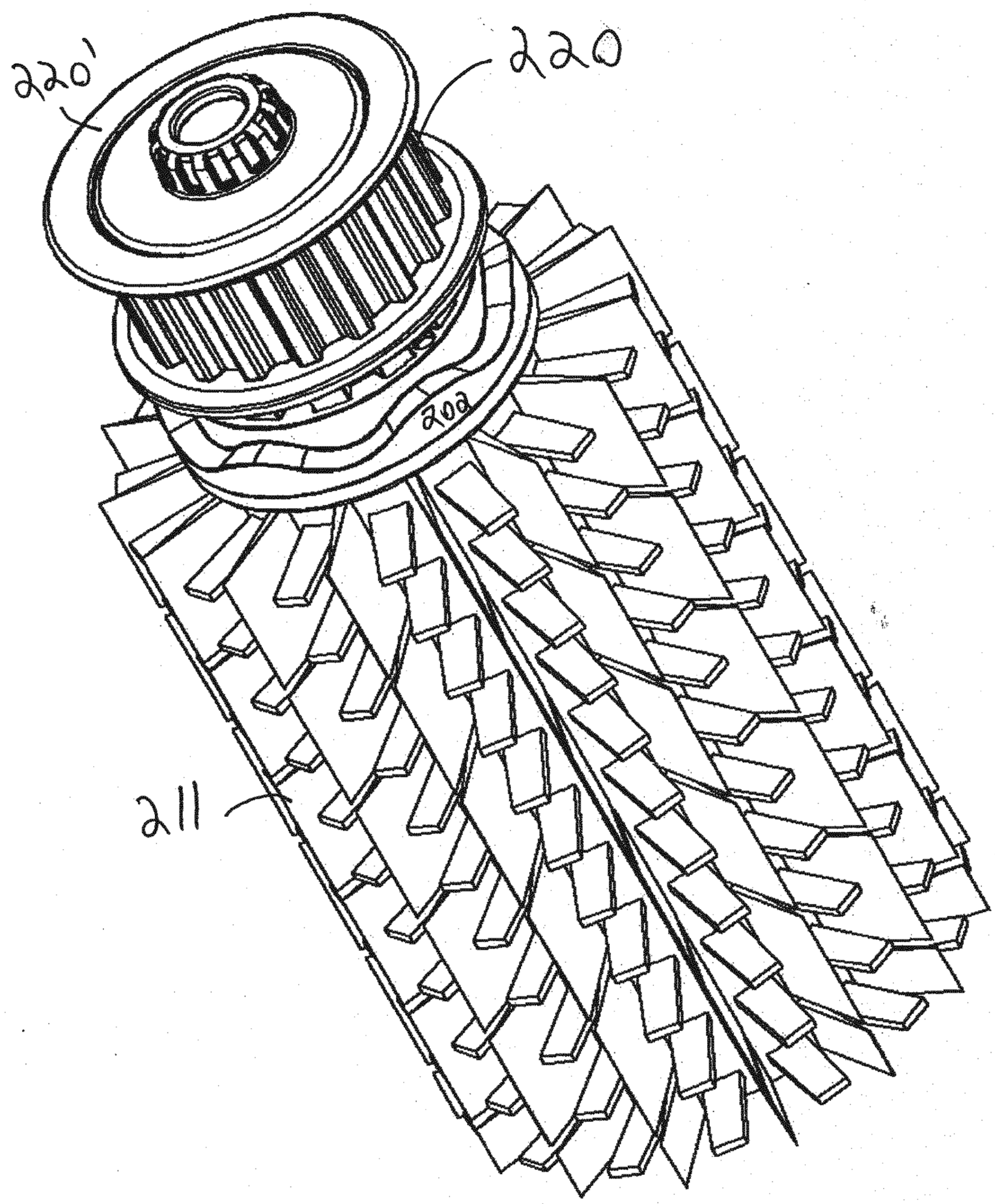


FIG. 3

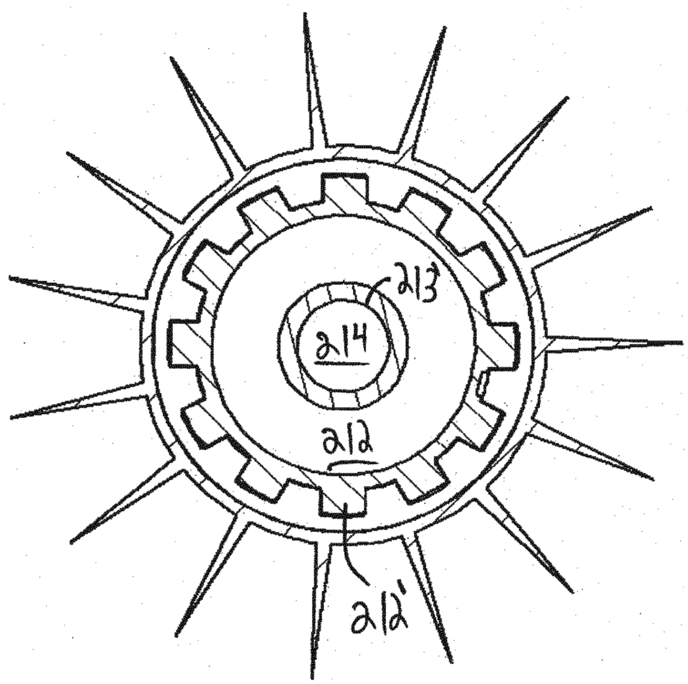


FIG. 4A

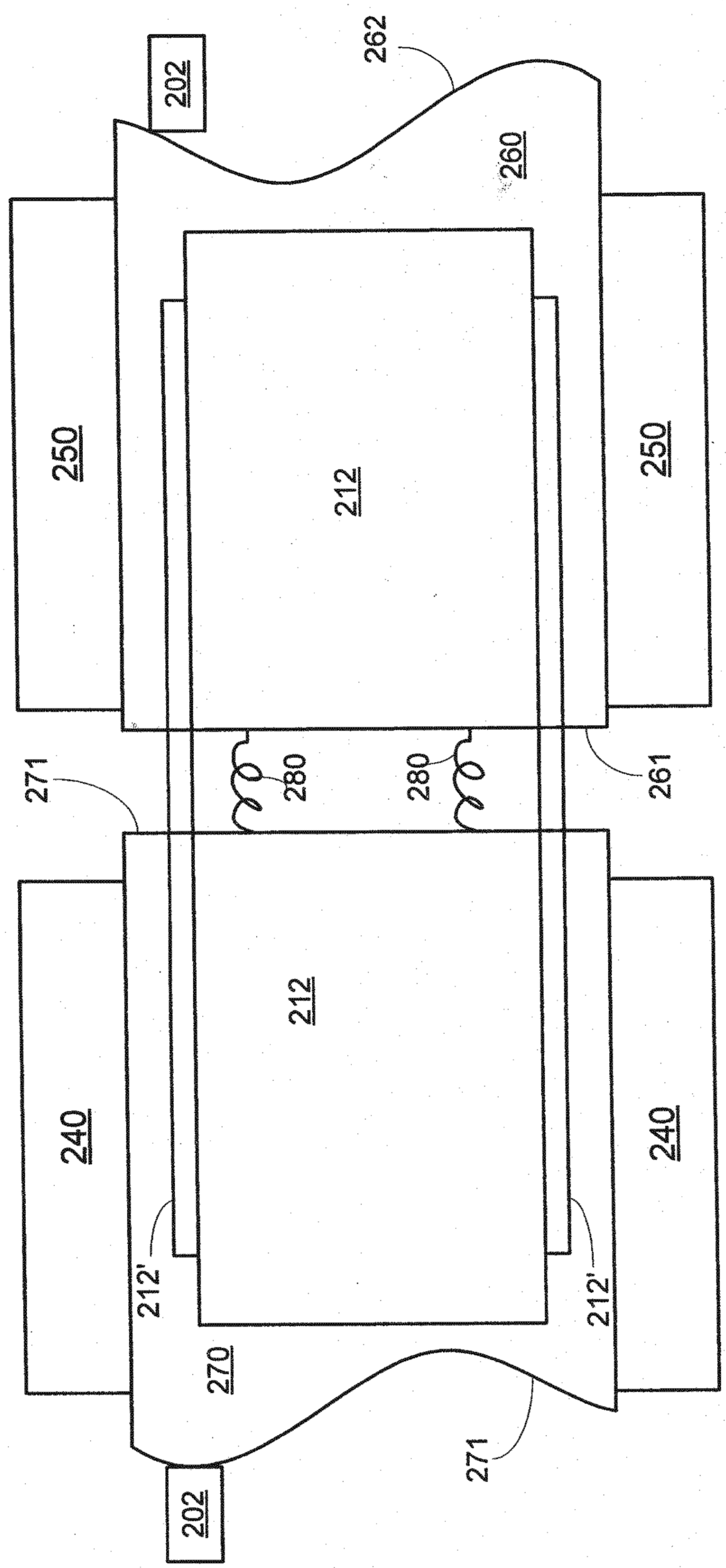

202
262
260
250
250
212
212
271
280
280
261
240
240
212'
212'
270
271
202

FIG. 4B

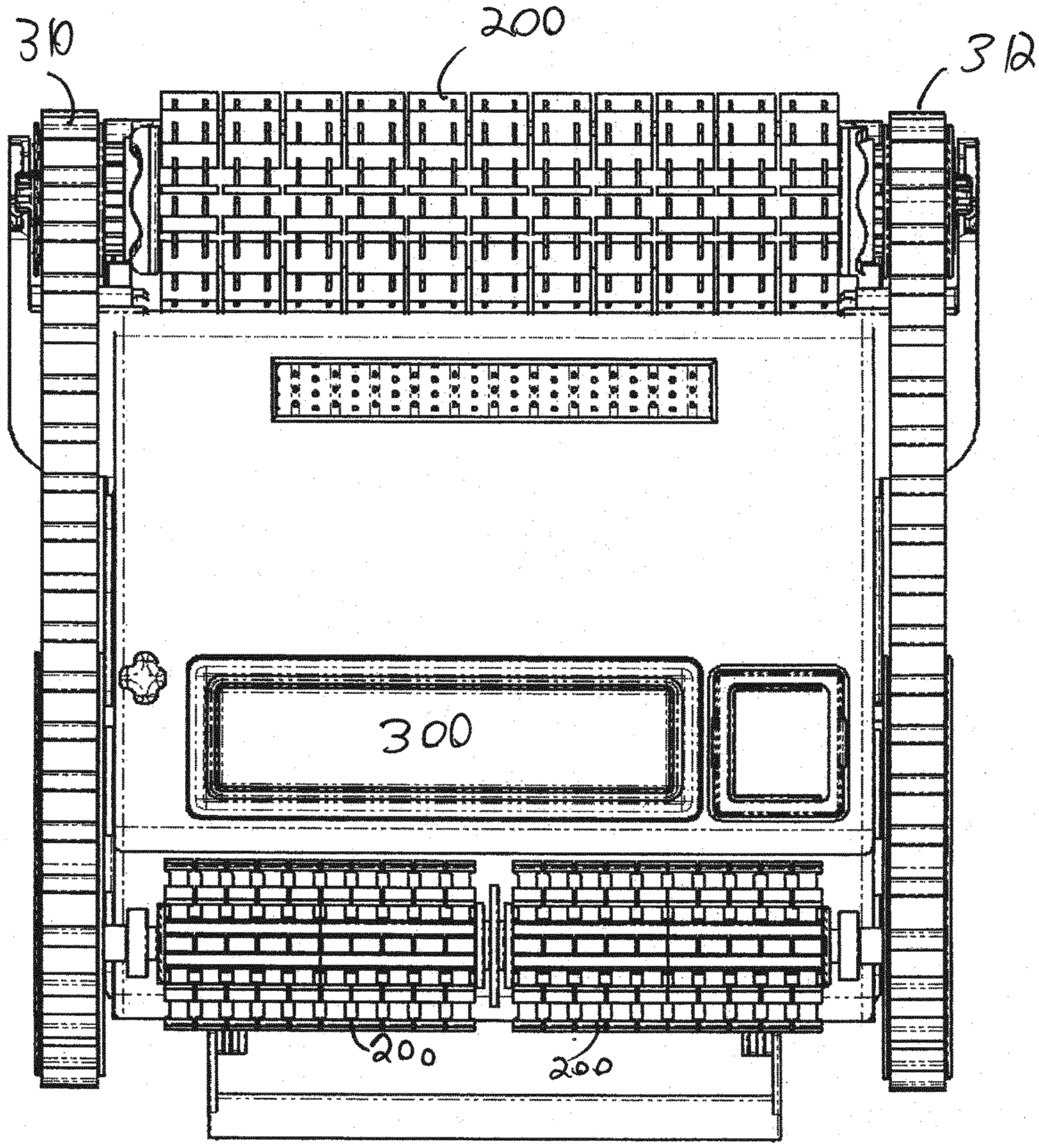


FIG.5

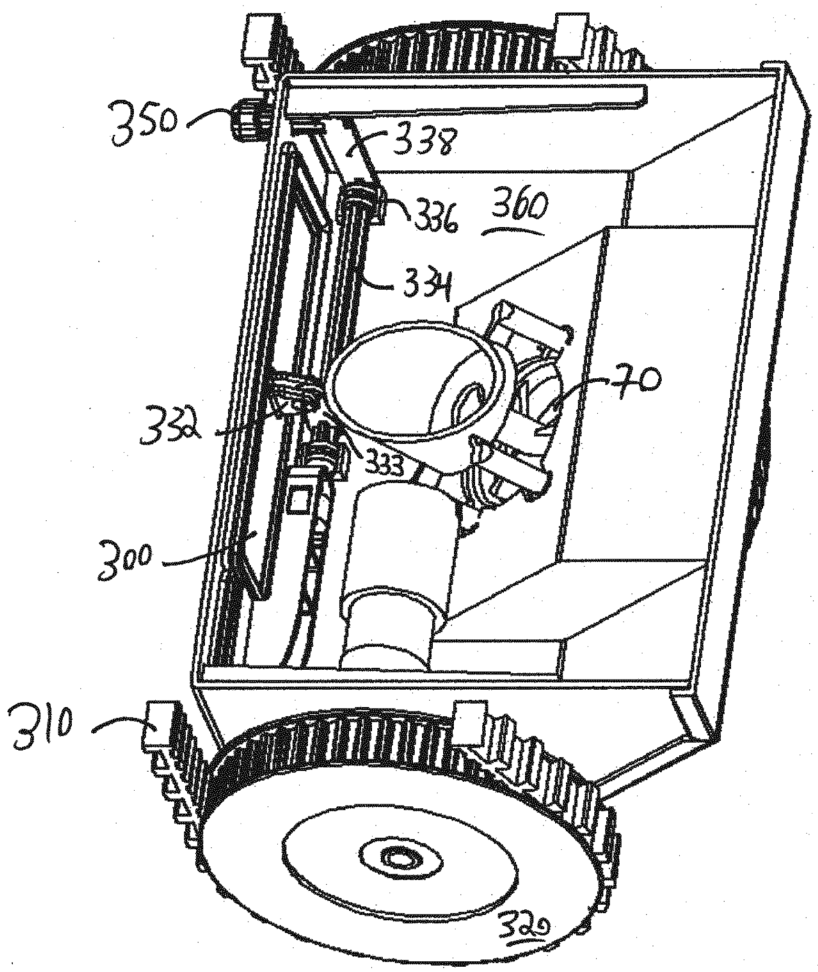


FIG. 6

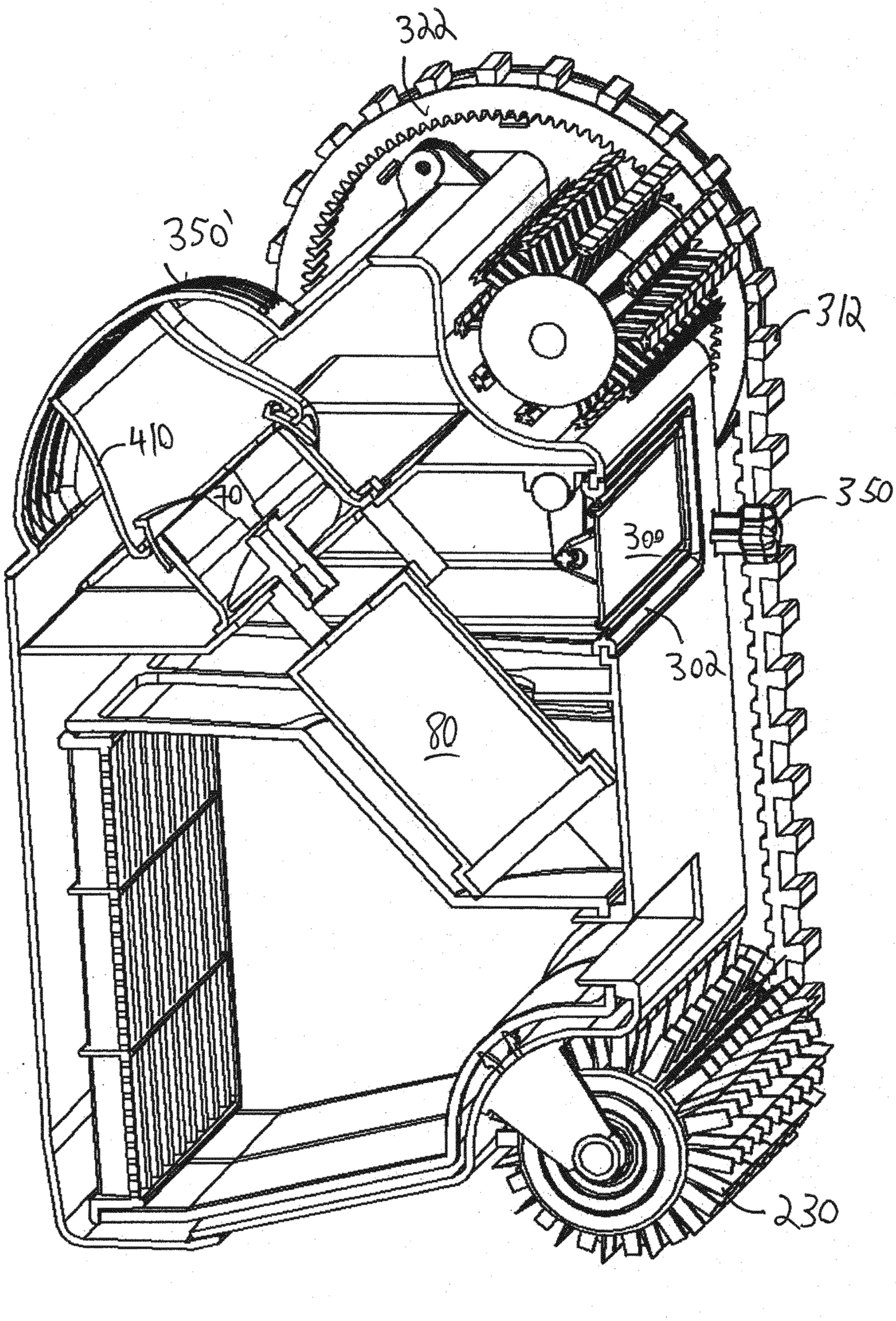


FIG. 7

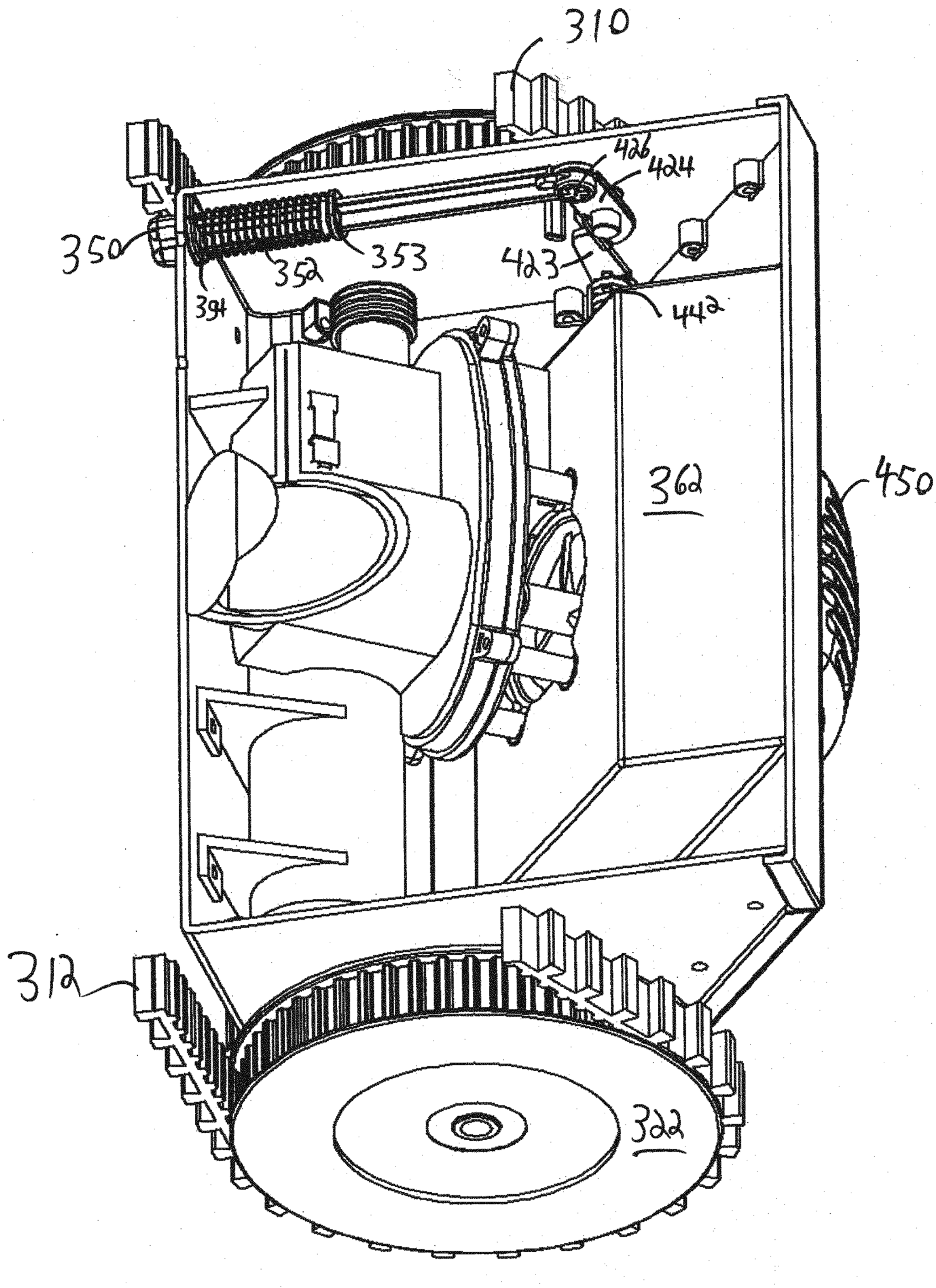


FIG. 8

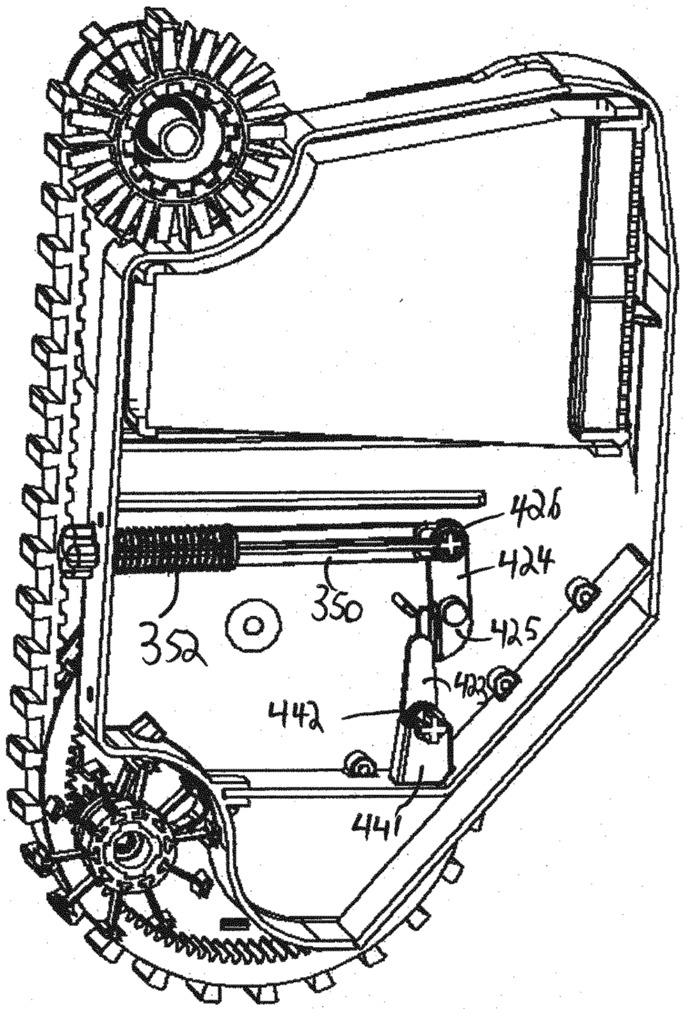


FIG. 9

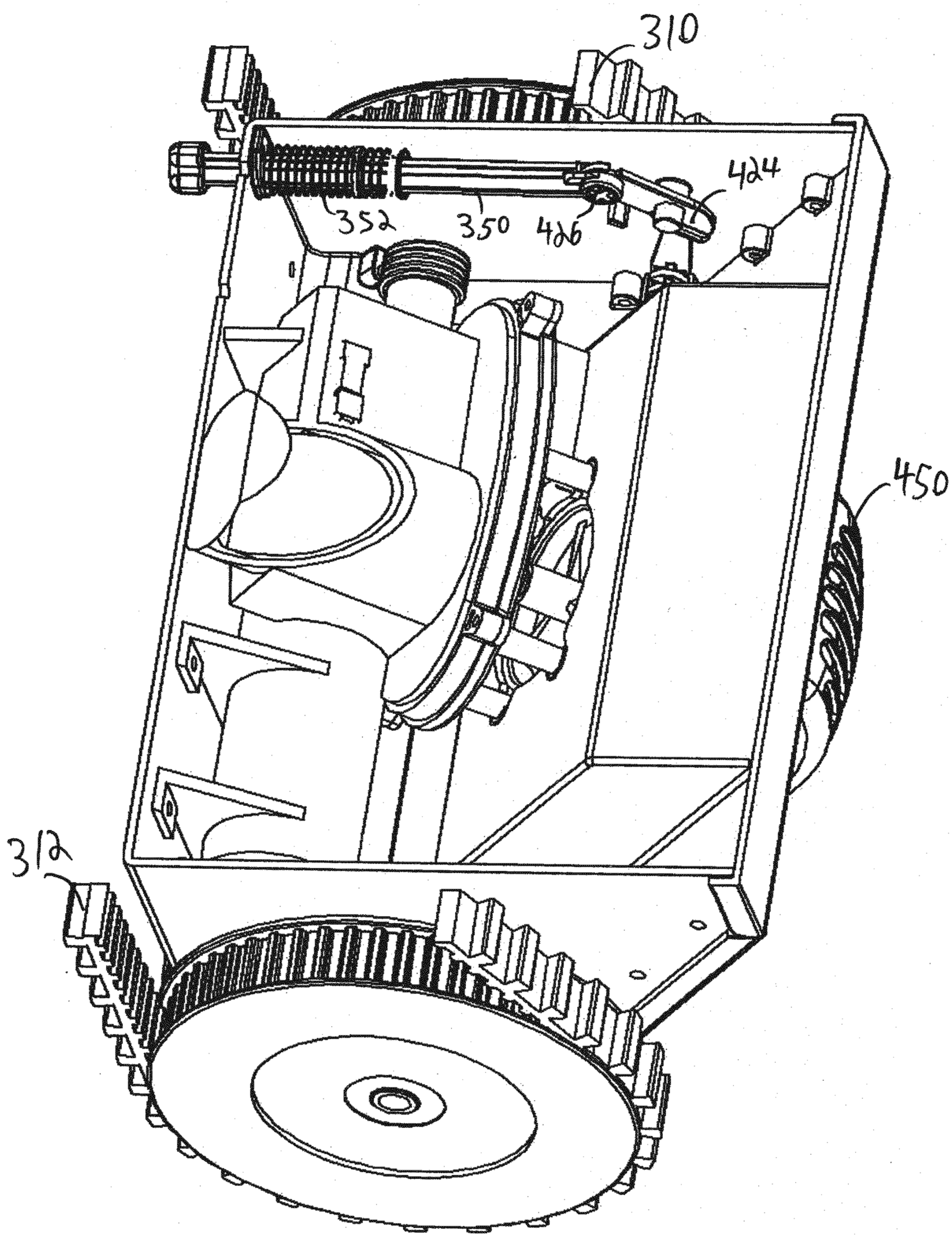


FIG. 10

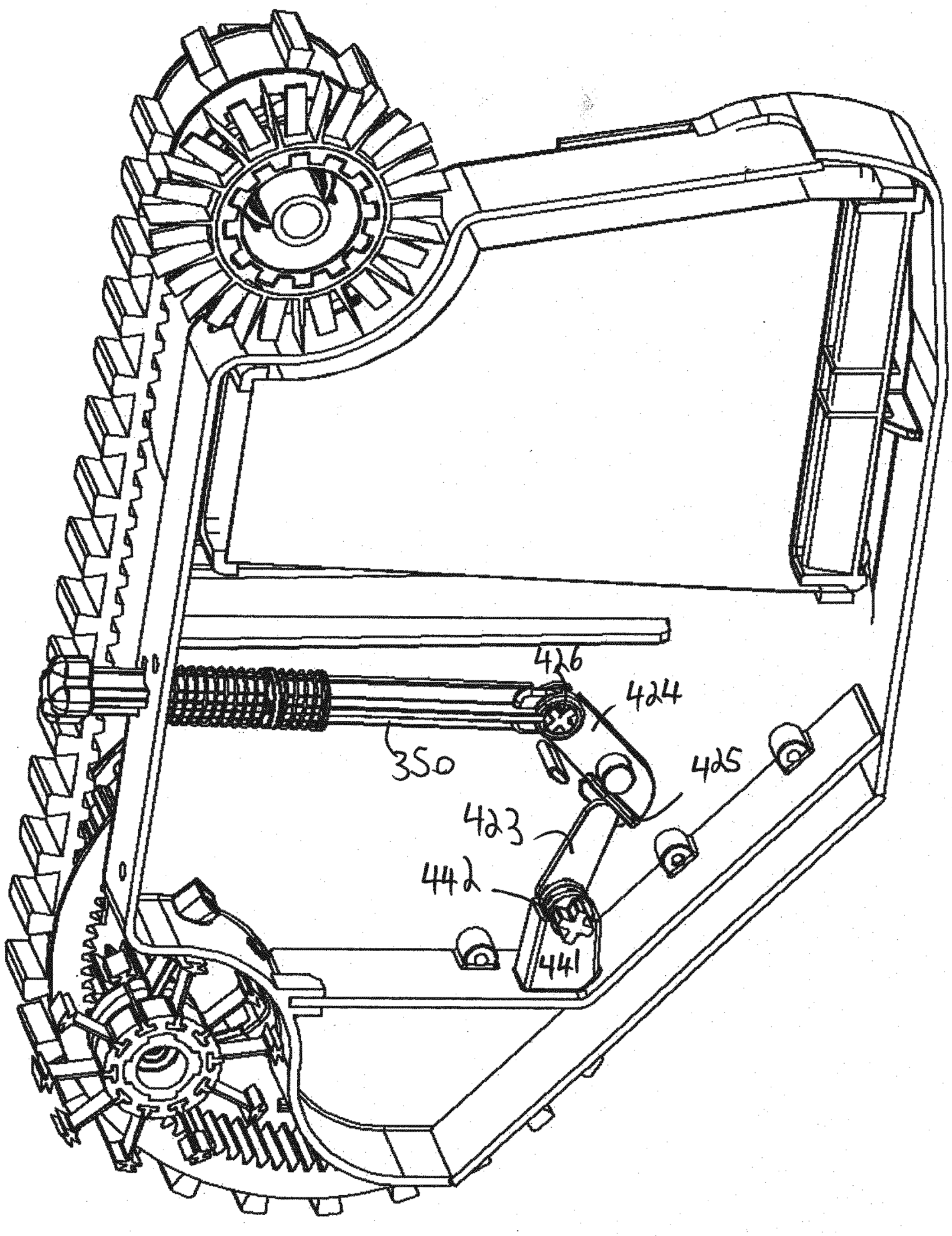


FIG. 11

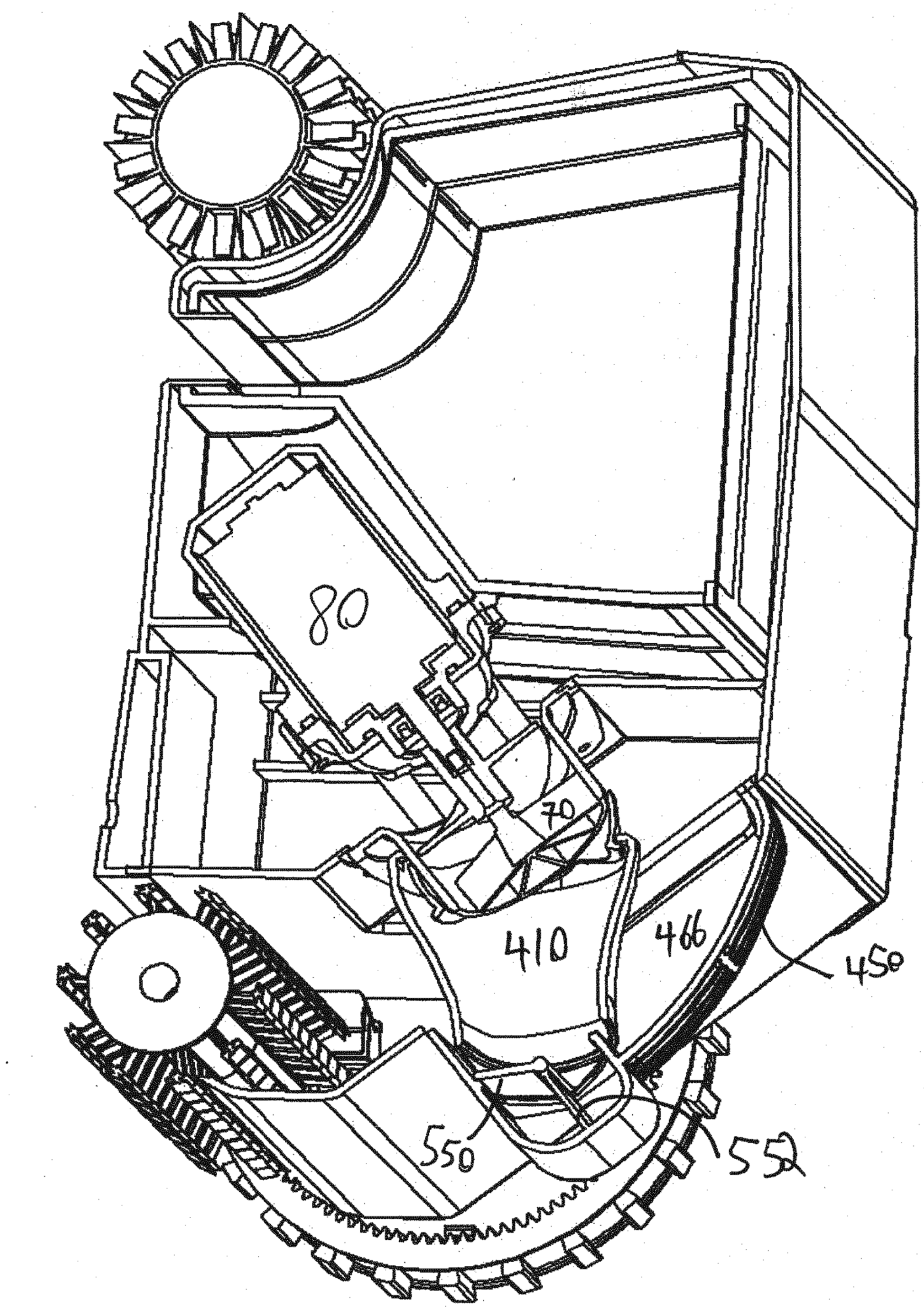


