



# Brevet canadien / Canadian Patent

Le commissaire aux brevets a reçu une demande de délivrance de brevet visant une invention. Ladite requête satisfait aux exigences de la *Loi sur les brevets*. Le titre et la description de l'invention figurent dans le mémoire descriptif, dont une copie fait partie intégrante du présent document.

Le présent brevet confère à son titulaire et à ses représentants légaux, pour une période expirant vingt ans à compter de la date du dépôt de la demande au Canada, le droit, la faculté et le privilège exclusif de fabriquer, construire, exploiter et vendre à d'autres, pour qu'ils l'exploitent, l'objet de l'invention, sauf jugement en l'espèce rendu par un tribunal compétent, et sous réserve du paiement des taxes périodiques.



The Commissioner of Patents has received a petition for the grant of a patent for an invention. The requirements of the *Patent Act* have been complied with. The title and a description of the invention are contained in the specification, a copy of which forms an integral part of this document.

The present patent grants to its owner and to the legal representatives of its owner, for a term which expires twenty years from the filing date of the application in Canada, the exclusive right, privilege and liberty of making, constructing and using the invention and selling it to others to be used, subject to adjudication before any court of competent jurisdiction, and subject to the payment of maintenance fees.

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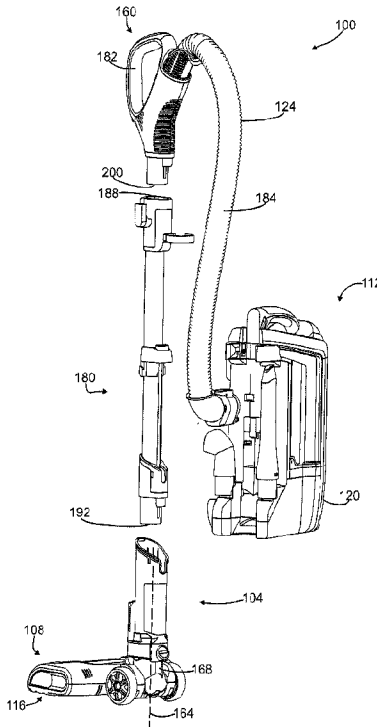
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 (54) Title: SURFACE CLEANING APPARATUS



(57) **Abrégé/Abstract:**

A surface cleaning apparatus is disclosed having an upper portion mounted to a surface cleaning head, a portable surface cleaning unit mounted to the upper portion, an above floor cleaning wand removably receivable in the upper portion, and a wand lock having a locked position in which the wand is secured to the upper portion and an unlocked position in which the wand is removable from the upper portion. The upper portion may stabilize the wand when the wand is drivingly connected to the cleaning head. An electrified flexible air flow conduit may electrically connect the surface cleaning head to the cleaning unit.

## SURFACE CLEANING APPARATUS

[0001] Blank.

### **FIELD**

[0002] This specification relates to a surface cleaning apparatus, which may be an upright vacuum cleaner having an upper section moveably, e.g., pivotally, mounted to a surface cleaning head, an above floor cleaning wand removable mounted to the upper section and a portable cleaning unit, e.g., a pod or hand vacuum cleaner, removably mounted to the upper section. The above floor cleaning wand and the portable cleaning unit may each be removable by themselves or with the other of the above floor cleaning wand and the portable surface cleaning unit.

**INTRODUCTION**

[0003] The following is not an admission that anything discussed below is part of the prior art or part of the common general knowledge of a person skilled in the art.

[0004] Various types of surface cleaning apparatus are known. Typically, an upright vacuum cleaner includes an upper portion or upper section, including an air treatment member such as one or more cyclones and/or filters, drivingly mounted to a surface cleaning head. An up flow conduit is typically provided between the surface cleaning head and the upper portion. In some such vacuum cleaners, a spine, casing or backbone extends between the surface cleaning head and the upper portion for supporting the air treatment member. The suction motor may be provided in the upper portion or in the surface cleaning head.

[0005] Surface cleaning apparatus having a portable cleaning module that is removably mounted to an upright vacuum cleaner are known. See for example US 5,309,600, US 4,635,315 and US 2011/0314629. US 2011/0314629 discloses an upright vacuum cleaner having a surface cleaning head and an upright section pivotally mounted thereto. A hand vacuum cleaner or a pod is removably mounted on the upper portion and is connected in airflow communication with the surface cleaning head via a flexible hose. A portion of the upper portion is bendable so as to allow the surface cleaning head to extend under furniture. This bendable portion is external to the airflow path. In use, the hand vacuum cleaner is locked on the upper portion. A user may manually unlock the hand vacuum cleaner so as to remove it for use as a hand vacuum cleaner and/or for emptying the cyclone bin assembly. In addition, an above floor cleaning wand may be provided and may be removable with the pod.

**SUMMARY**

[0006] This summary is intended to introduce the reader to the more detailed description that follows and not to limit or define any claimed or as yet unclaimed invention. One or more inventions may reside in any combination or sub-combination of the elements or process steps disclosed in any part of this document including its claims and figures.

[0007] In a first aspect there is provided an upright surface cleaning apparatus comprising a surface cleaning head and an upper section moveably mounted thereto

wherein each of an above floor cleaning wand and a portable cleaning unit is removable. The above floor cleaning wand may be receivable in the upper portion. The portable cleaning unit is removably mounted to the upper portion and the above floor cleaning wand. Optionally, the wand release actuator and, optionally the wand lock mechanism comprising the locking member, is removable with the wand. In one embodiment, the upper portion preferably comprises, consists essentially of or consists of a tube or cowling having an upper opening in which the an above floor cleaning wand may be received. An advantage of this design is that by using the wand to provide an upper mount for the portable cleaning unit, the upper portion on or in which the wand may be mounted may have a lower vertical extent, thereby simplifying the process for a user to reinsert the wand. For example, the user may have a lower target for aligning and installing the wand providing a better vantage to view the required action and permitting the user to handle the wand at a more comfortable height during the installation operation.

[0008] In a second aspect there is provided an upright surface cleaning apparatus comprising an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position, an above floor cleaning wand removably receivable in the upper portion, a portable surface cleaning unit removably mounted to the upper portion and optionally also mounted to the wand, and an electrified flexible air flow conduit forming at least part of an air flow path from the above floor cleaning wand to the surface cleaning unit and electrically connecting the surface cleaning head to the surface cleaning unit at a location on in the interior when the wand is received in the upper portion. An advantage of this design is that the wand may electrically connect the surface cleaning head to the source of power provided in the portable surface cleaning unit (e.g., batteries or an AC cord provided on the portable surface cleaning unit).

[0009] In a third aspect there is provided a surface cleaning apparatus wherein an above floor cleaning wand is removable from the upper portion with the wand release actuator and, optionally, the wand lock mechanism comprising the locking member is removable with the wand. The wand may be removable mounted in the upper portion. An advantage of this design is that the upper portion on or in which the wand may be mounted may have a lower vertical extent, yet the wand release actuator may be located, e.g., at about waist height, so that an operator does not have to bend down to actuate the wand release actuator.

[0010] In a fourth aspect there is provided a an upright surface cleaning apparatus wherein a portable surface cleaning unit, such as a pod or a hand vacuum cleaner is selectively detachable from the upper portion. Upper and lower mounting members are provided and one or both may be configured to inhibit both lateral movement and forward rotation of the surface cleaning unit. The lower mounting member may be provided on the upper section and the upper mounting member may be provided on the wand. Accordingly the surface cleaning apparatus may be used as an upright vacuum cleaner in a floor cleaning mode with the portable surface cleaning unit mounted to the upper portion and the portable cleaning unit stably mounted in position as the handle is used to drive and, preferably, steer, the surface cleaning head. For example, the upper portion may be provided with two laterally extending wings. The surface cleaning unit may have arms that surround the upper portion and have recesses for receiving the wings. The wings may have a sufficient height to prevent both lateral movement and forward rotation of the surface cleaning unit. This enables the portable unit to remain in position while the portable unit is in an unlocked mode. A second set of upper arms may be provided, e.g., on a removable wand to assist or prevent the surface cleaning unit rotating forward when the surface cleaning unit is unlocked.

[0011] In a fifth aspect there is provided a surface cleaning apparatus having an upper portion wherein an above floor cleaning wand is removably receivable in the upper portion and the upper portion and wand are configured to permit the wand to be driving connected to the surface cleaning head when the wand is installed in the upper portion. A portable surface cleaning unit may be removably mounted, e.g., to an outer surface of the upper portion.

[0012] For example, the upper portion may surround the up flow duct from the surface cleaning head and may be non-circular, e.g., egg shaped, and the inlet end of the wand may have a mating shape. Accordingly, the wand may be dynamically stably mounted when inserted into the upper portion. For example, the upper portion provides lateral support for the wand when the wand is inserted into the upper portion. This supports the mechanical stresses imposed when the wand is used to steer the surface cleaning head. In addition a keyed slot may also be provided in the upper housing to assist in aligning the wand during insertion.

[0013] It will be appreciated by a person skilled in the art that a surface cleaning apparatus may embody any one or more of the features contained herein and that the features may be used in any particular combination or sub-combination.

[0014] In particular, the first aspect may be used by itself or one or more of the second, third, fourth and fifth aspects.

[0015] The second aspect may be used by itself or one or more of the first, third, fourth and fifth aspects.

[0016] The third aspect may be used by itself or one or more of the first, second, fourth and fifth aspects.

[0017] The fourth aspect may be used by itself or one or more of the first, second, third and fifth aspects.

[0018] The fifth aspect may be used by itself or one or more of the first, second, third and fourth aspects.

[0019] The drawings included herewith are for illustrating various examples of articles, methods, and apparatuses of the teaching of the present specification and are not intended to limit the scope of what is taught in any way.

## **DRAWINGS**

[0020] FIG. 1 is a front perspective view of a surface cleaning apparatus in a storage position;

[0021] FIG. 2 is a rear perspective view of the surface cleaning apparatus of FIG. 1, in the storage position;

[0022] FIG. 3 is a front perspective view of the surface cleaning apparatus of FIG. 1, in a floor cleaning position;

[0023] FIG. 3a is a side elevation view of the surface cleaning apparatus of FIG. 1, in a storage position;

[0024] FIG. 4 is a partial cross-sectional view taken along line 4-4 in FIG. 1;

[0025] FIG. 5 is a rear perspective view of the surface cleaning apparatus of FIG. 1, in a partially disassembled configuration;

- [0026] FIG. 6 is a front perspective view of the surface cleaning apparatus of FIG. 1, with the pod removed but still in air flow communication with the surface cleaning head;
- [0027] FIG. 7 is a front perspective view of the surface cleaning apparatus of FIG. 1, in an above-floor cleaning configuration;
- [0028] FIG. 8 is a rear perspective view of the above floor cleaning wand disconnected from an upper portion for use in above floor cleaning, the remaining parts have been removed for clarity;
- [0029] FIG. 9 is a top plan view of the upper portion and the surface cleaning head of FIG. 8;
- [0030] FIG. 10 is a top plan view of the surface cleaning apparatus of FIG. 1, with the above floor cleaning wand removed from the upper portion;
- [0031] FIG. 11 is a rear perspective view of the above floor cleaning wand partially removed from the upper portion;
- [0032] FIG. 12 is a rear perspective view of the portable surface cleaning unit;
- [0033] FIG. 13 is a bottom plan view of the surface cleaning unit of FIG. 12;
- [0034] FIG. 14 is a front elevation view of the upper portion and the surface cleaning head of FIG. 8;
- [0035] FIG. 15 is a cross-sectional view taken along line 15-15 in FIG. 8;
- [0036] FIG. 16 is a cross-sectional view taken along line 16-16 in FIG. 4;
- [0037] FIG. 17 is a rear elevation view of the surface cleaning unit of FIG. 12;
- [0038] FIGS. 18a-18d are rear perspective views of the surface cleaning unit of FIG. 12 with a rear wall removed and the locking mechanism in different positions;
- [0039] FIG. 19 is a partial rear sectional perspective view of the wand of FIG. 11;
- [0040] FIGS. 20a-20d are partial rear perspective views of the wand of FIG. 8 with an outer wall removed.
- [0041] FIG. 21 is a front perspective view for the surface cleaning apparatus of FIG. 1 with the surface cleaning unit and the hose removed;



[0042] FIG. 22 is a partial cross-sectional view in perspective taken along line 4-4 in FIG. 1; and

[0043] FIGS. 23-25 are front perspective views of the surface cleaning unit being mounted on the upper portion.

#### **DESCRIPTION OF VARIOUS EMBODIMENTS**

[0044] Various apparatuses or processes will be described below to provide an example of an embodiment of each claimed invention. No embodiment described below limits any claimed invention and any claimed invention may cover processes or apparatuses that differ from those described below. The claimed inventions are not limited to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses described below. It is possible that an apparatus or process described below is not an embodiment of any claimed invention. Any invention disclosed in an apparatus or process described below that is not claimed in this document may be the subject matter of another protective instrument, for example, a continuing patent application, and the applicants, inventors or owners do not intend to abandon, disclaim or dedicate to the public any such invention by its disclosure in this document.

#### **GENERAL DESCRIPTION OF AN UPRIGHT VACUUM CLEANER**

[0045] Referring to FIGS. 1-3, a first embodiment of a surface cleaning apparatus 100 is shown. In the embodiment shown, the surface cleaning apparatus 100 is an upright vacuum cleaner. In alternate embodiments, the surface cleaning apparatus may be another suitable type of upright surface cleaning apparatus, such as a stick vac, a wet-dry type vacuum cleaner or a carpet extractor.

[0046] In the illustrated example, the surface cleaning apparatus 100 includes an upper portion or support structure 104 that is movably and drivingly connected to a surface cleaning head 108. A surface cleaning unit 112 is mounted on the upper portion 104. The surface cleaning apparatus 100 also has at least one dirty air inlet 116, at least one clean air outlet 120, and an air flow path or passage extending therebetween. In the illustrated example, the air flow path includes at least one flexible air flow conduit member

(such as a hose 124 or other flexible conduit). Alternatively, the air flow path may be formed from rigid members.

[0047] Preferably, as exemplified in FIG. 4, the portable surface cleaning unit 112 includes both the suction motor 128, which may be in a motor housing 132, and an air treatment member, which may be in the form of a cyclone bin assembly 136. The air treatment member may be any suitable air treatment member, including, for example, one or more cyclones, filters, and bags, and preferably the at least one air treatment member is provided upstream from the suction motor. Accordingly, surface cleaning unit 112 may be a hand vacuum cleaner, a pod or the like. The cyclone bin assembly 136 includes a cyclone chamber 144 and a dirt collection chamber 148.

[0048] In the embodiment shown, the surface cleaning head 108 includes the dirty air inlet 116 in the form of a slot or opening 152 (FIG. 4) formed in a generally downward facing surface of the surface cleaning head 108. From the dirty air inlet 116, the air flow path extends through the surface cleaning head 108, and through an up flow conduit 156 (FIG. 2) in the upper portion 104 to the surface cleaning unit 112.

[0049] A handle 160 is provided on a wand that is removably from the upper portion 104 to allow a user to manipulate the surface cleaning apparatus 100. Referring to FIGS. 2, 3, and 3a, the upper portion extends along an upper axis 164 and is moveably mounted to the surface cleaning head 108. In the illustrated example, the upper portion 104 is pivotally mounted to the surface cleaning head via a pivot joint 168. The pivot joint 168 may be any suitable pivot joint. In this embodiment, the upper portion 104 is movable, relative to the surface cleaning head 108, between a storage position (FIG. 1), and a use or floor cleaning position (FIG. 3). In the floor cleaning position, the upper portion 104 may be inclined relative to the surface being cleaned, and an angle 172 between a plane 176 parallel to the surface and the upper axis 164 may be between about 20° and about 85°. In the storage position (FIG. 3a), the upper portion 104 may be inclined relative to the surface being cleaned, and the angle 172 between the plane 176 parallel to the surface and the upper axis 164 may be between about 85° and 135°.

[0050] It will be appreciated that the forgoing discussion is exemplary and that an upright vacuum cleaner may use a surface cleaning head and upper portion of any design and they may be moveably connected together by any means known in the art.

[0051] In one aspect, the upright vacuum cleaner 100 may be operable in a variety of different functional configurations or operating modes. The versatility of operating in different operating modes may be achieved by permitting each of the surface cleaning unit 112 and the above floor cleaning wand to be individually detachable from the upper portion 104.

[0052] In the examples illustrated, mounting the surface cleaning unit 112 on the upper portion 104 increases the weight of the upper portion 104 and can affect the maneuverability and ease of use of the surface cleaning apparatus 100. With the surface cleaning unit 112 attached, the vacuum cleaner 100 may be operated like a traditional upright style vacuum cleaner, as illustrated in FIGS. 1-3.

[0053] To enable the vacuum suction generated by the surface cleaning unit 112 to remain in airflow communication with the surface cleaning head 108 when the surface cleaning unit 112 is detached from the support structure 104, the airflow connection between the surface cleaning head 108 and the cleaning unit 112 is preferably at least partially formed by a flexible conduit, such as flexible hose 124, which may be an electrified hose. Preferably, the hose 124 is extensible and more preferably is elastically or resiliently extensible. The use of a flexible conduit allows a user to detach the surface cleaning unit 112 and maintain a flow connection between the portable surface cleaning unit 112 and the surface cleaning head 108 without having to reconfigure or reconnect any portions of the airflow conduit 184 (FIG. 6).

[0054] In the example shown, the airflow path between the surface cleaning head 108 and the cleaning unit 112 further includes an above floor cleaning wand 180. Wand 180 may be positioned upstream of hose 124 and downstream of surface cleaning head 108. Preferably, wand 180 may be drivingly connected to upper portion 104 so that wand 180 may be used to direct surface cleaning head 108 (e.g., forwardly and rearwardly). Accordingly, wand 180 comprises a rigid airflow conduit having any suitable shape. For example, wand 180 may be straight as shown or it may be curved or bent. In some embodiments, wand 180 may be reconfigurable. For example, wand 180 may have upper and lower sections that are moveably mounted with respect to each other (e.g., pivotally connected) so that wand 180 may be converted from a straight configuration to a bent configuration. Further, wand 180 may have any suitable cross-sectional shape, such as a

circular cross-section as shown, or another cross-sectional shape such as square, triangular, or another regular or irregular shape such as “egg shaped”.

[0055] Wand 180 may be telescopic so that it is extendable.

[0056] In order to enable a user to use wand 180 to remotely maneuver surface cleaning head 108, wand 180 may be provided with a handle assembly. Preferably, handle assembly or handle 160 is positioned proximate an upper (i.e. downstream) end 188 of wand 180. For example, handle 160 may be connected to one or both of wand 180 and hose 124. Optionally, handle 160 may form part of the airflow path between wand 180 and hose 124. Alternatively, handle 160 may be peripherally attached to one or both of wand 180 and hose 124 without participating in the airflow communication between wand 180 and hose 124.

[0057] A user may grasp a hand grip portion 182 of handle 160 to manipulate wand 180 (e.g. for moving upper portion 104 and steering surface cleaning head 108). In alternative embodiments, surface cleaning apparatus 100 may not include a handle 160 and instead a user may grasp wand 180 directly.

[0058] Reference is now made to FIG. 5. As shown, upper portion 104 is moveably mounted with respect to surface cleaning head 108. Upper portion 104 may be connected to surface cleaning head 108 by any means known in the art, (e.g., it may be pivotally mounted, rotationally mounted or the like). As exemplified, pivot joint 168 permits upper portion 104 to tilt and/or pivot with respect to surface cleaning head 108.

[0059] As exemplified, each of wand 180 and surface cleaning unit 112 is selectively attachable or detachable from upper portion 104. An advantage of this design is that a user may convert the vacuum cleaner to a surface cleaning mode by removing the wand without having to remove surface cleaning unit 112. Preferably, each of wand 180 and surface cleaning unit 112 may be selectively connected or disconnected from upper portion 104 independently of the other. For example, wand 180 and surface cleaning unit 112 may be connected or disconnected from upper portion 104 in any order, sequentially or simultaneously. This may simplify the reconfiguration of surface cleaning apparatus 100 into different cleaning modes without requiring disruption to the operation of surface cleaning apparatus 100.

[0060] As exemplified, when upstream end 192 of wand 180 is connected to upper portion 104, the surface cleaning head 108 participates in the airflow path in a floor cleaning mode, e.g., for cleaning floors, stairs, and the like. In such a case, the surface cleaning unit 112 may be mounted on upper portion 104, for supporting the weight of surface cleaning unit on upper portion 104 (e.g., as shown in FIG. 3 which exemplifies a traditional floor cleaning mode for an upright vacuum cleaner). Alternately, surface cleaning unit 112 may be dismounted from upper portion 104 and carried by hand, worn as a backpack, or placed on the floor for example while wand 180 is connected to surface cleaning head 108 (e.g., as shown in FIG. 6 which exemplifies an alternate floor cleaning mode for an upright vacuum cleaner).

[0061] As exemplified, wand 180 may be disconnected from upper portion 104 for use in an above-floor cleaning mode. In one embodiment, surface cleaning unit 112 may be mounted on upper portion 104, for supporting the weight of surface cleaning unit on upper portion 104 while wand 180 is used in the above floor cleaning mode (e.g., as shown in FIG. 7 ). Alternately, in another optional embodiment, surface cleaning unit 112 may also be dismounted from upper portion 104 and carried by hand, worn as a backpack, or placed on the floor for example while wand 180 is used in the above floor cleaning mode.

[0062] Wand 180 and surface cleaning unit 112 may connect to upper portion 104 in any suitable fashion. In the example shown, wand 180 is inserted into upper portion 104, and surface cleaning unit 112 is mounted to an exterior of upper portion 104. In such a case, upper portion 104 may provide part or all of the air flow path from surface cleaning head 108 to wand 180. In other embodiments, upper portion 104 need not be part of the air flow path. For example, wand 180 may be mounted to the exterior of upper portion 104 and the inlet end may seat on an outlet end of a duct provided on the outer surface of the upper portion 104.

[0063] Referring to FIG. 6, when the surface cleaning apparatus 100 is in use, a user may detach the surface cleaning unit 112 from the upper portion 104 without interrupting the airflow communication between the cleaning unit 112 and the surface cleaning head 108. This allows a user to selectively detach and re-attach the cleaning unit 112 to the support structure 104 during use without having to stop and reconfigure the

connecting hose 124 or other portions of the airflow conduit 184. As exemplified, wand 180 is attached to upper portion 104 and surface cleaning unit 112 is detached from upper portion 104.

[0064] In this configuration, upper portion 104 may provide a connection between wand 180 and surface cleaning head 108, which may permit surface cleaning head 108 to be driven by manipulating wand 180.

