

(19)



(11)

EP 4 380 420 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
07.05.2025 Bulletin 2025/19

(21) Application number: **22761715.6**

(22) Date of filing: **01.08.2022**

(51) International Patent Classification (IPC):
A47L 9/14 ^(2006.01) **A47L 11/40** ^(2006.01)

(52) Cooperative Patent Classification (CPC):
A47L 11/4025; A47L 9/149; A47L 2201/024

(86) International application number:
PCT/US2022/039035

(87) International publication number:
WO 2023/014648 (09.02.2023 Gazette 2023/06)

(54) **EMPTYING STATION FOR CLEANING ROBOT**

ENTLEERUNGSVORRICHTUNG FÜR REINIGUNGSROBOTER

STATION DE VIDAGE POUR ROBOT DE NETTOYAGE

(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: **02.08.2021 US 202163228399 P**

(43) Date of publication of application:
12.06.2024 Bulletin 2024/24

(73) Proprietor: **iRobot Corporation**
Bedford, Massachusetts 01730 (US)

(72) Inventors:
• **DOUGHTY, Brian W.**
Framington, Massachusetts 01701 (US)
• **TORRENTE, Leo**
Somerville, Massachusetts 02144 (US)

- **GSCHREY, Travis**
Billerica, Massachusetts 01821 (US)
- **BURNETT, Scott Thomas**
Windham, New Hampshire 03087 (US)
- **DELL'ACCIO, Douglas**
Boston, Massachusetts 02130 (US)
- **CHUNG, Willy**
Wakefield, Massachusetts 01880 (US)

(74) Representative: **Peterreins Schley**
Patent- und Rechtsanwälte PartG mbB
Hermann-Sack-Straße 3
80331 München (DE)

(56) References cited:
EP-A1- 3 626 144 EP-A1- 3 777 629
US-A1- 2021 038 034

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).

Description

BACKGROUND

[0001] Autonomous mobile robots include autonomous mobile cleaning robots that can autonomously perform cleaning tasks within an environment, such as a home. Many kinds of cleaning robots are autonomous to some degree and in different ways. Some robots can interface with a docking station automatically. The docking station can perform maintenance on the robot such as charging of batteries of the robot and evacuation of debris from a debris bin of the robot.

SUMMARY

[0002] Mobile cleaning robots can include a variety of components that require maintenance or interaction between missions or during missions. For example, vacuuming robots that extract debris from an environment may need to empty their debris bins during missions or between missions. Some robots can automatically or autonomously evacuate their debris bins at a docking station. Further, mopping robots require filling of the robot with a cleaning solution, such as before every mopping mission commences or during a long mopping mission. Two-in-one (or mopping and vacuuming robots) may require both of these actions (evacuation and tank filling) to be performed before, during, or after a cleaning mission of the robot, which can necessitate a docking station including a variety of components to support debris evacuation, tank filling, and charging of the mobile cleaning robot.

[0003] This disclosure helps to support these operations by including a docking station with a filling spout for filling the robot with cleaning fluid. The docking station can also include wheel well switches to indicate when the robot has docked before evacuation, refilling, or charging is commenced. The docking station can further include a front-access panel for access to the fluid tank, the docking station debris bag, and storage compartments for storing accessories. The docking station can further include retracting contacts to limit interaction between the body of the robot and the contacts.

[0004] For example, a docking station for a mobile cleaning robot can include a base and a canister. The base can be configured to receive at least a portion of the mobile cleaning robot thereon. The base can include an electrical power interface configured to provide electrical power to the mobile cleaning robot. The canister can be connected to the base and can be located at least partially above the base. The canister can include a debris bin to receive debris from the mobile cleaning robot. A docking station according to the preamble of claim 1 is already known e.g. from EP-A-3777629.

[0005] The above discussion is intended to provide an overview of subject matter of the present patent application. It is not intended to provide an exclusive or exhaus-

tive explanation of the invention. The description below is included to provide further information about the present patent application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the drawings, which are not necessarily drawn to scale, like numerals may describe similar components in different views. Like numerals having different letter suffixes may represent different instances of similar components. The drawings illustrate generally, by way of example, but not by way of limitation, various embodiments discussed in the present document.

- 15 FIG. 1 illustrates an isometric view of a docking station and a mobile cleaning robot.
- FIG. 2 illustrates an isometric view of a docking station for a mobile cleaning robot.
- FIG. 3 illustrates an isometric view of a portion of a docking station for a mobile cleaning robot.
- FIG. 4 illustrates an isometric view of a docking station for a mobile cleaning robot.
- FIG. 5 illustrates an isometric view of a docking station for a mobile cleaning robot.
- 25 FIG. 6 illustrates an isometric view of a docking station for a mobile cleaning robot.
- FIG. 7 illustrates an exploded isometric view of a docking station for a mobile cleaning robot.
- FIG. 8 illustrates an exploded isometric view of a docking station for a mobile cleaning robot.
- FIG. 9A illustrates an enlarged side cross-sectional view of a docking station and a mobile cleaning robot.
- FIG. 9B illustrates an enlarged side cross-sectional view of a docking station and a mobile cleaning robot.
- 35 FIG. 10 illustrates front view of a docking station.
- FIG. 11 illustrates an enlarged side cross-sectional view of a docking station and a mobile cleaning robot.
- FIG. 12A illustrates an enlarged side cross-sectional view of a docking station and a mobile cleaning robot.
- FIG. 12B illustrates an enlarged side cross-sectional view of a docking station and a mobile cleaning robot.
- FIG. 13A illustrates an enlarged side view of a portion of a docking station in a first condition.
- FIG. 13B illustrates an enlarged side view of a portion of a docking station in a second condition.
- FIG. 13C illustrates an enlarged side view of a portion of a docking station in a third condition.
- FIG. 13D illustrates an enlarged side view of a portion of a docking station in a fourth condition.
- FIG. 14 illustrates an enlarged side view of a portion of a docking station.
- FIG. 15 illustrates an enlarged side cross-sectional isometric view of a docking station.
- FIG. 16 illustrates an isometric view of a portion of a docking station.
- FIG. 17A illustrates an enlarged cross-sectional isometric view of a docking station.
- FIG. 17B illustrates an enlarged bottom cross-section

tional isometric view of a docking station.

FIG. 18A illustrates an isometric view of a portion of a docking station.

FIG. 18B illustrates an isometric view of a portion of a docking station.

FIG. 19 illustrates an isometric view of a portion of a docking station.

FIG. 20 illustrates an enlarged side cross-sectional view of a docking station.

FIG. 21 illustrates an enlarged side cross-sectional view of a portion of a docking station.

FIG. 22 illustrates front isometric view of a portion of a docking station.

FIG. 23 illustrates an enlarged side cross-sectional view of a portion of a docking station.

FIG. 24 illustrates an enlarged side cross-sectional view of a portion of a docking station.

FIG. 25 illustrates an isometric view of a docking station.

FIG. 26 illustrates an isometric view of a docking station.

DETAILED DESCRIPTION

[0007] FIG. 1 illustrates an isometric view of a docking station 100 for a mobile cleaning robot 102. The mobile cleaning robot can be a vacuuming robot, a mopping robot, or a combination thereof (two-in-one) mobile cleaning robot configured to perform mopping and cleaning operations in an environment. The mobile cleaning robot 102 can include a body 104 and a mopping system 106 connected to the body 104. The mopping system can include a retractable mopping pad tray and pad as discussed in U.S. App. No. 17/388,293, titled, TWO IN ONE MOBILE CLEANING ROBOT, to Michael G. Sack.

[0008] The docking station 100 can include a canister 108 and a base 110. The canister 108 can include an outer wall 112 and a door 114. The base 110 can include a platform 116 including include tracks 118a and 118b including respective wheel wells 120a and 120b. The platform 116 can also include a vacuum port 122. The docking station 100 can also include a docking port 124 configured to at least partially receive the mobile cleaning robot 102 therein. For example, the mobile cleaning robot 102 can move into the docking port 124 by traversing over the tracks 118a and 118b until drive wheels of the mobile cleaning robot 102 rest in the wheel wells 120, which can align the vacuum port 122 with a debris port of the robot and can align charging contacts 126 of the dock with contacts of the mobile cleaning robot 102, along with other features of the mobile cleaning robot 102 and the docking station 100.

[0009] The components of the docking station 100 can be rigid or semi-rigid components made of materials such as one or more of metals, plastics, foams, elastomers, ceramics, composites, combinations thereof, or the like. Materials of some components are discussed in further detail below. The mobile robot 102 can be a mobile

cleaning robot including wheels, extractor, a debris bin, a controller, and various sensors. The robot 102 can be configured to perform autonomous cleaning missions or routines within an environment.

[0010] The base 110 can be a ramped member including the platform 116 and the tracks 118a and 118b, where the base 110 can be configured to receive the mobile cleaning robot 102 thereon for maintenance, such as charging and emptying debris from the mobile cleaning robot. The tracks 118 can be configured to receive wheels of the robot 102 to guide the robot 102 onto the base 110 for charging and debris evacuation using contacts 126. The contacts 126 can be (or can be part of) an electrical power interface configured to provide electrical power to the mobile cleaning robot 102. The platform 116 and the tracks 118 can be sloped toward the front portion to help allow the mobile robot 102 to dock on the station 100.

[0011] When the robot 102 is positioned on the base 110, such as when wheels of the robot 102 are in wheel wells 120, the vacuum port 122 can be aligned with a vacuum outlet of the robot 102. The vacuum port 122 can extend through the base 110 and can connect to the vacuum inlet of the canister 108.

[0012] The canister 108 can be an upper portion of the docking station 100 connected to a rear portion of the base 110 and can extend upward therefrom, such that the canister 108 can be located at least partially above the base 110. The outer wall 112 of the canister 108 can have a shape of a substantially rectangular hollow prism with rounded corners where the outer wall 112 can define a front portion of the canister 108 that is open. The outer wall 112 can at least partially enclose the debris bin and a fan compartment.

[0013] The door 114 can be connected to the outer wall 112 (such as by hinges or other fasteners), such as at a side portion of the door 114. The door 114 can be releasably securable to the outer wall 112, such as at a side portion of the door 114 and the outer wall 112 (such as via a friction/interference fit, latch, or the like). Removal of the door 114 or opening of the door 114 from the front portion of the canister 108 can provide access to debris bin and can optionally provide access to the fan compartment.

[0014] FIG. 2 illustrates an isometric view of the docking station 100. The docking station 100 can be consistent with the docking station 100 discussed above, FIG. 2 shows additional details of the docking station 100. For example, FIG. 2 shows the door 114 in an open position, exposing internal compartments of the docking station 100, such as a tank compartment 128, which can be at least partially formed into the outer canister 108, such as by the outer wall 112 and one or more inner walls of the canister 108. The tank compartment 128 can be configured to removably receive a fluid tank 130 therein for delivery of cleaning fluid to the mobile cleaning robot 102. The fluid tank 130 can be slidably insertable into (or removable from) the tank compartment 128 when the door 114 is in the open configuration.

[0015] FIG. 2 also shows a debris compartment 132

that can be at least partially formed into the outer canister 108, such as by the outer wall 112 and one or more inner walls of the canister 108. The debris compartment 132 can be configured to removably receive a bag drawer 134 therein for receiving a debris bag therein. The bag drawer 134 can be slidably insertable into (or removable from) the debris compartment 132 such as between an open position and a closed position (shown in FIG. 2) when the door 114 is in the open configuration. Optionally, the bag drawer 134 can be entirely removable from the debris compartment 132 and the canister 108.

[0016] The canister 108 can further include various storage compartments for storing one or more user-replaceable components of the mobile cleaning robot 102. For example, the door 114 can include a door compartment 136 connected to and extending from a top portion of the door 114. The door compartment 136 can be movable or rotatable with the door 114 such that the door compartment 136 is exposed when the door 114 is in the open position, as shown in FIG. 2, and such that the door compartment 136 can be concealed within the canister 108 when the door 114 is in the closed position, as shown in FIG. 1. Optionally, the door compartment 136 can be configured (e.g., sized or shaped) to hold or support user-replaceable components, such as a mopping pad 138.

[0017] The canister 108 can also include an upper shelf 140 that can be defined at least in part by the outer wall 112 and inner walls of the canister 108. The upper shelf 140 can be accessible or exposed when the door 114 is in the open position, as shown in FIG. 2. The upper shelf 140 can be configured (e.g., sized or shaped) to hold or support user-replaceable components, such as a replacement filter, rollers, side brush, or the like.

[0018] The canister 108 can also include a side shelf 142 that can be defined at least in part by the outer wall 112 and inner walls of the canister 108. The side shelf 142 can be accessible or exposed when the door 114 is in the open position, as shown in FIG. 2. The side shelf 142 can be configured (e.g., sized or shaped) to hold or support user-replaceable components, such as a debris bag. Optionally, the side shelf 142 can be located in front of a fan system, shown in FIG. 7. The canister 108 can optionally include more or fewer storage compartments.

[0019] FIG. 3 illustrates an isometric view of the fluid tank 130 of the docking station 100. FIG. 4 illustrates an isometric view of the docking station 100 and a mobile cleaning robot 102. FIGS. 3 and 4 are discussed together below. The docking station 100 and the fluid tank 130 can be consistent with the docking station 100 and the fluid tank 130 discussed above. FIG. 3 shows additional details of the fluid tank 130. For example, FIG. 3 shows that the fluid tank 130 can include a body 144, which can be defined by walls (e.g., 6 or more walls) to define a volume configured to contain or hold cleaning fluid therein. The fluid tank 130 can also include a handle 146 that can be user-graspable, such as to slidably insert or remove the fluid tank 130 from the tank compartment 128. For example, as shown in FIG. 4,

the fluid tank 130 can be slidably removable (or insertable) through a front portion of the canister, such as using the handle 146.

[0020] As also shown in FIG. 3, the fluid tank 130 can include a fluid port 148, which can be connected to the body 144. The fluid port 148 can be fluidly connectable to one or more lines in the docking station 100 to connect the fluid tank 130 to the docking station 100 when the fluid tank 130 is fully inserted into the tank compartment 128 of the docking station 100. The fluid port 148 can optionally include valve (fill valve 2051), as discussed in further detail below.

[0021] FIG. 5 illustrates an isometric view of the docking station 100 with the bag drawer 134 in an open position. FIG. 6 illustrates an isometric view of the docking station 100 with the bag drawer 134 in an open position and a debris bag 150 partially removed from the 134. FIGS. 5 and 6 are discussed together below.

[0022] The docking station 100 of FIGS. 5 and 6 can be consistent with the docking station 100 discussed above; FIGS. 5 and 6 show additional details of operation of the docking station 100. For example, FIG. 5 shows that the bag drawer 134 can be slid, translated, or otherwise moved forward to the open position when the door 114 is in the open position. Then, as shown in FIG. 6, when the bag drawer 134 is in the open position, the debris bag 150 can be moved upward relative to the bag drawer 134 to remove the debris bag 150 from the bag drawer 134 and the canister 108. Following removal of a dirty debris bag 150, a clean or new debris bag can be inserted (downward) into the bag drawer 134 when the bag drawer 134 is in the open position. The bag drawer 134 can then be translated or slid to rearward to the closed position before the door 114 is closed allowing operations (such as evacuation of the docking station 100) to continue.

[0023] FIG. 7 illustrates an exploded isometric view of the docking station 100. FIG. 8 illustrates an exploded isometric view of the docking station 100. The docking station 100 of FIGS. 7 and 8 can be consistent with the docking station 100 discussed above; FIGS. 7 and 8 show additional details of the docking station 100. For example, FIG. 7 shows a fan system 152 (including an evacuation fan), which can be an exhaust fan connected to the debris compartment 132 and the bag drawer 134 and can be located in a fan compartment 154 of the canister 108. The fan system 152 can be operable to draw debris through the docking station 100 via the vacuum port 122 and into the debris bag 150 in the bag drawer 134 where the debris can be captured by the debris bag 150. Exhaust air from the fan system 152 can be exhausted through an exhaust opening 156 into the docking port 124, such as through an internal wall of the canister 108. By discharging the exhaust air into the docking port 124 and toward the base 110, the discharge can be directed away from a rear or side portion of the canister 108, helping to reduce occurrence of exhausting onto items within an environment.

[0024] FIG. 7 also shows that the fluid tank 130 and the

bag drawer 134 can be removable from a front portion of the canister 108, such as when the door 114 is in the open position. FIG. 7 further shows that a front panel 158 can be optionally removable from a chassis 159 of the canister 108, such as for maintenance of components within the canister 108. Similarly, as shown in FIG. 8, any of panels 162a-162c (together, panels 162) can be removable from the chassis 159 of the canister 108, such as for access or service of any components therein. Also, a lid 160 can be user-removable from a top portion of the canister 108 such as for cosmetic replacement. Optionally, removal of the lid 160 can provide access to the fan system 152 or high voltage components 161. The components 161 can be connected to the fan system 152 and can be connected to any of the sensors or components of the canister 108, such as to distribute power to components of the canister 108.

[0025] FIG. 9A illustrates an enlarged side cross-sectional view of the docking station 100 and the mobile cleaning robot 102. FIG. 9B illustrates an enlarged side cross-sectional view of the docking station 100 and the mobile cleaning robot. The docking station 100 of FIGS. 9A and 9B can be consistent with the docking station 100 discussed above; FIGS. 9A-9B show additional details of the docking station 100. For example, FIGS. 9A and 9B show an image capture device 164, which can interface with docking tags, as discussed below with reference to FIG. 10.

[0026] FIGS. 9A and 9B also show a fill spout 166, which can be connected to the canister 108 and can be movable (e.g., rotatable) with respect to the canister 108. Also shown is an actuator 168, which can optionally be a rotating cam. The actuator 168 can be optionally driven by a motor to rotate with respect to the canister 108. In operation of some examples, as shown in FIG. 9A, the fill spout 166 can be in a stored position, such as within the canister 108. When the docking station 100 is fully docked on the base 110, the actuator 168 can be operated to rotate the fill spout 166 to extend from the canister 108 and insert into the mobile cleaning robot 102, as shown in FIG. 9B. For example, the fill spout 166 can engage a door 170 of the mobile cleaning robot 102, causing the door 170 to open to allow the 166 to enter a tank 172 of the mobile cleaning robot 102, and allowing fluid to be discharged from the canister 108 (e.g., the fluid tank 130) into the door 170 of the mobile cleaning robot 102. The door 170 can optionally be biased toward the closed position (FIG. 9A) such as to help limit fluid from escaping through the door 170 during a mission. Optionally, the fill spout 166 can be extended as (or prior to) the mobile cleaning robot 102 is moved into its final docking position.

[0027] FIG. 10 illustrates a front view of the docking station 100. The docking station 100 of FIG. 10 can be consistent with the docking station 100 discussed above; FIG. 10 shows additional details of the docking station 100. For example, FIG. 10 shows that the docking station 100 can include a docking sensor 174 located within the

docking port 124 and connected to the base 110 or the canister 108. The sensor 174 can be an optical sensor, such as an infrared (IR) sensor configured to detect a proximity of the mobile cleaning robot 102 relative to the canister 108, such as for use by the robot 102 for guidance during docking onto the base 110. FIG. 10 also shows that the door 114 can include a tab 115, which can be a rigid or semi-rigid member, such as a small handle. The tab 115 can be user-graspable such as to allow a user to open and close the door 114.

[0028] FIG. 10 also shows that the base 110 or the canister 108 can include identification (ID) tags 176a-176c, which can be April tags, QR tags, or the like. The tags 176 can be used by the image capture device 164 of the mobile cleaning robot 102 for navigating onto the base 110 (along with the sensor 174) properly for docking of the mobile cleaning robot 102, such as to allow for maintenance of the mobile cleaning robot 102 to be performed by the docking station 100.

[0029] FIG. 11 illustrates an enlarged side cross-sectional view of the docking station 100 and the mobile cleaning robot 102. The docking station 100 of FIG. 11 can be consistent with the docking station 100 discussed above; FIG. 11 shows additional details of the docking station 100. For example, FIG. 11 shows that the door 170 can rotate about a pivot 178 when engaged by the fill spout 166 such as to move the door 170 to an open or fill position. The door 170 or the pivot 178 can include a biasing element (such as a torsion spring) that can be configured to bias the door 170 to the closed position when the fill spout 166 is removed or not in contact with the door 170. FIG. 11 also shows that the mobile cleaning robot 102 can include a seal 180 engageable with the door 170 to seal the tank 172 when the door 170 is in the closed position.

[0030] FIG. 12A illustrates an enlarged side cross-sectional view of the docking station 100 and the mobile cleaning robot 102. FIG. 12B illustrates an enlarged side cross-sectional view of the docking station 100 and the mobile cleaning robot 102. FIGS. 12A and 12B are dThe docking station 100 of FIGS. 12A and 12B can be consistent with the docking station 100 discussed above; FIGS. 12A and 12B show additional details of the docking station 100. For example, FIGS. 12A and 12B show that the fill spout 166 can include a magnetic component 182 (such as a magnet or electromagnet) and show that the door 170 can include a sensor 184 (such as a Hall effect sensor or the like).