FIG. 12

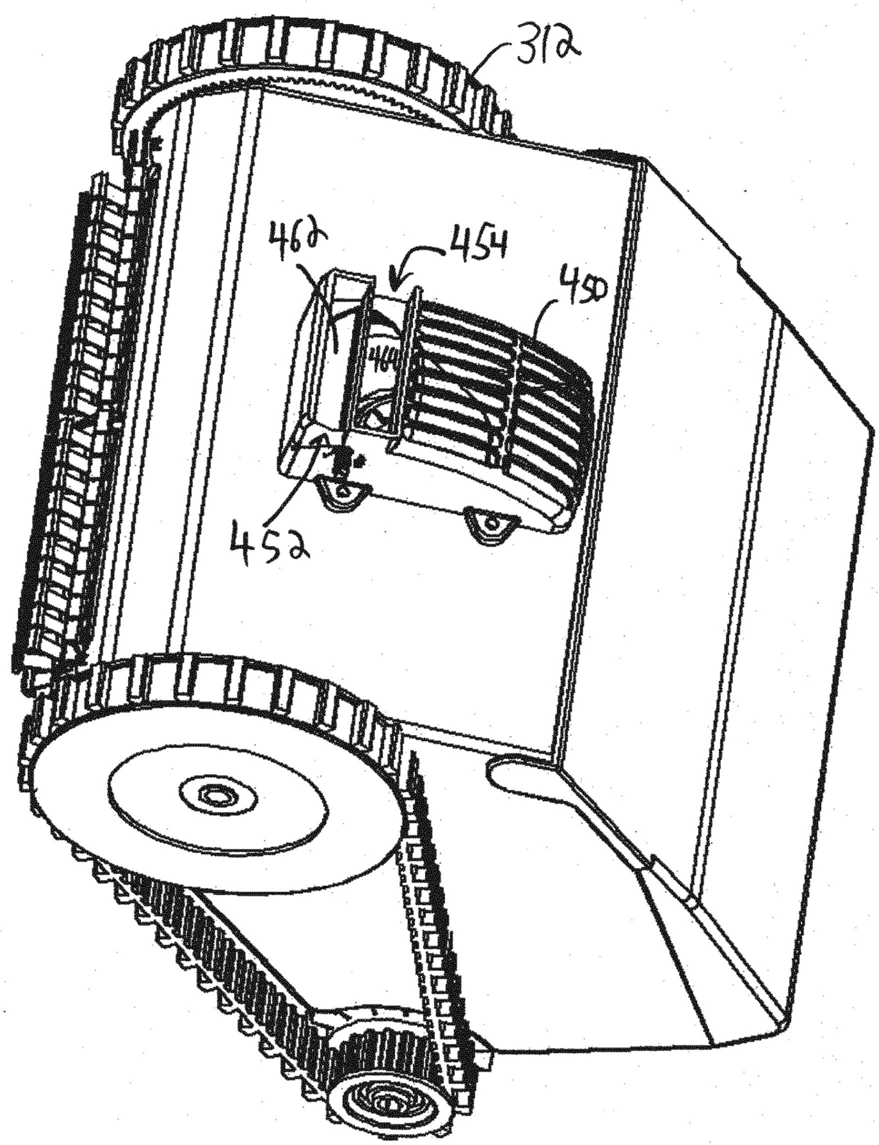


FIG.13

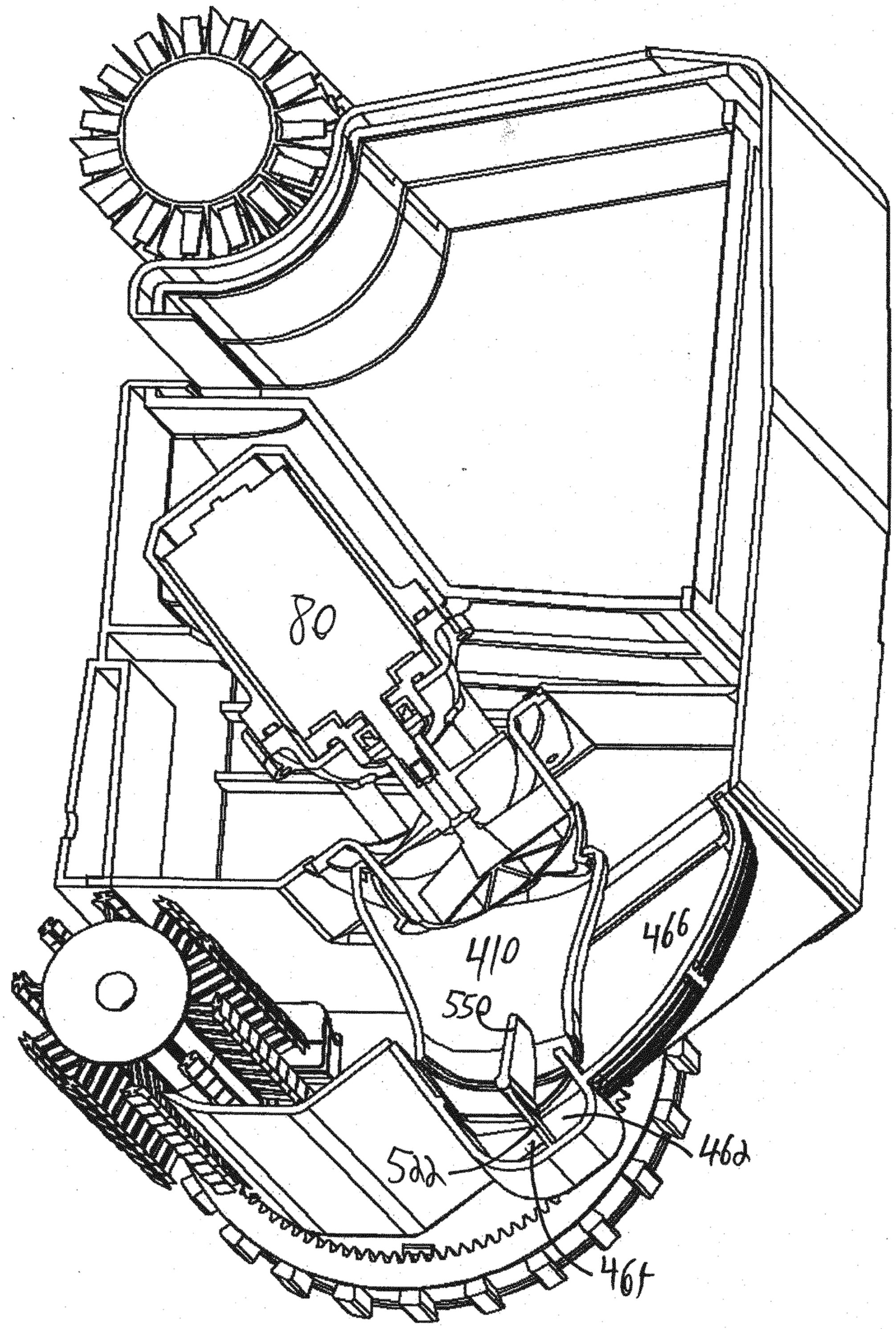


FIG. 14

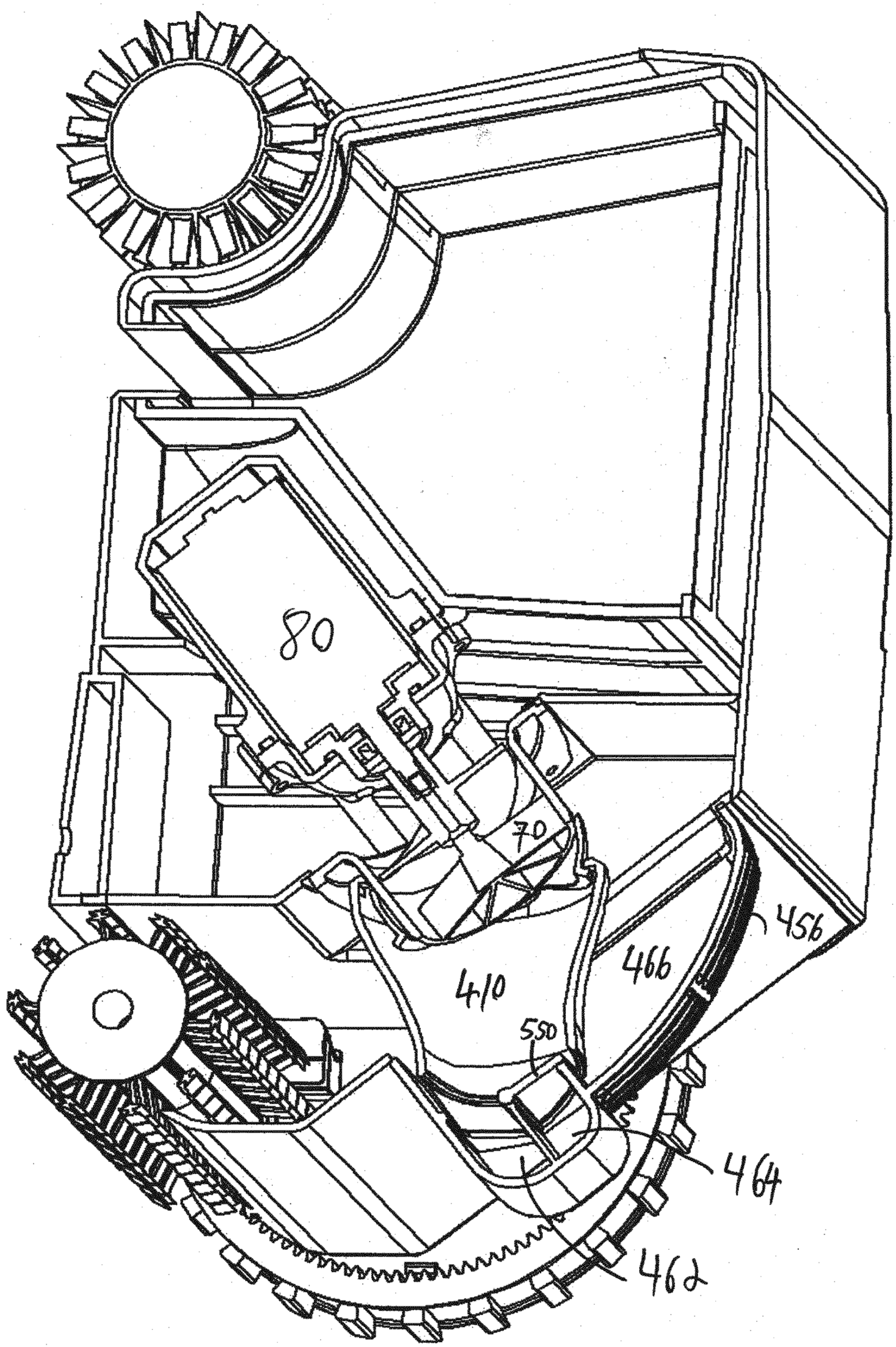


FIG.15

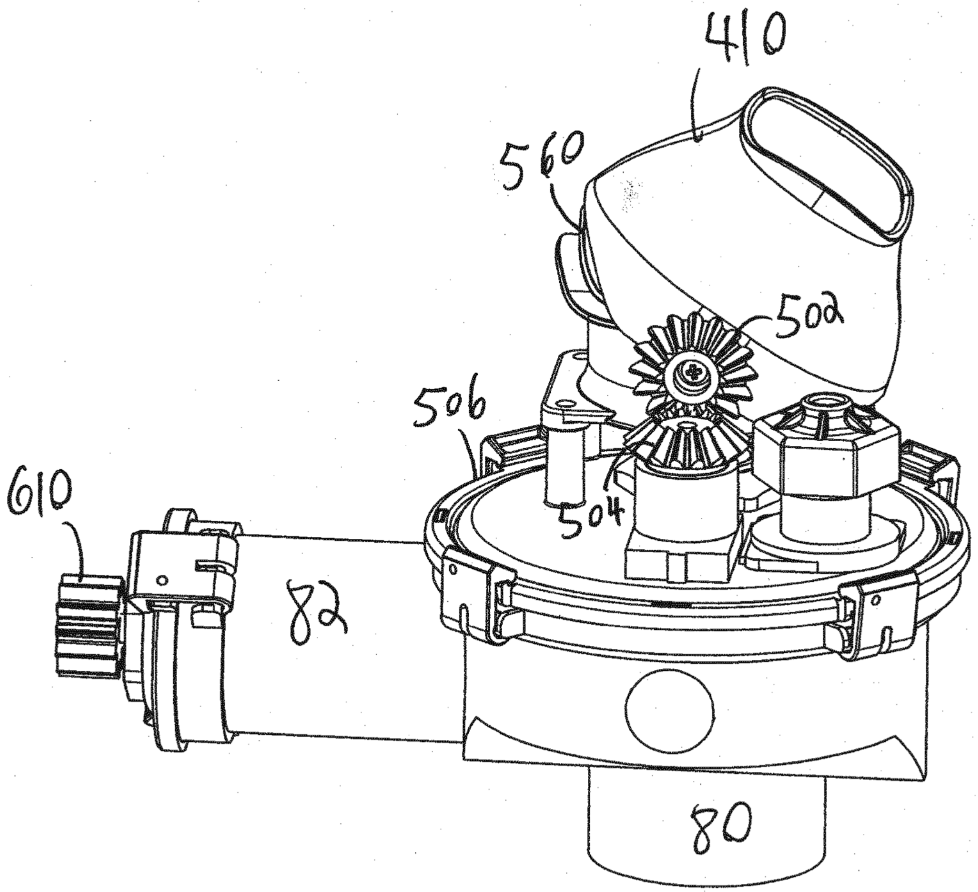


FIG. 16

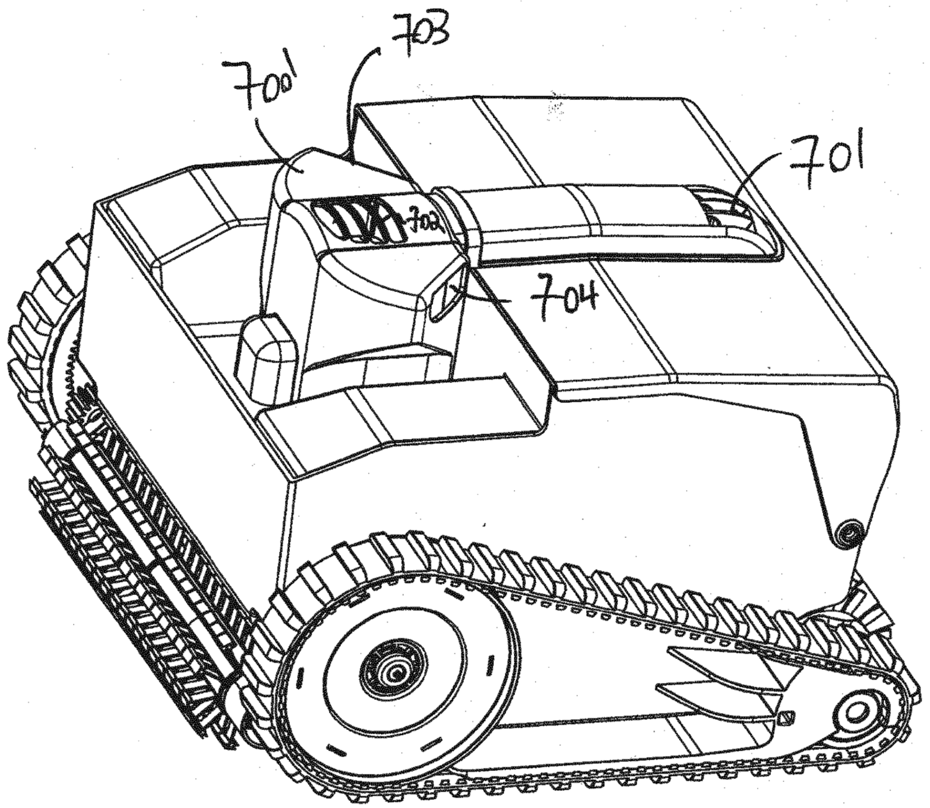


FIG. 17

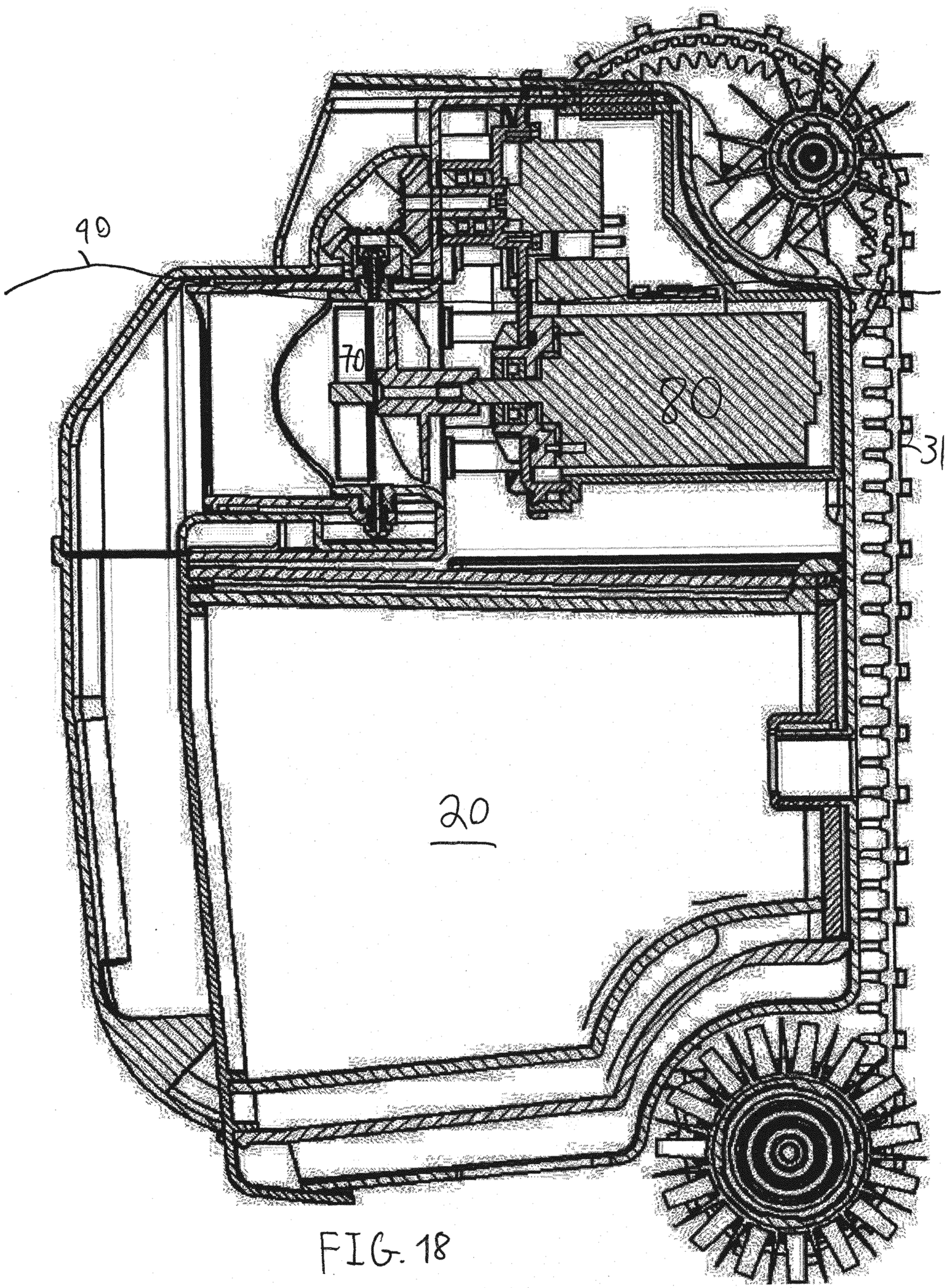


FIG. 18

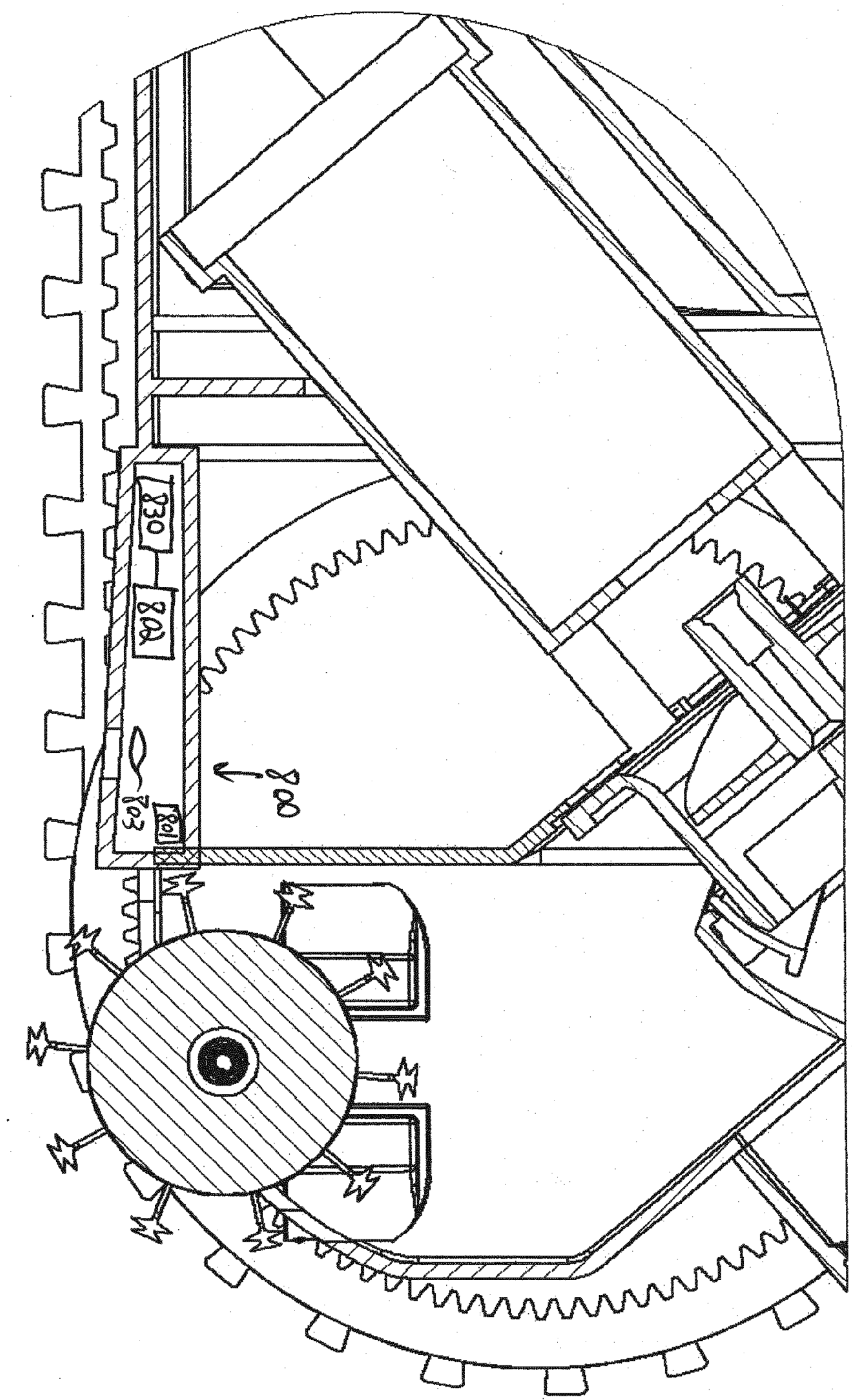


FIG. 19

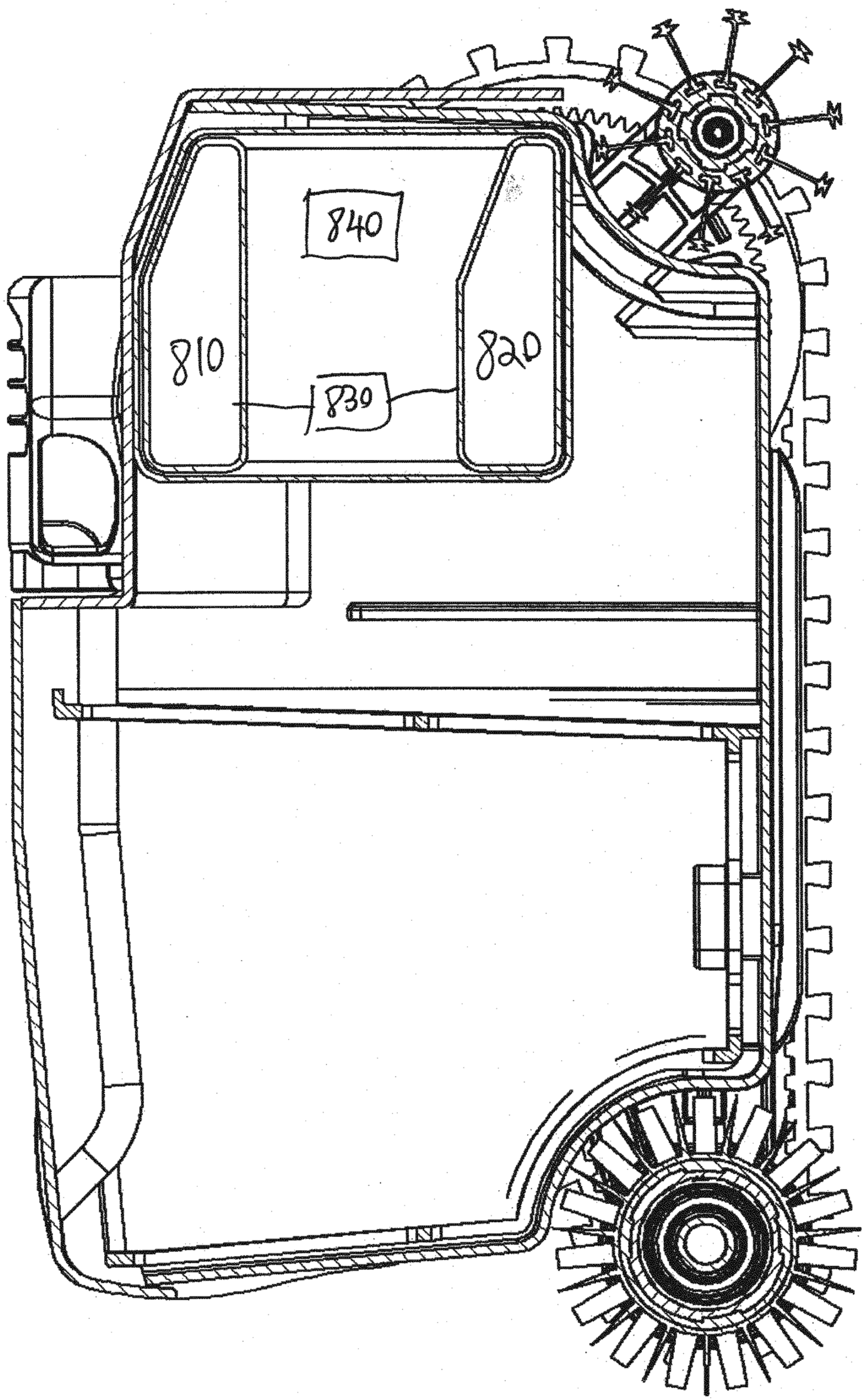


FIG. 20

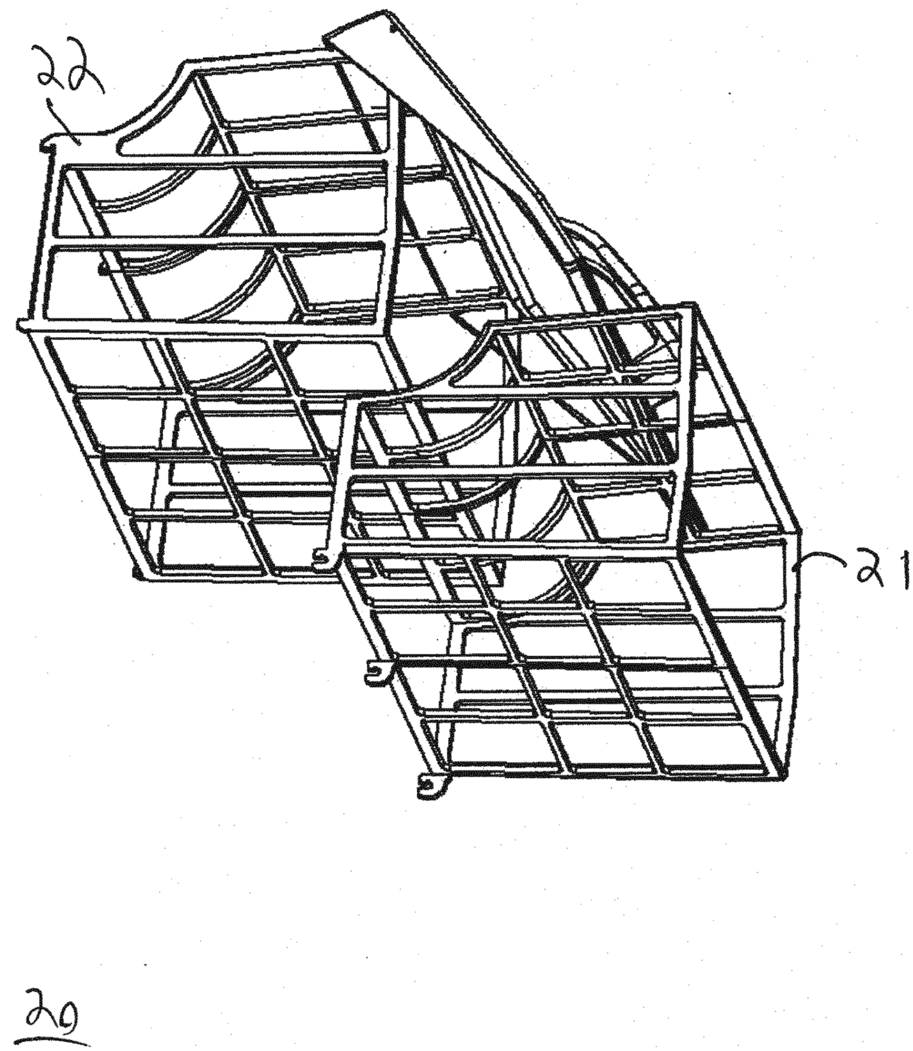


FIG. 21A

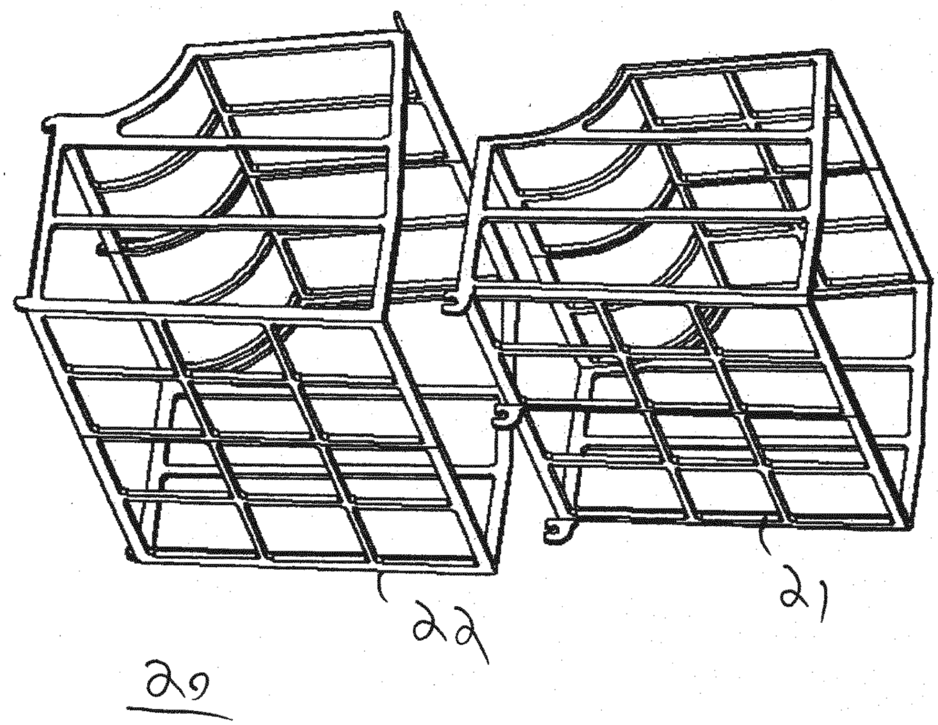


FIG. 21B

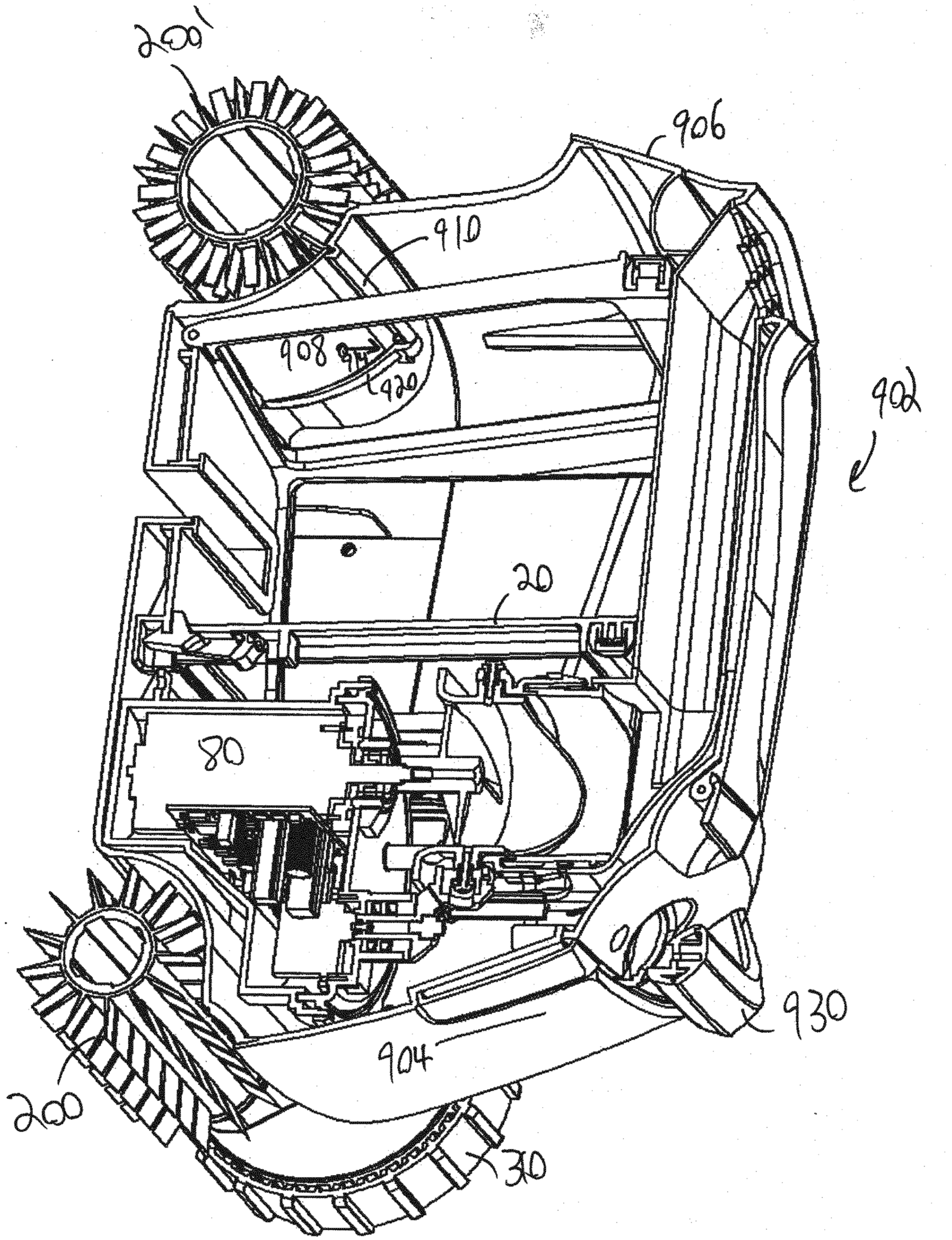


FIG. 22

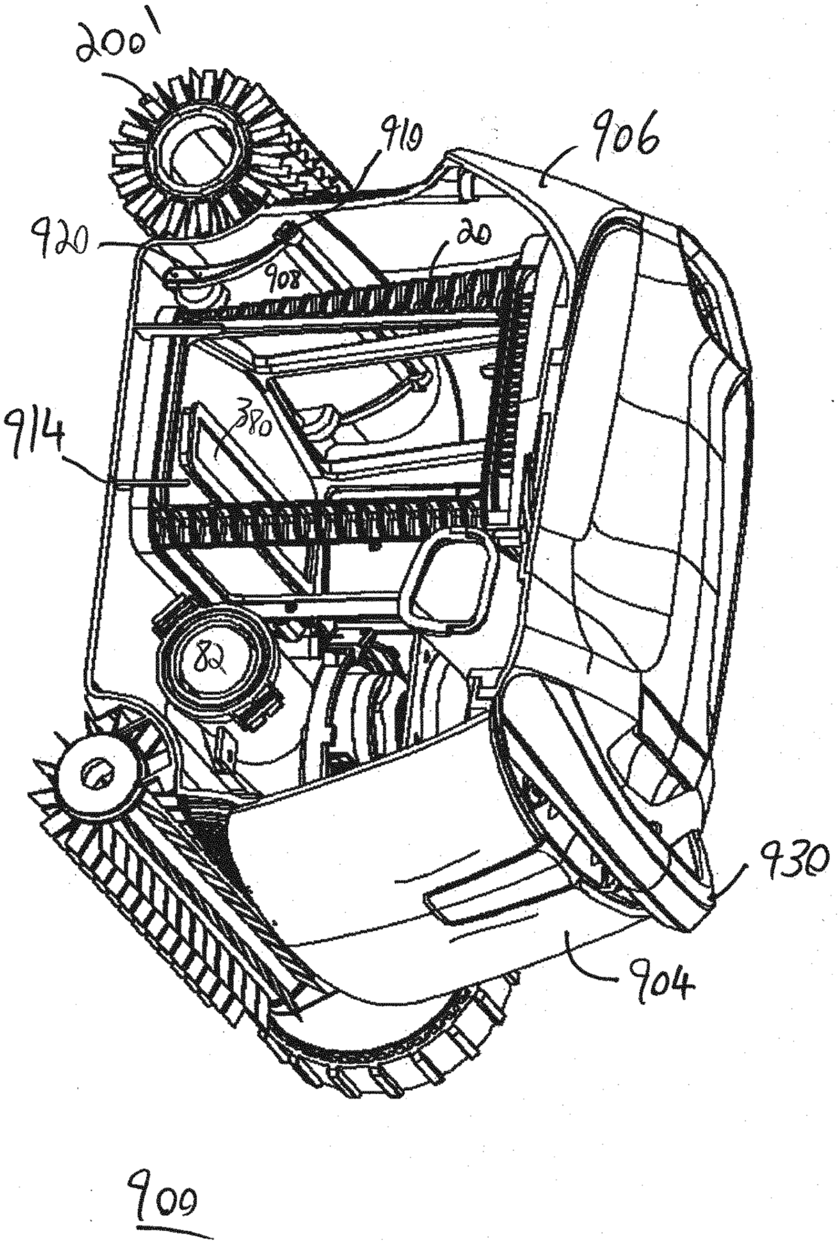