[0065] In addition to being operable to clean floors or surfaces, the vacuum cleaner may be operated in a variety of cleaning modes that do not include use of the surface cleaning head, and may be generally described as above floor cleaning modes. This can generally include cleaning furniture, walls, drapes and other objects as opposed to cleaning a large, planar surface.

[0066] In one example of an above floor cleaning mode, as exemplified in FIG. 7, the surface cleaning unit 112 can remain mounted on the upper portion 104. This eliminates the need for the user to separately support the weight of the surface cleaning unit 112 in an above floor cleaning mode. In the illustrated configuration, the surface cleaning unit 112 may remain mounted on the upper portion 104 and the wand 180 may be detached from upper portion 104 to provide an extended reach for above floor cleaning. Further, as illustrated in FIG. 5, the upstream end 200 of the handle 160 may be separated from the downstream end 188 of wand 180. In this configuration the upstream end 200 of the handle 160 can function as the dirty air inlet for the vacuum cleaner 100. Optionally, accessory tools, such as wands, crevasse tools, turbo brushes, hoses or other devices may be coupled to the upstream end 200 of the handle 160.

[0067] In another example of an above floor cleaning mode, as exemplified in FIG. 5, the surface cleaning unit 112 and wand 180 can both be detached from the upper portion 104. The upstream end 200 of handle 160 may be selectively connected or disconnected from downstream end 188 of wand 180 as desired. This configuration may be advantageous when surface cleaning unit 112 must be held above the floor (e.g. while the user is standing on a ladder). In this case, the upper portion 104 and surface cleaning head 108 may add unnecessary weight to the surface cleaning unit 112. Optionally, wand 180 and upper portion 104 may be configured to provide support and/or positioning or alignment of the wand 180 relative to the upper portion 104.

[0068] In the example shown, upper portion 104 may be configured to receive an upstream end of wand 180 to connect wand 180 to upper portion 104. When inserted, the outer wall of wand 180 and the inner wall of upper portion 104 may contact each other over a sufficient length to stabilize wand 180 so that upper portion 104 may provide a driving connection between wand 180 and surface cleaning head 108. This may permit upper portion 104 to transmit forces applied to wand 180 (e.g. via handle 160 or directly to wand 180) to surface cleaning head 108 by way of, e.g., pivot joint 168.

[0069] As exemplified in Figure 8, wand 180 includes an upstream portion 1002 bordered by upstream end 192. Upstream end 192 may define a wand air inlet for receiving dirty air to be communicated downstream through wand 180 to downstream end 188 (FIG. 5). Further, upper portion 104 is shown including a downstream portion 1006 bordered by downstream end 1010. As shown, downstream portion 1006 may include or surround an air outlet for discharging air received from surface cleaning head 108, downstream (e.g. to wand 180). For example, downstream portion 1006 may comprise a cowl that surrounds and extends upwardly from the outlet of an air flow path extending through the surface cleaning head 108. Accordingly, upstream portion 1002 of wand 180 may be removably receivable inside downstream portion 1006 of upper portion 104. Downstream end 1010 of upper portion 104 may define an opening 1014 for receiving upstream end 192 of wand 180.

[0070] Referring now to FIGS. 8-10, downstream portion 1006 may include inner walls 1018 having a transverse profile that corresponds to the transverse profile of outer walls 1022 of the upstream portion 1002 of wand 180. For example, the transverse profile of inner walls 1018 may have a substantially similar size and shape as the transverse profile of the outer walls 1022. Preferably, the transverse profile of outer walls 1022 is slightly smaller than the transverse profile of inner walls 1018 to provide a sufficient clearance to permit insertion and removal of wand 180 without play when wand 180 is inserted into upper portion 104. This may permit upstream portion 1002 to be easily inserted into downstream portion 1006.

[0071] The transverse profile of inner walls 1018 and outer walls 1022 may have any suitable shape. For example, the transverse profiles may be circular, triangular, square or another regular or irregular shape. Preferably, the transverse profiles have a

non-circular or irregular shape such that outer walls 1022 may fit between inner walls 1018 in only one orientation. This may force wand 180 to be specifically oriented with respect to upper portion 104 (e.g. to provide an intended orientation of handle 160 to surface cleaning head 108). In the example shown, the transverse profiles of inner walls 1018 and outer walls 1022 may be described as “egg-shaped”. That is, the transverse profiles are generally rounded and taper in width from one side to the other.

[0072] Alternatively, or in addition to the correspondence in transverse profiles of inner and outer walls 1018 and 1022, wand 180 and upper portion 104 may include mating elements that limit the number of orientations in which upstream portion 1002 may be received in downstream portion 1006. For example, wand 180 and upper portion 104 may collectively include one or more mating protrusions and recesses.

[0073] In the example shown, wand 180 includes a protrusion (or key) 1026 in upstream portion 1002 that protrudes outwardly along outer wall 1022. Protrusion 1026 is configured to mate with (i.e. insert into) recess (or slot) 1030 formed in a lip 1034 of inner walls 1018 when upstream portion 1002 is received in downstream portion 1006. When wand 180 is correctly oriented with respect to upper portion 104, key 1026 will align with slot 1030 to allow upstream portion 1002 to be inserted into downstream portion 1006. However, lip 1034 of downstream portion 1006 will interfere with key 1026 if attempting to insert upstream portion 1002 into downstream portion 1006 while wand 180 is incorrectly oriented with respect to upper portion 104 such that key 1026 is misaligned with slot 1030.

[0074] In the example shown, hose 124 is electrified and comprises part of a circuit extending from surface cleaning unit 112 to surface cleaning head. Accordingly, surface cleaning unit 112 may be provided with the electrical cord or an on board power source (e.g. one or more batteries) and an electrical component in the surface cleaning head 108 may be powered via the hose 124 and wand 180. Accordingly, wand 180 may provide an electrified air flow conduit for conducting electricity along the length of wand 180. As exemplified, upstream portion 1002 of wand 180 includes an electrical connector 1038, and downstream portion 1006 of upper portion 104 includes a mating electrical connector 1042. Electrical connectors 1038 and 1042 may be any suitable mating electrical connectors, such as for example a male connector (or plug) and a female connector (or jack). Further, electrical connectors 1038 and 1042 may connect any number of electrical



conductors (e.g. from 1 to 100 conductors). As exemplified, each of connectors 1038 and 1042 connects three electrical conductors 1046. Upstream and downstream portions 1002 and 1006 may each include any number of mating electrical connectors, each of which may connect different electrical conductors.

[0075] In some cases, electrical connectors 1038 and 1042 may be somewhat fragile. For example, electrical connectors 1038 and 1042 may suffer damage if subjected to certain stresses. In one aspect, the stability provided by upper portion 104 to wand 180 may advantageously reduce stresses on electrical connectors 1038 and 1042. For example, mating elements of upper portion 104 and wand 180, other than electrical connectors 1038 and 1042 (such as key 1026 and slot 1030, and/or the corresponding transverse profiles of walls 1018 and 1022) may provide stability (such as resistance to relative rotational movement between wand 180 and upper portion 104) which might otherwise be borne by electrical connectors 1042 and 1046.

[0076] As exemplified in Figure 4, downstream portion 1006 of upper portion 104 surrounds upstream portion 1002 of wand 180 when upstream portion 1002 is received in downstream portion 1006. Preferably, upper portion 104 surrounds a sufficient height of wand 180 to provide support to wand 180 to rest in the upright position. For example, upper portion 104 may surround any portion of the wand and may surround the entire wand. As exemplified, upper portion may surround between 10 percent and 30 percent of the total height of wand 180 (measured from upstream end 192 to downstream end 188), and more preferably about 20 percent of the total height of wand 180. As also exemplified, upstream end 192 is positioned proximate a lower end 1062 of surface cleaning unit 112 and well below upper end 1066 of surface cleaning unit 112 (when both surface cleaning unit 112 and wand 180 are connected to upper portion 104). It will be appreciated that upstream end 192 may seat against or in the outlet end of pivot joint 168.

[0077] Wand 180 may form an airtight seal with the airflow passage when connected to upper portion 104. As exemplified, upstream end 192 of wand 180 may be urged against a seal 1070 (e.g. O-ring) surrounding air outlet 1074 of upper portion 104 when wand 180 is connected to upper portion 104. Seal 1070 may prevent entry or escape of air through the interface between wand 180 and upper portion 104.

[0078] In the example shown, upstream portion 1002 of wand 180 includes a lower section 1078, and an upper section 1082. Lower section 1078 is bordered by upstream end 192, and upper section 1082 is downstream of lower section 1078. The transverse section of upper section 1082 may be sized and shaped to provide a tight fit with downstream portion 1006 of upper portion 104. At the same time, lower section 1078 may have a substantially smaller transverse section, which may provide a greater margin for alignment error when firstly inserting lower section 1078 into opening 1014. Accordingly, a user may insert upstream end 192 into upper portion 104. This is facilitated by the clearance between the facing walls of upstream end 192 and upper portion 104. Some or all of the weight of the wand 180 may then be supported by upper portion 104. The user may then rotate wand 180 to the required insertion orientation and complete the insertion of wand 180 into upper portion 104 by inserting part or all of upper section 1082. The stepwise insertion of a narrower lower section 1078 into upper portion 104 followed by a wider upper section 1082 may make inserting upstream portion 1002 into upper portion 104 easier for a user. Once lower section 1078 is inserted into opening 1014, lateral movements of wand 180 are substantially constrained, by the interaction of lower section 1078 with inner walls 1018, to positions that are in close proximity to the comparatively narrower range of positions that will allow upper section 1082 to pass through opening 1014 into downstream portion 1006. Such constraint may make finding the correct position faster and easier for a user because the constraint increases the proportion of available positions that will allow upper section 1082 to enter downstream portion 1006.

[0079] Alternatively, or in addition to a narrower lower section 1078, downstream end 1010 of upper portion 104 at opening 1014 may be transversely inclined (or “sloped”). As shown, a front side 1086 of opening 1014 extends higher (i.e. further downstream) than the rear side 1090. This may permit a user to more easily locate upstream portion 1002 into opening 1014. In use, the user may simply move front side 1094 of upstream portion 1002 against front side 1086 of opening 1014 to align upstream portion 1002 with opening 1014, and then move upstream portion 1002 downwardly through the remainder of opening 1014. In this way, front side 1086 of opening 1014 may act as a guide for directing upstream portion 1002 downwardly into the remainder of opening 1014. This may be easier to perform than having to maneuver upstream portion 1002 through a transversely uninclined (i.e. horizontal) opening, since such an opening forms a complete

periphery at its uppermost edge. If upstream portion 1002 includes a narrower lower section 1078, then preferably, lower and upper sections 1078 and 1082 may be flush along front side 1094 to permit upstream portion 1002 to slide downwardly through opening 1014, as described above, without interference by an overhanging lip of upper section 1082.

[0080] Reference is now made to FIG. 11. Alternately, or in addition, sloped opening 1014 may help to correct for rotational misalignment of wand 180 with respect to upper portion 104. After at least partially inserting lower section 1078 of upstream portion 1002 of wand 180 through opening 1014 of upper portion 104, if wand 180 is not properly oriented in rotation (i.e. rotationally misaligned) with opening 1014, then a lip 1098 of upper section 1082 may contact downstream end 1010 at opening 1014. In this case, the downward force  $F_w$  of wand 180, whether gravity or user applied to the point of contact between lip 1098 and downstream end 1010, is met with a reactionary force  $F_N$  by sloped downstream end 1010. As shown, reactionary force  $F_N$  includes a vertical component of force  $F_V$  in opposition to downward for  $F_W$  in addition to a horizontal component of force  $F_H$ . The horizontal component of force  $F_H$  urges the wand 180 to rotate back into alignment. For example, if wand 180 is rotated out of alignment in the clockwise direction 1102 then the component of force  $F_H$  urges the wand 180 to rotate counter-clockwise into alignment. In this way, sloped opening 1014 interacts with upper section 1082 of upstream portion 1002 to urge wand 180 into proper alignment for insertion into opening 1014.

## **WAND LOCKING MECHANISM**

[0081] The following is a description of the wand locking mechanism that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein.

[0082] Reference is now made to FIG. 8. Preferably, once wand 180 is connected to upper portion 104, wand 180 remains connected to upper portion 104 until wand 180 is selectively disconnected from upper portion 104. The connection between wand 180 and upper portion 104 may be maintained by one or more retentive elements of a locking mechanism, which may be selectively disengaged. When the locking mechanism is

engaged, upstream portion 1002 cannot be withdrawn from downstream portion 1006 unless the locking mechanism is unlocked. This may prevent the wand from 180 from disconnecting from upper portion 104 while wand 180 is used to maneuver surface cleaning head 108, for example.

[0083] Reference is now made to FIGS. 8 and 19. FIG. 19 shows a partial view of wand 180 including upstream portion 1002 with outer wall 1022 removed to expose the inner locking mechanism (or “wand lock”) 1106. Wand lock 1106 may include a locking member that releasably engages upper portion 104 to selectively secure wand 180 to upper portion 104 in a locked position. As exemplified, wand lock 1106 includes a plunger 1050 which may extend through opening 1054 of downstream portion 1006 to obstruct the withdrawal of upstream portion 1002 from downstream portion 1006. Further, plunger 1050 may be retractable to withdraw from opening 1054 and cease obstructing the withdrawal of upstream portion 1002 from downstream portion 1006.

[0084] As exemplified, plunger 1050 is positioned in a slot 1110 for translation between an extended position (shown), and a retracted position. A resilient member, such as spring 1114 (FIG. 20a) may act upon plunger 1050 to bias plunger 1050 toward the extended or locked position. In the extended position, an end portion 1118 of plunger 1050 protrudes from slot 1110 through an opening 1122 in outer wall 1022. In the retracted position, end portion 1118 of plunger 1050 is at least partially withdrawn back into slot 1110.

[0085] Preferably, wand lock 1106 is configured to automatically lock wand 180 to upper portion 104, upon insertion of wand 180 into upper portion 104. For example, the locking member of wand lock 1106 may automatically engage upper portion 104 upon the insertion of upstream portion 1002 into downstream portion 1006, thereby securing wand 180 to upper portion 104. In some cases, the locking member may translate laterally (i.e. substantially perpendicularly to the airflow path) to releasably engage the upper portion 104. As exemplified, plunger 1050 may automatically translate (or “extend”) laterally outwardly through opening 1054 in downstream portion 1006 upon the insertion of upstream portion 1002 into downstream portion 1006, without requiring further user action.

[0086] In the example shown, end portion 1118 of plunger 1050 includes a lower side 1126 and an opposite upper side 1130. Lower side 1126 includes a sloped face

1134. First, plunger 1050 may be in the extended position while upstream portion 1002 is withdrawn from downstream portion 1006. In the extended position, end portion 1118 including sloped face 1134 of lower side 1126 may protrude through opening 1122. When inserting upstream portion 1002 into downstream portion 1006, sloped face 1134 of lower side 1126 may make contact with downstream end 1010 at opening 1014 during insertion. For example, there may be less space between outer and inner walls 1022 and 1018 than the distance by which end portion 1118 protrudes through opening 1122 in the extended position. Downstream end 1010 may cam along sloped face 1134 forcing plunger 1050 to retract against the bias of spring 1114 until tip 1138 of plunger 1050 meets inner walls 1018. Upon further insertion, plunger 1050 may align with opening 1054 and translate laterally under the bias of spring 1114 through opening 1054.

[0087] When plunger 1050 is in the extended position and extending through opening 1054, wand 180 may not be withdrawn from upper portion 104 without first at least partially retracting plunger 1050. As exemplified, plunger 1050 includes an upper side 1130. Upper side 1130 is shown including a sloped outboard face 1142 bordered by tip 1138, and an unsloped (or less sloped) inboard face 1146 inboard of outboard face 1142. Preferably, at least a portion of inboard face 1146 projects through opening 1054 in the extended position. In this case, inboard face 1146 may contact an upper wall of opening 1054 if upstream portion 1002 is attempted to be withdrawn from downstream portion 1006 without first retracting plunger 1050. In turn, the slope of inboard face 1146 (or lack thereof) may be insufficient for the upper wall of opening 1054 to cam along inboard face 1146 to withdraw plunger 1050. Accordingly, upstream portion 1002 cannot be withdrawn from downstream portion 1006; wand lock 1106 is in the locked (or “engaged”) position.

[0088] Wand lock 1106 may be unlocked by a mechanical, electrical, or electromechanical device in response to a user action. For example, wand lock 1106 may include a wand release actuator which operates to unlock wand lock 1106. When wand lock 1106 is in the unlocked position, wand 180 may be freely removable from upper portion 104.

[0089] As exemplified, upper portion 104 may terminate well below waist height. For example, upper portion may be 12-14 inches tall. An advantage of a shorter upper

member is that it facilitates the insertion of wand 180 into upper portion 104. In order to avoid a user having to bend over to release wand 180 while enabling wand 180 to be locked to upper portion 104, an actuator 1058 may be provided at a height which may be actuated by a user while standing upright. An actuator, such as button 1058, may be drivingly connected to lock 1106 by a longitudinally extending member, such as shaft 1150. The actuator and shaft, as well as the linking member, may be provided as part of, and removable with, wand 180. Accordingly, by incorporating the lock and actuator into wand 180, upper portion 104 may be shorter.

[0090] For example, in the embodiment of Figure 19, wand lock 1106 includes a longitudinally extending transmission member that drivingly connects the wand release actuator and the locking member. For example, the transmission member may be translatable downwardly to move the wand lock 1106 into the unlocked position. Moving the transmission member downwardly may cause the locking member to move laterally to a disengaged position, and set the wand lock 1106 in the unlocked position.

[0091] In the example shown, a button 1058 is mounted to wand 180 that drives a shaft 1150 to translate toward plunger 1050. A biasing member, such as spring 1152 may bias shaft 1150 upwardly into a retracted position. Shaft 1150 may interact with plunger 1050 to move plunger 1050 into a retracted position, and thereby permit the upper wall of opening 1054 to clear at least inboard face 1146 (i.e. to engage with sloped outboard face 1142 instead, or to clear plunger 1050 altogether). As exemplified, plunger 1050 includes an upwardly-facing face 1154, and shaft 1150 includes a lower portion 1158 including a downwardly-facing face 1162. Faces 1154 and 1162 may be positioned to meet when shaft 1150 is translated downwardly toward plunger 1050 (as shown in FIG. 20b when button is partially pressed to move the lock to the unlocked position). Faces 1154 and 1162 may be shaped to provide a camming action that retracts plunger 1050 against the bias of spring 1114 as shaft 1150 is further translated toward plunger 1050. In the example shown, each of faces 1154 and 1162 are correspondingly sloped. As shaft 1150 is translated downwardly, face 1158 of shaft 1150 cams along face 1154 of plunger 1050 causing plunger 1050 to retract to the retracted position. In the retracted position, the upstream portion 1002 may be withdrawn from downstream portion 1006; the wand lock is unlocked (or "disengaged"). The upper wall of opening 1054 may be able to clear at least inboard face 1146 which was preventing the withdrawal in the locked condition.

[0092] Preferably, wand lock 1106 may remain in the unlocked (or “disengaged”) position after button 1058 is released. This may permit a user to use the same hand to activate button 1058 (unlocking wand 180) and to subsequently remove wand 180 from upper portion 104. In the example shown, shaft 1150 may be biased (e.g. by a resilient element such as spring 1152) upwardly. When plunger 1050 is in the retracted position, shaft 1150 may obstruct plunger 1050 from extending under the bias of spring 1114, and plunger 1050 may obstruct shaft 1150 from retracting upwardly. As exemplified, plunger 1050 includes a lip 1166 below face 1154, and shaft 1150 includes a lip 1170 above face 1162. Further, lower face 1162 may move past upper face 1154 during downward translation of shaft 1150. When this occurs, plunger 1050 translates laterally outwardly a short distance moving lips 1166 and 1170 into contact. The contact between lips 1166 and 1170 prevents shaft 1150 from withdrawing upwardly. Further, the position of lower portion 1158 in front of plunger 1050 obstructs plunger 1050 (as shown in FIG. 20c) from further translation toward the extended position. Accordingly, the lock is maintained in the unlocked position.

[0093] Preferably, wand lock 1106 may be freed from maintaining the unlocked position upon removing and/or reinserting wand 180 into upper portion 104. For example, shaft 1150 and plunger 1050 may be disentangled upon the withdrawal or reinsertion of upstream portion 1002 out of or into downstream portion 1006. As exemplified, sloped outboard face 1142 and a portion of sloped lower face 1134 of plunger 1050 may protrude outwardly through opening 1122 in upstream portion 1002, when plunger 1050 is in the retracted position. This may permit the upper wall of opening 1054 to cam sloped outboard face 1142 during withdrawal of upstream portion 1002 from downstream portion 1006 to further retract plunger 1050. This moves lip 1166 of plunger 1050 out of contact with lip 1170 of shaft 1150 (as shown in FIG. 20d), allowing shaft 1150 to retract upwardly. After plunger 1050 clears the downstream end 1010 of upper portion 104, plunger 1050 may extend under the bias of spring 1114 to the extended position.

[0094] Wand lock 1106 may also be maintained in the unlocked position while wand 180 is removed from upper portion 104. For example, button 1058 may be depressed to retract plunger 1050 and entangle shaft 1150 with plunger 1050 while wand 180 is removed from upper portion 104. In this case, reinserting wand 180 into upper portion 104 may release wand lock from the unlocked position. As exemplified, a portion of sloped

lower face 1134 of plunger 1050 may protrude outwardly through opening 1122 in upstream portion 1002, when plunger 1050 is in the retracted position. This may permit the downstream end 1010 at opening 1014 to cam sloped lower face 1134 during insertion of upstream portion 1002 into downstream portion 1006 to further retract plunger 1050. This moves lip 1166 of plunger 1050 out of contact with lip 1170 of shaft 1150 (as shown in FIG. 20d), allowing shaft 1150 to retract upwardly. Once plunger 1050 aligns with opening 1054 in downstream portion 1006, plunger 1050 may translate laterally outwardly under the bias of spring 1114 to the extended position.

### **WAND LOCK RELEASE ACTUATOR**

[0095] The following is a description of the wand lock release actuator that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, for example with one or more of the first, second, fourth and fifth aspects.

[0096] In some embodiments, the locking mechanism (e.g. wand lock 1106) that prevents wand 180 from being separated from upper portion 104 after they are connected, may be released by a wand lock release actuator. The actuator may have a mechanical, electrical, or electromechanical connection to the wand lock. Preferably, the actuator may be positioned remotely from upper portion 104 at a position above upper portion 104 toward handle 160 (FIG. 5). For example, the actuator may be positioned above upper portion 104 on wand 180 or on handle 160. In some cases, the actuator may be positioned between a user's knee height and chest height, and more preferably between a user's thigh height and waist height. This may reduce or eliminate the need for a user to bend over to activate the actuator to release the wand lock and separate the wand 180 from the upper portion 104 (e.g. to use the surface cleaning apparatus 100 in an above-floor cleaning mode).

