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February 22, 2024

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APPLICATION NUMBER: *17/830,507*
FILING DATE: *June 2, 2022*
PATENT NUMBER: *11,910,983*
ISSUE DATE: *February 27, 2024*

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office

Rodney Glover
Certifying Officer

Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorization/Internet Communications Authorization Withdrawal

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	
	Filing Date	June 2, 2022
	First Named Inventor	Wayne Ernest Conrad
	Art Unit	n/a
	Examiner Name	n/a
	Practitioner Docket No.	10452-P46958US16

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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☒ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

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I am the

☐ applicant.

☒ attorney or agent of record. Registration number 33,106.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Philip C. Mendes da Costa/ — Signature

June 2, 2022 — Date

Philip C. Mendes da Costa — Typed or printed name

416.957.1695 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

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Application Number	
Filing Date	June 2, 2022
First Named Inventor	Wayne Ernest Conrad
Title	SURFACE CLEANING APPARATUS
Art Unit	N/A
Examiner Name	N/A
Attorney Docket Number	10452-P46958US16

SIGNATURE of Applicant or Patent Practitioner

Signature	/Philip C. Mendes da Costa/	Date (Optional)	2022-06-02
Name	Philip C. Mendes da Costa	Registration Number	33106
Title (if Applicant is a juristic entity)	Vice-President and Agent of Record		
Applicant Name (if Applicant is a juristic entity)	Omachron Intellectual Property Inc.		

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I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

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☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Omachron Intellectual Property Inc.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

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SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Philip C. Mendes da Costa/	Date (Optional)	June 2, 2022
Name	Philip C. Mendes da Costa		
Title	Vice President		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10452-P46958US16
	Application Number	
Title of Invention	SURFACE CLEANING APPARATUS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

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☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Wayne	Ernest	Conrad	

Residence Information (Select One) US Residency ● Non US Residency Active US Military Service

City	Hampton	Country of Residence [i]	CA

Mailing Address of Inventor:

Address 1	9 King Lane		
Address 2			
City	Hampton	**State/Province**	ON
Postal Code	L0B 1J0	**Country** [i]	CA

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	01059		
Email Address	pmdcosta@bereskinparr.com	Add Email	Remove Email

Application Information:

Title of the Invention	SURFACE CLEANING APPARATUS		
Attorney Docket Number	10452-P46958US16	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	140	**Suggested Figure for Publication (if any)**	96

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10452-P46958US16
	Application Number	
Title of Invention	SURFACE CLEANING APPARATUS	

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Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Customer Number	01059		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	17/351943	2021-06-18

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10452-P46958US16
	Application Number	
Title of Invention	SURFACE CLEANING APPARATUS	

Prior Application Status	Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)	
17/351943	Continuation in part of	16/590972	2019-10-02	

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16/590972	Division of	16/156006	2018-10-10	10478030	2019-11-19

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16/156006	Continuation of	15/088876	2016-04-01	10219662	2019-03-05

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15/088876	Continuation of	14/822211	2015-08-10	9888817	2018-02-13

Prior Application Status	Expired			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)	
14/822211	Claims benefit of provisional	62/093189	2014-12-17	

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10452-P46958US16
	Application Number	
Title of Invention	SURFACE CLEANING APPARATUS	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

TITLE: SURFACE CLEANING APPARATUS

INVENTOR: WAYNE CONRAD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of co-pending United States Patent Application No. 17/351,943, filed on June 18, 2021, which is still pending, which is a continuation-in-part of co-pending United States Patent Application No. 16/590,972 filed on October 2, 2019, which is a divisional of United States Patent Application No. 16/156,006 filed on October 10, 2018, now issued as United States Patent 10,478,030, which is a continuation of United States Patent Application No. 15/088,876 filed on April 1, 2016, now issued as United States Patent No. 10,219,662, which is a continuation of United States Patent Application No. 14/822,211, filed August 10, 2015, now issued as United States Patent No. 9,888,817, which claimed priority from United States Provisional Patent Application No. 62/093,189, filed December 17, 2014, the entirety of which are hereby incorporated by reference.

FIELD

[0002] This disclosure relates to the field of surface cleaning apparatus. In some aspects, this disclosure relates to a type of stick vacuum cleaner wherein a hand vacuum cleaner is removably mounted to a drive handle and provides motive power to draw dirty air into the surface cleaning head.

INTRODUCTION

[0003] Various types of surface cleaning apparatus are known. These include upright vacuum cleaner, stick vacuum cleaners, hand vacuum cleaners and canister vacuum cleaners. Stick vacuum cleaners and hand vacuum cleaners are popular as they tend to be smaller and may be used to clean a small area or when a spill has to be cleaned up. Hand vacuum cleaners or handvacs are advantageous as they are

lightweight and permit above floor cleaning and cleaning in hard to reach locations. However, they have a limited dirt collection capacity. Upright vacuum cleaners enable a user to clean a floor and may be have a pod that is removably attached for above floor cleaning. In such cases, the pod comprises, e.g., a cyclone, a dirt collection chamber and the suction motor for the upright vacuum cleaner. However, such the pods tend to be bulky since they comprise the total dirt collection capacity for the upright vacuum cleaner.

SUMMARY

[0004] In accordance with one aspect of this disclosure, an air treatment assembly for a surface cleaning apparatus, such as a hand vacuum cleaner has an air treatment chamber (such as a cyclone chamber) and an external dirt collection chamber wherein dirt separated in the air treatment chamber travels to the dirt collection chamber via a dirt outlet of the air treatment chamber. A sidewall of the air treatment chamber separates the air treatment chamber and the dirt collection chamber. An end of the air treatment assembly is openable (e.g., the front end of the air treatment assembly if the air treatment assembly is part of a hand vacuum cleaner). When the openable end is moved to the open position, both the air treatment chamber and the dirt collection chamber are opened and at least a portion of the sidewall separating the air treatment chamber and the dirt collection chamber is moved as part of the openable end. Optionally, a portion of the sidewall that extends to the dirt outlet is opened such that the dirt outlet is also opened when the openable end is moved to the open position is openable. An advantage of this design is that the air treatment chamber and the dirt collection chamber may be more easily emptied and any debris that may bridge the dirt outlet, and thereby partially or fully block the dirt outlet, may be more easily removed. For example, elongated debris such as hair that may be extend through the dirt outlet and be difficult to dislodge

from the dirt outlet may be more easily removed than if only the dirt collection chamber is opened.

[0005] In accordance with this aspect, there is provided a hand vacuum cleaner comprising:

(a) an air flow path extending from a dirty air inlet to a clean air outlet with a suction motor positioned in the air flow path;

(b) a main body comprising a handle and the suction motor; and,

(c) a cyclone bin assembly comprising a cyclone chamber positioned in the air flow path and a dirt collection chamber, the cyclone chamber has a cyclone air inlet, a cyclone air outlet, a dirt outlet, a cyclone chamber front end having a cyclone chamber front end wall, a cyclone chamber rear end having a cyclone chamber rear end wall and cyclone axis of rotation that extends between the cyclone chamber front end wall and the cyclone chamber rear end wall, the dirt collection chamber having a dirt collection chamber front end having a dirt collection chamber front end wall and an axially spaced apart dirt collection chamber rear end having dirt collection chamber rear end wall, a portion of the dirt collection chamber is spaced from the cyclone chamber in a direction transverse to the cyclone axis of rotation whereby the portion faces towards the cyclone chamber and is separated from the cyclone chamber by a sidewall,

wherein the front end of the cyclone bin assembly comprises at least a portion of the cyclone chamber, at least a portion of the dirt collection chamber and at least a portion of the sidewall, the front end of the cyclone bin assembly is rotationally mounted between a closed position and an open position in which the rear end of the cyclone chamber and the rear end of the dirt collection chamber are opened.

[0006] In some embodiments, the dirt outlet may be provided in the sidewall.

[0007] In some embodiments, the cyclone air inlet may be provided at the cyclone chamber front end and the cyclone air outlet may be provided at the cyclone chamber rear end.

[0008] In some embodiments, the dirt outlet may be provided in the sidewall.

[0009] In some embodiments, the dirt outlet may comprise an opening in the sidewall that extends axially inwardly into the cyclone chamber from the cyclone chamber rear end wall.

[0010] In some embodiments, the hand vacuum cleaner may further comprise an inlet conduit, the dirty air inlet may be located at an inlet end of the inlet conduit and the inlet conduit may be part of the front end of the cyclone bin assembly.

[0011] In some embodiments, the dirt collection chamber front end may be positioned axially forwardly from the cyclone chamber front end whereby the cyclone axis of rotation extends through a portion of the dirt collection chamber that is located axially outwardly from the cyclone chamber front end.

[0012] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted to a rear end of the cyclone bin assembly.

[0013] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted at a location of the rear end wall of the cyclone chamber.

[0014] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted to a rear end of the cyclone bin assembly at a location midway along an axial length of the cyclone bin assembly.

[0015] In accordance with this aspect, there is also provided a surface cleaning apparatus comprising:

(a) an air flow path extending from a dirty air inlet to a clean air outlet with a suction motor positioned in the air flow path; and,

(b) a cyclone bin assembly comprising a cyclone chamber positioned in the air flow path and a dirt collection chamber, the cyclone chamber has a cyclone air inlet, a cyclone air outlet, a dirt outlet, a cyclone chamber first end having a cyclone chamber first end wall, a cyclone chamber second end having a cyclone chamber second end wall and cyclone axis of rotation that extends between the cyclone chamber first end wall and the cyclone chamber second end wall, the dirt collection chamber having a dirt collection chamber first end having a dirt collection chamber first end wall and an axially spaced apart dirt collection chamber second end having dirt collection chamber second end wall, a portion of the dirt collection chamber is spaced from the cyclone chamber in a direction transverse to the cyclone axis of rotation whereby the portion faces towards the cyclone chamber and is separated from the cyclone chamber by a sidewall,

wherein the first end of the cyclone bin assembly comprises at least a portion of the cyclone chamber, at least a portion of the dirt collection chamber and at least a portion of the sidewall, the first end of the cyclone bin assembly is rotationally mounted between a closed position and an open position in which the second end of the cyclone chamber and the second end of the dirt collection chamber are opened.

[0016] In some embodiments, the dirt outlet may be provided in the sidewall.

[0017] In some embodiments, the cyclone air inlet may be provided at the cyclone chamber first end and the cyclone air outlet may be provided at the cyclone chamber second end.

[0018] In some embodiments, the dirt outlet may be provided in the sidewall.

[0019] In some embodiments, the dirt outlet may comprise an opening in the sidewall that extends axially inwardly into the cyclone chamber from the cyclone chamber second end wall.

[0020] In some embodiments, the surface cleaning apparatus may further comprise an inlet conduit, the dirty air inlet may be located at an inlet end of the inlet conduit and the inlet conduit may be part of the first end of the cyclone bin assembly.

[0021] In some embodiments, the dirt collection chamber first end may be positioned axially outwardly from the cyclone chamber first end whereby the cyclone axis of rotation extends through a portion of the dirt collection chamber that is located axially outwardly from the cyclone chamber first end.

[0022] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted to a rear end of the cyclone bin assembly.

[0023] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted at a location of the second end wall of the cyclone chamber.

[0024] In some embodiments, the front end of the cyclone bin assembly may be rotationally mounted to a rear end of the cyclone bin assembly at a location midway along an axial length of the cyclone bin assembly.

DRAWINGS

[0025] FIG. 1 is a front perspective view of a surface cleaning apparatus in accordance with at least one embodiment;

[0026] FIG. 2 is a rear perspective view of the apparatus of FIG. 1;

[0027] FIG. 3 is a side elevation view of the apparatus of FIG. 1;

[0028] FIG. 4 is a front perspective view of the apparatus of FIG. 1 with a supplemental dirt collection chamber partially removed;

[0029] FIG. 5 is a front perspective view of a surface cleaning apparatus in accordance with another embodiment;

[0030] FIG. 6 is a rear perspective view of the apparatus of FIG. 5;

[0031] FIG. 7 is a side elevation view of the apparatus of FIG. 5 with an electrical cord bag;

[0032] FIG. 8 is a front elevation view of the apparatus of FIG. 5;

[0033] FIG. 9 is a rear elevation view of the apparatus of FIG. 5;

[0034] FIG. 10 is a top plan view of the apparatus of FIG. 5;

[0035] FIG. 11 is a bottom plan view of the apparatus of FIG. 5;

[0036] FIG. 12 is an exploded front perspective view of the apparatus of FIG. 5;

[0037] FIG. 12a is an exploded front perspective view of an alternate apparatus of FIG. 5;

[0038] FIG. 13 is a front perspective view of a surface cleaning apparatus in accordance with another embodiment;

[0039] FIG. 14 is a rear perspective view of the apparatus of FIG. 13;

[0040] FIG. 15 is a side elevation view of the apparatus of FIG. 13;

[0041] FIG. 16 is a front elevation view of the apparatus of FIG. 13;

[0042] FIG. 17 is a rear elevation view of the apparatus of FIG. 13;

[0043] FIG. 18 is a top plan view of the apparatus of FIG. 13;

[0044] FIG. 19 is a bottom plan view of the apparatus of FIG. 13;

[0045] FIG. 20 is a front perspective view of the apparatus of FIG. 13 with a supplemental cyclone bin assembly partially removed;

[0046] FIG. 21 is a cross-sectional view taken along line 21-21 in FIG. 1;

[0047] FIG. 22 is a bottom perspective view of a handvac of the apparatus of FIG. 1;

[0048] FIG. 23 is a perspective cross-sectional view of a cyclone bin assembly of the handvac of FIG. 22 transverse to the cyclone axis;

[0049] FIG. 23a is a top plan view of the cross-section of FIG. 23;

[0050] FIG. 24 is a front perspective view of the supplemental dirt collection chamber of the apparatus of FIG. 1;

[0051] FIG. 25 is a cross-sectional view taken along line 25-25 in FIG. 5;

[0052] FIG. 26 is a cross-sectional view taken along line 26-26 in FIG. 13;

[0053] FIG. 27 is a front perspective view of the apparatus of FIG. 1 in a lightweight upright mode;

[0054] FIG. 28 is a rear perspective view of the apparatus of FIG. 1 in the lightweight upright mode of FIG. 27;

[0055] FIG. 29 is a side elevation view of the apparatus of FIG. 1 in the lightweight upright mode of FIG. 27;

[0056] FIG. 30 is a cross-sectional view taken along line 30-30 in FIG. 27;

[0057] FIG. 31 is a front perspective view of the apparatus of FIG. 1 in an above-floor cleaning mode;

[0058] FIG. 32 is a rear perspective view of the apparatus of FIG. 1 in the above-floor cleaning mode of FIG. 31;

[0059] FIG. 33 is a side elevation view of the apparatus of FIG. 1 in the above-floor cleaning mode of FIG. 31;

[0060] FIG. 34 is a front perspective view of the apparatus of FIG. 1 in a stair-cleaning mode;

[0061] FIG. 35 is a rear perspective view of the apparatus of FIG. 1 in the stair-cleaning mode of FIG. 34;

[0062] FIG. 36 is a side elevation view of the apparatus of FIG. 1 in in the stair cleaning mode of FIG. 34;

[0063] FIG. 36a is a front perspective view of the apparatus of FIG. 5 in an above-floor cleaning mode;

[0064] FIG. 37 is a front perspective view of the apparatus of FIG. 13 in a lightweight upright mode;

[0065] FIG. 38 is a rear perspective view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0066] FIG. 39 is a front elevation view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0067] FIG. 40 is a rear elevation view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0068] FIG. 41 is a side elevation view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0069] FIG. 42 is a top plan view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0070] FIG. 43 is a bottom plan view of the apparatus of FIG. 13 in the lightweight upright mode of FIG. 37;

[0071] FIG. 44 is a cross-sectional view taken along line 44-44 in FIG. 37;

[0072] FIG. 44a is a perspective view of the apparatus of FIG. 13 in an above-floor cleaning mode;

[0073] FIG. 44b is another perspective view of the apparatus of FIG. 13 in the above-floor cleaning mode of FIG. 44a;

[0074] FIG. 45 is a rear perspective view of the supplemental dirt collection chamber of FIG. 24;

[0075] FIG. 46 is a side elevation view of the supplemental dirt collection chamber of FIG. 24;

[0076] FIG. 47 is a front perspective view of a surface cleaning apparatus in accordance with another embodiment;

[0077] FIG. 48 is a cross-sectional view taken along line 48-48 in FIG. 47;

[0078] FIG. 49 is a cross-section view taken along line 49-49 in FIG. 47;

[0079] FIG. 50 is a side elevation view of the apparatus of FIG. 47;

[0080] FIG. 51 is a front elevation view of the apparatus of FIG. 47;

[0081] FIG. 52 is a front perspective view of an upright section of the apparatus of FIG. 13 including a diversion valve in a closed position;

[0082] FIG. 53 is a front perspective view of the upright section of FIG. 52 with a cyclone bin assembly seated on a pedal of the diversion valve;

[0083] FIG. 54 is a front perspective view of the upright section of FIG. 52 with the cyclone bin assembly connected to a wand, and the diversion valve in the open position;

[0084] FIG. 55 is a cross-sectional view taken along line 55-55 in FIG. 52;

[0085] FIG. 56 is a cross-sectional view taken along line 56-56 in FIG. 53;

[0086] FIG. 57 is a cross-sectional view taken along line 57-57 in FIG. 54;

[0087] FIG. 58 is a front perspective view of an upright section of the apparatus of FIG. 13 including another diversion valve in a closed position

[0088] FIG. 59 is a front perspective view of the upright section of FIG. 58 with the cyclone bin assembly being connected to a wand, and the diversion valve in the closed position;

[0089] FIG. 60 is a front perspective view of the upright section of FIG. 58 with the cyclone bin assembly connected to the wand, and the diversion valve in the open position

[0090] FIG. 61 is a cross-sectional view taken along line 61-61 in FIG. 58;

[0091] FIG. 62 is a cross-sectional view taken along line 62-62 in FIG. 59;

[0092] FIG. 63 is a cross-sectional view taken along line 63-63 in FIG. 60;

[0093] FIG. 64 is a front perspective view of an upright section of the apparatus of FIG. 13 including another diversion valve in a closed position;

[0094] FIG. 65 is a front perspective view of the upright section of FIG. 64 with the diversion valve in a partially opened position;

[0095] FIG. 66 is a front perspective view of the upright section of FIG. 64 mounted to the wand with the diversion valve in an open position;

[0096] FIG. 67 is a cross-sectional view of the upright section of FIG. 64;

[0097] FIG. 68 is another cross-sectional view of the upright section of FIG. 64;

[0098] FIG. 69 is an enlarged view of a portion of FIG. 68;

[0099] FIG. 70 is a cross-sectional view taken along line 70-70 in FIG. 65;

[00100] FIG. 71 is a cross-sectional view taken along line 71-71 in FIG. 66;

[00101] FIG. 72 is a front perspective view of an upright section of the apparatus of FIG. 13 with another diversion valve in a closed position;

[00102] FIG. 73 is a front perspective view of the upright section of FIG. 72 being connected to the wand and with the diversion valve in a closed position;

[00103] FIG. 74 is a front perspective view of the upright section of FIG. 72 connected to the wand and with the diversion valve in an open position;

[00104] FIG. 75 is a cross-section view taken along line 75-75 in FIG. 72;

[00105] FIG. 76 is a cross-section view taken along line 76-76 in FIG. 73;

[00106] FIG. 77 is a cross-section view taken along line 77-77 in FIG. 74;

[00107] FIG. 78 is a side elevation view of the handvac of the apparatus of FIG. 1;

[00108] FIG. 79 is a side elevation view of the handvac of the apparatus of FIG. 5;

[00109] FIG. 80 is a side elevation view of the apparatus of FIG. 5 in an upright storage position with a surface cleaning head having rearwardly deployed wheels;

[00110] FIG. 81 is a side elevation view of the apparatus of FIG. 80 in a reclined in-use position with the rear wheels of the surface cleaning head retracted;

[00111] FIG. 82 is a front perspective view of the apparatus of FIG. 13 with a cyclone bin assembly in accordance with at least one embodiment;

[00112] FIG. 83 is a rear perspective view of the cyclone bin assembly of FIG. 82 in a closed position;

[00113] FIG. 84 is a side elevation view of the cyclone bin assembly of FIG. 82 in a closed position;

[00114] FIG. 85 is a front elevation view of the cyclone bin assembly of FIG. 82 in a closed position;

[00115] FIG. 86 is a front elevation view of the cyclone bin assembly of FIG. 82 with a cyclone chamber portion in an open position;

[00116] FIG. 87 is a front elevation view of the cyclone bin assembly of FIG. 82 with the cyclone chamber portion and a dirt collection portion in open positions;

[00117] FIG. 88 is a top perspective view of the cyclone bin assembly of FIG. 82 with the cyclone chamber portion and the dirt collection portion in open positions;

[00118] FIG. 89 is a front perspective view of the cyclone bin assembly of the apparatus of FIG. 13;

[00119] FIG. 90 is a rear perspective view of the cyclone bin assembly of FIG. 89;

[00120] FIG. 91 is a front elevation view of the cyclone bin assembly of FIG. 89;

[00121] FIG. 92 is a rear elevation view of the cyclone bin assembly of FIG. 89;

[00122] FIG. 93 is a side elevation view of the cyclone bin assembly of FIG. 89;

[00123] FIG. 94 is a top plan view of the cyclone bin assembly of FIG. 89;

[00124] FIG. 95 is a bottom plan view of the cyclone bin assembly of FIG. 89;

[00125] FIG. 95b is a front perspective view of the cyclone bin assembly of FIG. 89 with a bottom portion in an open position;

[00126] FIG. 95c is a front perspective view of the cyclone bin assembly of FIG. 89 with top and bottom portions in open positions;

[00127] FIG. 96 is a cross-sectional view taken along line 96-96 in FIG. 22;

[00128] FIG. 97a is a bottom perspective view of the handvac of the apparatus of FIG. 1;

[00129] FIG. 97b is a partial cross-sectional view taken along line 97b-97b of FIG. 97a;

[00130] FIG. 98a is a bottom perspective view of the handvac of the apparatus of FIG. 1 with an open door;

[00131] FIG. 98b a partial cross-sectional view taken along line 98b-98b of FIG. 98a;

[00132] FIG. 99 is a partial cross-sectional view of a surface cleaning apparatus having a handvac disconnected from the upright section, and a bypass valve in a first closed position;

[00133] FIG. 100 is a cross-sectional view of the surface cleaning apparatus of FIG. 99 having a handvac connected to the upright section and the bypass valve in the first closed position;

[00134] FIG. 101 is a cross-sectional view of the surface cleaning apparatus of FIG. 99 having the handvac connected to the upright section and a supplementary cyclone bin assembly, and the bypass valve in a second open position;

[00135] FIG. 102 is a cross-sectional view of a surface cleaning apparatus having a having a bypass airflow path and a pre-motor filter in a supplemental cyclone bin assembly;

[00136] FIG. 103 is a cross-sectional view of a surface cleaning apparatus having a clean air suction motor in a surface cleaning head;

[00137] FIG. 104a is a cross-sectional view of a surface cleaning apparatus having a having a clean air suction motor in a supplemental cyclone bin assembly;

[00138] FIG. 104b is a cross-sectional view of another surface cleaning apparatus having a clean air suction motor in a supplemental cyclone bin assembly;

[00139] FIG. 105a is a perspective view of a surface cleaning apparatus having a supplemental cyclone bin assembly disconnected from an upright section;

[00140] FIG. 105b is a perspective view of a surface cleaning apparatus having a cyclone chamber and dirt collection chamber disconnected from an upright section;

[00141] FIG. 106 is a side elevation view a surface cleaning apparatus in accordance with another embodiment;

[00142] FIG. 107 is a partial side elevation view of the apparatus of FIG. 106 with a handvac disconnected from an upright section;

[00143] FIG. 108 is a side elevation view of the apparatus of FIG. 106 in a reclined in-use position with an arm assembly in a first position;

[00144] FIG. 109 is a side elevation view of the apparatus of FIG. 106 in a steeply reclined in-use position with the arm assembly in a second position;

[00145] FIG. 110a is a rear perspective view of the handvac of the apparatus of FIG. 1 in an open position;

[00146] FIG. 110b is a front perspective view of the handvac of FIG. 110a in the open position;

[00147] FIG. 111 is a front perspective view of the dirt collection chamber of the apparatus of FIG. 1 in an open position;

[00148] FIG. 112 is a rear perspective view of the dirt collection chamber of FIG. 111 in the open position;

[00149] FIG. 113 is a side elevation view of the dirt collection chamber of FIG. 111 in the open position;

[00150] FIG. 114 is a front perspective view of the upright section of the apparatus of FIG. 5 with a cyclone bin assembly in a closed position;

[00151] FIG. 115 is a front perspective view of the upright section of FIG. 114 with the cyclone bin assembly in an open position;

[00152] FIG. 116 is a cross-sectional view of the handvac of the apparatus of FIG. 1 having a pre-motor filter chamber in an open position;

[00153] FIG. 117 is an exploded view of the handvac of FIG. 116;

[00154] FIG. 118 is a cross-sectional view of a surface cleaning apparatus having a plurality of cyclone chambers in parallel;

[00155] FIG. 119a is a cross-sectional view of a surface cleaning apparatus having a dirty air suction motor in a surface cleaning head in series with a clean air suction motor in a handvac;

[00156] FIG. 119b is a cross-sectional view of the surface cleaning apparatus of FIG. 119a with a supplemental cyclone bin assembly removed;

[00157] FIG. 120 is a cross-sectional view of a surface cleaning apparatus having a clean air suction motor in a surface cleaning head in series with a clean air suction motor in a handvac;

[00158] FIG. 121a is a cross-sectional view of a surface cleaning apparatus having a clean air suction motor in a supplemental cyclone bin assembly in series with a clean air suction motor in a handvac;

[00159] FIG. 121b is a cross-sectional view of the surface cleaning apparatus of FIG. 121a with a hose connecting the handvac suction motor and the suction motor of the supplemental cyclone bin assembly;

[00160] FIG. 122 is a cross-sectional view of a surface cleaning apparatus having an airflow which bypasses the handvac;

[00161] FIG. 123 is a perspective view of a surface cleaning apparatus in accordance with another embodiment;

[00162] FIG. 124 is an exploded perspective view of the surface cleaning apparatus of FIG. 123;

[00163] FIG. 125 is a cross-sectional view taken along line 125-125 in FIG. 123;

[00164] FIG. 126 is enlarged partial view of FIG. 125;

[00165] FIG. 127 is an enlarged partial view of FIG. 126;

[00166] FIG. 128 is a perspective view of a surface cleaning apparatus in accordance with another embodiment;

[00167] FIG. 129 is a cross sectional perspective view of the surface cleaning apparatus of FIG. 128;

[00168] FIG. 130 is a front perspective view of the surface cleaning apparatus of FIG. 128 with a front end open;

[00169] FIG. 131 is a bottom perspective view of the surface cleaning apparatus of FIG. 128 with the front end open;

[00170] FIG. 132 is a perspective view of a surface cleaning apparatus in accordance with another embodiment;

[00171] FIG 133 is a cross sectional perspective view of the surface cleaning apparatus of FIG. 132;

[00172] FIG. 134 is a rear perspective view of the surface cleaning apparatus of FIG. 132 with a front end open;

[00173] FIG. 135 is a front perspective view of the surface cleaning apparatus of FIG. 132 with the front end open;

[00174] FIG. 136 is a perspective cross sectional view of a surface cleaning apparatus in accordance with another embodiment; and,

[00175] FIG. 137 is a perspective cross sectional view of the surface cleaning apparatus of FIG. 136 with a front end open.

DESCRIPTION OF VARIOUS EMBODIMENTS

[00176] Numerous embodiments are described in this application, and are presented for illustrative purposes only. The described embodiments are not intended to be limiting in any sense. The invention is widely applicable to numerous embodiments, as is readily apparent from the disclosure herein. Those skilled in the art will recognize that the present invention may be practiced with modification and alteration without departing from the teachings disclosed herein. Although particular features of the present invention may be described with reference to one or more particular embodiments or figures, it should be understood that such features are not limited to usage in the one or more particular embodiments or figures with reference to which they are described.

[00177] The terms "an embodiment," "embodiment," "embodiments," "the embodiment," "the embodiments," "one or more embodiments," "some embodiments," and "one embodiment" mean "one or more (but not all) embodiments of the present invention(s)," unless expressly specified otherwise.

[00178] The terms "including," "comprising" and variations thereof mean "including but not limited to," unless expressly specified otherwise. A listing of items does not imply that any or all of the items are mutually exclusive, unless expressly specified otherwise. The terms "a," "an" and "the" mean "one or more," unless expressly specified otherwise.

[00179] As used herein and in the claims, two or more parts are said to be "coupled", "connected", "attached", or "fastened" where the parts are joined or operate together either directly or indirectly (i.e., through one or more intermediate parts), so long as a link occurs. As used herein and in the claims, two or more parts are said to be "directly coupled", "directly connected", "directly attached", or "directly fastened" where the parts are connected directly in physical contact with each other. As used herein, two or more parts are said to be "rigidly coupled", "rigidly connected", "rigidly attached", or "rigidly fastened" where the parts are coupled so as to move as one while maintaining a constant orientation relative to each other. None of the terms "coupled", "connected", "attached", and "fastened" distinguish the manner in which two or more parts are joined together.

General Overview

[00180] Referring to FIGS. 1-3, a surface cleaning apparatus 100 is shown in accordance with a first embodiment. In the embodiment shown, the surface cleaning apparatus 100 is a type of upright vacuum cleaner which is referred to as a stick vacuum cleaner. As illustrated, surface cleaning apparatus 100 includes a surface cleaning head 104, an upright section 108, and a hand-carriable vacuum cleaner 112 (also referred to as handvac or hand vacuum cleaner 112).

[00181] Upright section 108 may be movably and drivingly connected to surface cleaning head 104. For example, upright section 108 may be permanently or removably connected to surface cleaning head 104 and moveably mounted thereto for movement from a storage position to an in use position, such as by a pivotable joint 116. Joint 116 may permit upright section 108 to pivot (i.e., rotate) with respect

to surface cleaning head 104 about a horizontal axis. Accordingly, upright section 108 may be rotatable rearwardly so as to be positionable in a plurality of reclined floor cleaning positions (see for example Figures 81 and 108).

[00182] Upright section 108 may also be steeringly connected to surface cleaning head 104 for maneuvering surface cleaning head 104. For example, joint 116 may be a swivel joint.

[00183] Handvac 112 may be removably connected to upright section 108. When mounted to upright section 108, a user may grasp handvac 112 to manipulate upright section 108 to steer surface cleaning head 104 across a surface to be cleaned. Accordingly, when handvac 112 is mounted to upright section 108, handle 484 is the drive handle of surface cleaning apparatus 100

[00184] Surface cleaning apparatus 100 has at least one dirty air inlet, one clean air outlet, and an airflow path extending between the inlet and the outlet. In the illustrated example, lower end 120 of surface cleaning head 104 includes a dirty air inlet 124, and a rear end 128 of handvac 112 includes a clean air outlet 132. An airflow path extends from dirty air inlet 124 through surface cleaning head 104, upright section 108, and handvac 112 to clean air outlet 132. As exemplified in Figures 128 to 135, the handvac 112 may include a main body 129 and a dirty air inlet 131, and an air flow path of the handvac 112 may extend from the dirty air inlet 131 to the clean air outlet 132 with the suction motor 204 positioned in the air flow path.

[00185] As exemplified, at least one suction motor, and preferably the only suction motor, and one air treatment member, which may be the only air treatment member, is provided in the handvac 112 to permit handvac 112 to operate independently when disconnected from surface cleaning head 104 and optionally from upright section 108. It will be appreciated that while at least one suction motor and at least one air treatment member are positioned in the airflow path to separate dirt and other debris from the airflow, that when used with other aspects disclosed

herein, each of the suction motor and the air treatment member may be provided in the surface cleaning head 104, the upright section 108, and/or the handvac 112.

[00186] The air treatment member may be any suitable air treatment member, including, for example, one or more cyclones, filters, and bags. The air treatment member may be an air treatment chamber wherein air is redirected to assist dirt being removed from an incoming air stream and is optionally a cyclone chamber. Preferably, at least one air treatment member is provided upstream of the suction motor to clean the dirty air before the air passes through the suction motor. In the illustrated embodiment, handvac 112 includes a cyclone bin assembly 136 including a cyclone chamber and a dirt collection region. In some embodiments, the dirt collection region may be a portion (e.g., a lower portion) of the cyclone chamber. In other embodiments, the dirt collection region may be a dirt collection chamber that is separated from the cyclone chamber by a dirt outlet of the cyclone chamber. The following description utilizes the exemplified embodiments set out in the drawings, which utilize a cyclone chamber. It will be appreciated that the aspects disclosed herein may be used with an air treatment member as discussed previously and, optionally, an air treatment chamber. It will also be appreciated that if the air treatment member is an air treatment chamber, then the cyclone bin assembly 136 may be referred to as an air treatment assembly.

Plurality of Dirt Collection Chambers

[00187] In accordance with one aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a stick surface cleaning apparatus may have more than one dirt collection chamber. For example, the handvac may include a first dirt collection chamber, and the upright section may include a second dirt collection chamber. The second dirt collection chamber provides the surface cleaning apparatus with an enlarged dirt collection capacity in comparison with the dirt collection capacity of the handvac alone.

Accordingly, the surface cleaning apparatus may operate for longer intervals before one or more of the dirt collection chambers needs to be emptied.

[00188] In accordance with this aspect, and as exemplified in FIG. 4, upright section 108 may have an auxiliary dirt collection assembly 140, which may comprise or consist of an auxiliary dirt collection chamber 141. For example, the auxiliary dirt collection chamber 140 may be the only component provided in the auxiliary dirt collection assembly and therefore the auxiliary dirt collection chamber 140 may be the auxiliary dirt collection assembly. Alternately, as disclosed in alternate embodiments, the auxiliary dirt collection assembly may also include one or more of a pre-motor filter, one or more cyclone chambers that may have one or more associated dirt collection chambers and a suction motor.

[00189] As illustrated, up flow duct 144 (also referred to as a wand if removable for use, e.g., in an above floor cleaning mode as exemplified in Figures 33 and 44a) may define the airflow path between surface cleaning head 104 and handvac 112. Auxiliary dirt collection chamber 140 may be a supplemental dirt collection chamber that is selectively mounted to up flow duct 144 and augments the dirt collection capacity of surface cleaning apparatus 100 when mounted to upper section 108.

[00190] It will be appreciated that if up flow duct 144 is the member that supports handvac 112 when auxiliary dirt collection assembly 140 is removed, the up flow duct is designed to be load supporting and may be a rigid tube. Further if the up flow duct is removable to function as an above floor cleaning wand, then the up flow duct may also be a rigid tube. In other embodiments, e.g., the up flow duct is not a load supporting member, then all or a portion of up flow duct 144 may be flexible, such as a flexible hose.

[00191] As exemplified in FIGS. 1 and 21, the dirt collection assembly 140 of the upright section 108 may collect at least a portion of the dirt separated from the dirty airflow by the handvac 112. Accordingly, the dirt collection assembly 140 of the upright section 108 may be in communication with the dirt collection chamber of

handvac 112 all or a portion of the time when the handvac 112 is mounted to the upright section 108. For example, the dirt collection chamber of handvac 112 may have a door that automatically opens when handvac 112 is mounted to the upright section 108. Accordingly, dirt separated by handvac 112 may travel to the supplemental dirt collection assembly 140. Alternately, the door may be manually operable by a user. Accordingly, dirt may only be transferred to the supplemental dirt collection assembly 140 when a user elects to open the door. Alternately, the supplemental dirt collection assembly 140 may receive dirt from an auxiliary air treatment member, in which case the auxiliary dirt collection assembly may comprise a housing having both the auxiliary air treatment member and the auxiliary dirt collection chamber.

[00192] The dirt collection chamber of auxiliary dirt collection assembly 140 and handvac dirt collection chamber 188 may be of any suitable volumetric sizes. Preferably, the volumetric storage capacity of the dirt collection chamber of auxiliary dirt collection assembly 140 is at least equal to the volumetric storage capacity of handvac dirt collection chamber 188, and more preferably larger than the volumetric storage capacity of handvac dirt collection chamber 188. For example, the volumetric storage capacity of the dirt collection chamber of auxiliary dirt collection assembly 140 may be 1-20 times the volumetric storage capacity of handvac dirt collection chamber 188, more preferably 1.5-10 times, and most preferably 3-5 times. In alternative embodiments, the volumetric storage capacity of the dirt collection chamber of auxiliary dirt collection assembly 140 may be less than that of handvac dirt collection chamber 188.

[00193] As exemplified in FIG. 21, handvac 112 may include a cyclone bin assembly 136 including one or more cyclone chambers 184 and one or more dirt collection chambers 188. The cyclone chamber or chambers and the dirt collection chamber or chambers may be of any design. As exemplified, cyclone chamber 184 includes an air inlet 192 in fluid communication with wand 144, an air outlet 196 downstream of air inlet 192, and a dirt outlet 200 in fluid communication with dirt

collection chamber 188. Suction motor 204 or another suction source may draw dirty air to enter air inlet 192 and travel cyclonically across cyclone chamber 184 to dirt outlet 200 where dirt is ejected into dirt collection chamber 188. Afterwards, the air is discharged from cyclone chamber 184 at air outlet 196.

[00194] As exemplified in FIGS. 21-23, cyclone bin assembly 136 may include laterally opposed side walls 208, a top wall 212, a bottom wall 216, a first end wall 220, and a second end wall 224. As shown, a common interior wall 226 may divide cyclone chamber 184 from dirt collection chamber 188. For example, cyclone chamber 184 may be defined by top wall 212 and interior wall 226 which extend between end walls 220 and 224. Top wall 212 and interior wall 226 may be curved to define a substantially cylindrical or frustroconical sidewall of cyclone chamber 184. In alternative embodiments, cyclone chamber 184 may have a sidewall of any other suitable shape that is conducive to cyclonic flow. In some alternative embodiments, interior wall 226 of cyclone chamber 184 may be discrete from dirt collection chamber 188 instead of forming a common wall dividing cyclone chamber 184 from dirt collection chamber 188.

[00195] Dirt collection chamber 188 may be defined by bottom wall 216, side walls 208, and interior wall 226. In some embodiments, bottom wall 216 may be openable for fluidly connecting handvac dirt collection chamber 188 to supplemental dirt collection assembly 140 of upright section 108. This may permit dirt separated by cyclone chamber 184 and discharged through dirt outlet 200 to move through opened bottom wall 216 and collect in supplemental dirt collection assembly 140.

[00196] Optionally, when the auxiliary dirt collection assembly is mounted to upright section 108, dirt separated in the cyclone chamber is collectable in the dirt collection chamber of the auxiliary dirt collection assembly. The auxiliary dirt collection assembly may be selectively connectable in communication with the dirt collection region of the hand vacuum cleaner by, e.g., an openable door 228 (also referred to as a dumping door). The door may be manually openable, such as by a

handle, or automatically operated, such as when the auxiliary dirt collection assembly is mounted to upright section 108. In this case, dirt will collect in the handvac 112 and will remain there until door 228 is openable so as to allow the collected dirt to transfer to supplemental dirt collection assembly 140. In the latter case, supplemental dirt collection assembly 140 is automatically connected in communication with a dirt outlet of the cyclone chamber when the auxiliary dirt collection assembly is mounted to upright section 108. In this case, dirt will collect in the supplemental dirt collection assembly 140 when handvac 112 is mounted to the upright section 108.

[00197] In the illustrated example, bottom wall 216 includes a door 228, which may be a pivotally openable door 228. As shown, door 228 may be pivotally connected to dirt collection chamber 188 by a hinge 232 for rotation about a hinge axis 236. Door 228 may extend forwardly from a rear end 240 to a front end 244. Preferably, hinge 232 and hinge axis 236 are positioned at rear end 240 of door 228. In alternative embodiments, hinge 232 and hinge axis 236 may be positioned at front end 244 or intermediate front and rear ends 240 and 244.

[00198] Door 228 is preferably outwardly pivotal of dirt collection chamber 188. For example, door 228 may be movable between a closed position (FIG. 22) in which door 228 closes bottom wall 216, and an open position (FIG. 21) in which door 228 is rotated away from dirt collection chamber 188 for opening bottom wall 216 to permit dirt to move from handvac dirt collection chamber 188 to supplemental dirt collection assembly 140. As shown, in the open position front end 244 of door 228 may be moved away from handvac dirt collection chamber 188.

[00199] Hinge axis 236 may have any suitable orientation. In the illustrated example, hinge axis 236 extends laterally side-to-side of surface cleaning apparatus 100. Hinge axis 236 may be transverse to one or more of cyclone axis 248 of cyclone chamber 184, motor axis 252 of suction motor 204, or downstream direction 256 through air inlet 192. In the example shown, hinge axis 236 is perpendicular to cyclone axis 248, motor axis 252, and downstream direction 256. In alternative

embodiments, hinge axis 236 may be substantially parallel to one or more of cyclone axis 248, motor axis 252, or downstream direction 256.

[00200] In some embodiments, door 228 may extend upwardly and forwardly between rear end 240 and front end 244. For example, front end 244 may be positioned closer to cyclone chamber 184 and cyclone axis 248 than rear end 240. When door 228 is opened (FIG. 21), this may provide a bottom opening 260 having a transverse width 264 between cyclone chamber 184 and bottom wall 216.

[00201] Optionally, the dirt collection region (the dirt collection chamber) of the hand vacuum cleaner is positioned above the supplemental dirt collection assembly 140. Accordingly, dirt that is received in the dirt collection chamber of the hand vacuum cleaner may be transferred by due to gravity to the supplemental dirt collection assembly 140. Accordingly, for example, dirt outlet 200 may be positioned on a bottom end 268 of cyclone chamber 184 for discharging dirt toward bottom wall 216 and opening 260 to be delivered by gravity into supplemental dirt collection assembly 140 of upright section 108.

[00202] Reference is now made to FIGS. 21, 22, and 24. Preferably, when handvac 112 is connected to upright section 108, opening 260 is fluidly coupled to an inlet to dirt collection assembly 140. In the illustrated example, door 228 and opening 260 of cyclone bin assembly 136 align with an inlet 272 of dirt collection assembly 140. As shown, inlet 272 may be formed as an opening in an upper portion 276 of dirt collection assembly 140. In some embodiments, inlet 272 may include a door (not shown) which opens automatically and concurrently with door 228. Optionally, the door of inlet 272 may be biased (e.g., by a spring) to close inlet 272 and seal dirt collection assembly 140 when door 228 is closed or handvac 112 is disconnected from upright section 108.

[00203] Preferably, opening 260 and inlet 272 of upper portion 276 of dirt collection assembly 140 are sized and positioned to receive at least a portion of door

228 when door 228 is in the open position. This may permit door 228 to open outwardly into the open position as shown in FIG. 21.

[00204] If door 228 is moveable from the closed position to the open position automatically upon connecting handvac 112 to upright section 108, then handvac 112 may include an actuator drivingly connected to door 228 to move door 228 (e.g., pivot door 228 about hinge axis 236) to the open position when handvac 112 is connected to upright section 108. In the illustrated embodiment, door 228 includes an arm 280 pivotally connected at hinge 232. As shown, arm 280 may include a lever portion 284 which extends rearwardly of hinge 232, and which may be depressed to pivot door 228 to the open position. Further, dirt collection assembly 140 is shown including an engaging member 288 positioned to align with lever portion 284 of arm 280. In use, engaging member 288 may depress lever portion 284 of arm 280 upon connecting handvac 112 to upright section 108 to automatically pivot door 228 into the open position, whereby opening 260 may be fluidly connected to inlet 272 of supplemental dirt collection assembly 140. In one aspect, this may permit a user, who has used handvac 112 when disconnected from upright section 108, to automatically empty handvac dirt collection chamber 188 by connecting handvac 112 to upright section 108. Afterwards, handvac 112 may be disconnected from upright section 108 with an empty dirt collection chamber 188.

[00205] If door 228 is manually moveable from the closed position to the open position then, as exemplified in FIGS. 97a-b and 98a-b, door 228 may be provided with an actuator, e.g., a manually operable lever portion 284. Lever portion 284 may extend downwardly from door 228 such that lever portion 284 is user-accessible and user-operable while handvac 112 is mounted to upright section 108. As exemplified, lever portion 284 may protrude from the bottom wall 216 of cyclone bin assembly 136 to provide user-accessibility to lever portion 284.

[00206] As exemplified in FIGS. 21, 22, 24, 97a-b, and 98a-b, whether door 228 is manually or automatically operable, door 228 may be biased to the closed position.

For example, door 228 may be biased for rotation about hinge axis 236 toward the closed position by a biasing member (not shown), such as a torsion spring. This may permit door 228 to close automatically upon disconnecting handvac 112 from upright section 108, to prevent dirt from spilling from dirt collection chamber 188 and to permit immediate use of handvac 112 for cleaning. In alternative embodiments, door 228 may not be biased toward the closed position. For example, door 228 may remain in the open position upon disconnecting handvac 112 from upright section 108. In such a case, door 228 may remain open until manually closed. For example, referring to FIGS. 98a-b, door 228 may remain in the open position shown until lever portion 284 of arm 280 is user-activated to move door 228 to the closed position.

Removable Supplemental Dirt Collection Assembly

[00207] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a surface cleaning apparatus has two or more dirt collection chambers wherein one of the dirt collection chambers is optionally removable, and the surface cleaning apparatus is operable when the removable dirt collection chamber has been removed. Accordingly, as discussed with respect to the previous embodiment, a supplemental dirt collection chamber may be provided on the up flow duct or wand of a stick vacuum cleaner and may be the main dirt collection chamber (e.g., it may collect most or all of the separated dirt when the stick vacuum cleaner is operated with the supplemental dirt collection chamber in position). This may be referred to as a large dirt capacity upright mode or a second upright mode of operation.

[00208] The supplemental dirt collection chamber may be removable for emptying and to reconfigure the vacuum to a light weight upright mode or a first upright mode of operation. Once removed, the vacuum cleaner may be operable to separate dirt and collect the separated dirt in another dirt collection chamber (e.g., the handvac dirt collection chamber). An advantage of the light weight upright mode is that the size and weight of the vacuum cleaner may be reduced by removal of the supplemental dirt collection chamber. This may be of assistance when the vacuum

cleaner is used to clean around and under furniture, and when the vacuum cleaner is to be carried upstairs.