FIG. 23

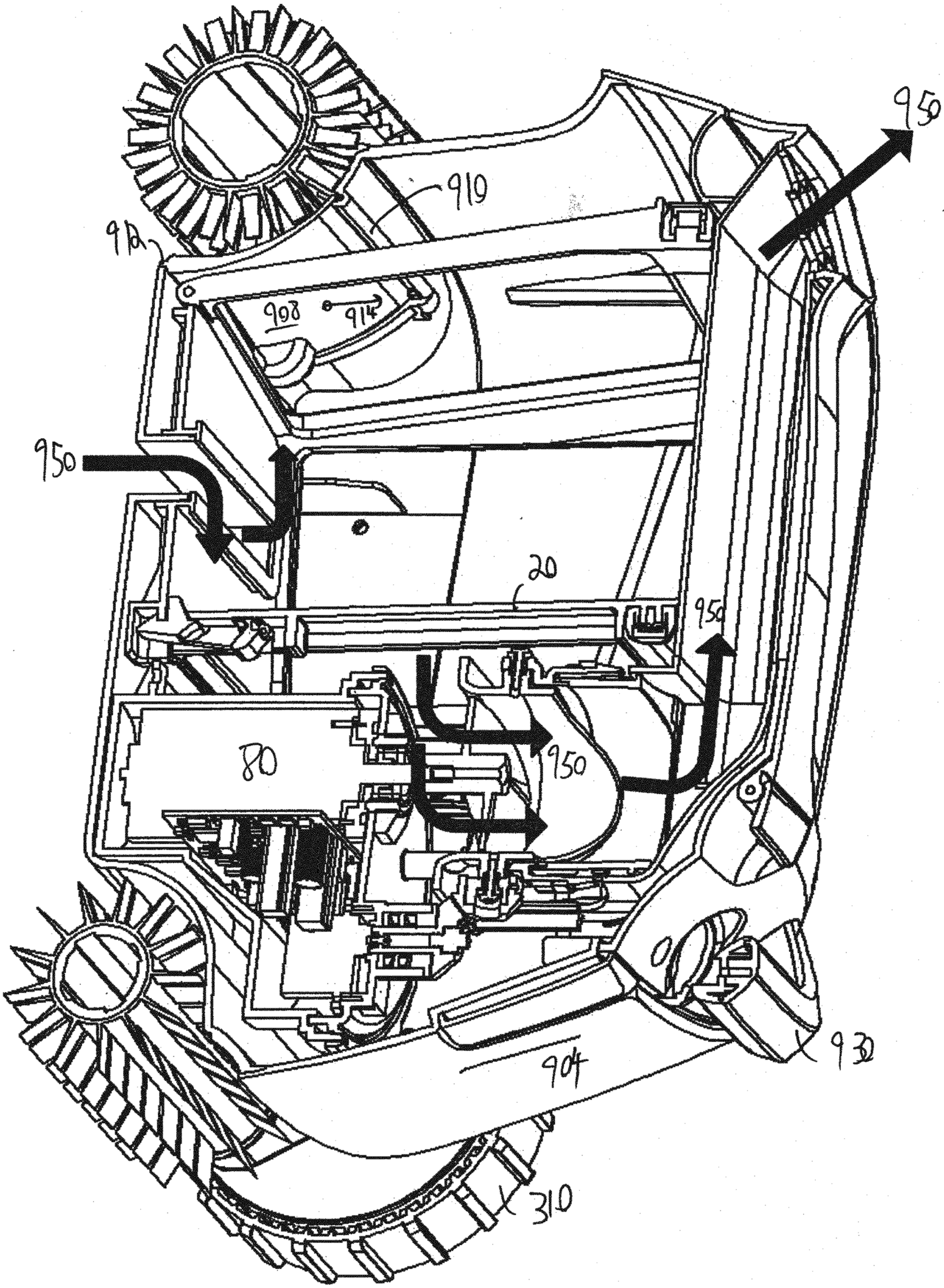


FIG. 24

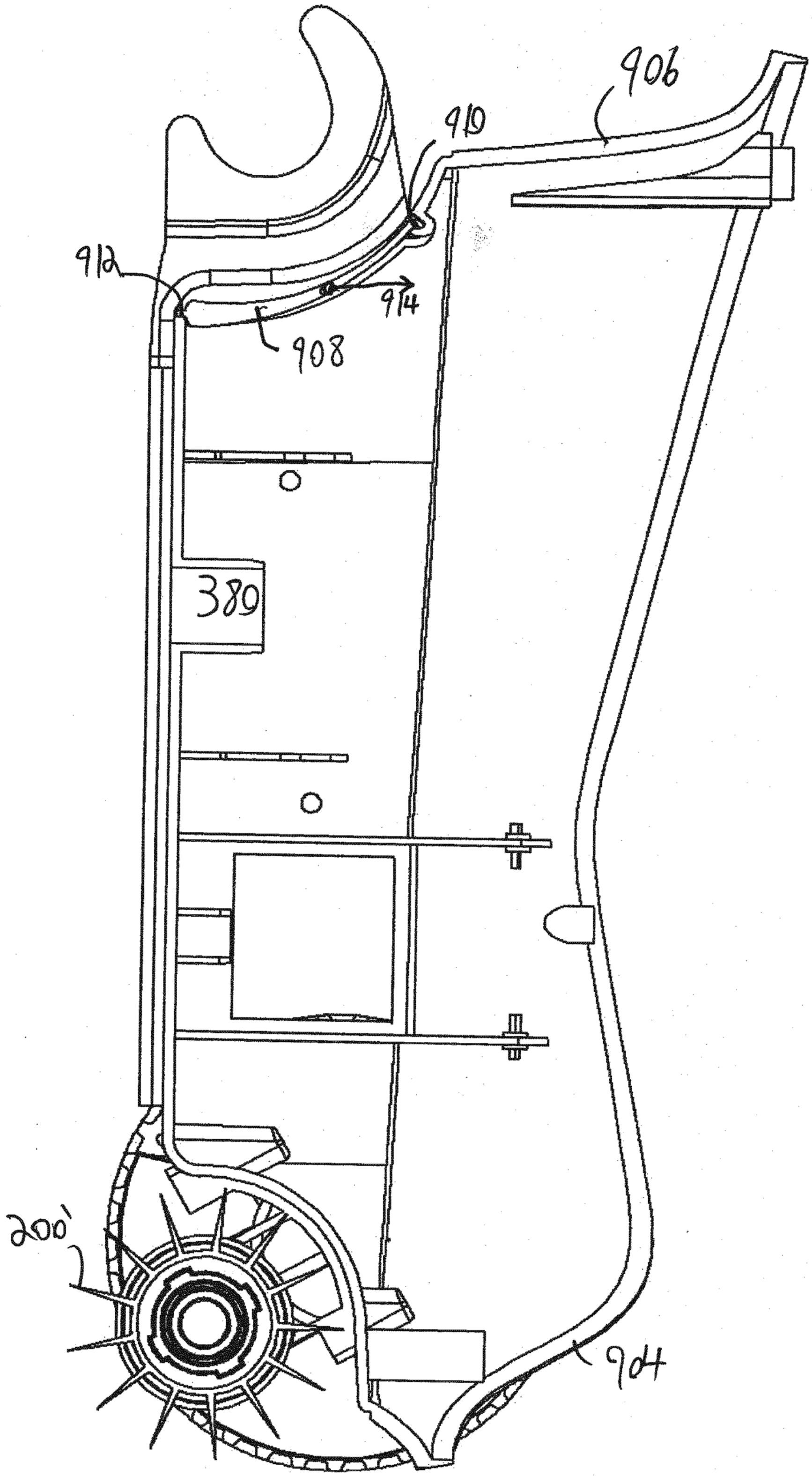


FIG. 25

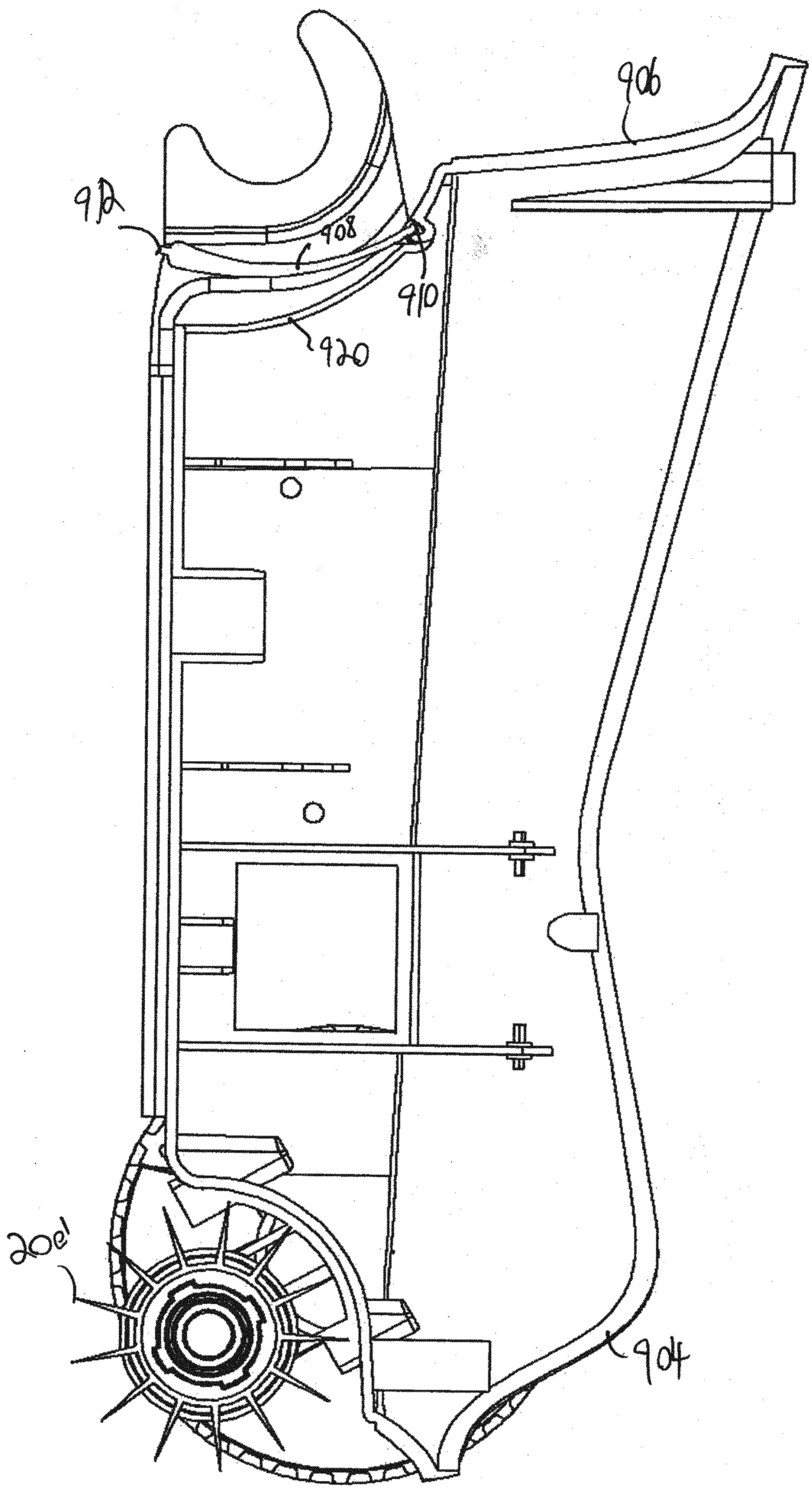


FIG. 26

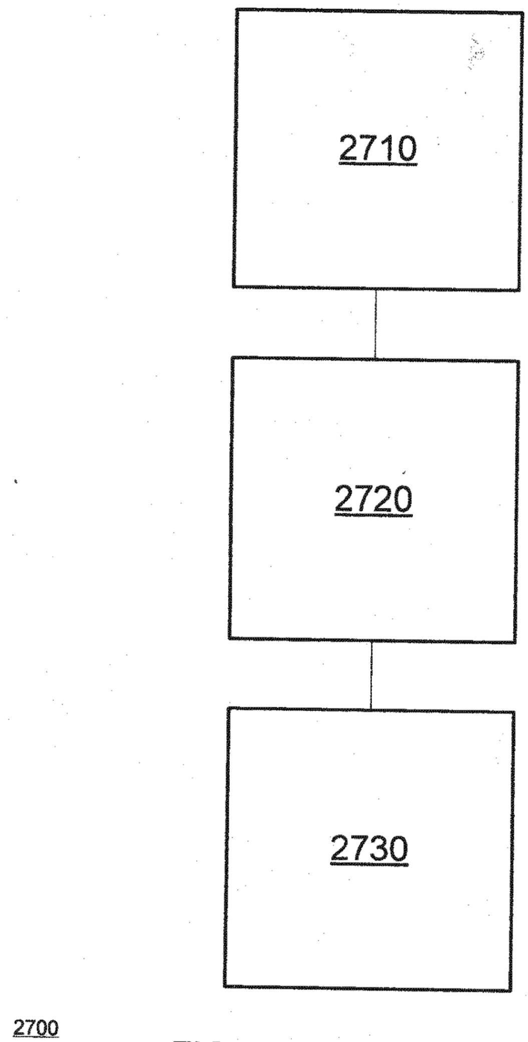


FIG. 27

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

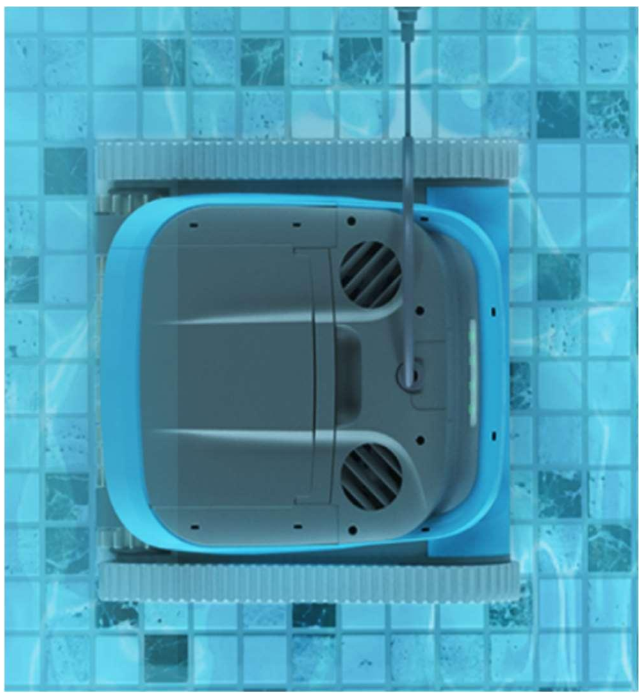
- US 2010306931 A1 **[0004]**
- US 20090045110 A, Garti **[0032]**

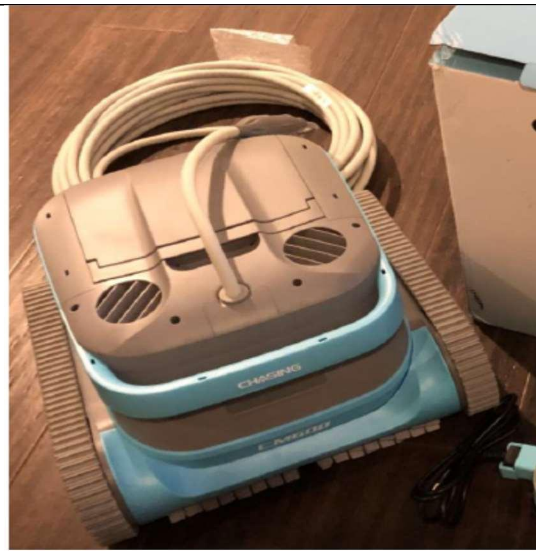
EXHIBIT D

EXHIBIT D: EXEMPLARY CLAIM CHART

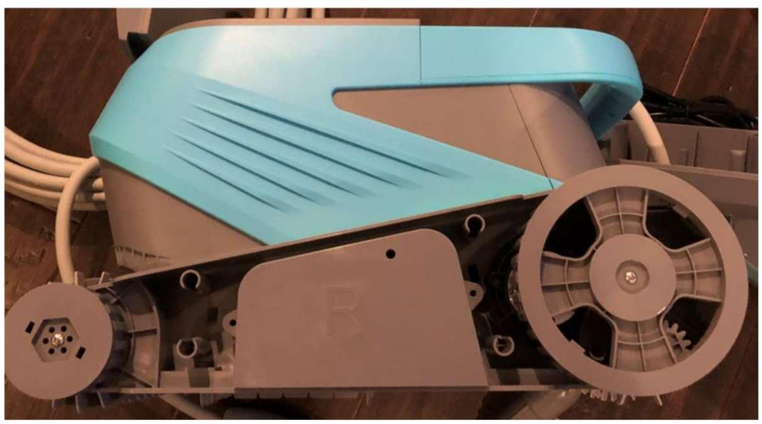
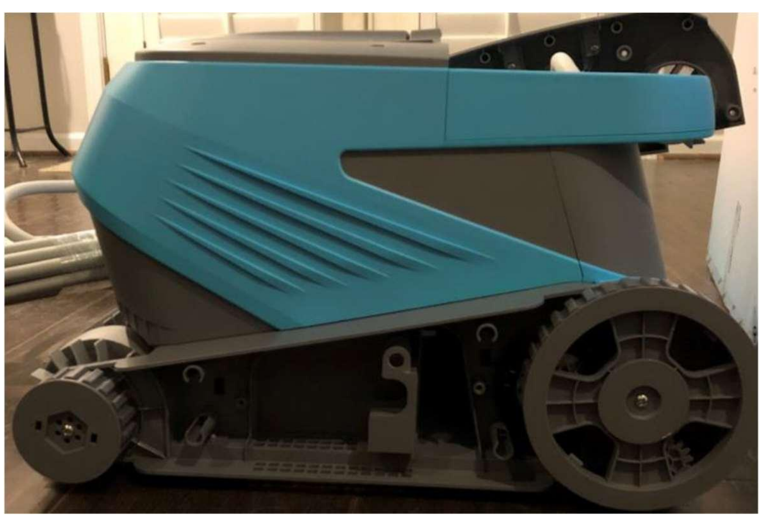
Claim 1: Maytronics U.S. Patent No. 10,378,229	Chasing Innovation CM600 Pool Robot