[0031] As shown in FIG. 12A, the sensor 184 can produce a field F1 and the magnetic component 182 can produce a field F2. When in the position of FIG. 12A, the field F2 of the magnetic component 182 can be outside the field F1 before the fill spout 166 is inserted into the mobile cleaning robot 102. As shown in FIG. 12B, when the fill spout 166 is inserted into the mobile cleaning robot 102 past the seal 180, the field F2 can interact with the field F1, allowing the sensor 184 to detect the presence of the magnetic component 182 and therefore to

detect the presence of the fill spout 166 within the robot 102. A controller can be connected to the sensor 184 and can receive a signal therefrom to indicate that the fill spout 166 is fully inserted into the mobile cleaning robot 102 such that filling of liquid through the fill spout 166 can commence.

[0032] FIG. 13A illustrates an enlarged side view of the fill spout 166 and the actuator 168 in a first condition. FIG. 13B illustrates an enlarged side view of the fill spout 166 and the actuator 168 in a second condition. FIG. 13C illustrates an enlarged side view of the fill spout 166 and the actuator 168 in a third condition. FIG. 13D illustrates an enlarged side view of the fill spout 166 and the actuator 168 in a fourth condition. FIGS. 13A-13D are discussed together below.

[0033] The fill spout 166 and the actuator 168 of FIGS. 13A-13D can be consistent with the fill spout 166 and the actuator 168 discussed above; FIGS. 13A-13D show additional details of operation of the fill spout 166 and the actuator 168. For example, FIG. 13A shows that shows the actuator 168 (which can be a cam) can clear or pass a counter element 186 of the fill spout 166 allowing a torsion spring 188 to apply a force on the fill spout 166 to rotate the fill spout 166 to a stowed, vertical position, as shown in FIG. 13B.

[0034] As the actuator 168 continues to rotate, it can interact with an end 190 of the fill spout 166, such that the actuator 168 can move the fill spout 166 from the position shown in FIG. 13B to the position shown in FIG. 13C. As the actuator 168 rotates beyond the end 190 of the fill spout 166, a biasing portion 192 (a portion of a profile of the actuator 168) can engage a contoured portion 194 of the fill spout 166, limiting movement of the fill spout 166 for a significant portion of rotation of the actuator 168, such as between 90 degrees and 180 degrees of rotation of the actuator 168. FIG. 13D shows a final portion of engagement of the actuator 168 with the fill spout 166 prior to the actuator 168 disengaging with the fill spout 166 and allowing the torsion spring 188 to return the fill spout 166 to a stowed vertical position.

[0035] FIG. 14 illustrates an enlarged side view of fill spout 166 and the actuator 168, showing additional details of the engagement between the fill spout 166 and the actuator 168. For example, FIG. 14 shows engagement between the fill spout 166 and the actuator 168, which can result in a reliable interface yielding reliable positioning of the fill spout 166 with respect to a rear robot door.

[0036] More specifically, as the actuator 168 rotates through its position, the biasing portion 192 of the actuator 168 and the contoured portion 194 of the fill spout 166 can come into alignment. A detent 196 in the contoured portion 194 can force deflection of the torsion spring 188, resulting in a reliable position of the fill spout 166. A force A can be created by the detent 196 interacting with the torsion spring 188, causing the fill spout 166 to pivot about a pin axis of a pin 198 of the fill spout 166. This can result in a force B forcing the fill spout 166 down into a hard stop 199 of the docking station 100, helping to hold

the fill spout 166 in a fill position. The interaction between the detent 196 of the biasing portion 192 (cam profile) and the biasing portion 192 can help to provide a mechanism that is robustly positioned allowing the mobile cleaning robot 102 to back into the fill spout 166 while limiting movement of the fill spout 166 and while helping to limit damage to the fill spout 166.

[0037] FIG. 15 illustrates an enlarged side cross-sectional isometric view of a docking station 1500. The docking station 1500 can be similar to the docking station and mobile cleaning robot discussed above; the 1500 can include a fill spout that uses a rack and pinion mechanism. Any of the docking stations discussed above or below can be modified to include the features of the docking station 1500.

[0038] More specifically, the 1500 can include a fill spout 1566 including a rack 1501 connected to or integrated with the fill spout 1566, such as on a bottom portion thereof. The docking station 1500 can also include a pinion 1503, which can be connected to a motor to rotate the pinion 1503. The pinion 1503 can be engaged with the rack 1501 such that rotation of the pinion 1503 can cause translation of the rack 1501 and therefore the fill spout 1566, such that the fill spout 1566 can translate between an extended position (such as for filling of a tank of the mobile cleaning robot 1502) and a retracted position (when the robot is not docked). FIG. 15 also shows that the fill spout 1566 can include a fitting 1505 connected to a tube or pipe within the docking station 1500 to connect the fill spout 1566 to a fluid tank.

[0039] FIG. 15 further shows that a base 1510 of the 1500 can include charging contacts 1526a and 1526b, which can extend at least partially through the base 1510, such as to engage a robot for charging of the robot. FIG. 15 also shows that the contacts 1526 can be connected to a contacts mechanism 1507 that can be operable to move the contacts 1526 with respect to the base 1510. The charging contacts 1526 can be movable between a retracted position and an extended position, such that the dock charging contacts 1526 can be engageable with robot charging contacts when in the extended position and when the mobile cleaning robot is docked on the base 1510, as discussed in further detail below.

[0040] FIG. 15 also shows a docking switch 1509 that can be configured to engage a mobile cleaning robot (e.g., the mobile cleaning robot 102 or 1502 [discussed below]). The docking switch 1509 can be connected to a controller (or in communication therewith) such as to indicate that the robot is properly or completely docked on the base 1510.

[0041] FIG. 16 illustrates an isometric view of a portion of the docking station 1500, which can be consistent with the docking station 1500 discussed above with respect to FIG. 15. FIG. 16 shows additional details of the docking station 1500. For example, FIG. 16 shows that the docking switch 1509 can extend at least partially into the docking station 1500, such as into a canister 1508 or the base 1510.

[0042] FIG. 16 also shows that the docking station 1500 can include a contact switch 1511. The contact switch 1511 can be connected to the base 1510 and can be engageable with the mobile cleaning robot to move the dock charging contacts to the extended position (shown in FIG. 16), as discussed in further detail below with regard to FIGS. 17A-17B.

[0043] FIG. 16 also shows that the base 1510 can include tracks 1518a and 1518b including respective wheel wells 1520a and 1520b, which can be similar to the tracks 118 and the wheel wells 120 of the docking station 100. The wheel wells 1520 can be configured to receive respective drive wheels of the mobile cleaning robot therein to align robot charging contacts of the mobile cleaning robot with the electrical power interface of the base 1510 (e.g., the contacts 1526).

[0044] FIG. 16 further shows that the base 1510 can include a pair of wheel switches 1513a and 1513b located in the pair of wheel wells 1520a and 1520b, respectively. The switches 1513 can each extend at least partially through their respective wheel wells 1520 such as to be engageable by respective drive wheels of the robot. The switches 1513 can be break beam sensors, mechanical push switches, or the like.

[0045] The wheel switches 1513 can be independently engageable by respective drive wheels when the drive wheels are positioned in respective ones of the wheel wells 1520 such as to produce independent docking signals that can be transmitted to one or more controllers, e.g., within the docking station 1500. Because the switches 1513 can be independently actuated by their respective drive wheels, the switches 1513 can help to reduce an occurrence of failure to detect docking when proper docking has occurred, which may be more likely to occur with a single switch.

[0046] FIG. 17A illustrates an enlarged cross-sectional isometric view of the docking station 1500. FIG. 17B illustrates an enlarged bottom cross-sectional isometric view of the docking station 1500. FIGS. 17A and 17B are discussed together below.

[0047] The docking station 1500 of FIGS. 17A and 17B can be consistent with the docking station 1500 discussed above. FIGS. 17A and 17B show additional details of the docking station 1500. For example, FIG. 17A shows that the contact switch 1511 of the contacts mechanism 1507 can extend through an opening 1515 in the base 1510, which can be located between the contacts 1526. The opening 1515 can allow the contact switch 1511 to extend above a surface of the base 1510 to allow for engagement with the robot.

[0048] FIG. 17B shows that the contacts mechanism 1507 can be located, at least in part, on an underside of the base 1510 and can be connected thereto. FIG. 17B also shows that the contact switch 1511 can be connected to an arm 1517. The arm 1517 can be located on an underside of the base 1510 and can be connected to a biasing element, such as a spring (e.g., a torsion spring). The spring can be connected to a support 1523,

where the support or base 1523 can be configured to secure the contacts mechanism 1507 to the base 1510.

[0049] FIG. 18A illustrates an isometric view of the contacts mechanism 1507. FIG. 18B illustrates an isometric view of a portion of the contacts mechanism 1507. FIGS. 18A and 18B are discussed together below. The contacts mechanism 1507 can be consistent with the contacts mechanism 1507 discussed above; FIGS. 18A and 18B show additional details of the contacts mechanism 1507.

[0050] For example, FIG. 18A shows that the charging contacts 1526a and 1526b can be connected to armatures 1519a and 1519b, respectively. The armatures 1519 can support the contacts 1526 and can connect the contacts 1526 to respectively linkages 1521a and 1521b. The linkages 1521a and 1521b can each be connected to supports 1523a and 1523b, respectively, such that the linkages 1521a and 1521b can be rotatable or pivotable with respect to the supports 1523a and 1523b, respectively. The supports 1523a and 1523b can be secured to the base 1510 as shown in FIG. 17B.

[0051] FIGS. 18A and 18B also show that the bases 1523 can be configured to receive fasteners 1525 to secure the bases or supports 1523 to the base 1510. The fasteners 1525 can be screws, rivets, or the like. FIGS. 18A and 18B further show that the linkages 1521a and 1521b can be connected to arms 1517a and 1517b by pins 1525a and 1525b, respectively. Also shown are biasing elements 1527a and 1527b, which can be secured to the pins 1525a and 1525b, respectively, and engaged with the linkages 1521a and 1521b, respectively.

[0052] In operation, when the supports or bases 1523 are secured to (the underside of) the base 1510 of the dock 1500, the biasing elements 1527 can engage the base 1510 and the linkages 1521 such as to bias the linkages 1521 (and therefore the contacts 1526) to a retracted position. Then, when the contact switch 1511 is engaged by the robot during docking, such as a caster of the robot, the arms 1517a and 1517b can move, overcoming a biasing force of the biasing elements 1527a and 1527b. When the biasing force is overcome, the linkages 1521a and 1521b can be caused to rotate or pivot, resulting in moving of the contacts 1526 to an extended position, such as for engaging charging contacts of the robot. In this way, the contacts 1526 can be protected within the base 1510 until the robot is fully docked on the base 1510.

[0053] FIG. 18B also shows a magnetic element 1529 (location shown in FIG. 17B), which can be configured to attract a charging contact of the robot to help ensure the 1526a is in contact the charging contact of the robot. The charging contact 1526b can optionally include a similar magnetic element.

[0054] FIG. 18B also shows a tab 1531 that can be connected to the contact 1526a. The tab 1531 can connect the contact 1526, such as to electrically, to a power supply of the dock 1500. Optionally, the tab 1531 can

complete a circuit only when the contacts 1526 are in an extended position, such that the tab 1531 moves to break the circuit as the contacts 1526 move to the retracted position.

[0055] FIG. 19 illustrates an isometric view of a portion of a docking station 1900. The docking station 1900 can be similar to the docking stations discussed above; the docking station 1900 can differ in that it can be divided into segments. Any of the docking stations discussed above or below can include the features of the docking station 1900.

[0056] As shown in FIG. 19, the docking station 1900 can include a base segment 1933 that can include a docking port 1924 and can include or be connected to a base 1910 (which can be similar to the docking port 124 and the base 110 discussed above). An evacuation segment 1935 can be connected to the base segment 1933 and can be configured to support or include a bag drawer 1934 and a fan system 1952 (which can be similar to the bag drawer 134 and the fan system 152 discussed above). Optionally, the evacuation segment 1935 can be removably connected to the base segment 1933 such that the base segment 1933 can be used for docking stations having only a base 1910 and can be used for docking stations including evacuation components (such as the bag drawer 1934 and the fan system 1952).

[0057] A fluid segment 1937 can be connected to the evacuation segment 1935 and can include a clean fluid tank 1930 and a dirty fluid tank 1939. The clean fluid tank 1930 can be configured to deliver cleaning fluid to a robot and the dirty fluid tank 1939 can be configured to receive dirty fluid from the robot. Optionally, the fluid segment 1937 can be removably connected to the evacuation segment 1935 such that the evacuation segment 1935 can be used for docking stations not including a fluid segment 1937 and can be used for docking stations including the fluid segment 1937.

[0058] The docking station 1900 can also optionally include a pad washing system 1941 connected to the 1910. The pad washing system 1941 can be a roller engageable with a pad of a robot and operable (e.g., rotatable) to agitate and clean a dirty pad, such as following a mopping mission or during a mopping mission. Optionally the pad washing system 1941 can connect to the clean fluid tank 1930 and the dirty fluid tank 1939 for use of the fluids during pad washing operations.

[0059] FIG. 20 illustrates an enlarged side cross-sectional view of a docking station 2000. The docking station 2000 can be similar to the docking stations discussed above; the docking station 2000 can differ in that it can include a drawer with a seal. Any of the docking stations discussed above or below can include the features of the docking station 2000.

[0060] The docking station 2000 can include a debris compartment 2032 and a bag drawer 2034 slidably movable therein. The debris compartment 2032 and the bag drawer 2034 can be similar to the debris compartment 132 and the bag drawer 134 discussed above. FIG. 20

shows that the bag drawer 2034 can include a seal 2043 connected to an inner front face 2045 of the bag drawer 2034. The seal 2043 can be engageable with the bag or debris compartment 2032 such as to seal the bag drawer 2034 when the bag drawer 2034 is in the closed position, as shown in FIG. 20. In such a configuration, the seal 2043 can be compressed between the bag drawer 2034 and the debris compartment 2032 to create a sealed compartment within the debris compartment 2032. Optionally, the bag drawer 2034 can include a retainer 2047. The retainer 2047 can be connected to the inner face 2045. The retainer 2047 can extend inward from the inner front face 2045 and can be configured to mechanically retain the seal 2043 to the bag drawer 2034. Optionally, the seal 2043 can be secured to the bag drawer 2034 using one or more fasteners or adhesive.

[0061] FIG. 21 illustrates an enlarged side cross-sectional view of a portion of the docking station 2000. FIG. 22 illustrates a front isometric view of a portion of the docking station 2000. FIG. 23 illustrates an enlarged side cross-sectional view of a portion of the docking station 2000. FIG. 24 illustrates an enlarged side cross-sectional view of a portion of the docking station 2000. FIGS. 21-24 are discussed together below. The docking station 2000 can be consistent with the docking station 2000 discussed above and can be similar to the docking stations discussed above or below. Any of the features of the docking station 2000 can be incorporated into the docking stations discussed above or below.

[0062] FIGS. 21 and 22 show that a tank compartment 2028 of the docking station 2000 can include a fill port 2049, which can be connected to and located in a rear portion of the tank compartment 2028. As shown in FIG. 21, the fill port 2049 can be configured to interface with a fill valve 2051 of a tank 2030. As discussed below with respect to FIGS. 23 and 24, engagement of the fill valve 2051 with the fill port 2049 when the tank 2030 is fully inserted into the tank compartment 2028 can cause the fill valve 2051 to open, allowing fluid to enter the fill port 2049 and a supply tube 2053, such as for supply to a mobile cleaning robot (e.g., the mobile cleaning robot 102).

[0063] FIG. 21 also shows a support 2055 that can be configured to engage the supply tube 2053, such as to limit rearward movement of the supply tube 2053 as the tank 2030 is inserted into the tank compartment 2028 and the fill valve 2051 engages the fill port 2049. FIGS. 21 and 22 further show a latch 2057 connected to a floor 2059 of the tank compartment 2028. The latch 2057 can be configured to engage a recess 2061 of the tank 2030, such as to help limit translation of the tank 2030 with respect to the tank compartment 2028. The latch 2057 can be configured to release the tank 2030 when a force large enough to overcome a biasing force of the latch 2057 applied to the tank 2030 is overcome. Optionally, the latch 2057 can be user-actuable to release the latch 2057 from the recess 2061 and to therefore allow the tank 2030 to be removed from the tank compartment 2028.

[0064] FIGS. 23 and 24 show additional details of the

fill port 2049 and the fill valve 2051. For example, FIGS. 23 and 24 show that the fill port 2049 can include a flange 2063 securable to a rear wall 2065 of the tank compartment 2028, such as to limit movement of the fill port 2049 with respect to the tank compartment 2028.

[0065] FIGS. 23 and 24 also show that the fill port 2049 can include projections 2067, which can extend radially outward from a tube 2069 of the fill port 2049. The projections 2067 can extend outward at different lengths such that the projections 2067 are configured to matingly engage a stopper 2071 of the fill valve 2051, which can help to limit relative movement of the fill valve 2051 with respect to the fill port 2049 and can allow the tube 2069 to engage a plunger 2075 of the fill valve 2051.

[0066] The fill valve 2051 can also include a plunger biasing element 2073 engaged with the plunger 2075 to bias the plunger 2075 to a closed position. When the force applied by the tube 2069 on the plunger 2075 is sufficient to overcome a biasing force of the biasing element 2073 of the fill valve 2051, the plunger 2075 can move to an open position, allowing fluid to flow out of the tank 2030 and through the fill port 2049 such as to fill a tank of a robot (e.g., the mobile cleaning robot 102). In this way, the fill port 2049 can be configured to automatically open the fill valve 2051 when the tank 2030 is fully or properly inserted into the tank compartment 2028.

[0067] FIG. 25 illustrates an isometric view of a docking station 2500 for a mobile cleaning robot. The docking station 2500 can be similar to the docking stations discussed above; the docking station 2500 can differ in that it can be divided into segments and can include a horizontal fill tank. Any of the docking stations discussed above or below can include the features of the docking station 2500.

[0068] As shown in FIG. 25, the docking station 2500 can include a base segment 2533 that can include a docking port 2524 and can include or be connected to a base. An evacuation segment 2535 can be connected to the base segment 2533 and can be configured to support or include a bag drawer and a fan system. Optionally, the evacuation segment 2535 can be removably connected to the base segment 2533 such that the base segment 2533 can be used for docking stations having only a base and can be used for docking stations including evacuation components (such as a bag drawer and a fan system).

[0069] A fluid segment 2537 can be connected to the evacuation segment 2535 and can include a fluid tank 2530. Optionally, the fluid segment 2537 can be removably connected to the evacuation segment 2535 such that the evacuation segment 2535 can be used for docking stations not including a fluid segment 2537 and can be used for docking stations including the fluid segment 2537. The fluid tank 2530 can be insertable into a tank compartment 2528, which can be configured to receive the tank 2530, which can be horizontally oriented. The horizontally oriented tank can help to reduce a total height of the fluid segment 2537. For example, the fluid tank

2530 can be configured to extend across 60 percent to 95 percent of a width W of the fluid segment 2537. Optionally the fluid tank 2530 can extend across about 80 percent of the width W.

[0070] FIG. 26 illustrates an isometric view of a docking station 2600 for a mobile cleaning robot. The docking station 2600 can be similar to the docking stations discussed above; the docking station 2600 can differ in that it can be divided into segments and can include a horizontal fill tank. Any of the docking stations discussed above or below can include the features of the docking station 2600.

[0071] As shown in FIG. 26, the docking station 2600 can include a base segment 2633 that can include a docking port 2624 and can include or be connected to a base 2610. The base 2610 can include various components such as switches and contacts similar to those discussed with respect to the docking stations above, such as the docking station 100.

[0072] An evacuation segment 2635 can be connected to the base segment 2633 and can be configured to support or include a bag drawer and a fan system. Optionally, the evacuation segment 2635 can be removably connected to the base segment 2633 such that the base segment 2633 can be used for docking stations having only a base and can be used for docking stations including evacuation components (such as a bag drawer 2634 insertable into a bag debris compartment 2632, and a fan system).

[0073] A fluid segment 2637 can be connected to the evacuation segment 2635 and can include a fluid tank 2630. Optionally, the fluid segment 2637 can be removably connected to the evacuation segment 2635 such that the evacuation segment 2635 can be used for docking stations not including the fluid segment 2637 and can be used for docking stations including the fluid segment 2637. The fluid tank 2630 can be insertable into a tank compartment 2628, which can be configured to receive the tank 2630 therein. The tank 2630 can be horizontally oriented.

NOTES AND EXAMPLES

[0074] The following, non-limiting examples, detail certain aspects of the present subject matter to solve the challenges and provide the benefits discussed herein, among others.

[0075] Example 1 is a docking station for a mobile cleaning robot, the docking station comprising: a base configured to receive at least a portion of the mobile cleaning robot, the base including an electrical power interface configured to provide electrical power to the mobile cleaning robot; and a canister connected to the base and located at least partially above the base, the canister comprising: a debris bin to receive debris from the mobile cleaning robot.