[00209] As exemplified in FIGS. 1 and 4, dirt collection assembly 140 of upright section 108 may be removably connected to wand 144 and handvac 112. This may permit dirt collection assembly 140 to be removed for emptying, or to operate apparatus 100 in a light weight upright mode. It will be appreciated that, in alternate embodiments, wand 144 and dirt collection assembly 140 of upright section 108 may be integrally formed or permanently connected as a one piece assembly.

[00210] Dirt collection assembly 140 may be removably mounted to wand 144 in any suitable fashion. In the illustrated embodiment, a lower end 292 of dirt collection assembly 140 may be toed onto a lower end 296 of wand 144, and then dirt collection assembly 140 may be pivoted about lower end 292 toward wand 144 and held in position by a suitable releasable fastening mechanism.

[00211] In the illustrated embodiment, handvac 112 may remain in fluid communication with wand 144 and surface cleaning head 104 while supplemental dirt collection assembly 140 is disconnected from wand 144 and removed altogether from apparatus 100. This may permit dirt collection assembly 140 to be removed (e.g., for emptying or to operate apparatus 100 in a light weight upright mode) without disrupting the operation of apparatus 100.

Upstream Air Treatment Member

[00212] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, an upstream air treatment member may be provided. The upstream air treatment member may be removably connectable upstream of the handvac. For example, the supplemental dirt collection assembly may have one or more cyclone chambers associated therewith. Accordingly, when the supplemental dirt collection assembly is positioned on upright section 108 (e.g., up flow duct 144), a supplemental cyclone chamber assembly 160 may be connected in series or parallel with the cyclone

chamber of the handvac. Accordingly, when operated as an upright vacuum, the surface cleaning apparatus may be a dual cyclonic stage surface cleaning apparatus. When used in an above floor cleaning mode, the handvac may be a single cyclonic stage surface cleaning apparatus. Typically, the surface cleaning apparatus may be used as an upright vacuum cleaner (i.e., with the supplemental cyclonic bin assembly attached) for cleaning floors. This may represent the majority of area that is to be cleaned. Therefore, for a majority of the use of the surface cleaning apparatus, it may be used as a dual stage cyclonic surface cleaning apparatus.

[00213] In accordance with this aspect, the upright section may include a first air treatment member for separating at least large dirt particles from the airflow, and the air treatment member of the handvac may be positioned downstream of the first air treatment member for separating small dirt particles ("fines") from the airflow. In this case, the greatest volume of separated dirt may be collected in the dirt collection chamber of the upright section, and a lesser volume of fines may be collected in the dirt collection chamber of the handvac. This may reduce the rate at which the handvac dirt collection chamber may be filled, and reduce the frequency at which the handvac dirt collection chamber must be emptied. It will be appreciated that each cyclonic stage may be of any design and may be designed to remove any type of dirt.

[00214] It will be appreciated that, in some embodiments, dirt separated by the handvac may be collected in the supplemental dirt collection assembly. In such a case, the dirt collection region of the handvac may be in communication (automatically or manually selectively) with a dirt collection region in the supplemental dirt collection assembly, which region may be isolated from the dirt collection chamber for the cyclonic stage of the supplemental cyclone chamber assembly.

[00215] It will be appreciated that, if air travels through up flow duct 144 to handvac 112, when cyclone bin assembly 160 is connected to wand 144, air travelling through wand 144 may be diverted into cyclone bin assembly 160 and

returned to wand 144 from cyclone bin assembly 160 downstream of the diversion. Optionally, in accordance with another aspect with is discussed in more detail subsequently, and which is exemplified in the embodiment of FIGS. 20 and 26, in some embodiments the diversion may occur automatically upon mounting of the supplemental cyclone bin assembly 160 to upright section 108. For example, cyclone bin assembly 160 may include a diversion member 428 which may be positionable in the conduit of wand 144 between the upstream and downstream ends 364 and 360 of wand 144. As shown, diversion member 428 may divide wand 144 into an upstream wand portion 440 and a downstream wand portion 444. Diversion member 428 may form an air-tight seal inside wand 144 for redirecting substantially all air travelling through upstream wand portion 440 into air inlet 316 of cyclone bin assembly 160. In turn, air outlet 320 of cyclone bin assembly 160 may discharge into downstream wand portion 444 for travel downstream to handvac 112.

[00216] As exemplified in the embodiment of FIGS. 5, 12, and 25 supplemental cyclone bin assembly 160, 160 may be any suitable cyclone bin assembly and may include a cyclone chamber 308 and a dirt collection chamber 141. Cyclone chamber 308 may include an air inlet 316 for receiving dirty air from the surface cleaning head, e.g., via wand 144, an air outlet 320 for discharging air, e.g., to handvac 112, a dirt outlet 324 for discharging separated dirt into dirt collection chamber 141, a vortex finder 400 and a cyclone axis 392. Wand 144 may include an upstream end 360 connected to surface cleaning head 104, and a downstream end 364 connected to air inlet 316 of cyclone chamber 308.

[00217] From cyclone bin assembly 160, the airflow may flow downstream to handvac 112. Accordingly, handvac cyclone bin assembly 136 is positioned downstream of and in series with supplemental cyclone bin assembly 160. The air may be received in handvac cyclone bin assembly 136 where additional particulate matter may be further separated from the airflow and deposited into dirt collection chamber 188. In many cases, the additional particulate matter separated by cyclone bin assembly 136 may constitute less than 30% of the total volume of dirt separated

from apparatus 100, and may constitute all or a majority of the fines that are separated. Accordingly, dirt collection chamber 188 may be filled at a lower volumetric rate than supplemental dirt collection chamber 141. This may help to maintain dirt collection capacity in handvac 112.

[00218] In operation, air exiting air outlet 320 of cyclone bin assembly 160 may enter handvac 112 for a second stage of cleaning by cyclone bin assembly 136. As illustrated, handvac 112 may include a nozzle 412 having an upstream end 416 and a downstream end 420. When handvac 112 is connected to upright section 108, upstream end 416 may be fluidly connected with air outlet 320 of upright section 108, and downstream end 420 may be fluidly connected with inlet 192 of handvac cyclone chamber 184.

[00219] In operation, air may be drawn into dirty air inlet 124 and enter upstream wand portion 440. Diversion member 428 may redirect the air traveling through upstream wand portion 440 to enter air inlet 316 of cyclone chamber 308. Air may travel through air inlet 316 tangentially to sidewall 376 and spiral downwardly toward lower end wall 368, whereby dirt may be separated from the airflow and pass through dirt outlet 324 to accumulate in dirt collection chamber 141. The airflow may then travel downstream into vortex finder 400 and exit cyclone chamber 308 at air outlet 320 at downstream end 404 of vortex finder 400, into an outlet passage 476. Outlet passage 476 may have a downstream end fluidly connected to downstream wand portion 444. The air may travel through downstream wand portion 444 to downstream wand end 364 into handvac 112. In handvac 112, additional dirt may be separated from the airflow by cyclone bin assembly 136 before the air is discharged through clean air outlet 132.

[00220] It will be appreciated that, in accordance with this aspect, cyclone bin assembly 160 may be any suitable cyclone bin assembly. In the example shown in FIGS. 5, 12, and 25, cyclone chamber 308 includes a lower end wall 368, an upper end wall 372, and a sidewall 376 extending between the lower end wall 368 and the

upper end wall 372. Preferably, sidewall 376 is substantially cylindrical or frustroconical in accordance with conventional cyclone chamber design.

[00221] Dirt outlet 324 may be formed as an opening in sidewall 376 for directing separated dirt into dirt collection chamber 141. In some embodiments, at least a portion of sidewall 376 of cyclone chamber 308 may form a common dividing wall between cyclone chamber 308 and dirt collection chamber 141. In this case, dirt outlet 324 may be formed as an opening in the common portion of sidewall 376.

[00222] Dirt outlet 324 may be formed at any suitable position on sidewall 376. In the illustrated example, dirt outlet 324 is positioned at an upper end of cyclone chamber 308 proximate upper end wall 372. More particularly, the illustrated embodiment includes a dirt outlet 324 defined by a slot 380 in sidewall 376 bordered by upper end wall 372. This may increase the capacity of dirt collection chamber 141. More specifically, dirt may accumulate by gravity from the bottom of dirt collection chamber 141 upwardly. Thus, the capacity of the dirt collection chamber 141 may be defined at least in part by the position of dirt outlet 324. Dirt collection chamber 141 is full when the level of dirt in dirt collection chamber 141 rises to dirt outlet 324. Accordingly, the capacity of dirt collection chamber 141 is the volume of the dirt collection chamber 141 below dirt outlet 324. Thus, the capacity of dirt collection chamber 141 may be increased by positioning dirt outlet 324 in an uppermost position, such as proximate the upper end wall 372 of cyclone chamber 308 as shown.

[00223] Alternately, in some embodiments as exemplified in FIG 26, lower end wall 368 may comprise or be an arrester plate 1280 which separates cyclone chamber 308 from dirt collection chamber 141. In this case, dirt outlet 324 may be formed by a gap between arrester plate 1280 and sidewall 376, where dirt particles may fall by gravity into dirt collection chamber 141.

[00224] In accordance with another aspect which is discussed in more detail subsequently, as exemplified, cyclone chamber 308 may include an inlet passage

384 for redirecting axially-directed inlet air to flow tangentially to promote cyclonic action in cyclone chamber 308. An upstream end 388 of inlet passage 384 may face axially (i.e., substantially parallel to cyclone axis 392), and a downstream end (not shown) of inlet passage 384 may face tangentially to cyclone chamber 308. Air entering upstream end 388 of inlet passage 384 from air inlet 316 may travel along inlet passage 384 and exit downstream end (not shown) in a tangential direction. After spiraling upwardly around vortex finder 400 of cyclone chamber 308, the airflow may enter vortex finder 400 and exit cyclone chamber 308 through air outlet 320 at a downstream end 404 of vortex finder 400.

[00225] Handvac cyclone chamber 184 may be any suitable cyclone chamber. In some embodiments, cyclone chamber 184 is substantially similar to cyclone chamber 308. For example, cyclone chamber 184 may include an air inlet 192, an inlet passage 420, a dirt outlet 200, a vortex finder 424, a dirt outlet 200, an air outlet 196, and a cyclone axis 248. Air from upright section 108 may axially enter air inlet 192, be redirected to a tangential direction by inlet passage 420, spiral upwardly around vortex finder 424, deposit dirt into dirt outlet 200, and then exit cyclone chamber 184 through air outlet 196 at a downstream end of vortex finder 424.

Modes of Operation

[00226] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the surface cleaning apparatus is reconfigurable to operate in a plurality of different modes of operation. For example, the surface cleaning apparatus may be operable in two or more of a handvac mode, a stair-cleaning mode, an above-floor cleaning mode, a large dirt capacity upright mode, a lightweight upright mode, or a dual motor upright mode. In some cases, the surface cleaning apparatus may be reconfigurable between different modes of operation with a single act of connection or disconnection. This may permit the surface cleaning apparatus to be quickly reconfigured with minimal interruption.

[00227] Referring to FIGS. 1, 5, and 13, surface cleaning apparatus 100, 152, and 168 are shown in a large dirt capacity upright cleaning mode. In the large dirt capacity upright cleaning mode, surface cleaning apparatus 100, 152, and 168 may include surface cleaning head 104, upright section 108 including wand 144 and supplemental dirt collection assembly 140, and handvac 112. The airflow path may extend from dirty air inlet 124 of surface cleaning head 104 downstream through wand 144 and then cyclone bin assembly 136 of handvac 112 to separate dirt from the airflow and deposit that dirt into dirt collection chamber 141 of upright section 108 and/or handvac dirt collection chamber 188. In apparatus 152 and 168, cyclone bin assembly 160 is also positioned in the airflow path for separating and collecting dirt from the airflow and cyclone bin assembly 136 of handvac 112 may optionally be bypassed as discussed subsequently.

[00228] As exemplified in FIGS. 12 and 12a one or more of the surface cleaning head 104, upright section 108, and handvac 112 may be removably connected to each other so as to be able to be assembled in a number of different combinations to provide apparatus 152 with a number of different modes of operation. In some embodiments, the wand 144 and supplemental assembly 140, 160 of upright section 108 may also be removably connected to each other to provide additional modes of operation. For example, in the large dirt capacity upright cleaning mode, surface cleaning head 104 may be connected to upstream end 360 of wand 144, downstream end 364 of wand 144 may be connected to an air inlet 316 of cyclone bin assembly 160, and air outlet 320 of cyclone bin assembly 160 may connected to upstream end 416 of handvac nozzle 412.

[00229] The large dirt capacity upright cleaning mode as shown may be particularly effective for cleaning large surface areas (e.g., the floor of one or more rooms). The user may grasp handvac handle 484 to steer surface cleaning head 104 across the surface to be cleaned (i.e., handle 484 may be a drive handle of the surface cleaning apparatus). The tall height 492 of apparatus 100, 152, and 168 provided in part by the interposition of wand 144 between surface cleaning head 104

and handvac 112 may permit apparatus 100 to be operated by a user standing upright. The large dirt capacity of dirt collection chamber 141 of upright section 108 may permit extended usage of apparatus 100 before the dirt collection chamber 141 becomes full and must be emptied.

[00230] As exemplified in FIGS. 4, 5, 12, 12a, 20 and 27-30, and 37-44 dirt collection assembly 140 or cyclone bin assembly 160 may be selectively disconnected from upright section 108 to reconfigure apparatus 100, 152, or 168 from the large dirt capacity upright mode to a light weight upright mode. Likewise, dirt collection assembly 140 or cyclone bin assembly 160 may be selectively reconnected to upright section 108 to reconfigure apparatus 100, 152, or 168 from a light weight mode to a large dirt capacity upright mode.

[00231] Preferably, reconfiguring the apparatus from the large dirt capacity upright mode to the light weight upright mode may require only a single user action (e.g., disconnecting the dirt collection assembly 140 or cyclone bin assembly 160 from the upright section 108 may automatically close a dumping door of the handvac if the dumping door is open and may also automatically close a diversion member if the vacuum cleaner includes a supplemental cyclone bin assembly 160).

[00232] As exemplified in apparatus 100, door 228 which may have been open in the large dirt capacity upright mode for connecting dirt collection chambers 188 and 141, may close automatically (i.e., without any further user interaction) upon disconnecting dirt collection chamber 141, to seal bottom wall 216 of dirt collection chamber 141. Exemplary mechanisms include a biasing member, such as a spring and a mechanical or electrical drive member drivingly connected to the door to close the door as supplemental assembly 140, 160 is removed.

[00233] As exemplified in apparatus 168, disconnecting cyclone bin assembly 160 from wand 144 may automatically reroute the airflow path to extend directly from upstream wand end 360 to downstream wand end 364 without the intermediary diversion to cyclone bin assembly 160. Therefore, the airflow path between surface

cleaning head 104 and handvac 112 is automatically reconfigured by disconnection of cyclone bin assembly 160 to reconfigure apparatus 168 to the light weight upright mode. Accordingly, apparatus 168 may be continually operated while being reconfigured.

[00234] In alternative embodiments, door 228 of apparatus 100 may be manually closed as another step before, during or after dirt collection assembly 140 is disconnected from upright section 108 to complete the reconfiguration to the light weight upright mode. For example, a user may manually close the door. In other embodiments, as described in more detail below, a diversion valve of apparatus 168 may require manual closure as another step after cyclone bin assembly 160 is disconnected from wand 144 to complete the reconfiguration to the light weight upright mode. Alternately, a single actuator may be manually operated to close the door and the diversion valve.

[00235] As exemplified in FIG. 4, apparatus 152 may be reconfigurable from the large dirt capacity upright mode to a light weight upright mode by disconnecting assembly 140, 160 from wand 144. In some cases, it may be desirable to momentarily reconfigure an apparatus to the lightweight upright mode to complete a task (e.g., clean under an article of furniture), and afterward reconfigure the apparatus to the large dirt capacity upright mode. In the illustrated example, the airflow path between surface cleaning head 104 and handvac 112 persists during and after reconfiguration of apparatus 100 from the large dirt capacity upright mode to the lightweight upright mode. This may permit apparatus 100,to be operated continuously (i.e., air to continue to travel between inlet 124 and outlet 132) before, during, and after reconfiguration to the lightweight upright mode. In turn, this may allow for a quick reconfiguration with little or no disruption. It will be appreciated that if a cyclone is provided in the supplemental assembly (e.g., assembly 160), there may be a short period during which the diversion valve is not closed during the transition.

[00236] In some cases, reconfiguring apparatus 100, 152, or 168 from the large dirt capacity upright mode to the lightweight upright mode may provide a reduction in weight (i.e., by the removal of dirt collection assembly 140 or cyclone bin assembly 160), and a more slender profile. Thus, the lightweight upright mode may make apparatus 100, 152, or 168 easier to lift (e.g., carry upstairs), and easier to maneuver under and around furniture and the like. However, in this mode, all of the dirt separated by cyclone bin assembly 136 in the lightweight upright mode is collected in dirt collection chamber 188. Thus, apparatus 100, 152, or 168 may have less dirt collection capacity in the lightweight upright mode as compared with the large dirt capacity upright mode.

[00237] Referring now to FIGS. 31-33, 44a, and 44b, apparatus 100 and 168 are shown in an above-floor cleaning mode. As illustrated, apparatus 100 and 168 in the above-floor cleaning mode include handvac 112 and wand 144. Apparatus 100, 152, and 168 may be reconfigured from the lightweight upright mode to the above-floor cleaning mode by disconnecting surface cleaning head 104 from wand 144. It will be appreciated that assembly 140,160 may be retained in an above floor cleaning mode if desired. However, this would add extra weight to the apparatus in the above floor cleaning mode.

[00238] Referring to FIG. 36a, apparatus 152 is shown in another above-floor cleaning mode. As shown, apparatus 152 in an above-floor cleaning mode may include handvac 112 and an accessory wand 145. Accessory wand 145 may be provided supplementary to wand 144 of upright section 108. For example, accessory wand 145 may be removably mountable to a sidewall of upright section 108, as shown in FIG. 5. Still referring to FIG. 36a, in the above-floor cleaning mode shown, upstream end 360 may provide the dirty air inlet, and downstream end 364 may be removably fluidly connected to handvac nozzle 412. Accessory wand 145 may have any suitable length 516. For example, wand 144 may have a length sufficient to permit apparatus 100 to be used as an upright vacuum cleaner in the configuration of Figure 5. Accordingly, wand 144 may be 2 – 4 feet long. In contrast, accessory wand

145 may be shorter than wand 144 (e.g., a user wants to be closer to the area to be cleaned in an above floor cleaning mode) and accordingly accessory wand 145 may be 6-18 inches.

[00239] In the above-floor cleaning mode, the upstream end 496 of wand 144 may provide the dirty air inlet of apparatus 100, 152, or 168. The above-floor cleaning mode may be well suited to cleaning surfaces above the floor, or more generally surfaces that are not substantially horizontal, and for cleaning in crevices which surface cleaning head 104 might be unable to access. The wand 144 may provide extended reach for distant cleaning surfaces (e.g., curtains, and ceilings). An auxiliary cleaning tool such as a crevice tool, brush or the like may be attached to the inlet end of the wand.

[00240] Preferably, apparatus 100, 152, or 168 may be reconfigured from the lightweight upright mode to the above-floor cleaning mode by a single user action – disconnection of surface cleaning head 104 from the upstream end 496 of wand 144. This may permit the apparatus to be quickly reconfigured with little or no disruption. For example, the apparatus may operate continuously before, during, and after reconfiguration from the lightweight upright mode to the above-floor cleaning mode. This may permit a user to conveniently reconfigure the apparatus to the above-floor cleaning mode to clean a surface inaccessible in the lightweight upright mode, and afterward reconfigure the apparatus to the lightweight upright mode to continue cleaning, e.g., the floor.

[00241] In some embodiments, the above-floor cleaning mode may further include dirt collection assembly 140. For example, a user may reconfigure apparatus 100, 152, or 168 from the large dirt capacity upright mode (FIGS. 1, 5, and 13) to the above-floor cleaning mode by disconnecting surface cleaning head 104 from wand 144, while maintaining dirt collection assembly 140 in place on wand 144. An above-floor cleaning mode of this configuration may provide apparatus 100 with the reach of the above-floor cleaning mode, and the storage capacity of the large dirt capacity

upright mode. In some embodiments, dirt collection assembly 140 may be a one piece assembly with the wand 144 (i.e., irremovably connected to wand 144), in which case the wand 144 may be an up flow duct.

[00242] Referring to FIG. 22, apparatus 100, 152, and 168 may be reconfigured to a handvac mode from any other mode of operation by disconnecting handvac 112 (e.g., from wand 144). As illustrated, the handvac mode may include handvac 112 alone. In the handvac mode, upstream end 416 of nozzle or inlet conduit 412 may provide the dirty air inlet 131. Optionally, one or more accessories (not shown), such as a brush, crevice tool, auxiliary wand 145 may be connected to nozzle 412. If a wand 144 is part of dirt collection assembly 140 then an accessory wand 145 may be provided which is connectable to nozzle 412.

[00243] The handvac mode of apparatus 100 may be lighter, smaller, and more agile than the other modes of operation. However, the handvac mode may have a smaller dirt collection capacity than the large dirt capacity upright mode (FIGS. 1, 5, and 13) for example.

[00244] In some cases, a user may wish to momentarily disconnect handvac 112 for use in the handvac mode (e.g., to clean a surface that is more accessible in the handvac mode), and then return the apparatus to the previous mode. For example, apparatus 100, 152, or 168 may be momentarily reconfigured from the large dirt capacity upright mode (FIGS. 1, 5, and 13) or from the lightweight upright mode (FIGS. 27 and 37) to the handvac mode be merely removing the handvac and afterward reconfigured again to the upright mode.

[00245] It may be beneficial for the dirt collection chamber 188 of handvac 112 to have capacity available for use in the handvac mode upon disconnecting handvac 112 from upright section 108. Further, it may be beneficial for dirt collection chamber 188 of handvac 112 to reclaim capacity after reconnecting handvac 112 to upright section 108. This may be achieved by having dirt collection chamber 188 empty into assembly 140, 160 continually while handvac 112 is attached to the assembly,

manually before removal of the handvac or upon removal of the handvac. The dirt capacity may be reclaimed by having dirt collection chamber 188 empty into assembly 140, 160 upon replacing handvac 112 to the assembly (either manually or automatically upon replacement).

[00246] An example of such a reconfiguration is discussed with respect to the embodiment of FIG. 21, In the illustrated example, handvac dirt collection chamber 188 has a bottom wall 216 that remains open to dirt collection assembly 140 while the handvac is attached to permit dirt from handvac dirt collection chamber 188 to transfer (e.g., by gravity) to dirt collection chamber 141 thereby preventing dirt collection chamber 188 from being filled while the apparatus is used in one of the upright operating modes. .

[00247] Apparatus 100 may be reconfigured from the handvac mode to the large dirt capacity upright mode by reconnecting handvac 112 to upright section 108. Preferably, reconnecting handvac 112 to upright section 108 automatically opens handvac dirt collection chamber 188 to dirt collection chamber 141 for transferring at least a portion of the dirt, collected while in the handvac mode, to dirt collection chamber 141 thereby emptying dirt collection chamber 188 so that dirt collection chamber 188 is not full when the handvac is once again used in the handvac mode.

[00248] In some embodiments, handvac dirt collection chamber 188 does not empty into assembly 140, 160 when attached to the assembly, manually or automatically. For example, FIGS. 25 and 26 show exemplary embodiments of apparatus 152 and 168 where assemblies 160 and 188 receive and store dirt separately at all times. As shown, upright dirt collection chamber 141 may receive and collect dirt separated by auxiliary cyclone bin assembly 160, and handvac dirt collection chamber 188 may separately receive and collect dirt separated by handvac cyclone bin assembly 136.

[00249] Turning now to FIGS. 123-126, apparatus 152 is shown in accordance with another embodiment. As exemplified, handvac cyclone bin assembly 136 may

include a plurality of cyclonic cleaning stages arranged in series. For example, and referring to FIGS. 125 and 126, cyclone bin assembly 136 may include a first cyclonic cleaning stage 640 arranged in series upstream from a second cyclonic cleaning stage 644. First cyclonic cleaning stage 640 may include one or more air outlet(s) 196a which discharge into air inlet(s) 192b of second cyclonic cleaning stage 644.

[00250] Referring now to FIG. 127, each cyclonic cleaning stage 640 and 644 may include one or more cyclone chambers 184 in parallel. For example, cyclonic cleaning stages 640 and 644 may each include one cyclone chamber 184, or may each include a plurality of cyclone chambers 184. Alternatively, one of cyclonic cleaning stages 640 and 644 may include one cyclone chamber 184 and the other stage may include a plurality of cyclone chambers 184. In the illustrated example, first cyclonic cleaning stage 640 includes one cyclone chamber 184a, and second cyclonic cleaning stage 644 includes a plurality of cyclone chambers 184b arranged in parallel. For example, second cyclonic cleaning stage 644 may include four or more cyclone chambers 184b arranged in parallel.

[00251] Second stage cyclone chamber(s) 184b may have any suitable orientation relative to first stage cyclone chamber(s) 184a. For example, each of second stage cyclone chamber(s) 184b may have an air inlet 192b and an air outlet 196b both positioned proximate a rear end 648 of the second cyclonic cleaning stage 644 (rearward with respect to the inlet of the handvac), or both positioned proximate a front end 652 of the second cyclonic cleaning stage 644. Alternatively, each of second stage cyclone chamber(s) 184b may have an air inlet 192 positioned proximate one of the front and rear ends 648 and 652, and an air outlet 196b positioned proximate the other of the front and rear ends 648 and 652. In the illustrated example, second stage cyclone chambers 184b are shown including air inlets 192b at front end 648 and air outlets at rear end 652. This may reduce directional changes in the airflow which may reduce backpressure developed through second stage cyclone chambers 184b for enhanced airflow efficiency. As shown,

axes 248b of second stage cyclone chamber 184b may be parallel to axis 248a of first stage cyclone chamber 184a.

[00252] Handvac cyclone bin assembly 136 may include one or more dirt collection regions 188. For example, cyclone chambers 184 of first and second cyclonic cleaning stages 640 and 644 may separate dirt into one common dirt collection region 188, or each cyclonic cleaning stage 640 and 644 may include a separate dirt collection region 188. In the latter case, all first stage cyclone chamber(s) 184a may discharge dirt into the first stage dirt collection region 188a, and all second stage cyclone chamber(s) 184b may discharge dirt into the second stage dirt collection region 188b. In the illustrated embodiment, handvac cyclone bin assembly 136 includes one first stage dirt collection region 188a, and a plurality of second stage dirt collection regions 188b, where each second sage dirt collection region 188b receives dirt discharged by a respective second stage cyclone chamber 184b.

[00253] Reference is now made to FIGS. 34-36, which show apparatus 100, 152, or 168 in a stair-cleaning mode of operation. As shown, apparatus 100, 152, or 168 in stair-cleaning mode may include handvac 112 directly connected to surface cleaning head 104. For example, nozzle 412 may be connected to pivot joint 116 of surface cleaning head 104.

[00254] The stair-cleaning mode of operation may be especially suitable for cleaning stairs and the like, where frequent lifting is required to clean the desired surface areas.

Handvac Center of Gravity in the Upright Modes

[00255] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, when the apparatus is in an upright mode and, in particular in a large dirt capacity upright mode, the center of gravity of the handvac may be located directly above the cyclone bin assembly (or dirt collection chamber) of the upright section.

[00256] As exemplified in FIGS. 21 and 25, apparatus 100 is shown in a large dirt capacity upright mode in a storage position. In the illustrated example, handvac 112 is shown including a handvac center of gravity 524. As shown, center of gravity 524 may be positioned vertically above dirt collection assembly 140/cyclone bin assembly 160 between the front and rear ends 532, 544 and 536, 548 of dirt collection assembly 140/cyclone bin assembly 160. Preferably, center of gravity 524 is positioned substantially centrally between front and rear ends 532, 544 and 536, 548 of dirt collection assembly 140/cyclone bin assembly and may be aligned with the wand.

[00257] Alternately, or in addition, as exemplified, center of gravity 524 is positioned between cyclone bin assembly 136 and suction motor 204, inside premotor filter chamber 556 of handvac 112.

Configuration of the Auxiliary Assembly

[00258] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a surface cleaning apparatus may have an upright section with an auxiliary dirt collection assembly 140 or auxiliary cyclone bin assembly 160 sized, shaped, and positioned according any one of a plurality of different configurations relative to the wand of the upright section and the handvac.

[00259] In some embodiments, a surface cleaning apparatus is provided having an upright mode wherein the auxiliary assembly 140, 160 and the handvac are positioned on the same side of the wand. As exemplified in FIGS. 1, 21, 24, 45, and 46, auxiliary assembly 140, 160 and handvac dirt collection chamber 188 may both extend rearwardly of wand 144. Referring to FIG 21, rear end 536 of dirt collection assembly 140 is shown positioned a rearward distance 564 from wand axis 568. Bottom wall 216 of dirt collection chamber 188 is shown positioned a rearward distance 576 from wand axis 568. Preferably, distances 564 and 576 are substantially equal. In alternative embodiments, distances 564 and 576 may be

different. For example, distance 560 may be greater than distance 576, or distance 576 may be greater than distance 564. If rear end 536 is at an angle to the vertical as exemplified, then the handvac is preferable designed such that the rear end does not extend rearwardly past a projection of the line of rear end 536. Accordingly, the lowest extend to which upright section 108 may be pivoted rearwardly is determined by the auxiliary assembly and not the handvac.

[00260] In some embodiments, a surface cleaning apparatus is provided having an upright mode wherein the auxiliary assembly 140, 160 and the handvac are positioned on opposite sides of the wand. As exemplified in FIG. 26, dirt collection assembly 140 of upright section 108 is positioned forwardly of wand 144, and handvac dirt collection chamber 188 is positioned rearwardly of wand 144. An advantage of this design is that the weight of the auxiliary assembly 140, 160 is on the opposite side of wand 144 from the handvac and may assist in offsetting the hand weight of the handvac felt by a user holding the handle of the handvac.

[00261] In some embodiments, a surface cleaning apparatus is provided having an upright mode where the auxiliary assembly 140, 160 and handvac are positioned on opposite left and right sides of the wand. For example, in apparatus 168, cyclone bin assembly 160 may be mounted to one of the left or right sides of upright section 108, and handvac 112 may be oriented relative to the upright section 108 such that dirt collection chamber 188 extends to the other of the left or right sides of upright section 108.

[00262] In some embodiments, the auxiliary assembly 140, 160 of the upright section surrounds at least a portion of the wand. Referring to FIGS. 1, 21, 24, 45 and 46, apparatus 100 is shown including an upright section 108 having dirt collection assembly 140 which partially surrounds wand 144. In the illustrated example, dirt collection assembly 140 includes a channel 584 for receiving at least a portion of wand 144. As shown, channel 584 may extend the height 588 of dirt collection

assembly 140 between lower and upper ends 292 and 596. Channel 584 may also extend in depth from front end 532 rearwardly toward rear end 536.

[00263] As exemplified, dirt collection assembly 140 includes left and right portions 600 and 604 on opposite left and right sides of channel 584. In the upright mode of apparatus 100, wand 144 may be at least partially received in channel 584, whereby left and right portions 600 and 604 are positioned to the left and right sides of wand 144. As shown, a front end 532 of dirt collection assembly 140 may extend forwardly of wand 144, such that at least a portion of wand 144 is positioned between the front and rear ends 532 and 536 of dirt collection assembly 140.

[00264] In the illustrated embodiment, dirt collection assembly 140 may also surround at least a portion of handvac 112 in the upright mode of apparatus 100. In the illustrated embodiment, an outlet end 608 of wand 144 may be received in channel 584 of dirt collection assembly 140. Accordingly, a front portion of handvac 112 may extend into channel 584 for connection with outlet end 608 of wand 144. In the illustrated embodiment, nozzle 412 and inlet passage 420 of handvac 112 may be positioned inside channel 584 of dirt collection assembly 140 in the upright mode of apparatus 100.

Upright section with a Plurality of Cyclones

[00265] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the supplemental cyclone bin assembly 160 may have a plurality of cyclones positioned in series and/or in parallel in the airflow path. The cyclones may be positioned to the same side of the upright section (e.g., front or back, left or right), or on different sides of the upright section (e.g., one front and one back or one on the right side and one on the left side).In one embodiment, the upright section may use two cyclones and the wand may be positioned between the two cyclones.

[00266] As exemplified in FIGS. 47-51,auxiliary cyclone assembly 160 comprises first and second supplemental cyclone bin assemblies 161, which may be

individual units or may be formed as a single unit or housing. Each cyclone bin assembly 161 is shown including a cyclone chamber 308 and a dirt collection chamber141. Dirt collection chambers 141 may be combined to form a common repository for dirt separated by both cyclone bin assemblies 161 or each cyclone bin assembly 161 may have a separate dirt collection chamber 141.

[00267] Each cyclone chamber 308 may be any suitable cyclone chamber and maybe the same or different. As shown, each cyclone chamber 308 may include a tangential air inlet 344 proximate upper end 374, and an axial air outlet 320 at a downstream end of vortex finder400.

[00268] Cyclone bin assemblies 161 may be positioned in parallel in the airflow path between surface cleaning head 104 and handvac 112. As exemplified, the airflow path may extend from surface cleaning head 104 through an upstream wand portion 440, diverge into the inlets 316 of cyclone chambers 308 through cyclone chambers 308 to their respective air outlets 320. Each cyclone bin assembly 161 may include an outlet passage 476 connecting air outlets 320 to downstream portion 444 of wand 144 where the airflow path converges. From downstream portion 444 of wand 144, the airflow path may extend through handvac 112 and exit out clean air outlet 132.

[00269] As exemplified, upstream and downstream portions 440 and 444 of wand 144 may be divided by a diversion member 712, which is described subsequently with respect to a further alternate aspect. Air traveling downstream through upstream portion 440 may contact diversion member 712 and be redirected laterally into air inlets 316 of cyclone chambers 308. Outlet passages 476 of cyclone bin assemblies 161 may converge to form a single airflow path in downstream portion 444 of wand 144 above diversion member 712.

Diversion Valve

[00270] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure,

a diversion valve is provided which diverts air travelling through upright section 108 (e.g., the wand 144) into the auxiliary assembly 160 (e.g., supplemental cyclone or cyclones 308). Preferably, the diversion valve operates automatically upon the auxiliary assembly 160 being disconnected from and/or connected to the surface cleaning apparatus.

[00271] As exemplified in FIG. 20, cyclone bin assembly 160 may be selectively connected to upright section 108 whereby the airflow path may be reconfigured to extend through cyclone bin assembly 160. Similarly, cyclone bin assembly 160 may be selectively disconnected from upright section 108 whereby the airflow path may be reconfigured to extend through wand 144 from end to end without diversion. Preferably, the airflow path reconfiguration is automatic upon connection and/or disconnection of cyclone bin assembly 160 to upright section 108.

[00272] In some embodiments, wand 144 may include a diversion outlet 704 and a diversion inlet 708 positioned between the upstream and downstream ends 360 and 364 of wand 144. The diversion outlet 704 and diversion inlet 708 may be selectively opened when connecting cyclone bin assembly 160 to upright section 108 to reconfigure the airflow path to divert into the cyclone bin assembly 160 at diversion outlet 704, and to return to the wand 144 from cyclone bin assembly 160 at diversion inlet 708. Upright section 108 may include a diversion valve for opening and closing diversion outlet 704 and inlet 708.

[00273] A diversion valve 712 according to a first embodiment is exemplified in FIGS. 52-57. As exemplified, diversion valve 712 may include a sleeve 716 positioned inside of wand 144, and a pedal 720 for moving sleeve 716 between an open position and a closed position.

[00274] Sleeve 716 may be a conduit for fluidly coupling upstream and downstream wand portions 440 and 444 in the closed position of diversion valve 712 (see FIGS. 52 and 55) to bypass diversion outlet and inlet 704 and 708. Preferably, sleeve 716 may be a rigid conduit. Alternatively, sleeve 716 may include flexible

and/or collapsible elements. Effectively, sleeve 716 may close diversion outlet and inlet 704 and 708 in the closed position of diversion valve 712. Optionally, diversion valve 712 may include one or more sealing members (e.g., O-rings) which may form an air-tight seal between sleeve 716 and upstream wand portion 440, and between sleeve 716 and downstream wand portion 444 to help prevent the escape of air through diversion outlet and inlet 704 and 708 in the closed position of diversion valve 712.

[00275] Sleeve 716 may be movable axially along wand 114 between the closed position (FIGS. 52 and 55) and the open position (FIGS. 54 and 57). Preferably, sleeve 716 is moved to the open position automatically by mounting cyclone bin assembly 160 to upright section 108 (e.g., connecting to wand 144), and/or moved to the closed position automatically by dismounting cyclone bin assembly 160 from upright section 108 (e.g., disconnecting from wand 144). In the illustrated embodiment, sleeve 716 is drivingly coupled to a pedal 720. Pedal 720 may be depressed to move sleeve 716 from the closed position of FIGS. 52 and 55 to the open position of FIGS. 54 and 57. As shown, pedal 720 may be positioned axially below sleeve 716 and extend outwardly of wand 144 to be depressed by cyclone bin assembly 160 when mounting cyclone bin assembly 160 to upright section 108. Pedal 720 and sleeve 716 may be integrally molded, or separately formed and connected, to move axially up and down as a unit.

[00276] As exemplified, pedal 720 and sleeve 716 may be movably mounted to wand 144 for axial movement between the open and closed position. As shown, pedal 720 and sleeve 716 may move downwardly from the closed position (FIGS. 52 and 55) to the open position (FIGS. 54 and 57). In the closed position, sleeve 716 may extend the airflow path directly across the threshold between the upstream and downstream wand portions 440 and 444. In the open position, sleeve 716 may be retracted into the upstream wand portion 440 to open diversion outlet 704 and inlet 708, and thereby permit the airflow path to be diverted through diversion outlet 704, cyclone bin assembly 160 and diversion inlet 708. As shown, diversion outlet 704

may be positioned at a downstream end 724 of upstream wand portion 440, and diversion inlet 708 may be positioned at an upstream end 728 of downstream wand portion 444.

[00277] In an alternative embodiment, sleeve 716 may have one or more openings which align with diversion outlet and inlet 704 and 708 in the open position of valve 712. In the closed position, the openings in sleeve 716 may be closed by alignment with solid wall portions of wand 144, and diversion outlet and inlet 704 and 708 may be closed by alignment with solid wall portions of sleeve 716. In this case, sleeve 716 may be positioned inside the upstream and downstream wand portions 440 and 444 in both the open and closed positions of valve 712.

[00278] Preferably, sleeve 716 is biased to the closed position. For example, valve 712 may include a biasing member which acts on sleeve 716 to bias sleeve 716 to the closed position. In the illustrated example, valve 712 includes a spring 732 which acts on pedal 720 to urge pedal 720 and sleeve 716 upwardly to the closed position. In alternative embodiments, sleeve 716 may not be biased to the closed position. For example, sleeve 716 may include an actuator, such as a switch or lever, which must be manually activated to move sleeve 716 to the closed position or is moved by assembly 160 when assembly 160 is removed.

[00279] Still referring to FIGS. 52-57, cyclone bin assembly 160 may include an engagement member for mating with pedal 720 to mount cyclone bin assembly 160 on pedal 720. In the illustrated example, a cavity 736 is formed in sidewall 376 of cyclone bin assembly 160 for receiving pedal 720. In use, cyclone bin assembly 160 may be set onto pedal 720 such that pedal 720 is received in cavity 736. Preferably, the weight of cyclone bin assembly 160 on pedal 720 is sufficient to overcome the bias of valve biasing member 732, and move pedal 720 and sleeve 716 downwardly to the open position. In alternative embodiments, additional downward force must be applied by the user to move pedal 720 and sleeve 716 downwardly against the bias of the biasing member 732 and/or an actuator, such as a foot pedal, may be utilized.

[00280] Cyclone bin assembly 160 may be toed onto pedal 720 (see e.g., FIGs 53, 56), and then pivoted on pedal 720 into position (see e.g., FIGs 54, 57) after pedal 720 and sleeve 716 have moved downwardly to the open position. In the illustrated example, cyclone bin assembly 160 may be set onto pedal 720 with cyclone axis 392 extending at a (non-zero) angle to wand axis 740, and then lowered with pedal 720 to move valve 712 to the open position, and finally pivoted about pedal 720 toward wand 144 to complete the connection of cyclone bin assembly 160 to wand 144. A locking member, such as a latch 744, which may be located at the end of the upper end or wand 144, may be provided to secure assembly 160 in position. In some embodiments, cyclone axis 392 may be substantially parallel to wand axis 740 when cyclone bin assembly 160 is connected to wand 144.

[00281] Cyclone bin assembly 160 may include a diversion member 428 for dividing wand 144 into upstream and downstream wand portions 440 and 444, and for diverting flow from the upstream wand portion 440 into cyclone bin assembly inlet 316. Diversion member 428 may take any suitable form. In the illustrated embodiment, diversion member 428 is a substantially flat plate which extends outboard of sidewall 376 for protruding into wand 144 through one of diversion outlet 704, diversion inlet 708, or another opening into wand 144. Alternatively, diversion member 428 may be curved to provide a less abrupt change in airflow direction, which may reduce the pressure drop across the diversion member 428. Optionally, diversion member 428 may include or interface with a sealing member (e.g., a deformable elastomeric seal) to form an airtight barrier between upstream and downstream wand portions 440 and 444. Alternately, the diversion member may be a separate member that is installed as a separate step when (i.e., before, during, and/or after) connecting cyclone bin assembly 160 to the wand 144.

[00282] As exemplified, when cyclone bin assembly 160 is mounted to wand 144, as shown in FIGS. 54 and 57, air inlet 316 of cyclone chamber 308 is connected to diversion outlet 704 for receiving air from upstream wand portion 440 into cyclone

chamber 308, and outlet passage 476 is connected to diversion inlet 708 for discharging air from cyclone bin assembly 160 into downstream wand portion 444.

[00283] Cyclone bin assembly 160 may be removably mounted to wand 144 by any suitable mechanism. In the illustrated embodiment, cyclone bin assembly 160 includes a latch 744 on handle 616 for engaging a tab 746 which extends outwardly of wand 144. Latch 744 may be user-operable by a user grasping handle 616 to release latch 744 from tab 746 for disconnecting cyclone bin assembly 160 from wand 144. Preferably, biasing member 732 of valve 712 automatically and immediately moves sleeve 716 to the closed position upon disconnection of cyclone bin assembly 160 to reconfigure the airflow pathway by closing diversion inlet and outlet 704 and 708.

[00284] A diversion valve 712 according to a second embodiment is exemplified in FIGS. 58-63. Diversion valve 712 is similar to diversion valve 712 of FIGS. 52-57 in many respects except, for example that sleeve 716 is embodied by a collapsible hose 716 instead of a more rigid conduit.

[00285] As exemplified, diversion valve 712 includes a collapsible sleeve 716 positioned inside of wand 144, and a pedal 720 for moving hose 716 been an open position and a closed position.

[00286] Sleeve 716 may be a collapsible conduit for fluidly coupling upstream and downstream wand portions 440 and 444 in the closed position of diversion valve 712 (see FIGS. 60 and 63) to bypass diversion inlet and outlet 708 and 712. Optionally, diversion valve 712 may include one or more seals (e.g., O-rings) which form an air-tight seal between sleeve 716 and upstream wand portion 440, and between sleeve 716 and downstream wand portion 444 to help prevent the escape of air through diversion inlet and outlet 704 and 708 in the closed position of diversion valve 716.

[00287] In the illustrated embodiment, sleeve 716 has a fixed-position upstream end 756 sealed to upstream wand portion 440, and a downstream end 760 axially

movable inside wand 144. Downstream end 760 may be movable toward upstream end 756 to the open position (FIG. 60 and 63) whereby sleeve 716 is partially collapsed with downstream end 760 positioned in the upstream wand portion 440 upstream of diversion outlet 704. Downstream end 760 may also be movable away from upstream end 756 to the closed position (FIGS. 58 and 61) whereby sleeve 716 is extended with downstream end 760 position in the downstream wand portion 444 downstream of diversion inlet 708.

[00288] As exemplified, pedal 720 may be drivingly coupled to downstream end 760 of sleeve 716. Pedal 720 may be depressed (e.g. by the weight of cyclone bin assembly 160) to move downstream end 760 into the upstream wand portion 440, collapsing sleeve 716 into the open position of FIGS. 60 and 63. Pedal 720 may also be raised (e.g. automatically by action of biasing member 732 upon release of pedal 720 or pulled upwardly by assembly 160) to move downstream end 760 into the downstream wand portion 444, extending sleeve 716 into the closed position of FIGS. 58 and 61. Alternately, a manual actuator may be used.

[00289] A diversion valve 712 according to a third embodiment is exemplified in FIGS. 64-71. As exemplified, diversion valve 712 may include a diversion outlet door 772 and a diversion inlet door 776. Doors 772 and 776 may be opened when cyclone bin assembly 160 is connected to wand 144 for reconfiguring the airflow path to extend through cyclone bin assembly 160. Doors 772 and 776 may also be closed when cyclone bin assembly 160 is disconnected from wand 144 for reconfiguring the airflow path to extend directly across the threshold between upstream and downstream wand portions 440 and 444.

[00290] In the illustrated embodiment, doors 772 and 776 are pivotally mounted to wand 144 for movement between a closed position (see FIGS. 64 and 67-69) in which doors 772 and 776 seal diversion outlet 704 and inlet 708 respectively, and an open position (see FIGS. 66 and 71) in which doors 772 and 776 are open to allow air to flow through doors 772 and 776 between wand 144 and cyclone bin assembly

160. Doors 772 and 776 may be pivotally mounted to wand 144 in any suitable manner. In the example shown, doors 772 and 776 are pivotally mounted to wand 144 by a common hinge 780. As shown, door 772 may pivot inwardly about hinge 780 toward a downstream direction, and door 776 may pivot inwardly about hinge 780 toward an upstream direction. In alternative embodiments, each of doors 772 and 776 may be pivotally mounted to wand 144 by a different hinge.