A cleaning robot comprising:	The Chasing CM600 is an automatic robotic pool cleaner.  
a housing comprising at least one inlet and an outlet;	The CM600 has at least an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.

The inlet is in the bottom of the housing as shown below.

	 The top of the housing includes two outlets as shown below. 

	
a filtering unit, located within the housing, for filtering fluid;	A filtering unit is located within the housing for filtering fluid directed into the inlet in the housing.  **Double-layer Filter for Precise Filtration of Dirt** CHASING CM600 Robotic Pool Cleaner is designed with a double-layer filter. The inner filter bag filters coarse sand, leaves, stones, and other types of impurities in large particles. The outer filter sheet filters sludge, dander, grease, and other smaller debris. Double-layer filtration offers better cleaning performance.

	  CHASING

<table>
<tr><td></td><td>
</td></tr>
<tr><td>a bypass mechanism for bypassing the filtering unit;</td><td>The Chasing CM600 includes a bypass mechanism for bypassing the filtering unit as shown below.

</td></tr>
</table>

	 
and a fluid suction unit that is arranged to direct towards the outlet fluid that	The Chasing CM600 is equipped with dual suction pumps that takes in fluid from the inlet in the bottom of the housing and directs it towards the two outlets in the top of the housing. 


CHASING
CM600
CHASING CM600


CHASING CM600
CHASING

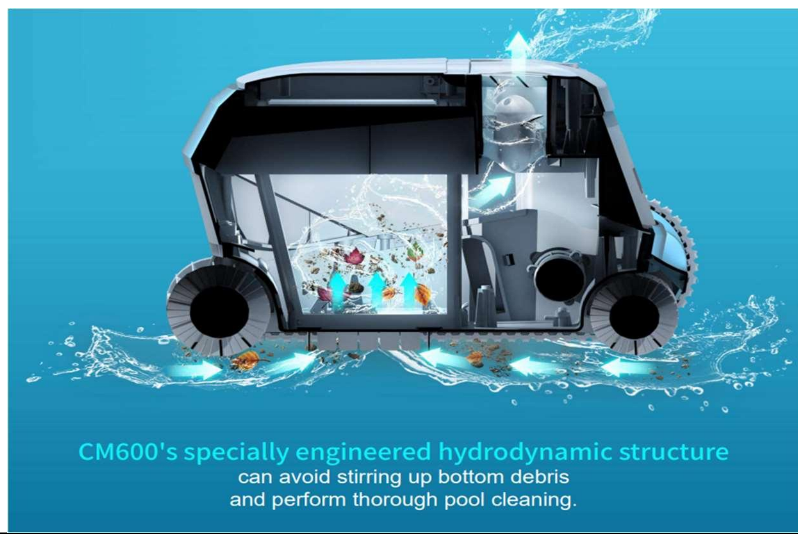
	
(a) passes through the at least one inlet and	As shown above and below, the fluid (here pool water) passes through the inlet in the bottom of the housing.
(b) passes through at least one of the filtering unit and the bypass mechanism.	The fluid passes through either the filtering unit or the bypass mechanism before exiting through one of the two outlets in the top of the housing. 