[0076] In Example 2, the subject matter of Example 1 optionally includes wherein the base defines a pair of

wheel wells configured to receive respective drive wheels of the mobile cleaning robot therein to align robot charging contacts of the mobile cleaning robot with the electrical power interface of the base.

[0077] In Example 3, the subject matter of Example 2 optionally includes a pair of wheel switches located in the pair of wheel wells, respectively, the pair of wheel switches independently engageable by respective drive wheels when the drive wheels are positioned in respective ones of the wheel wells to produce independent docking signals.

[0078] In Example 4, the subject matter of any one or more of Examples 1-3 optionally include wherein the electrical power interface includes a pair of dock charging contacts connected to the base and configured to engage the robot charging contacts when the mobile cleaning robot is docked on the base, the dock charging contacts movable between a retracted position and an extended position, the dock charging contacts engageable with the robot charging contacts when in the extended position.

[0079] In Example 5, the subject matter of Example 4 optionally includes a switch connected to the base and engageable with the mobile cleaning robot to move the dock charging contacts to the extended position.

[0080] In Example 6, the subject matter of Example 5 optionally includes wherein the dock charging contacts are biased to the retracted position.

[0081] In Example 7, the subject matter of Example 6 optionally includes wherein the switch is engageable with a wheel of the mobile cleaning robot to overcome bias of the dock charging contacts.

[0082] In Example 8, the subject matter of any one or more of Examples 4-7 optionally include a pair of magnets associated with respective ones of the dock charging contacts and attractable to the robot charging contacts, respectively.

[0083] In Example 9, the subject matter of any one or more of Examples 1-8 optionally include a fluid tank connected to the canister to deliver cleaning fluid to the mobile cleaning robot.

[0084] In Example 10, the subject matter of Example 9 optionally includes a fill spout connected to the canister and fluidly connected to the fluid tank, the fill spout insertable into a portion of the mobile cleaning robot to deliver cleaning fluid from the fluid tank to the mobile cleaning robot.

[0085] In Example 11, the subject matter of any one or more of Examples 9-10 optionally include wherein the fluid tank is insertable through a front portion of the canister.

[0086] In Example 12, the subject matter of Example 11 optionally includes a fill valve connected to the fluid tank and engageable with a port of the canister to move the fill valve to an open position when the fluid tank is secured to the canister.

[0087] In Example 13, the subject matter of Example 12 optionally includes wherein the port of the canister is secured by a brace.

[0088] In Example 14, the subject matter of any one or more of Examples 1-13 optionally include an evacuation fan connected to the canister and connectable to the mobile cleaning robot to evacuate debris from a debris bin of the mobile cleaning robot to a debris bag of the canister.

[0089] In Example 15, the subject matter of Example 14 optionally includes an evacuation discharge connected to a discharge side of the evacuation fan and extending through the canister, the evacuation discharge configured to discharge evacuation air toward the base.

[0090] Example 16 is a docking station for a mobile cleaning robot, the docking station comprising: a base configured to receive at least a portion of the mobile cleaning robot, the base including an electrical power interface configured to provide electrical power to the mobile cleaning robot; and a canister connected to the base and located at least partially above the base, the canister comprising: a debris bin to receive debris from the mobile cleaning robot, the debris bin; and a door connected the canister and movable between an open position and a closed position, a front portion of the canister user-accessible when the door is in the open position.

[0091] In Example 17, the subject matter of Example 16 optionally includes an evacuation fan connected to the canister and connectable to the mobile cleaning robot to evacuate debris from a debris bin of the mobile cleaning robot to a debris bag of the canister.

[0092] In Example 18, the subject matter of Example 17 optionally includes a bag drawer slidably insertable into a bag compartment of the canister between an open position and a closed position, the bag drawer configured to releasably receive the debris bag therein.

[0093] In Example 19, the subject matter of Example 18 optionally includes wherein the bag drawer includes a seal connected to an inner front face of the bag drawer, the seal engageable with the bag compartment to seal the bag drawer when the bag drawer is in the closed position.

[0094] In Example 20, the subject matter of Example 19 optionally includes an evacuation discharge connected to a discharge of the bag drawer and extending through the canister, the evacuation discharge configured to discharge evacuation air toward the base.

[0095] In Example 21, the apparatuses or method of any one or any combination of Examples 1 - 20 can optionally be configured such that all elements or options recited are available to use or select from.

[0096] The above detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as "examples." Such examples can include elements in addition to those shown or described. However, the present inventors also contemplate examples in which only those elements shown or described are pro-

vided. Moreover, the present inventors also contemplate examples using any combination or permutation of those elements shown or described (or one or more aspects thereof), either with respect to a particular example (or one or more aspects thereof), or with respect to other examples (or one or more aspects thereof) shown or described herein.

[0097] In this document, the terms "a" or "an" are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of "at least one" or "one or more." In this document, the term "or" is used to refer to a nonexclusive or, such that "A or B" includes "A but not B," "B but not A," and "A and B," unless otherwise indicated. In this document, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, composition, formulation, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

[0098] The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description as examples or embodiments, with each claim standing on its own as a separate embodiment, and it is contemplated that such embodiments can be combined with each other in various combinations or permutations. The scope of the invention should be determined with reference to the appended claims.

Claims

1. A docking station (100; 1500; 1900; 2000; 2500; 2600) for a mobile cleaning robot (102; 1502), the docking station comprising:

a base (110; 1510; 1910; 2610) configured to receive at least a portion of the mobile cleaning robot, the base including an electrical power interface configured to provide electrical power to the mobile cleaning robot; and
a canister (108) connected to the base and

located at least partially above the base, the canister comprising:

a debris bin to receive debris from the mobile cleaning robot, **characterized in that** the docking station further comprises:
a fluid tank (130; 1930; 2030; 2530; 2630) connected to the canister to deliver cleaning fluid to the mobile cleaning robot.

2. The docking station of claim 1, wherein the base defines a pair of wheel wells (120a, 120b; 1520a, 1520b) configured to receive respective drive wheels of the mobile cleaning robot therein to align robot charging contacts of the mobile cleaning robot with the electrical power interface of the base.
3. The docking station of claim 2, further comprising: a pair of wheel switches (1513a, 1513b) located in the pair of wheel wells, respectively, the pair of wheel switches independently engageable by respective drive wheels when the drive wheels are positioned in respective ones of the wheel wells to produce independent docking signals.
4. The docking station of any of claims 1-3, wherein the electrical power interface includes a pair of dock charging contacts (126; 1526) connected to the base and configured to engage the robot charging contacts when the mobile cleaning robot is docked on the base, the dock charging contacts movable between a retracted position and an extended position, the dock charging contacts engageable with the robot charging contacts when in the extended position.
5. The docking station of claim 4, further comprising: a switch (1511) connected to the base and engageable with the mobile cleaning robot to move the dock charging contacts to the extended position.
6. The docking station of claim 5, wherein the dock charging contacts are biased to the retracted position.
7. The docking station of claim 6, wherein the switch is engageable with a wheel of the mobile cleaning robot to overcome bias of the dock charging contacts.
8. The docking station of claim 4, further comprising: a pair of magnets (1529) associated with respective ones of the dock charging contacts and attractable to the robot charging contacts, respectively.
9. The docking station of claim 1, further comprising: a fill spout (166) connected to the canister and fluidly connected to the fluid tank, the fill spout insertable into a portion of the mobile cleaning robot to deliver

cleaning fluid from the fluid tank to the mobile cleaning robot.

10. The docking station of claim 1, wherein the fluid tank is insertable through a front portion of the canister. 5
11. The docking station of claim 10, further comprising: a fill valve (2051) connected to the fluid tank and engageable with a port of the canister to move the fill valve to an open position when the fluid tank is secured to the canister. 10
12. The docking station of claim 11, wherein the port of the canister is secured by a brace. 15
13. The docking station of any of claims 1-12, further comprising: an evacuation fan connected to the canister and connectable to the mobile cleaning robot to evacuate debris from a debris bin of the mobile cleaning robot to a debris bag of the canister. 20
14. The docking station of claim 13, further comprising: an evacuation discharge connected to a discharge side of the evacuation fan and extending through the canister, the evacuation discharge configured to discharge evacuation air toward the base. 25

Patentansprüche

1. Andockstation (100; 1500; 1900; 2000; 2500; 2600) für einen mobilen Reinigungsroboter (102; 1502), wobei die Andockstation Folgendes umfasst:

eine Basis (110; 1510; 1910; 2610), die dazu ausgelegt ist, zumindest einen Teil des mobilen Reinigungsroboters aufzunehmen, wobei die Basis eine elektrische Leistungsschnittstelle beinhaltet, die dazu ausgelegt ist, dem mobilen Reinigungsroboter elektrische Leistung bereitzustellen; und einen Kanister (108), der mit der Basis verbunden ist und sich zumindest teilweise über der Basis befindet, wobei der Kanister Folgendes umfasst:

einen Schmutzbehälter zum Aufnehmen von Schmutz aus dem mobilen Reinigungsroboter, **dadurch gekennzeichnet, dass** die Andockstation ferner Folgendes umfasst:

einen Fluidtank (130; 1930; 2030; 2530; 2630), der mit dem Kanister verbunden ist, um Reinigungsfluid zu dem mobilen Reinigungsroboter zu liefern.

2. Andockstation nach Anspruch 1, wobei die Basis ein

Paar Radkästen (120a, 120b; 1520a, 1520b) definiert, die dazu ausgelegt sind, jeweilige Antriebsräder des mobilen Reinigungsroboters darin aufzunehmen, um Roboterladekontakte des mobilen Reinigungsroboters mit der elektrischen Leistungsschnittstelle der Basis auszurichten.

3. Andockstation nach Anspruch 2, ferner umfassend: ein Paar Radschalter (1513a, 1513b), die sich jeweils in dem Paar Radkästen befinden, wobei das Paar Radschalter unabhängig durch jeweilige Antriebsräder in Eingriff bringbar ist, wenn die Antriebsräder in jeweiligen der Radkästen positioniert sind, um unabhängige Andocksignale zu erzeugen.

4. Andockstation nach einem der Ansprüche 1-3, wobei die elektrische Leistungsschnittstelle ein Paar Andockladekontakte (126; 1526) beinhaltet, die mit der Basis verbunden und dazu ausgelegt sind, die Roboterladekontakte in Eingriff zu bringen, wenn der mobile Reinigungsroboter an der Basis andockt ist, wobei die Andockladekontakte zwischen einer eingefahrenen Position und einer ausgefahrenen Position beweglich sind, wobei die Andockladekontakte mit den Roboterladekontakten in Eingriff bringbar sind, wenn sie sich in der ausgefahrenen Position befinden.

5. Andockstation nach Anspruch 4, ferner umfassend: einen Schalter (1511), der mit der Basis verbunden und mit dem mobilen Reinigungsroboter in Eingriff bringbar ist, um die Andockladekontakte in die ausgeführte Position zu bewegen.

6. Andockstation nach Anspruch 5, wobei die Andockladekontakte in die eingefahrene Position vorgespannt sind.

7. Andockstation nach Anspruch 6, wobei der Schalter mit einem Rad des mobilen Reinigungsroboters in Eingriff bringbar ist, um eine Vorspannung der Andockladekontakte zu überwinden.

8. Andockstation nach Anspruch 4, ferner umfassend: ein Paar Magnete (1529), die jeweiligen der Andockladekontakte zugeordnet sind und jeweils von den Roboterladekontakten angezogen werden können.

9. Andockstation nach Anspruch 1, ferner umfassend: einen Einfüllstutzen (166), der mit dem Kanister verbunden und mit dem Fluidtank strömungstechnisch verbunden ist, wobei der Einfüllstutzen in einen Abschnitt des mobilen Reinigungsroboters einführbar ist, um Reinigungsfluid aus dem Fluidtank zu dem mobilen Reinigungsroboter zu liefern.

10. Andockstation nach Anspruch 1, wobei der Fluidtank durch einen vorderen Abschnitt des Kanisters eins-

etzbar ist.

11. Andockstation nach Anspruch 10, ferner umfassend:
ein Füllventil (2051), das mit dem Fluidtank verbunden und mit einem Anschluss des Kanisters in Eingriff bringbar ist, um das Füllventil in eine geöffnete Position zu bewegen, wenn der Fluidtank am Kanister befestigt ist. 5
12. Andockstation nach Anspruch 11, wobei der Anschluss des Kanisters durch eine Strebe gesichert ist. 10
13. Andockstation nach einem der Ansprüche 1-12, ferner umfassend:
ein Absauggebläse, das mit dem Kanister verbunden und mit dem mobilen Reinigungsroboter verbindbar ist, um Schmutz aus einem Schmutzbehälter des mobilen Reinigungsroboters in einen Schmutzbeutel des Kanisters abzusaugen. 15
14. Andockstation nach Anspruch 13, ferner umfassend:
einen Absaugauslass, der mit einer Auslassseite des Absauggebläses verbunden ist und sich durch den Kanister erstreckt, wobei der Absaugauslass dazu ausgelegt ist, Absaugluft in Richtung der Basis auszulassen. 20

Revendications

1. Station d'accueil (100 ; 1500 ; 1900 ; 2000 ; 2500 ; 2600) pour un robot de nettoyage mobile (102 ; 1502), la station d'accueil comprenant : 35
 une base (110 ; 1510 ; 1910 ; 2610) configurée pour recevoir au moins une partie du robot de nettoyage mobile, la base incluant une interface d'alimentation électrique configurée pour fournir de la puissance électrique au robot de nettoyage mobile ; et
 une chambre (108) reliée à la base et située au moins partiellement au-dessus de la base, la chambre comprenant : 40
 un compartiment de débris destiné à recevoir des débris provenant du robot de nettoyage mobile, **caractérisée en ce que** la station d'accueil comprend en outre : 45
 un réservoir de fluide (130 ; 1930 ; 2030 ; 2530 ; 2630) relié à la chambre pour distribuer du fluide de nettoyage au robot de nettoyage mobile. 50
2. Station d'accueil selon la revendication 1, dans laquelle la base définit une paire de cavités de roues 55

(120a, 120b ; 1520a, 1520b) configurées pour recevoir des roues d'entraînement respectives du robot de nettoyage mobile dans celles-ci pour aligner des contacts de charge de robot du robot de nettoyage mobile avec l'interface d'alimentation électrique de la base.

3. Station d'accueil selon la revendication 2, comprenant en outre :
une paire de commutateurs de roues (1513a, 1513b) situés dans la paire de cavités de roues, respectivement, la paire de commutateurs de roues pouvant être mis en prise indépendamment par des roues d'entraînement respectives lorsque les roues d'entraînement sont positionnées dans les cavités respectives des cavités de roues pour produire des signaux d'arrimage indépendants.
4. Station d'accueil selon l'une quelconque des revendications 1 à 3, dans laquelle l'interface d'alimentation électrique inclut une paire de contacts de charge d'accueil (126 ; 1526) reliés à la base et configurés pour mettre en prise les contacts de charge de robot lorsque le robot de nettoyage mobile est arrimé sur la base, les contacts de charge d'accueil étant mobiles entre une position rétractée et une position étendue, les contacts de charge d'accueil pouvant être mis en prise avec les contacts de charge de robot lorsqu'ils sont dans la position étendue.
5. Station d'accueil selon la revendication 4, comprenant en outre :
un commutateur (1511) relié à la base et pouvant être mis en prise avec le robot de nettoyage mobile pour déplacer les contacts de charge d'accueil vers la position étendue.
6. Station d'accueil selon la revendication 5, dans laquelle les contacts de charge d'accueil sont sollicités vers la position rétractée.
7. Station d'accueil selon la revendication 6, dans laquelle le commutateur peut être mis en prise avec une roue du robot de nettoyage mobile pour surmonter une sollicitation des contacts de charge d'accueil.
8. Station d'accueil selon la revendication 4, comprenant en outre :
une paire d'aimants (1529) associés à des contacts respectifs des contacts de charge d'accueil et pouvant être attirés par les contacts de charge de robot, respectivement.
9. Station d'accueil selon la revendication 1, comprenant en outre :
un bec de remplissage (166) relié à la chambre et relié de manière fluide au réservoir de fluide, le bec

de remplissage pouvant être inséré dans une partie du robot de nettoyage mobile pour distribuer du fluide de nettoyage du réservoir de fluide au robot de nettoyage mobile.

5

10. Station d'accueil selon la revendication 1, dans laquelle le réservoir de fluide peut être inséré dans une partie avant de la chambre.
11. Station d'accueil selon la revendication 10, comprenant en outre :
une vanne de remplissage (2051) reliée au réservoir de fluide et pouvant être mise en prise avec un orifice de la chambre pour déplacer la vanne de remplissage vers une position ouverte lorsque le réservoir de fluide est verrouillé à la chambre.
12. Station d'accueil selon la revendication 11, dans laquelle l'orifice de la chambre est verrouillé par une cale.
13. Station d'accueil selon l'une quelconque des revendications 1 à 12, comprenant en outre :
un ventilateur d'évacuation relié à la chambre et pouvant être relié au robot de nettoyage mobile pour évacuer des débris d'un compartiment de débris du robot de nettoyage mobile vers un sac de débris de la chambre.
14. Station d'accueil selon la revendication 13, comprenant en outre :
un dispositif de décharge d'évacuation relié à un côté de décharge du ventilateur d'évacuation et s'étendant à travers la chambre, le dispositif de décharge d'évacuation étant configuré pour décharger de l'air d'évacuation vers la base.

40

45

50

55

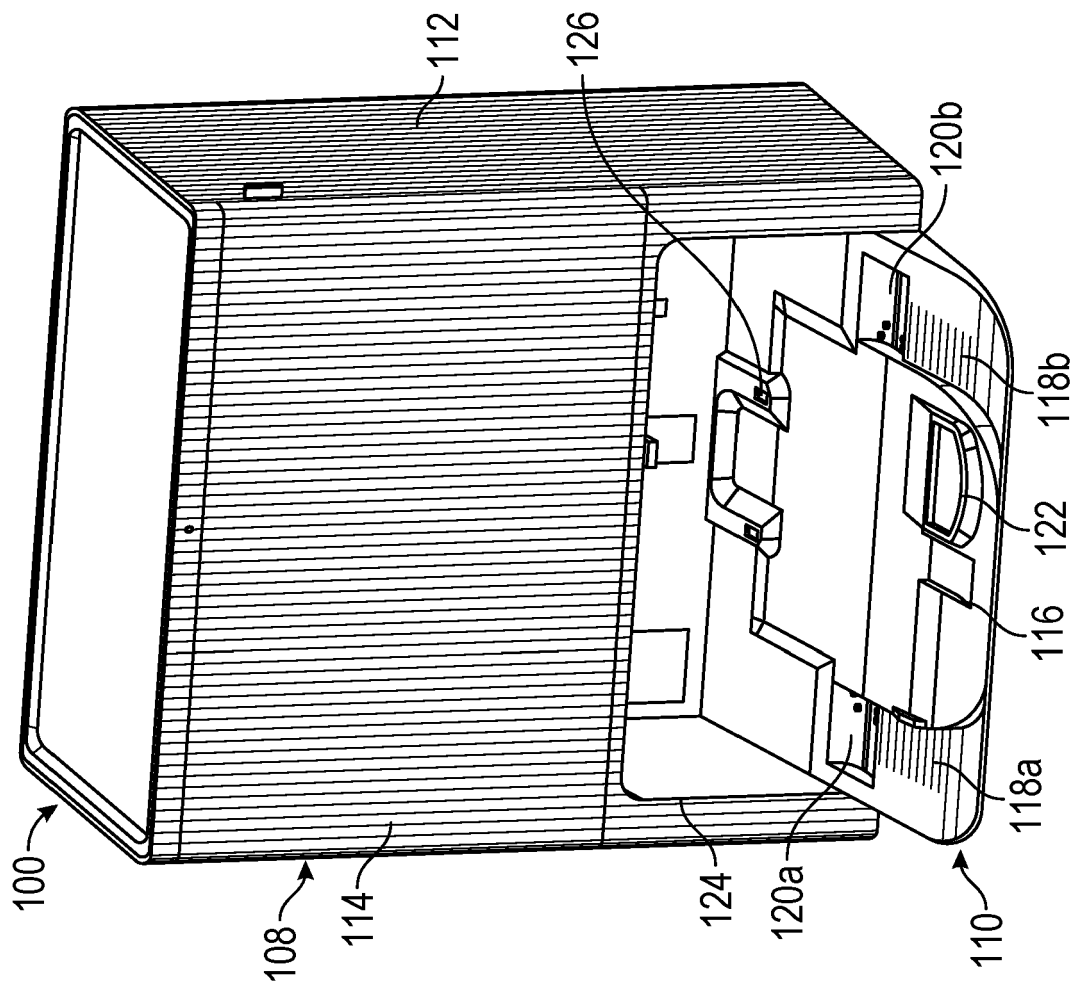
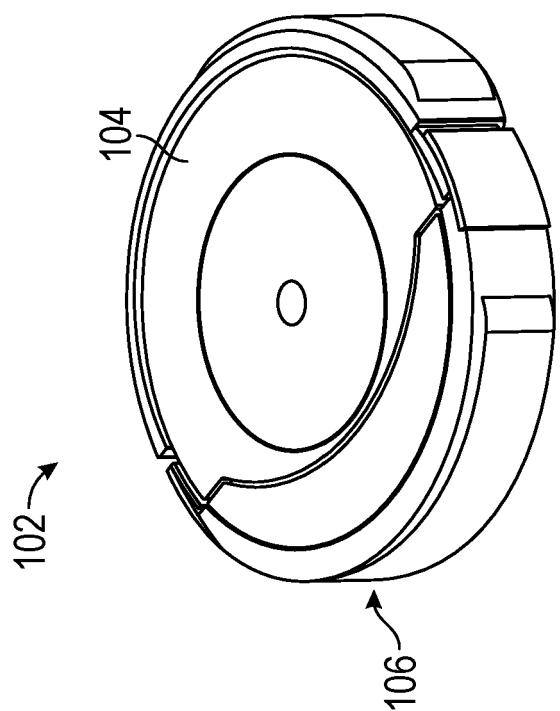