[0097] Referring to FIGS. 8 and 19, as exemplified, a button 1058 may be positioned at approximately a midpoint along the length of wand 180. Button 1058 is an example of a lock release actuator. This may generally correspond to a height of a user's thighs. As shown, button 1058 may be substantially parallel with an upper end 1066 of



surface cleaning unit 112. Button 1058 is drivingly connected to the plunger 1050 by shaft 1150.

[0098] The lock release actuator may be connected to wand 180, and removable from upper portion 104 and surface cleaning unit 112 when wand 180 is separated from upper portion 104 and surface cleaning unit 112 (e.g. for use in an above-floor cleaning mode). Similarly, a longitudinally extending transmission member drivingly connecting the lock release actuator to the locking member of wand lock 1106 may be mounted to wand 180 and removable from upper portion 104 and surface cleaning unit 112 when wand 180 is separated from upper portion 104 and surface cleaning unit 112. For example, wand lock 1106 in its entirety may be mounted to wand 180 and removable from upper portion 104 and surface cleaning unit 112 when wand 180 is separated from upper portion 104 and surface cleaning unit 112. This may advantageously allow surface cleaning apparatus 100 to be easily reconfigured into different modes of operation. For example, when surface cleaning unit 112 is unmounted from (removed from) upper portion 104, the wand lock 1106 may remain with wand 180 to allow wand 180 to remain releasably connected to upper portion 104.

[0099] In the example shown, wand lock 1106 including button 1058, shaft 1150, and plunger 1050 are all connected to wand 180 independent of surface cleaning unit 112 and upper portion 104, and remain so connected after surface cleaning unit 112 and upper portion 104 are separated from wand 180.

## **SURFACE CLEANING UNIT MOUNTING STRUCTURE**

[00100] The following is a description of the surface cleaning unit mounting structure that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, for example with one or more of the first, second, third, fourth and fifth aspects.

[00101] Reference is now made to FIG. 5. Surface cleaning unit 112 may be removably mountable to one or more of upper portion 104 and wand 180. Preferably, surface cleaning unit 112 may be mounted to upper portion 104 independent of wand 180, such that surface cleaning unit 112 may be mounted and dismantled from upper portion

104 without adjusting the position of wand 180 or removing wand 180. Accordingly, for example, wand 180 may remain in upper portion 104 while surface cleaning unit 112 is mounted to or removed from upper portion 104.

[00102] Alternately, or in addition, when surface cleaning unit 112 is mounted to upper portion 104, upper portion 104 may stabilize surface cleaning unit 112 (e.g. surface cleaning unit 112 may remain in a fixed position on upper portion 104 as upper portion 104 is manipulated to maneuver surface cleaning head 108). For example, upper portion 104 may inhibit translational movement of surface cleaning unit 112 along upper axis 164 (FIG. 2) toward surface cleaning head 108, and/or may inhibit rotational movement of surface cleaning unit 112 around upper axis 164.

[00103] Accordingly, surface cleaning unit 112 may be mounted on the exterior of upper portion 112 by two mounting members wherein the mounting members are provided a two longitudinally (e.g., along axis 164) spaced apart locations wherein at least one of the two mounting members provides lateral stability as upper portion 104 is manipulated to maneuver surface cleaning head 108. It will be appreciated that more than two mounting members may be provided.

[00104] Surface cleaning unit 112 may be slidably receivable on one or both of the mounting members. For example, surface cleaning unit 112 may have one or more recess to receive one of the mounting members therein. Accordingly, if one of the mounting members comprises a pair of laterally extending portions (e.g., left and right laterally extending wings that extend outwardly from opposed sides of the upper portion, or a mounting member provided on the front or rear of the exterior of the upper portion which has left and right laterally extending wings), then the surface cleaning unit 112 may have one or two groves in which the laterally extending position may be received.

[00105] One of the mounting members may have a sufficient height such that surface cleaning unit remains in a fixed position if wand 180 is removed and/or surface cleaning unit 112 is unlocked for removal from upper portion. For example, if the mounting member comprises laterally extending portions that are received in a recess, groove or the like then the engagement between abutting surfaces of the laterally extending portions and the recess, groove or the likes may dimensionally stabilize surface cleaning unit 112 in position in the unlocked position and with the wand removed.

[00106] Referring to FIGS. 12-15 and 21-25, surface cleaning unit 112 and upper portion 104 may include one or more mounting elements or members for connecting surface cleaning unit 112 to upper portion 104. For example, the mounting elements may include outwardly projecting mounting members or wings and corresponding mounting recesses for receiving those mounting members.

[00107] As exemplified, upper portion 104 includes outwardly projecting wings 1174a and 1174b. Wings 1174 are examples of mounting members. As shown, wings 1174 may extend laterally from a front side 1178 of upper portion 104. Although upper portion 104 is shown including two mounting members, in alternative embodiments, upper portion 104 may include any suitable number of mounting members. For example, upper portion 104 may include between one wing 1174 and ten wings 1174, which may extend in any number of directions. Further, wings 1174 may each be discrete elements, or they may be integrally formed as are 1174a and 1174b in the example shown.

[00108] As exemplified, surface cleaning unit 112 includes recesses 1182a and 1182b. Each recess 1182 may include an opening 1186 in a bottom surface 1190 of surface cleaning unit 112. Recesses 1182 may be sized and positioned to receive wings 1174. For example, surface cleaning unit 112 may be positioned above upper portion 104 and lowered to slide wings 1174 into recesses 1182. Thereafter, surface cleaning unit 112 may be separated from upper portion 104 by moving surface cleaning unit 112 vertically away from upper portion 104 to remove wings 1174 from recesses 1182.

[00109] Although surface cleaning unit 112 is shown including two recesses 1182, in alternative embodiments, surface cleaning unit 112 may include any suitable number of recesses for receiving some or all of the mounting members of upper portion 104. Further, the arrangement of recesses and protruding mounting members may be reversed. Each of surface cleaning apparatus 112 and upper portion 104 may include one or more recesses and mounting members sized and positioned to mate with one another.

[00110] Optionally, openings 1186 to recesses 1182 may be shaped to make it easier for a user to insert wings 1174 into recesses 1182. In some cases, mating recesses 1182 over wings 1174 may include lowering surface cleaning unit 112 onto upper portion 104. The openings 1186 to recesses 1182 on the bottom surface 1190 of

surface cleaning unit 112 may be well below a user's eye-level and obscured from view. This may make aligning openings 1186 with recesses 1182 more difficult.

[00111] As exemplified, each recess 1182 may be flared in a lower portion 1194 of the recess 1182 to provide an enlarged opening 1186. Enlarged openings 1186 may make aligning openings 1186 over wings 1174 less difficult. Once wings 1174 enter the enlarged openings 1186, surface cleaning unit 112 may self-align as surface cleaning unit 112 is lowered further and wings 1174 enter the narrower upper portions 1198 of recesses 1182.

[00112] In the example shown, at least upper portion 1198 of each recess 1182 has a sectional profile that closely corresponds to the sectional profile of respective mating wings 1174. This may provide a tight interface between recesses 1182 and wings 1174 for stabilizing surface cleaning unit 112 on upper portion 104.

[00113] The fit between wings 1174 and recesses 1182 may stabilize surface cleaning unit 112 from rotating in all directions. This may prevent surface cleaning unit 112 from tipping over, e.g. when upper portion 104 is manipulated to maneuver surface cleaning head 108. Further, wings 1174 may support surface cleaning unit 112 from translating toward surface cleaning head 108. For example, one or more of recesses 1182 may include an end wall 1202 bordering upper portion 1198. Wings 1174 may insert far enough into recesses 1182 that an upper surface 1204 of at least one of wings 1174 contacts an end wall 1202. This contact may inhibit further translation of surface cleaning unit 112 toward surface cleaning head 108. Accordingly, for example, if wand 180 is removed and/or surface cleaning unit 112 is unlocked for removal from upper portion, then surface cleaning unit 112 may remain in position on upper portion 104.

[00114] In alternative embodiments, different mounting element(s) inhibit movement of surface cleaning unit 112 toward surface cleaning head 108. In this case, recesses 1182 may be open ended (i.e. without end walls 1202), wings 1174 may not reach an end wall 1202, or both. Instead the different mounting element(s) may inhibit movement of surface cleaning unit 112 toward surface cleaning head 108.

[00115] Reference is now made to FIGS. 12, 14, and 17. In addition to, or instead of wings 1174 and recesses 1182, surface cleaning unit 112 may include a different mounting member that engages downstream end 1010 of upper portion 104. As

exemplified, surface cleaning unit 112 includes a clip 1206. Clip 1206 is an example of a mounting member. Clip 1206 may extend downwardly in spaced apart relation from a rear surface 1210 of surface cleaning unit 112 forming a slot 1214 for receiving a portion of downstream end 1010 of upper portion 104.

[00116] In use, surface cleaning unit 112 may be lowered onto upper portion 104 such that a front side 1178 of downstream portion 1006 enters slot 1214, and clip 1206 enters upper portion 104. Clip 1206 may grasp front side 1178 of upper portion 104 to inhibit surface cleaning unit 112 from rotating forwardly, over surface cleaning head 108, or rearwardly. In some cases, upper portion 104 may abut upper end 1218 of slot 1214 such that the weight of surface cleaning unit 112 may be supported on downstream end 1010 of upper portion 104. Clip 1206 may be disconnected from upper portion 104 by raising surface cleaning unit 112 vertically away from upper portion 104. Accordingly, upper portion 104 provides a support on which the surface cleaning unit 112 (clip 1206) seats when mounted to upper portion 104.

[00117] As shown in FIG. 15, a clearance 1222 may be provided between inner wall 1018 of upper portion 104 and outer wall 1022 of wand 180, toward the front side 1178 of upper portion 104, when wand 180 is inserted into upper portion 104. Clearance 1222 may provide space for clip 1206 to be received in upper portion 104 simultaneously with wand 180. Further, either of clip 1206 or wand 180 may be removed from upper portion 104 while the other remains inserted in upper portion 104. This may make reconfiguring surface cleaning apparatus 100 into different cleaning modes quick and easy.

[00118] Reference is now made to FIGS. 8, 10, 12, and 17. Alternatively, or in addition to wings 1174, recesses 1182, and clip 1206, wand 180 may include mounting members for supporting surface cleaning unit 112 and or dynamically stabilizing or assisting in dynamically stabilizing surface cleaning unit 112 on upper portion 104. Accordingly, for example, the mounting members of wand 180 enhance stability of surface cleaning unit 112 when both wand 180 and surface cleaning unit 112 are connected to upper portion 104. For example, mounting members of wand 180 may inhibit the rotation and/or the translation forward of surface cleaning unit 112, e.g. when upper portion 104 and/or wand 180 are manipulated to maneuver surface cleaning head 108.

[00119] As exemplified, wand 180 may include wings 1226a and 1226b. Wings 1226 are examples of mounting members. Further, surface cleaning unit 112 may include arms 1230a and 1230b for at least partially surrounding wings 1226. As shown, each arm 1230 may define a slot 1234 for receiving a wing 1226. Preferably, slots 1234 are open ended. This may permit wings 1226 to be received from above or below slots 1234. For example, if surface cleaning unit 112 is connected to upper portion 104, then wings 1226 may enter and exit slots 1234 through the open upper end 1238 of slots 1234, as wand 180 is lowered into upper portion 104 or raised away from upper portion 104. Further, if wand 180 is connected to upper portion 104, then wings 1226 may enter and exit through slots 1234 through the open bottom end 1242 of slots 1234, as surface cleaning unit 112 is lowered onto upper portion 104 or raised away from upper portion 104.

[00120] Slots 1234 may be shaped to make aligning wings 1226 with slots 1234 easier. As exemplified, each end 1238 and 1242 of slots 1234 may be flared to provide a widened opening for easier alignment with wings 1226. Further, each slot 1234 may include a narrow region 1246 between upper and lower ends 1238 and 1242. Preferably, narrow region 1246 may make contact with wings 1226 when wings 1226 are received in slots 1234. As exemplified, each of wings 1226 includes a front surface 1250 that faces forward toward surface cleaning unit 112 (when surface cleaning unit 112 and wand 180 are connected to upper portion 104), and an opposite rear face 1254. In use, when wings 1226 are received in slots 1234, slots 1234 may contact at least a portion of rear faces 1254 of wings 1226. This may permit arms 1230 to inhibiting surface cleaning unit 112 from tilting forwardly over surface cleaning head 108.

[00121] Alternatively, or in addition to providing support for surface cleaning unit 112, the interaction between wings 1226 and arms 1230 may help to support wand 180 in an upright position. Wand 180 may be releasably securable to upper portion 104. For example, a wand lock may be releasably engaged to secure wand 180 to upper portion 104. However, in some embodiments, after the wand lock is disengaged, upper portion 104 may not provide good support to maintain wand 180 in position. For example, wand 180 may tip over after the wand lock is disengaged if no further support is provided. This may be exacerbated where the wand lock remains disengaged after a user ceases interaction with a wand lock release actuator. In this case, when a user activates the wand lock release actuator, the user may release control of wand 180, such that wand 180

may fall over if no further support is provided to keep wand 180 in position. Such further support may be provided by arms 1230 which may receive wings 1226 to support wand 180 in an upright position, e.g. when wand lock is unlocked. This may provide a user with time to develop a proper grip on wand 180 after unlocking the wand lock.

[00122] In operation, a user may position surface cleaning unit 112 adjacent upper portion 104 and above upper wings 1226 and above lower wings 1174. Slots 1234 may be generally aligned with upper wings 1226 and recesses 1182 may be generally aligned with lower wings 1174. This is the position shown in Figure 23. Surface cleaning unit 112 may then be lowered. As surface cleaning unit 112 is lowered, arms 1230 extend to surround upper wings 1226 and lower wings 1174 commence to be received in recesses 1182. This is the position shown in Figure 24. Continual lowering of surface cleaning unit to the mounted position shown in FIG 25 results in surface cleaning unit being seated on lower wings 1174, clip 1206 being received in upper portion 104 and arms 1230 of the surface cleaning unit surrounding upper wings 1226 of the wand 180.

#### **SURFACE CLEANING UNIT LOCKING MECHANISM**

[00123] The following is a description of the surface cleaning unit locking mechanism that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein, for example with one or more of the first, second, third, fourth and fifth aspects.

[00124] Preferably, once surface cleaning unit 112 is connected to upper portion 104, surface cleaning unit 112 remains connected to upper portion 104 until surface cleaning unit 112 is selectively disconnected from upper portion 104. The connection between surface cleaning unit 112 and upper portion 104 may be maintained by one or more retentive elements of a locking mechanism, which may be selectively disengaged. When the locking mechanism is engaged, surface cleaning unit 112 may not be separable from upper portion 104 unless the locking mechanism is unlocked. This may prevent the upper portion 104 from disconnecting from upper portion 104, e.g. while upper portion 104 is used to maneuver surface cleaning head 108 or if surface cleaning apparatus 100 is carried by grasping surface cleaning unit 112.

[00125] As discussed previously, upper portion 104 may terminate well below waist height. An advantage of a shorter upper member is that it facilitates the insertion of wand 180 into upper portion 104. In order to avoid a user having to bend over to release surface cleaning unit 112 while enabling surface cleaning unit 112 to be locked to upper portion 104, an actuator may be provided at a height which may be actuated by a user while standing upright. The actuator may be drivingly connected to lock by a longitudinally extending member, such as shaft. The actuator and shaft, as well as any linking member, may be provided as part of, and removable with, surface cleaning unit 112. Accordingly, by incorporating the lock and actuator into surface cleaning unit 112, upper portion 104 may be shorter.

[00126] Reference is made to FIGS. 14, 17, and 18a-d, where like part numbers refer to like parts in the other figures. As exemplified, surface cleaning unit 112 may include a locking mechanism 1258 that is substantially similar to wand lock 1106 describe above. Accordingly, the description below of locking mechanism 1258 is abbreviated so as not to unnecessarily repeat details and variants already described above.

[00127] In the example shown, locking mechanism 1258 may include an unlock actuator 1058 drivingly connected to a locking member 1050 by a longitudinally extending transmission member 1150. Locking member 1050 may translate laterally outwardly to engage with upper portion 104, placing locking mechanism 1258 into a locked position (FIG. 18a). Vertical translation of longitudinally extending transmission member 1150 toward locking member 1050 (e.g. by interaction with unlock actuator 1058) may urge locking member 1050 to translate laterally inwardly (FIG. 18b) to disengage with upper portion 104, placing locking mechanism 1258 in an unlocked position (FIG. 18c). Once in the unlocked position, locking mechanism 1258 may remain unlocked until the surface cleaning unit 112 is withdrawn from upper portion 104 or reengaged with the upper portion 104. The act of withdrawing or reengaging surface cleaning unit 112 with upper portion 104 may release locking mechanism 1258 from the unlocked position (FIG. 18d), allowing locking mechanism 1258 to move to the locked position when appropriate.

[00128] As exemplified, locking mechanism 1258 may be wholly connected to surface cleaning unit 112. When surface cleaning unit 112 is removed from upper portion 104, so too may locking mechanism 1258, which may remain connected to surface



cleaning unit 112. In the example shown, locking mechanism 1258 is positioned behind rear surface 1210 of surface cleaning unit 112. Locking member 1050 of locking mechanism 1258 is exemplified as a plunger which is extendable through an opening 1262 in rear surface 1210 of surface cleaning unit 112. Locking member 1050 of locking mechanism 1258 may engage with a front side 1178 of upper portion 104. As exemplified, front side 1178 includes an opening 1266. Opening 1266 may be sized and positioned to receive locking member 1050 when locking mechanism 1258 is in the locked position.

[00129] Lock release actuator 1058 may be positioned in any suitable location. Preferably, lock release actuator 1058 is positioned proximate upper end 1066 of surface cleaning apparatus 112. This may permit a user to activate lock release actuator 1058 (e.g. depressing a button actuator) with little or no bending over. Further, lock release actuator 1058 is preferably positioned proximate handle 160. In some embodiments, this may permit a user to simultaneously grasp handle 160 and activate lock release actuator 1058. In the example shown, lock release actuator 1058 is positioned on openable lid 228 of cyclone bin assembly 136. As shown in FIG. 18c, lock release actuator 1058 may extend through an opening 1270 in an inner surface of lid 228 for interacting with transmission member 1150. When lid 228 is in an open position, lock release actuator 1058 may disengage (e.g. separate from) transmission member 1150. When lid 228 is in a closed position, lock release actuator 1058 may re-engage (e.g. reestablish contact with) transmission member 1150 for driving the translation of transmission member 1150.

[00130] Preferably, locking mechanism 1258 inhibits vertical translation of surface cleaning unit 112 away from upper portion 104 (e.g. in the downstream direction) when locking mechanism 1258 is in the locked condition. However, in some embodiments, locking mechanism 1258 may not inhibit forward rotation (i.e. rotation over surface cleaning head 108) of locking mechanism 1258, which in some circumstances may remove locking member 1050 from opening 1266 defeating locking mechanism 1258. Therefore, surface cleaning apparatus 100 may include additional retentive elements for at least inhibiting forward rotation of surface cleaning unit 112 when connected to upper portion 104. For example, one or both of surface cleaning unit 112 and upper portion 104 may include one or more mounting members, such as wings 1174 and/or clip 1206, for mounting surface cleaning unit 112 to upper portion 104 and inhibiting at least forward rotation of surface cleaning unit 112.

[00131] What has been described above has been intended to be illustrative of the invention and non-limiting and it will be understood by persons skilled in the art that other variants and modifications may be made without departing from the scope of the invention as defined in the claims appended hereto. The scope of the claims should not be limited by the preferred embodiments and examples, but should be given the broadest interpretation consistent with the description as a whole.

## CLAIMS

1. A surface cleaning apparatus comprising:
  - (a) a surface cleaning head having a dirty air inlet;
  - (b) an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position;
  - (c) an above floor cleaning wand removably receivable in the upper portion and having a longitudinally extending axis;
  - (d) a flexible air flow conduit forming at least part of an air flow path from the above floor cleaning wand to the surface cleaning unit;
  - (e) a lower mounting member provided on an outer surface of the upper portion;
  - (f) an upper mounting member provided on at least one of the outer surface of the upper portion and the wand; and,
  - (g) a portable surface cleaning unit comprising a suction motor and an air treatment member removably mounted to the upper portion:

wherein the lower mounting member comprises a pair of lower wings extending laterally outwardly from the upper portion and the portable surface cleaning unit has mating recesses provided on a lower surface thereof.
2. The surface cleaning apparatus of claim 1 wherein at least one of the upper and lower mounting members inhibits rotational movement of the portable surface cleaning unit around the axis of the wand.
3. The surface cleaning apparatus of claim 1 wherein the portable surface cleaning unit is slidably mountable with respect to the upper and lower mounting members.
4. The surface cleaning apparatus of claim 1 wherein the portable surface cleaning unit is vertically removable from the upper and lower mounting members.
5. The surface cleaning apparatus of claim 1 further comprising a wand lock having a locked position in which the wand is secured to the upper portion and an unlocked

position in which the wand is removable from the upper portion, wherein the upper mounting member is provided on the wand.

6. The surface cleaning apparatus of claim 1 wherein the upper portion is steeringly coupled to the surface cleaning head.

7. The surface cleaning apparatus of claim 1 further comprising a wand lock having a locked position in which the wand is secured to the upper portion and an unlocked position in which the wand is removable from the upper portion, wherein the upper mounting member is provided on the wand.

8. The surface cleaning apparatus of claim 7 wherein the wand lock is operable to remain in the unlocked position once moved to the unlocked position and the upper mounting member comprises a pair of upper wings extending laterally outwardly from the wand, the portable surface cleaning apparatus comprises a pair of arms that at least partially surround the upper wings, whereby the wand remains in position when the wand lock is moved to the unlocked position.

9. The surface cleaning apparatus of claim 7 wherein the wand lock is operable to remain in the unlocked position once moved to the unlocked position and the upper mounting member comprises a pair of wings extending laterally outwardly from the wand, each wing having a first surface that faces towards the portable surface cleaning unit and an opposed face and the portable surface cleaning apparatus comprises a pair of arms wherein each arm contacts a portion of the opposed face of one of the wings, whereby the wand remains in position when the wand lock is moved to the unlocked position.

10. The surface cleaning apparatus of claim 1 further comprising a turbo brush that is connectable to the above floor cleaning wand when the above floor cleaning wand is removed from the upper portion.