[00291] Preferably, doors 772 and 776 open automatically by connecting cyclone bin assembly 160 to wand 144. In the illustrated example, cyclone bin assembly 160 includes an inlet nose 784 for pushing open diversion outlet door 772, and an outlet nose 788 for pushing open diversion inlet door 776. As shown, noses 784 and 788 may extend outwardly of sidewall 376 for projecting through diversion outlet and inlet 704 and 708 respectively upon connecting cyclone bin assembly 160 to wand 144.

[00292] Preferably, when cyclone bin assembly 160 is connected to wand 144, an airflow path is formed between diversion outlet 704 and air inlet 316, and between diversion inlet 708 and air outlet 320, such that the airflow path from upstream wand portion 440 to downstream wand portion 444 is reconfigured to extend through cyclone bin assembly 160. In the illustrated example, connecting cyclone bin assembly 160 to wand 144 may include pushing noses 784 and 788 into diversion outlet and inlet 704 and 708 respectively to open doors 772 and 776.

[00293] Noses 784 and 788 may take any suitable form. As exemplified, nose 784 may be formed as a diversion member including an inlet passage having an upstream end 792 and a downstream end 796. Upstream end 792 may extend into wand 144 and form a seal with upstream wand portion 440 to redirect the airflow in upstream wand portion 440 to enter nose 784 toward downstream end 796. In the illustrated embodiment, upstream wand portion 440 includes a sealing ring 800 adjacent an upstream side 804 of diversion outlet door 772 onto which downstream end 796 may be seated for forming an airtight seal between upstream wand portion

440 and downstream end 796. Alternatively, or in addition, upstream side 804 may include a sealing member. Downstream end 796 of nose 784 may be integrally formed or otherwise connected with air inlet 316.

[00294] In the illustrated example, nose 788 is formed as a triangular plate which projects outwardly from air outlet 320. In other embodiments, nose 788 may have another suitable form for pushing diversion inlet door 776, such as a circular or rectangular plate or a rod for example. As shown, when cyclone bin assembly 160 is connected to wand 144, nose 788 projects into diversion inlet 708 pushing open diversion inlet door 776. This may permit air outlet 320 to sealingly abut diversion inlet 708 for forming an airflow path between air outlet 320 and downstream wand portion 444. Optionally, a seal 808 may be provided at the interface between air outlet 320 and diversion inlet 708 for enhancing the airtightness of the connection.

[00295] It will be appreciated that in alternative embodiments, nose 788 may be formed as an outlet passage, which may be curved similar to nose 784. This may make the change in airflow direction across nose 788 less abrupt, which may reduce pressure losses.

[00296] Preferably, when cyclone bin assembly 160 is disconnected from wand 144, doors 772 and 776 automatically close to reconfigure the airflow passage to extend directly from upstream wand portion 440 to downstream wand portion 444 without diversion through diversion outlet 704 or inlet 708. For example, doors 772 and 776 may be biased to the closed position by a biasing member, such as a spring. In the illustrated embodiment, diversion valve 712 includes a torsional spring 812. Spring 812 may be positioned to bias both of doors 772 and 776 to the closed position. In the illustrated embodiment, spring 812 is held in a spring housing 816 mounted to an inside face 820 of diversion outlet door 772. As shown, spring 812 may have an arm 824 connected to diversion inlet door 776, effectively biasing doors 772 and 776 away from each other to their respective closed positions. In alternative embodiments, each of doors 772 and 776 may have a separate biasing member.

[00297] A diversion valve 712 according to a fourth embodiment is exemplified in FIGS. 72-77. Diversion valve 712 is similar to diversion valve 712 of FIGS. 64-71 in many respects except, for example, the door which selectively closes diversion outlet 704 and inlet 708.

[00298] In the illustrated embodiment, diversion valve 712 includes a door 772. Door 772 may be movable between a closed position (FIGS. 72 and 75) in which door 772 seals diversion outlet 704 and inlet 708, and an open position (FIGS. 74 and 77) in which door 772 is unsealed from outlet 704 and inlet 708 to allow the airflow to pass through diversion outlet 704 and inlet 708. As exemplified, diversion valve 712 may include one door 772 for closing both of diversion outlet 704 and inlet 708, or separate doors 772 for diversion outlet 704 and inlet 708.

[00299] As shown, door 772 may be pivotally mounted to wand 144 in any suitable manner for movement between the open and closed positions. For example, door 772 may be pivotally mounted outside of wand 144 by a hinge 780. In the illustrated example, door 772 may pivot outwardly about hinge 780 away from wand 144 to the open position, and may pivot inwardly about hinge 780 toward wand 144 to the closed position. Preferably, door 772 is manually openable, whereby a user may grasp door 772 and manually move door 772 from the closed position to the open position. For example, door 772 may have a lever 840, a handle, or another gripping member for a user to grasp for manipulating the position of door 772.

[00300] Once door 772 is opened, as shown in FIGS. 73 and 76, cyclone bin assembly 160 may be connected to wand 144. In the illustrated embodiment, cyclone bin assembly 160 includes a diversion member 428 of the type describe above with reference to FIGS. 52-57. Diversion member 428 may be moved into wand 144 through diversion outlet 704, diversion inlet 708, or another opening in wand 144, for dividing wand 144 into an upstream portion 440 and a downstream portion 444, substantially as described above.

[00301] When cyclone bin assembly 160 is disconnected from wand 144, door 772 may be moved back into the closed position for reconfiguring the airflow path in wand 144 to extend directly from upstream portion 440 to downstream portion 444 without diversion. For example, door 772 may be manually moved from the open position to the closed position by hand, or door 772 may move automatically to the closed position by the bias of a biasing member (e.g., a spring).

[00302] In some embodiments, door 772 may be held in the closed position by the bias of a biasing member, or by a releasable locking mechanism (e.g., a latch). This may permit door 772 to form a tight seal against diversion outlet 704 and inlet 708.

[00303] In some embodiments, pedal 720 may be foot operable and may be located close to or on the surface cleaning head.

Angular Surface of Upright section

[00304] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a surface cleaning apparatus is provided having an upright section with a dirt collection chamber or cyclone bin assembly having a side profile that tapers or narrows from top to bottom. For example, the rear wall of the supplemental dirt collection chamber or supplemental cyclone bin assembly may extend upwardly at an acute angle relative to the wand axis such that the rear wall is farther from the wand axis at the top end than at the bottom end of the dirt collection chamber or cyclone bin assembly. An advantage of this design is that the surface cleaning apparatus may extend under furniture while providing a large dirt collection capacity.

[00305] As exemplified in FIGS. 3 and 7, surface cleaning apparatus 100 and 152 include an upright section 108 having a dirt collection chamber 140 or cyclone bin assembly 160 that extends from a lower end 292, 856 proximate surface cleaning head 104 to an upper end 596, 860. A rear end 536, 548 of auxiliary assembly 140/160 may extend upwardly from lower end 292 or 856 at a (non-zero) acute angle

848 to wand axis 568. Angle 848 is preferably between 10 and 70 degrees, and more preferably between 20 and 40 degrees. For example, a distance 538 between wand axis 568 and rear end 536, 548, measured normal to wand axis 568, may increase continually or generally continuously from lower end 292, 856 upwardly. As shown, distance 538 is greater at upper end 596. 860 than at lower end 292, r 856.

Handvac with Angled Bottom Wall

[00306] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a handvac may be provided having a bottom, such as a flat bottom wall, for supporting the handvac on a horizontal surface, and which extends at an acute angle (e.g., between 20 and 40 degrees) away from the inlet nozzle axis, and optionally at about the in-use orientation of the hand vac. This may provide the handvac with a resting orientation that is closer to or essentially at the in-use orientation of the handvac. For example, the in-use orientation of the handvac may normally have the inlet nozzle axis extending at a downward angle relative to a horizontal surface to be cleaned. Thus, a user may not have to substantially reorient the handvac upon grasping the handvac in the resting orientation to reposition the handvac into the in-use orientation.

[00307] Reference is now made FIG. 78, where handvac 112 is shown resting on a horizontal surface 876. As shown, nozzle axis 884 extends at an angle 880 to horizontal surface 876. Angle 880 may be an acute angle which may be between 10 and 80 degrees, and preferably between 25 and 65 degrees, more preferably between 35 and 55 degrees or between 20 and 40 degrees. It will be appreciated that handvac 112 may be stably supported in any suitable manner, with nozzle axis 884 extending at angle 880 to horizontal surface 876. For example, handvac 112 may include one or more support elements (e.g., a wall or feet) which collectively provide a support for handvac 112 on a horizontal planar surface at a desired acute angle, and a center of gravity 524 vertically aligned with or between the support

elements for stability when handvac 112 is so supported by the support element(s) on the horizontal surface.

[00308] As exemplified, bottom wall 216 of handvac 112 may extend at an angle 880 to inlet nozzle axis 884 of nozzle 412. Bottom wall 216 may be planar, and the plane of bottom wall 216 may intersect with nozzle axis 884 at angle 880. Bottom wall 216 may provide a flat planar surface for making broad contiguous contact with horizontal surface 876, or bottom wall 216 may include a plurality of discrete contact points or surfaces which collectively contact the horizontal surface 876 to support the handvac 112 (e.g., as in the feet of a tripod, or the wheels of a car). Preferably, handvac center of gravity 524 is preferably aligned vertically above bottom wall 216 when handvac 112 is supported on horizontal surface 876 by bottom wall 216. This may permit handvac 112 to rest stably (i.e., statically without tipping over) on horizontal surface 876 while supported solely by bottom wall 216.

[00309] Handvac 112 may have an in-use orientation relative to horizontal surface 876 at which a user may comfortably operate handvac 112 during cleaning. Typically, handvac 112 is most comfortably operated in an orientation that does not require an application of torque by the user's hands when the handvac 112 is held by handle 484. This may be the case where the center of gravity 524 of the handvac 112 is aligned vertically below the user's hand. Accordingly, the center of gravity 524 may be vertically aligned below handle 484 in comfortable in-use orientations of handvac 112.

[00310] Preferably, center of gravity 524 is aligned vertically below handle 484 when handvac 112 is supported on horizontal surface 876. In the illustrated embodiment, center of gravity 524 is aligned vertically below handle 484 when bottom wall 216 is horizontal and supporting handvac 112 on a horizontal surface 876. Thus, the resting orientation of handvac 112 supported by bottom wall 216 on a horizontal surface 876 may be substantially the same as the in-use orientation of handvac 112. Accordingly, when a user grasps handvac 112 by handle 484 and lifts

handvac 112, handvac 112 may already be in a balanced in-use position with the center of gravity 524 aligned below the user's hands.

[00311] In many cases, handvac 112 may be stored on a surface below a user's elbows. A user may angle their forearm downwardly to grasp handle 484 of handvac 112. In this case, the user's fingers and palm may be naturally aligned for grasping a handle which is angled forwardly of vertical. For example, to grasp a vertically oriented handle that is positioned below a user's elbow, a user may need to contort their wrist to conform to the orientation of the handle.

[00312] In the illustrated embodiment, handle axis 888 of handle 484 extends at a (non-zero) forward angle 892 to the vertical (e.g., e.g., when bottom wall 216 is horizontal). This may provide a comfortable handle alignment for grasping by a user when picking up handvac 112, and when using handvac 112 for cleaning surfaces below the user's elbows. Preferably, angle 892 is an acute angle of between 10 and 80 degrees, more preferably between 20 and 70 degrees and most preferably between 30 and 60 degrees.

[00313] Bottom wall 216 may be a wall of any component of handvac 112. In the illustrated embodiment, bottom wall 216 is a wall of cyclone bin assembly 136. Preferably, bottom wall 216 is a wall of dirt collection chamber 188. In the example shown, bottom wall 216 is an openable wall of dirt collection chamber 188. FIG. 79 shows another embodiment of handvac 112 where bottom wall 216 is not openable.

[00314] Referring to FIG. 78, bottom wall 216 of handvac 112 may include front wheels, rear wheels, or both. Wheels may provide rolling support for handvac 112 when cleaning under furniture, for example. In alternative embodiments, handvac 112 may not include wheels on bottom wall 216 as shown.

Handle Position

[00315] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a floor cleaning apparatus is provided having a handvac with a handle, and an

upright section with a cyclone bin assembly or dirt collection chamber with a handle. Preferably, the handles are centrally aligned with a plane of symmetry of the apparatus. This may permit the handles to be grasped for a balanced control of the apparatus. For example, the handles may be parallel to the same plane of symmetry.

[00316] Alternately, as exemplified in FIG. 2, one handle may be parallel to a plane of symmetry and the other transverse thereto but positioned such that the plane of symmetry extends through the transversely oriented handle. In the illustrated example, handvac 112 includes a handle 484 which extends along a handle axis 888. As exemplified, handle axis 888 may lie in a vertical plane 1044, which is aligned centrally between left and right sides of apparatus 100 (i.e., a plane of symmetry). Turning to FIG. 78, handle 484 is shown extending in length between a first handle end 1048 at the upper end 1052 of handvac 112, and a second handle end 1056 intermediate the upper and lower ends 1052 and 1060 of handvac 112.

[00317] Returning to FIG. 2, assembly 140 is shown including a handle 1064. As illustrated, handle 1064 may have a handle axis 1068 which extends perpendicularly or transverse to plane 1044 and handle axis 888. Handle 1064 may be formed in a rear end 536 of assembly 140. For example, handle 1064 may be flush with rear end 536 and include a concave finger cavity 1072 to facilitate grasping handle 1064. Preferably, handle 1064 is positioned laterally centrally such that plane 1044 intersects handle 1064, and optionally bisects handle 1064 at a midpoint between handle ends 1076 and 1080.

[00318] Handles 484 and 1064 may be positioned on opposite sides of surface cleaning apparatus 100. For example, handle 484 is shown extending from an upper end 1052 proximate the front surface of apparatus 100, and handle 1064 is shown extending flush with a rear surface of apparatus 100.

[00319] Apparatus 100 may include one or more actuator controls (e.g., buttons, levers, or switches) for controlling various functionality such as opening or disconnected elements, or connecting power to elements. Preferably, at least some

of the actuator controls are positioned on or within finger reach of a handle to permit the control to be activated while grasping the handle. This may permit single handed operation of the function provided by the control.

[00320] Referring to FIG. 1, apparatus 100 is shown including a power switch 1084 located on upper end 1052 of handvac 112 proximate first handle end 1048 within finger-reach when grasping handvac handle 484. As illustrated, power switch 1084 may be laterally centrally positioned such that plane 1044 intersects and more preferably bisects power switch 1084.

[00321] Referring now to FIGS. 15 and 16, apparatus 168 is shown including an upright section 108 having a cyclone bin assembly 160 with a handle 616, and handvac 112 with handle 484. As shown, handle axis 1092 of handle 616, and handle axis 888 of handvac handle 484 may extend in a same plane 1096. Preferably, plane 1096 is a vertical plane positioned laterally centrally between left and right sides of apparatus 168 as shown. In the illustrated embodiment, plane 1096 bisects handles 616 and 484.

[00322] In the illustrated embodiment, handvac 112 includes a power switch 1084 located on upper end 1052 of handvac 112 which is bisected by plane 1044. Handle 616 of cyclone bin assembly 160 is also shown including a button 1100 for releasing latch 744 to disconnect cyclone bin assembly 160 from wand 144. As illustrated, button 1100 may be positioned laterally centrally between left and right sides of apparatus 168 such that button 1100 is bisected by plane 1096.

Handvac Axial Alignment

[00323] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a plurality of airflow path segments in the handvac may extend in parallel. In some cases, this may reduce the number of bends in the airflow path through the handvac, which may reduce the pressure drop across the airflow path.

[00324] As exemplified in FIG. 96, handvac inlet nozzle 412 may extend in length from an inlet end or upstream nozzle end 416 (dirty air inlet 131) rearwardly along a nozzle axis 884, handvac cyclone chamber 184 may extend from an air inlet 192 along a cyclone axis 248 to an air outlet 196, and handvac suction motor 204 may extend from a motor inlet 1108 along a motor axis 252 to a motor outlet 1112.

[00325] In some embodiments, two or more of nozzle axis 884, cyclone axis 248, and motor axis 252 may be parallel. For example, in the illustrated embodiment, nozzle axis 884, cyclone axis 248, and motor axis 252 are parallel. In some embodiments, two or more of nozzle axis 884, cyclone axis 248, and motor axis 252 may be co-axial. For example, in the illustrated embodiment, nozzle axis 884 and cyclone axis 248 are co-axial. In other embodiments, nozzle axis 884, cyclone axis 248, and motor axis 252 may all be co-axial.

[00326] In the illustrated embodiment, handvac 112 may include an electrical connector 1116 for providing power to an upstream attachment (e.g., a surface cleaning head). As shown, connector 1116 may extend from a front connector end 1120 along a connector axis 1124 to a rear connector end 1128. In some embodiments, connector axis 1124 may be parallel to one or more of nozzle axis 884, cyclone axis 248, and motor axis 252. In the illustrated embodiment, connector axis 1124 is parallel to nozzle axis 884, cyclone axis 248, and motor axis 252.

[00327] In some embodiments, handvac 112 may include one or more electrical cables 1132 which extend from electrical connector 1116 rearwardly to electrically couple electrical connector 1116 with a source of power (not shown). In the illustrated embodiment, electrical cables 1132 extend from electrical connector 1116 rearwardly along vortex finder 1136 of cyclone chamber 184 toward motor housing 1138. As shown, at least the portion of electrical cables 1132 which along vortex finder 1136 across cyclone chamber 184 is parallel to cyclone axis 248.

Axial Cyclone Inlet

[00328] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a handvac may be provided having a cyclone chamber with an axial inlet. That is, the inlet axis may be parallel to the cyclone axis, and more preferably co-axial with the cyclone axis. In some cases, this may reduce the bends in the airflow path through the cyclone, which may reduce the pressure drop across the cyclone for better pneumatic efficiency. Preferably, the cyclone is a uniflow cyclone wherein the air outlet is at the opposite end from the air inlet. Alternately, or in addition, the axial inlet includes a portion that converts the axial flow to a tangential flow wherein the portion is provided within the diameter of the cyclone chamber. Optionally, the axial inlet is parallel to and may be co-axial with the handvac air inlet.

[00329] As exemplified in FIG. 96, handvac cyclone chamber 184 includes an air inlet 192 and an air outlet 196. As shown, air inlet 192 may include an inlet axis 1140 which is parallel to cyclone axis 248. Air inlet 192 may have a circular section transverse to axis 1140 with an inlet diameter 1144, or rectangular with a side dimension 1144. Preferably, the cross-sectional area of air inlet 192 is approximately equal to the cross-sectional area of inlet nozzle 412. Preferably, the cross-sectional area of air inlet 192 is between 80%-125% of the cross-sectional area of the inlet nozzle 412, more preferably 90%-120%, and most preferably 100%-115%.

[00330] Preferably, inlet 192 is in fluid communication with an upstream end 388 of an inlet passage 384. Inlet passage 384 may redirect the axial flow through inlet 192 to a tangential flow for developing a cyclonic motion inside cyclone chamber 184. Referring to FIGS. 23 and 23a, inlet passage 384 may extend from upstream passage end 388 to downstream passage end396 across an arcuate angular extent 1148. Preferably angular extent 1148 is between 45 and 300°, more preferably between 60 and 250°, and most preferably between 90 and 200°.

[00331] Returning to FIG. 96, inlet passage 384 is shown having a width 1152, and a height 1108. In some embodiments, the cross-sectional area of inlet passage 384 may be approximately equal to the cross-sectional area of air inlet 192. Preferably, the cross-sectional area of inlet passage 384 is between 80%-125% of the cross-sectional area of the inlet passage 384, more preferably 90%-120%, and most preferably 100%-115%.

[00332] Vortex finder 1136 may define an outlet passage to air outlet 196 of cyclone chamber 184. As shown, vortex finder 1136 may be substantially cylindrical having a diameter 1160. In the illustrated embodiment, the cross-sectional area of vortex finder 1136 may be approximately equal to the cross-sectional area of inlet nozzle 412. For example, diameter 1160 may be approximately equal to diameter 1164 of inlet nozzle 412. Preferably, the cross-sectional area of vortex finder 1136 is between 80%-125% of the cross-sectional area of the inlet nozzle 412, more preferably 90%-120%, and most preferably 100%-115%.

Uniflow Cyclone

[00333] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a handvac may be provided having a cyclone chamber wherein the air outlet is at the opposite end from the air inlet. In some cases, this may reduce the bends in the airflow path through the cyclone, which may reduce the pressure drop across the cyclone for better pneumatic efficiency. Optionally, the cyclone inlet is at the front or inlet end of the handvac and may be parallel to or co-axial with the handvac air inlet.

[00334] As exemplified in FIG. 96, handvac inlet 192 is shown positioned at a front end 220 of cyclone chamber 184, and outlet 196 is shown positioned at a rear end 224 of cyclone chamber 184. Inlet 192 may have an inlet axis 1140 that is parallel to the outlet axis 1168 of air outlet 196. In the illustrated embodiment, inlet axis 1140 is co-axial with outlet axis 1168.

[00335] Optionally, the suction motor axis may be parallel to or co-axial with axis 1140, 1168. Accordingly, air may travel in a generally uniform direction through the components of the handvac.

Handvac Cyclone Dirt Collection Chamber

[00336] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the dirt collection chamber of the handvac may have a dirt inlet which is located at the upper end of the dirt collection chamber when the hand vac is oriented for cleaning a floor (see e.g., FIGS 81 and 103). In addition, the dirt collection chamber may be shaped to encourage dirt to collect at another end of the handvac away from the dirt outlet of the cyclone chamber (e.g., it may extend downwardly away from the dirt inlet). This may clear the dirt inlet to permit additional dirt to enter.

[00337] As exemplified in FIG. 96, dirt may enter dirt collection chamber 188 from cyclone chamber 184 through dirt outlet 200 of cyclone chamber 184. In the illustrated embodiment, dirt outlet 200 is at a rear end 224 of cyclone chamber 184. In use, handvac 112 may be normally oriented with the nozzle 412 at the front end oriented downwardly for cleaning a surface below. Accordingly, dirt entering dirt collection chamber 188 from dirt outlet 200 may fall by gravity toward front end 220 of dirt collection chamber 188 away from dirt outlet 200. This may help to keep dirt outlet 200 clear for subsequent dirt to move through dirt outlet 200 during use.

[00338] In the illustrated embodiment, handvac 112 may be supportable on a horizontal surface 876 by contact between dirt collection chamber 188 and the horizontal surface 876. For example, dirt collection chamber 188 may include a bottom wall 216 for supporting handvac 112 on horizontal surface 876. Preferably, as discussed previously, handvac 112 is inclined with nozzle 412 facing downwardly when handvac 112 is supported on horizontal surface 876 by bottom wall 216. In the illustrated embodiment, bottom wall 216 is angled downwardly between front end 220 and rear end 224 for orienting nozzle axis 884 downwardly to horizontal when

handvac 112 is supported on horizontal surface 876. As shown, this may provide dirt collection chamber 188 with a wedge-like shape having a height 1172 measured between upper and lower dirt collection chamber walls 226 and 216 which increases from the front end 220 to the rear end 224.

Pre-motor Filter Housing

[00339] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, a pre-motor filter housing may be provided in the airflow path between the cyclone bin assembly and the suction motor for directing the airflow through one or more pre-motor filters contained therein.

[00340] As exemplified in FIGS. 96 and 117, handvac 112 has a pre-motor filter chamber 556 containing pre-motor filters 1176 and 1180, and a suction motor housing 1138 containing suction motor 204. The airflow path from inlet nozzle 412 to clean air outlet 132 may extend downstream from cyclone bin assembly 136 to pre-motor filter chamber 556 to suction motor housing 1138. That is, cyclone bin assembly 136, pre-motor filter chamber 556, and suction motor housing 1138 may be positioned in the airflow path with pre-motor filter chamber 556 downstream of cyclone bin assembly 136 and suction motor housing 1138 downstream of pre-motor filter chamber 556.

[00341] In the illustrated example, pre-motor filter chamber 556 extends in height 1184 between an upper end 1188 to a lower end 1192 in the direction of pre-motor filter axis 560, and extends in depth 1216 between front wall 1220 and rear wall 1224. In some embodiments, cyclone axis 248 and motor axis 252 may be parallel and vertically offset as shown. For example, each of cyclone axis 248 and motor axis 252 may intersect pre-motor filter chamber 556 as shown. In some embodiments, outlet axis 1168 of cyclone chamber outlet 196 and, motor inlet axis 1196 of motor inlet 1108 may be parallel and vertically offset. For example, each of

outlet axis 1168 and motor inlet axis 1196 may intersect pre-motor filter chamber 556 as shown.

[00342] In some embodiments, cyclone chamber outlet 196 discharges air from cyclone chamber 184 into pre-motor filter chamber 556, and pre-motor filter chamber 556 discharges air into motor inlet 1108. For example, cyclone chamber outlet 196 may be positioned at the threshold between cyclone chamber 184 and pre-motor filter chamber 556, and motor inlet 1108 may be positioned at the threshold between pre-motor filter chamber 556 and suction motor housing 1138. In alternative embodiments, one or more conduits (not shown) may separate pre-motor filter chamber 556 from cyclone chamber outlet 196 and/or motor inlet 1108.

[00343] In the illustrated embodiment, pre-motor filter chamber 556 extends in length between a front end 1200 and a rear end 1204. As shown, pre-motor filter chamber 556 may hold pre-motor filters 1176 and 1180 in the airflow path between cyclone chamber outlet 196 and motor inlet 1108 for filtering residual dirt particles remaining in the airflow. In some embodiments, pre-motor filter chamber 556 may hold pre-motor filters 1176 and 1180 in spaced apart relation to front and rear ends 1200 and 1204. An upstream plenum 1208 may be provided in the space between upstream pre-motor filter 1176 and front end 1200. A downstream plenum 1212 may be provided in the space between downstream pre-motor filter 1176 and rear end 1204. Air entering upstream plenum 1208 from cyclone bin assembly 136 may distribute across the surface area of pre-motor filter 1176 for traversing filters 1176 and 1180 to downstream plenum 1212.

[00344] In the illustrated embodiment, cyclone chamber outlet 196 may direct air into an upper portion of upstream plenum 1208. For example, cyclone chamber outlet 196 may be connected to pre-motor filter chamber 556 proximate upper end 1188. In the illustrated embodiment, motor inlet 1108 may receive air from a lower portion of downstream plenum 1212. For example, motor inlet 1108 may be connected to pre-motor filter chamber 556 proximate lower end 1192. Accordingly,

pre-motor filter chamber 556 may be used to redirect the air from transversely to the cyclone and motor axis without requiring conduits having bends therein.

Battery Power

[00345] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the surface cleaning head or upright section of the surface cleaning apparatus may include one or more batteries for powering the handvac when the handvac is connected to the surface cleaning head or upright section. The handvac may also include handvac batteries which may power the handvac when connected to or disconnected from the upright section and surface cleaning head (e.g., in an above-floor cleaning mode or handvac mode). When the handvac is electrically connected to the surface cleaning head, the batteries in the surface cleaning head may supplement the batteries in the handvac or be the sole power source.

[00346] As exemplified in FIG. 3, surface cleaning apparatus 100 (or any other surface cleaning apparatus embodiment disclosed herein) may include one or more handvac batteries 1268 mounted to the handvac 112, and one more supplemental batteries 1272. Supplemental batteries 1272 may be mounted to any other suitable component of apparatus 100 other than handvac 112. For example, supplemental batteries 1272 are shown mounted to surface cleaning head 104. Alternatively or additionally, supplemental batteries 1272 may be mounted to upright section 108.

[00347] As used herein, the plural term "batteries" means one or more batteries. For example, supplemental batteries 1272 may be one battery or a plurality of batteries. Similarly, handvac batteries 1268 may be one battery or a plurality of batteries. Batteries 1272 and 1268 may be any suitable form of battery such as NiCad, NiMH, or lithium batteries, for example. Preferably, batteries 1272 and 1268 are rechargeable, however, in alternative embodiments, one or both of batteries 1272 and 1268 may be non-rechargeable single-use batteries.

[00348] In the illustrated embodiment, when handvac 112 is connected to upright section 108, an electrical connection may be formed between supplemental batteries 1272 and handvac 112, e.g., for powering suction motor 204.

[00349] In some embodiments, supplemental batteries 1272 may provide handvac 112 with enhanced power for generating greater suction with suction motor 204. For example, suction motor 204 may operate in a high power consumption mode, drawing power from supplemental batteries 1272, or supplemental batteries 1272 and handvac batteries 1268 simultaneously.

[00350] In some embodiments, supplemental batteries 1272 may provide the handvac 112 with extra energy for prolonged cleaning time between charges. For example, supplemental batteries 1272 may have a greater energy capacity (e.g., measured in Watt-hours) than handvac batteries 1268, such that handvac 112 may be sustained by supplemental batteries 1272 for a longer operating time. In some embodiments, handvac 112 may draw power from both of supplemental batteries 1272 and handvac batteries 1268, which have a greater combined energy storage capacity than handvac batteries 1268 alone.

[00351] In some embodiments, supplemental batteries 1272 may supply power to the handvac in preference to the handvac batteries 1268 to delay or avoid draining the handvac batteries 1268. For example, handvac 112 may draw power from supplemental batteries 1272 until substantially depleted before drawing power from handvac batteries 1268. This may conserve power in handvac batteries 1268 for use when handvac 112 is disconnected from supplemental batteries 1272 (e.g., in an above-floor cleaning mode, or handvac mode of apparatus 100). In some embodiments, handvac 112 may never draw power from handvac batteries 1268 when handvac 112 is electrically connected to supplemental batteries 1272.

[00352] In some embodiments, handvac 112 may draw power from supplemental batteries 1272 to recharge handvac batteries 1268. This may help to ensure that handvac batteries 1268 are not depleted when handvac 112 is

disconnected from supplemental batteries 1272 (e.g., for use in an above-floor cleaning mode, or handvac mode of apparatus 100). In some cases, supplemental batteries 1272 may recharge handvac batteries 1268 only when apparatus 100 is not turned on.

[00353] In some embodiments, supplemental batteries 1272 may be recharged whenever the surface cleaning apparatus is connected to an external power outlet. In some cases, handvac batteries 1268 may be recharged when handvac 112 is electrically connected to an external power outlet (e.g., when surface cleaning head 104 or upright section 108 is connected to a power outlet by an electrical cord (not shown), and handvac 112 is connected to the surface cleaning head 104 or upright section 108).

[00354] In some embodiments, one or more of supplemental batteries 1272 and handvac batteries 1268 may be positioned in the airflow path. This may provide cooling for the batteries so positioned, which may help to prevent the batteries from overheating and may improve the performance of the batteries. In the illustrated example, handvac batteries 1268 are positioned in the airflow path inside motor housing 1138. For example, handvac batteries 1268 may be positioned inside motor housing 1138 between suction motor 204 and clean air outlet 132. The air passing over the handvac batteries 1268 may help to keep the batteries 1268 cool.

[00355] Supplemental batteries 1272 may be positioned in the airflow path to promote cooling of the batteries 1272. In the illustrated example, supplemental batteries 1272 are shown positioned inside surface cleaning head 104 in the airflow path between dirty air inlet 124 and downstream end 1240. The air passing over batteries 1272 may help to keep batteries 1272 cool.

[00356] In alternative embodiments, one or both of supplemental batteries 1272 and handvac batteries 1268 may be positioned outside of the airflow path (e.g., to be cooled passively).

Handvac Wheels

[00357] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the handvac may be provided with one or more sets of wheels, and a handle which may articulate to facilitate different cleaning postures.

[00358] As exemplified in FIGS. 106-109, surface cleaning apparatus 1292 may include a surface cleaning head 104, an upright section 108 (which may receive any assembly 140, 160 discussed previously), and a handvac 112. An airflow path through apparatus 1292 may extend from dirty air inlet 124 in surface cleaning head 104, downstream through upright section 108 and then handvac 112 to clean air outlet 1304. Upright section 108 may include a wand 144 having an upstream end 360 drivingly connected to a pivot joint 116 of surface cleaning head 104, and a downstream end 364 connected to an inlet nozzle 412 of handvac 112.

[00359] Handvac 112 may include an air treatment member positioned in the airflow path between inlet nozzle 412 for separating dirt from the airflow. In the illustrated example, handvac 112 includes a cyclone bin assembly 136 including a cyclone chamber 184, and a dirt collection chamber 188. Optionally, a bottom wall 216 of dirt collection chamber 188 may be pivotally openable for emptying dirt collection chamber 188.

[00360] As exemplified, apparatus 1292 may be movable between an upright storage position (FIG. 106) in which handvac 112 is substantially vertically aligned above surface cleaning head 104 and wand 144 is substantially vertically oriented, and an in-use floor cleaning position (FIG. 108) in which surface cleaning head 104 is positioned behind surface cleaning head 104 and wand 144 extends at an angle to vertical.

[00361] In the illustrated example, apparatus 1292 may include a handle 1340. Handle 1340 may be connected to wand 144 by an arm assembly 1344. As shown, arm assembly 1344 may include a first arm 1348 joined to a second arm 1352 by an

articulating joint 1356. First arm 1348 may be connected to wand 144 and joint 1356, and second arm 1352 may be connected to handle 1340. Alternately, joint 1356 may be used to connect second arm 1352 to wand 144.

[00362] As shown, first arm 1348 may be rigidly connected to wand 144, and extend transversely to wand 144. For example, first arm 1348 may extend perpendicularly to wand 144. Second arm 1352 may be rotatable about joint 1356 between at least two positions. In the first position (FIG. 108), second arm 1352 may extend at an angle to first arm 1348 substantially in parallel with wand 144. In the second position (FIG. 109), second arm 1352 may extend substantially parallel to first arm 1348. An actuator (e.g., a button) 1358 may be provided on handle 1340 for toggle joint 1356 between an unlocked position in which second arm 1352 can move with respect to first arm 1348, and a locked position in which the position of second arm 1352 is fixed with respect to first arm 1348. Optionally, joint 1356 may be locked in a number of alternate positions. Alternately, joint 1356 may not be locked in the second bent position shown in FIG 109.

[00363] The first position (FIG. 108) may be suitable for cleaning open areas where vertical clearance is not an issue. The second position (FIG. 109) may be suitable for cleaning under furniture and the like, where wand 144 must be lowered to clear the furniture height. In the second position, the orientation of second arm 1352 may permit a user to grasp handle 1340 and lower wand 144 while conveniently standing upright.

[00364] In some embodiments, handvac 112 may include one or more front wheels 1364. Front wheel 1364 may be positioned to make rolling contact with a horizontal surface when wand 144 is lowered sufficiently. Thus, front wheel 1364 may assist with supporting the weight of handvac 112 and permit handvac 112 to roll across the horizontal surface. In the illustrated example, a front end 1360 of bottom wall 216 is provided with one or more front wheels 1364.

[00365] It will be appreciated that if rear end of assembly 140,160 is tapered as discussed previously, then assembly 140, 160 is configured to permit the vacuum cleaner to extend further under furniture than if the assembly 140,160 had the depth (front to back when in an upright storage position) as the upper end of the assembly 140, 160.

Openable Handvac Cyclone Bin Assembly

[00366] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the cyclone bin assembly of the handvac may be opened to empty the cyclone chamber and/or the dirt collection chamber, to access the pre-motor filter or access a door to open the cyclone chamber and/or the dirt collection chamber by moving part or all of the cyclone bin assembly relative to a main body of the handvac which include the suction motor while the parts remain connected together. For example, the parts may be pivotally mounted to each other.

[00367] Referring to FIGS. 110a and 110b, front portion 1372 of the cyclone bin assembly 136 may be pivotally connected to rear portion 1376 of the cyclone bin assembly 136 for pivoting between the open position shown and a closed position. In the open position, cyclone bin assembly 136 may be accessible, e.g., for emptying or cleaning.

[00368] Front portion 1372 may be pivotally connected to rear portion 1376 in any suitable fashion. In the illustrated embodiment, front portion 1372 is pivotally connected to rear portion 1376 by a hinge 1380 for rotation about a hinge axis 1384 between the open and closed positions.

[00369] The openable portion (e.g., front portion 1372) may be mounted to (e.g., rotationally mounted) or removable from the remaining portion (e.g., rear portion 1376) at any suitable location. As illustrated in Figures 110a and 110b, the openable portion may be mounted to the remaining portion at the second end wall 224 of the cyclone chamber 184. As illustrated in Figures 128 to 135, the openable

portion may be mounted to the remaining portion at a location, such as midway along an axial length of the cyclone bin assembly 160. If the openable portion includes a portion of a sidewall separating the air treatment chamber (e.g., cyclone chamber 184) from dirt collection chamber 188, then opening an end of the cyclone assembly, including a portion of the sidewall (e.g., some or all of at least one wall extending parallel to a cyclone axis of rotation), rather than just a front door or wall may permit easier removal of debris (e.g., the material in the forward part of the dirt collection chamber can fall out when the end is a front end and is pivoted upwardly). Optionally, at least the portion of common interior wall 226 that divides cyclone chamber 184 from dirt collection chamber 188 that extends to dirt outlet 200 is moveable with the openable portion so as to open dirt outlet 200.

[00370] In the illustrated embodiment of Figures 110a and 110b, front portion 1372 and rear portion 1376 separate at the interface between cyclone bin assembly 136 and pre-motor filter chamber 556. For example, front portion 1372 may include cyclone bin assembly 136 except for second end wall 224, and rear portion may include pre-motor filter chamber 556 and second end wall 224 of cyclone bin assembly 136. Accordingly, in the open position, access may be provided to empty and clean dirt collection chamber 188 and cyclone chamber 184 of cyclone bin assembly 136.

[00371] Referring to FIG. 116, in some embodiments handvac 112 may include a handle assembly 300 including handle 484 and suction motor 204. As exemplified, handle assembly 300 and rear wall 1224 of pre-motor filter chamber 556 may be removable from (entirely, or pivotally connected to) pre-motor filter chamber 556 as a unit to access the pre-motor filters 1176 and 1180 inside pre-motor filter chamber 556, e.g., for cleaning or replacement. As shown in FIG. 117, in some embodiments, handle assembly 300 may also be removably connected to rear wall 1224. In alternative embodiments, handle assembly 300 may be permanently connected to rear wall 1224.

Openable Dirt Collection Chamber

[00372] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the supplemental assembly may have a top and/or bottom openable portion.

[00373] As exemplified in FIGS. 111-113, dirt collection assembly 140 is shown including an upper portion 276 in an open position. Upper portion 276 may be moveably connected to (e.g., pivotally) or removable from dirt collection assembly 140 in any suitable manner. As exemplified, upper portion 276 may be connected to dirt collection chamber 140 by a hinge 1392 for rotation about a hinge axis 1(not shown) between the open and closed positions.

[00374] Upper portion 276 may be retained in the closed position in any suitable fashion. In the illustrated example, dirt collection chamber 140 includes a latch 1400 for securing upper portion 276 in the closed position. Latch 1400 may be user operable for selectively releasing upper portion 276 for movement to the open position.

[00375] As exemplified in FIGS. 114 and 115, upright section 108 of surface cleaning apparatus 152 is shown including a cyclone bin assembly 160. Cyclone bin assembly 160 is preferably openable for accessing cyclone chamber 308 and dirt collection chamber 141, e.g., for cleaning or emptying. Preferably, an upper and/or lower portion of cyclone bin assembly 160 may be openable. In the illustrated embodiment, upright section 108 includes an upper portion 1408 and a lower portion 1412. As shown, upper portion 1408 may be moveably connected to (e.g., pivotally connected to) or removable from lower portion 1412 for movement been a closed position (FIG. 114) and an open position (FIG. 115).

[00376] Upper portion 1408 may be pivotally connected to lower portion 1412 in any suitable manner. In the illustrated embodiment, lower portion 1412 is pivotally connected to lower portion 1412 by a hinge 1416 for rotation about a hinge axis 1420 between the closed and open positions.

[00377] Upper portion 1408 may be retained in the closed position in any suitable manner. For example, upper portion 108 may include a releasable catch for selectively securing upper portion 1408 to lower portion 1412 in the closed position.

Openable Dirt Outlet and/or Connecting the Cyclone and Dirt Collection Chamber Volumes

[00378] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the dirt outlet from the cyclone chamber may be openable. For example, the dirt collection chamber may be an opening in a wall, e.g., a wall separating an air treatment chamber and a dirt collection chamber. The opening has an outer perimeter defined by the wall in which the dirt outlet is provided or the walls which abut the dirt outlet. During use, dirt may get trapped in the dirt outlet or bridge the dirt outlet. During an emptying operation, a wall or walls defining a first part of the perimeter of the dirt outlet may be moved relative to a wall or walls defining a second part of the dirt outlet thereby opening the dirt outlet.

[00379] The dirt outlet may be provided in a common wall dividing cyclone chamber 184 from dirt collection chamber 188. During an emptying operation, part of the common wall 226 may be moved. As a result, the portion of the cyclone chamber and the portion of the dirt collection chamber that are separated by the common wall 226 become a contiguous volume defined by the volume of the portion of the cyclone chamber and the volume of the portion of the dirt collection chamber that are separated by the common wall. If the part of the common wall 226 that is moved comprises part of the perimeter of the dirt outlet, then the dirt outlet is also opened when the openable portion of the cyclone bin assembly is opened.

[00380] It will be appreciated that the openable portion may comprise a part of (e.g., a front part or wall of) the cyclone chamber, and/or an end or portion of the surface cleaning apparatus or air treatment assembly and/or dirt collection chamber. Accordingly, the dirt outlet may be openable and/or part of the common wall 226

may be moveable when the cyclone chamber and/or an end or portion of the surface cleaning apparatus or air treatment assembly and/or dirt collection chamber is opened. For example, the sidewall 226 may be moved as part of opening the cyclone chamber and/or an end or portion of the surface cleaning apparatus or air treatment assembly and/or dirt collection chamber (e.g., to clean or empty debris from the cyclone chamber or another part of the surface cleaning apparatus).

[00381] Opening the dirt outlet may allow any debris (e.g., elongated debris such as hair) that is caught in the outlet (e.g., bridging the outlet) to come free or be more easily freed. Opening the dirt outlet when opening the cyclone chamber, opening an end or portion of the surface cleaning apparatus or air treatment assembly, and/or opening the dirt collection chamber may allow a user to more easily remove debris from the device.

[00382] As exemplified in Figures 128 to 135, the handvac 114 may include a front end 1402, a rear end 1404, a top end 1406, a bottom end 1410, a right lateral side 1414, and a left lateral side 1418.

[00383] The dirt outlet 200 may be opened when a portion or end, (e.g., front end 1402, a rear end 1404) of the surface cleaning apparatus (e.g., handvac 112) is opened. In the illustrated example, the dirt outlet 200 is opened when a front end 1372 of the cyclone bin assembly 136 is opened, although it will be understood that in other examples another end or portion of a surface cleaning apparatus may be opened (e.g., a rear portion). As in the illustrated example, the first end or portion of the handvac 112 may be a first end or portion of the cyclone assembly 136 (e.g., a front end and/or an end comprising an inlet conduit and/or dirty air inlet).

[00384] The dirt outlet 200 may be between the openable first end or portion 1372 and the remaining end or portion 1376 of the surface cleaning apparatus. Opening the first end or portion 1372 (e.g., removing the first end or rotating the first end) may open the dirt outlet by moving a wall or a portion of a wall defining an edge

or part of the perimeter of the dirt outlet 200 (e.g., a wall in which the dirt outlet 200 is formed or a wall that extends up to an edge of the dirt outlet 200).

[00385] The dirt outlet 200 may be at any position in the walls of the cyclone chamber 184. As exemplified, the dirt outlet 200 may be provided in a common wall that divides the cyclone chamber 184 from the dirt collection chamber 188. As in the illustrated example, at least a portion of the dirt collection chamber 188 may be spaced from the cyclone chamber 184 in a direction transverse to the cyclone axis of rotation 1371. The at least a portion of the dirt collection chamber 188 may face towards the cyclone chamber 184 and be separated from the cyclone chamber by a sidewall 226. As exemplified, the dirt outlet 200 may be in the sidewall 226.

[00386] The dirt outlet 200 may be at one end of the chamber 184 (e.g., at or adjacent an end wall) and/or adjacent the air inlet and/or air outlet of the chamber 184 (e.g., separated from the air inlet and/or air outlet by less than half the length of the chamber or less than a quarter of the length of the chamber). In the illustrated example, the dirt outlet 200 comprises an opening in the sidewall 226 that extends axially inwardly into the cyclone chamber 184 from the cyclone chamber second end wall 224.

[00387] At least a portion of the sidewall 226 is included in the openable first (e.g., front) end 1372, and moving the first end 1372 (e.g., including at least a portion of the cyclone chamber 184 and/or at least a portion of the dirt collection chamber 188) from a closed or cleaning position as exemplified in Figures 128, 129 132, 133 and 136 to the open or emptying position of Figures 130, 131, 134, 135 and 137 moves the portion of the sidewall 226 to open the dirt outlet 200, as exemplified in Figures 128 to 135. As exemplified in Figures 96, 110a, and 110b, in some examples, the entire sidewall 226 of the cyclone and dirt collection chambers may be part of the front end 1372 and/or the hinge 1380 may be at or adjacent an end (e.g., the rearward end) of the cyclone chamber 184 and/or the dirt collection chamber 188 (e.g., if the dirt collection chamber 188 and cyclone chamber 184 are not coextensive

along the cyclone axis of rotation). Alternately, as exemplified in Figures 130, 131, 134, 135 and 137, only a portion of the sidewall of the cyclone and/or dirt collection chambers may be opened. Alternately, it will be appreciated that the common wall 226 may be moveable with a front wall of the cyclone chamber (see for example Figure 137). In such an embodiment, it will be appreciated that the front end or front wall of the dirt collection chamber may not be opened. Similarly, it will be appreciated that the common wall 226 may be moveable with a front wall of the dirt collection chamber. In which case it will be appreciated that the front end or front wall of the cyclone chamber may not be opened.

Extended Dirt Collection Chamber

[00388] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, all or a portion of the dirt collection chamber may be positioned forward and/or rearward of the cyclone chamber. The dirt collection chamber may include at least a portion that is spaced from the cyclone chamber in a direction transverse to the cyclone axis of rotation and another portion that is forward and/or rearward of the cyclone chamber, e.g., that is intersected by the cyclone axis of rotation or through which a projection of the cyclone chamber extends.