FIG. 1



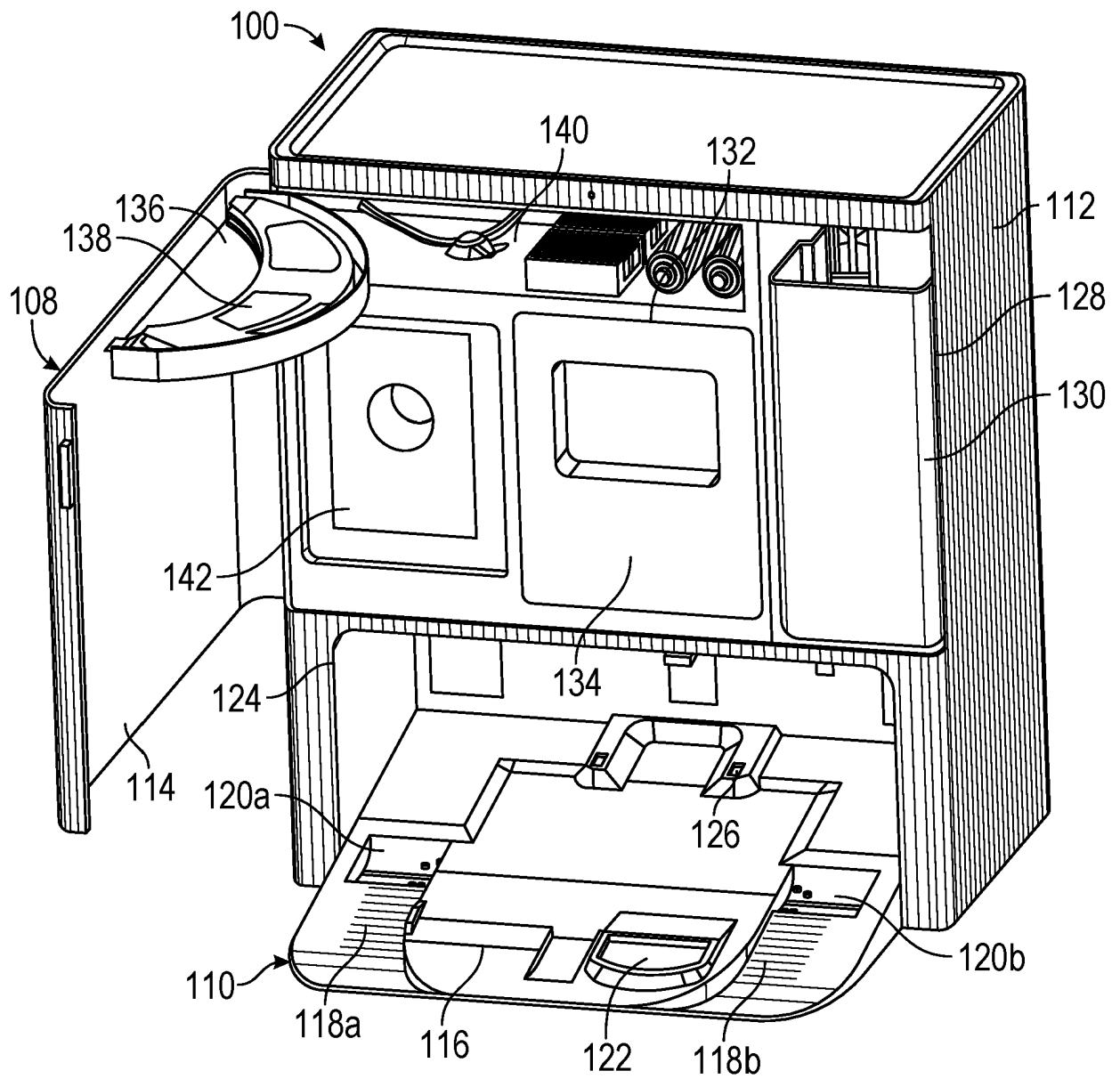


FIG. 2

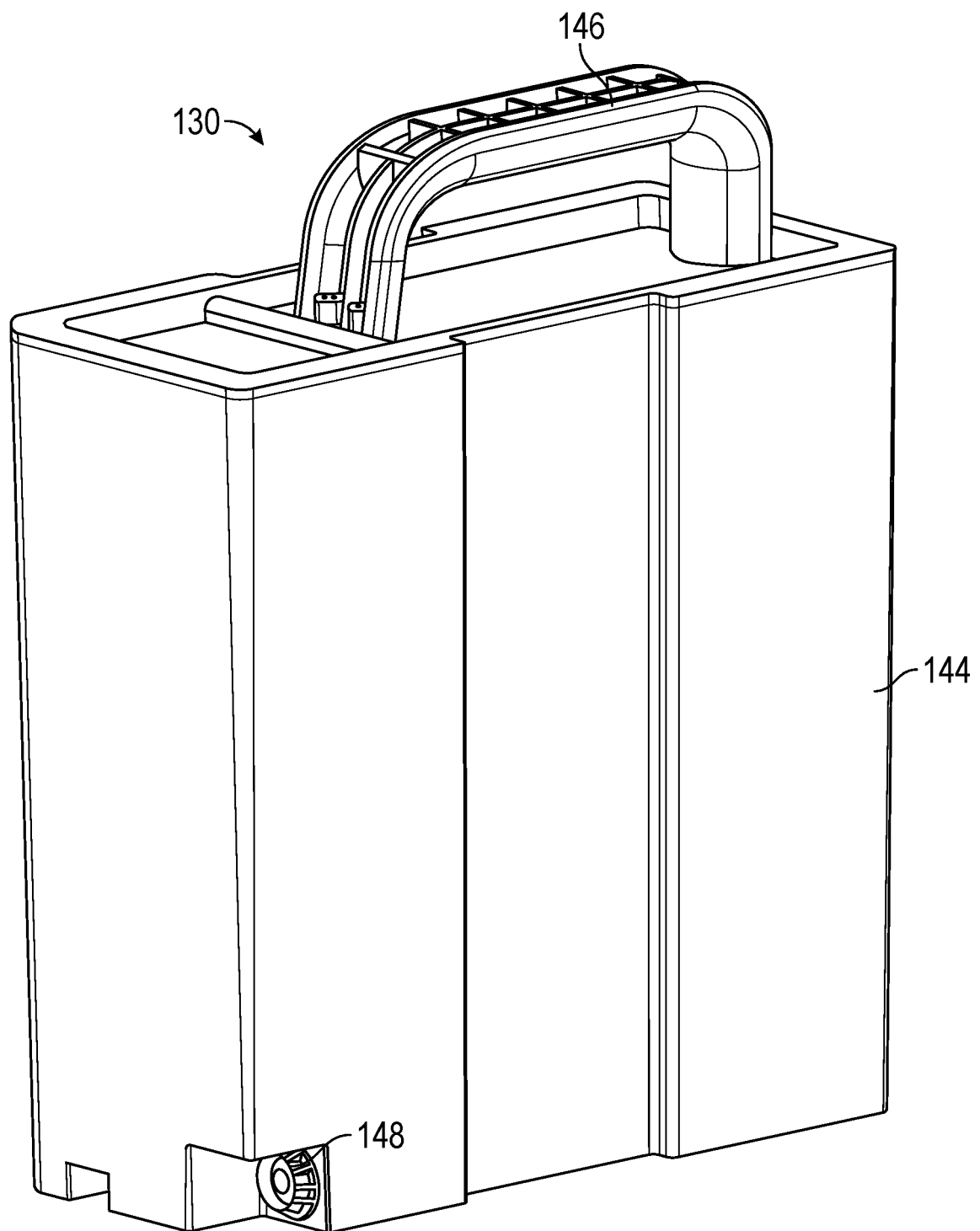


FIG. 3

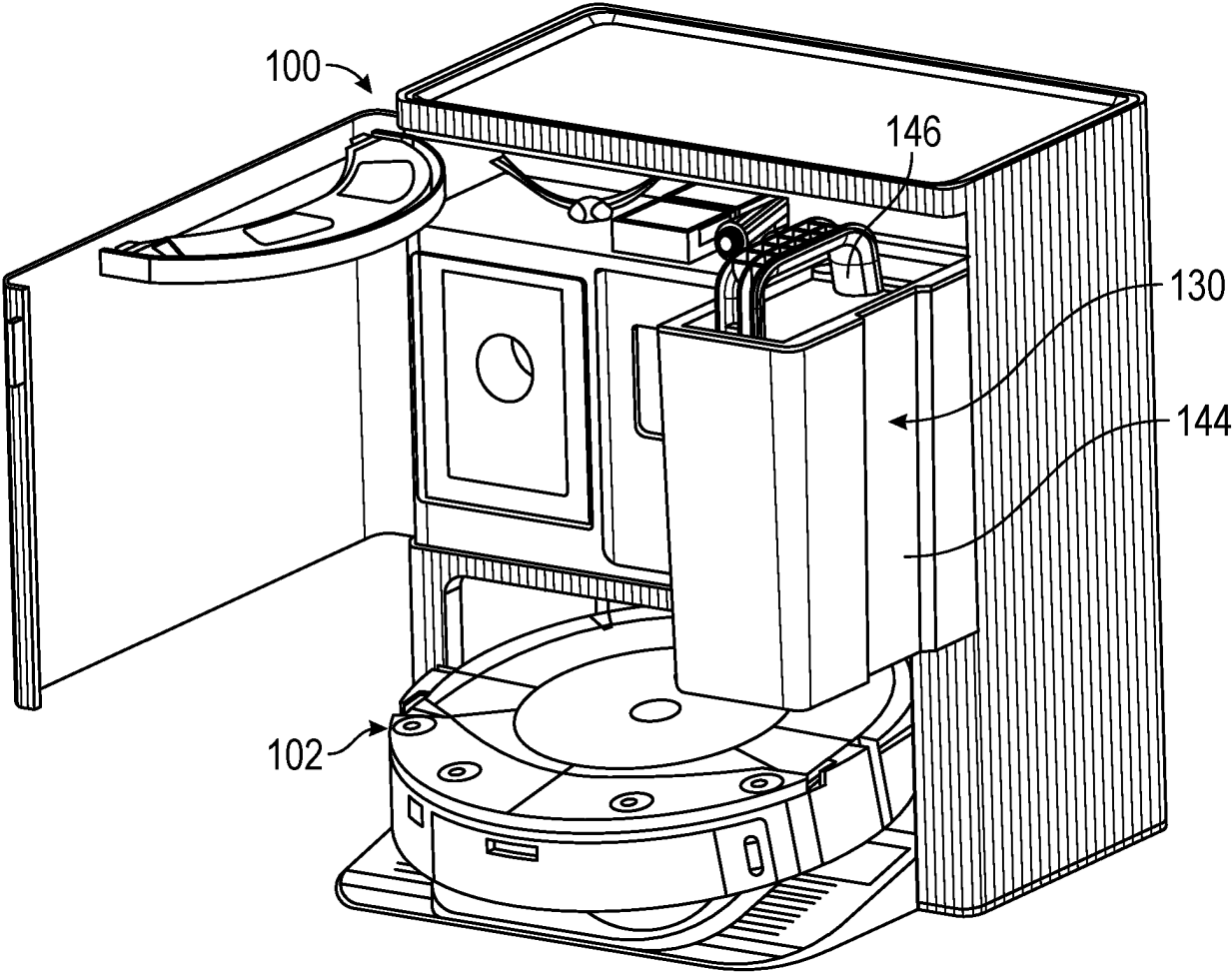


FIG. 4

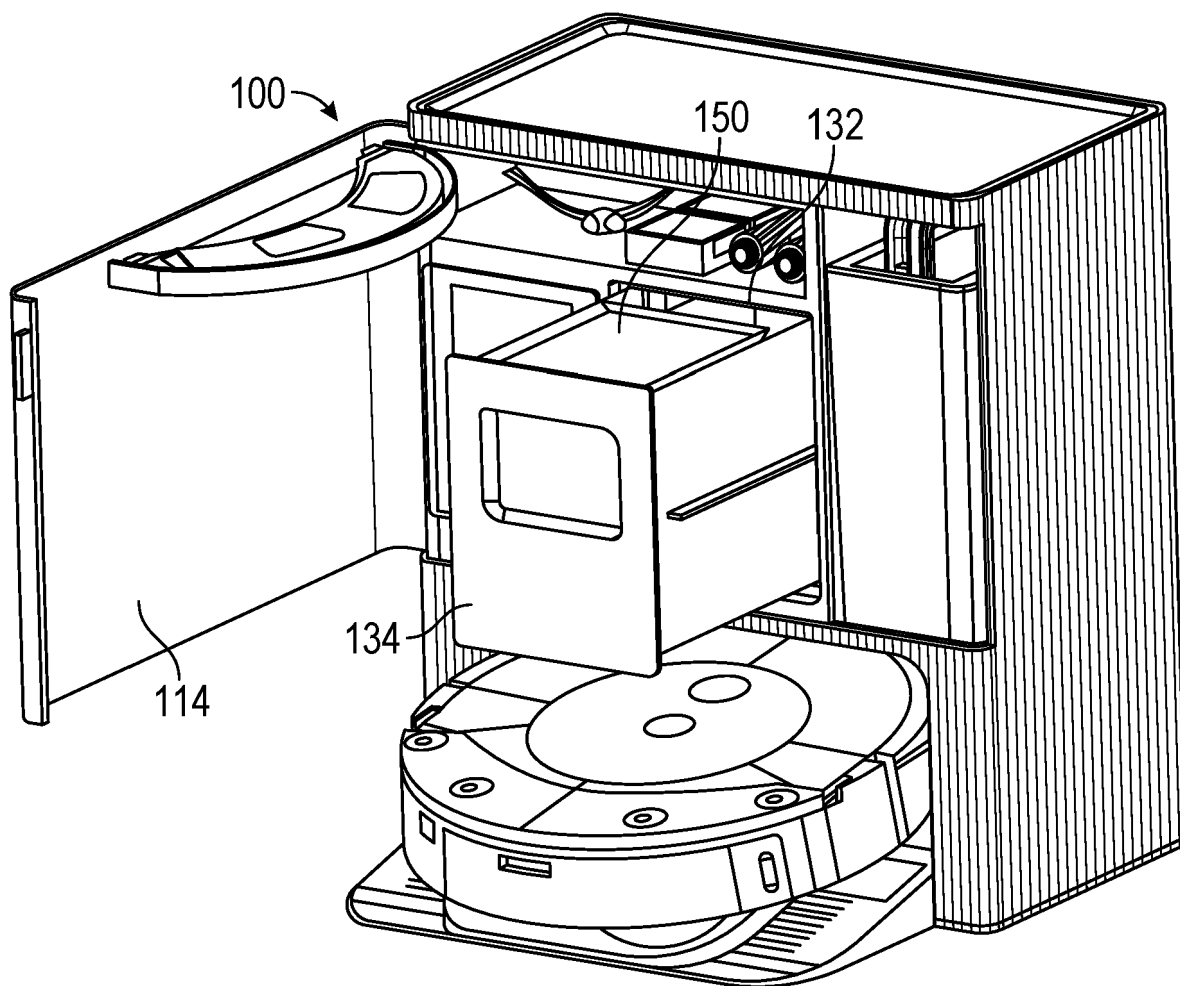


FIG. 5

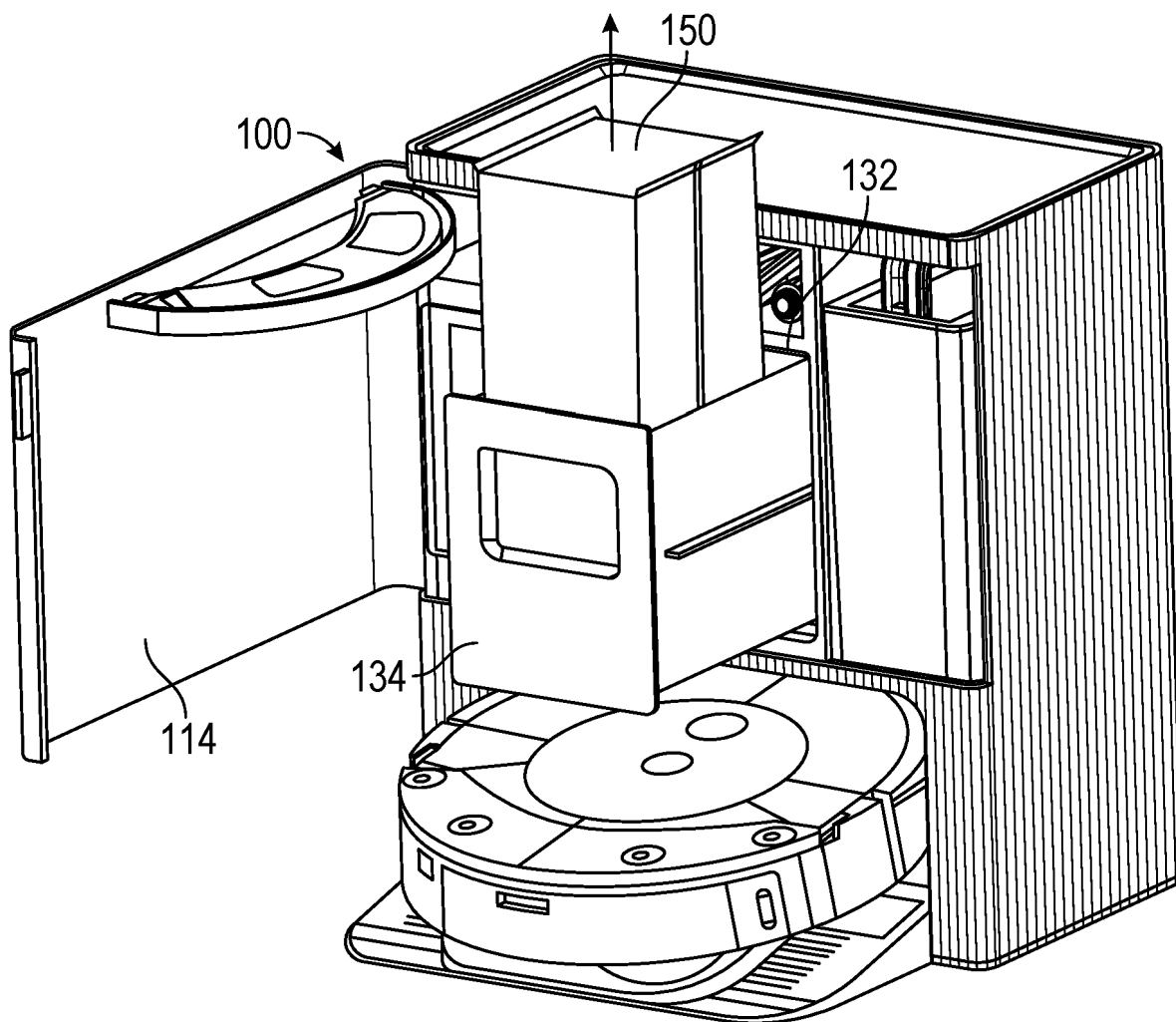


FIG. 6

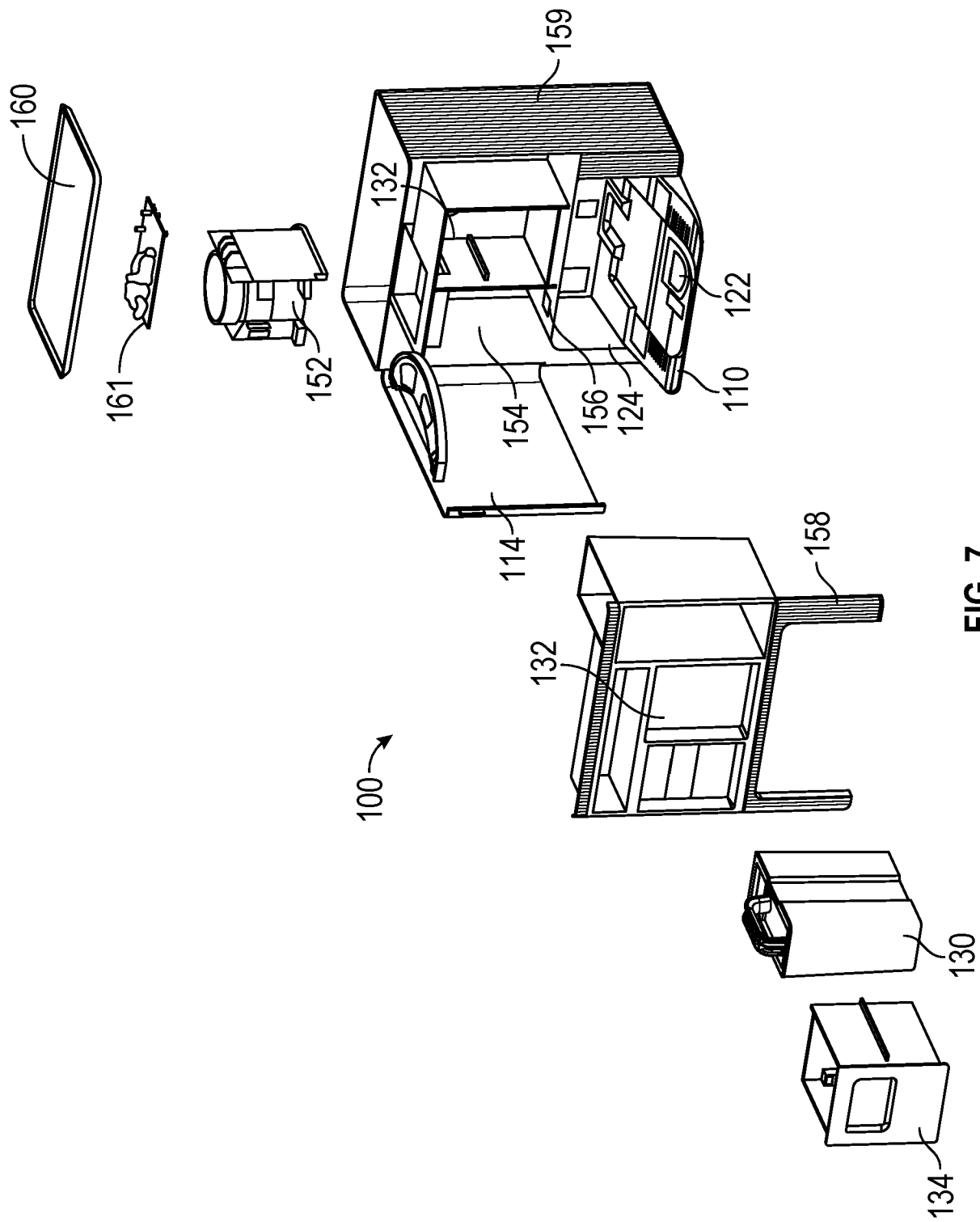


FIG. 7