11. A surface cleaning apparatus having comprising:
  - (a) a surface cleaning head having a dirty air inlet;
  - (b) an upper portion moveably mounted to the surface cleaning head between a storage position and a floor cleaning position;
  - (c) an above floor cleaning wand removably mounted to the upper portion;
  - (d) a flexible air flow conduit forming at least part of an air flow path from the above floor cleaning wand to the surface cleaning unit;
  - (e) a lower mounting member provided on an outer surface of the upper portion and comprising a pair of lower wings extending laterally outwardly from the upper portion and the portable surface cleaning unit has mating recesses provided on a lower surface thereof;
  - (f) an upper mounting member provided on at least one of the outer surface of the upper portion and the wand;
  - (g) a portable surface cleaning unit comprising a suction motor and an air treatment member removably mounted on an outer surface of the upper portion, wherein the portable surface cleaning unit is slidably mountable with respect to the upper and lower mounting members.
  
12. The surface cleaning apparatus of claim 11 wherein at least one of the upper and lower mounting members inhibits rotational movement of the portable surface cleaning unit around the axis of the wand.
  
13. The surface cleaning apparatus of claim 12 wherein the portable surface cleaning unit is vertically removable from the upper and lower mounting members.
  
14. The surface cleaning apparatus of claim 12 further comprising a steering coupling wherein the upper portion is steeringly coupled to the surface cleaning head.

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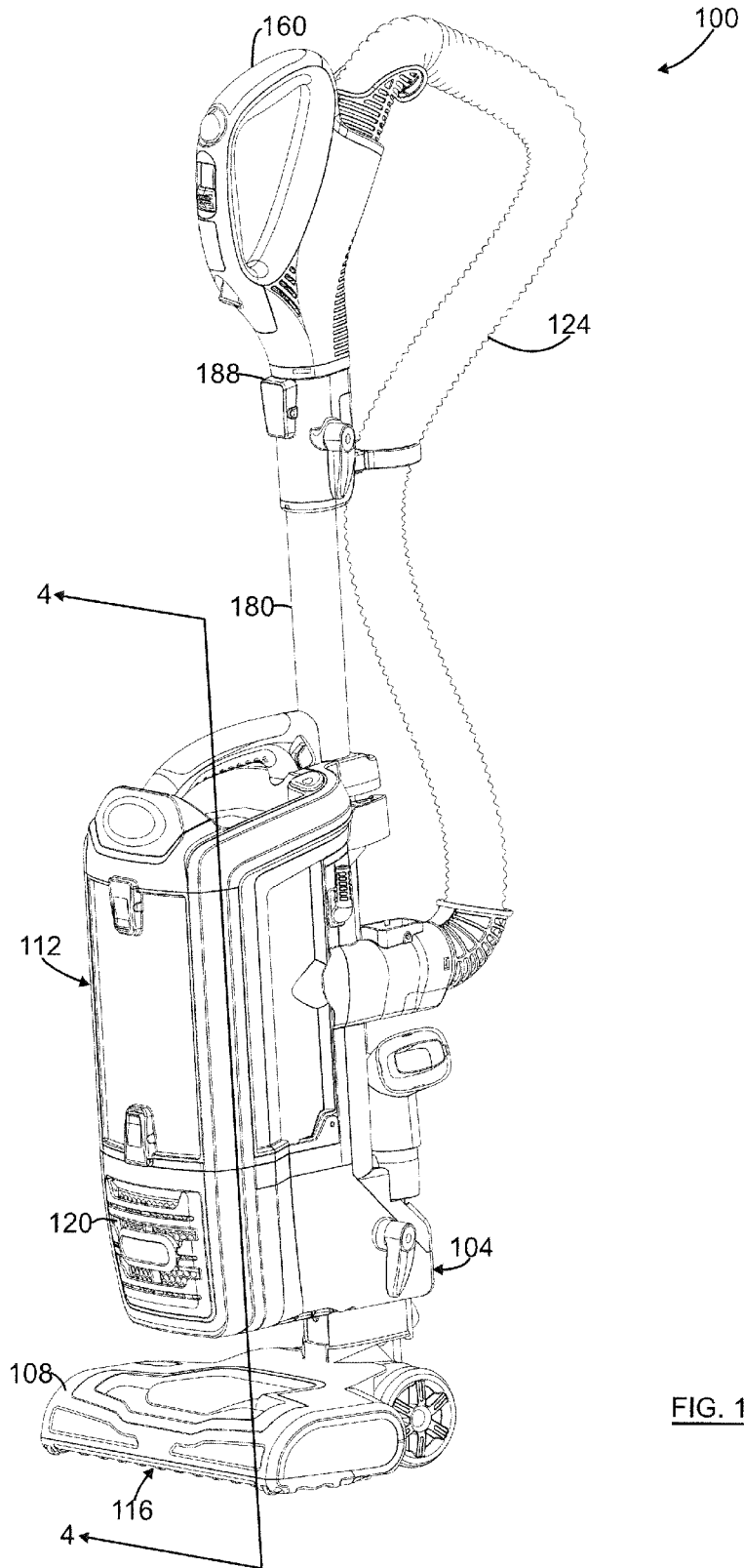


FIG. 1

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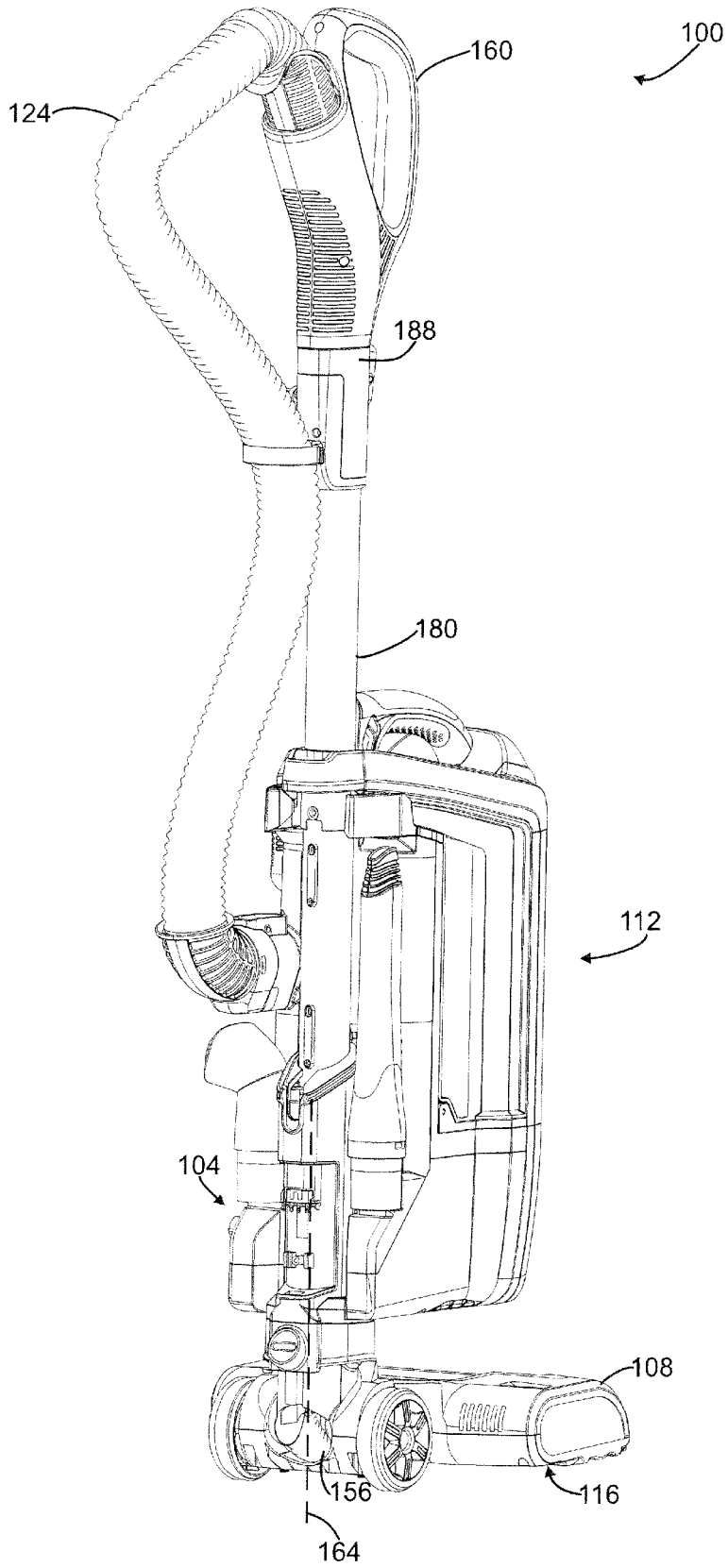


FIG. 2





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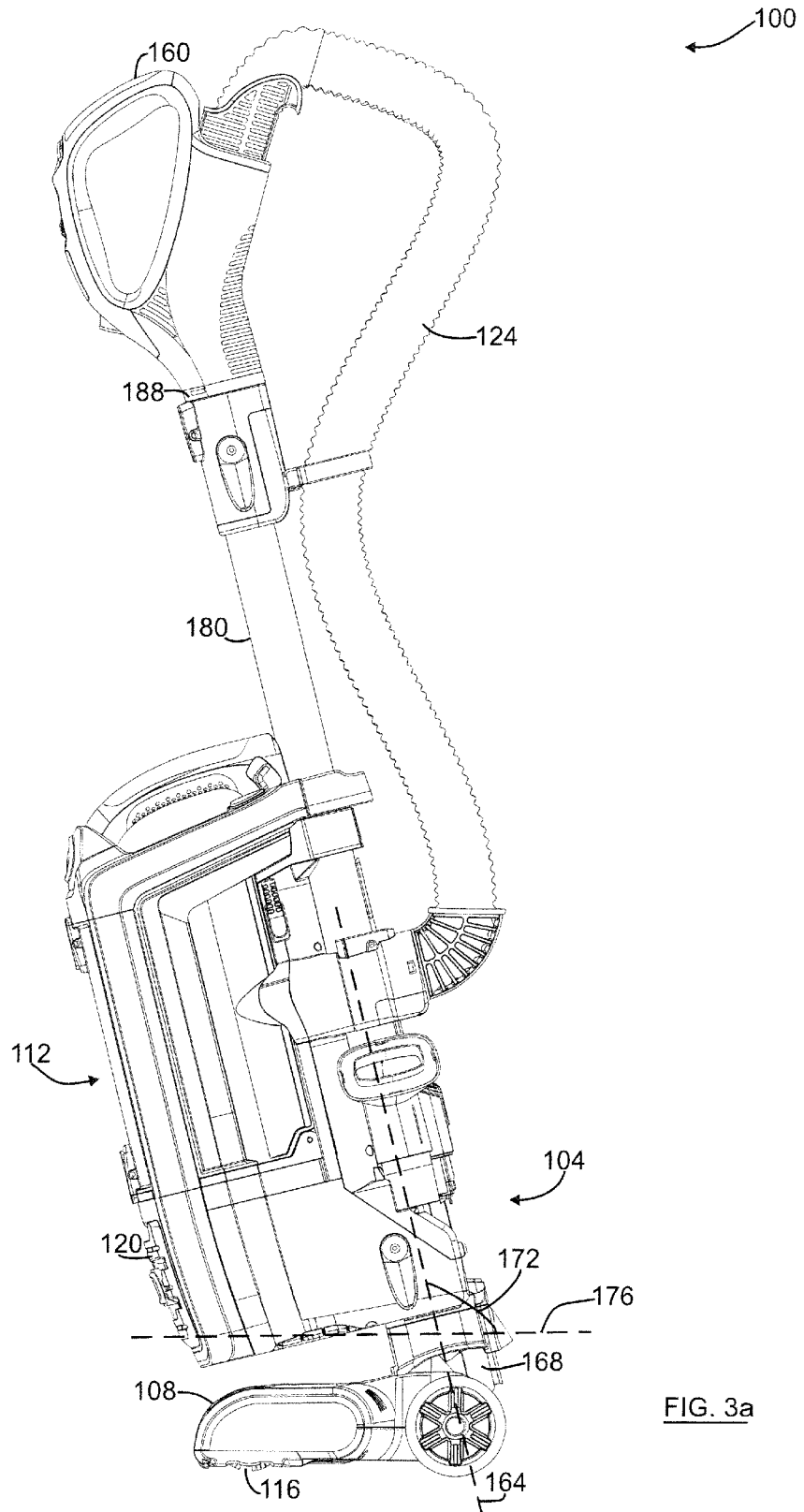


FIG. 3a

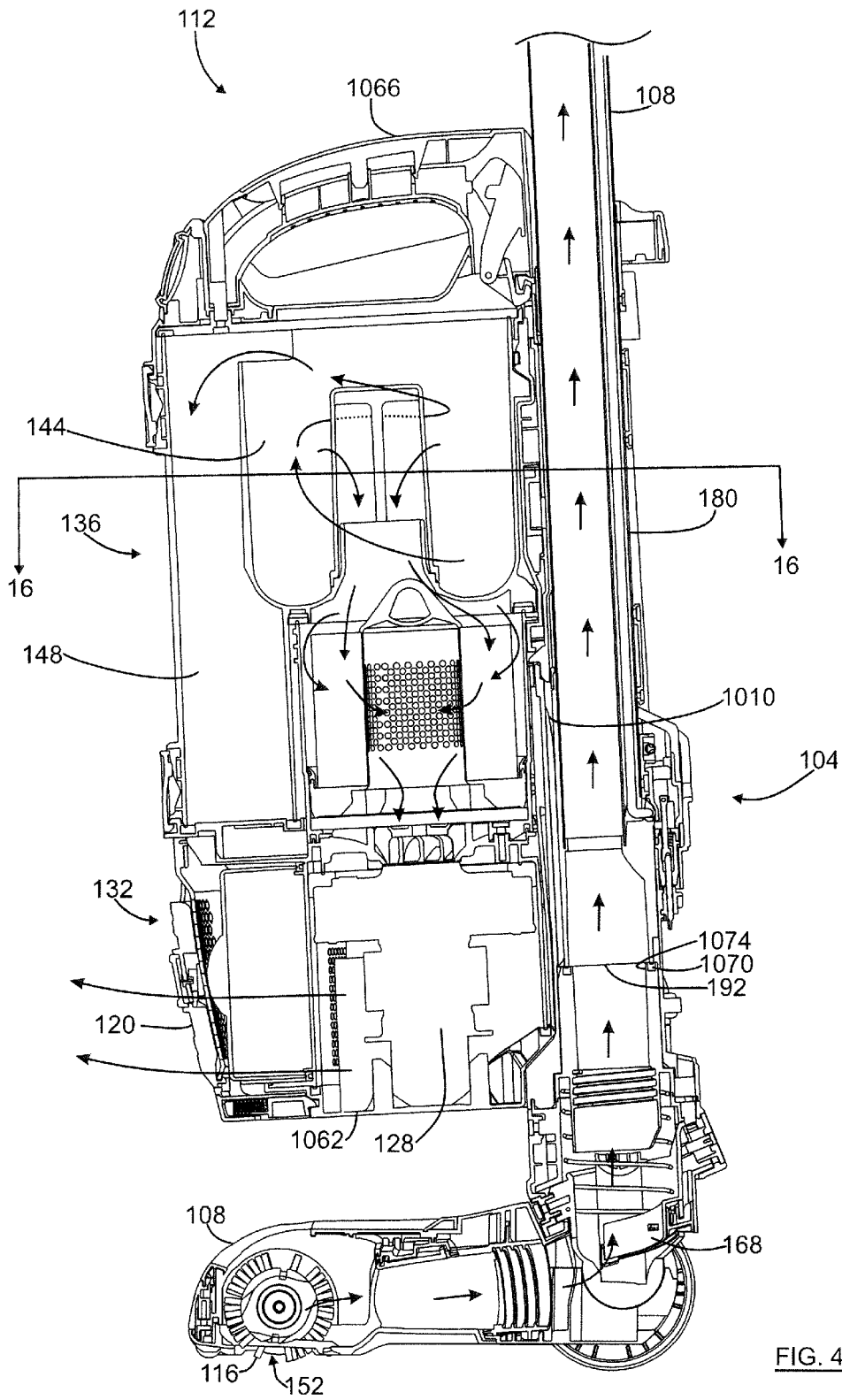


FIG. 4

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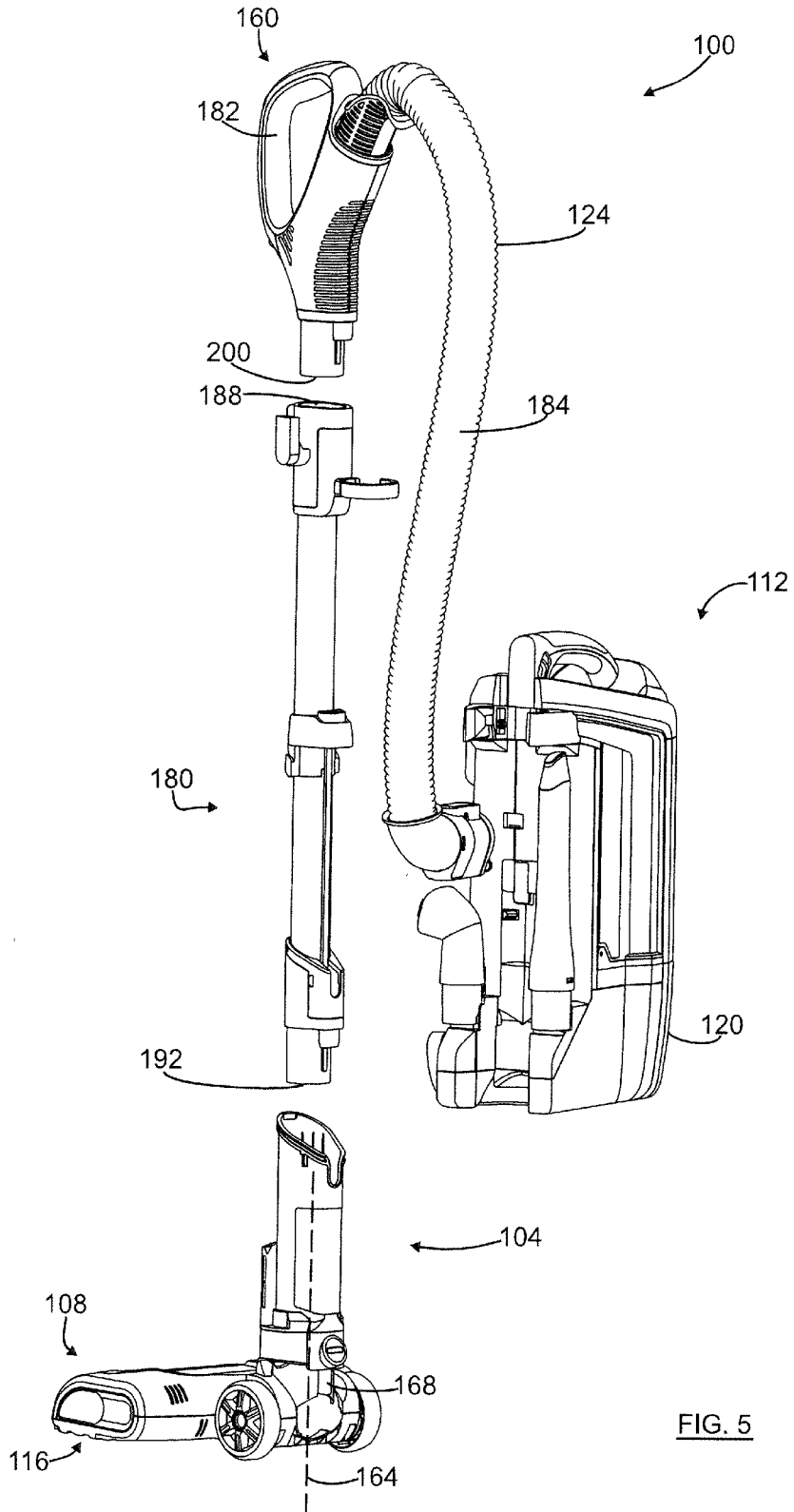