EXHIBIT E

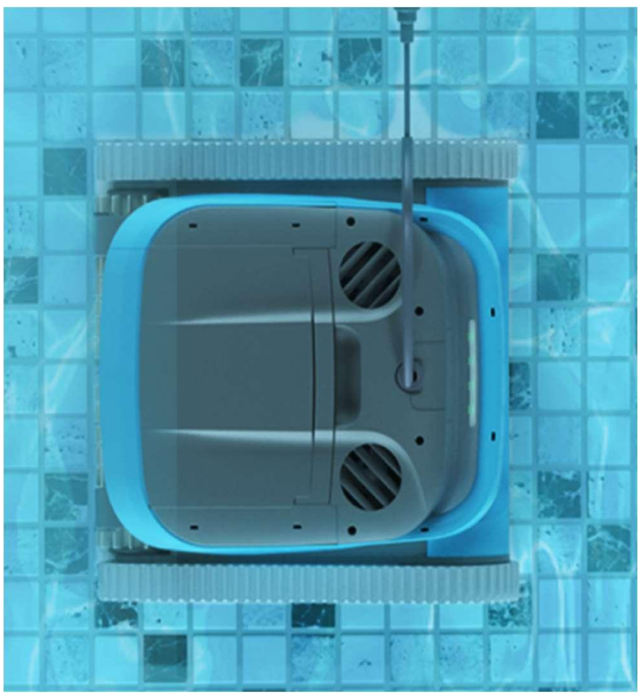
EXHIBIT E: EXEMPLARY CLAIM CHART

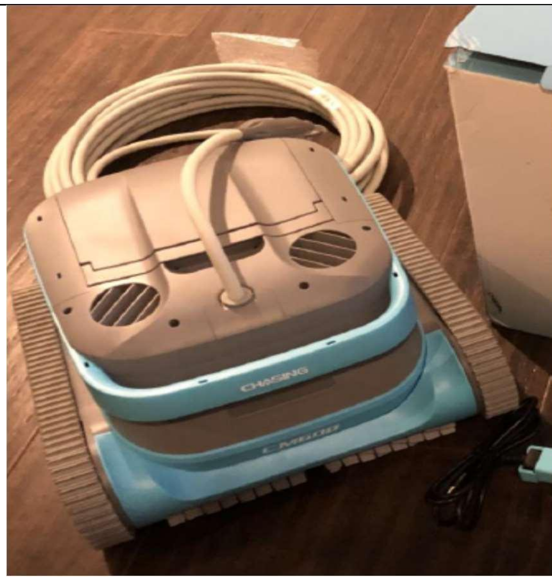
Claim 1: Maytronics EP 2 845 969 B1	Chasing Innovation CM600 Pool Robot
A cleaning robot comprising:	The Chasing CM600 is an automatic robotic pool cleaner.  
a housing (20) comprising at least one inlet	The CM600 has at least an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.

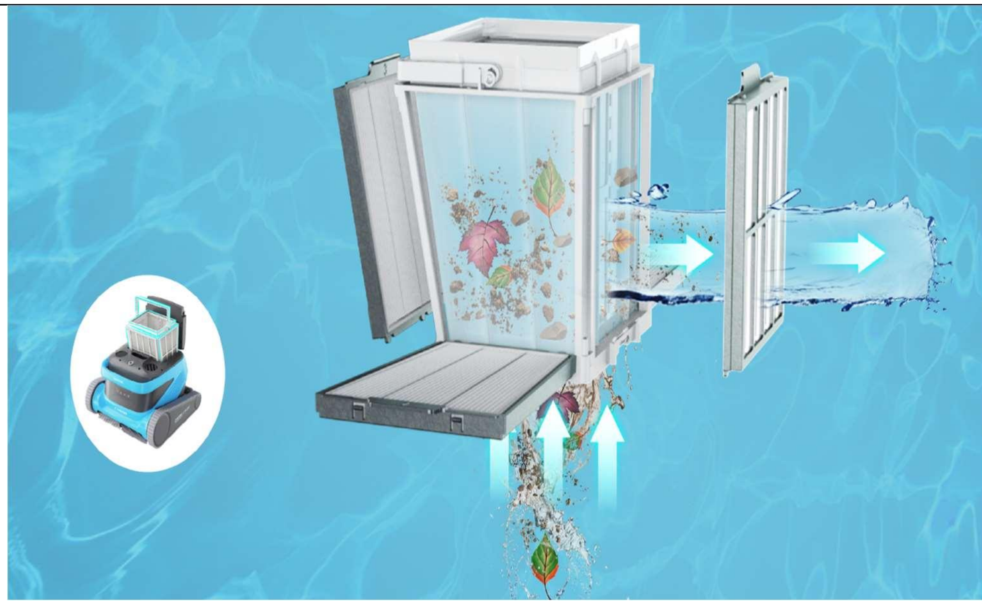
<table>
<tr>
<td>(26) and an outlet;</td>
<td>


The inlet is in the bottom of the housing as shown below.