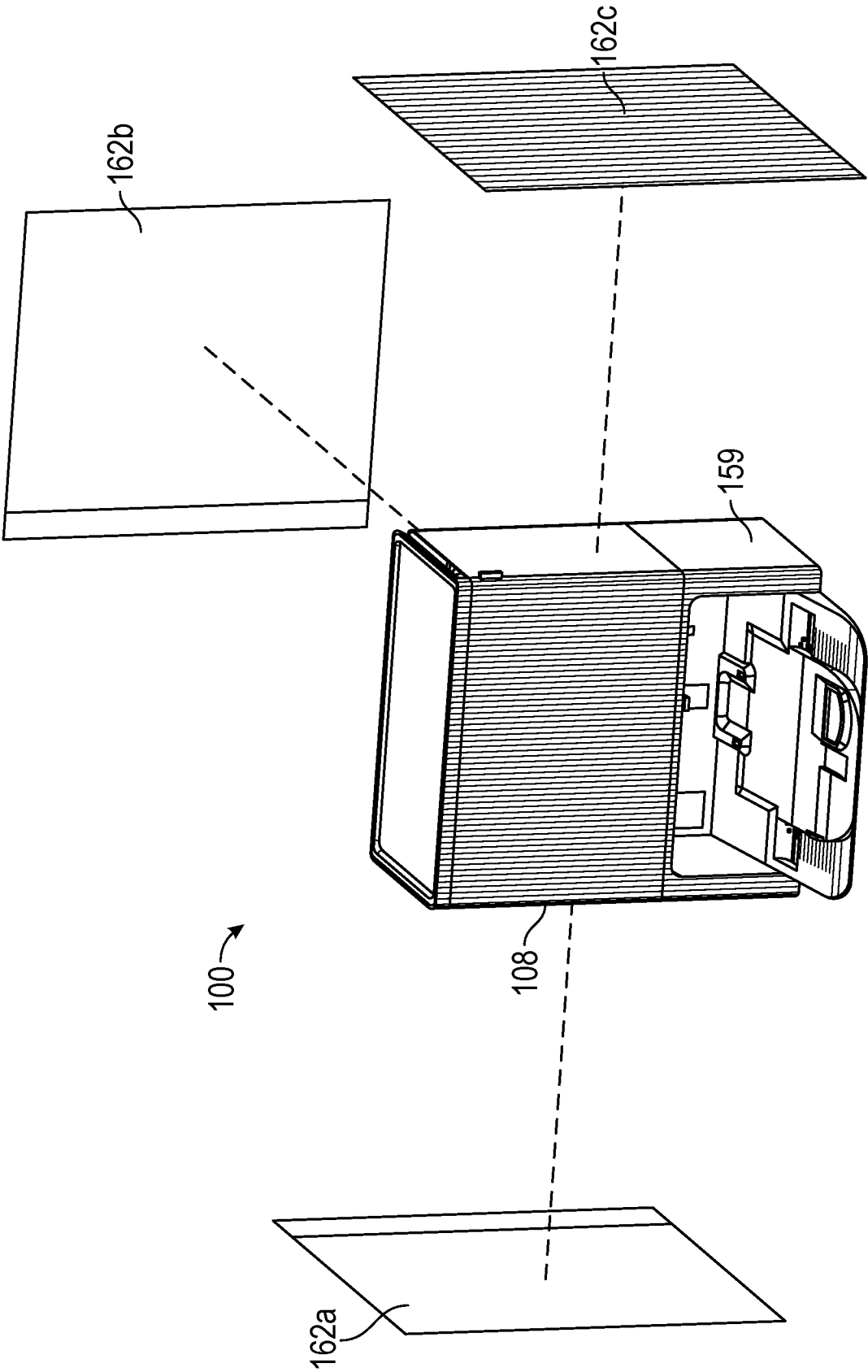


FIG. 8

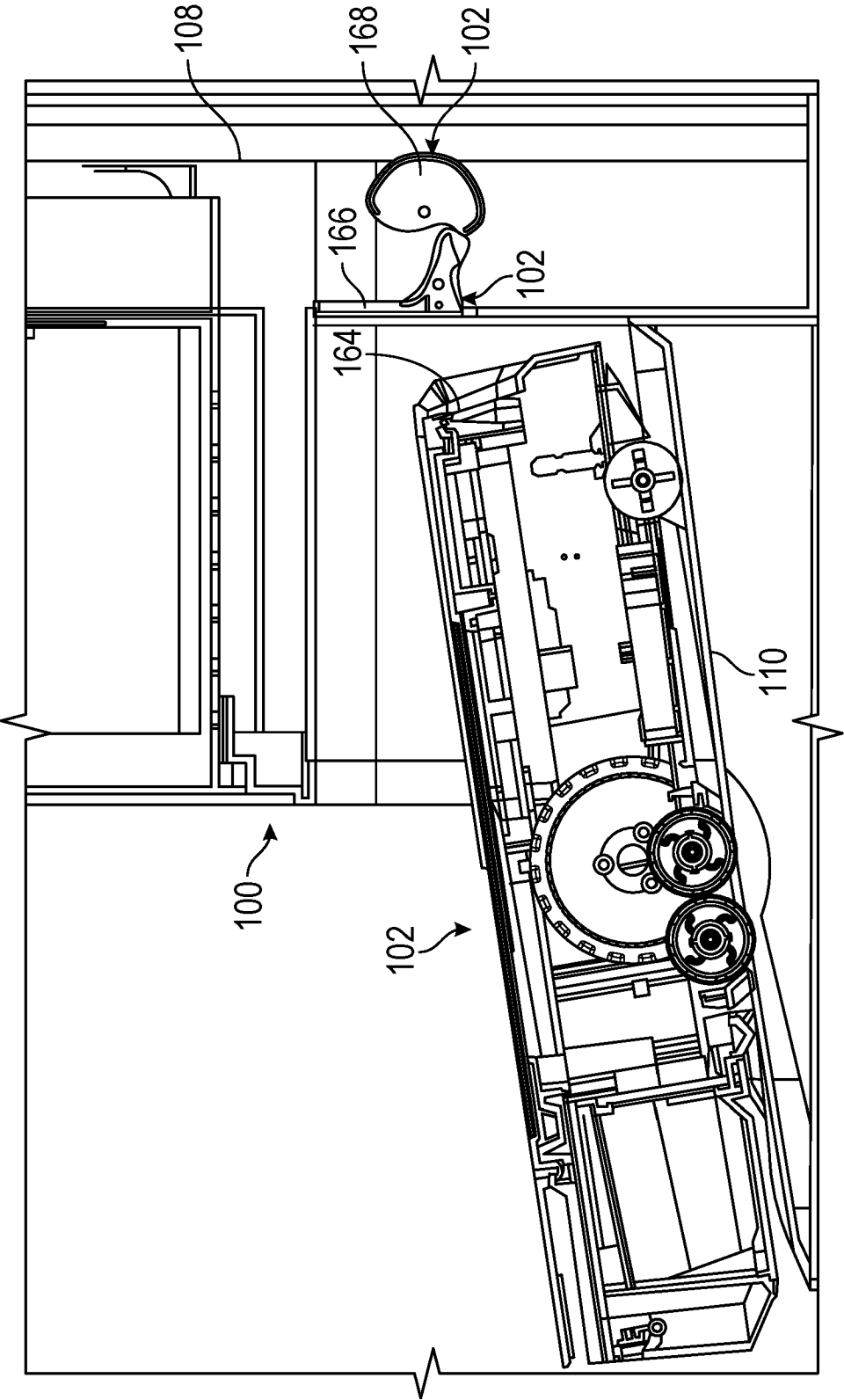


FIG. 9A

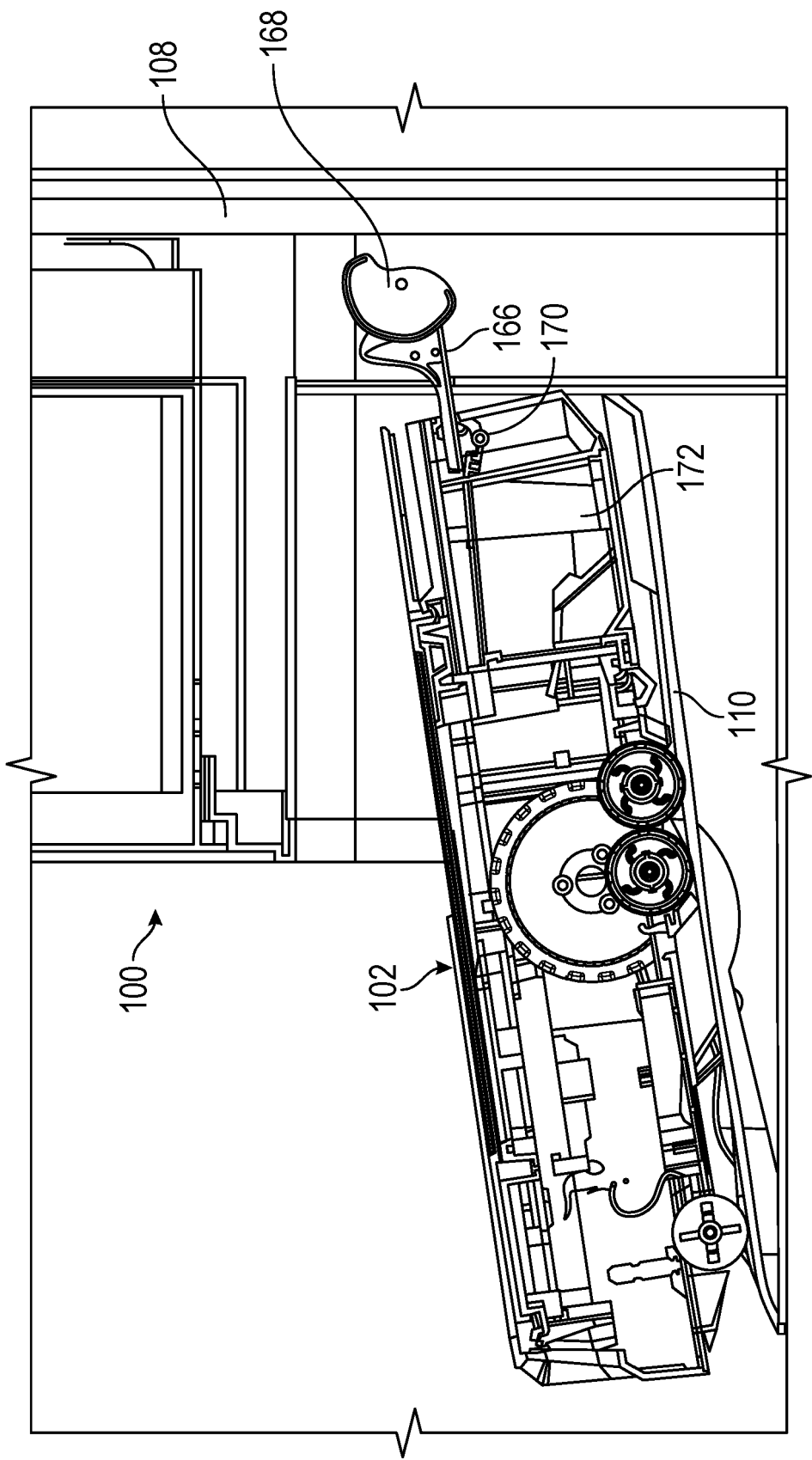


FIG. 9B

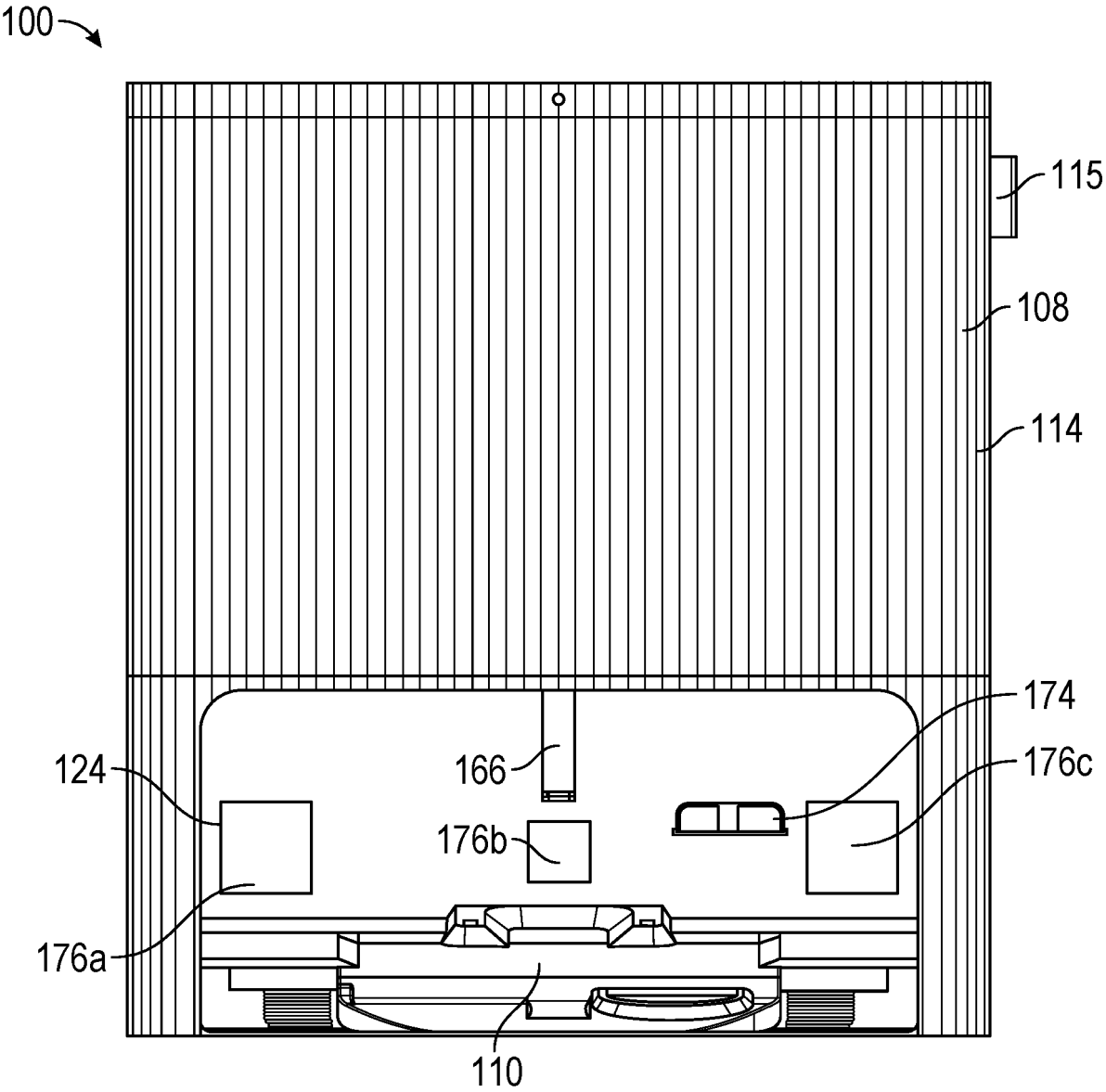


FIG. 10

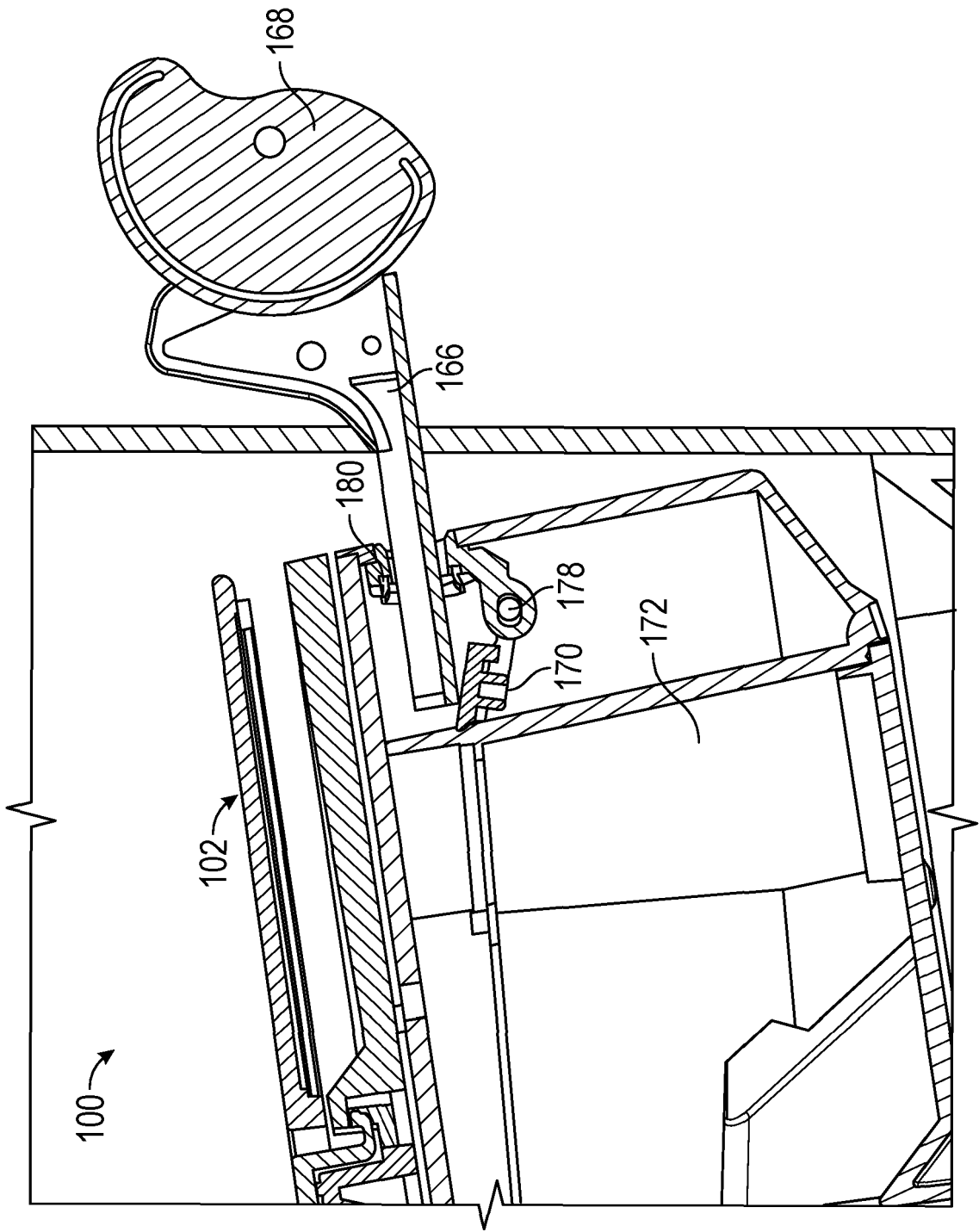


FIG. 11

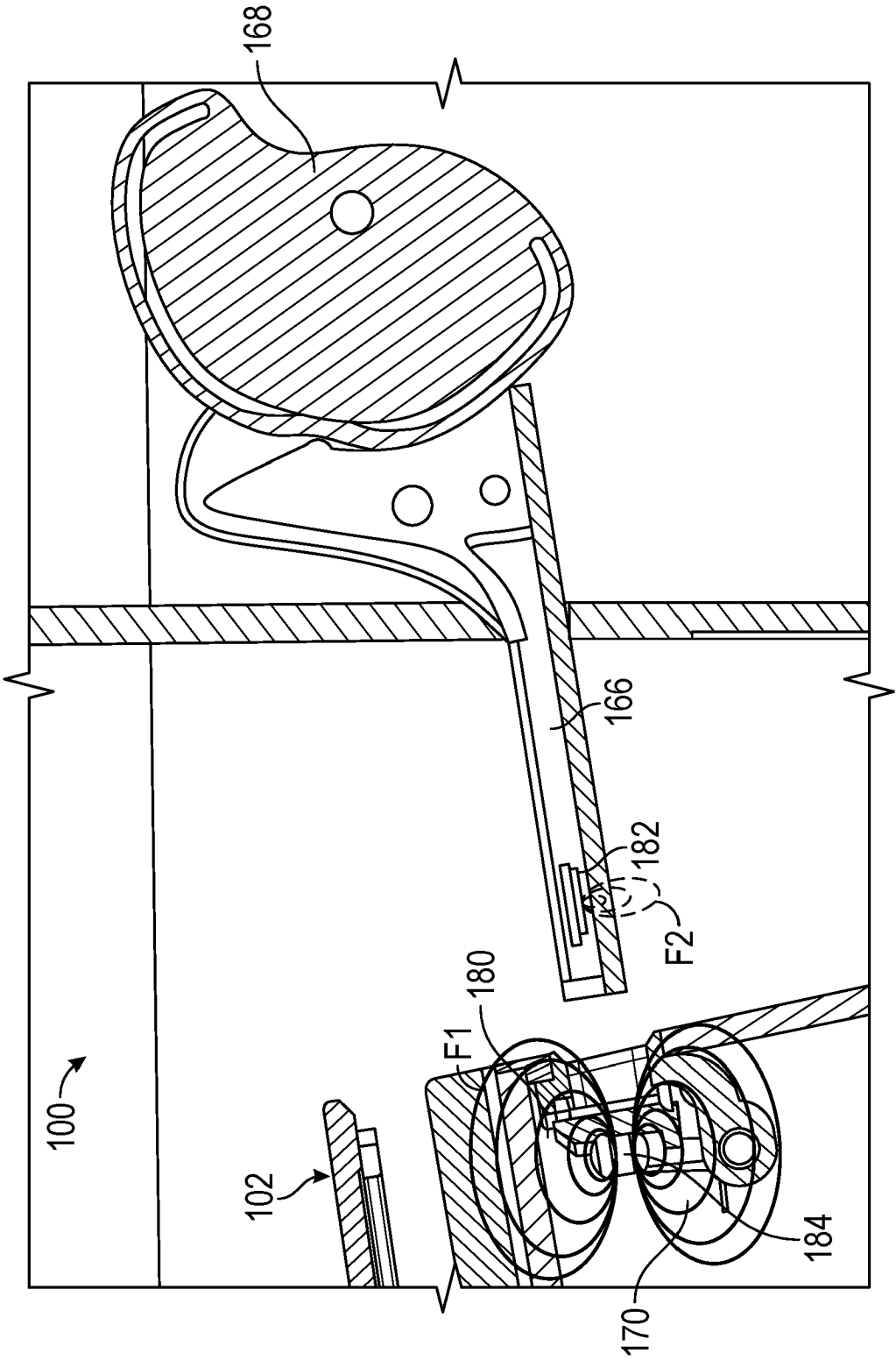


FIG. 12A

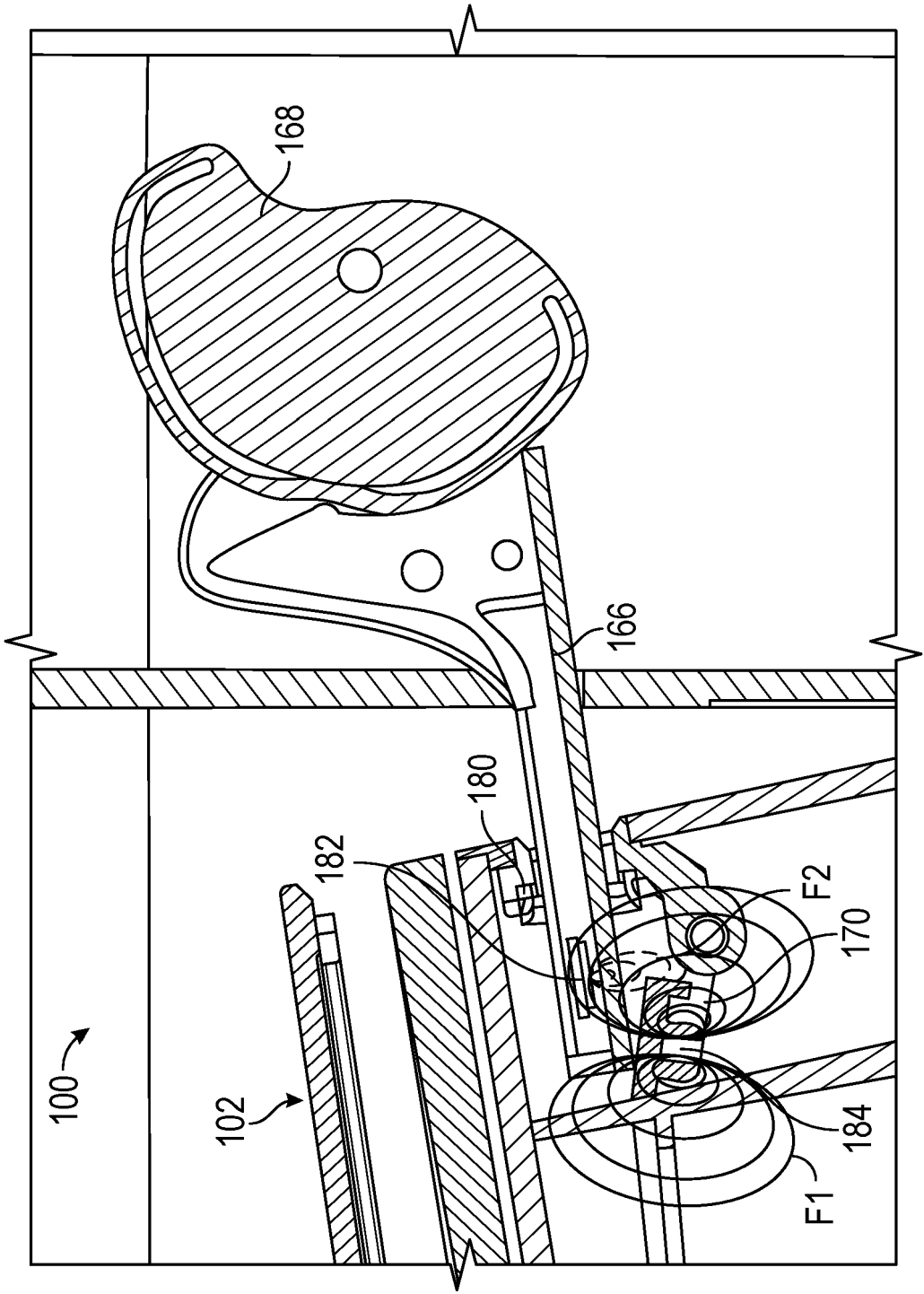