FIG. 5

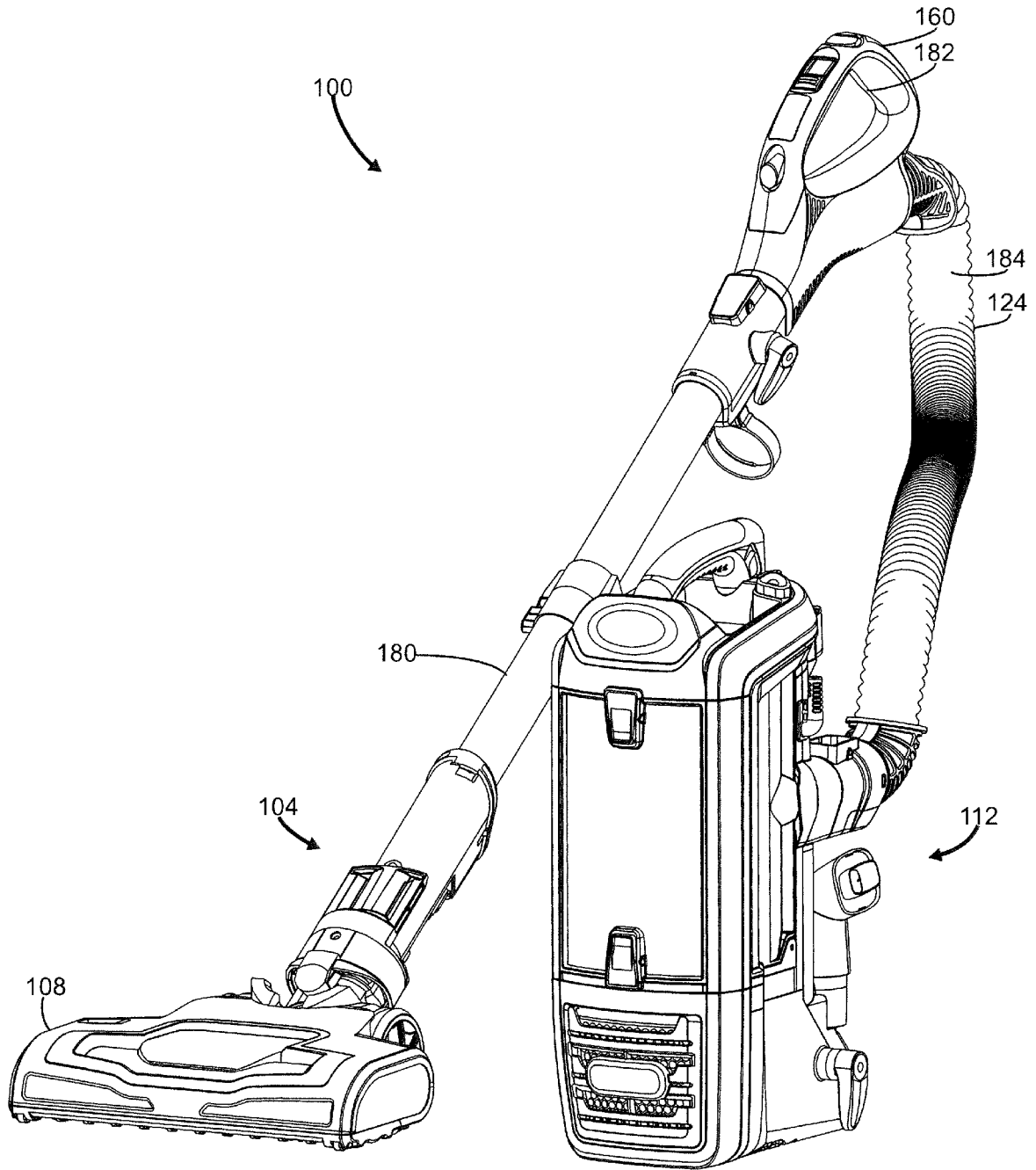


FIG. 6

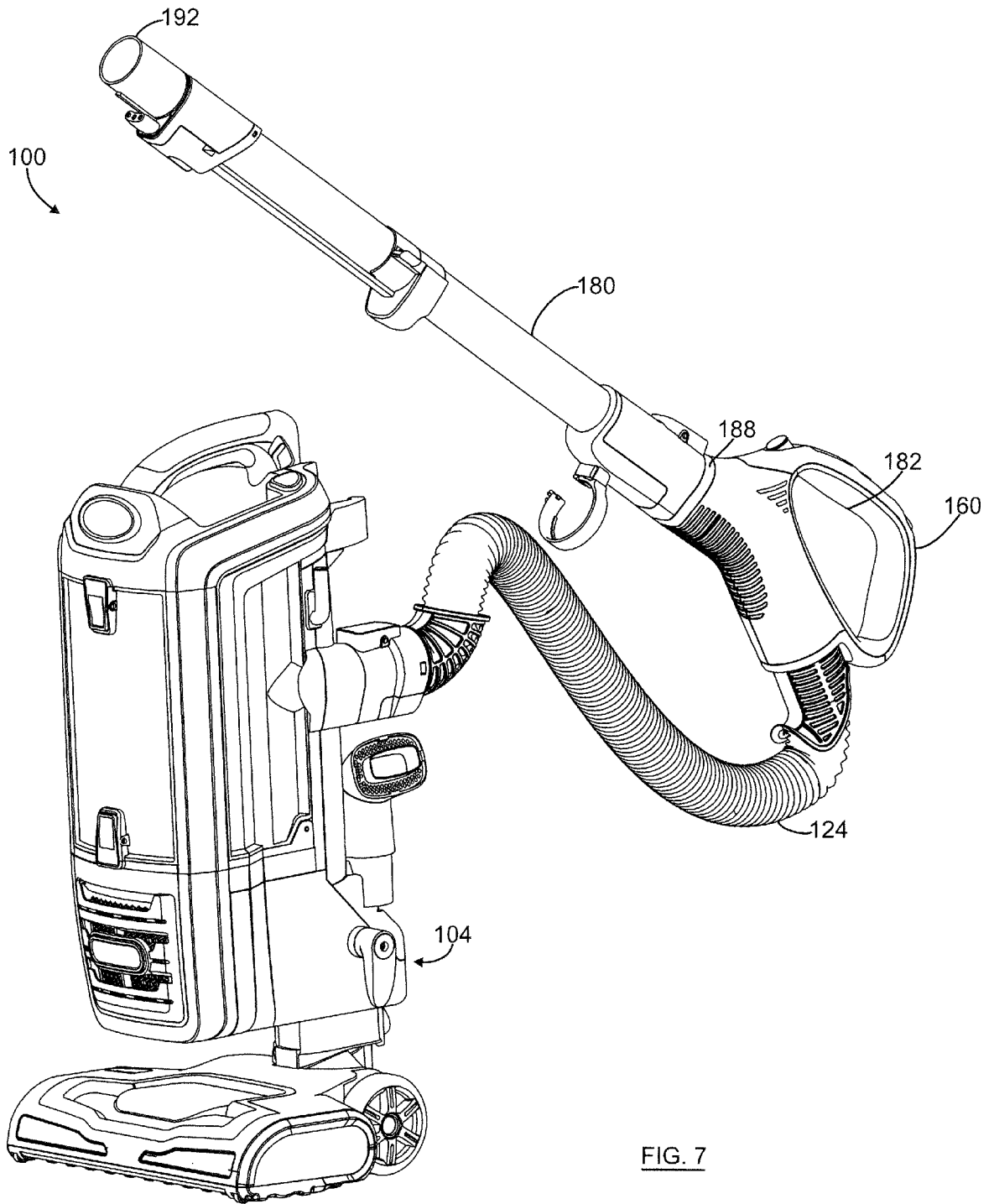


FIG. 7



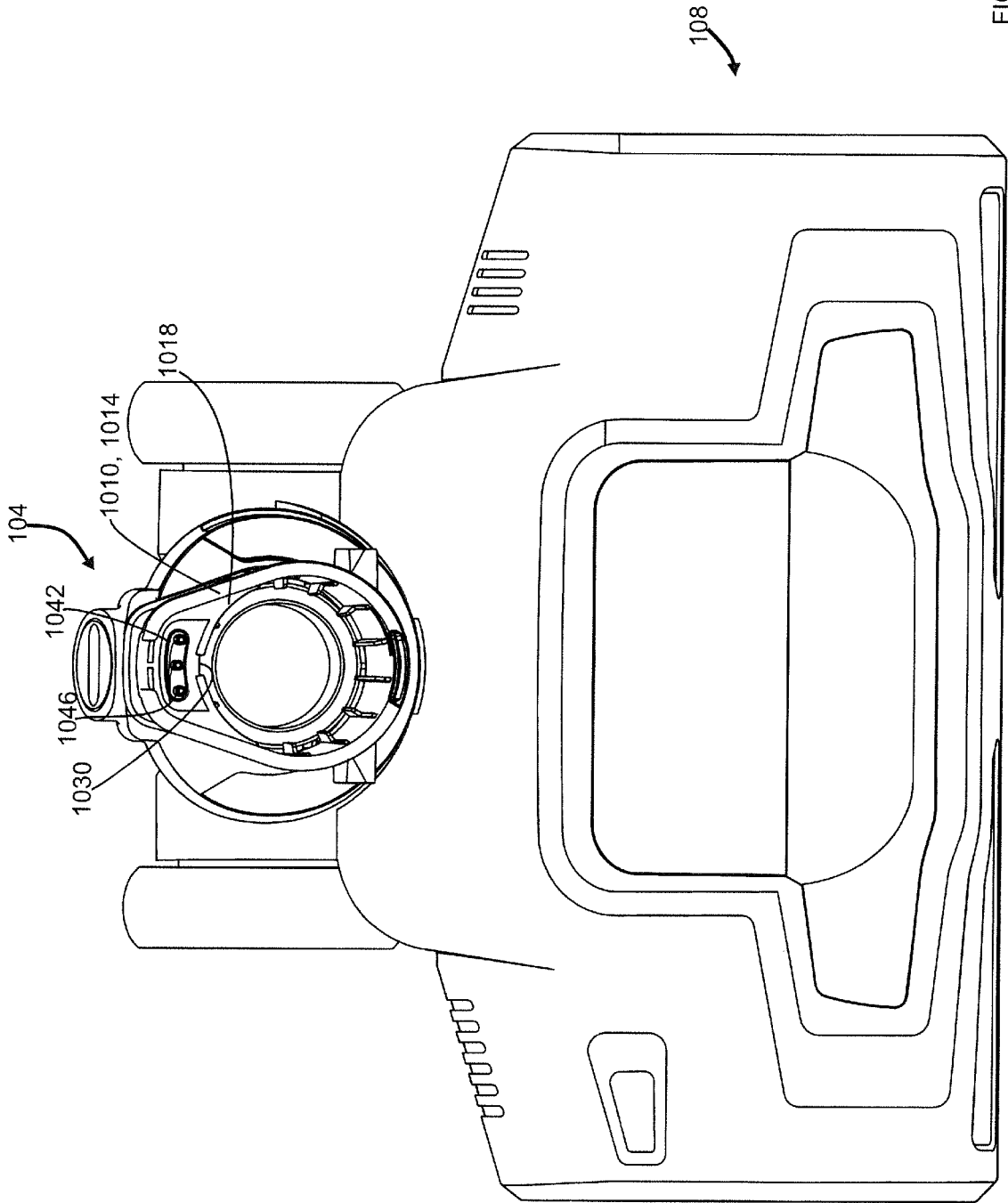


FIG. 9

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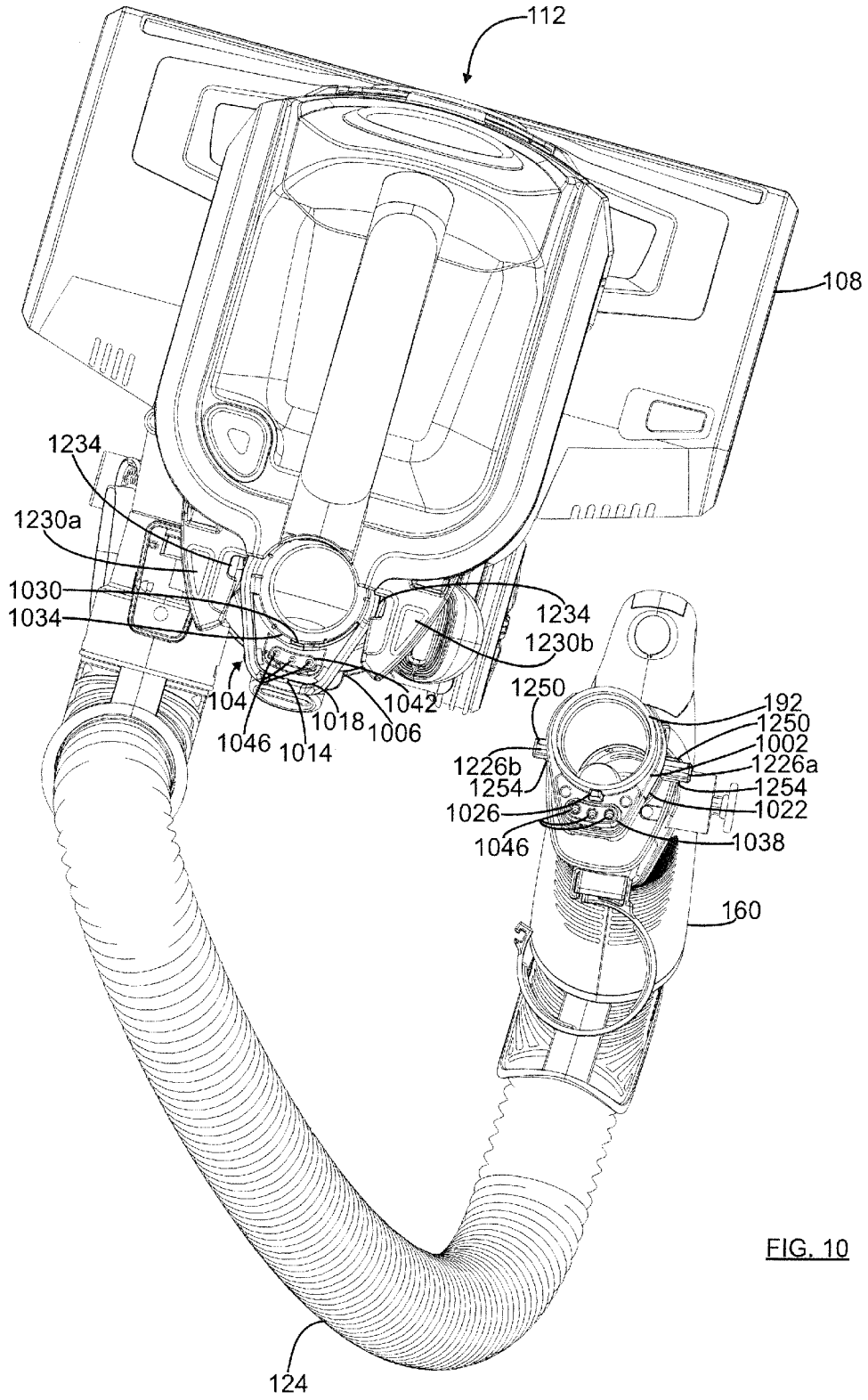


FIG. 10



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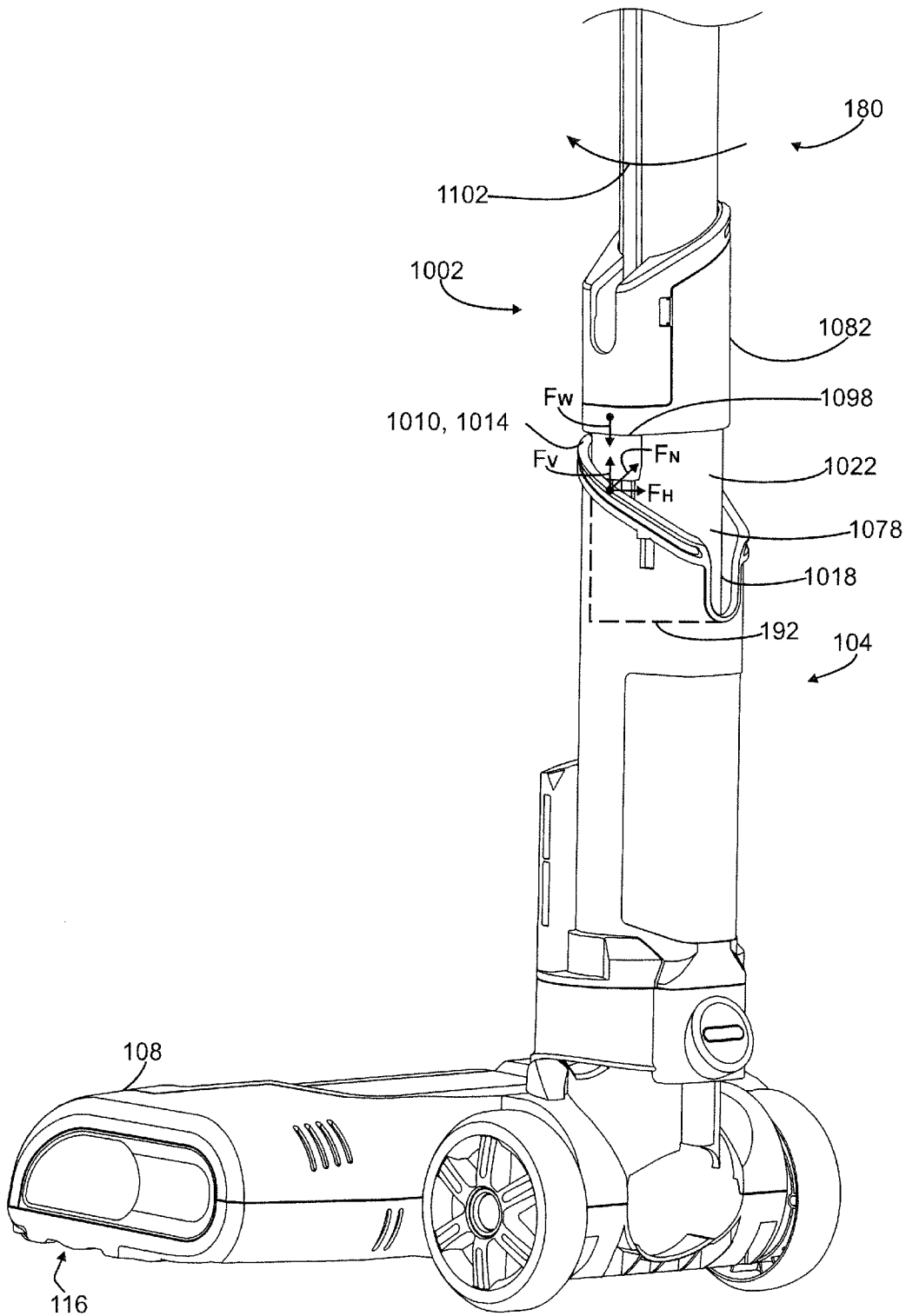


FIG. 11

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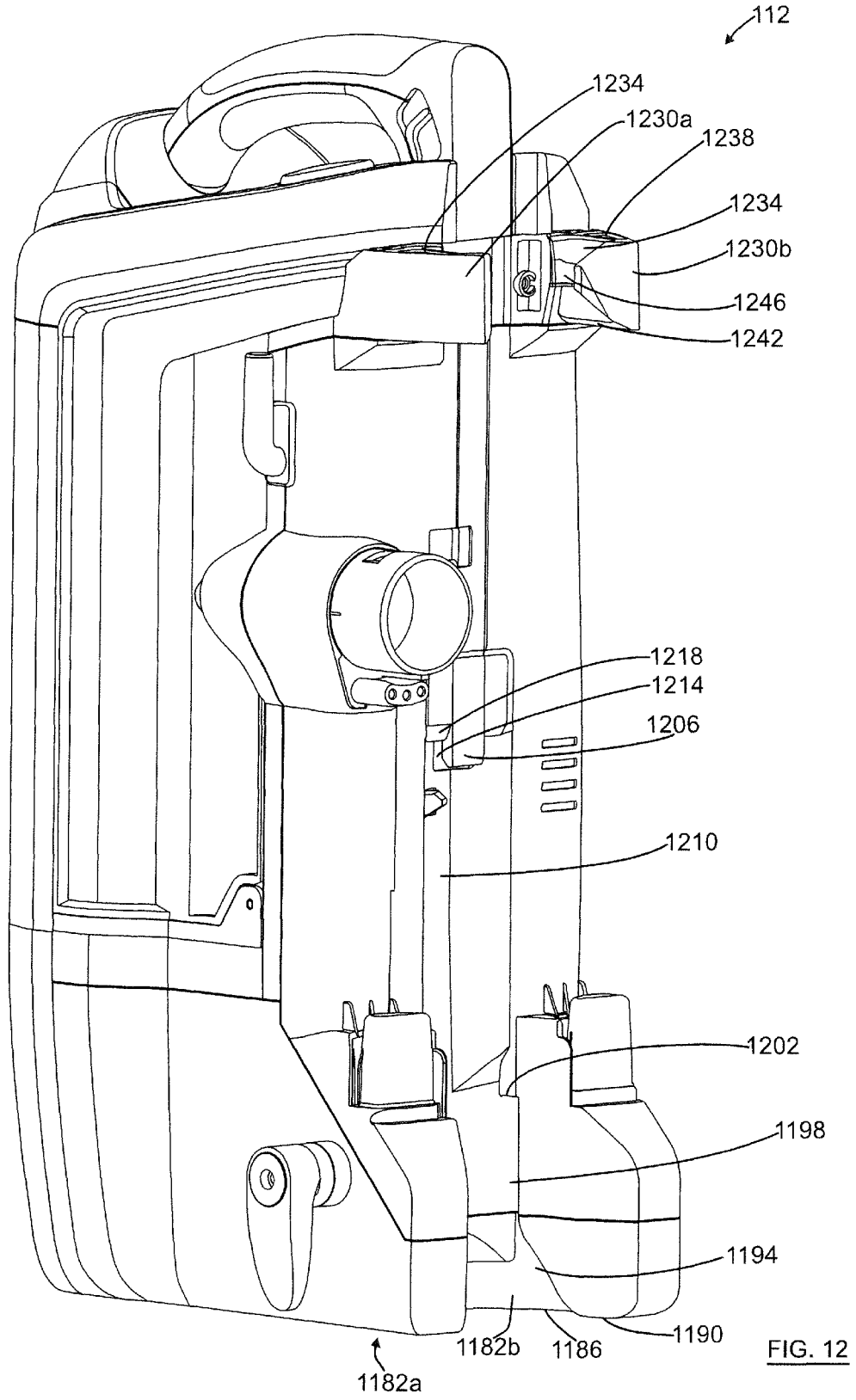


FIG. 12

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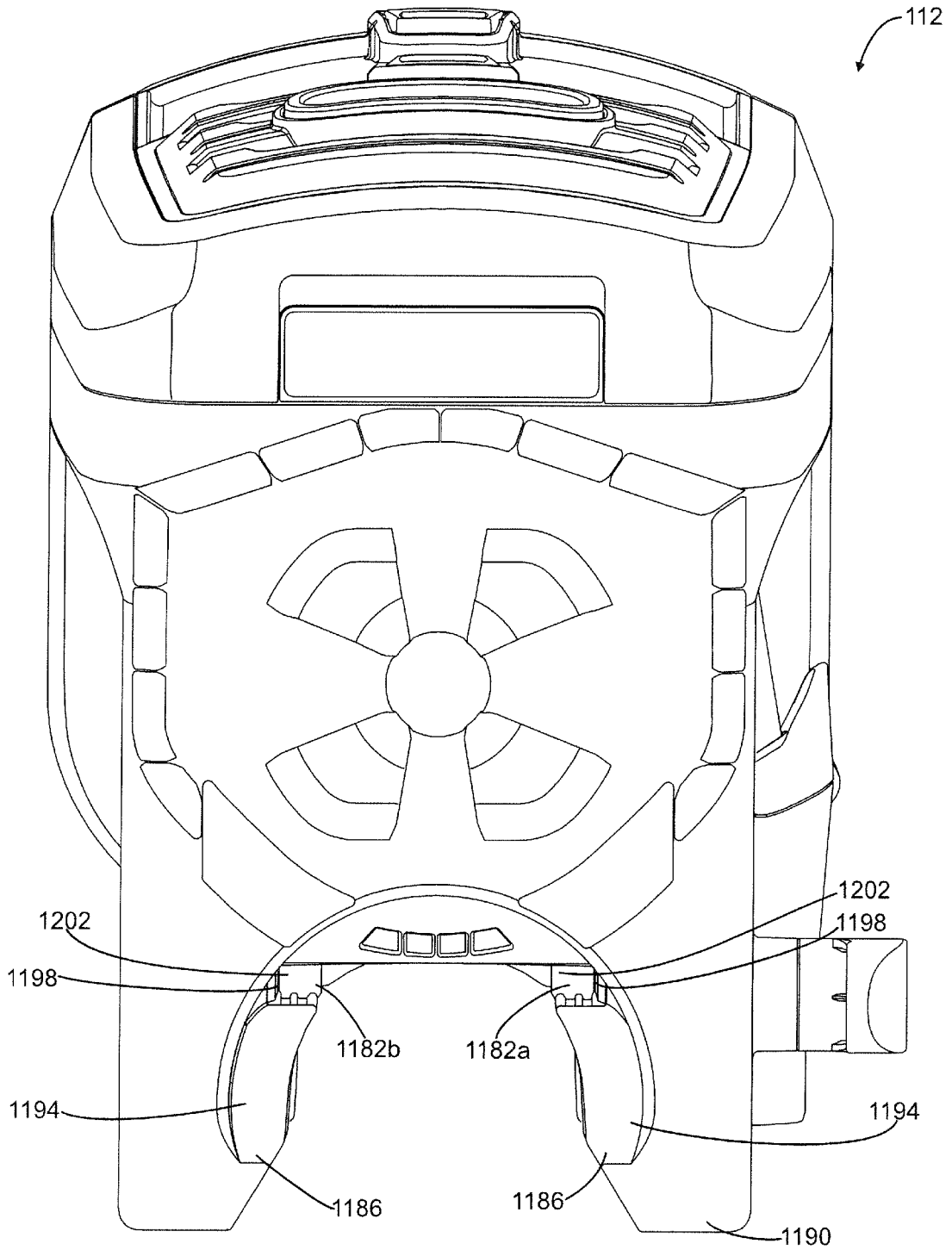