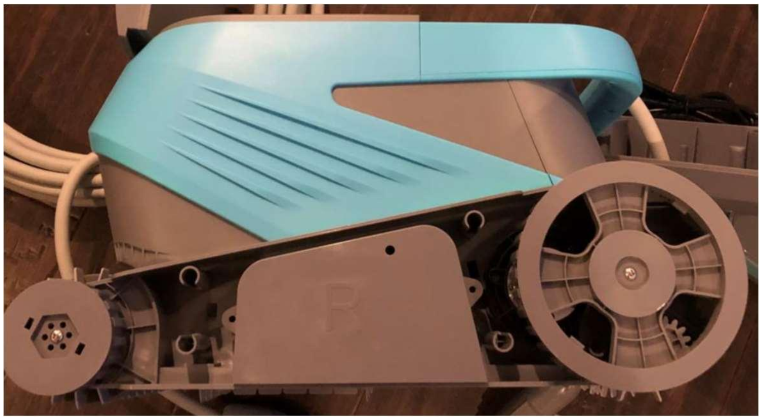
</td>
</tr>
</table>

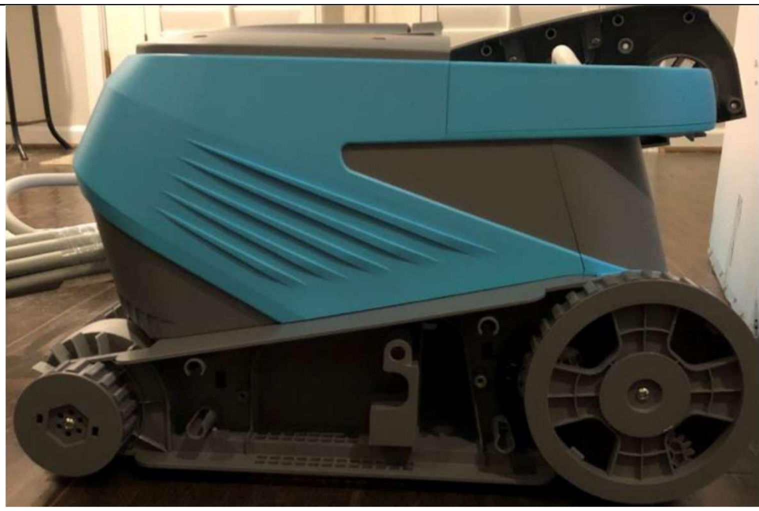
	 The top of the housing includes two outlets as shown below. 

	
a filtering unit for filtering fluid;	A filtering unit is located within the housing for filtering fluid directed into the inlet in the housing.  




CHASING

	
a bypass mechanism (40, 140, 240) for bypassing the filtering unit; and	The Chasing CM600 includes a bypass mechanism for bypassing the filtering unit as shown below. 



<table>
<tr>
<td>a fluid suction unit that is arranged to direct towards the outlet (142) fluid that</td>
<td>
The Chasing CM600 is equipped with dual suction pumps (i.e., a fluid suction unit) that takes in fluid from the inlet in the bottom of the housing and directs it towards the two outlets in the top of the housing.


</td>
</tr>
</table>

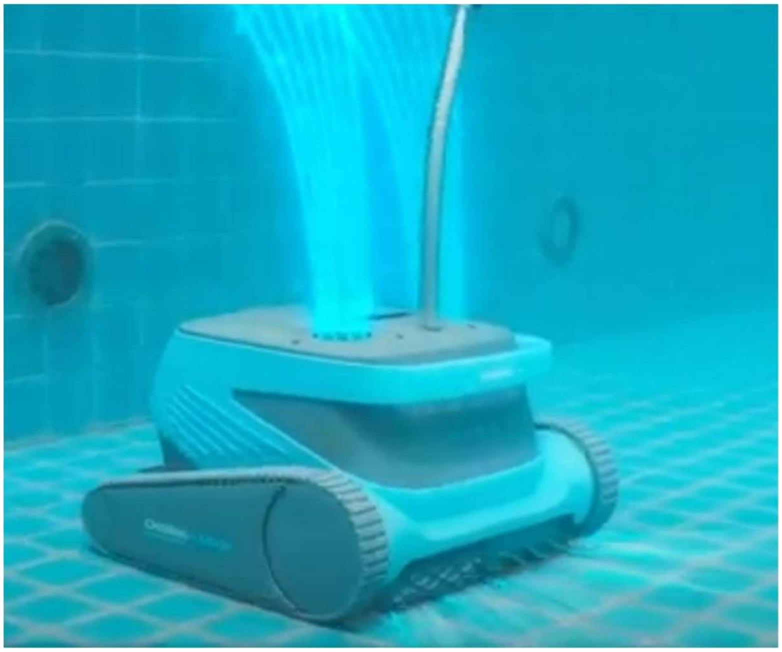
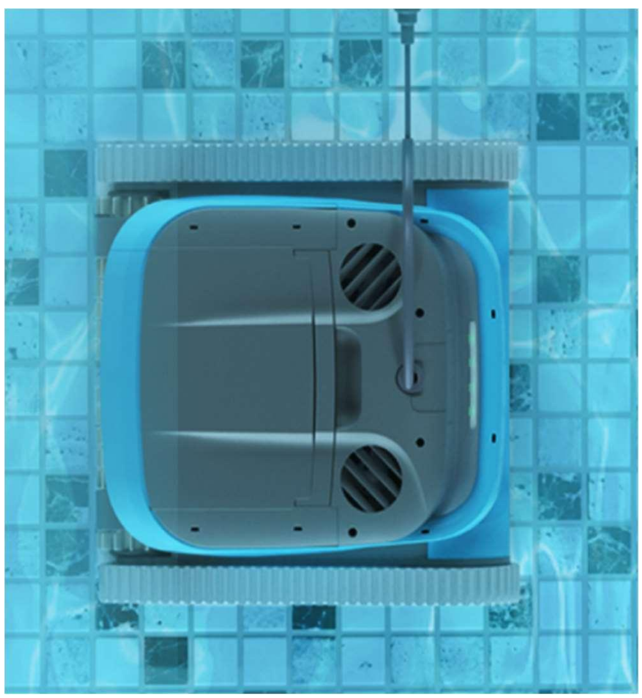
	
(a) passes through the at least one inlet (26) and	As shown above and below, the fluid (here pool water) passes through the inlet in the bottom of the housing.
(b) passes through at least one out of the filtering unit and the bypass mechanism (40, 140, 240).	The fluid passes through either the filtering unit or the bypass mechanism before exiting through one of the two outlets in the top of the housing. 

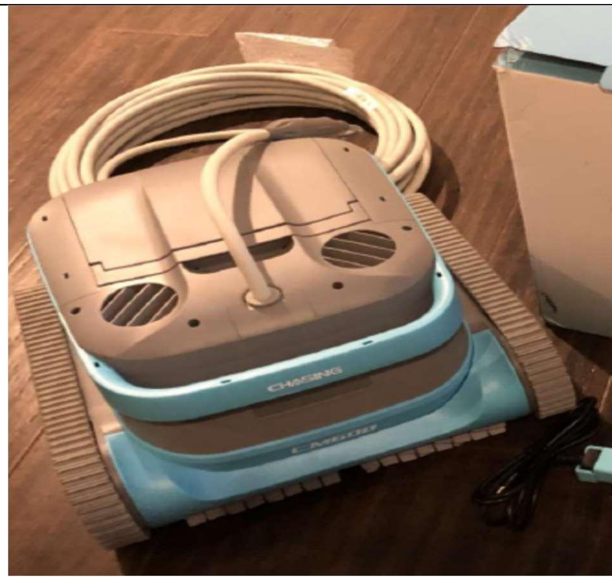
EXHIBIT F

EXHIBIT F: EXEMPLARY CLAIM CHART

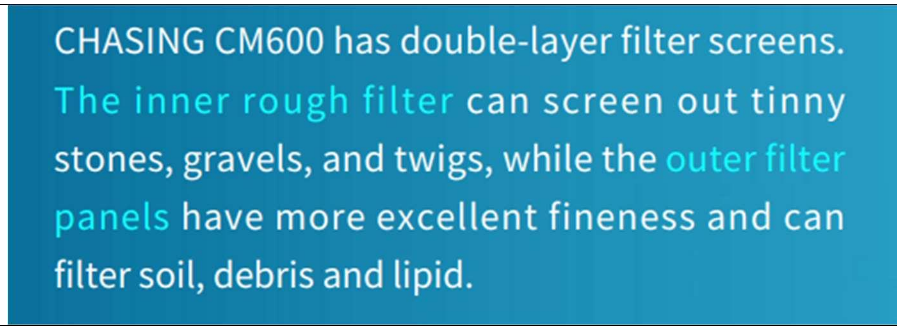
Claim 1: Maytronics EP 2 706 170 B1	Chasing Innovation CM600 Pool Robot
A cleaning robot (10, 900) comprising:	The Chasing CM600 is an automatic robotic pool cleaner.  
a housing (13, 902) that comprises an inlet (380)	The CM600 has an inlet at the bottom of the housing and two outlets at the top of the housing as shown below.

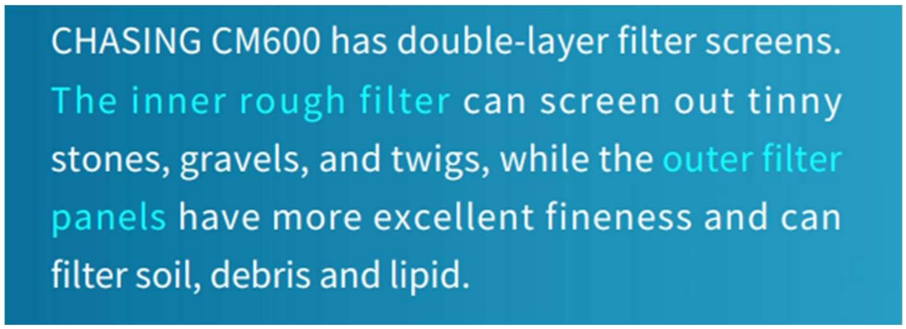
and an outlet (450, 410);	 The inlet is in the bottom of the housing as shown below.  

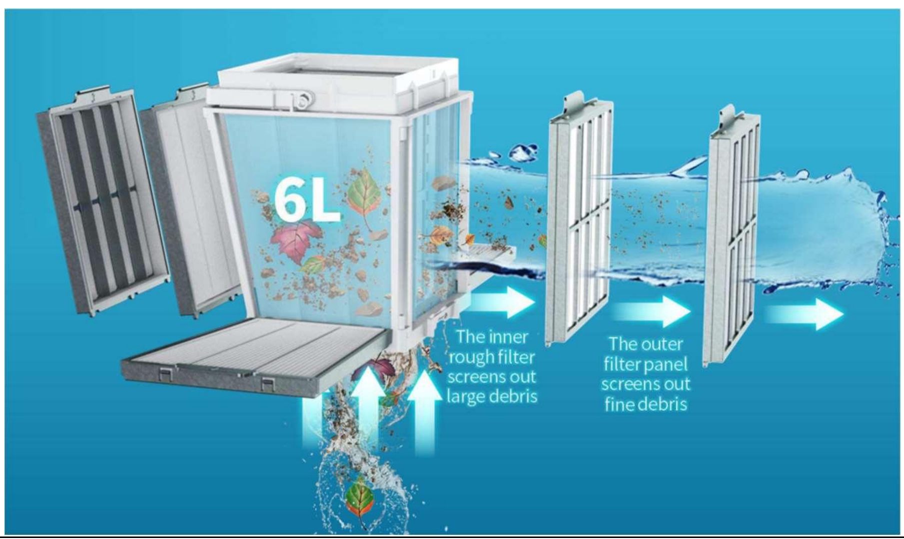
	 The top of the housing includes two outlets as shown below. 

	
a filtering unit (20) that is arranged to filter fluid that enters through the inlet to provide filtered fluid that flows through the outlet;	The Chasing CM600 has a filtering unit that is arranged to filter fluid that enters through the inlet and direct the filtered fluid out through the two outlets at the top of the housing.  

	
wherein the filtering unit (20) comprises a first filter (21) that has a first filtering level and	The filtering unit has an inner filter bag (i.e., first filter) that filters coarse sand, leaves and other large particles. Thus, the inner filter bag has a first filtering level. 
a second filter (22) that has a second filtering level that differs from the first filtering level;	The filtering unit has an outer filter sheets (i.e., second filter) that filters sludge, grease and other smaller debris. Thus, the outer filter sheets have a second filtering level that is different from the inner filter bag.

<table>
<tr>
<td></td>
<td>

CHASING CM600 has double-layer filter screens. The inner rough filter can screen out tinny stones, gravels, and twigs, while the outer filter panels have more excellent fineness and can filter soil, debris and lipid.
</td>
</tr>
<tr>
<td>the first filter (21) being arranged to perform a coarser filtering than the second filter (22),</td>
<td>
The inner filter bag (first filter) performs a coarser filtering than the outer filter sheets (second filter).


CHASING CM600 has double-layer filter screens. The inner rough filter can screen out tinny stones, gravels, and twigs, while the outer filter panels have more excellent fineness and can filter soil, debris and lipid.



</td>
</tr>
<tr>
<td>characterized in that the second filter (22) at least partially surrounds the first filter (21).</td>
<td>The outer filter sheets (second filter) at least partially surrounds the inner filter bag (first filter).</td>
</tr>
</table>

	CHASING	

EXHIBIT 10

From: TrackingUpdates@fedex.com
To: Haffron, Laurie
Subject: FedEx Shipment 397820923445: Your package has been delivered
Date: Thursday, May 4, 2023 11:29:42 AM

FedEx

Hi. Your package was delivered Thu, 05/04/2023 at 9:22am.

Delivered to 506 2ND AVE 1400, SEATTLE, WA 98104
Received by P.PATSY

OBTAIN PROOF OF DELIVERY

How was your delivery ?

Personal Message

PSShip eMail Notification

TRACKING NUMBER	397820923445
FROM	K & L Gates 70 W. Madison Street Suite 3100 Chicago, IL, US, 60602
TO	Chasing Innovation Technology Co. Xun Zhang 506 2ND AVE STE 1400 SEATTLE, WA, US, 98104
REFERENCE	0528113.00045
SHIPPER REFERENCE	0528113.00045
SHIP DATE	Wed 5/03/2023 07:05 PM
DELIVERED TO	Receptionist/Front Desk
PACKAGING TYPE	FedEx Envelope
ORIGIN	Chicago, IL, US, 60602
DESTINATION	SEATTLE, WA, US, 98104
SPECIAL HANDLING	Deliver Weekday NSR
NUMBER OF PIECES	1
TOTAL SHIPMENT WEIGHT	0.50 LB
SERVICE TYPE	FedEx Priority Overnight

Manager® to give your driver delivery preferences.

ENROLL FOR FREE

This tracking update has been requested by:

Company name:	K & L Gates
Name:	Jeffrey Gargano
Email:	Jeffrey.Gargano@klgates.com

FOLLOW FEDEX

Please do not respond to this message. This email was sent from an unattended mailbox. This report was generated at approximately 11:29 AM CDT 05/04/2023.

All weights are estimated.

To track the latest status of your shipment, click on the tracking number above.

Standard transit is the date and time the package is scheduled to be delivered by, based on the selected service, destination and ship date. Limitations and exceptions may apply. Please see the FedEx Service Guide for terms and conditions of service, including the FedEx Money-Back Guarantee, or contact your FedEx Customer Support representative.

Thank you for your business.