FIG. 12B

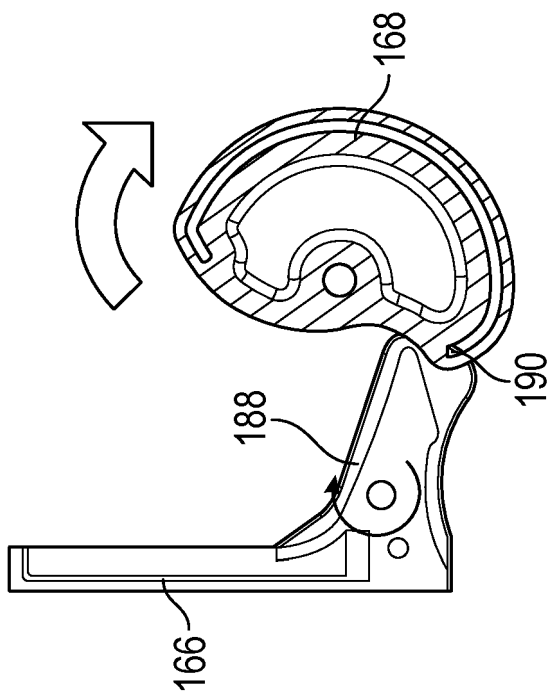


FIG. 13A

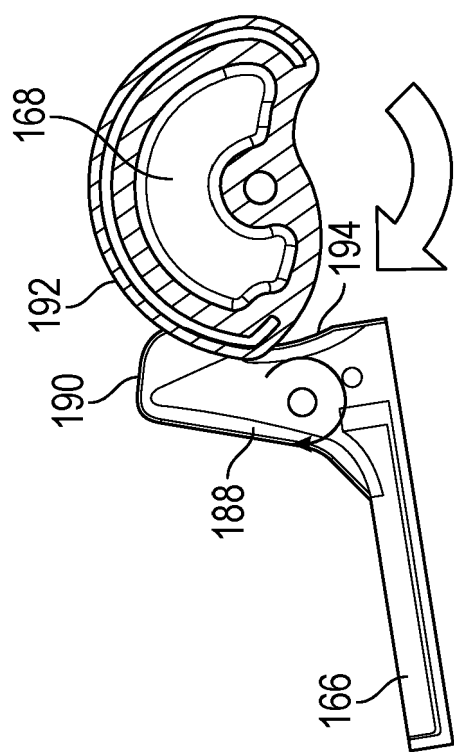


FIG. 13B

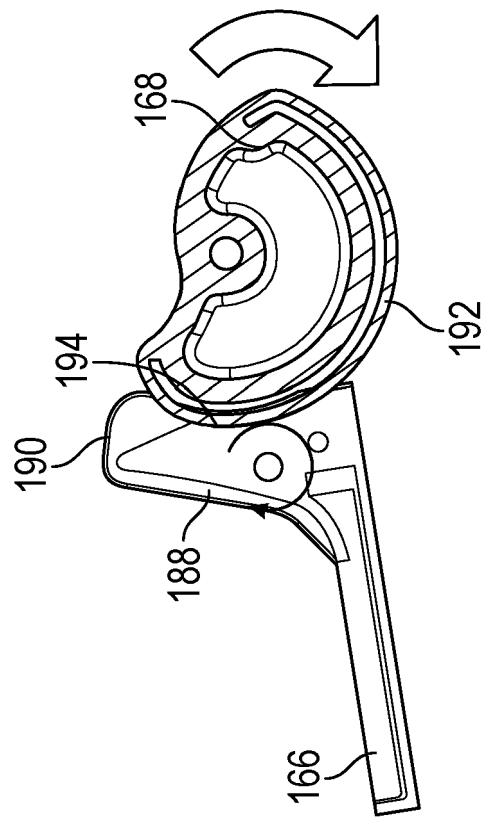


FIG. 13C

FIG. 13D

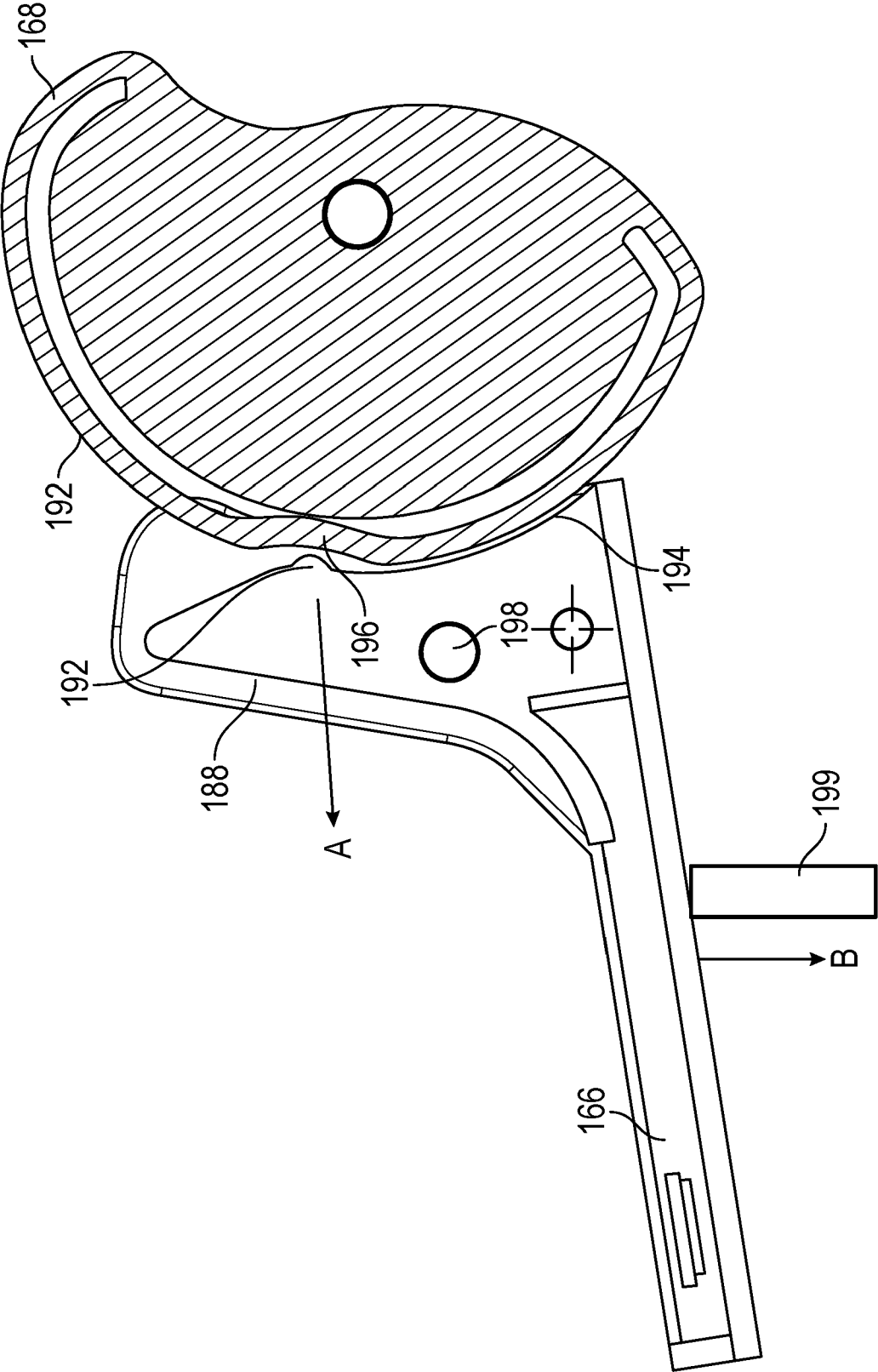


FIG. 14

1500→

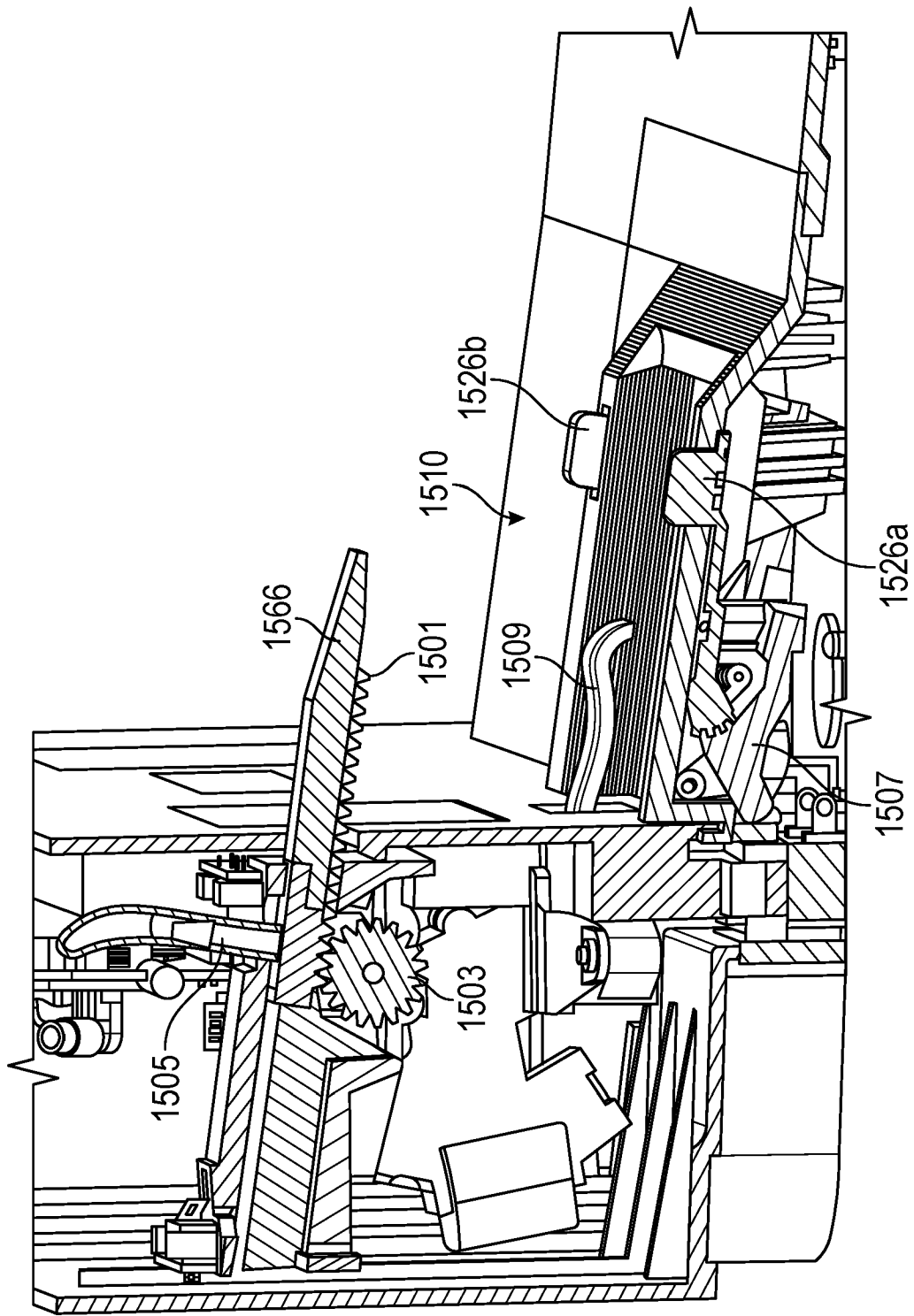


FIG. 15