FIG. 13

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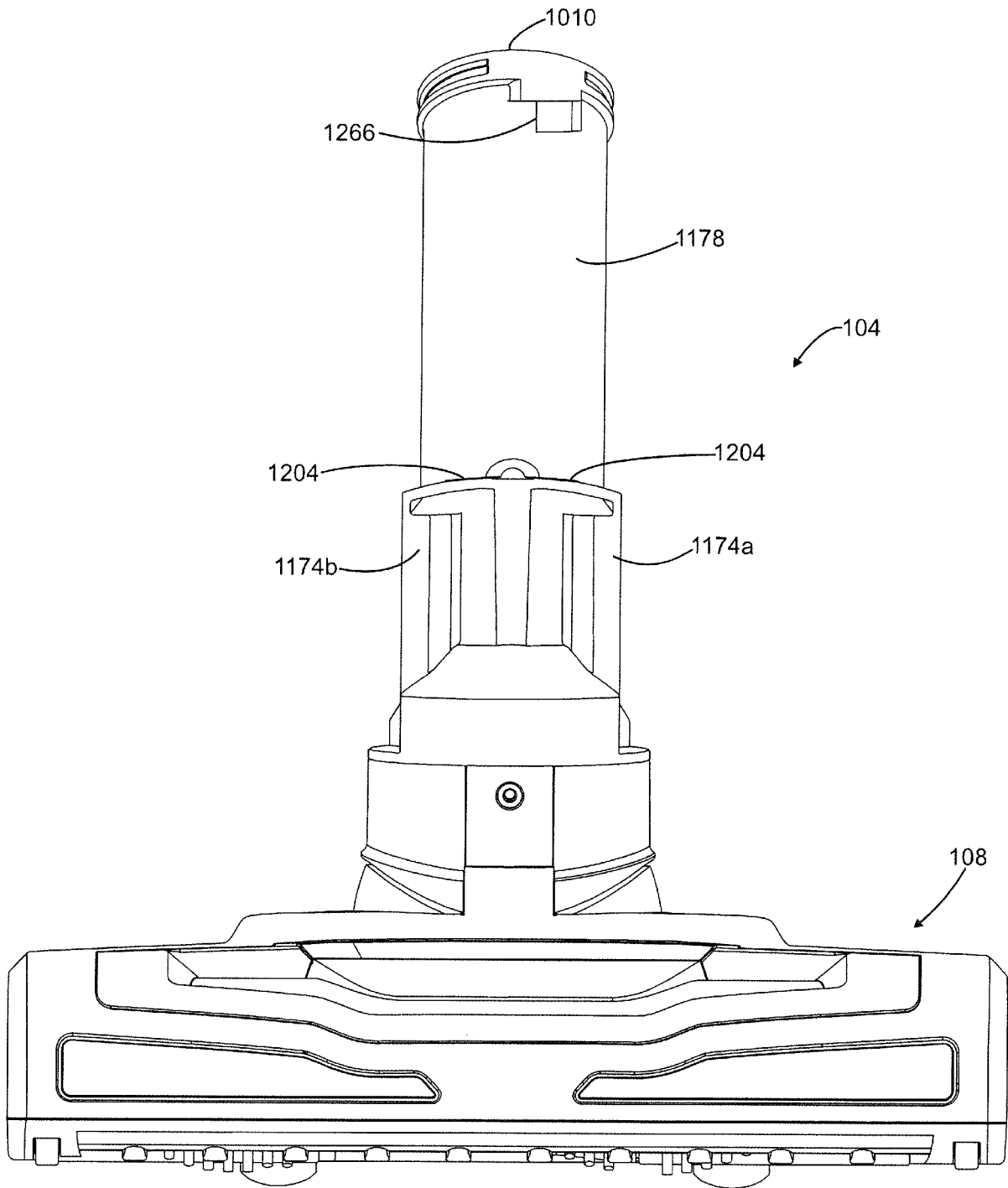


FIG. 14

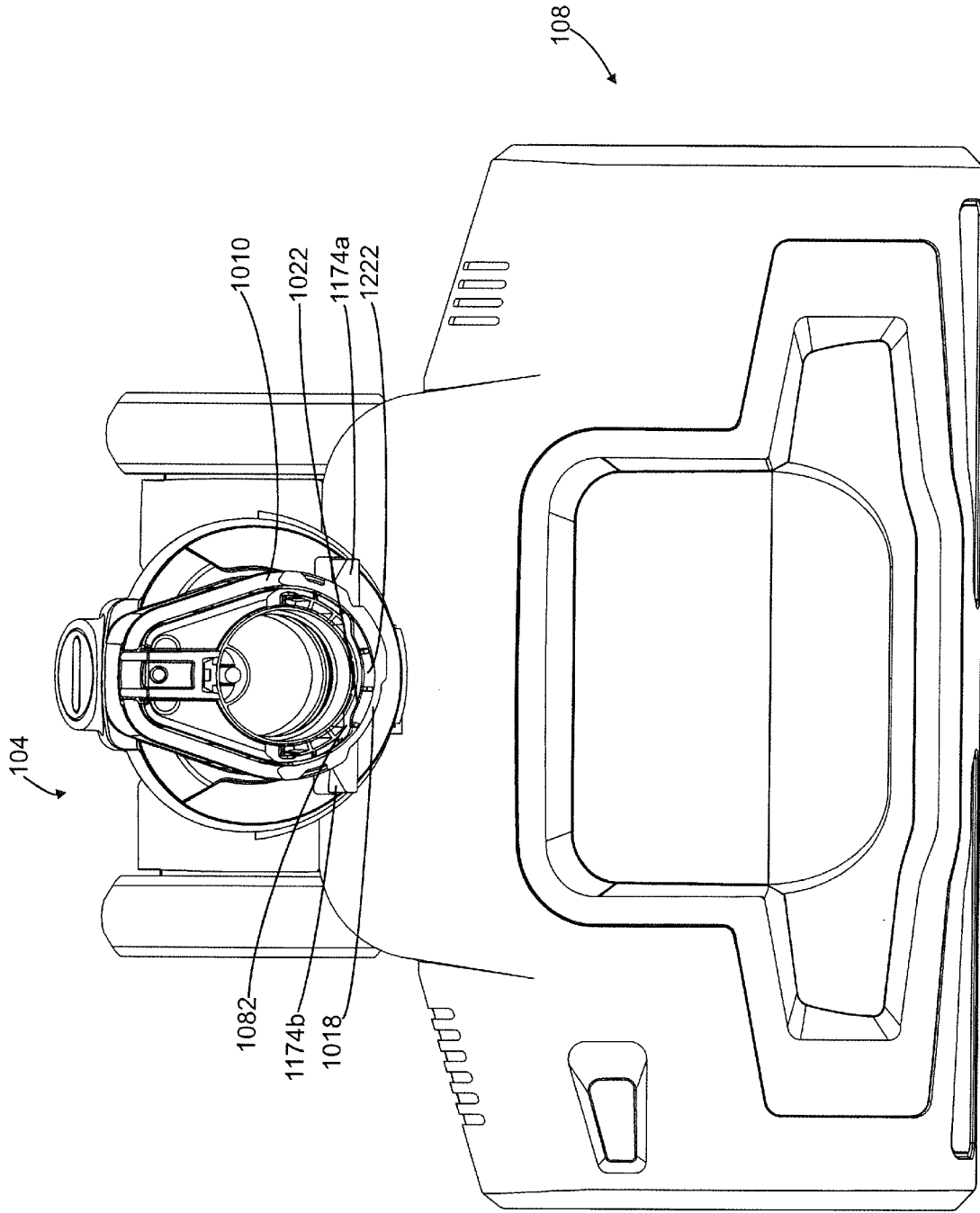


FIG. 15

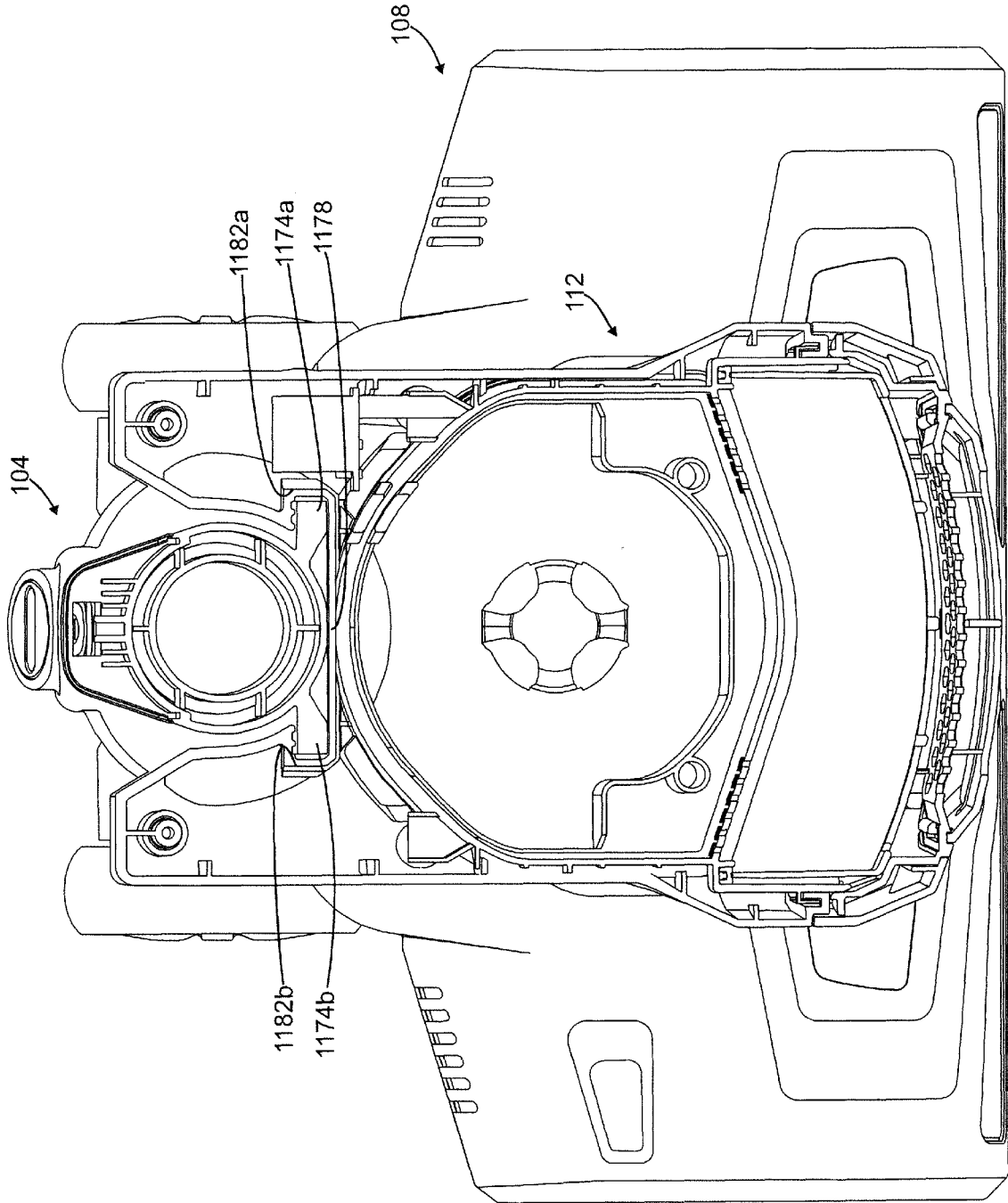


FIG. 16

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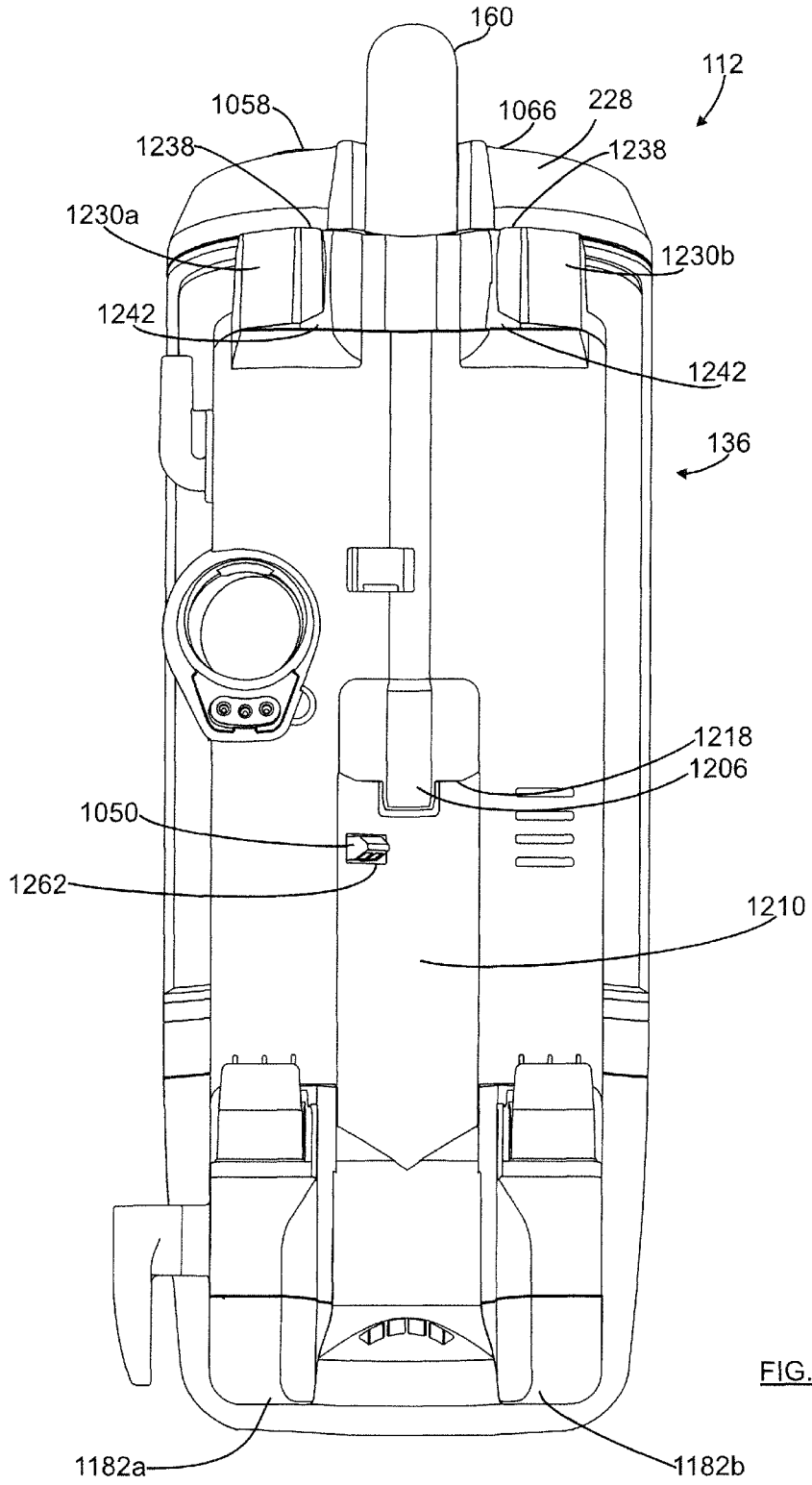
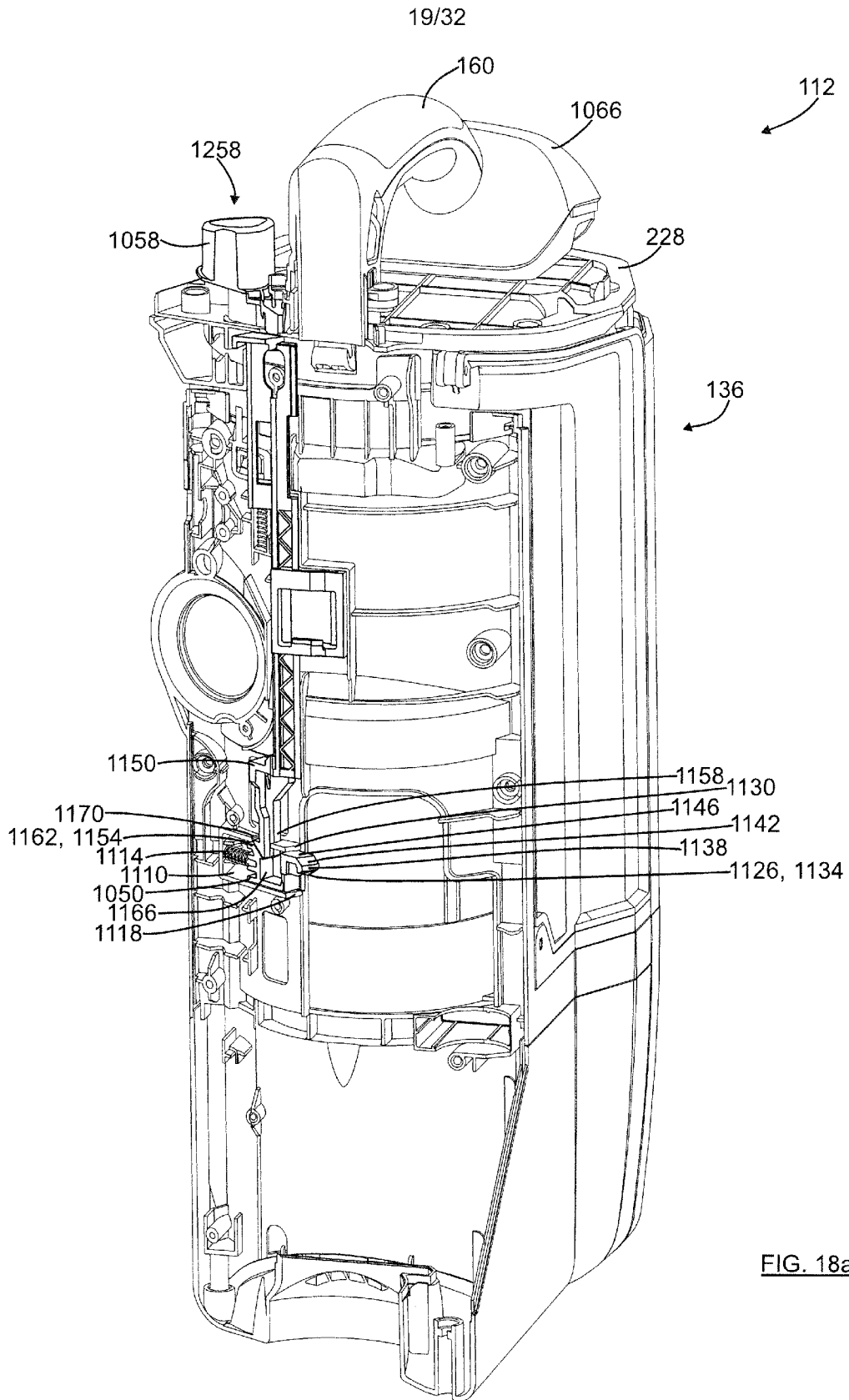