[00389] Extending the dirt collection chamber to include a portion that is forward or rearward of the cyclone chamber may provide an additional volume in which to collect debris and/or allow the diameter of the dirt collection chamber, in a direction transverse to the cyclone axis of rotation, to be reduced. Accordingly, the volume of the dirt collection chamber may be increased without increasing the height of the surface cleaning apparatus in a direction transverse the cyclone axis of rotation. For example, if the cyclone chamber is a horizontally extending cyclone chamber, then extending the dirt collection chamber to include a portion that is forward or rearward of the cyclone chamber may allow a larger dirt collection volume without increasing

the height of the handvac and/or allow for a similar sized dirt collection chamber while decreasing the height of the collection chamber and cyclone chamber.

[00390] As exemplified in Figures 136 and 137, the dirt collection chamber 188 includes a first portion that is below the cyclone chamber and a second portion 1422 that is forward of the cyclone chamber 188. The first and second portions 1420, 1422 may be contiguous, in which case the dirt outlet may communicate with either the first portion 1420 or the second portion 1422. As exemplified, the lower end of the second portion 1422 communicates with a front end of the first portion 1420. Alternately, the first and second portions need not be contiguous, in which case a first dirt outlet may connect the cyclone chamber in air flow communication with first portion 1420 and a second dirt outlet may connect the cyclone chamber in air flow communication with second portion 1422.

[00391] In the exemplified embodiment, second portion 1422 is located between a first (e.g., front) end 1390 having a first (e.g., front) end wall 1394, which is spaced axially forward of the cyclone chamber first end 220, and cyclone chamber first end 220. As exemplified, the lower end of second portion 1422 may be radially spaced from the cyclone axis of rotation by at least the same distance as the lower end of first portion 1420 is radially spaced from the cyclone axis or rotation. Accordingly, as exemplified in Figure 136, the lower end of first portion 1420 may have a height H_1 that extends between the lower end of first portion 1420 and the cyclone axis of rotation that is the same as height H_2 that extends between the lower end of second portion 1422 and the cyclone axis of rotation. Alternately, H_1 may be greater or less than H_2.

[00392] Second portion 1420 has an axially spaced apart second (e.g., rear) end 1396 having a second (e.g., rear) end wall 1398. Accordingly, as exemplified, second portion 1420 may extend to the rear end of the cyclone chamber and may communicate with a dirt outlet 200 provided at the rear end of common wall 226.

Accordingly, as exemplified in Figure 137, when the front end is opened, the cyclone and the dirt chamber are concurrently opened and the dirt outlet is also opened.

[00393] It will be appreciated that, as in Figures 128-135, part or a majority of the sidewalls of the cyclone chamber and/or part or a majority of the sidewalls of the dirt collection chamber (in addition to common wall 226) may be moved when the front end is opened.

[00394] It will be appreciated that the height H_3 of second portion in a direction transverse to the cyclone axis of rotation may be the same as the height of the rest of the cyclone bin assembly. The height H_3 may be such that the cyclone axis of rotation 1371 extends through first portion 1422. In an alternate embodiment, the cyclone axis of rotation 1371 may not extend through first portion 1422 but a projection of a portion of the cyclone chamber may extend through second portion 1422. In a further alternate embodiment, the height H_3 may be such that a projection of all of the cyclone chamber may extend through second portion 1422.

Handvac Cyclone Bin Assembly Bypass

[00395] In accordance with another aspect of this disclosure, which may be used by itself or in combination with any one or more other aspects of this disclosure, the cyclonic air treatment member of the handvac may be bypassed when a supplemental cyclonic bin assembly is provided. This may prevent accumulation of dirt in the handvac so that the handvac may have more or all of its dirt collection capacity available when disconnected from the upright section. Alternately or in addition, a pre-motor filter of handvac 112 may be bypassed when a supplemental cyclonic bin assembly is provided. For example, the supplemental cyclonic bin assembly may be provided with a pre-motor filter. The pre-motor filter may have a larger surface area than the pre-motor filter of handvac 112. Accordingly, by bypassing the pre-motor filter of handvac 112, the pre-motor filter of handvac 112 may only be used in an above floor cleaning mode thereby extending the useable

time of the pre-motor filter of handvac 112 before cleaning or replacement may be needed.

[00396] Referring to FIGS. 99-101, handvac 112 may include a primary airflow path 1228 and a bypass airflow path 1232. As shown, primary airflow path 1228 may extend from air inlet 192 through cyclone bin assembly 136 to suction motor 204, and bypass airflow path 1232 may extend from air inlet 192 to suction motor 204 bypassing cyclone bin assembly 136. In some embodiments, bypass airflow path 1232 may extend through the pre-motor filters of pre-motor filter chamber 556, and in other embodiments, bypass airflow path 1232 may bypass pre-motor filters of pre-motor filter chamber 556. It will be appreciated that the cyclone and/or the pre-motor filter of the handvac may be bypassed. If both are bypassed, then the handvac may be used to provide some or all of the motive force to draw air through apparatus 168 but not any air treatment upstream of the suction motor.

[00397] In the illustrated embodiment, bypass airflow path 1232 is formed in part by a bypass passage 1236. Bypass passage 1236 may have an upstream end 1238 in airflow communication with handvac inlet 416, and a downstream end 1240 in airflow communication with motor inlet 1108. As exemplified by the embodiment illustrated in FIG. 101, upstream end 1238 may be formed in a sidewall of handvac nozzle 412, and downstream end 1239 may be formed in a wall of premotor filter chamber 556. In some embodiments, downstream end 1239 may direct air from bypass passage 1236 into upstream plenum 1208 for routing bypass airflow path 1228 through pre-motor filters 1176 and 1180 as shown. In alternative embodiments, downstream end 1239 may direct air from bypass passage 1236 into downstream plenum 1212 for bypassing pre-motor filters 1176 and 1180.

[00398] As exemplified, apparatus 168 may include a bypass valve 1240 for selectively opening and closing primary and bypass airflow paths 1228 and 1232. Bypass valve 1240 may be positioned in any one or more of handvac 112, wand 144, and supplemental cyclone bin assembly 160, and may take any suitable form. For

example, in some embodiments bypass valve 1240 may include components parts positioned in two or more of handvac 112, wand 144, and supplemental cyclone bin assembly 108 which cooperate and interact to open and close primary and bypass airflow paths 1228 and 1232.

[00399] In the illustrated embodiment bypass valve 1240 is positioned in inlet nozzle 412 of handvac 112. Bypass valve 1240 may be movable between a first position (FIGS. 99 and 100) in which bypass airflow path 1232 is closed and primary airflow path 1228 is open, and a second position (FIG. 101) in which bypass airflow path 1232 is open and primary airflow path 1228 is closed.

[00400] As exemplified in FIGS. 99-101, bypass valve 1240 may include a wheel 1242, a door 1244, and an actuator 1246. Wheel 1242 may be rotatably connected to nozzle 412 for rotation about its center. Door 1244 may be rigidly connected to wheel 1242 for rotation as one with wheel 1242. For example, door 1244 and wheel 1242 may rotate together as a unit. As shown, door 1244 and wheel 1242 may be rotatable between a first position (FIGS. 99 and 100) in which door 1244 seals an upstream end 1238 of bypass passage 1236, and a second position (FIG. 101) in which door 1244 seals an air inlet 192 of cyclone chamber 184.

[00401] As exemplified, actuator 1246 may include an upper end 1248 connected to wheel 1242 radially outboard of the center of wheel 1242. Actuator 1246 may be movable vertically between a lowered position (FIGS. 99 and 100), and a raised position (FIG. 101). As shown, moving actuator 1246 from the lowered position to the raised position may rotate wheel 1242 and door 1244 clockwise which may move door 1244 to the second position (FIG. 101) in which door 1244 seals air inlet 192 of cyclone chamber 184. Further, moving actuator 1246 from the raised position to the lowered may rotate wheel 1242 and door 1244 counter clockwise which may move door 1244 to the first position (FIGS. 99 and 100) in which door 1244 seals upstream end 1238 of bypass passage 1236.

[00402] In some embodiments, actuator 1246 may be biased to the lowered position (FIGS. 99 and 100). Consequently, door 1244 and wheel 1242 may be biased to the first position (FIGS. 99 and 100) in which door 1244 seals an upstream end 1238 of bypass passage 1236. Actuator 1246 may be biased in any suitable fashion, such as by a linear coil spring 1250. In alternative embodiments, wheel 1242 may be biased clockwise in a suitable manner, such as by a torsional spring.

[00403] Actuator 1246 may have a lower end 1252 which extends outside of the airflow path. Lower end 1252 may be acted upon to move actuator 1246 vertically from the lowered position to the raised position for opening bypass airflow path 1232 and closing primary airflow path 1228. As shown, when handvac 112 is disconnected from wand 144 (FIG. 99), bypass valve 1240 may close the bypass airflow path 1232 (e.g., under the bias of spring 1250). Further, when handvac 112 is connected to wand 144 without supplemental cyclone bin assembly 160 (FIG. 100), bypass valve 120 may also close the bypass airflow path 1232. In each of these cases, the air entering handvac 112 is directed through handvac cyclone bin assembly 136 to separate dirt from the airflow. This may permit handvac 112 to operate when disconnected from supplemental cyclone bin assembly 160.

[00404] As shown in FIG. 101, when handvac 112 and cyclone bin assembly 160 are both connected to wand 144, an upper end 1254 of cyclone bin assembly 160 (handle 1254 in the illustrated example) may push against actuator lower end 1252 thereby moving actuator 1246 upwardly. This may rotate wheel 1242 and door 1244 counter clockwise, opening bypass airflow path 1232 and closing primary airflow path 1228. As shown, air exiting cyclone bin assembly 160 may travel through bypass airflow path 1232 toward suction motor 204 bypassing cyclone chamber 184. This may permit supplemental cyclone bin assembly 160 to separate and collect dirt from the airflow path instead of handvac cyclone bin assembly 136. In turn, this may inhibit dirt accumulation in handvac dirt collection chamber 188, which may help to maximize the available dirt collection capacity of handvac dirt

collection chamber 188 when the user chooses to disconnect cyclone bin assembly 160.

[00405] In the illustrated example, lower end 1252 is sloped. This may permit supplemental bin assembly 160 to be toed into wand 144 and then rotated horizontally towards wand 144 to complete the connection with wand 144, whereby the upper end 1254 of supplemental bin assembly 160 may ride the slope of lower end 1252 to push actuator 1246 upwardly.

[00406] Accordingly, bypass valve 1240 may be actuated to reconfigure the airflow path through handvac 112 automatically upon connecting and disconnecting supplemental bin assembly 160 from airflow communication with handvac 112. For example, bypass valve 1240 may be biased to close bypass airflow path 1232 whenever handvac 112 is not in airflow communication with supplemental bin assembly 160 so that the air treatment member of handvac 112 may separate dirt from the airflow. Similarly, bypass valve 1240 may be configured to open bypass airflow path 1232 and close primary airflow path 1228 whenever handvac 112 is in airflow communication with supplemental bin assembly 160 so that the air treatment member of handvac 112 does not separate and store dirt from the airflow.

[00407] The following is a description of numerous embodiments of surface cleaning apparatus 168. In the figures associated with some embodiments, a bypass valve 1232 and/or a diversion valve 712 may be represented schematically. It will be appreciated that the embodiments may be practiced using the bypass valves 1232 and/or diversion valves 712 described above, or other suitable valves.

[00408] Referring to FIG. 102, in some embodiments supplemental cyclone bin assembly 160 may include one or more pre-motor filters 1256 (herein after referred to as pre-motor filter 1256 in the singular) positioned in the airflow path. Preferably, pre-motor filter 1256 is positioned downstream of cyclone chamber 308. As shown, pre-motor filter 1256 may be positioned between cyclone chamber air outlet 320 and outlet passage 476.

[00409] In some embodiments, pre-motor filter 1256 may separate fine dirt particles from the airflow in substitution for the pre-motor filters 1176 and 1180 of handvac 112. As shown, bypass valve 1232 may divert air from supplemental cyclone bin assembly 160 into a bypass airflow path which bypasses handvac cyclone bin assembly 136 and pre-motor filters 1176 and 1180. For example, downstream end of 1239 of bypass passage 1236 may direct the bypass airflow path 1232 to downstream plenum 1212 for bypassing pre-motor filters 1176 and 1180.

[00410] It will be appreciated that a pre-motor filter will have a certain filtering capacity of fine particles at which point the filter should be cleaned or replaced. By incorporating a pre-motor filter into the supplemental cyclone bin assembly 160, and using this filter whenever the supplemental cyclone bin assembly 160 is connected to the handvac, the filtering capacity of the handvac pre-motor filters may be preserved. This may permit extended use of the handvac pre-motor filters before they require cleaning or replacement.

[00411] It will also be appreciated that there will be a measurable pressure drop across a pre-motor filter placed in an airflow path. If positioned in series, too many filters may produce a pressure drop that materially reduces air flow at the dirty air inlet. By filtering the airflow alternately by the supplemental pre-motor filter 1256 and by the handvac pre-motor filter when the handvac is used without assembly 140, 160 attached the operational life of the handvac pre-motor filter may be extended.

[00412] As exemplified in the alternate embodiment of FIG. 103, surface cleaning head 104 may include a second suction motor 1258. Second suction motor 1258 may operate in parallel with or alternately instead of handvac suction motor 204 when handvac 112 is attached in flow communication with surface cleaning head 104. For example, a portion of air exiting supplemental cyclone bin assembly 160 may proceed to handvac suction motor 204 and a different portion may proceed to second suction motor 1258. In the illustrated embodiment, a second airflow path

1260 from diversion valve 712 to second suction motor 1258 is formed by an airflow conduit 1262 which connects diversion valve 712 to surface cleaning head 104.

[00413] As shown, when supplemental cyclone bin assembly 160 is in airflow communication with handvac 112, the airflow path extends through the air treatment member(s) of supplemental cyclone bin assembly 160 (e.g., cyclone chamber 308 and pre-motor filter 1256) and then divides into two parallel air flow paths 1232 and 1260. Bypass airflow path 1232 directs one portion of the airflow to the handvac suction motor 204 bypassing handvac cyclone chamber 184 (and optionally bypassing handvac pre-motor filters 1176 and 1180), and second airflow path 1260 directs a second portion of the airflow path to the second suction motor 1258 in head 104.

[00414] It will be appreciated that suction motors 1258 and 204 operating in parallel may generate greater suction at surface cleaning head 104 than any one of suction motors 1258 and 204 may generate operating alone. This may also permit supplemental cyclone bin 160 to include a pre-motor filter 1256 having greater surface area than the pre-motor filter of the handvac, where the additional pressure drop due to the use of two pre-motor filters may be compensated for by the enhanced suction generation of the parallel motors 1258 and 204.

[00415] As exemplified in the alternate embodiment of FIG. 104a, supplemental suction motor 160 may include a second suction motor 1258 which may operate in the same way as the embodiment of FIG 103. Second suction motor 1258 may operate in parallel with handvac suction motor 204. For example, a portion of air exiting supplemental cyclone chamber 160 may proceed to handvac suction motor 204 and a different portion may proceed to second suction motor 1258. In the illustrated embodiment, a second airflow path 1260 from outlet passage 478 to second suction motor 1258 is formed by an airflow conduit 1262.

[00416] As shown, when supplemental cyclone bin assembly 160 is in airflow communication with handvac 112, the airflow path extends through the air treatment

member(s) of supplemental cyclone bin assembly 160 (e.g., cyclone chamber 308 and pre-motor filter 1256) and then divides into two parallel air flow paths 1232 and 1260. Bypass airflow path 1232 directs one portion of the airflow to the handvac suction motor 204 bypassing handvac cyclone chamber 184 (and optionally bypassing handvac pre-motor filters 1176 and 1180), and second airflow path 1260 directs a second portion of the airflow path to the second suction motor 1258.

[00417] As shown, second suction motor 1258 may be positioned below dirt collection chamber 140 and cyclone chamber 308 of supplemental cyclone bin assembly 160, and second suction motor 1258 may be vertically aligned above surface cleaning head 104. This may help to lower the center of gravity of the apparatus 168 for enhanced stability against tipping.

[00418] In some embodiments, a pre-motor filter may be positioned in each of bypass airflow path 1232 and second airflow path 1260, as shown. For example, a pre-motor filter 1256 may be positioned in the second airflow path 1260 between outlet passage 478 and second suction motor 1258, and bypass airflow path 1232 may direct the airflow through handvac pre-motor filters 1176 and 1180. In the illustrated embodiment, pre-motor filter 1256 is shown positioned below dirt collection chamber 140 of supplemental cyclone bin assembly 160.

[00419] In alternative embodiments, air exiting cyclone chamber 308 may pass through a common pre-motor filter before dividing between the second airflow path 1260 and bypass airflow path 1232. For example, in FIG. 104b pre-motor filter 1256 is shown positioned downstream of cyclone chamber 308 and upstream of outlet passage 478. As shown, bypass airflow path 1232 may bypass handvac pre-motor filters 1176 and 1180. This may permit the filtration capacity of handvac pre-motor filters 1176 and 1180 to be preserved for use when supplemental cyclone bin assembly 160 is disconnected from airflow communication with handvac 112. In alternative embodiments, pre-motor filters 1176 and 1180 may be positioned in the bypass airflow path 1232.

[00420] As exemplified in FIG. 105a dirt collection chamber 140 and cyclone chamber 308 may be removable as a sealed unit from wand 144 and second suction motor 1258. For example, second suction motor 1258 may be mounted or removably mounted to wand 144 so that dirt collection chamber 140 and cyclone chamber 308 may be removed while second suction motor 1258 remains mounted to wand 144. This may permit cleaning and/or emptying of dirt collection chamber 140 and cyclone chamber 308 (e.g., carrying the same to a garbage bin to dump their contents) without having to carry second suction motor 1258 (which may have a non-trivial weight). Also, assembly 160 may be removable as a unit to convert the apparatus to a lightweight or above floor operating mode.

[00421] As exemplified in FIG. 118, the air treatment members of handvac 112 and supplementary cyclone bin assembly 160 may operate in parallel. For example, handvac 112 and supplementary cyclone bin assembly 160 may separate dirt from mutually exclusive portions of the airflow entering dirty air inlet 124.

[00422] In the illustrated example, wand 144 may define two airflow paths. A first airflow path 1428 may be formed by a first division of wand 144 and may direct airflow moving therein to supplemental cyclone bin assembly 160 for cleaning, and then from supplemental cyclone bin assembly 160 to bypass airflow path 1232 of handvac 112. A second airflow path 1432 may be formed by a second division of wand 144 and may direct airflow moving therein to primary airflow path 1228 of handvac 112 for cleaning by cyclone bin assembly 136.

[00423] As exemplified, dirty air entering dirty air inlet 124 may divide into two airflows at wand upstream end 360 and then travel through the first and second airflow paths 1428 and 1432. Dirt may be separated from each airflow stream by a different one of supplementary cyclone bin assembly 160 and handvac 112. In the illustrated embodiment, the two airflows may recombine in pre-motor filter chamber 556. For example, the two airflows may recombine at the upstream plenum 1208 so that both airflows pass through pre-motor filters 1176 and 1180 before exiting

through suction motor 204. In alternative embodiments, the two airflows may recombine at the downstream plenum 1212. For example, supplemental cyclone bin assembly 160 may have its own pre-motor filter for filtering the air of the first airflow path 1428.

[00424] In some embodiments, surface cleaning apparatus 168 may include two or more suction motors operating in series. In one aspect, this may enhance the suction at dirty air inlet 124 and/or compensate for suction loss from additional or higher efficiency air treatment members.

[00425] Referring to FIGS. 119a and 119b, a second suction motor 1258 may be positioned in the airflow path between dirty air inlet 124 and handvac 112. For example, second suction motor 1258 may be a dirty air suction motor positioned in surface cleaning head 104. As shown, dirty air entering dirty air inlet 124 may be drawn through second suction motor 1258 before the airflow is cleaned by supplemental dirt collection chamber 160 and/or handvac 112 and discharged through handvac suction motor 204.

[00426] Referring to FIG. 120, second suction motor 1258 may be a clean air motor positioned downstream of handvac suction motor 204. As exemplified, motor outlet 1112 of handvac suction motor 204 may be fluidly connected to second suction motor 1258 in surface cleaning head 104 by an airflow path 1436. As shown, airflow path 1436 may be formed by a conduit 1440.

[00427] Referring to FIG. 121a, in some embodiments second suction motor 1258 may be positioned in supplementary cyclone bin assembly 160. For example, second suction motor 1258 may be positioned below dirt collection chamber 140. As shown, airflow path 1436 from motor outlet 1112 may direct air from suction motor 204 to second suction motor 1258 in supplementary cyclone bin assembly 160. For example, conduit 1440 may extend from motor outlet 1112 to second suction motor 1258. Conduit 1440 may take any suitable form. For example, conduit 1440 may be

a rigid conduit as shown. Alternatively, FIG. 121b shows an embodiment where conduit 1440 is a flexible hose.

[00428] In some embodiments, when handvac is connected with supplement cyclone bin assembly 160, handvac 112 may not be positioned in the airflow path through the surface cleaning apparatus. For example, air entering the dirty air inlet 124 of the surface cleaning head may be cleaned by the supplementary cyclone bin assembly 160 and discharged without ever passing through handvac 112. In this way, handvac 112 may act as a handgrip for manipulating and steering surface cleaning apparatus 168 in the upright mode but not as an air cleaning implement.

[00429] In some embodiment, as exemplified in FIG. 122, , the handvac may be bypassed when assembly 160 is attached to upright section 108. As exemplified, air entering dirt air inlet 124 may move through wand 144 to supplemental cyclone bin assembly 160 and be discharged without moving through handvac 112. For example, the airflow path through surface cleaning apparatus 168 may direct all air from dirty air inlet 124 through wand 144 to cyclone chamber 308 to outlet passage 476 to second airflow path 1260 to suction motor 1258 of supplemental cyclone bin assembly 160, which may discharge the air to the outside environment.

[00430] Still referring to FIG. 122, in some embodiments there may be a plurality of suction motors in series. In the illustrated embodiment, surface cleaning head 104 includes a suction motor 1258 positioned in the airflow path between dirty air inlet 124 and wand 144. In alternative embodiments, suction motor 1258 may be the only suction motor in the airflow path.

[00431] While the above description provides examples of the embodiments, it will be appreciated that some features and/or functions of the described embodiments are susceptible to modification without departing from the spirit and principles of operation of the described embodiments. Accordingly, 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 hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end and a pistol grip handle, the hand vacuum cleaner comprising:

(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the main body having an axially extending sidewall wherein an end of the pistol grip handle is mounted to the sidewall; and,

(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit;

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,

(c) a rigid air flow conduit extending between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner, the rigid air flow conduit is removably mounted to the surface cleaning head,

wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and

wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.

2. The surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mounted to the main body.

3. The surface cleaning apparatus of claim 1 wherein the cyclone chamber has a sidewall extending between the front and rear walls and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in communication with a dirt collection chamber that is exterior to the cyclone chamber.

4. The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation is generally parallel to the suction motor axis of rotation.

5. The surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly.

6. The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

7. The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle intersects the suction motor and fan assembly.

8. The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle intersects a housing of the suction motor and fan assembly.

9. The surface cleaning apparatus of claim 2 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.

10. The surface cleaning apparatus of claim 9 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

11. The surface cleaning apparatus of claim 10 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

12. A surface cleaning apparatus comprising:

(a) a hand vacuum cleaner comprising:

(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,

(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation;

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,

(c) a rigid air flow conduit extending between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis, and the rigid air flow conduit is removably mounted to the surface cleaning head,

wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation.

13. The surface cleaning apparatus of claim 12 further comprising a pre-motor filter, wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, a projection of the longitudinally extending conduit axis intersects the pre-motor filter.

14. The surface cleaning apparatus of claim 12 wherein the cyclone unit is removably mounted to the main body.

15. The surface cleaning apparatus of claim 12 wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit and when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the suction motor axis of rotation is vertically spaced from the longitudinally extending conduit axis.

16. The surface cleaning apparatus of claim 12 wherein the cyclone chamber has a sidewall extending between the front and rear walls and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in

communication with a dirt collection chamber that is exterior to the cyclone chamber.

17. The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

18. The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle intersects the suction motor and fan assembly.

19. The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle intersects a housing of the suction motor and fan assembly.

20. The surface cleaning apparatus of claim 14 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body.

21. The surface cleaning apparatus of claim 20 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

22. The surface cleaning apparatus of claim 21 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

23. The surface cleaning apparatus of claim 12 wherein the main body has an axially extending sidewall, wherein an end of the pistol grip handle is mounted to the sidewall.

ABSTRACT

A surface cleaning apparatus comprises a hand vacuum cleaner, a surface cleaning head and a rigid air flow conduit removably mountable between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner. The hand vacuum cleaner comprises a main body and a cyclone unit. The main body has a suction motor axis of rotation and an axially extending sidewall wherein an end of a pistol grip handle is mounted to the sidewall. The dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit. When the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SURFACE CLEANING APPARATUS

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Wayne Ernest Conrad Date (Optional): _____

Signature: Wayne Conrad

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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FIG. 1

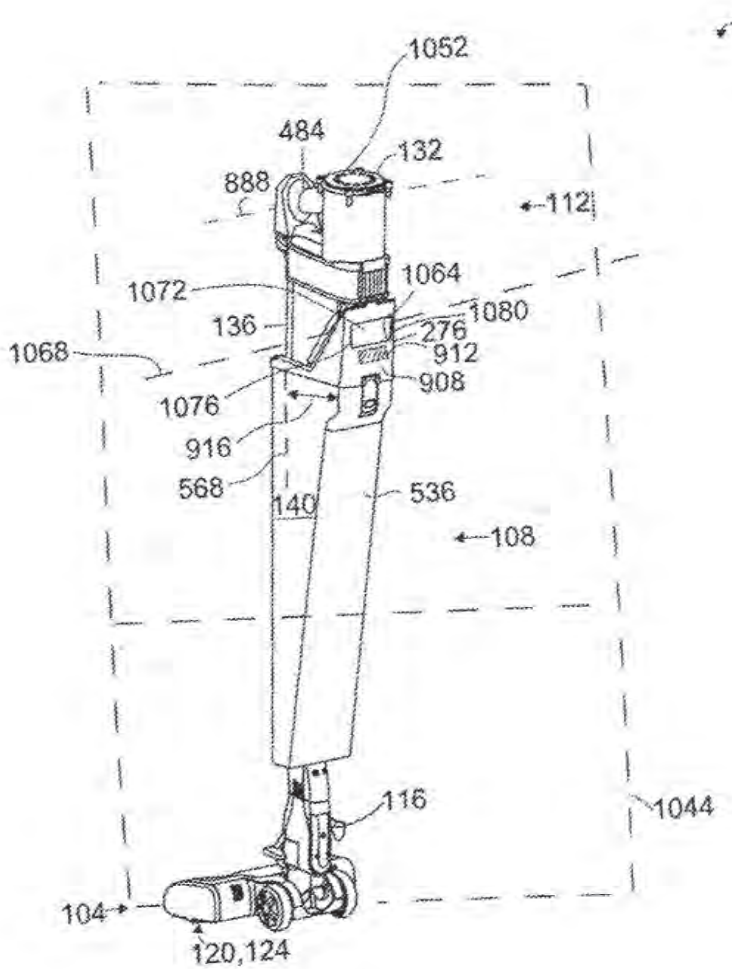


FIG. 2

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FIG. 3

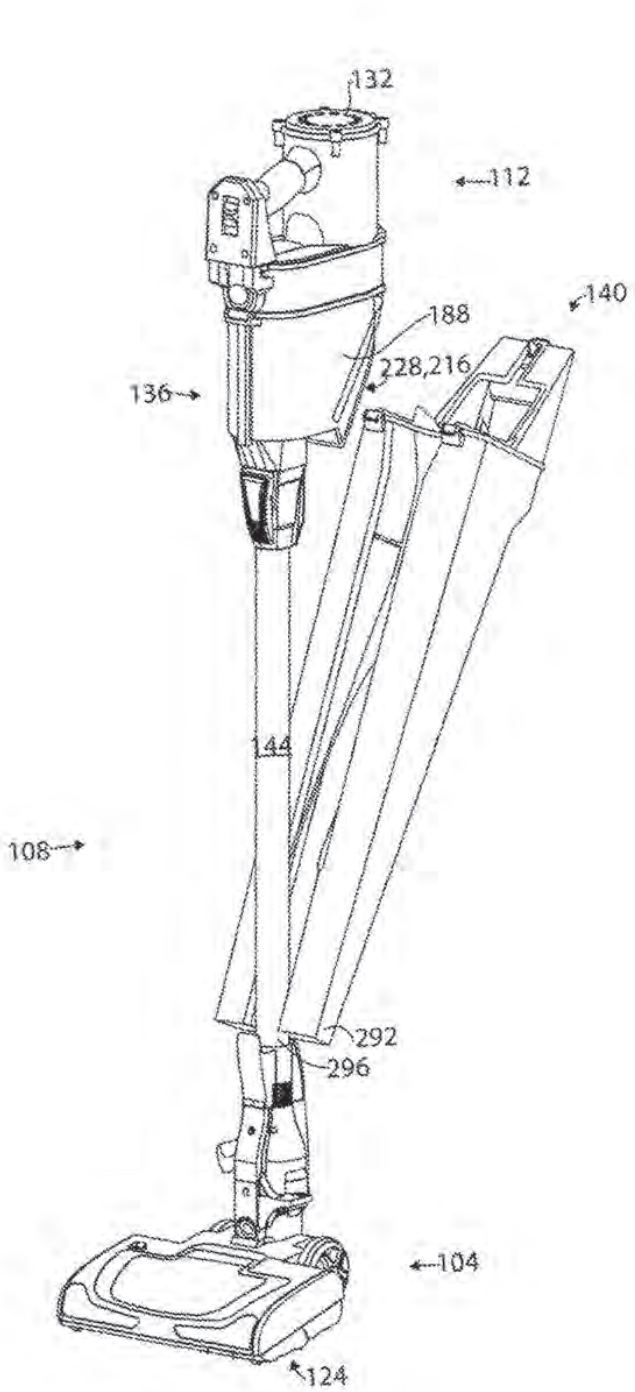


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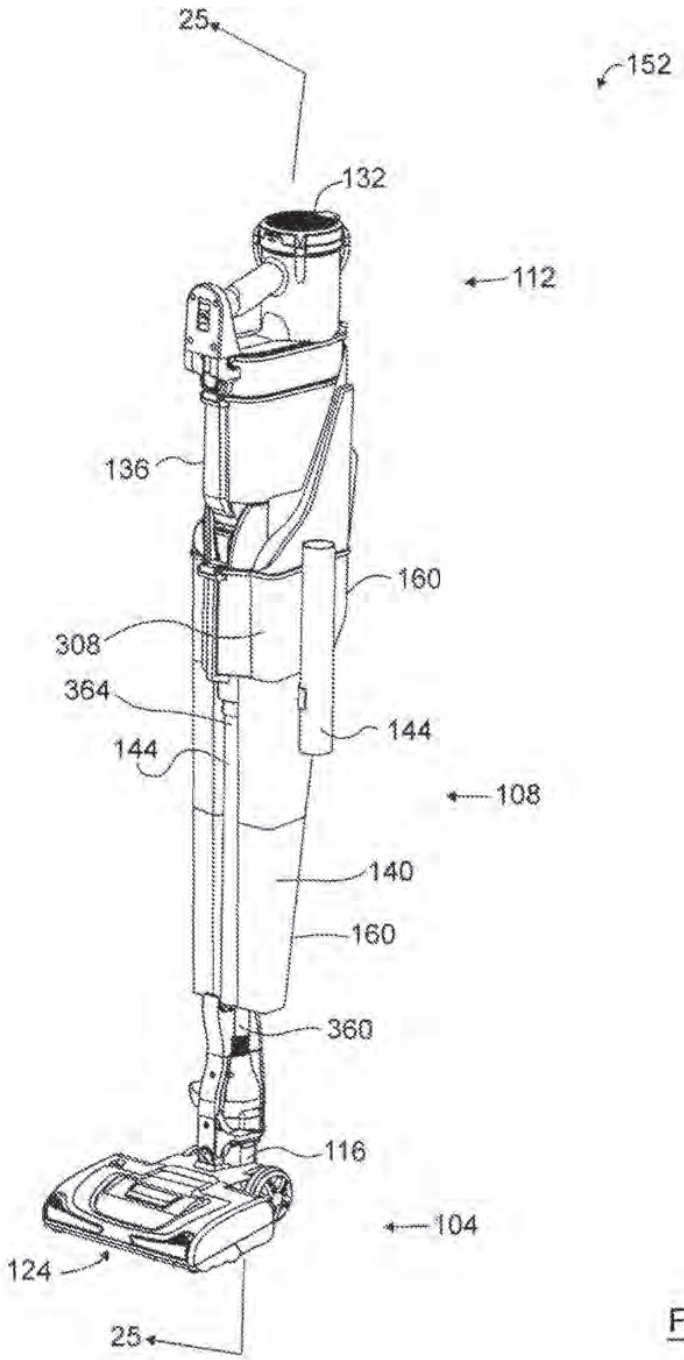

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FIG. 5

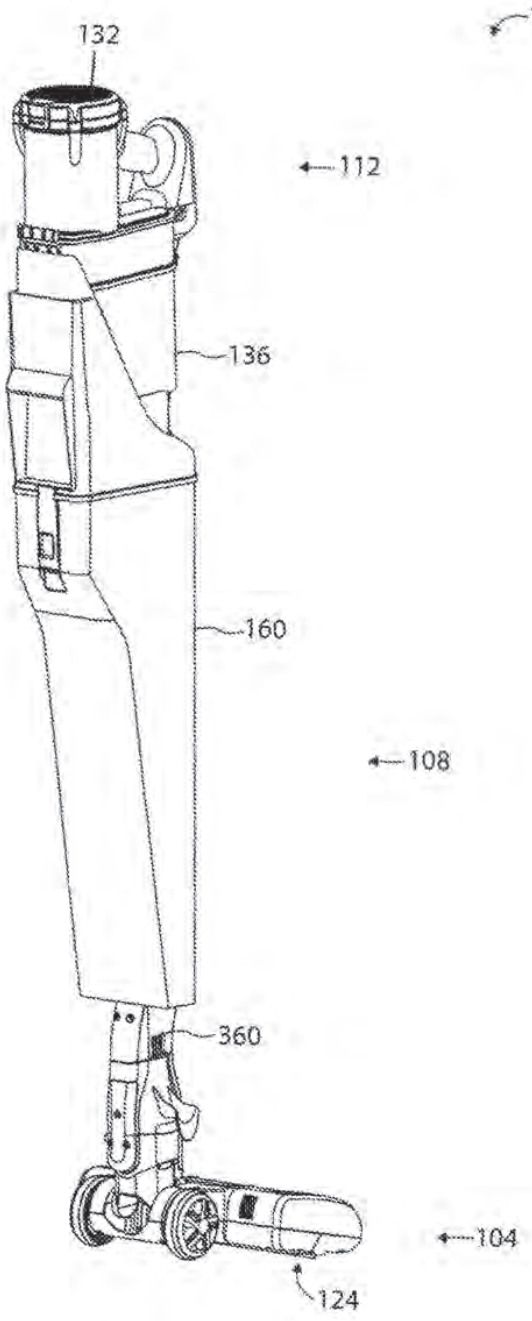


FIG. 6

FIG. 7

FIG. 8

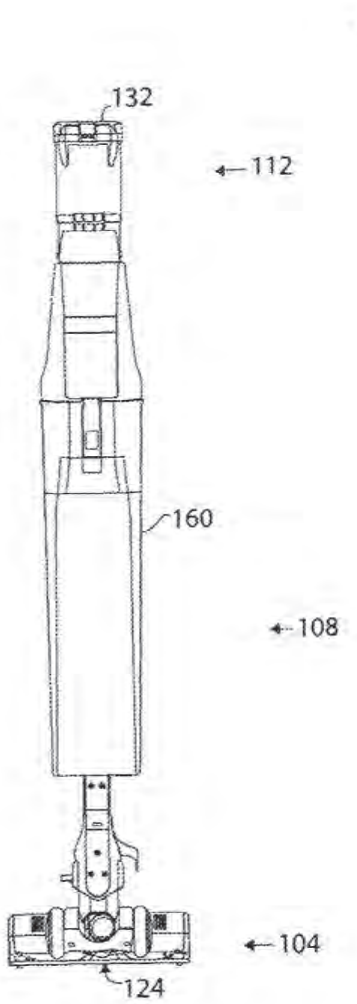


FIG. 9

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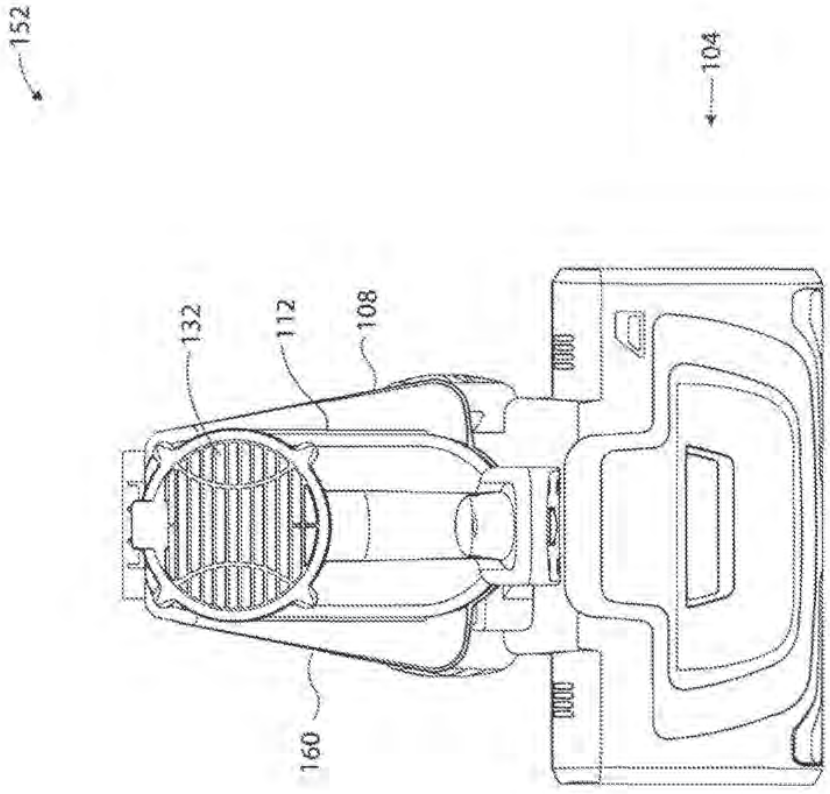