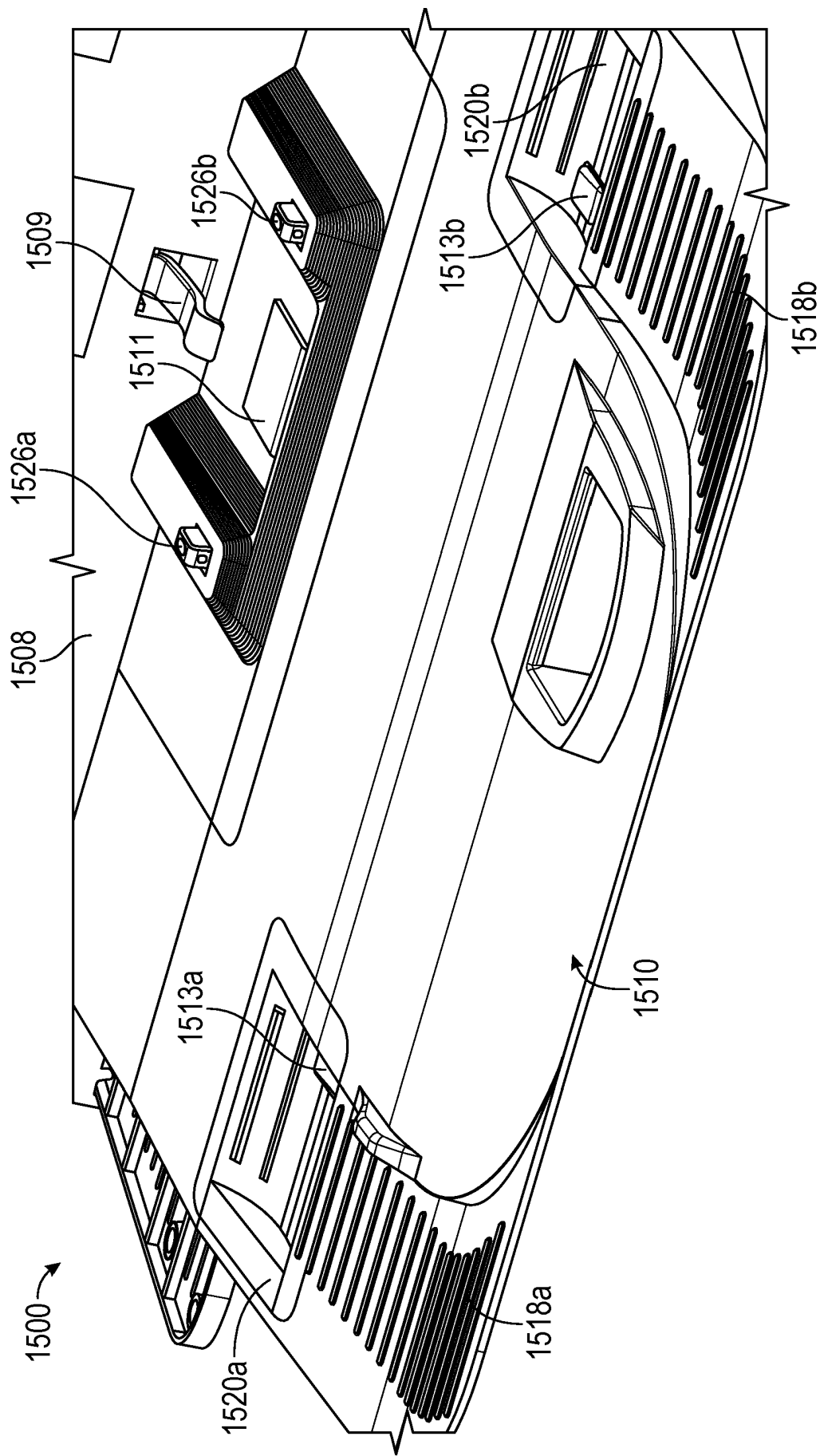


FIG. 16

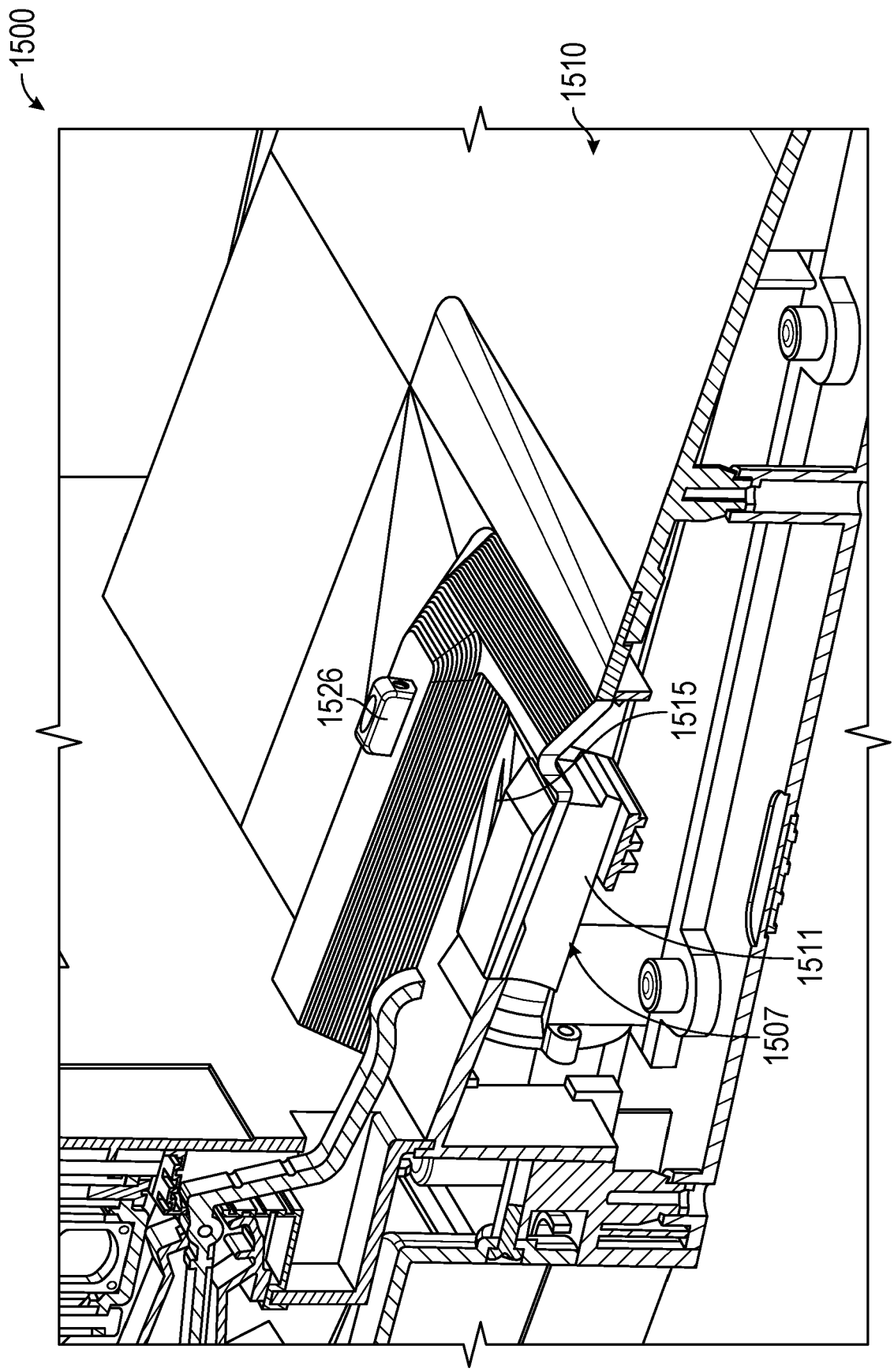


FIG. 17A

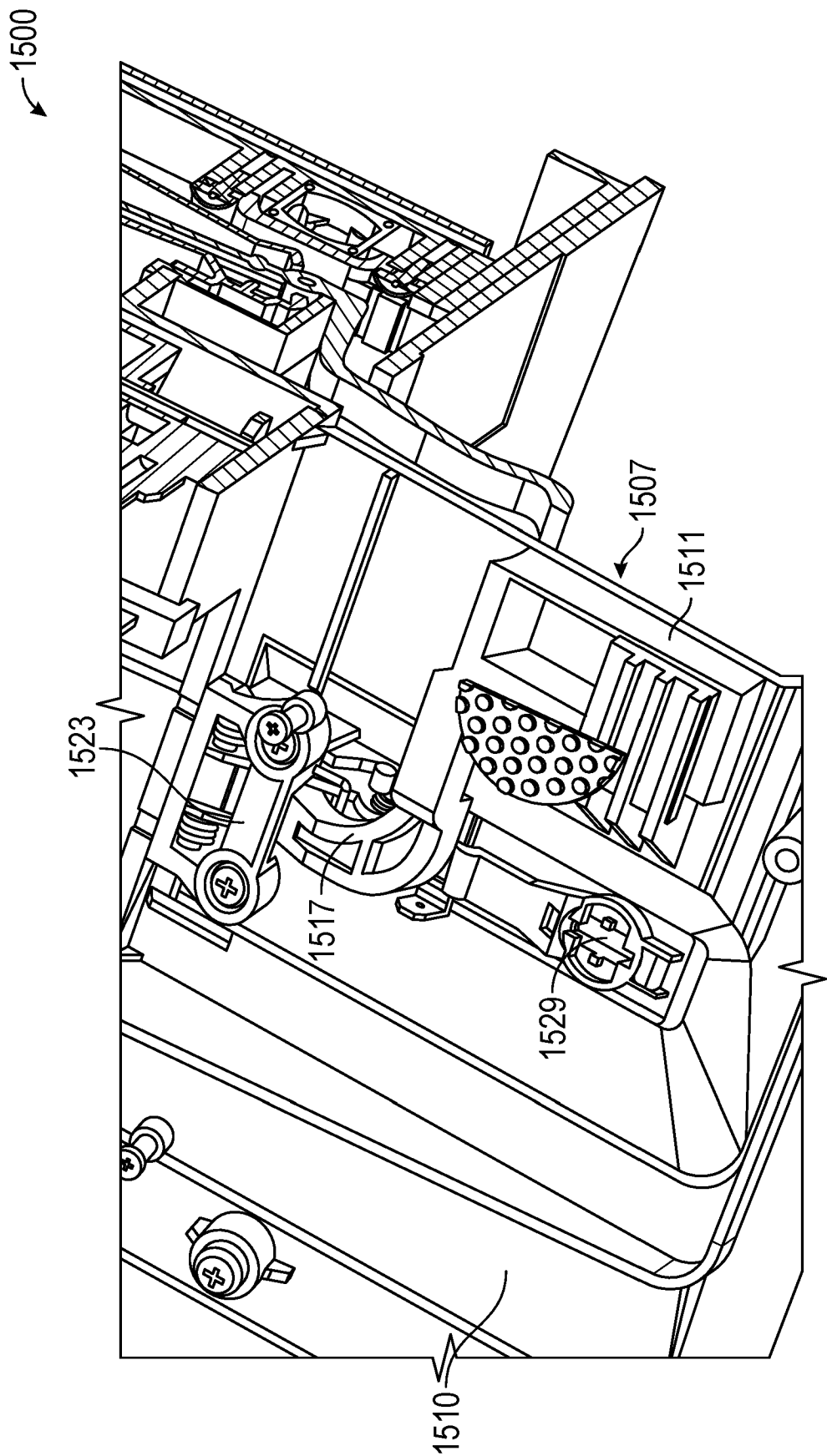


FIG. 17B

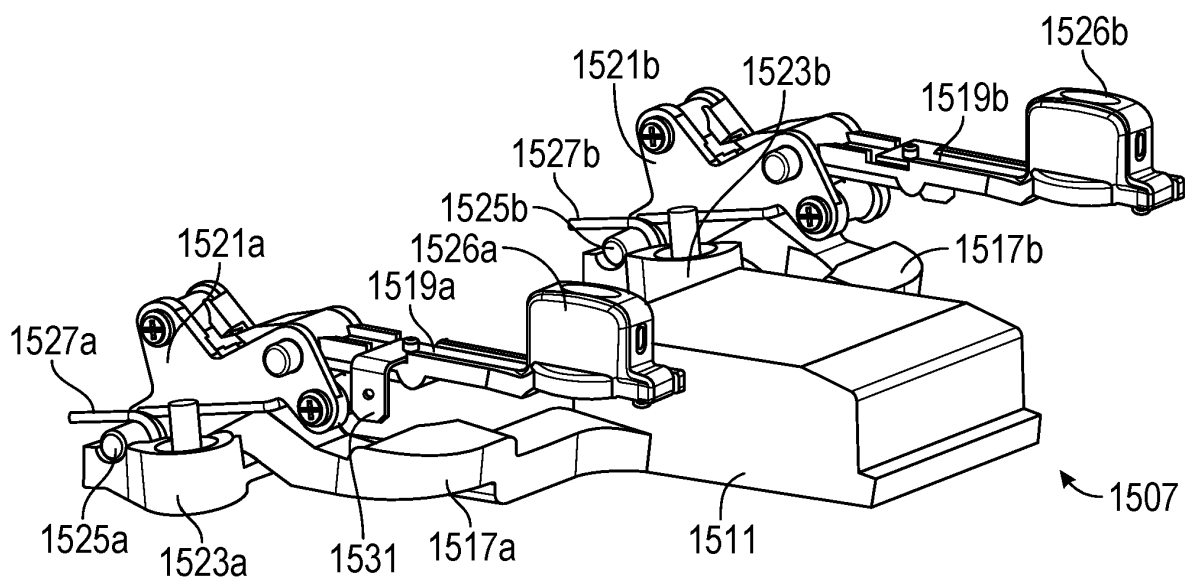


FIG. 18A

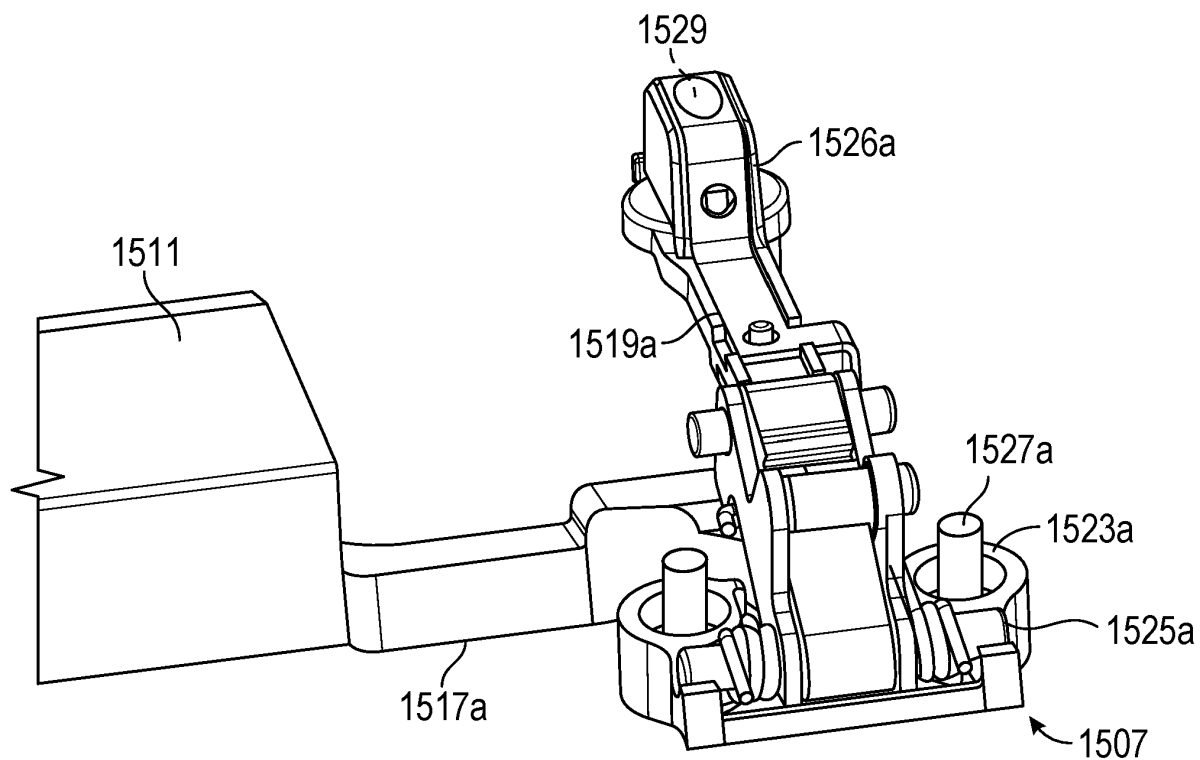


FIG. 18B

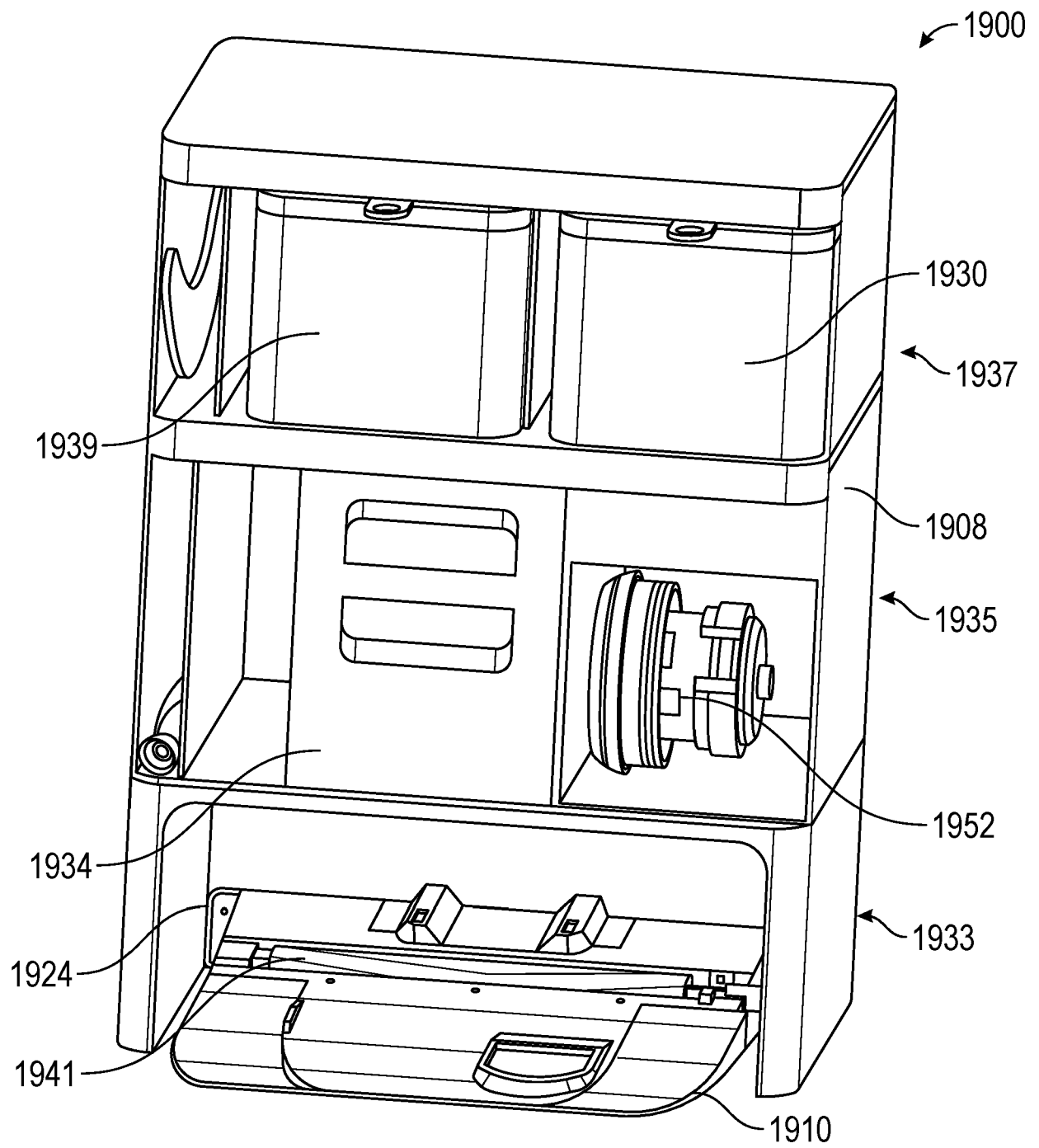
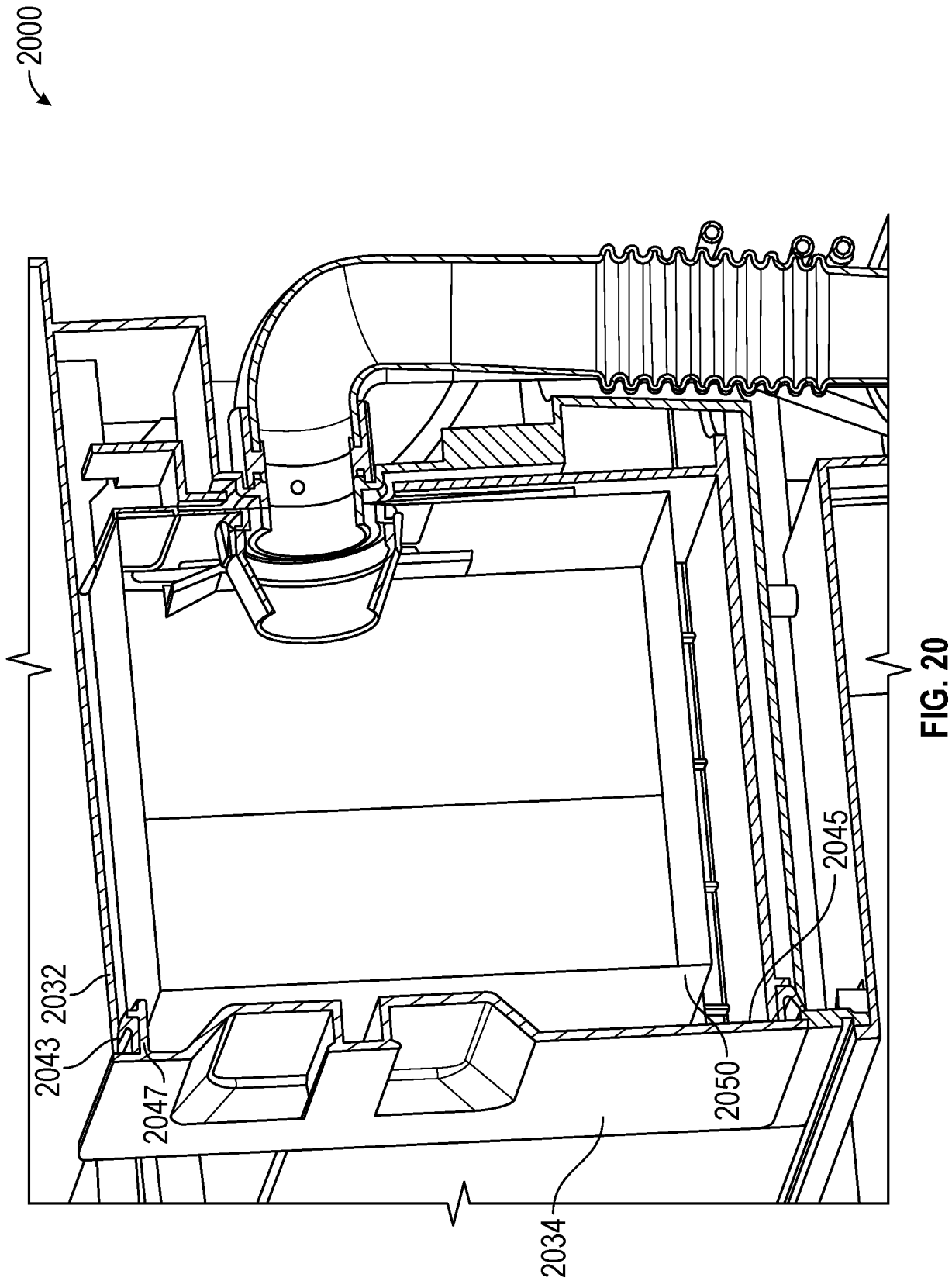