FIG. 17





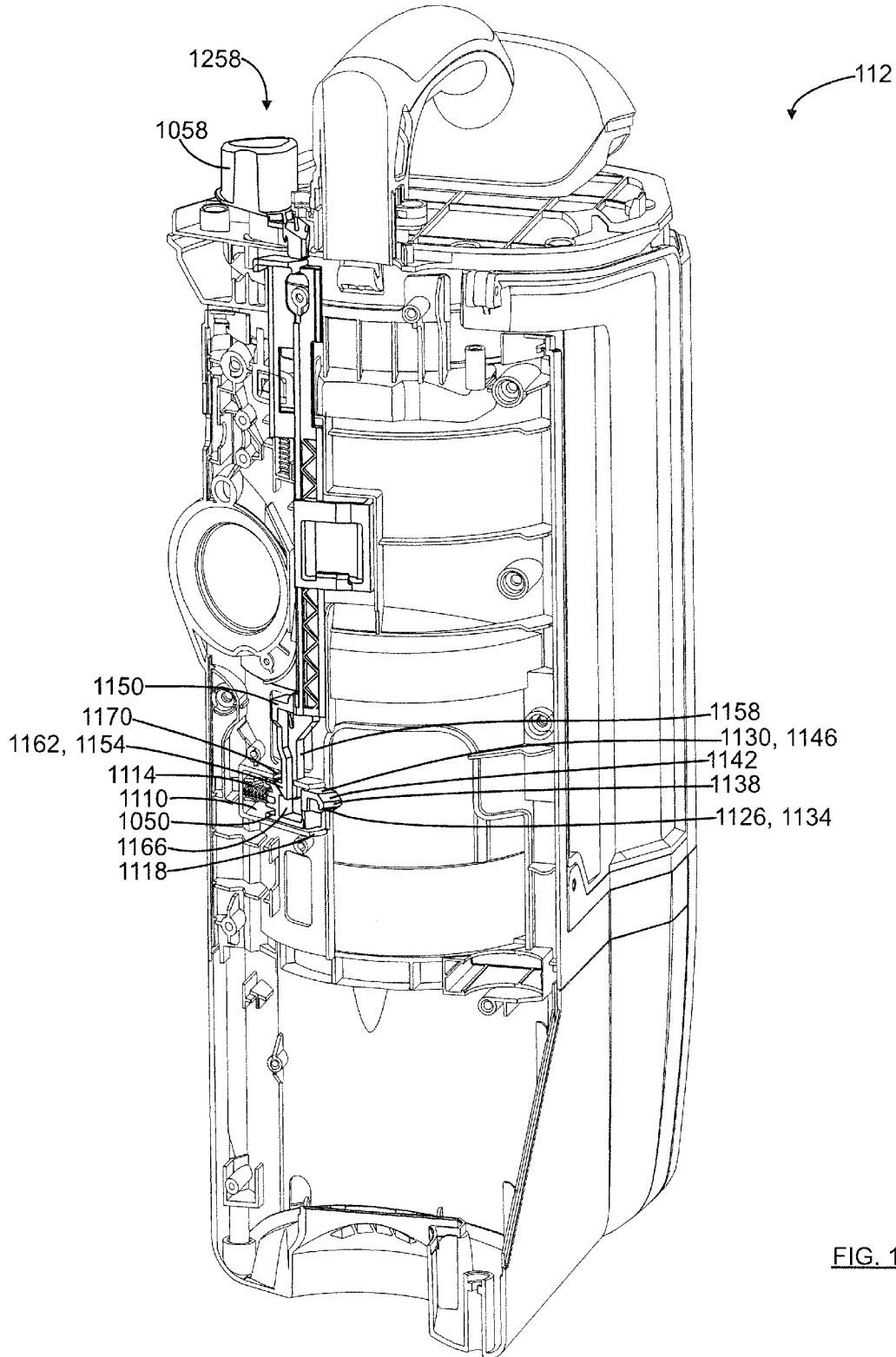


FIG. 18b

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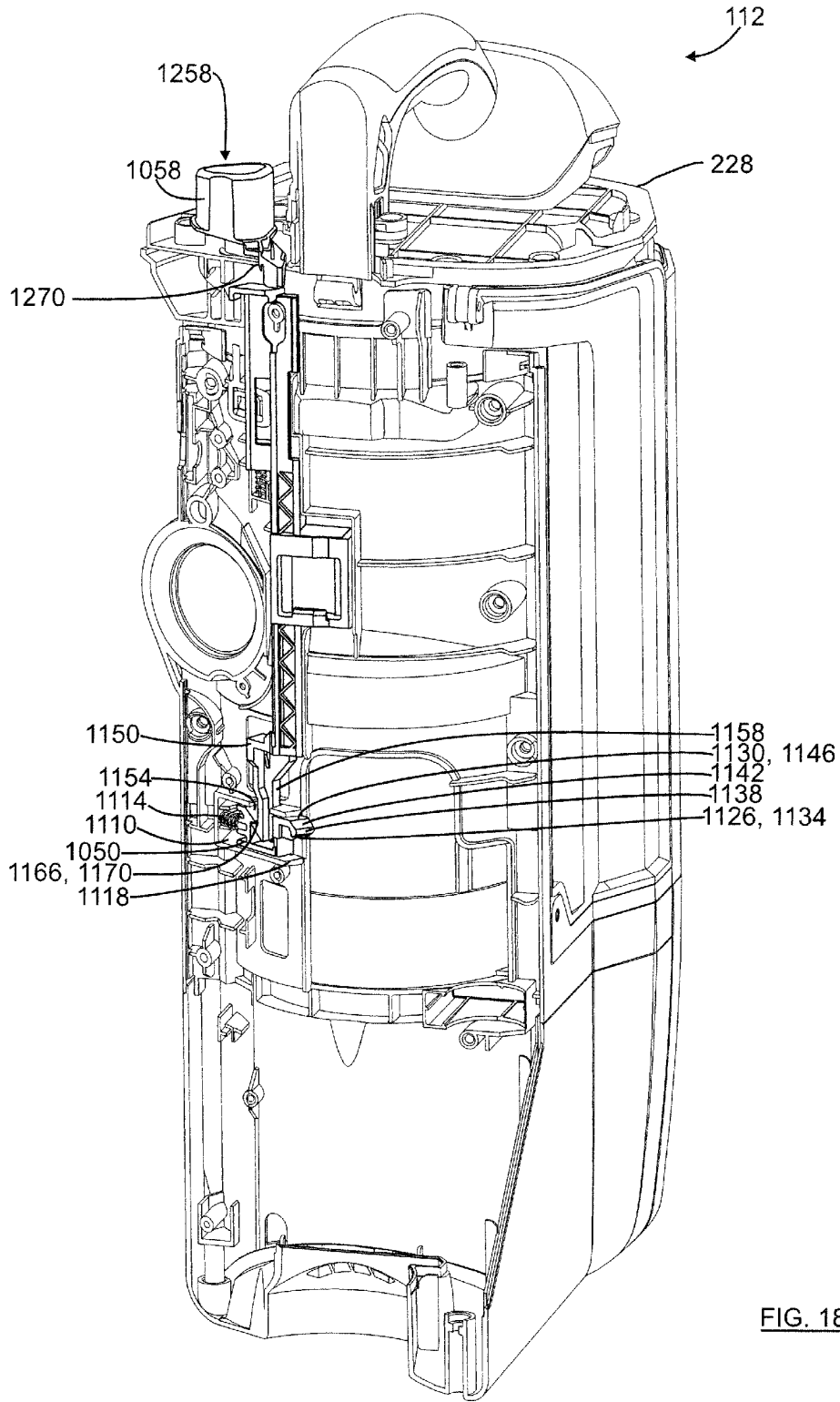


FIG. 18c

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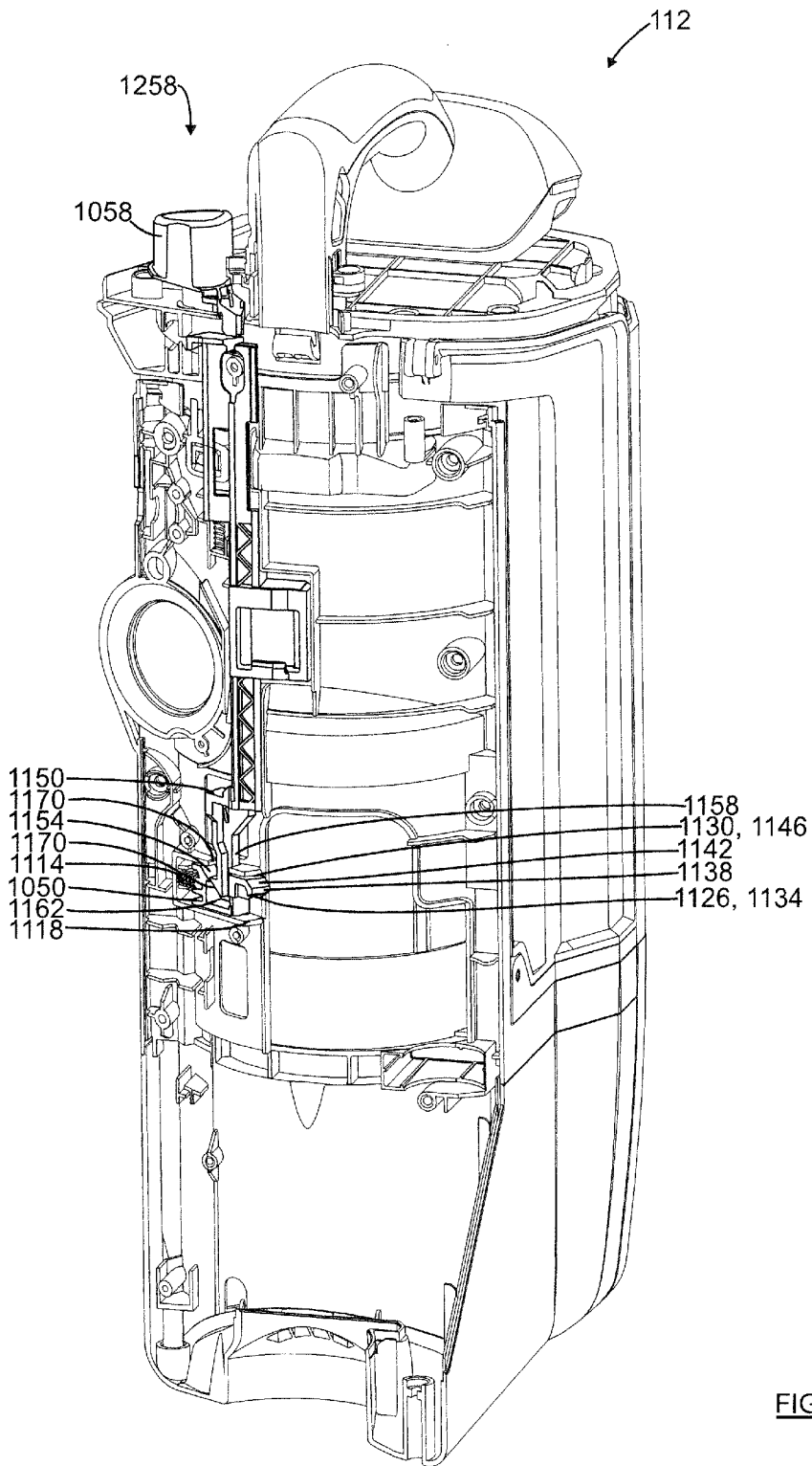


FIG. 18d

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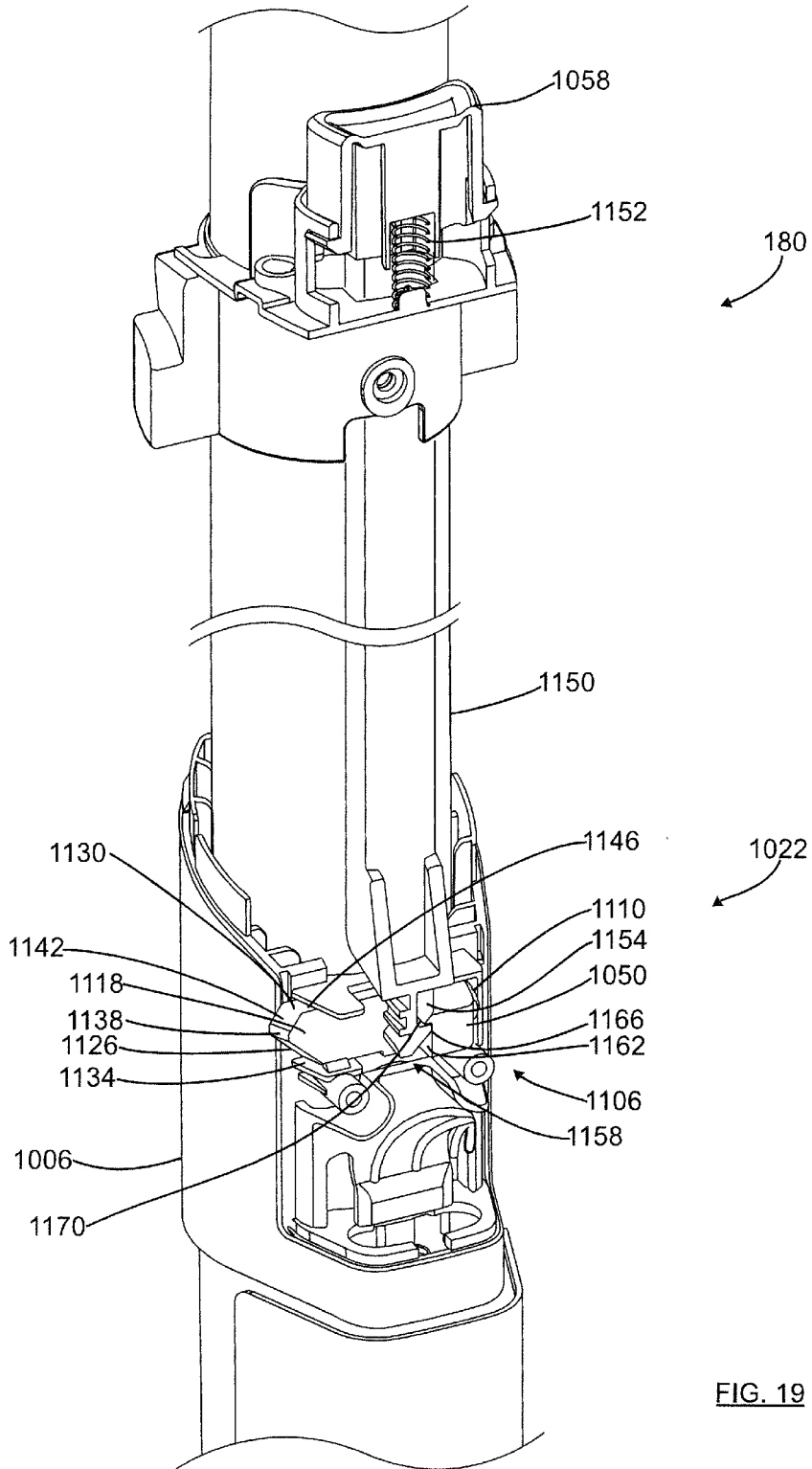


FIG. 19

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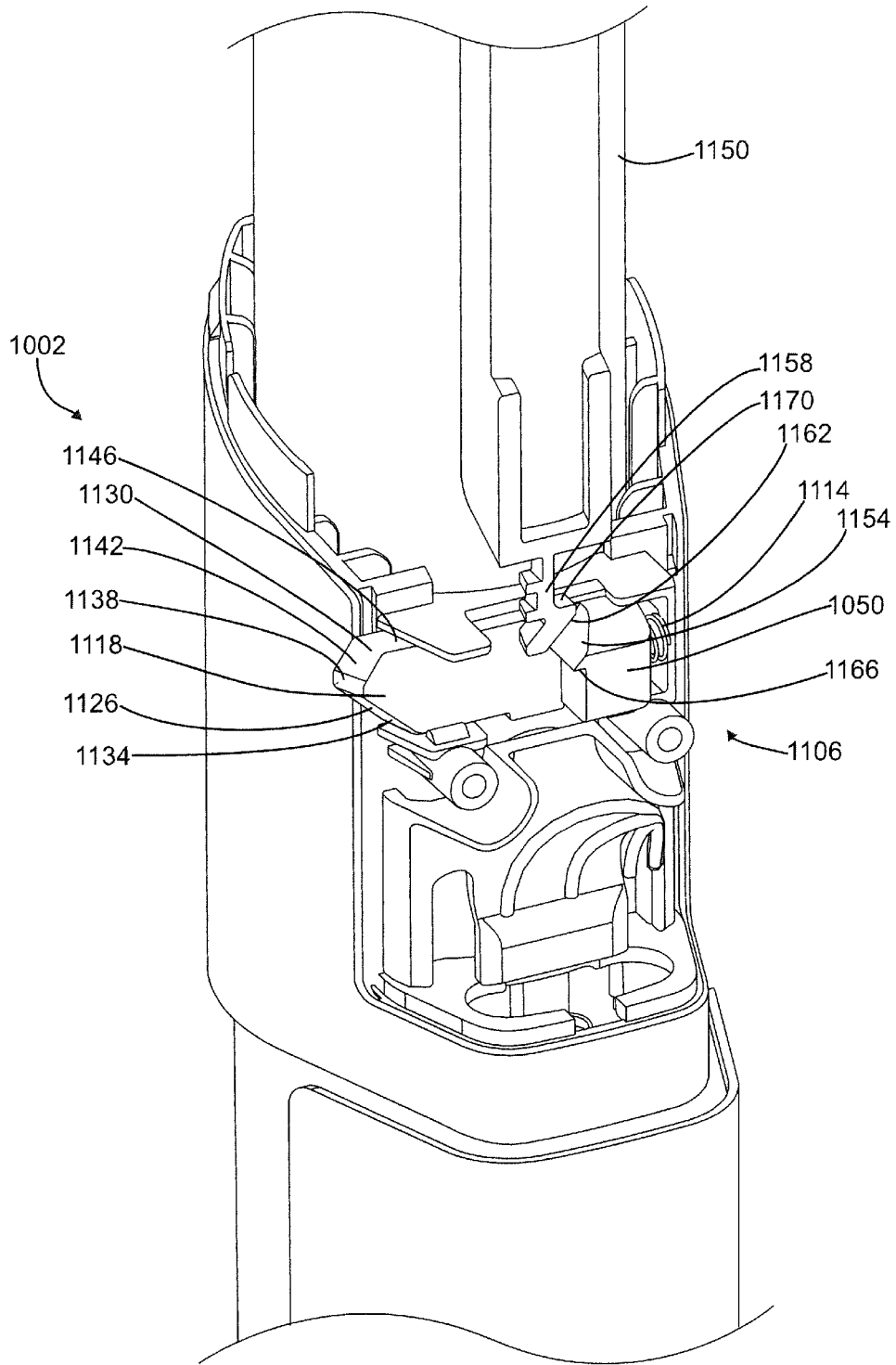