FIG. 10

FIG. 11

FIG. 12

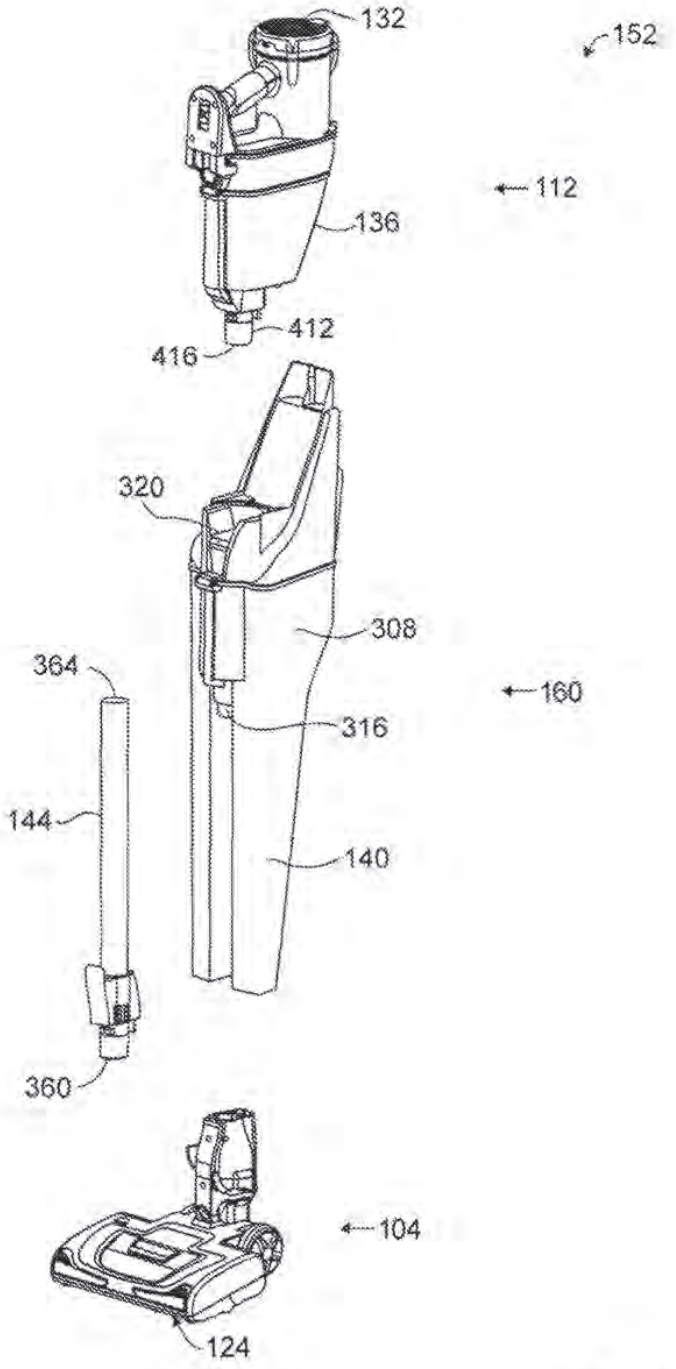


FIG. 12a

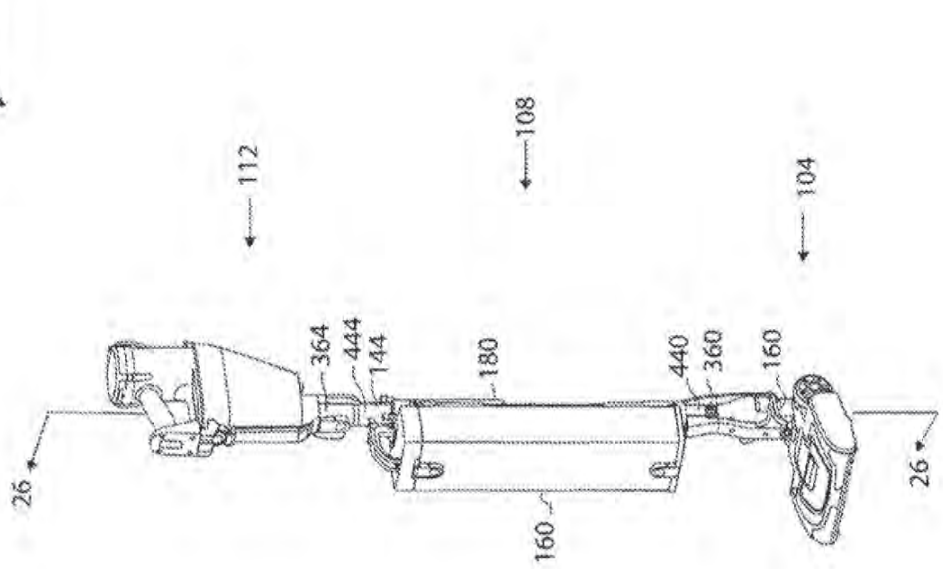


FIG. 13

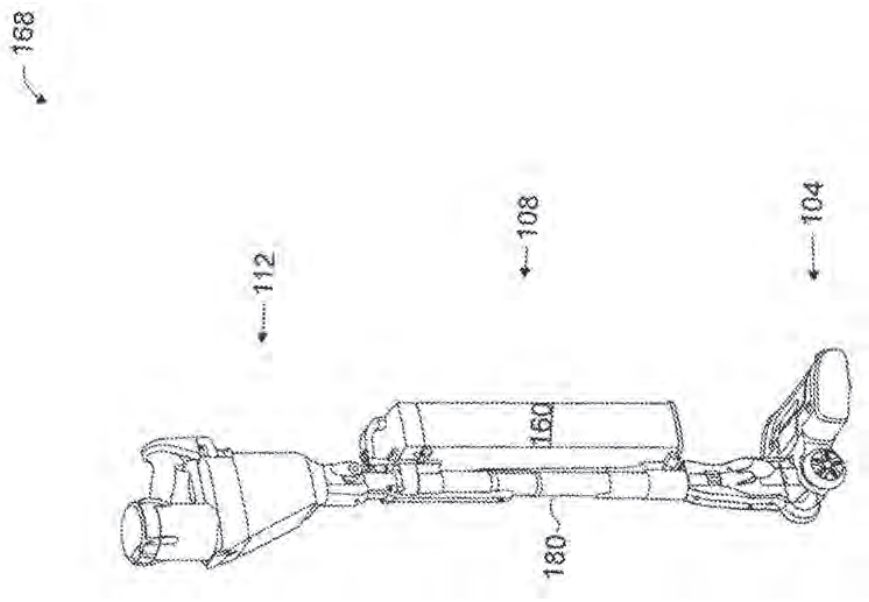


FIG. 14

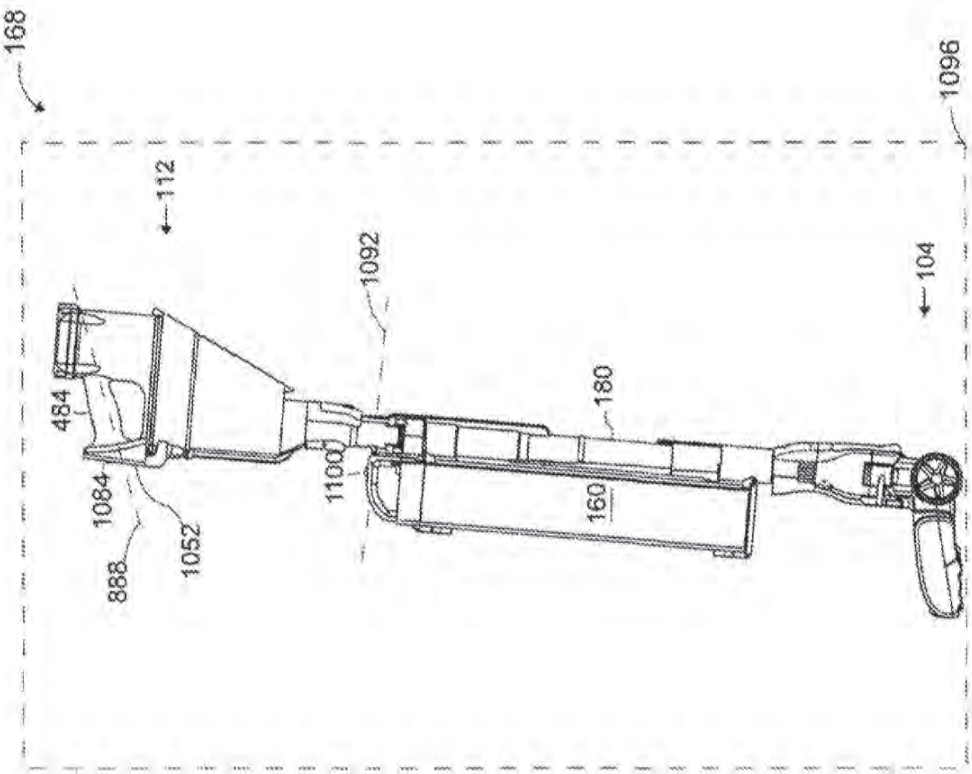


FIG. 15

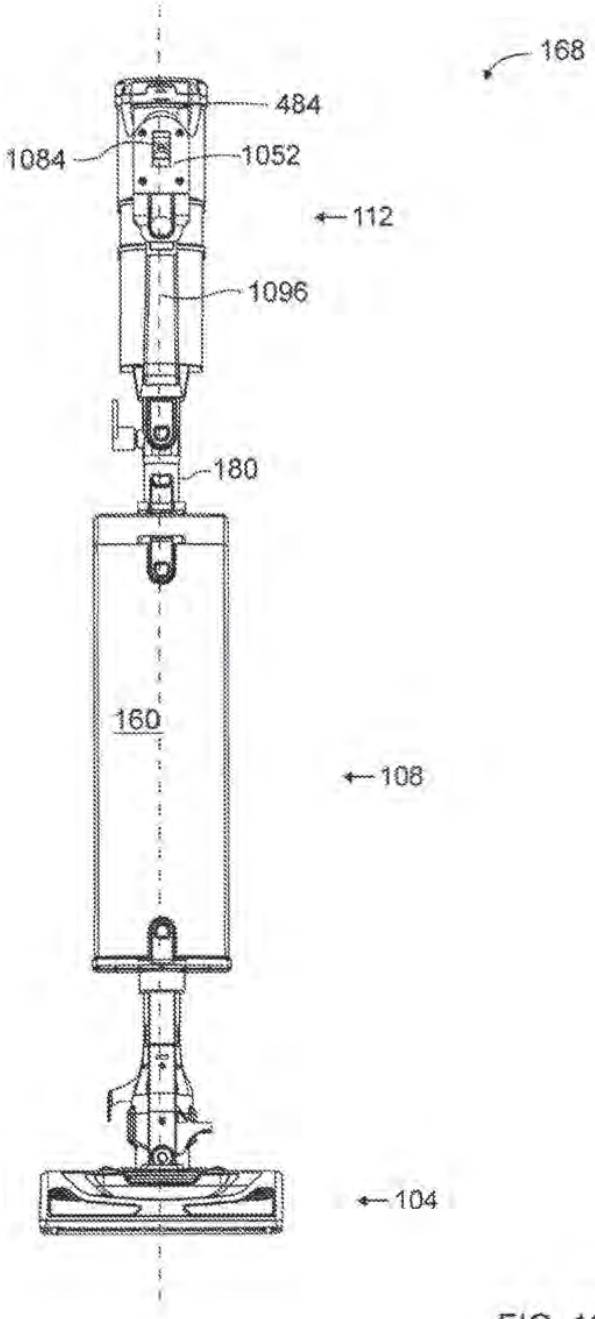


FIG. 16

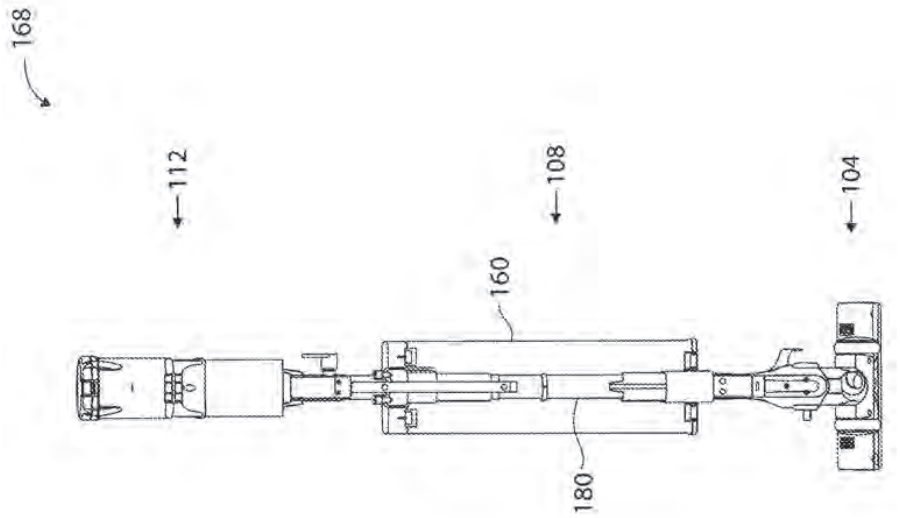


FIG. 17

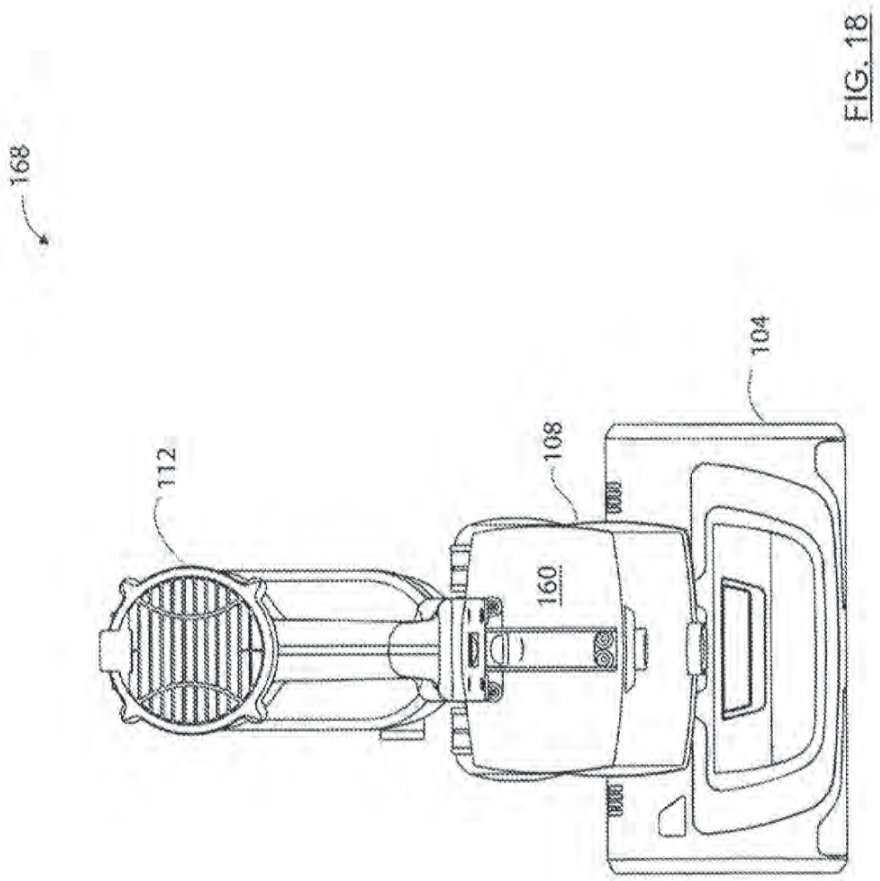


FIG. 18

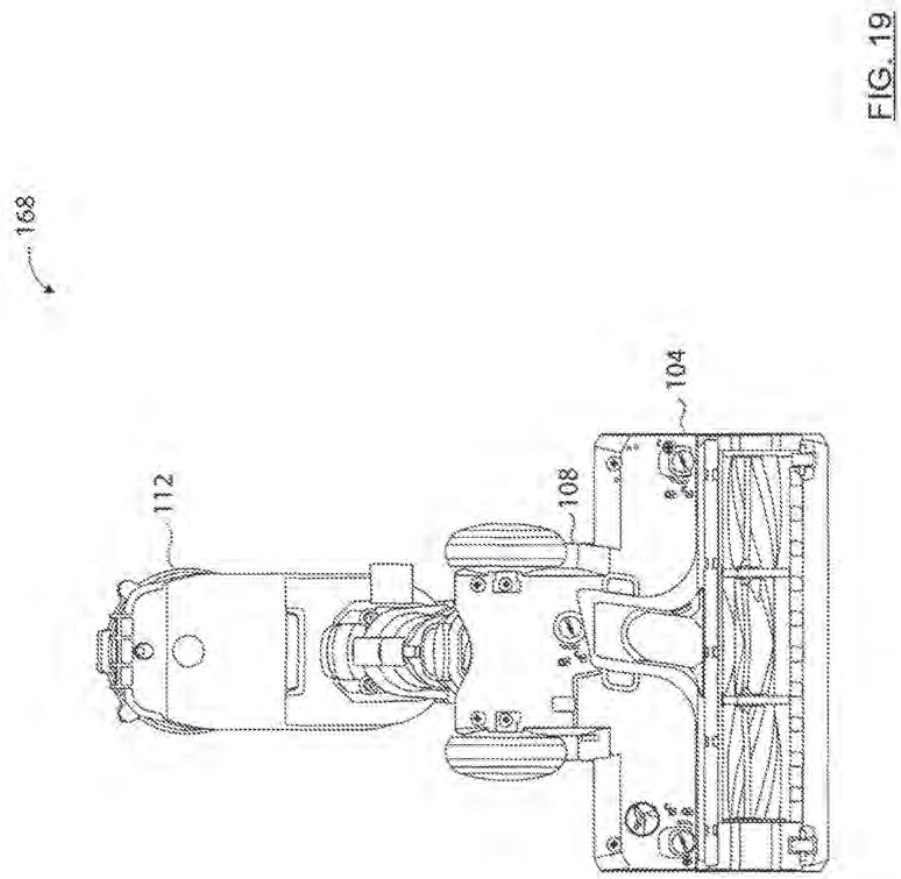


FIG. 19

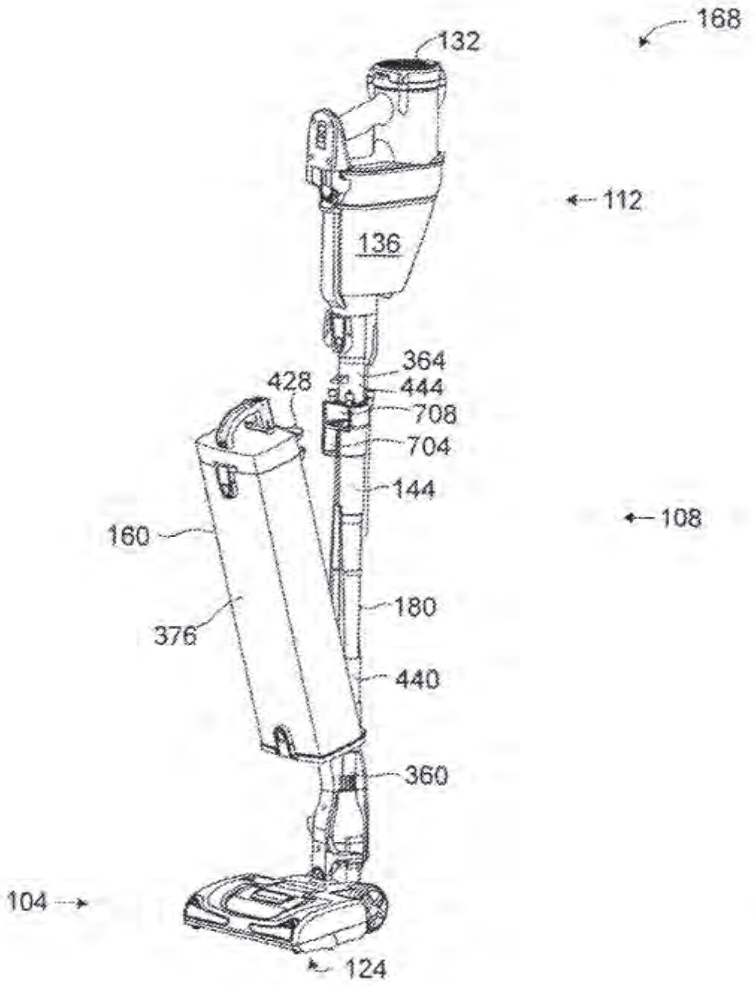


FIG. 20

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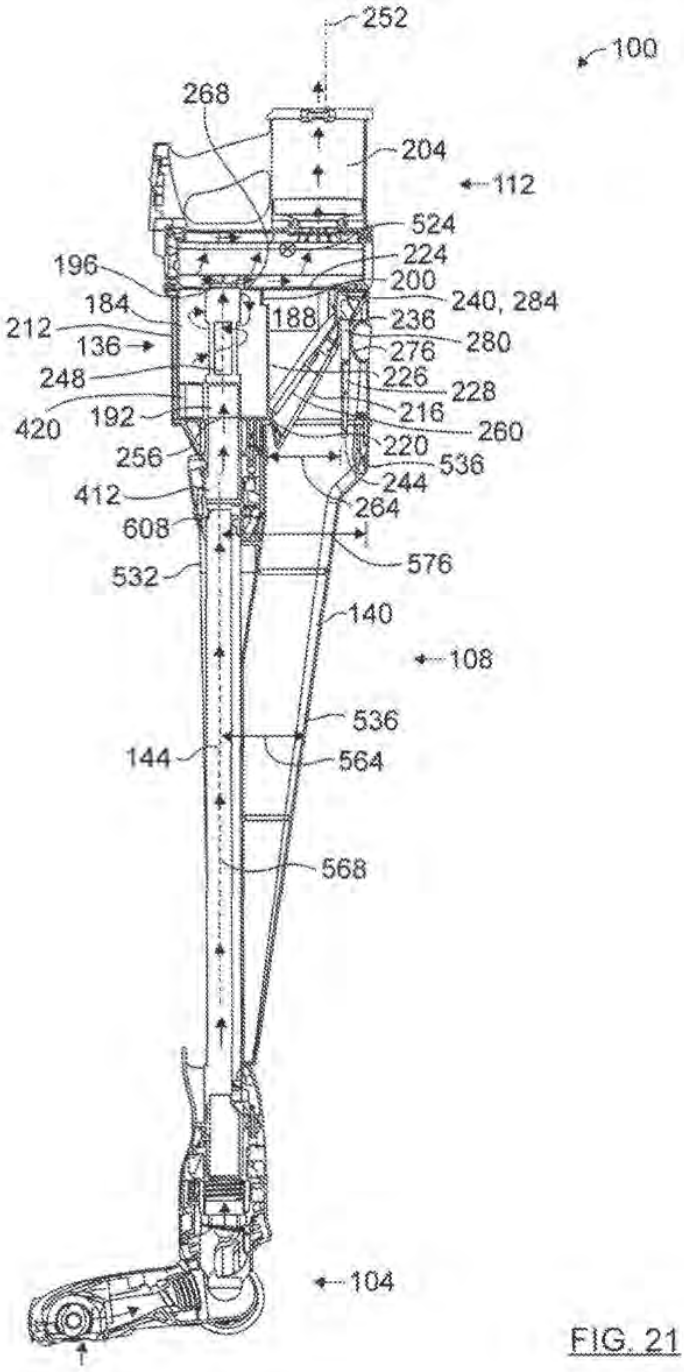

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FIG. 21

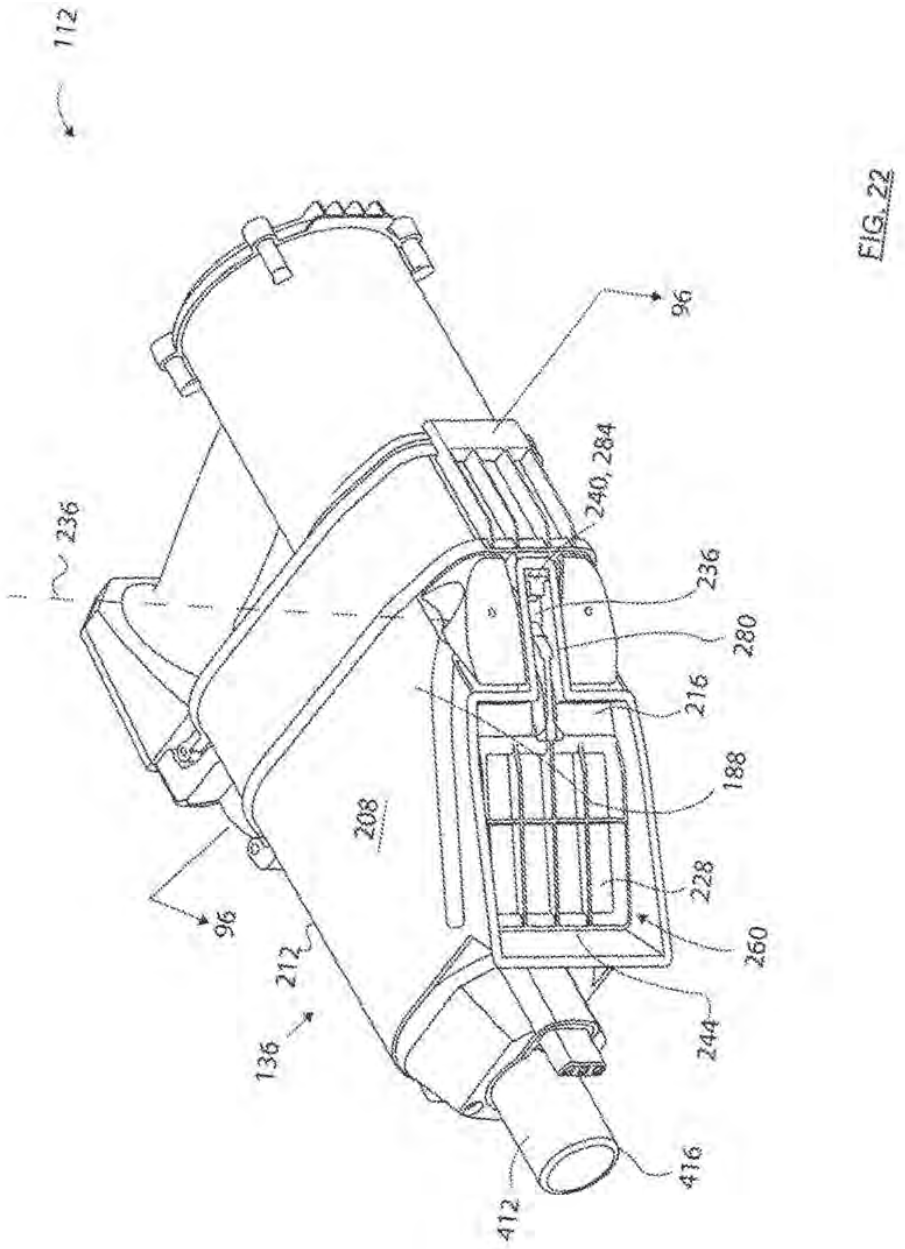

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FIG. 22

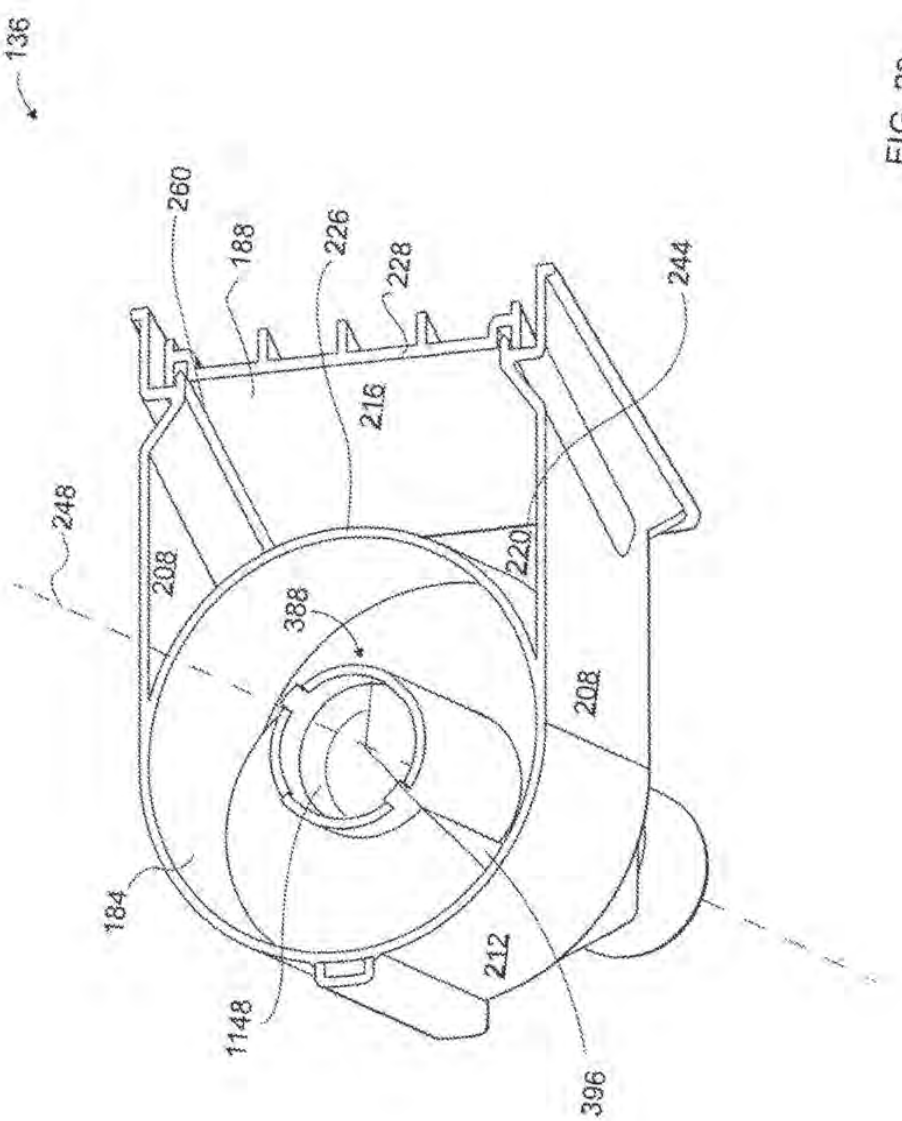


FIG. 23

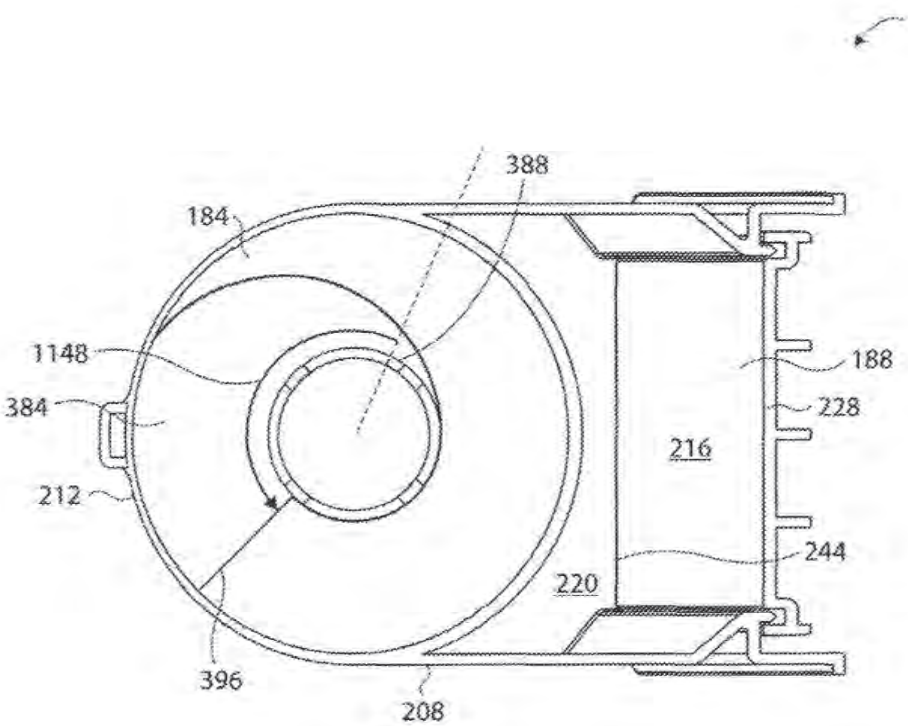


FIG. 23a

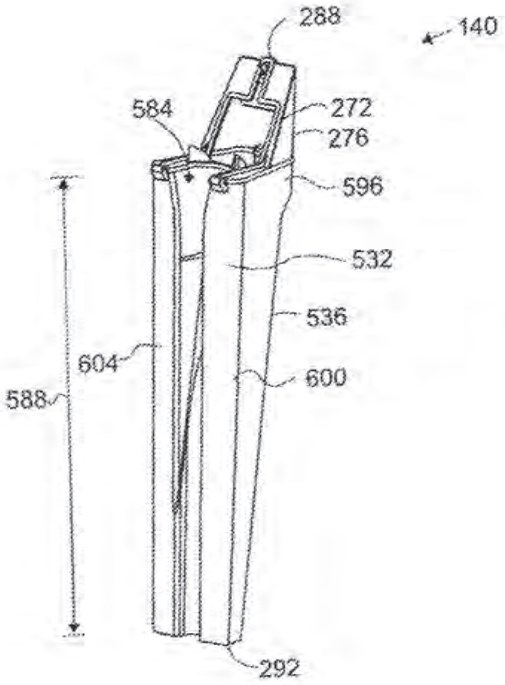


FIG. 24

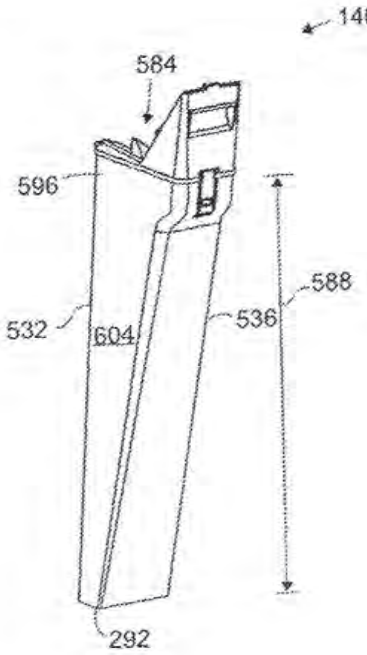


FIG. 45

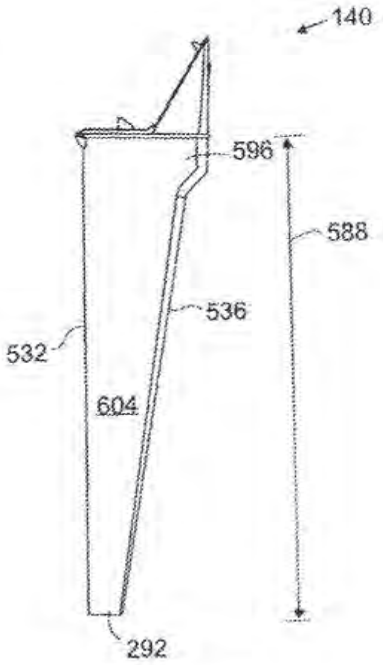


FIG. 46

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Page 134

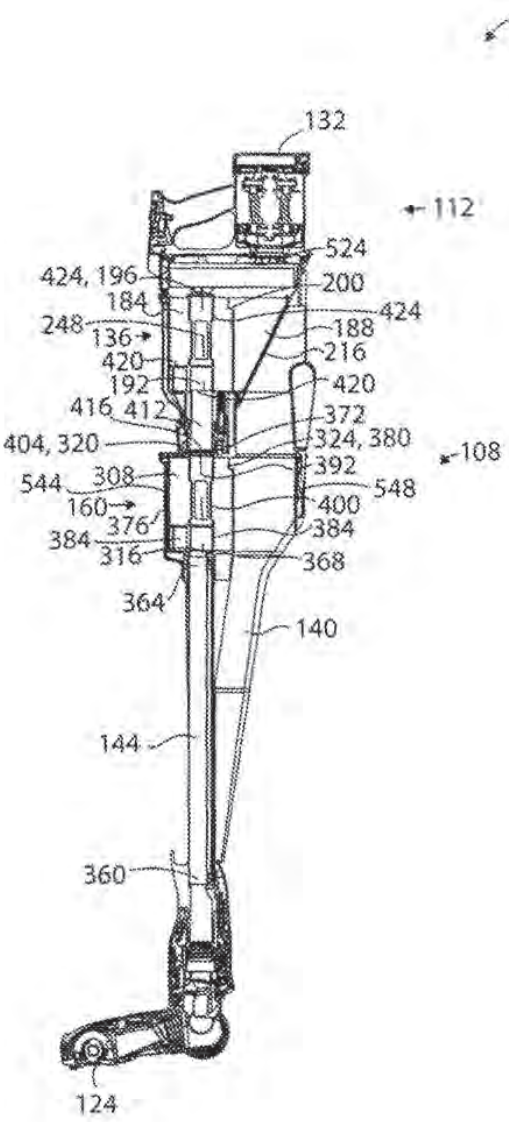

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FIG. 25

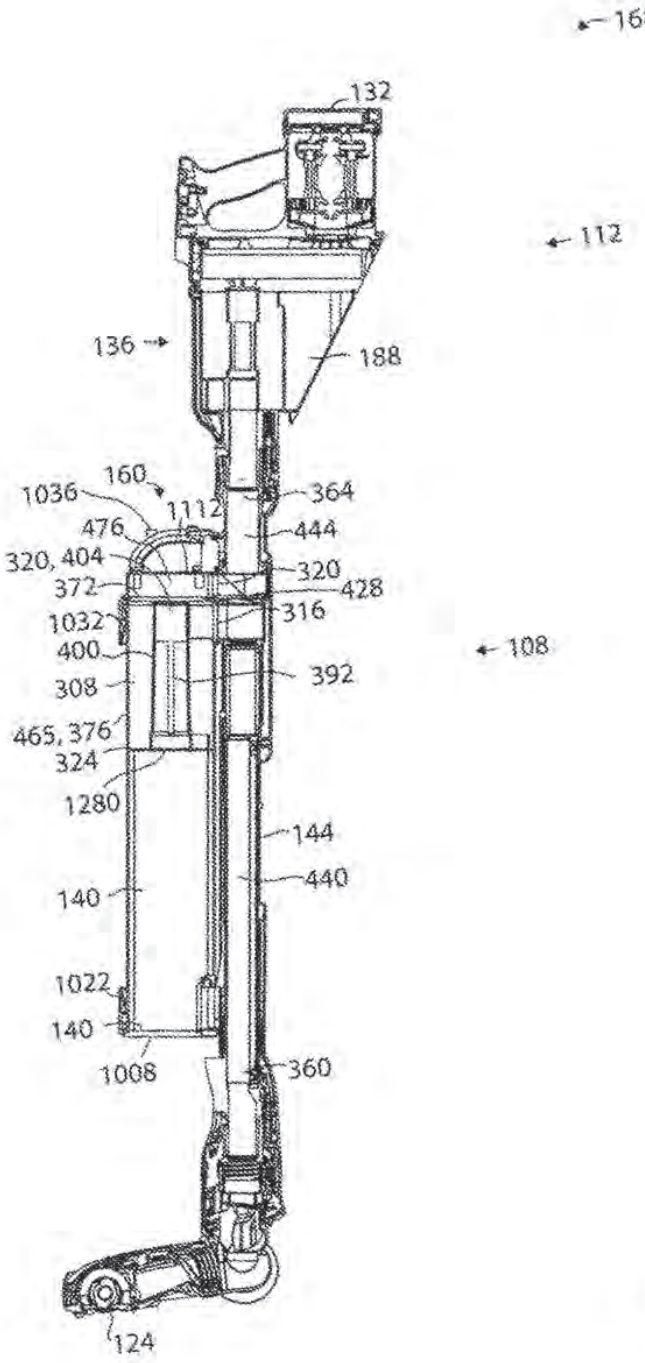

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FIG. 26

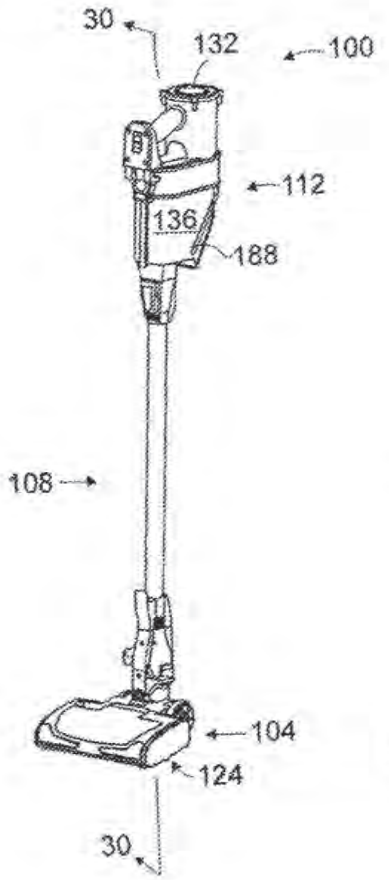


FIG. 27

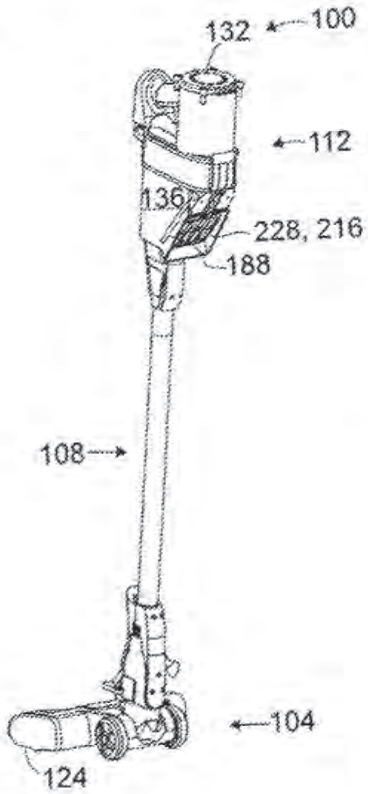


FIG. 28

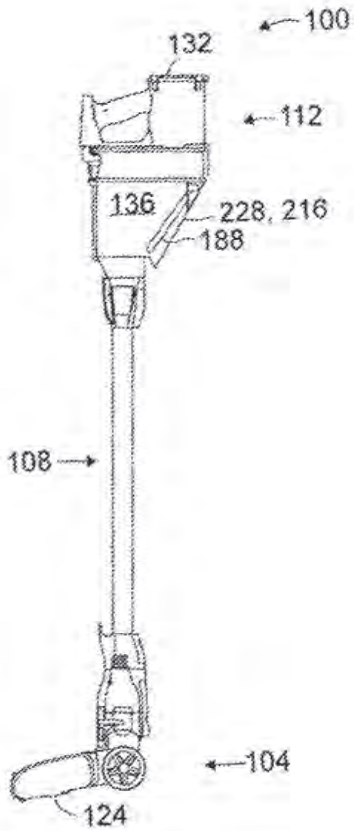


FIG. 29

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FIG. 30

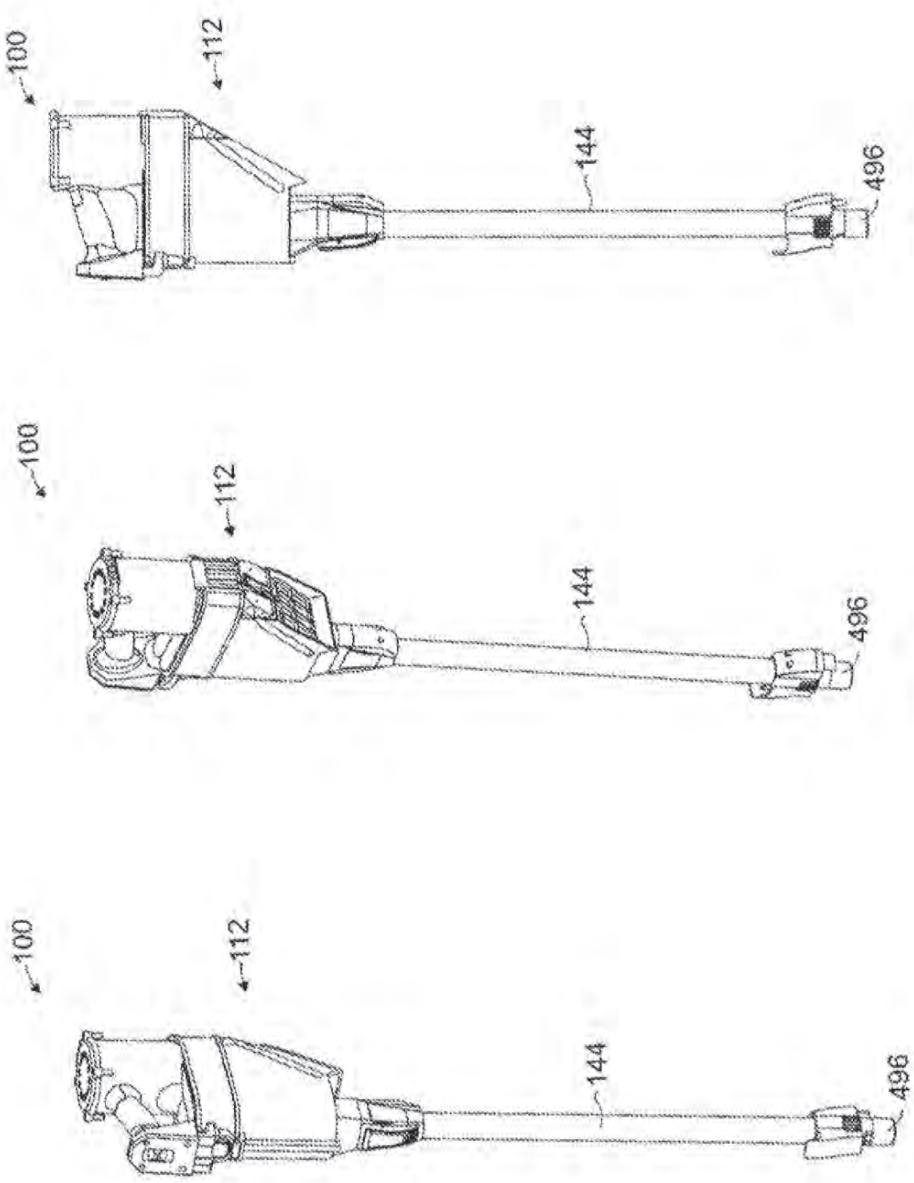


FIG_31

FIG_32

FIG_33

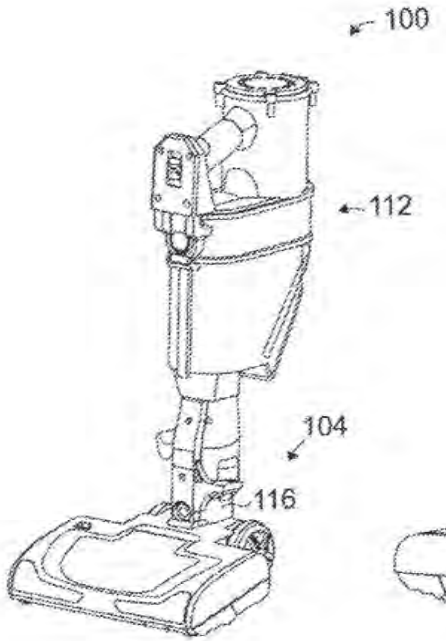


FIG. 34

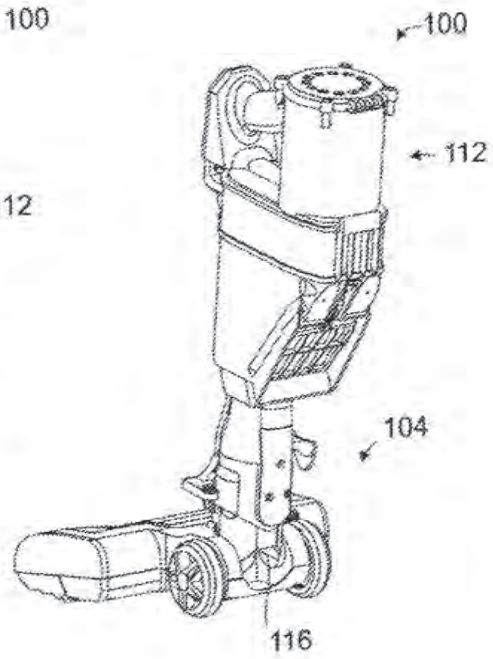


FIG. 35

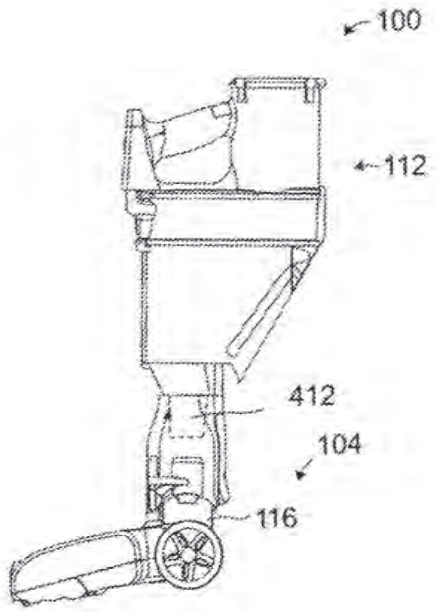


FIG. 36

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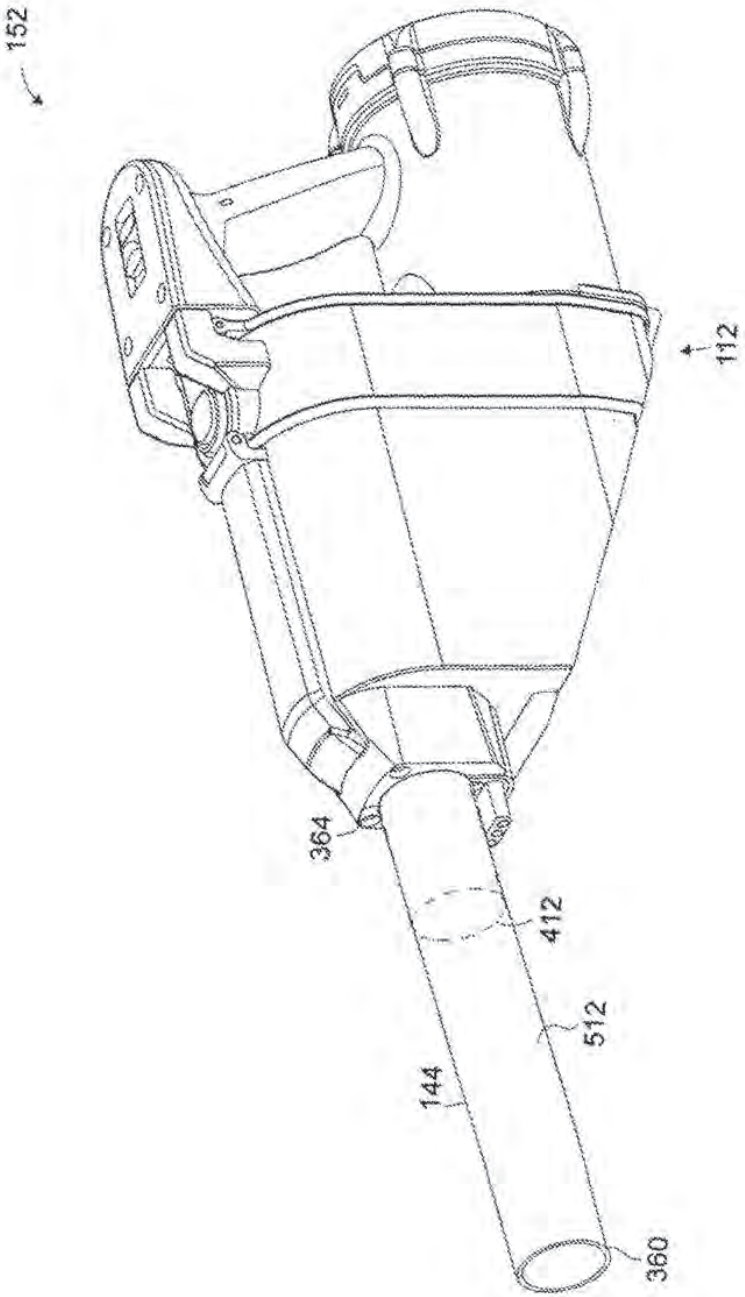