FIG. 19



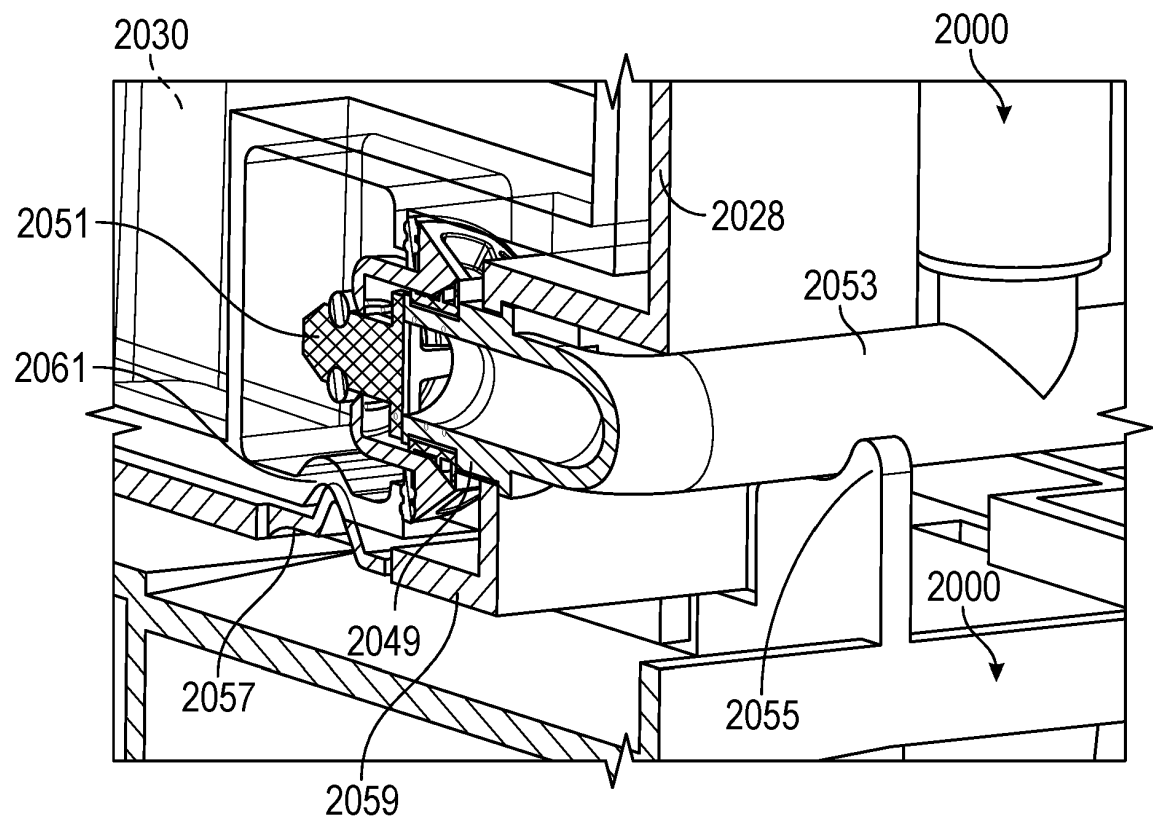


FIG. 21

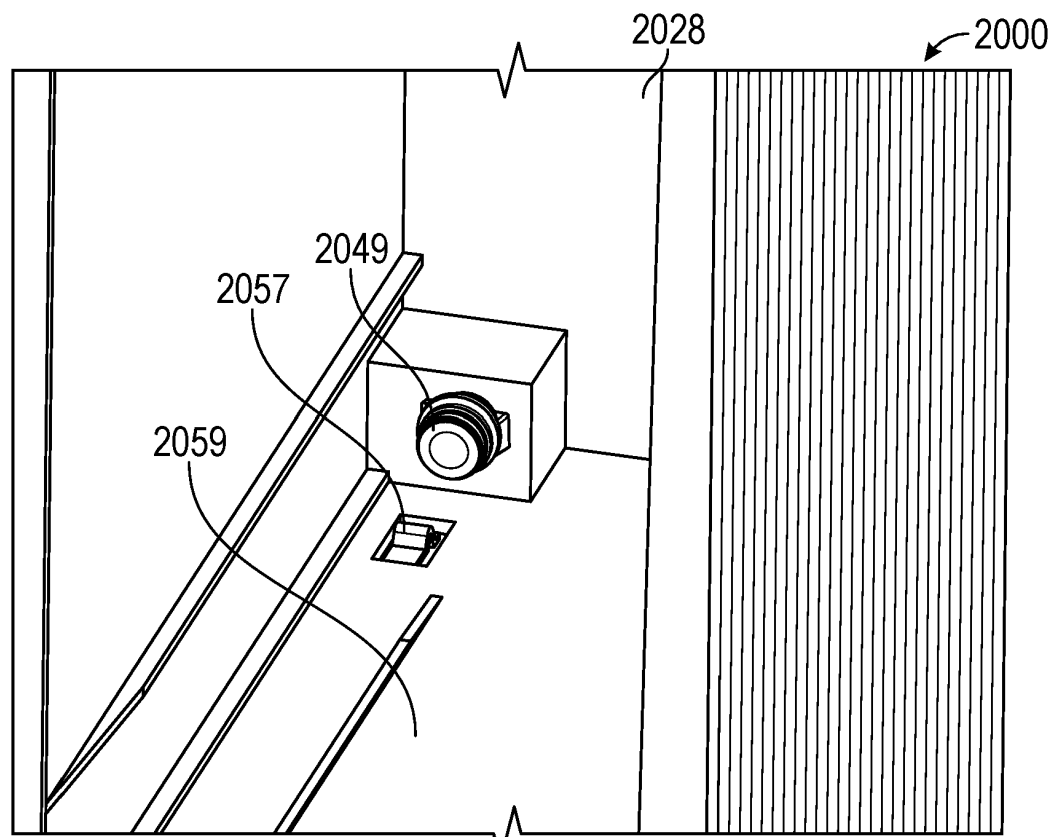


FIG. 22

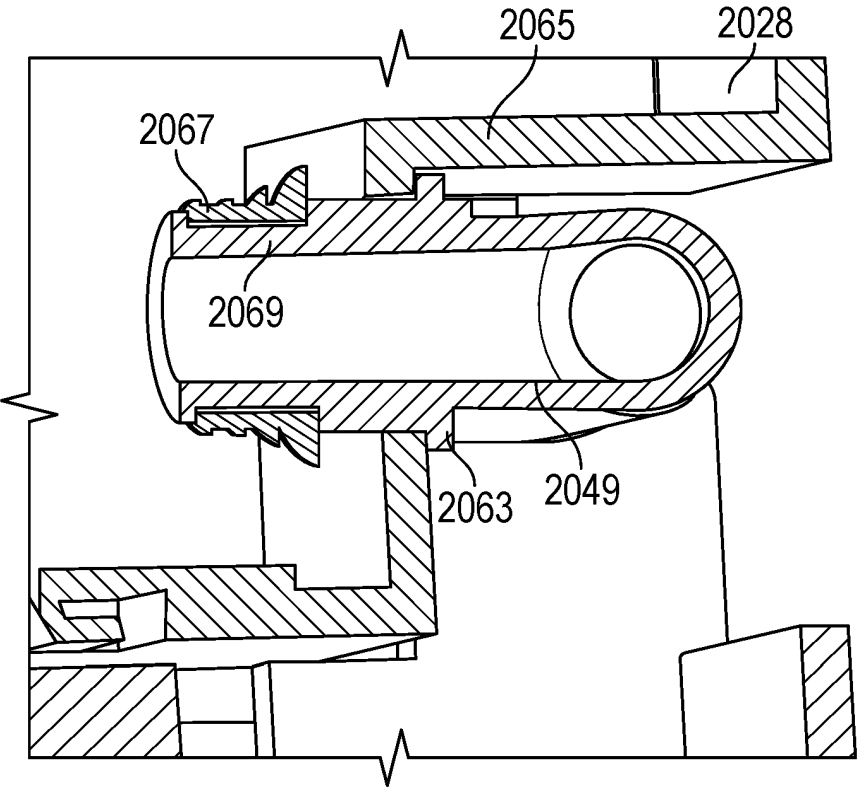


FIG. 23

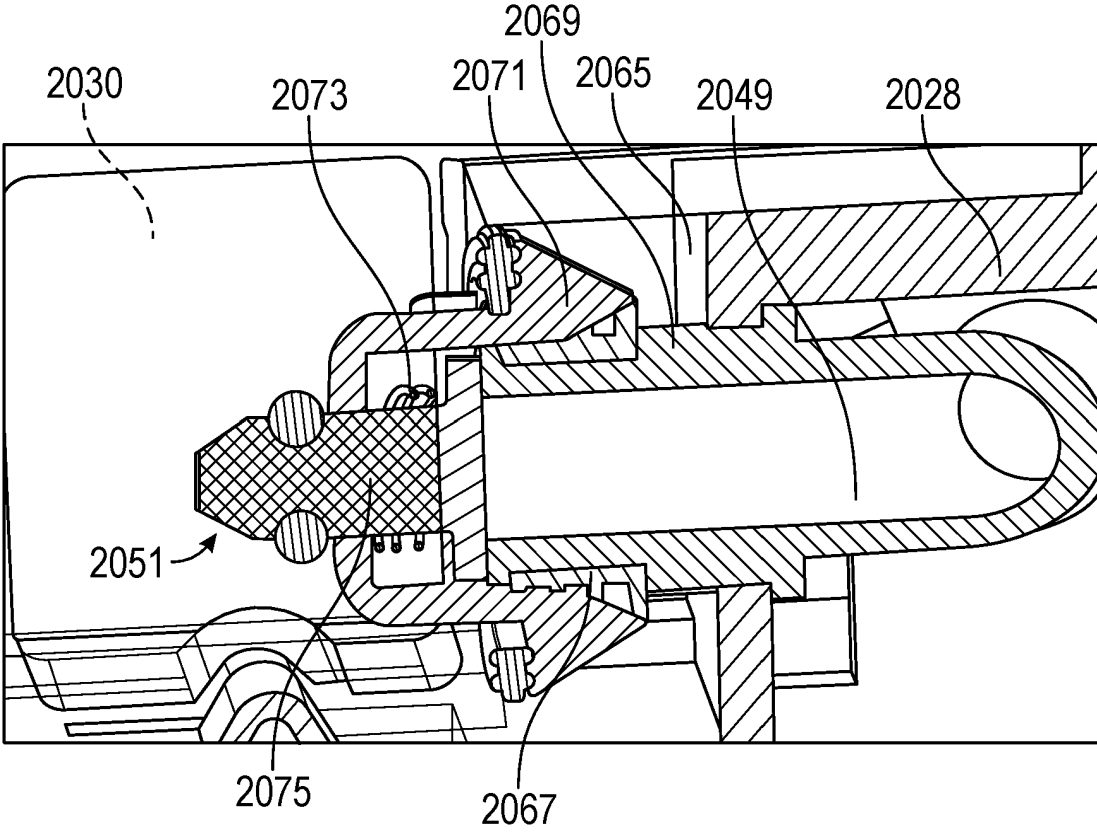


FIG. 24

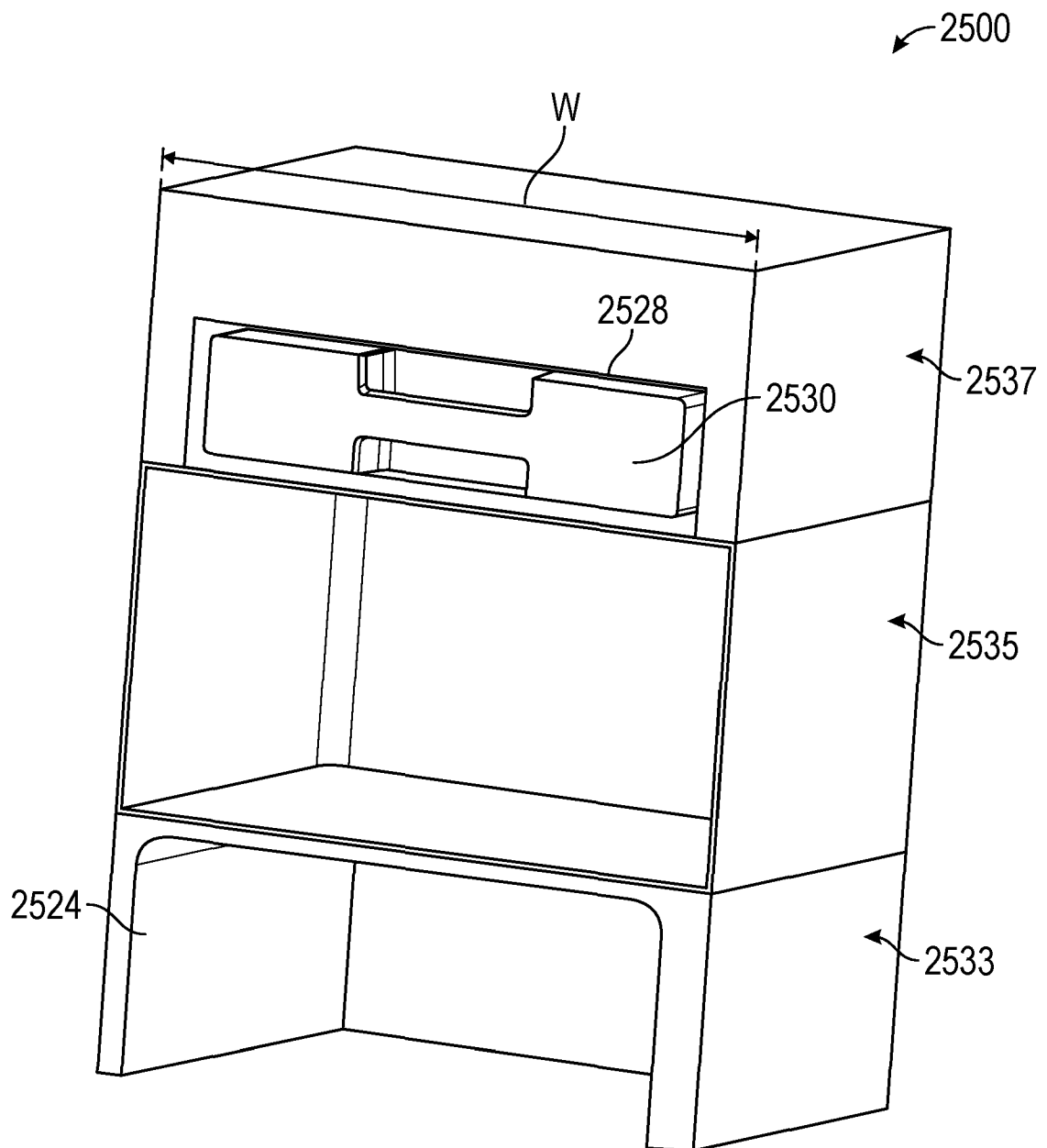
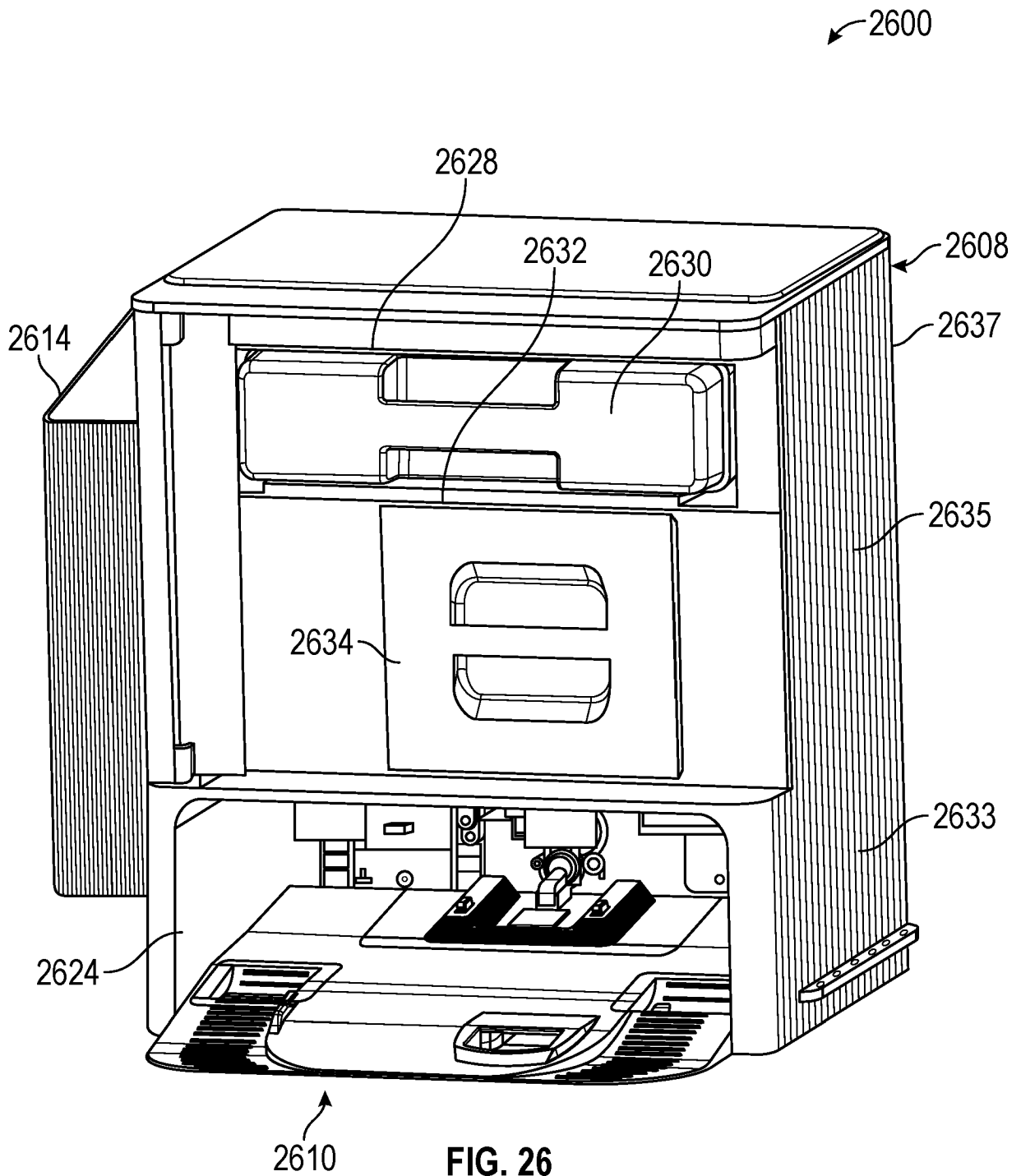


FIG. 25



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

- EP 3777629 A [0004]
- US 388293, Michael G. Sack [0007]