FIG. 20a

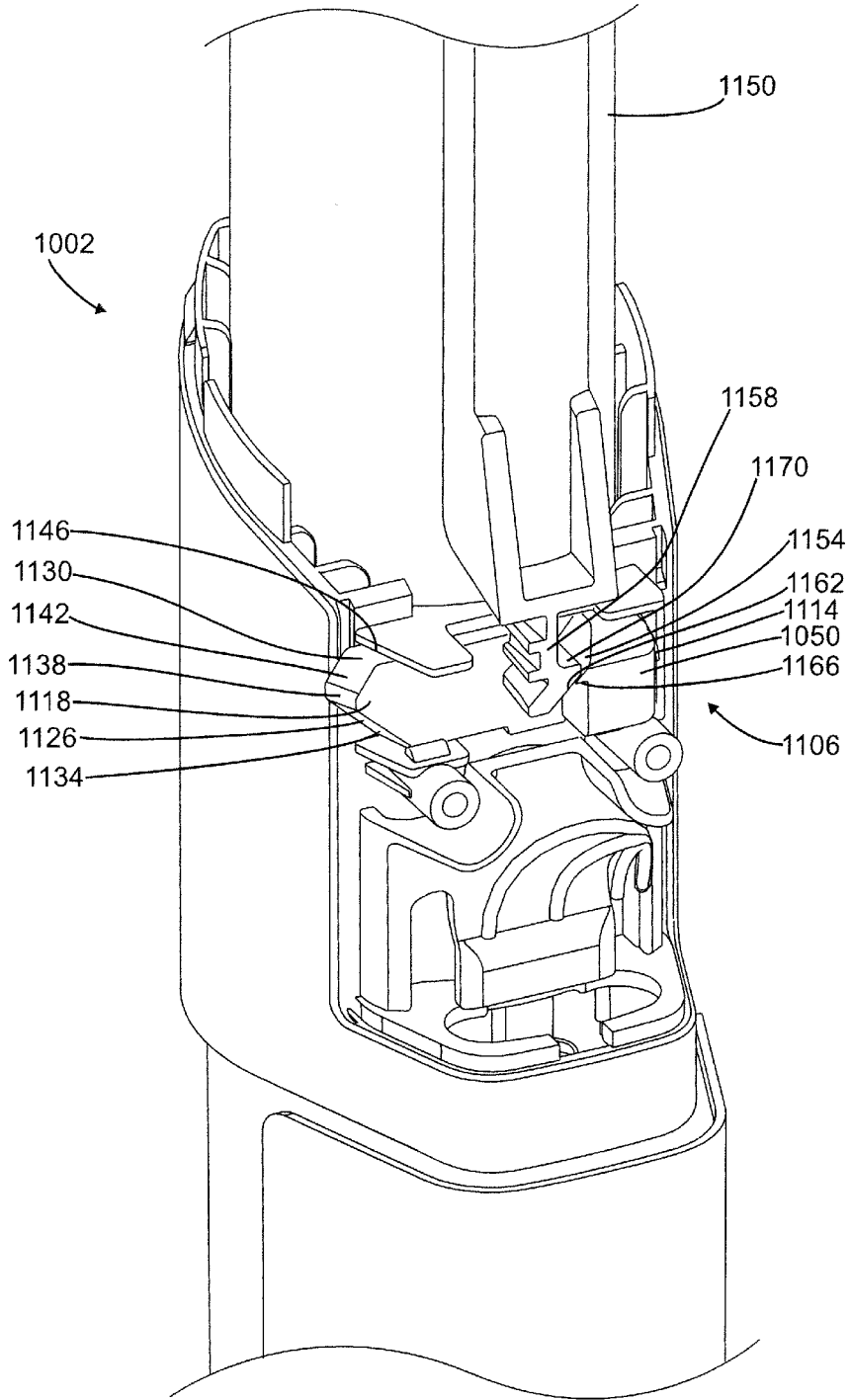


FIG. 20b

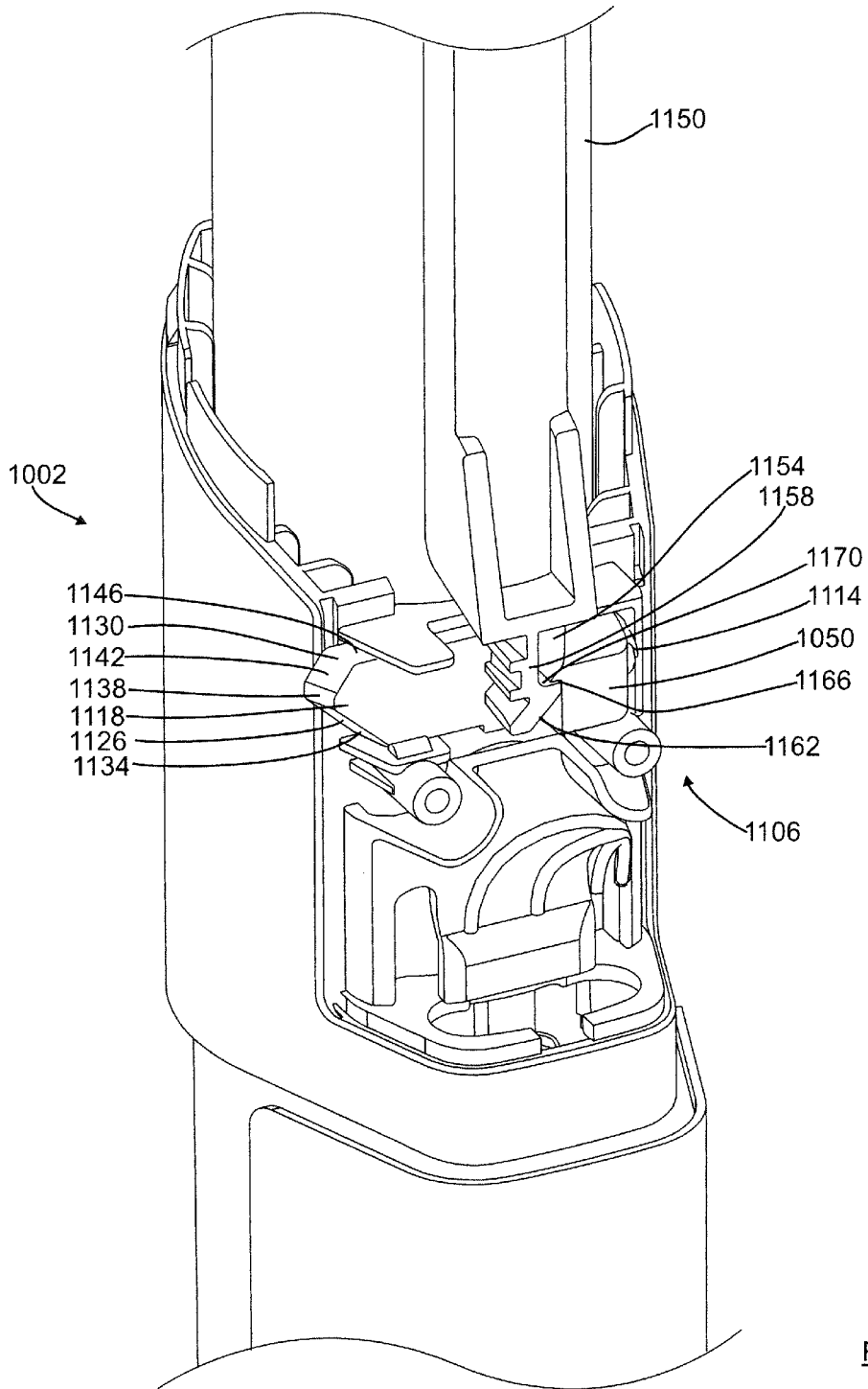


FIG. 20c

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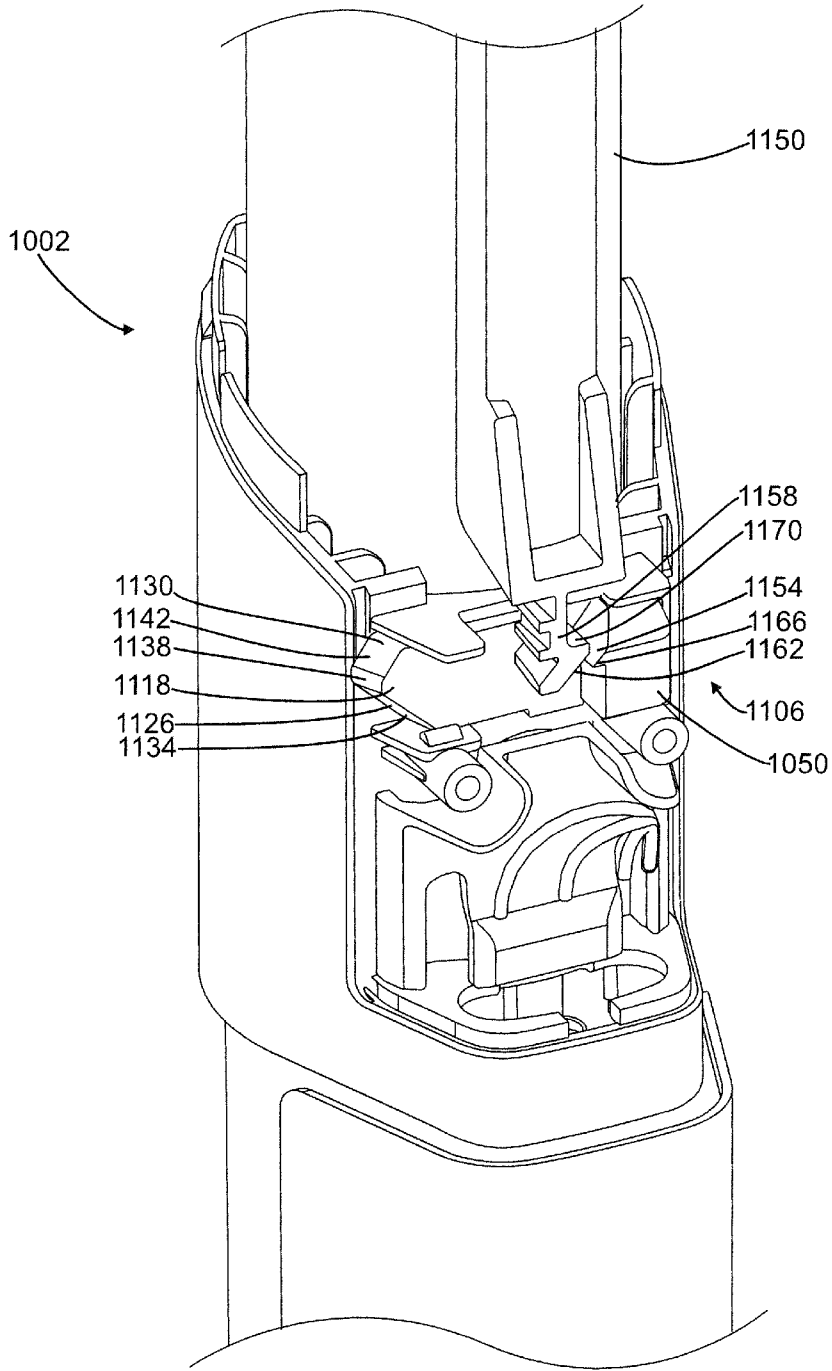


FIG. 20d



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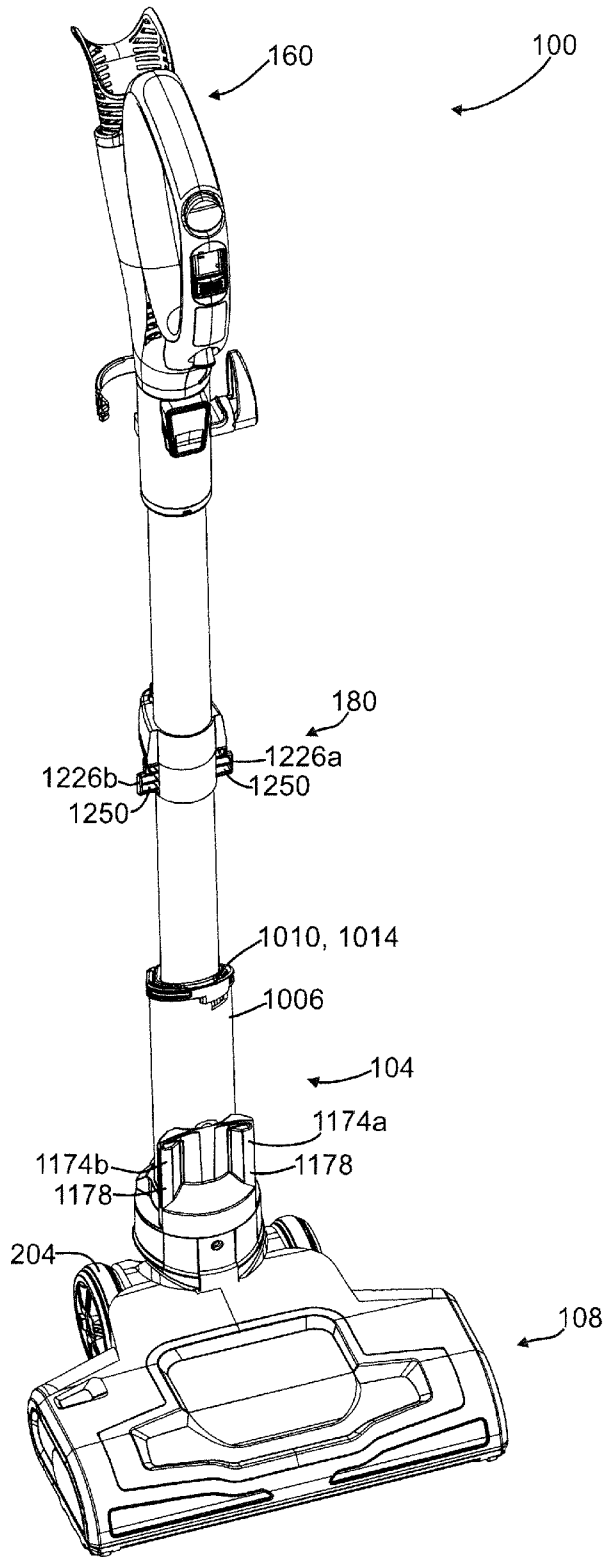
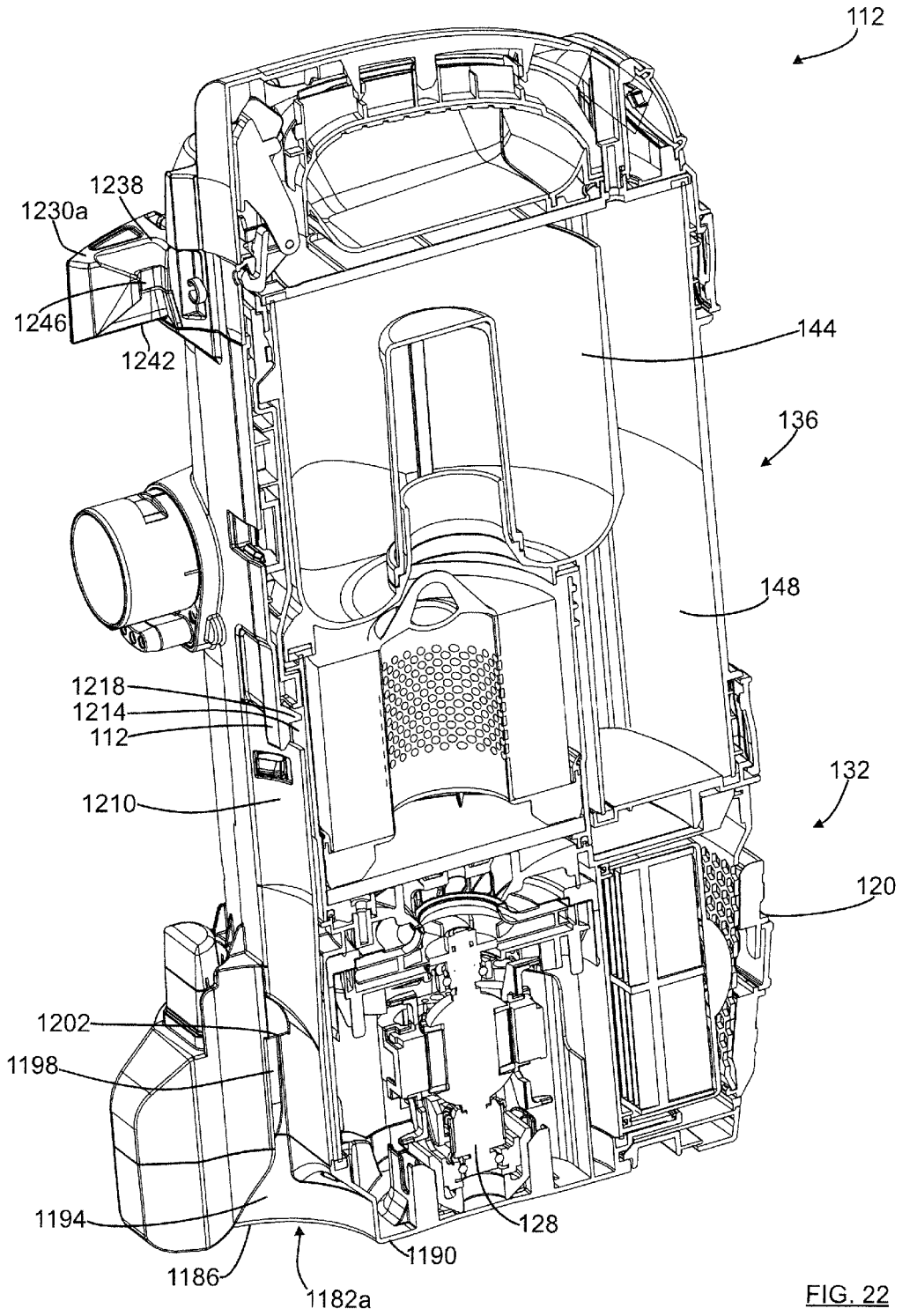
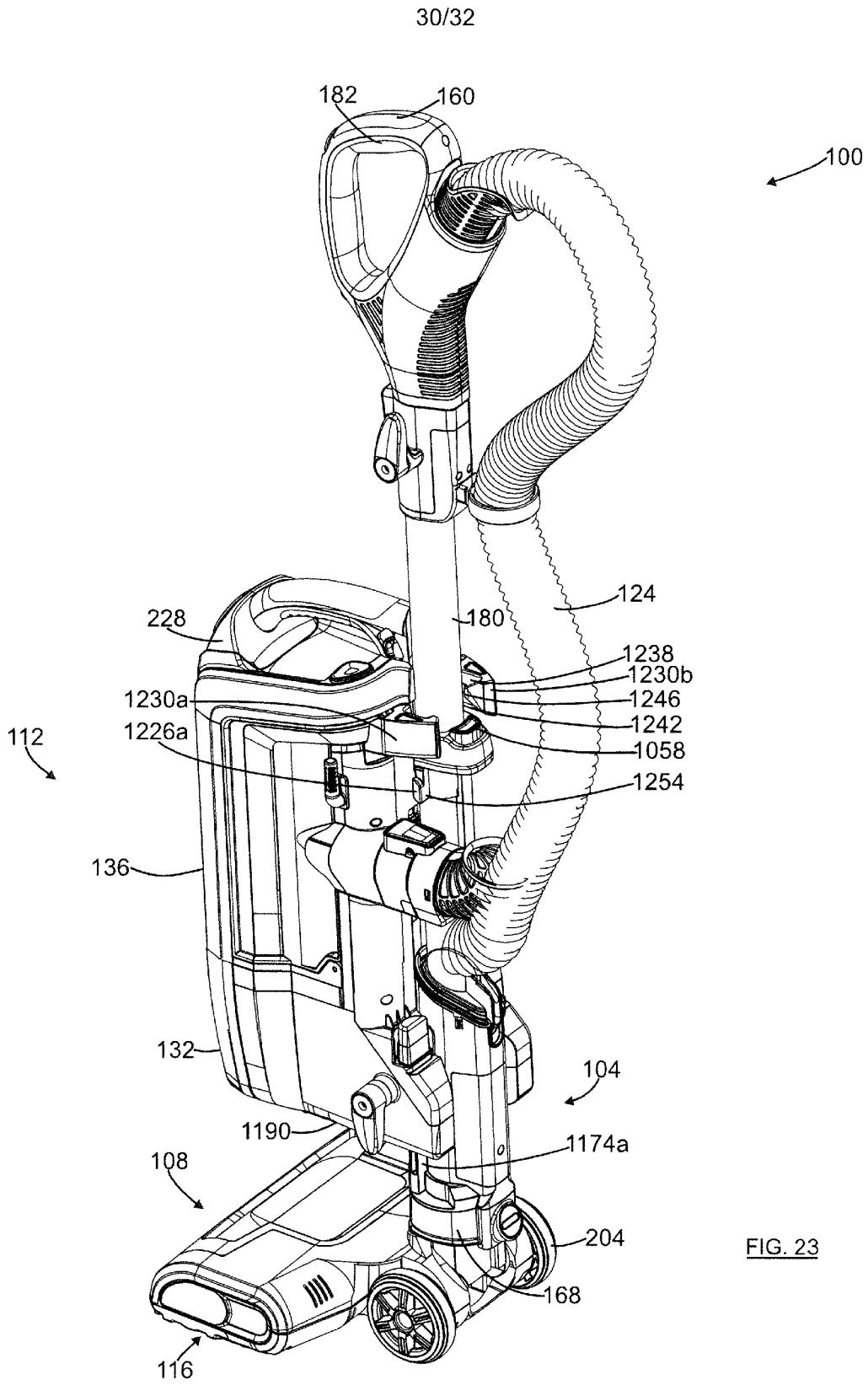


FIG. 21

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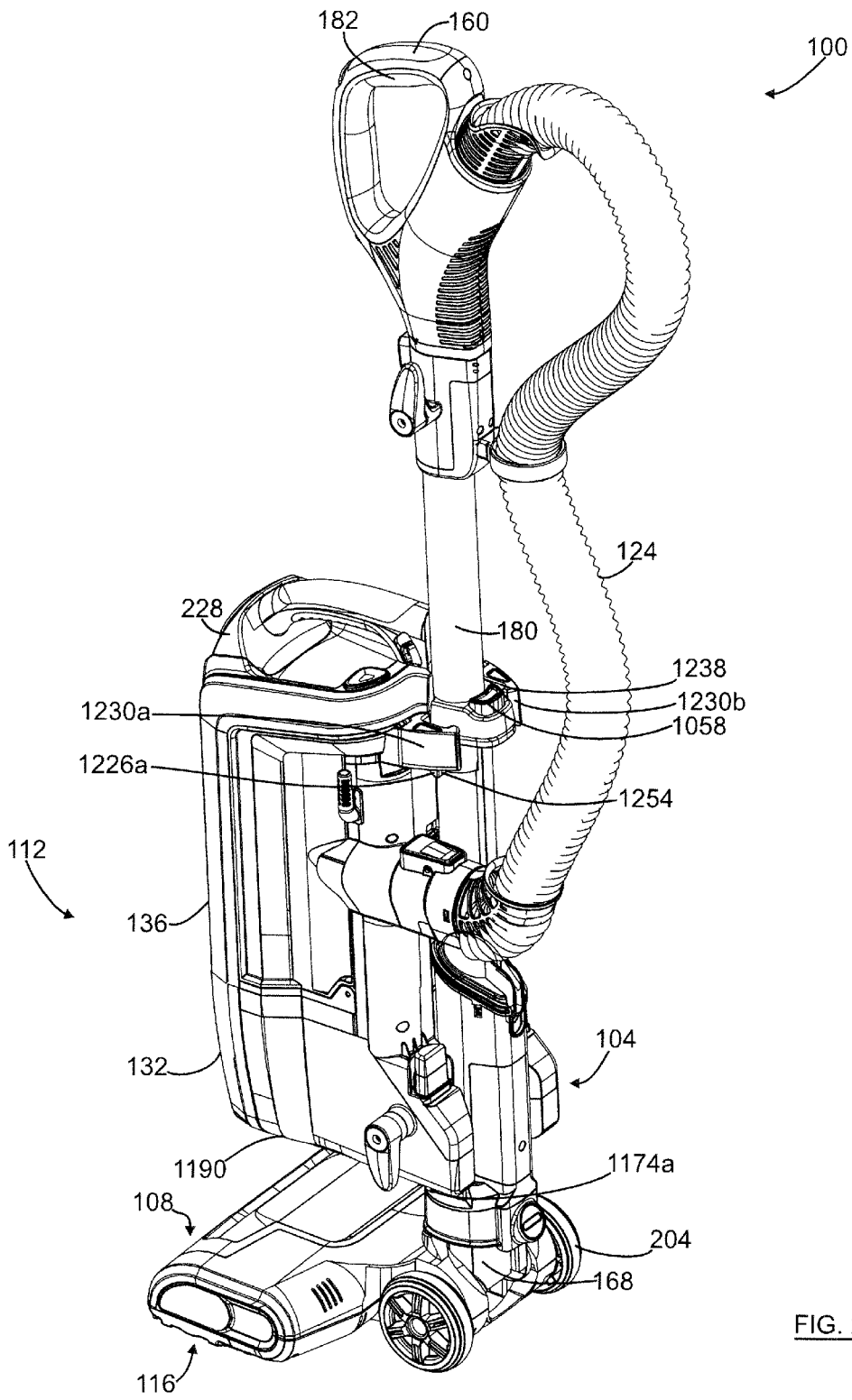


FIG. 24

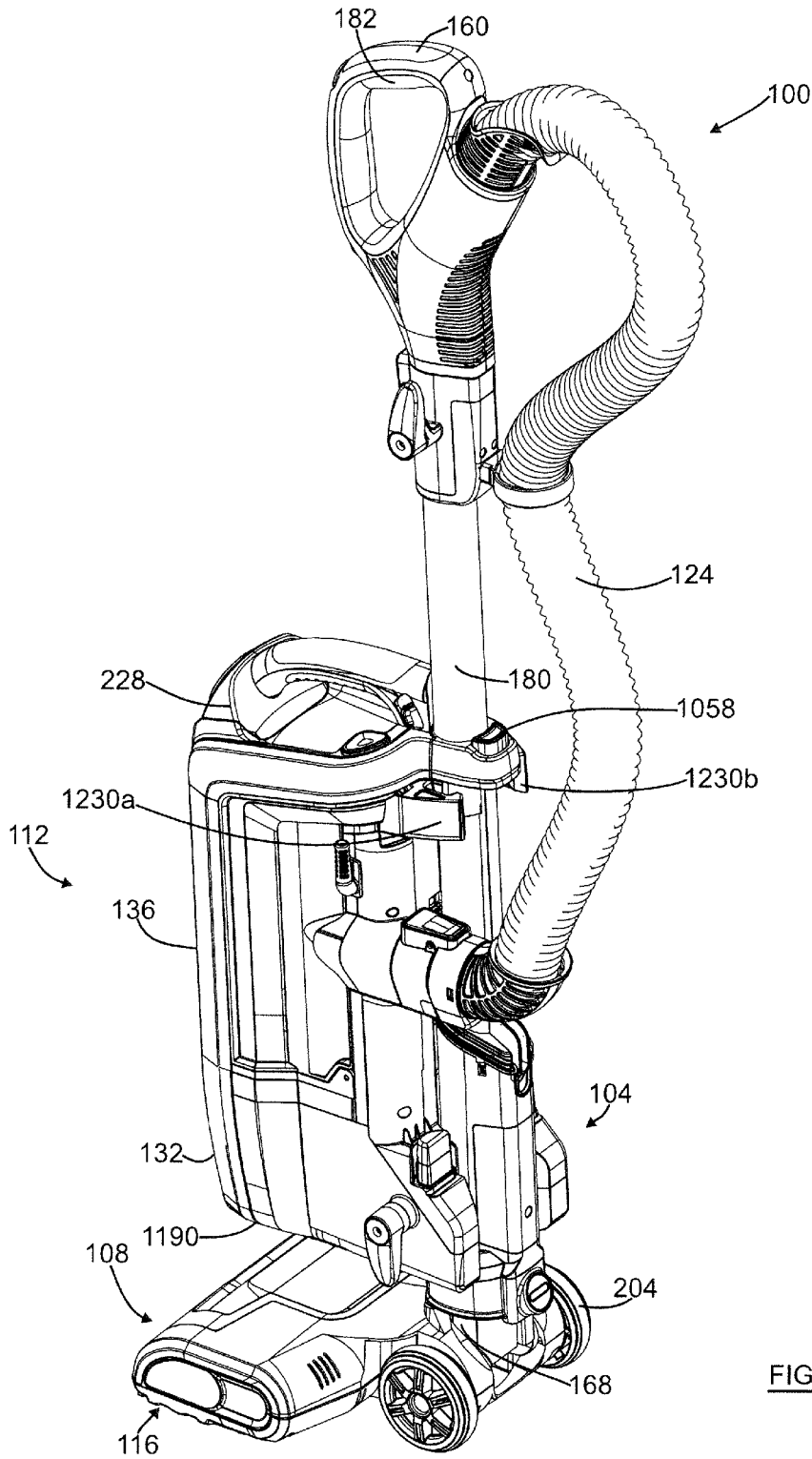


FIG. 25