FIG. 36a

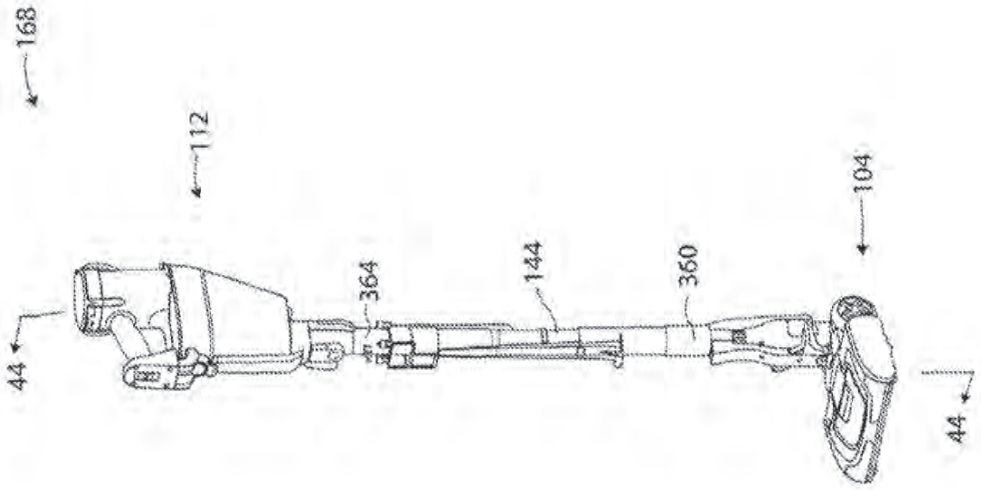


FIG. 37

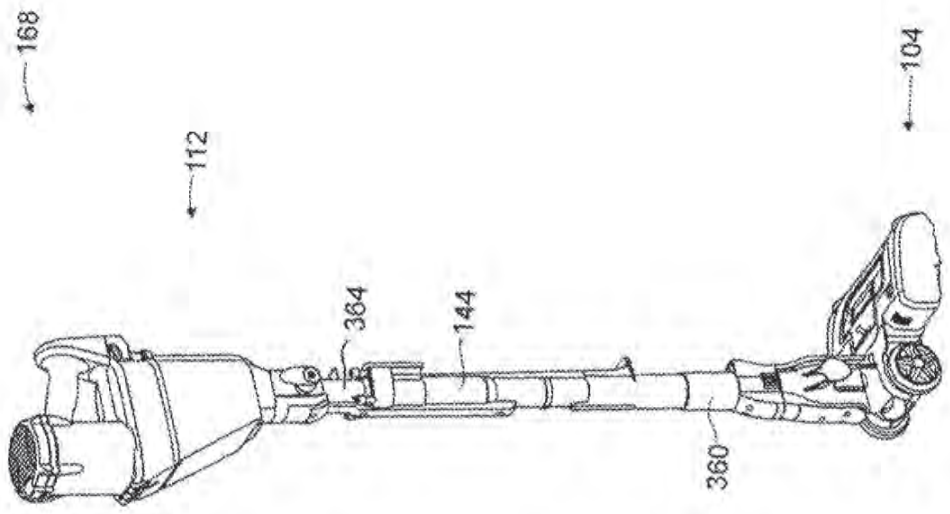


FIG. 38

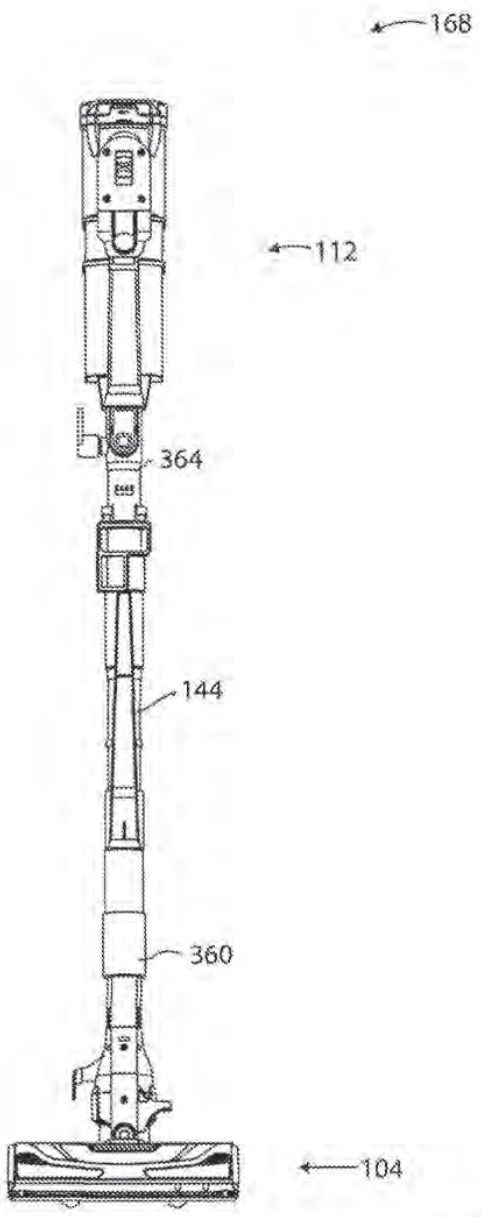


FIG. 39

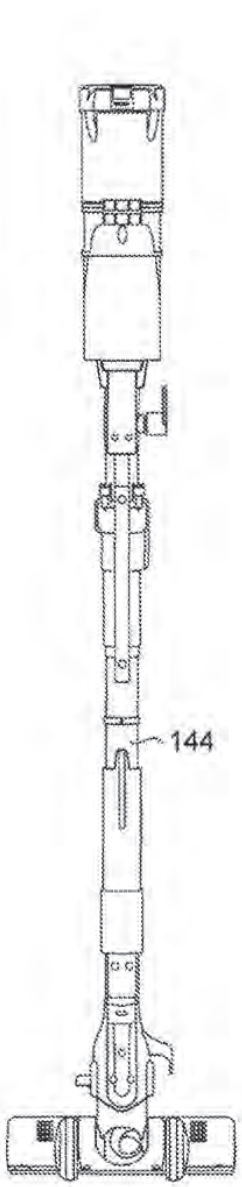


FIG. 40

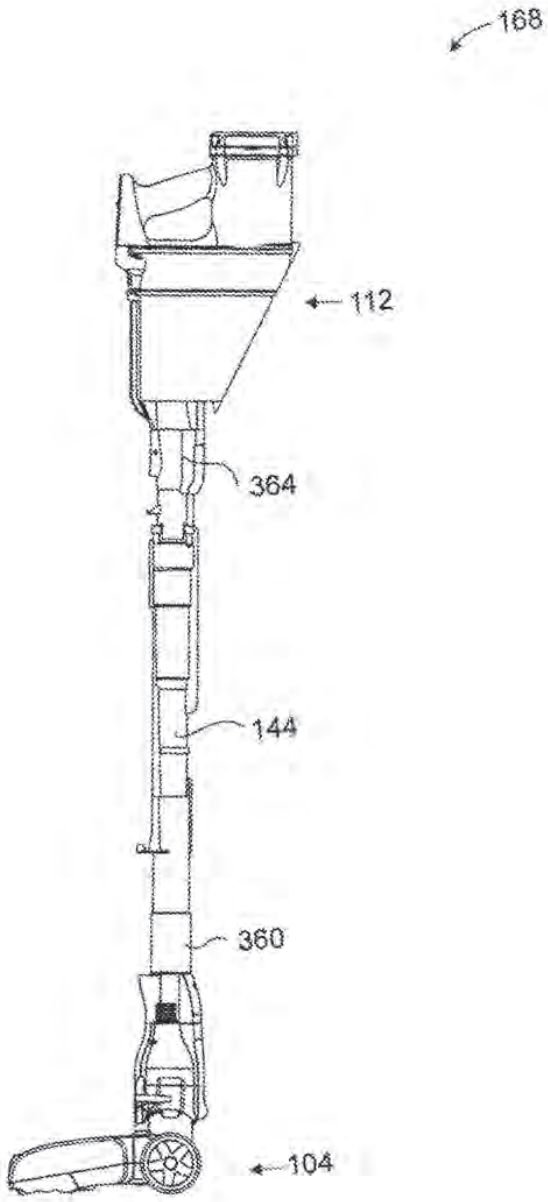


FIG. 41

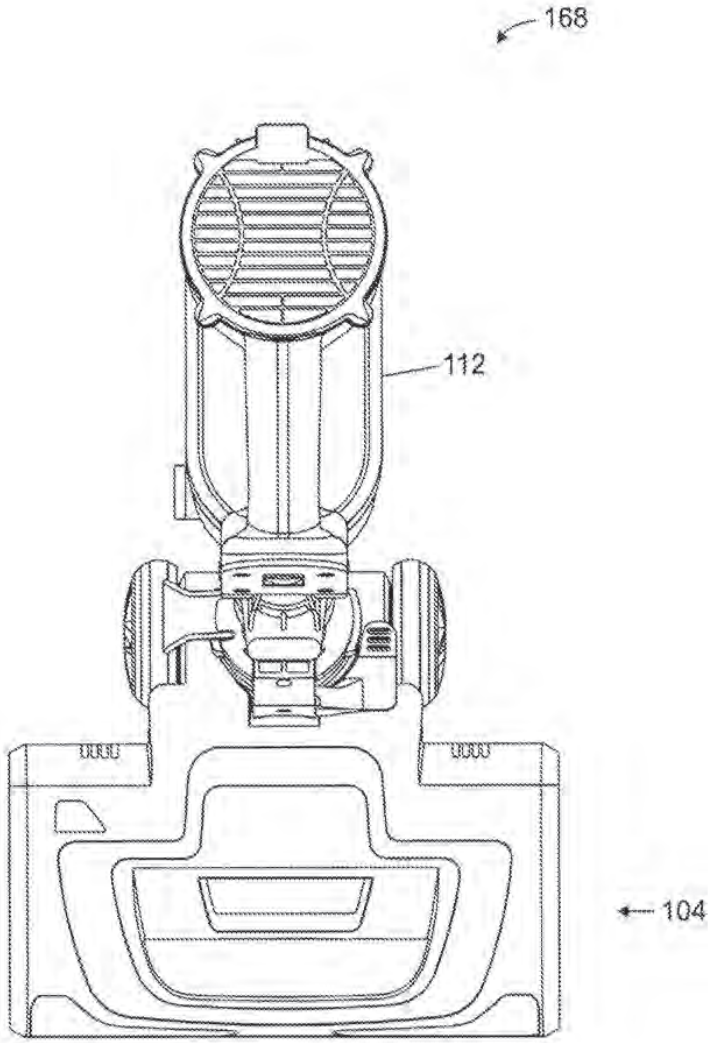


FIG. 42

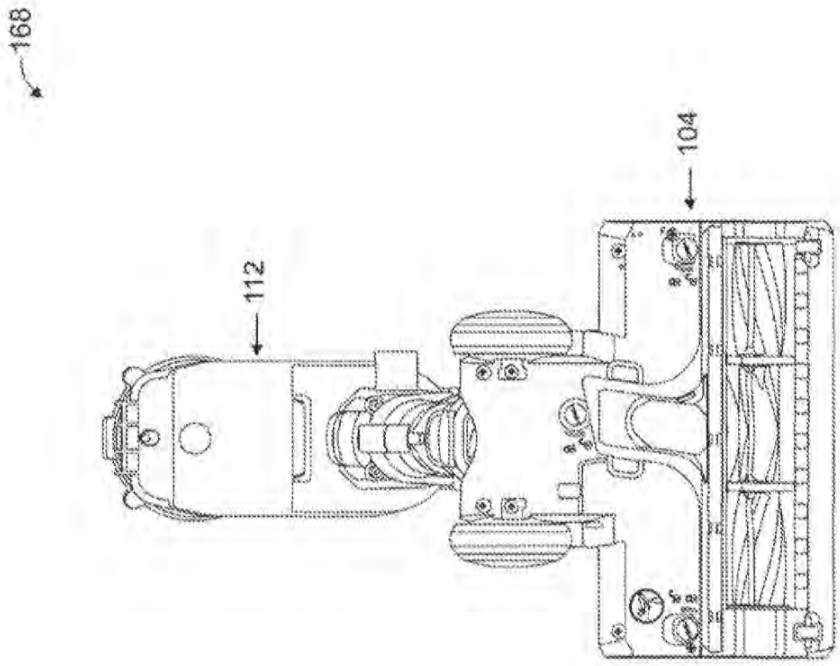


FIG. 43

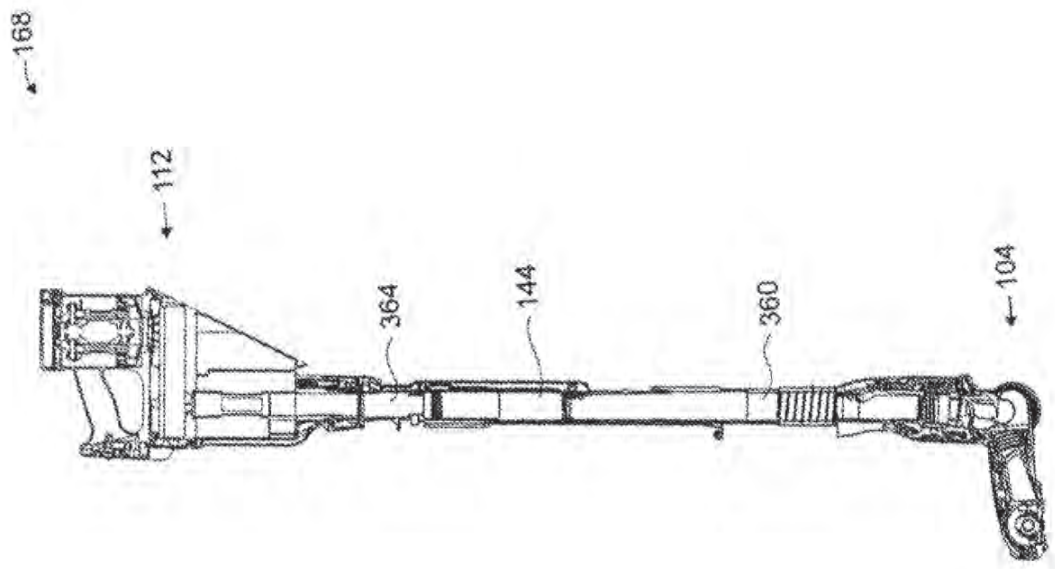


FIG. 44

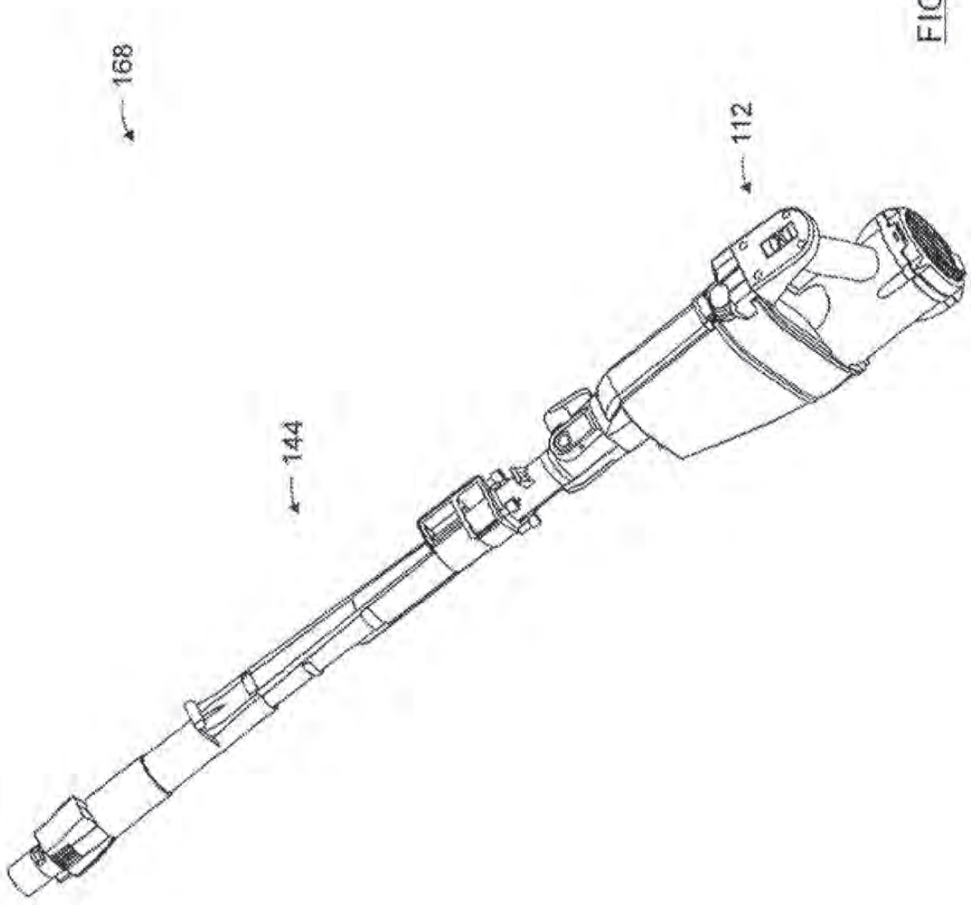


FIG. 44a

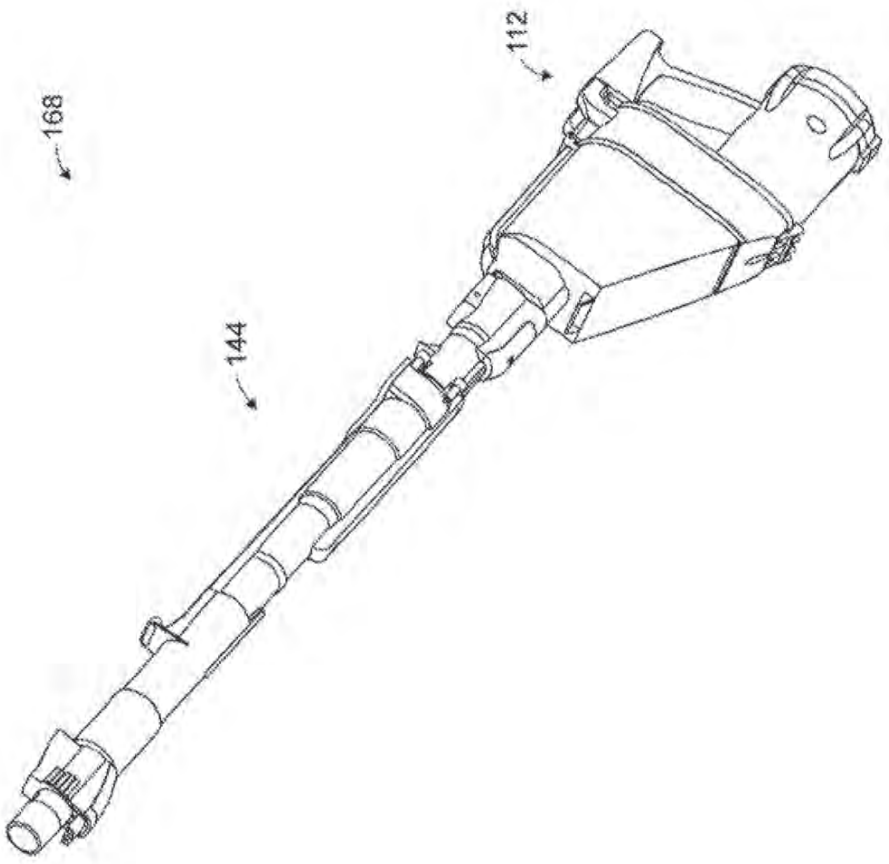


FIG. 44b

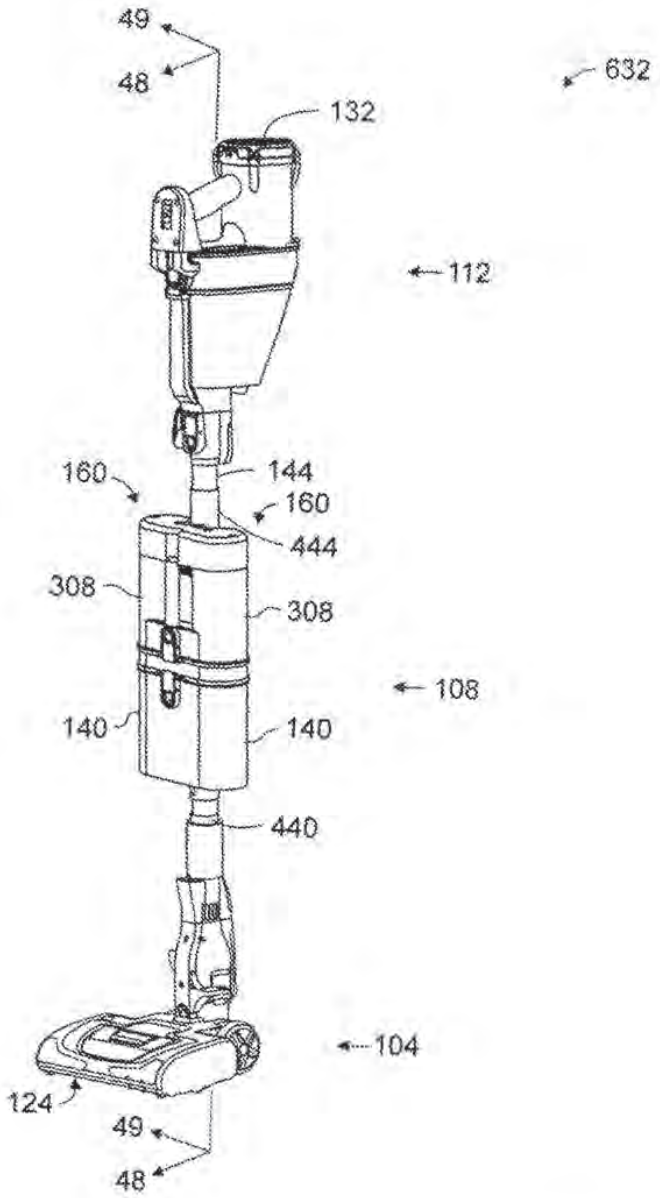

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FIG. 47

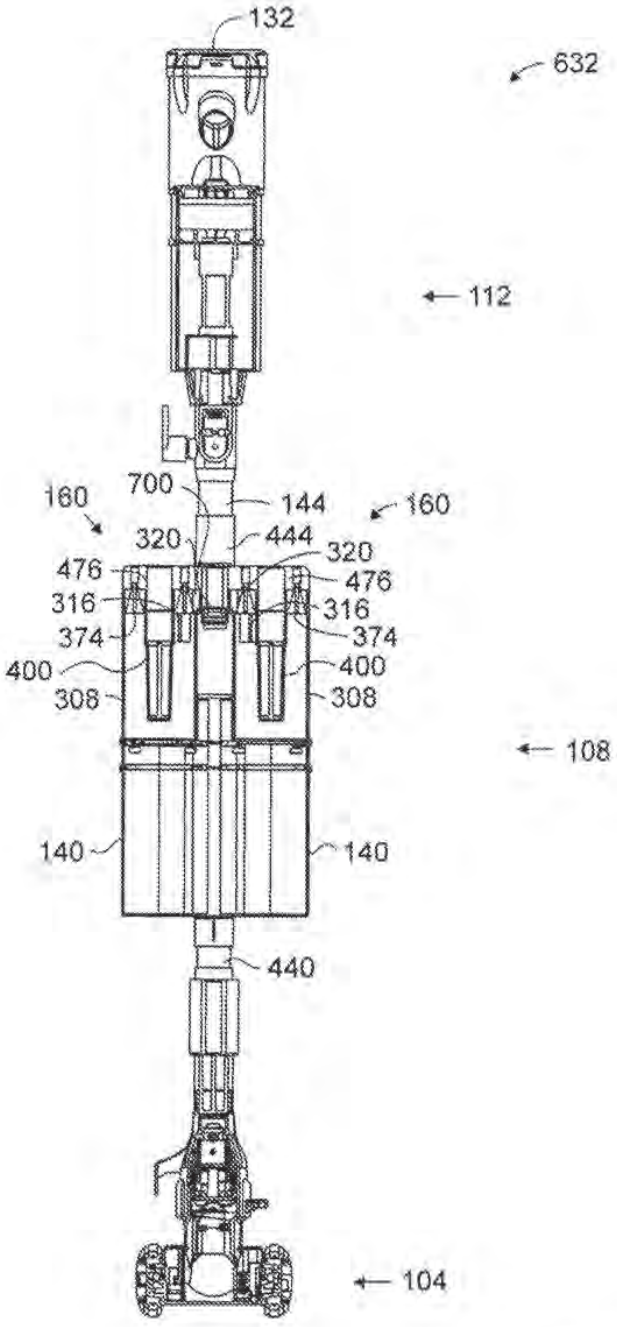

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FIG. 48

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FIG. 49

FIG. 50

FIG. 51

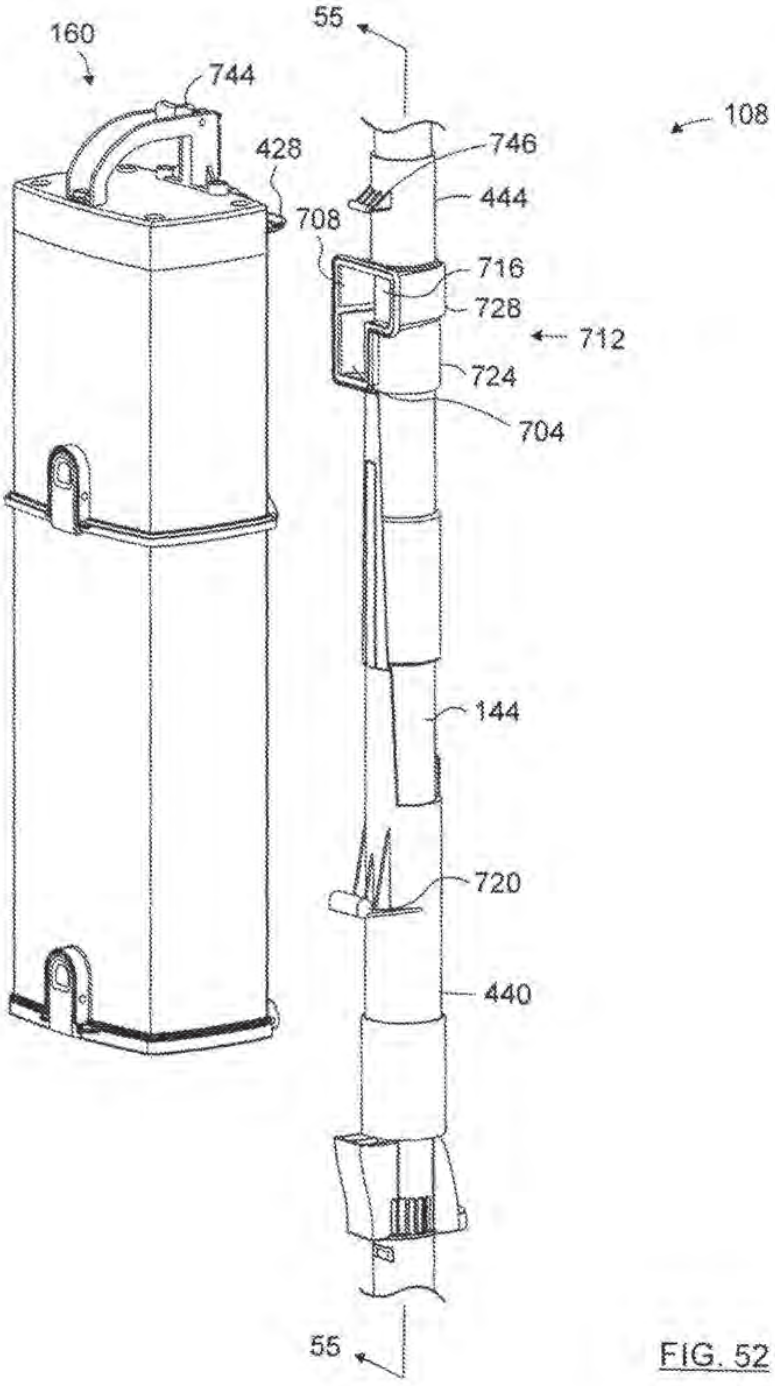


FIG. 52

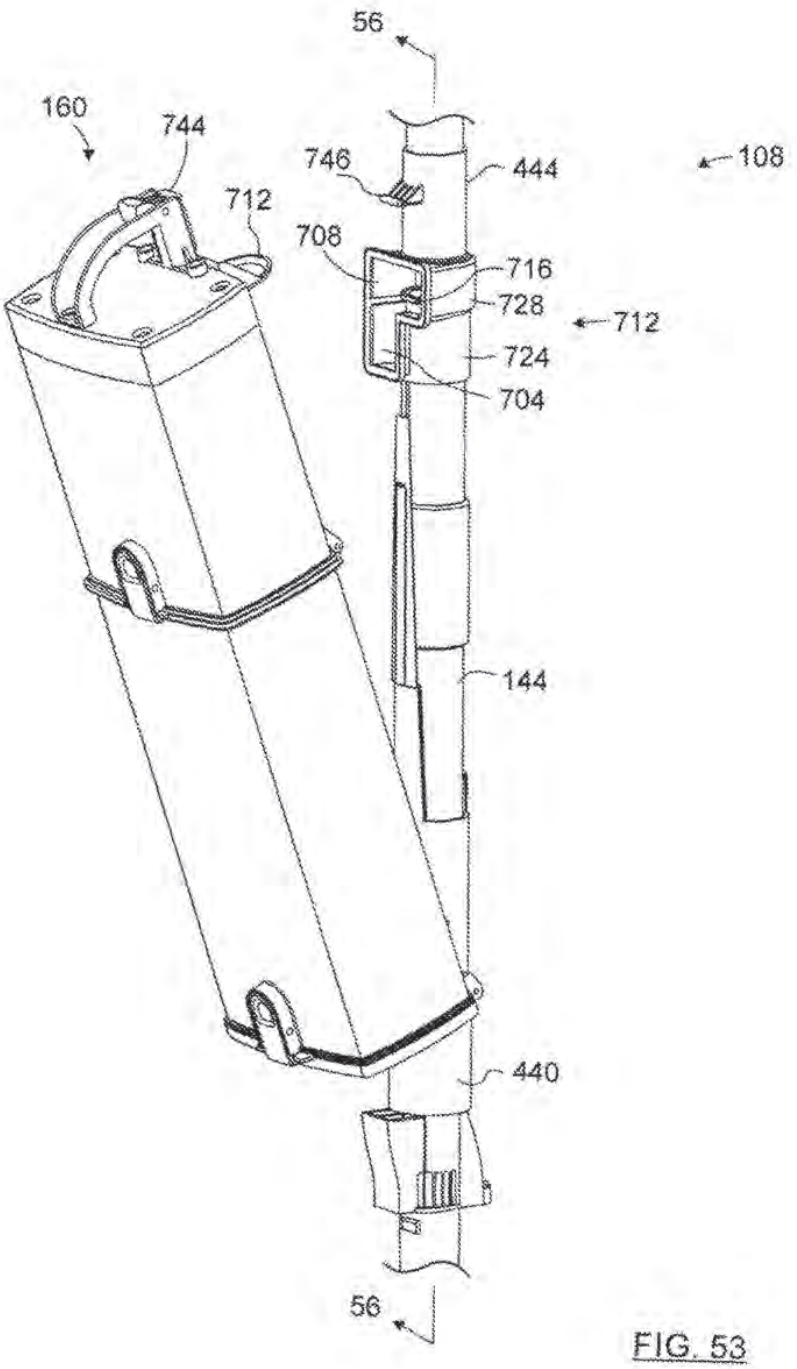


FIG. 53

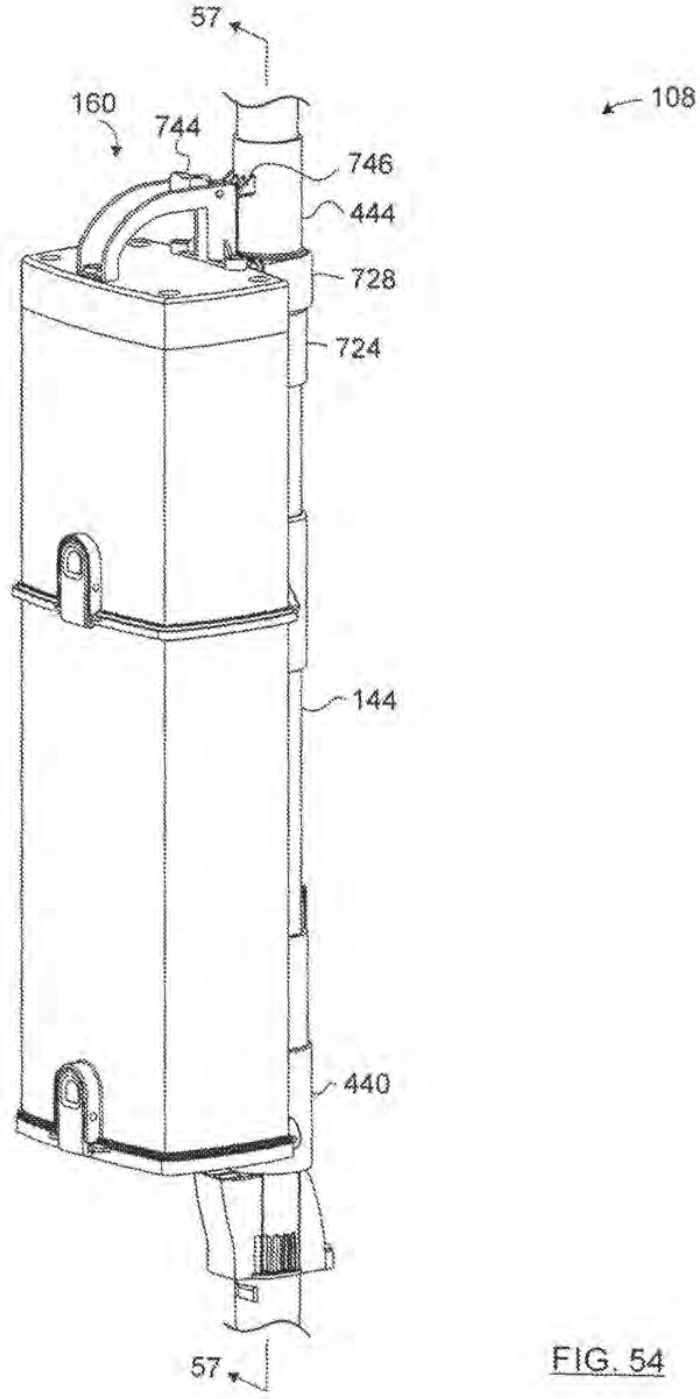


FIG. 54

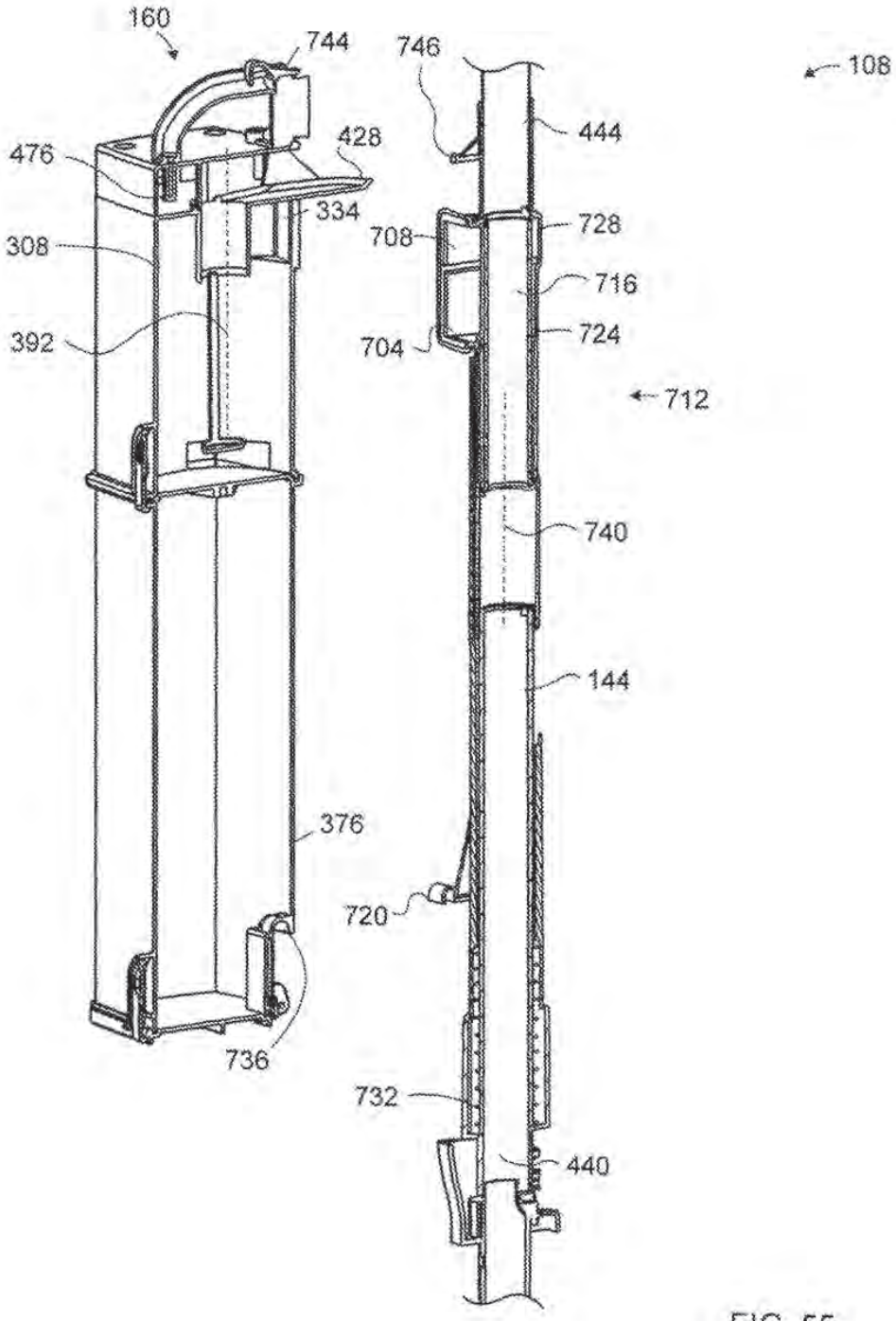

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FIG. 55

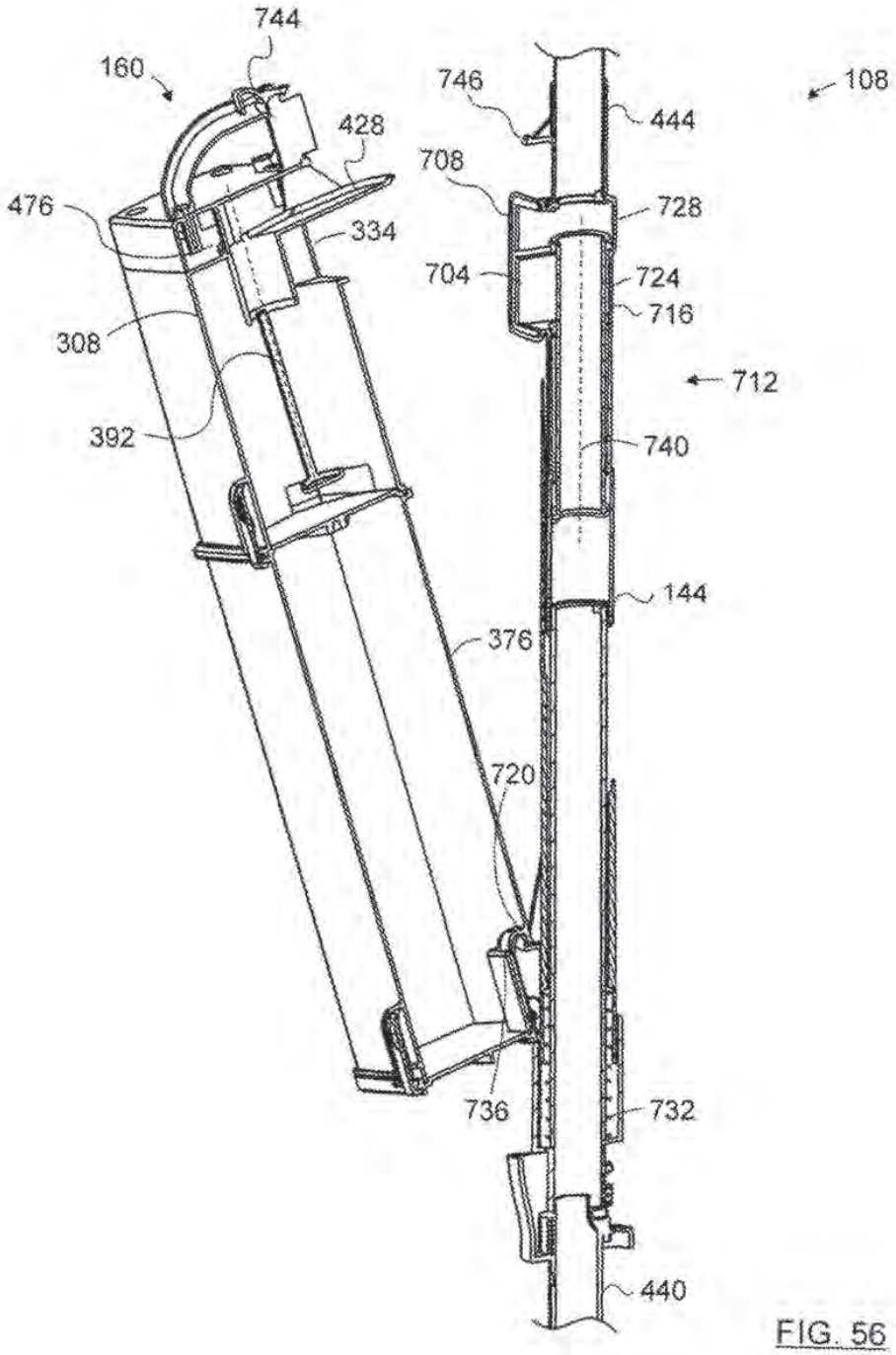

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FIG. 56

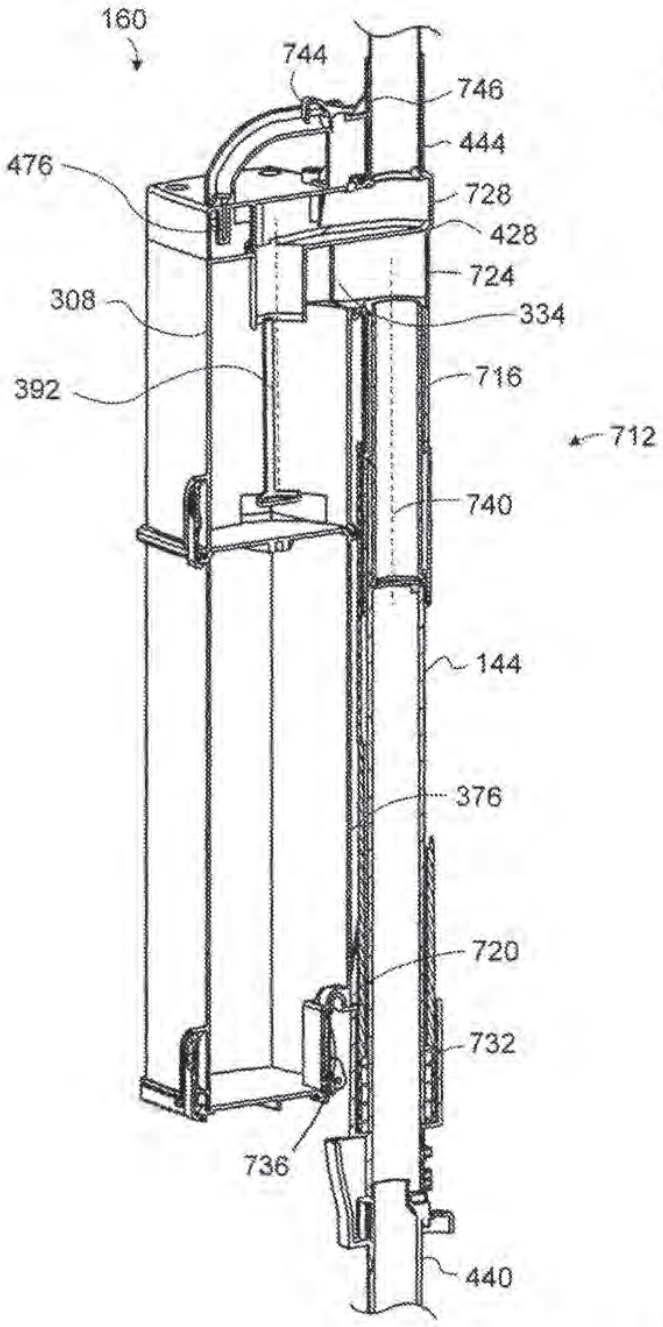

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FIG. 57

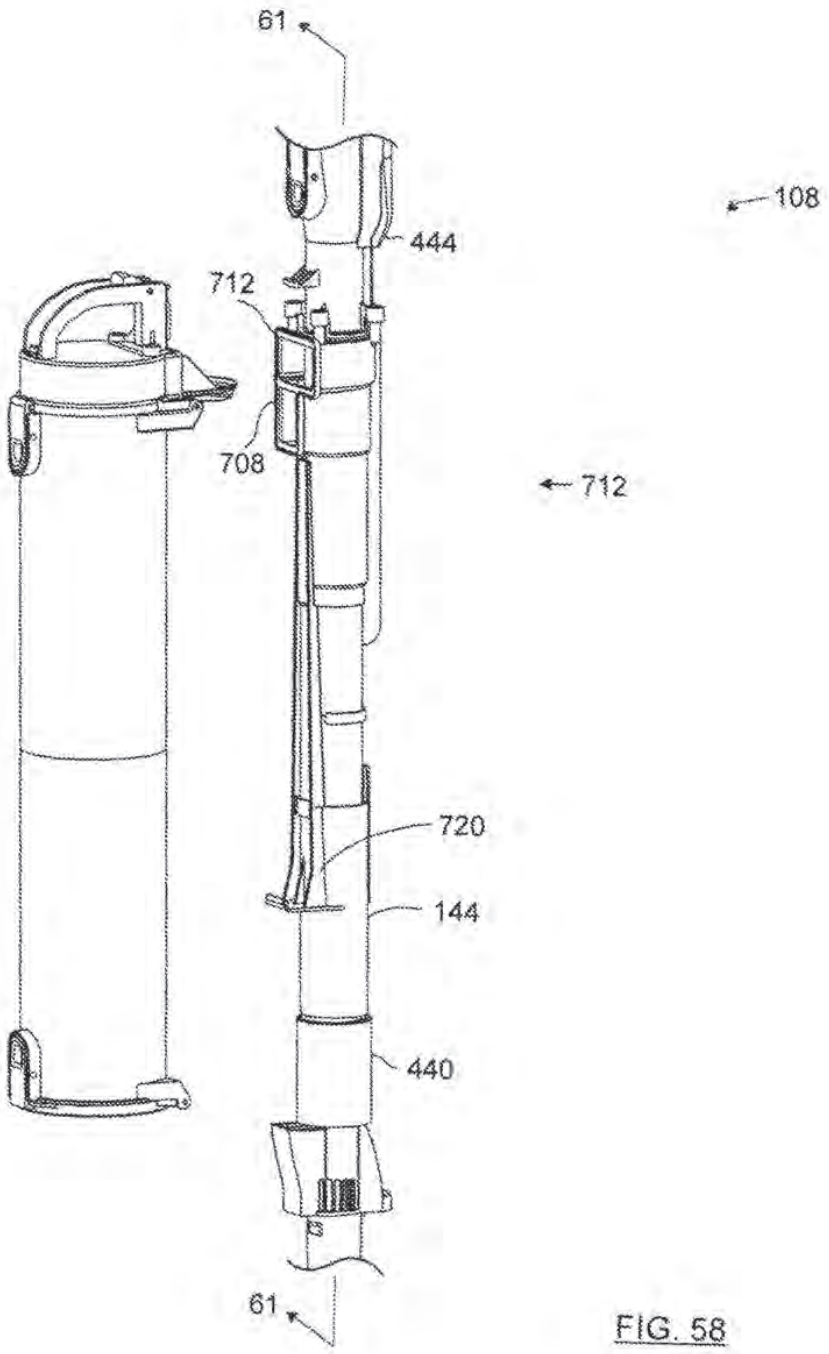


FIG. 58

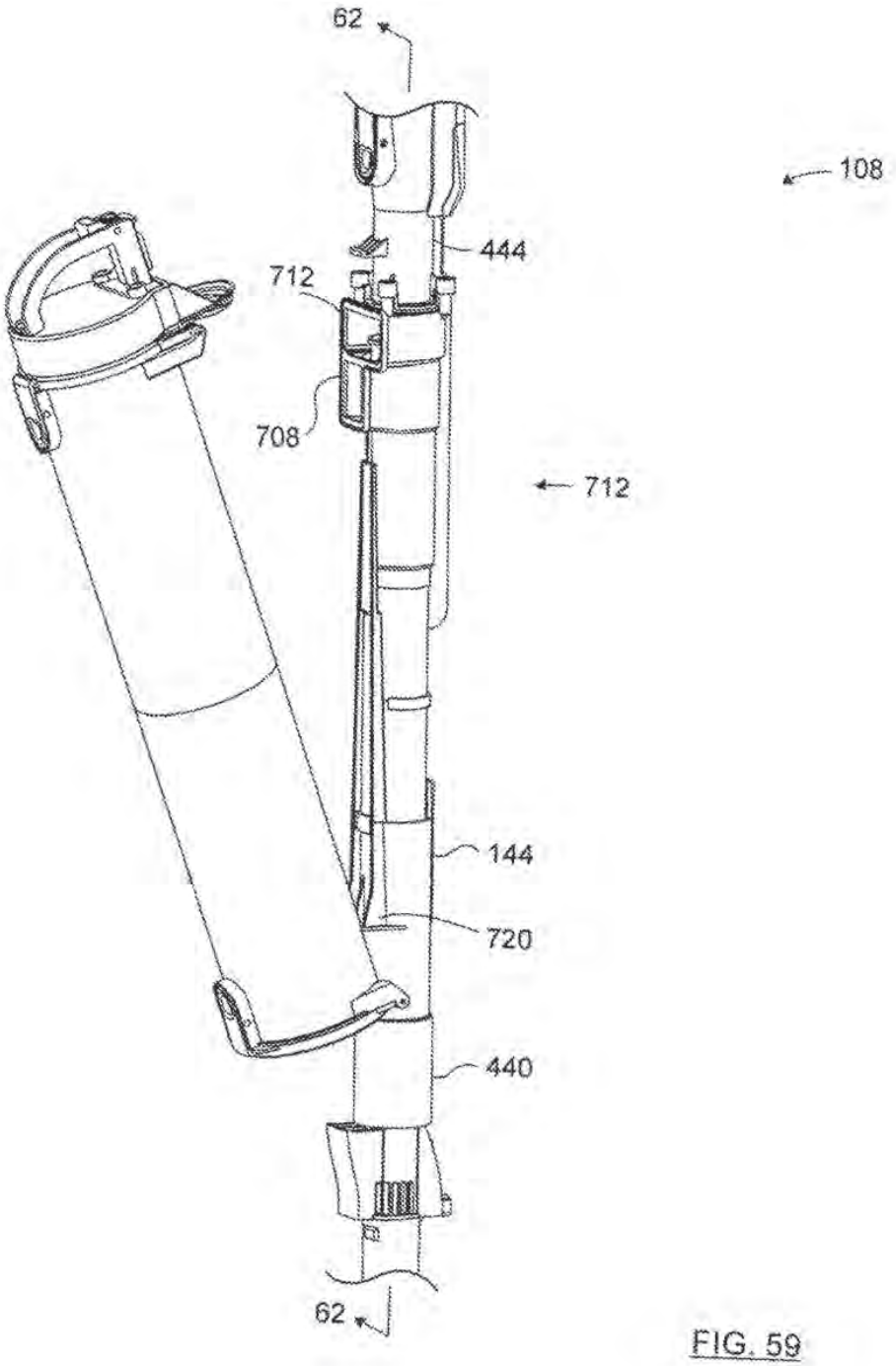


FIG. 59

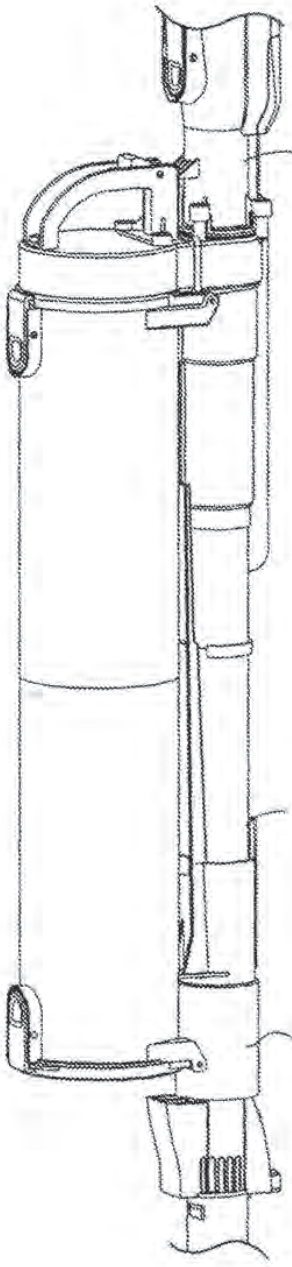


FIG. 60

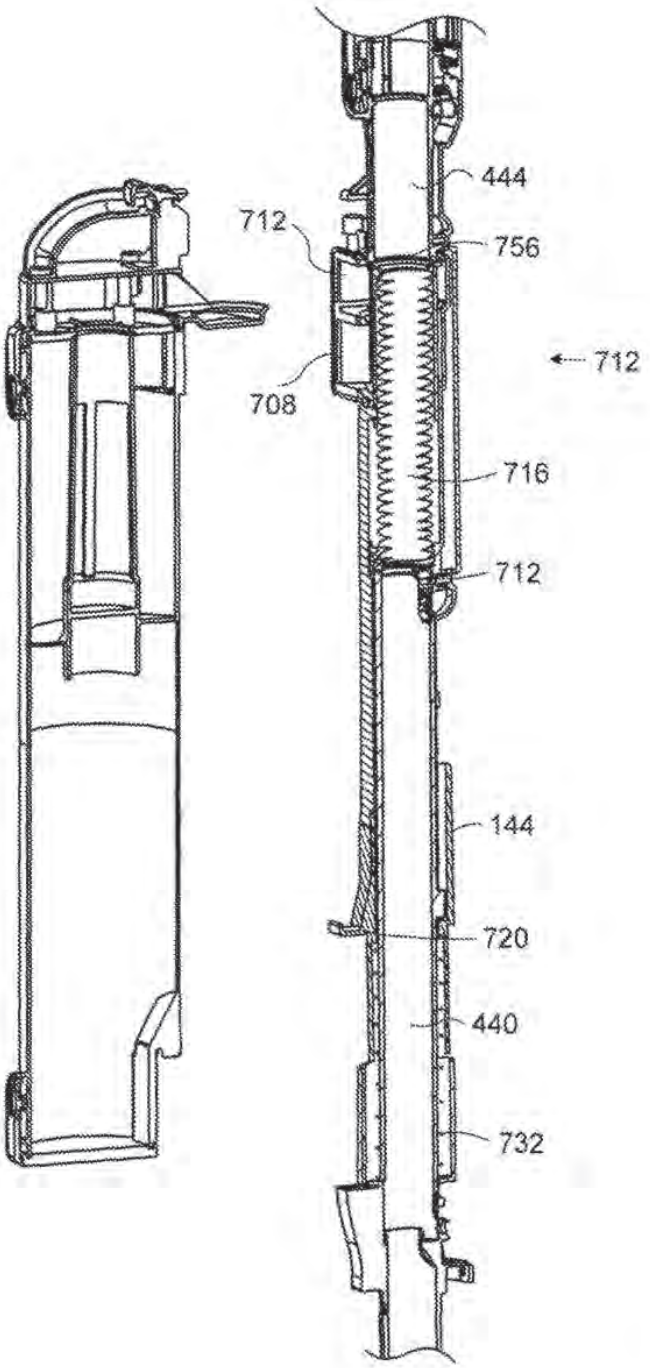


FIG. 61

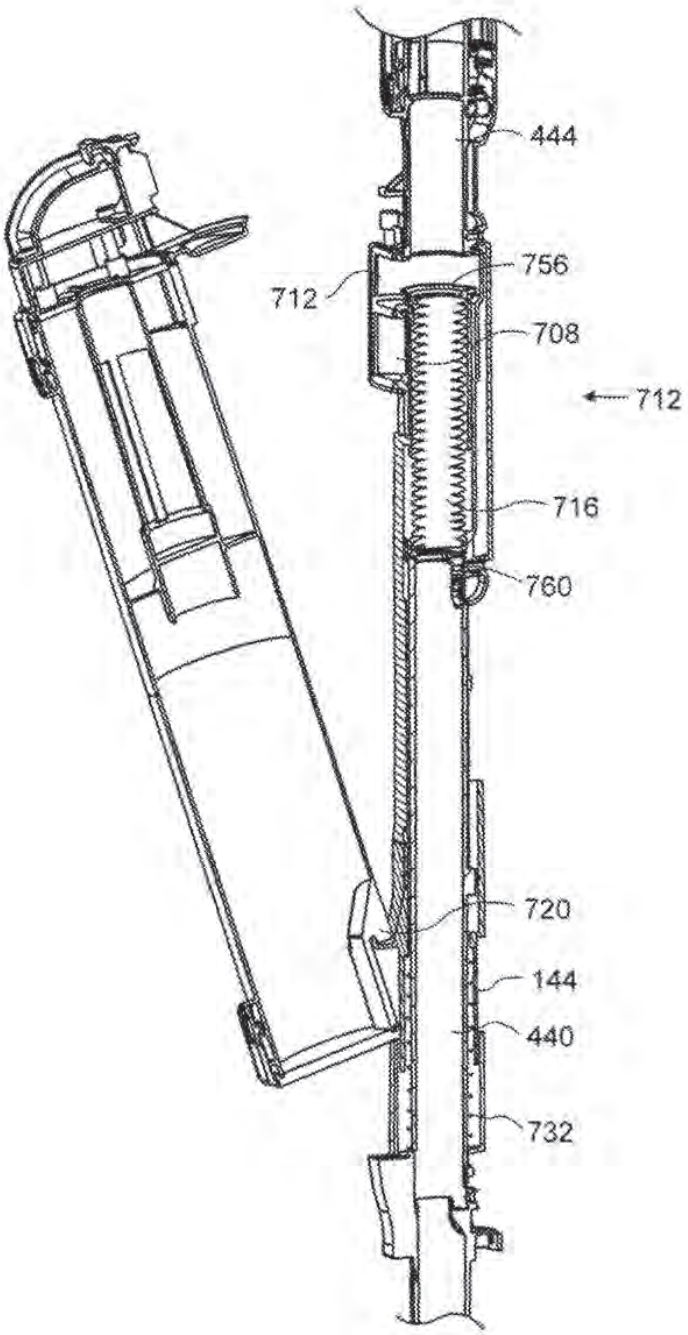


FIG. 62

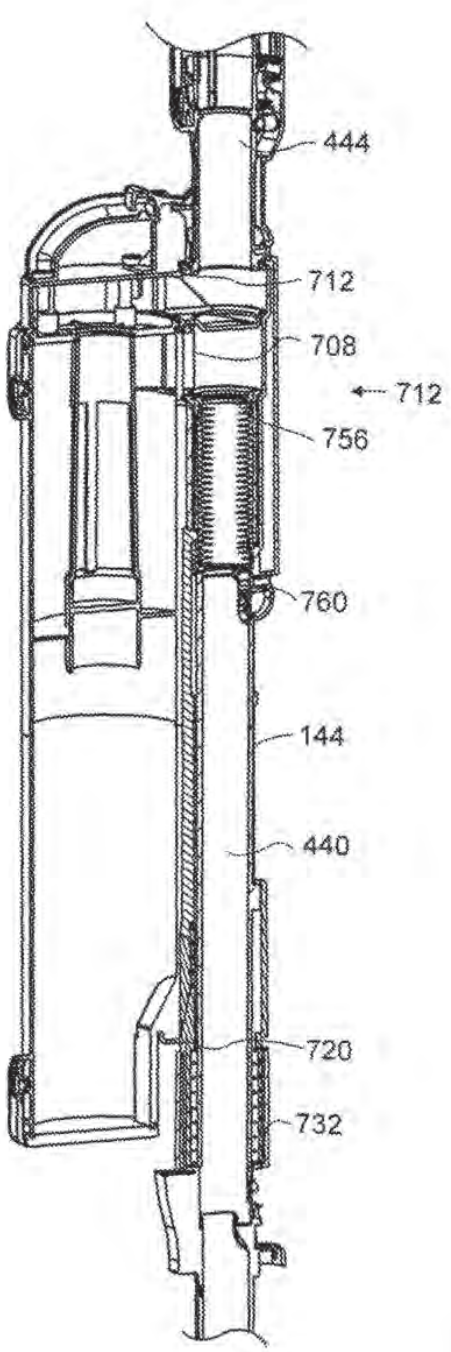


FIG. 63

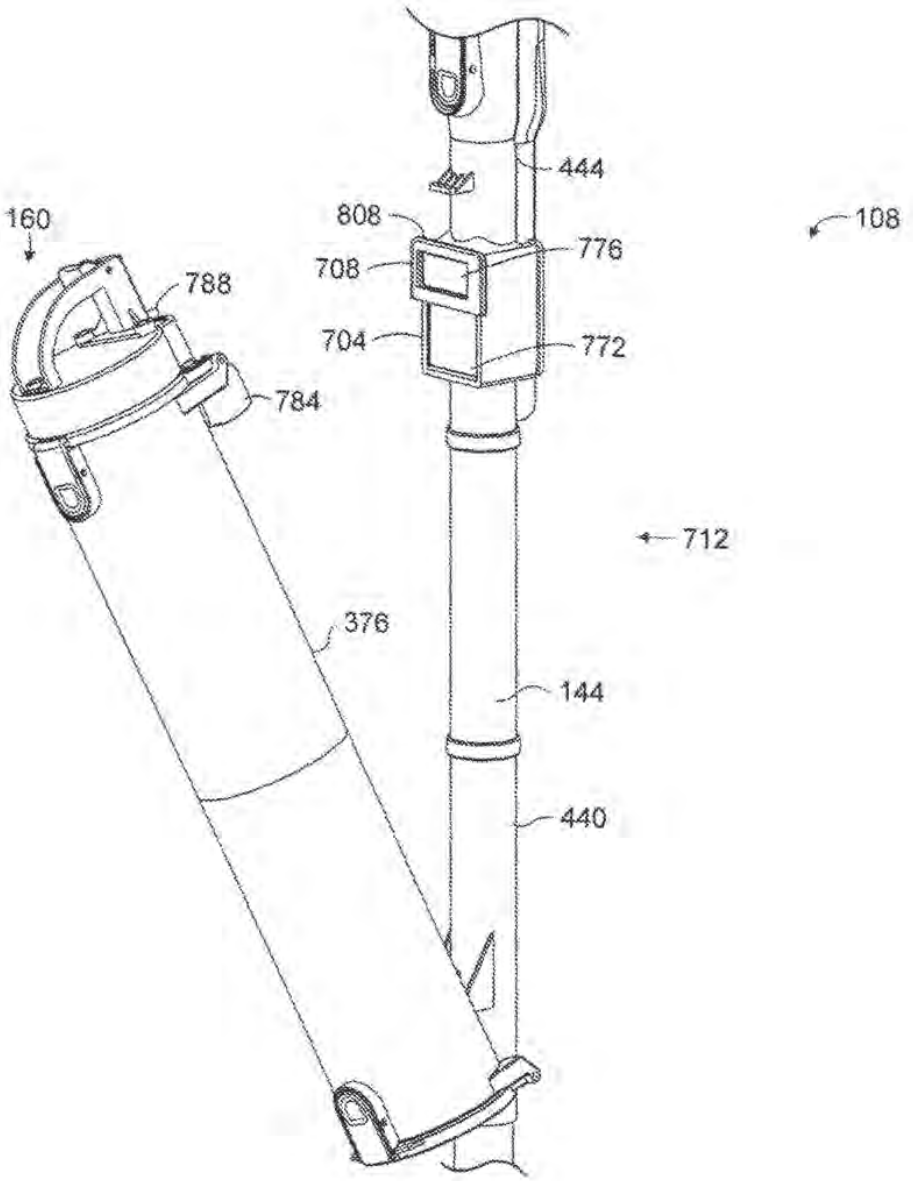


FIG. 64

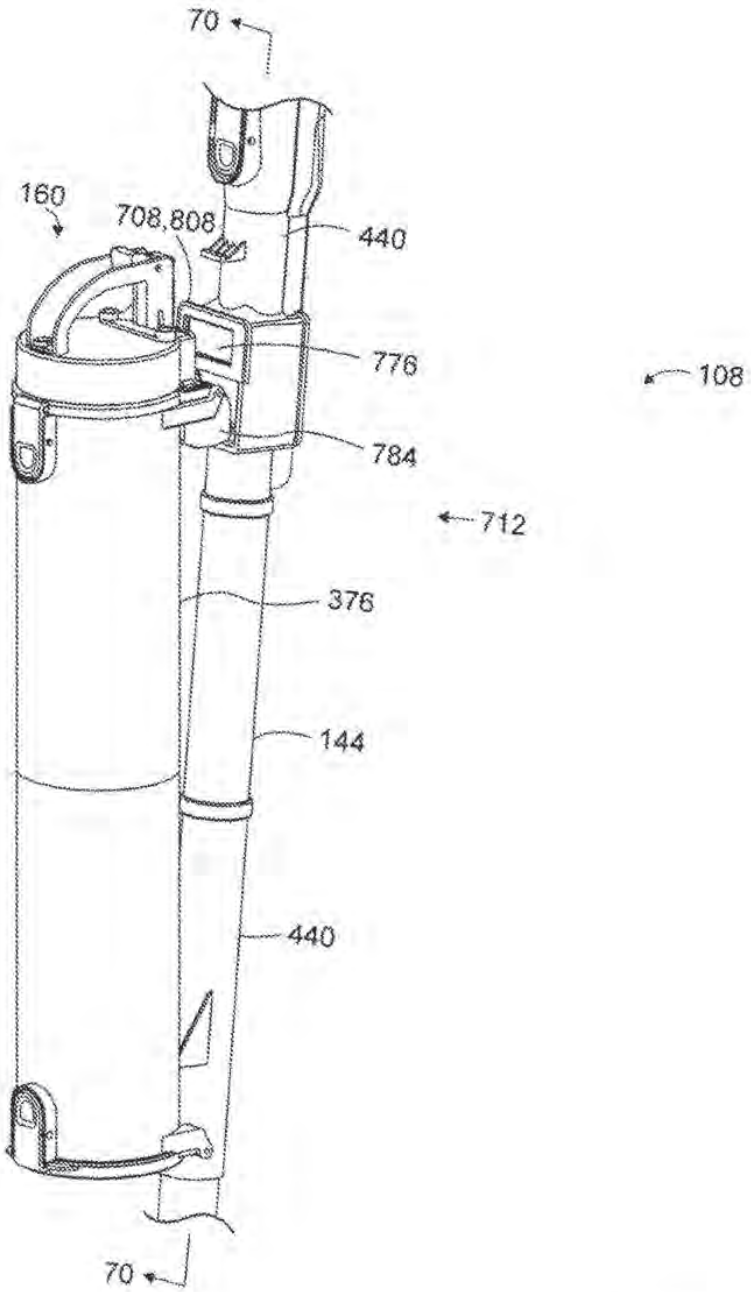


FIG. 65

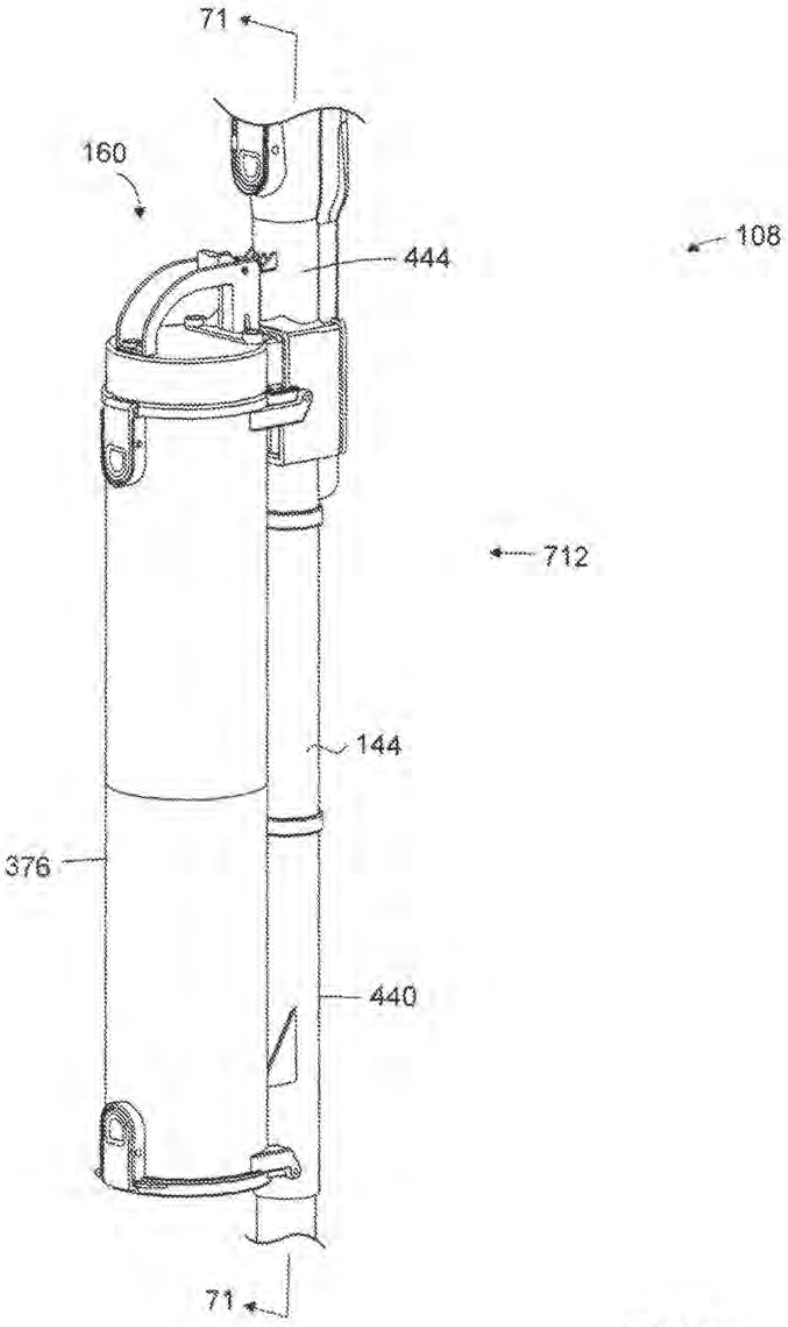


FIG. 66

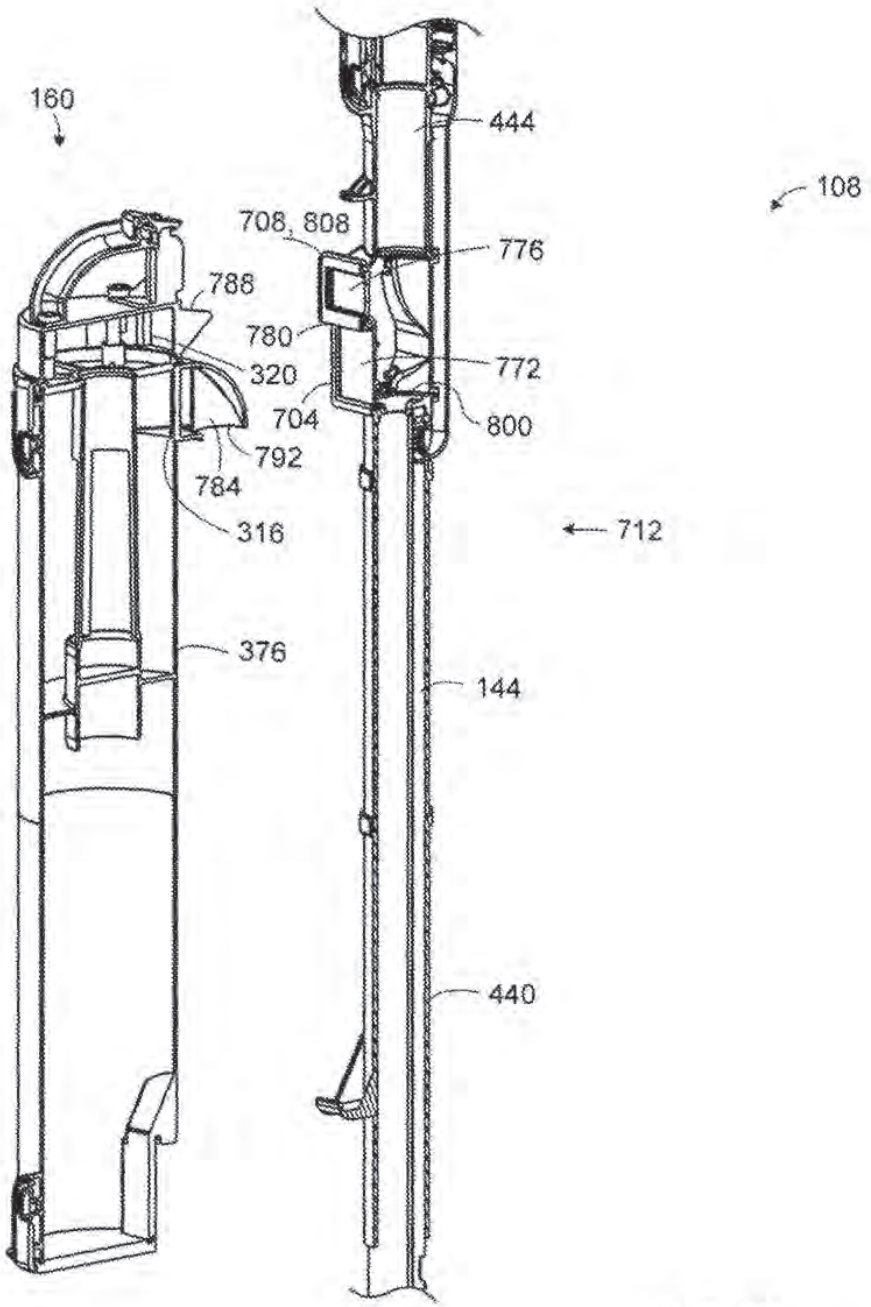

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FIG. 67

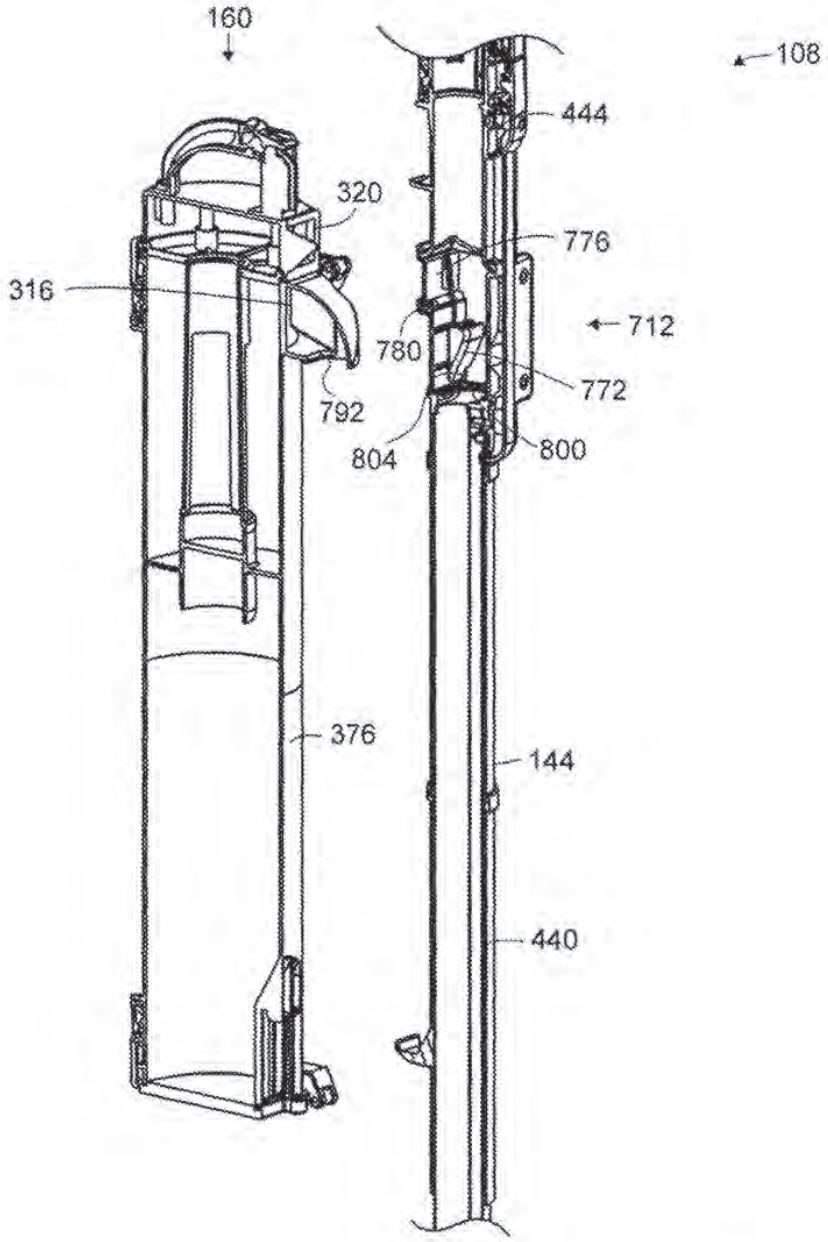


FIG. 68

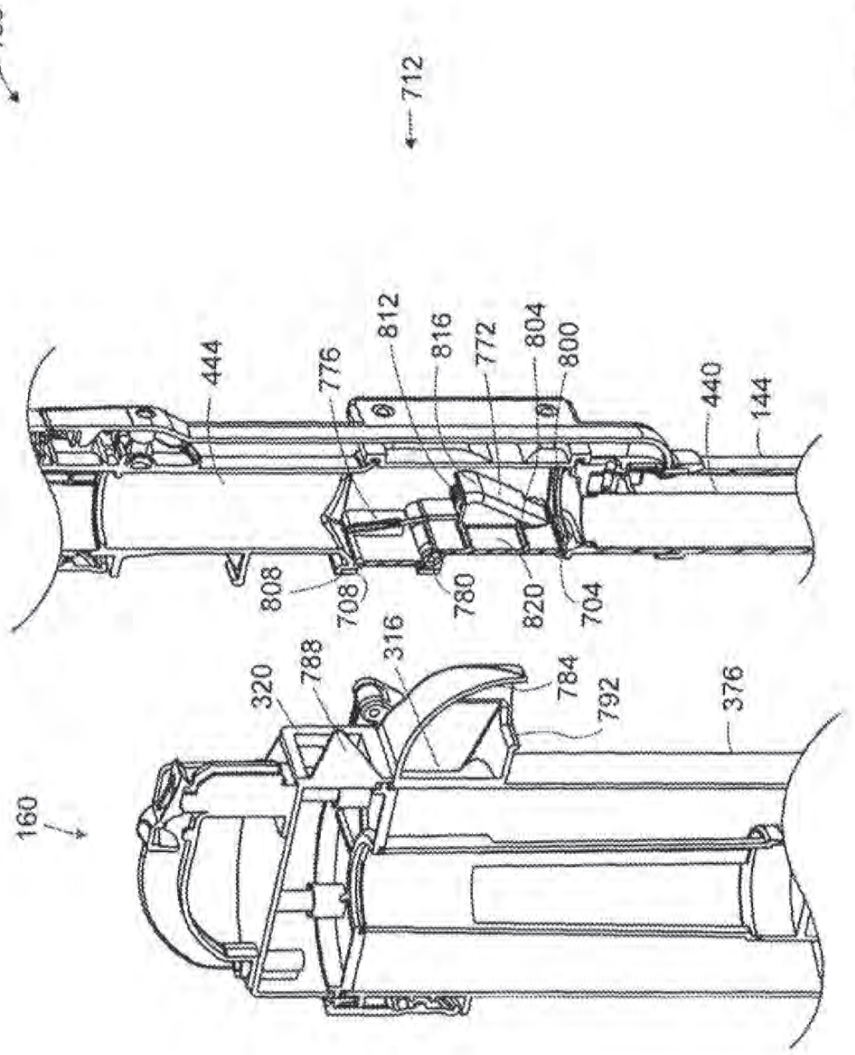

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FIG. 69

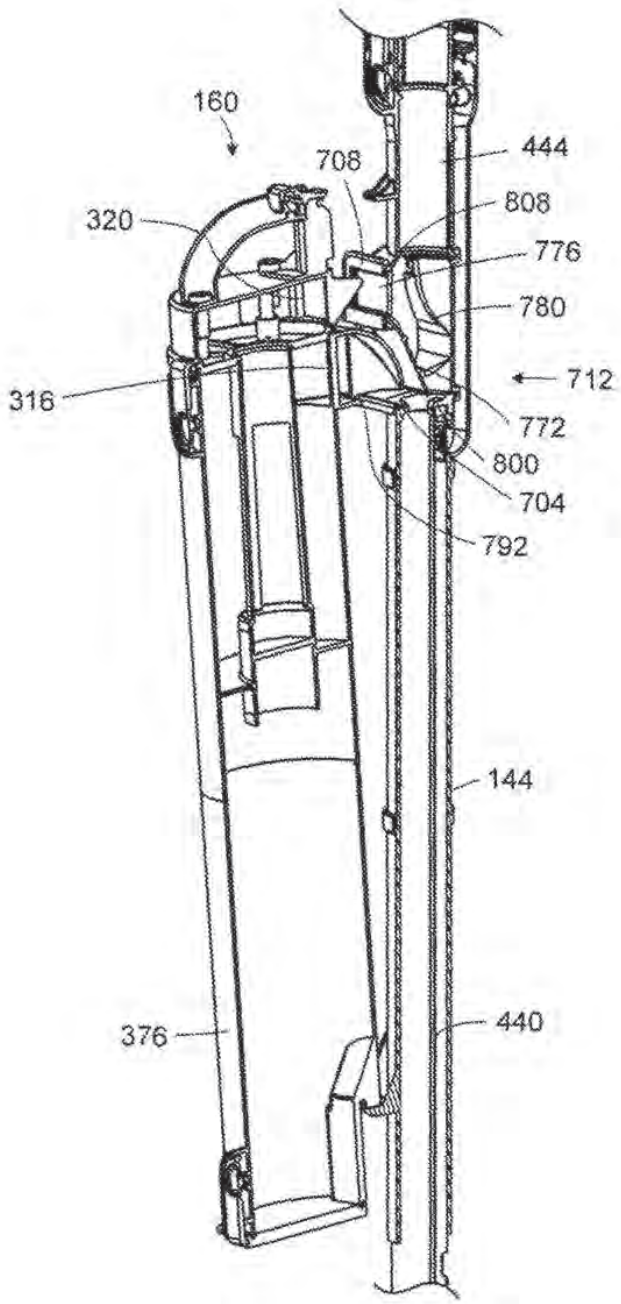

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FIG. 70

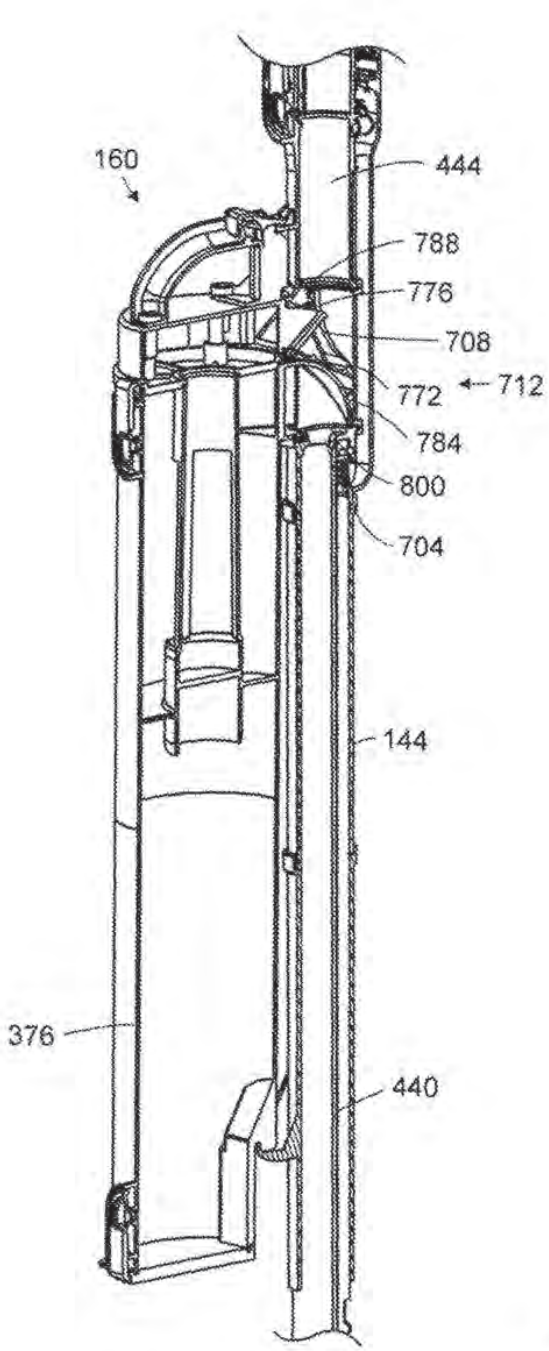


FIG. 71

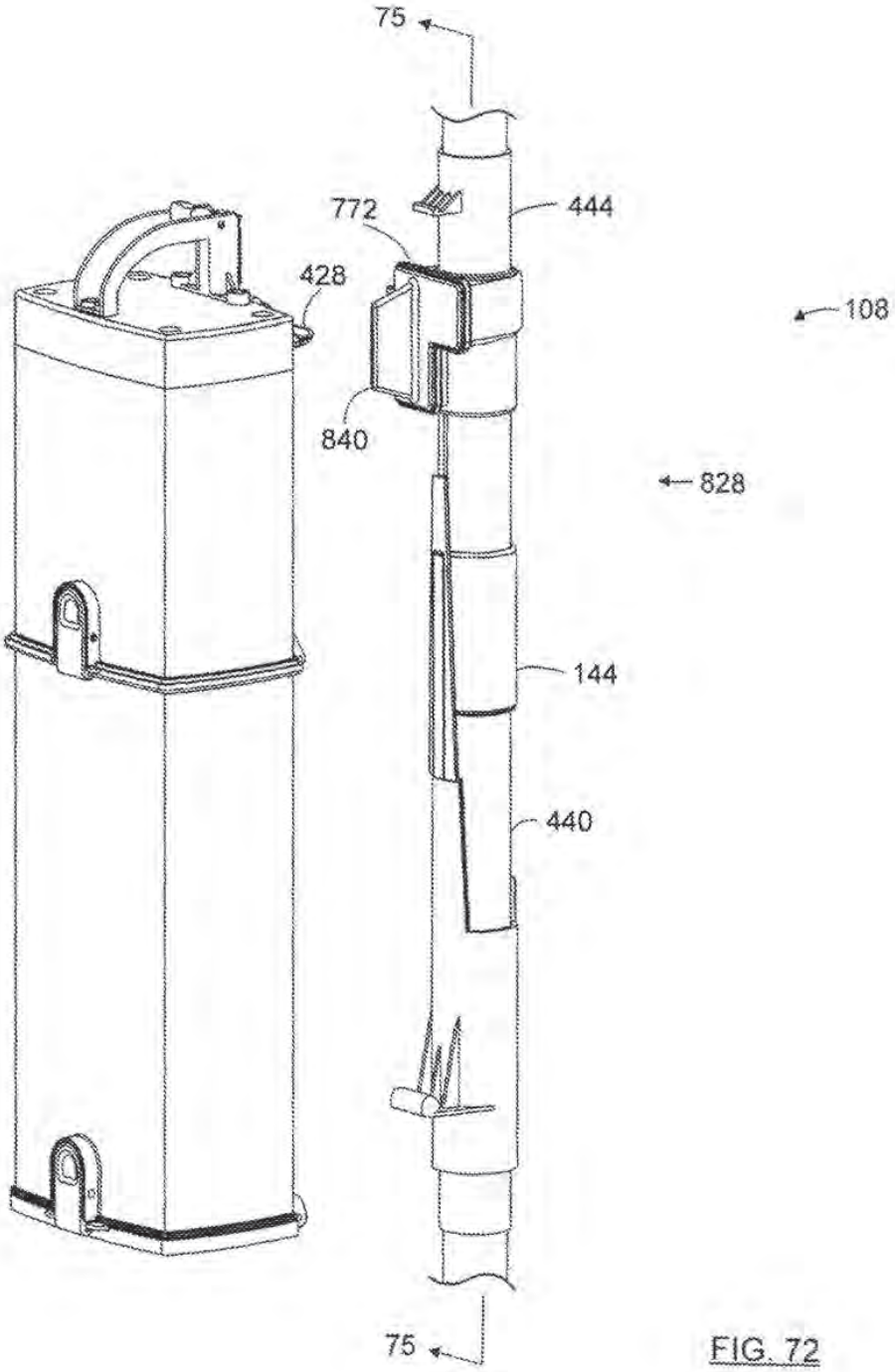


FIG. 72

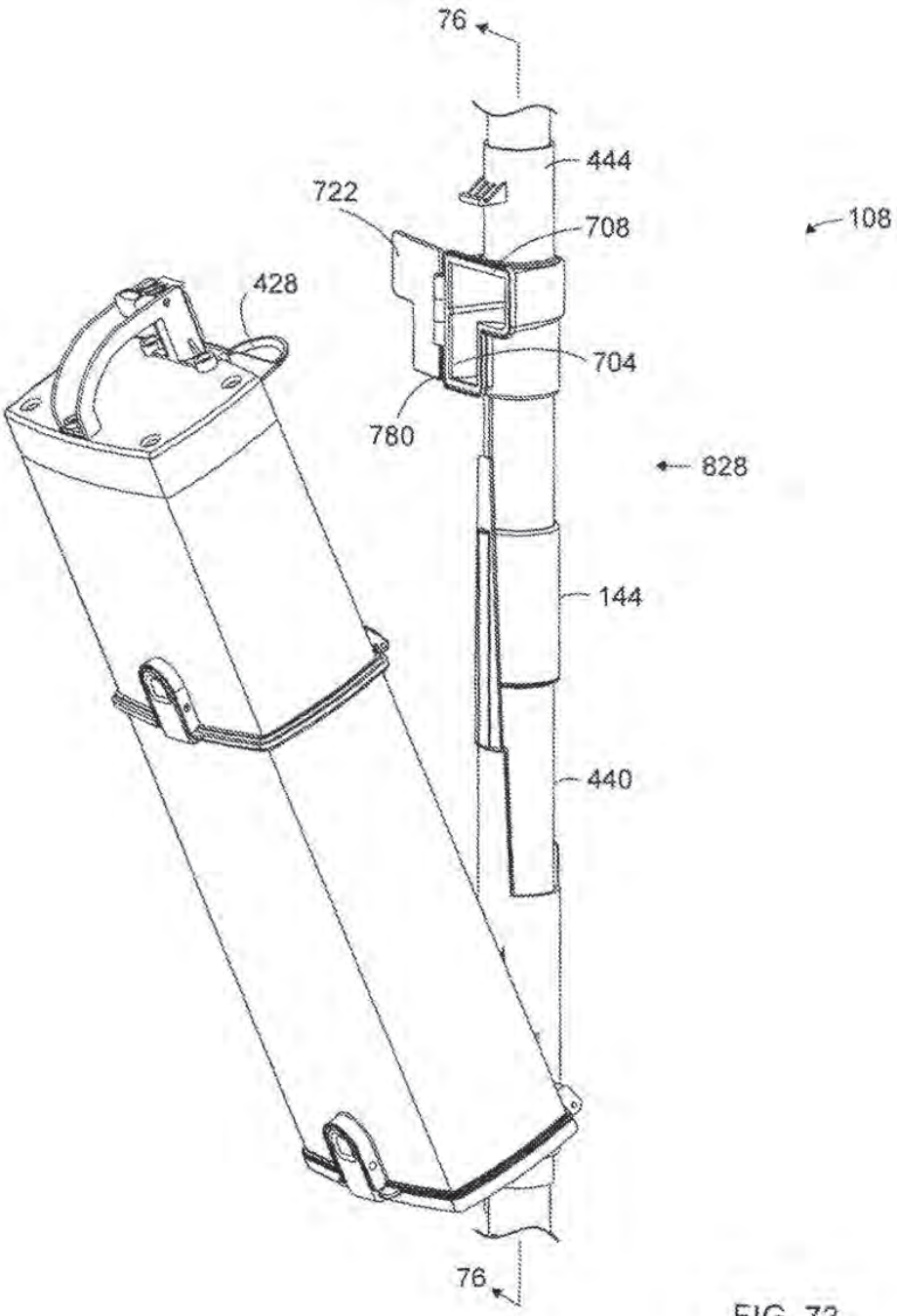


FIG. 73

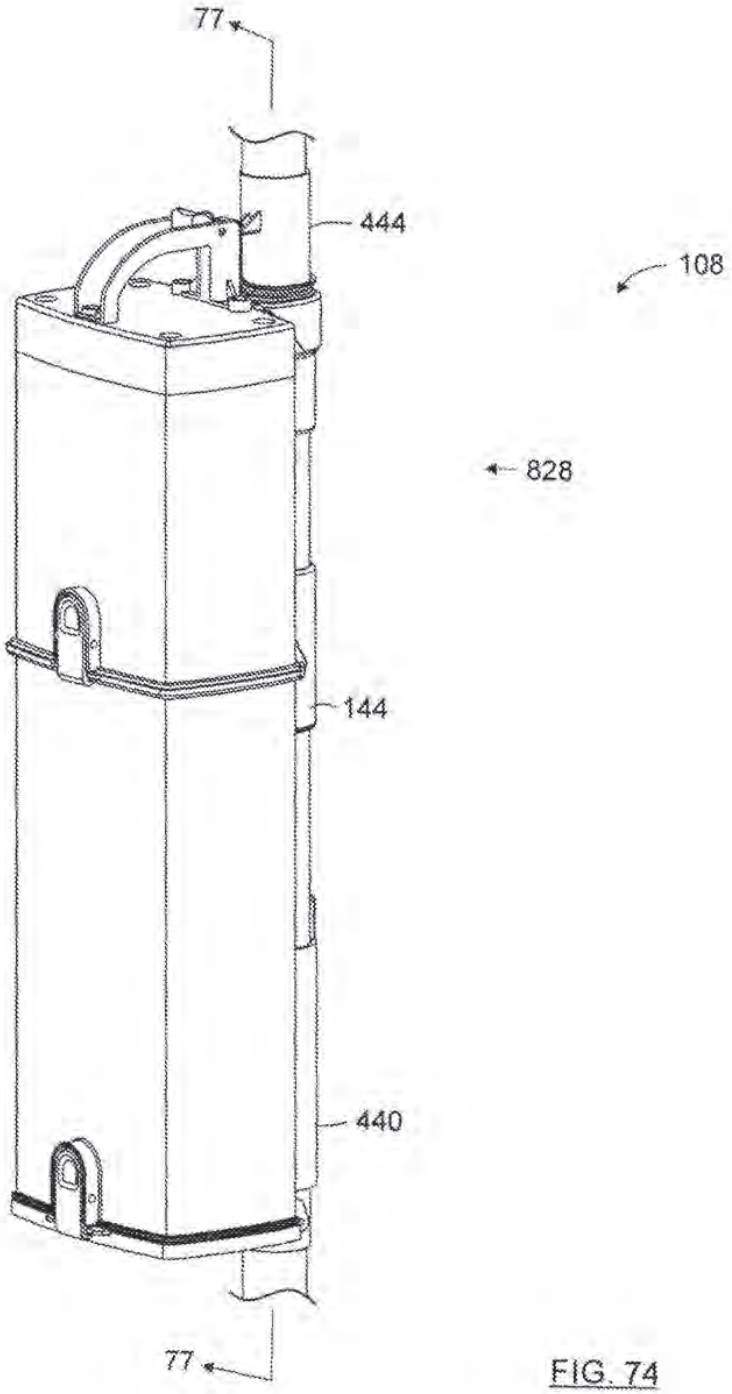


FIG. 74

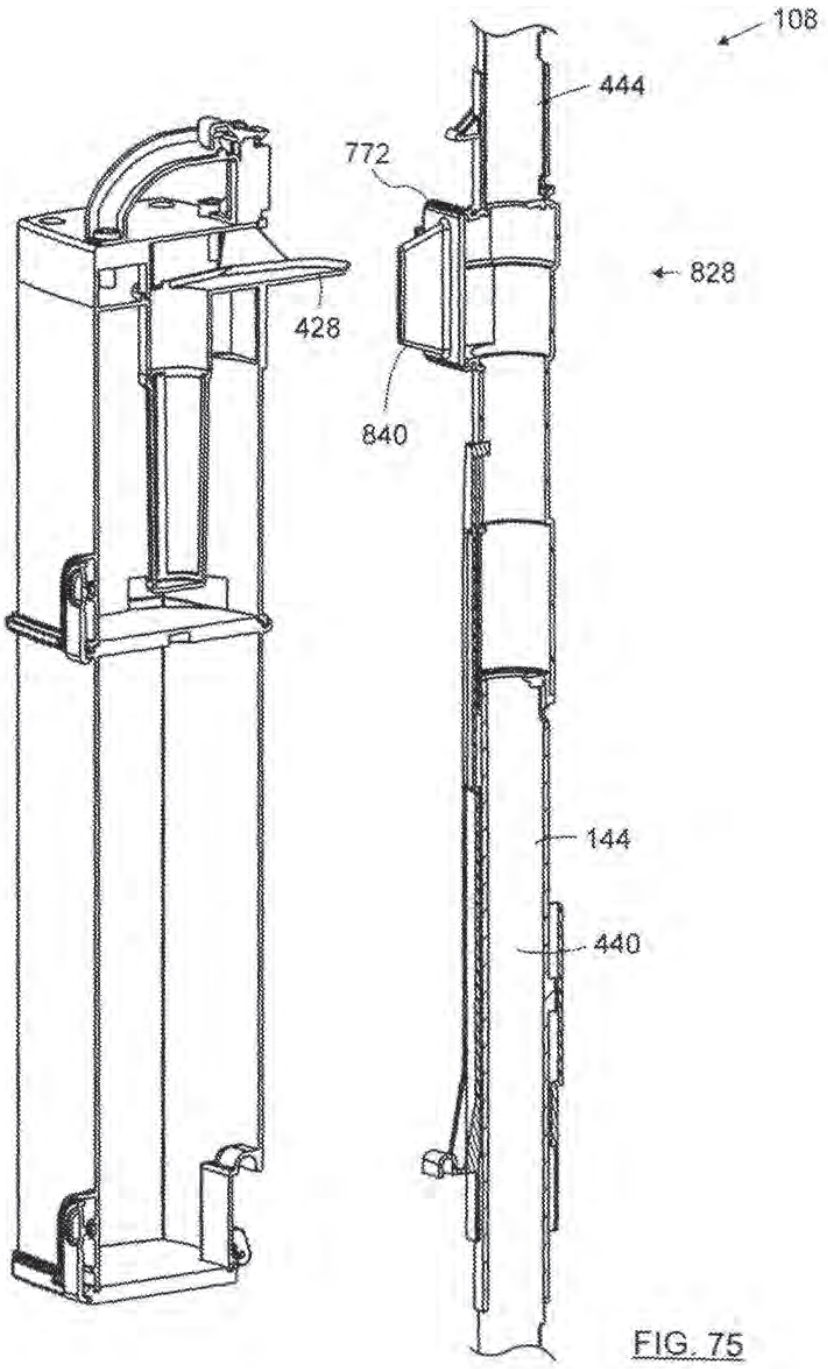


FIG. 75

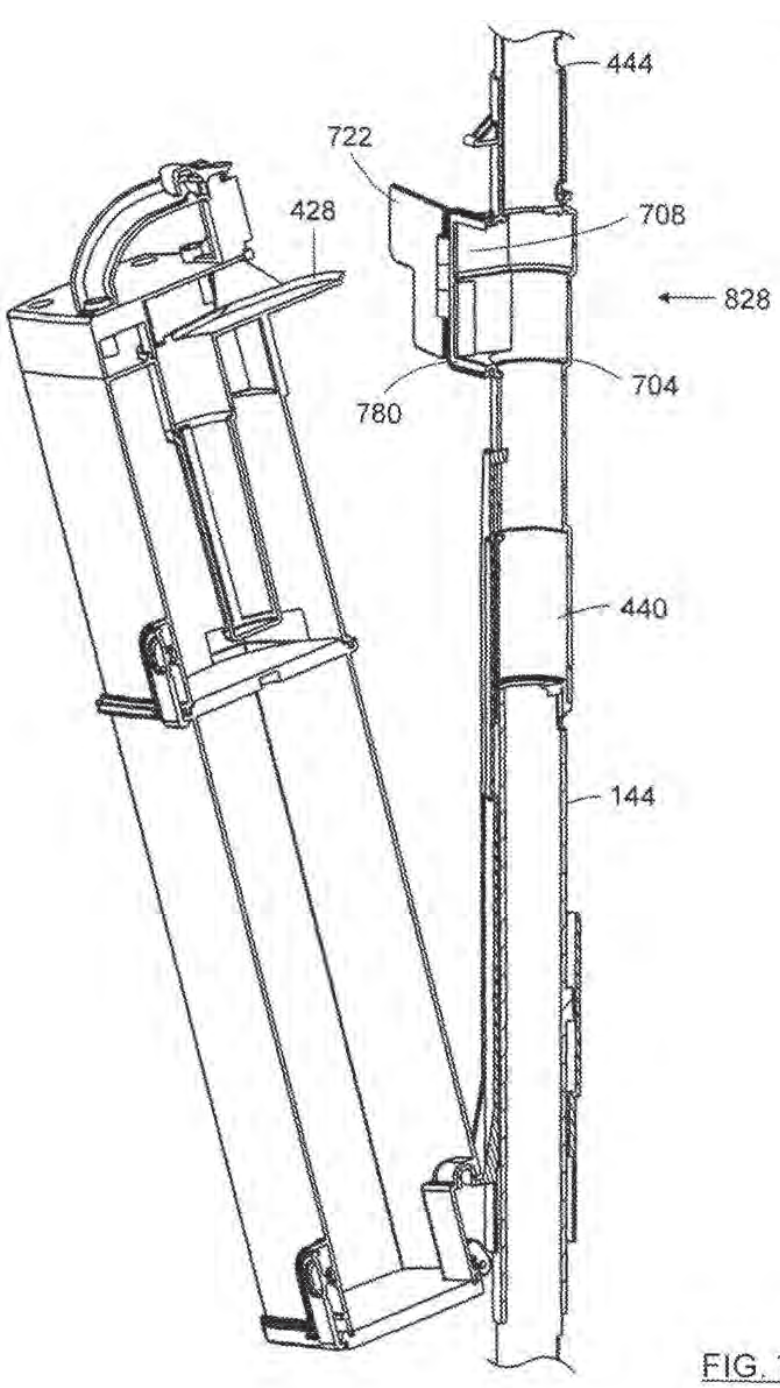


FIG. 76

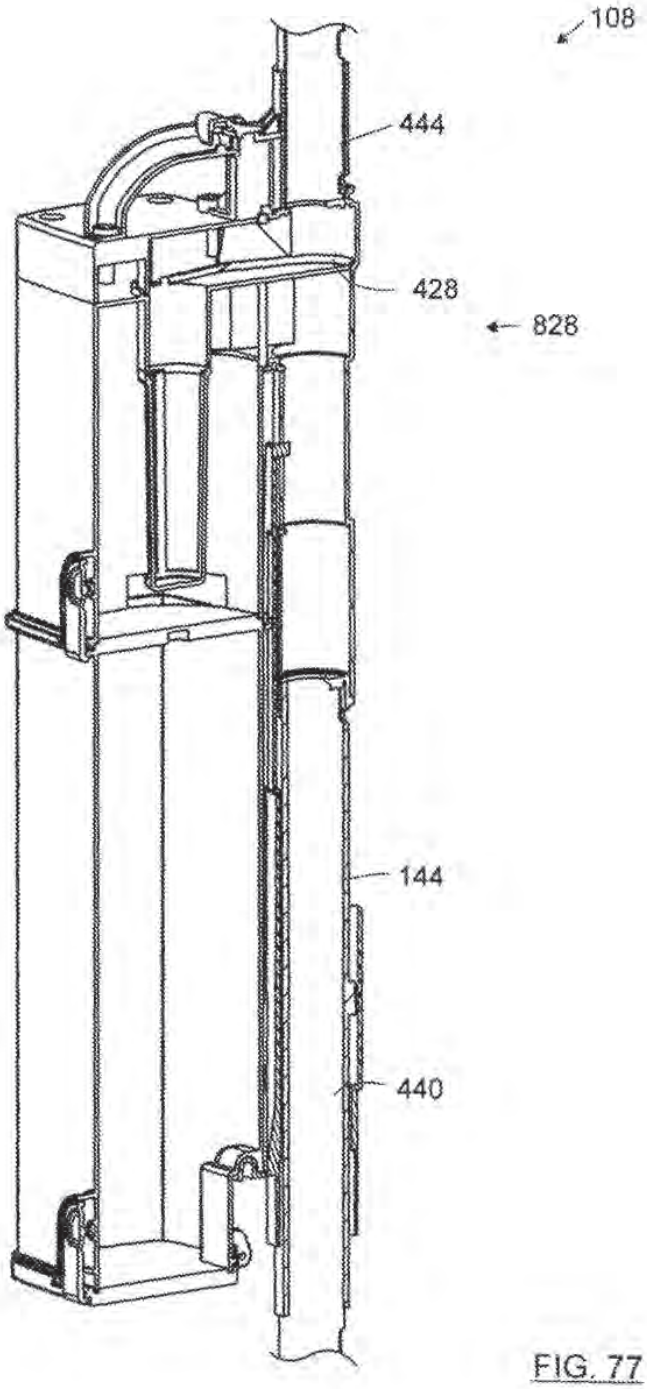


FIG. 77

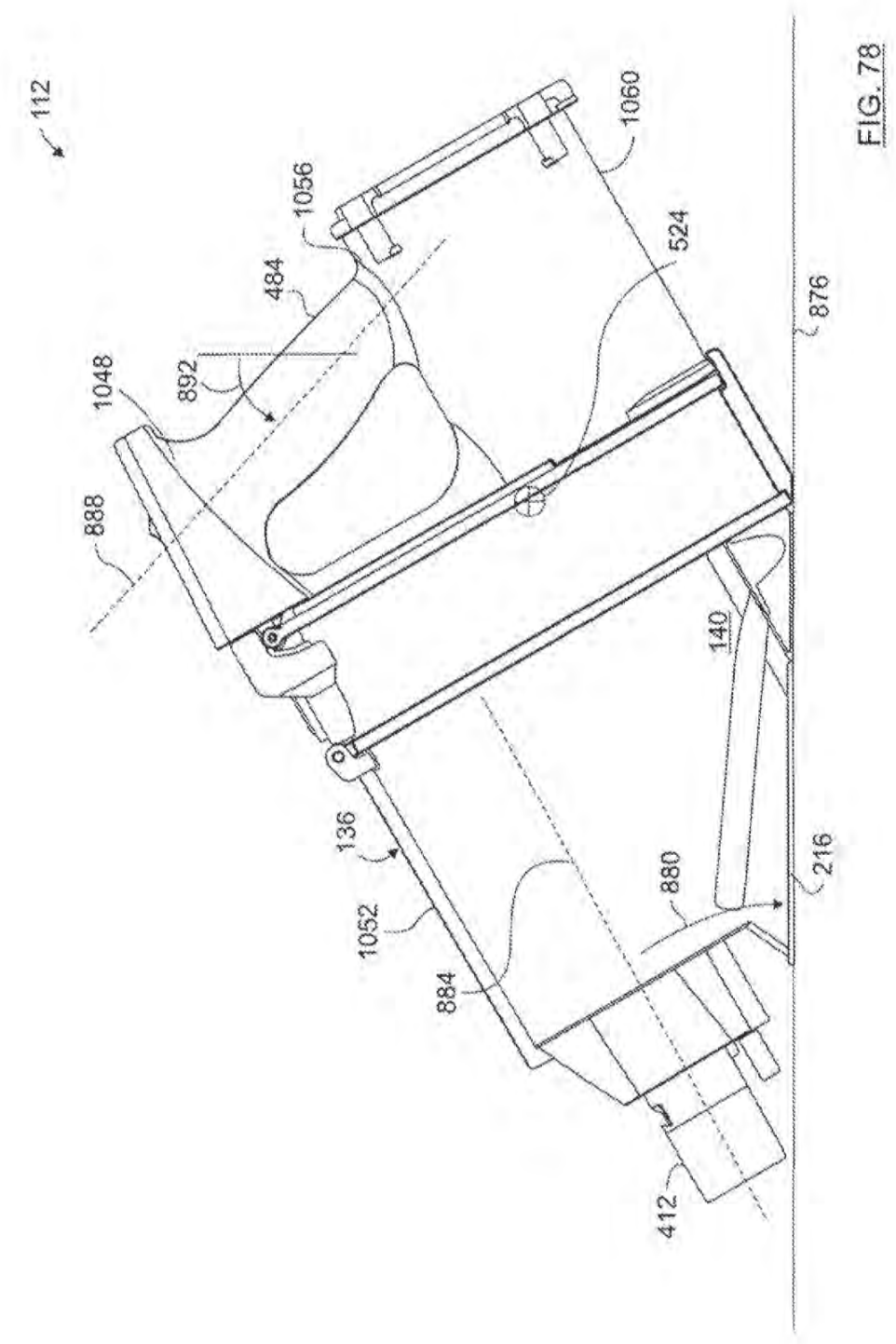

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FIG. 78

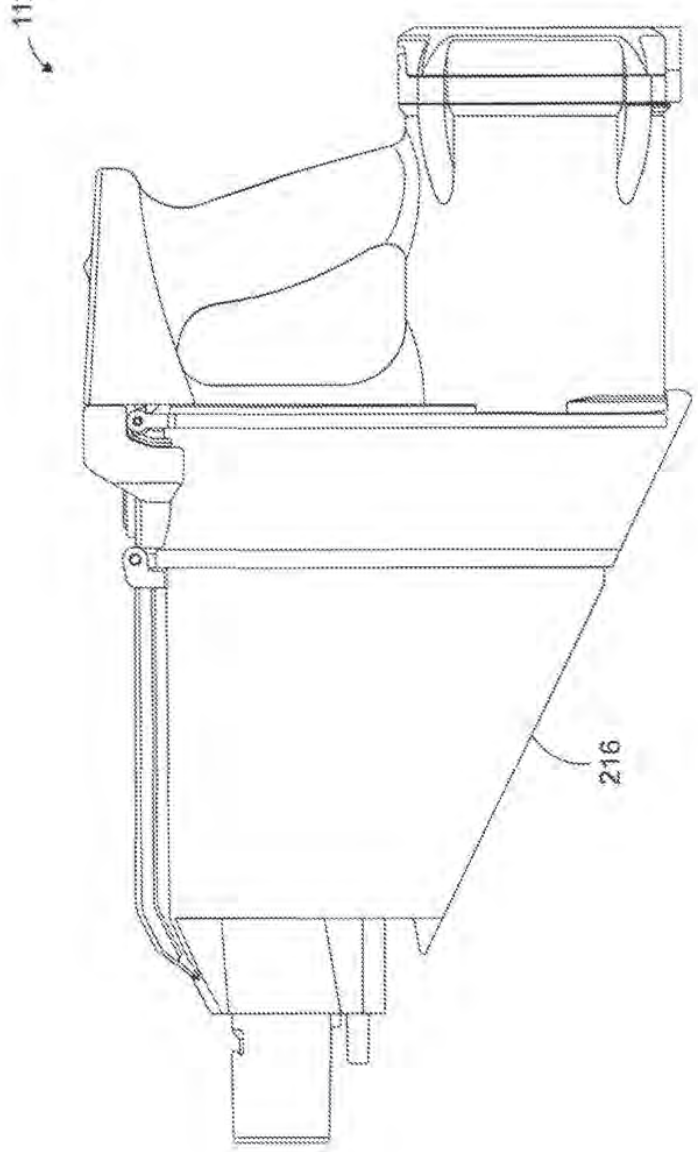


FIG. 79

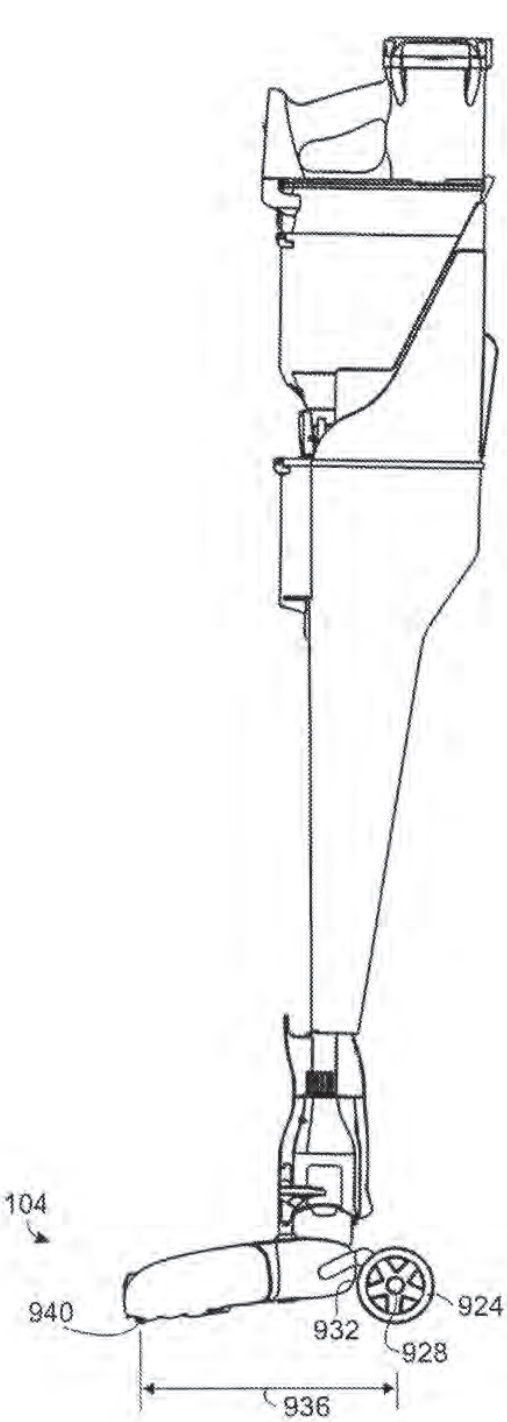


FIG. 80

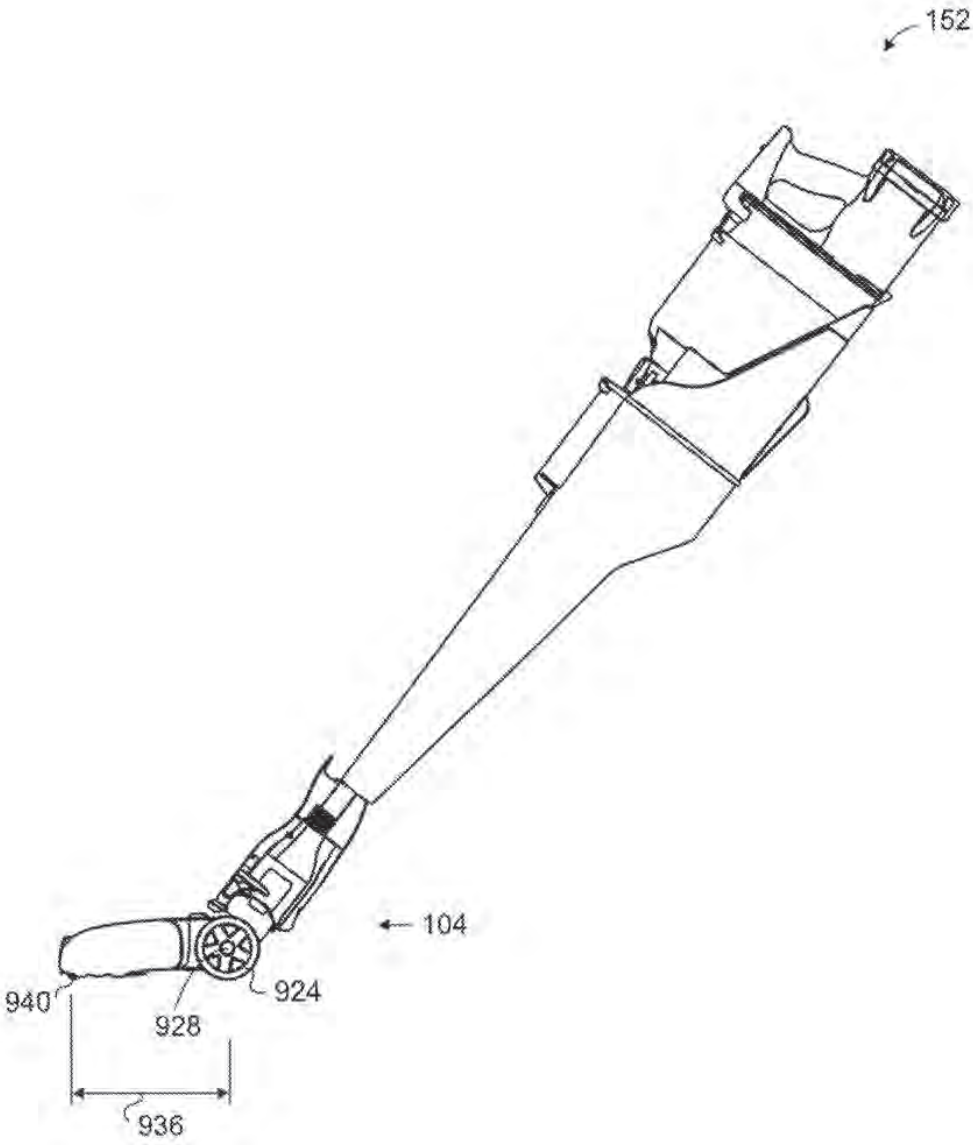


FIG. 81

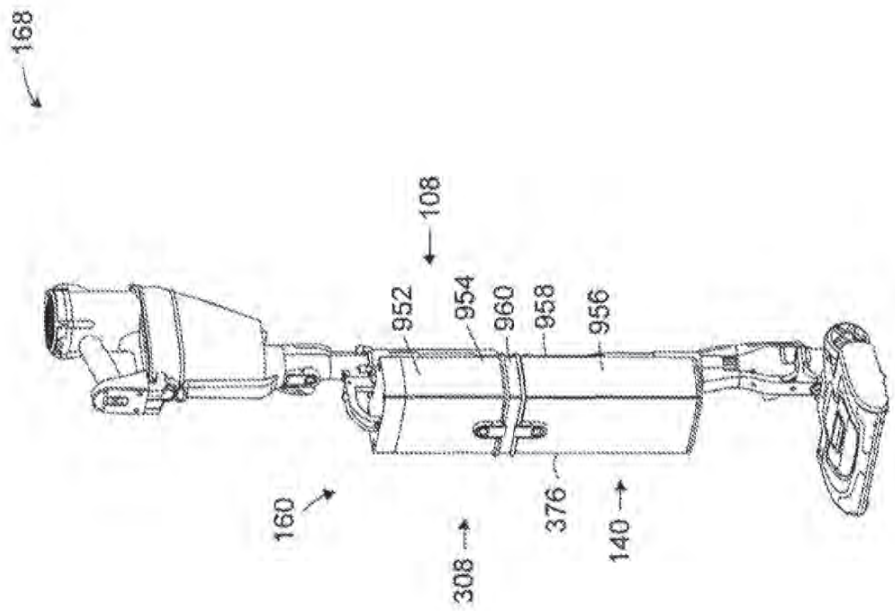


FIG. 82

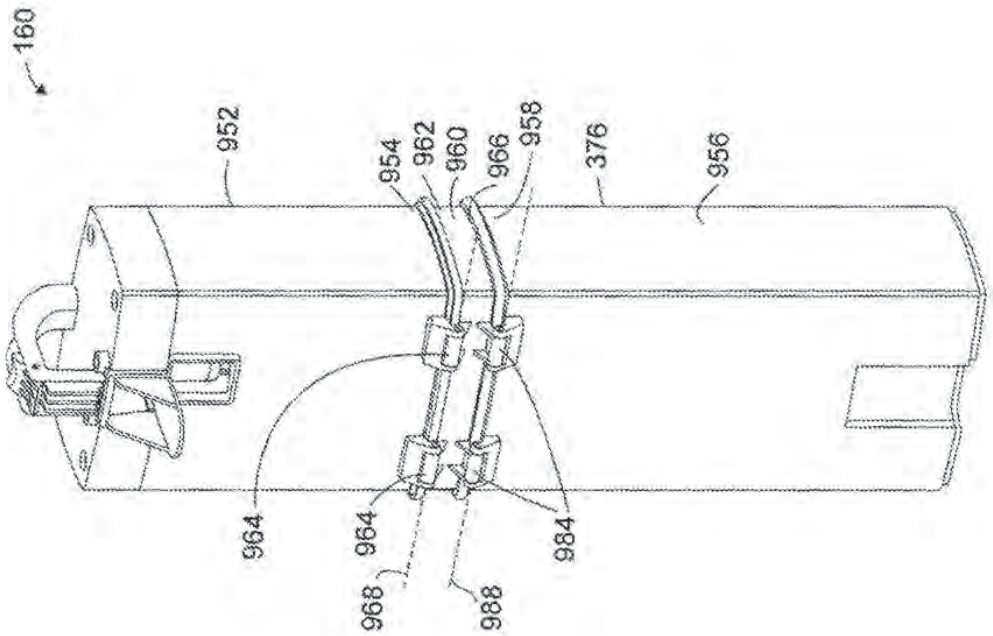


FIG. 83

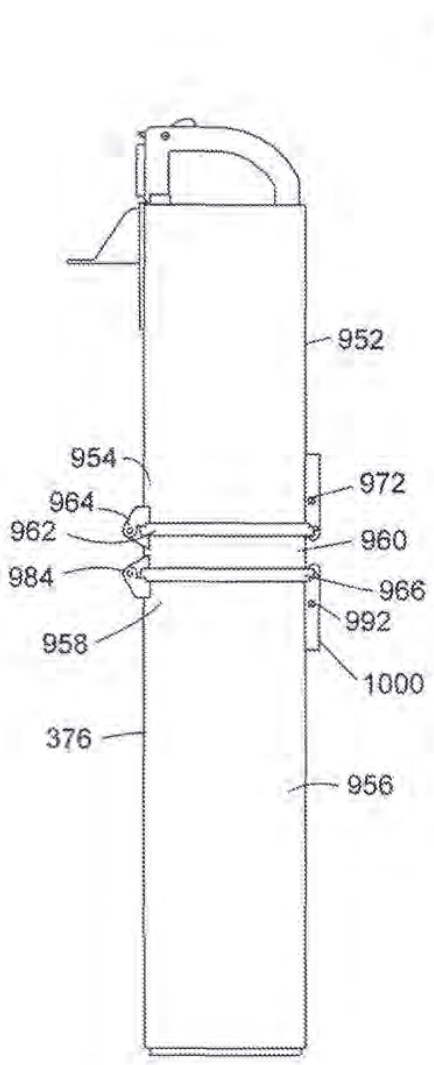


FIG. 84

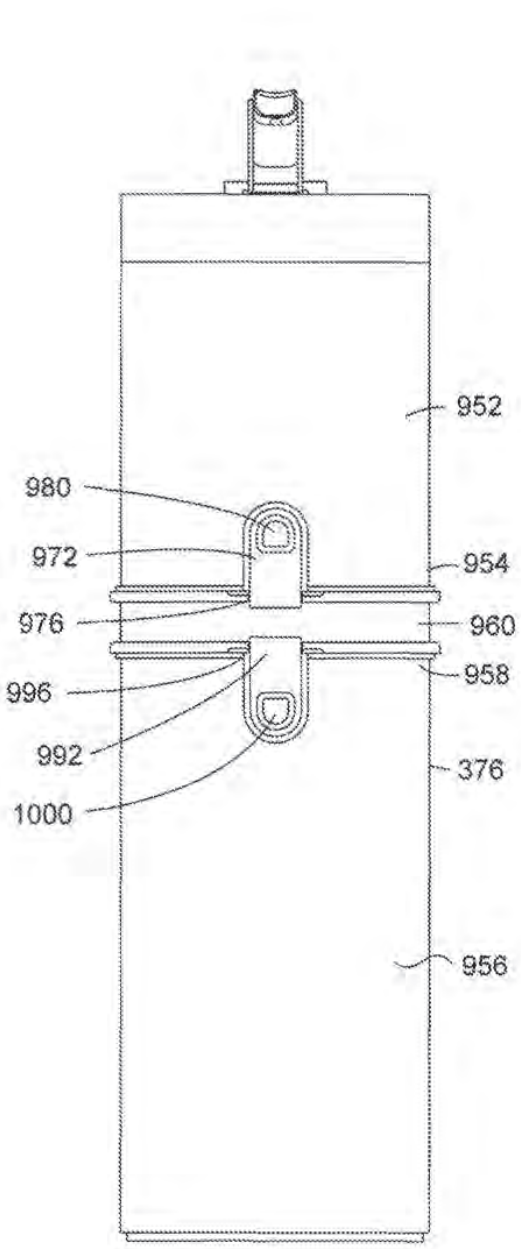


FIG. 85

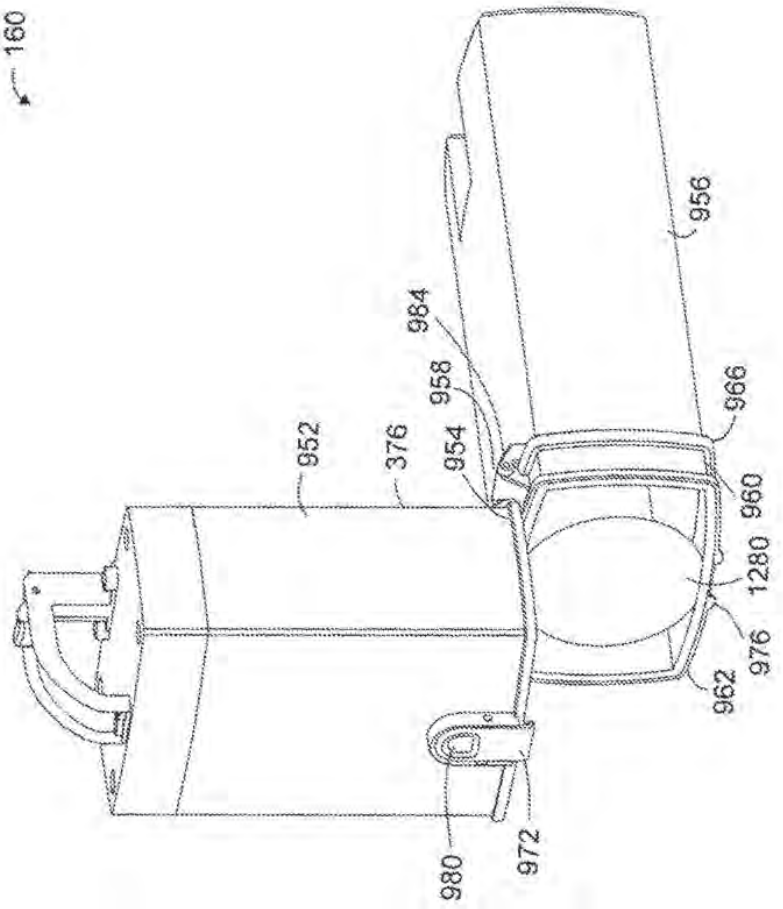


FIG. 86

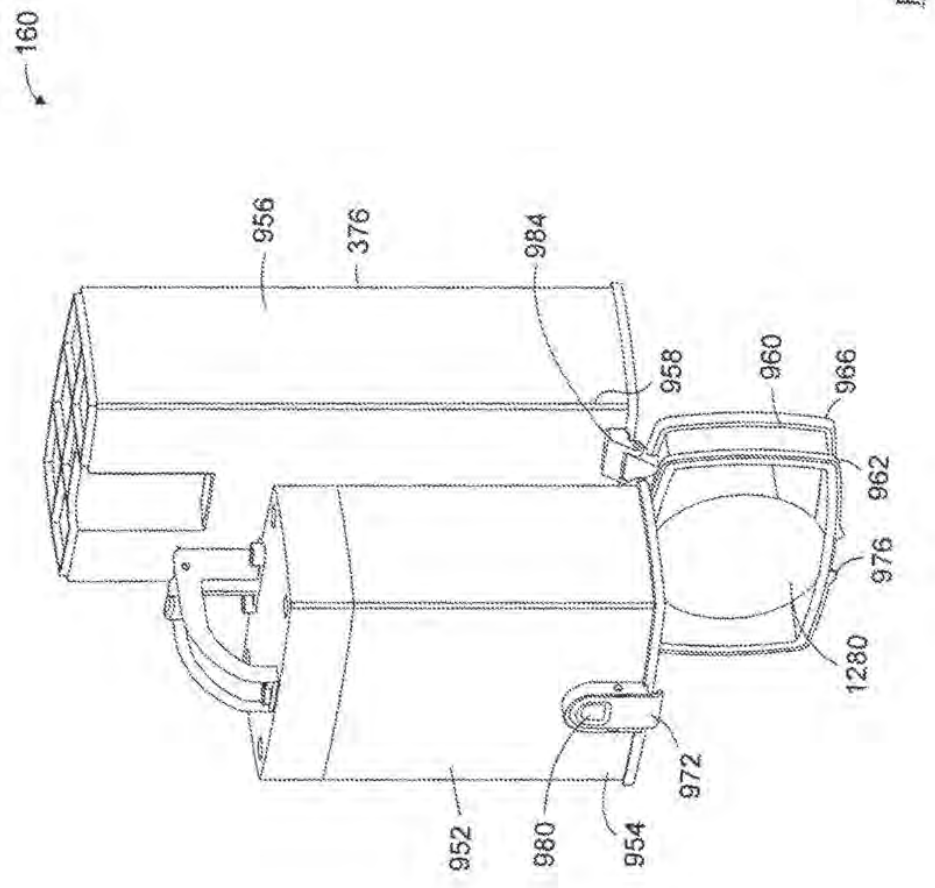


FIG. 87

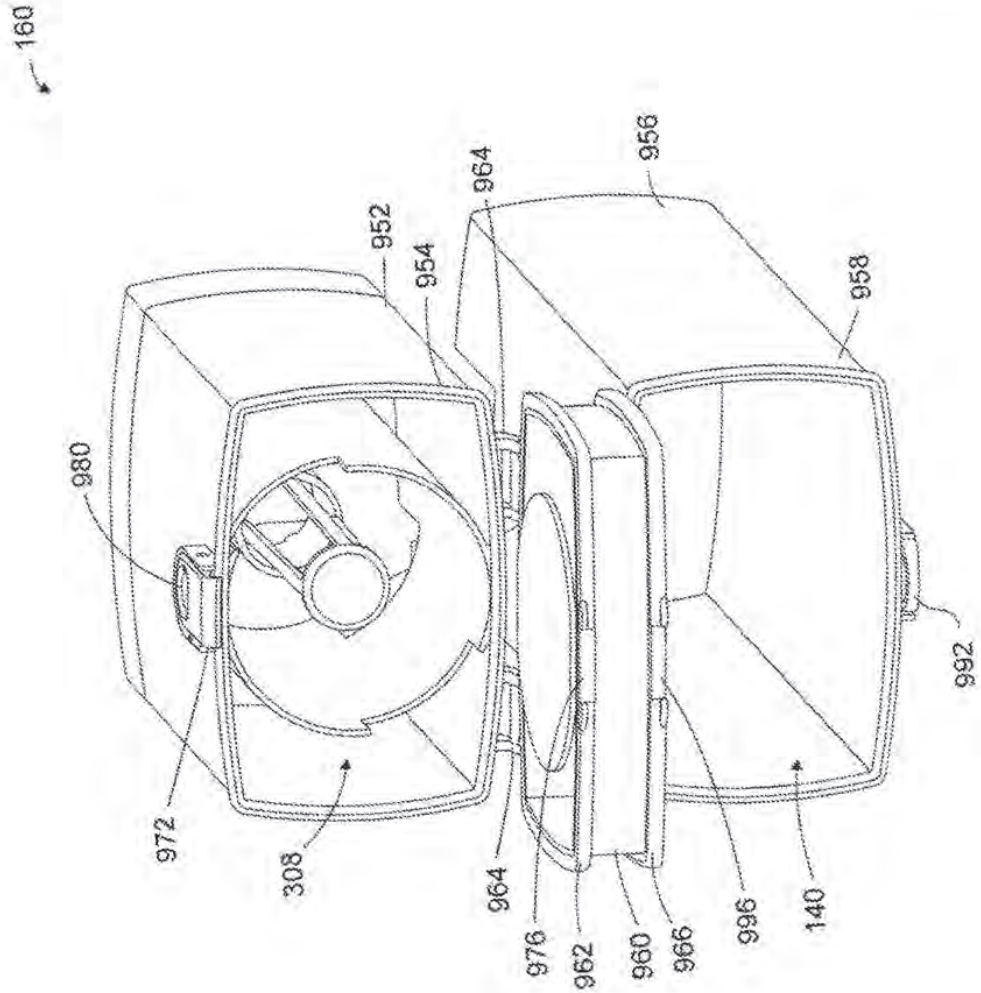

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FIG. 88

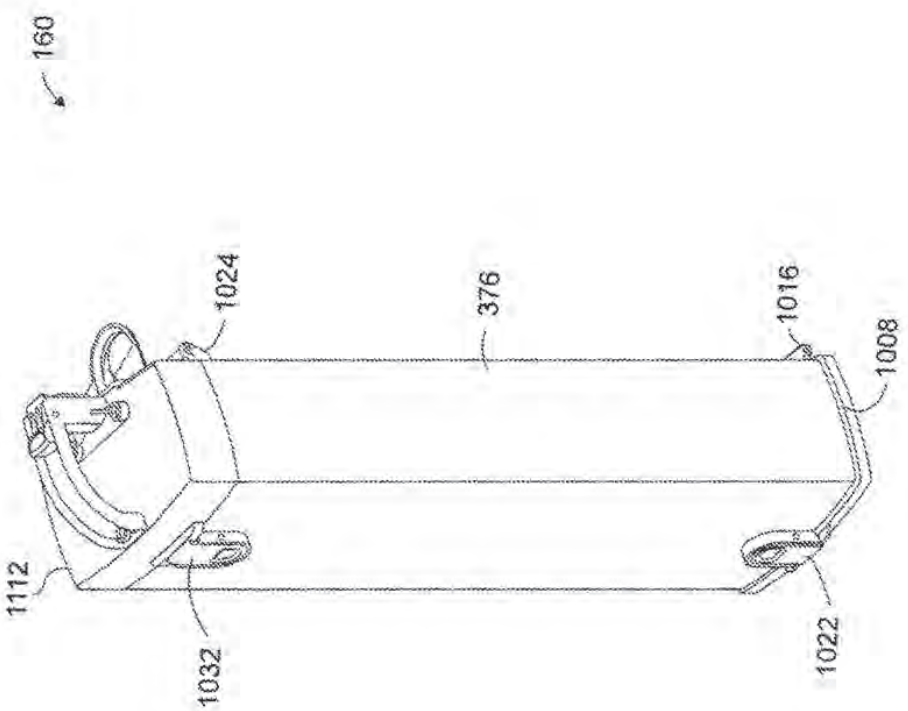


FIG. 89

FIG. 90

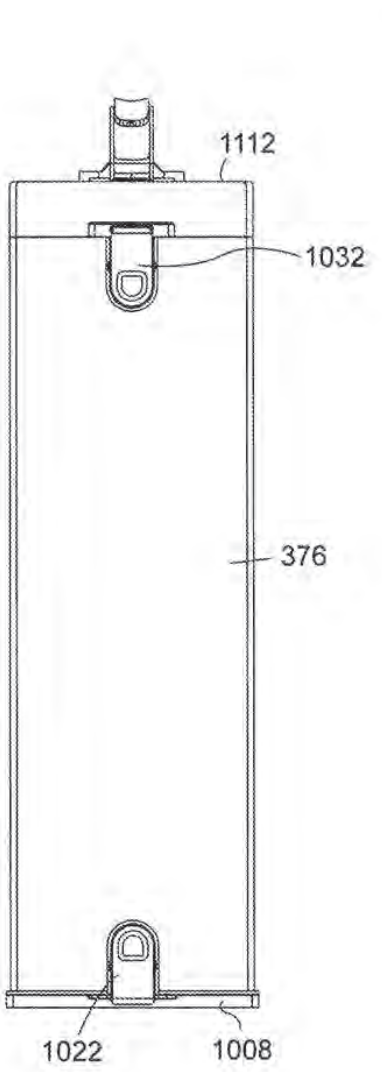


FIG. 91

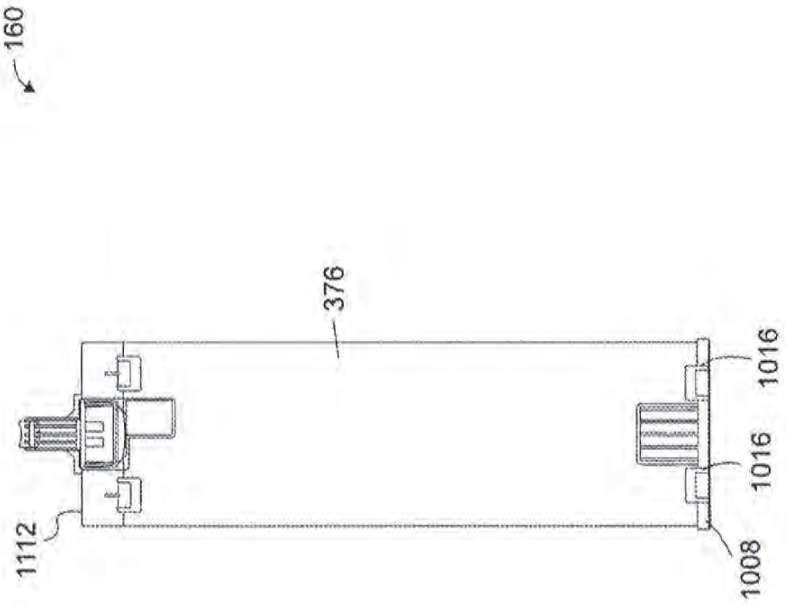


FIG. 92

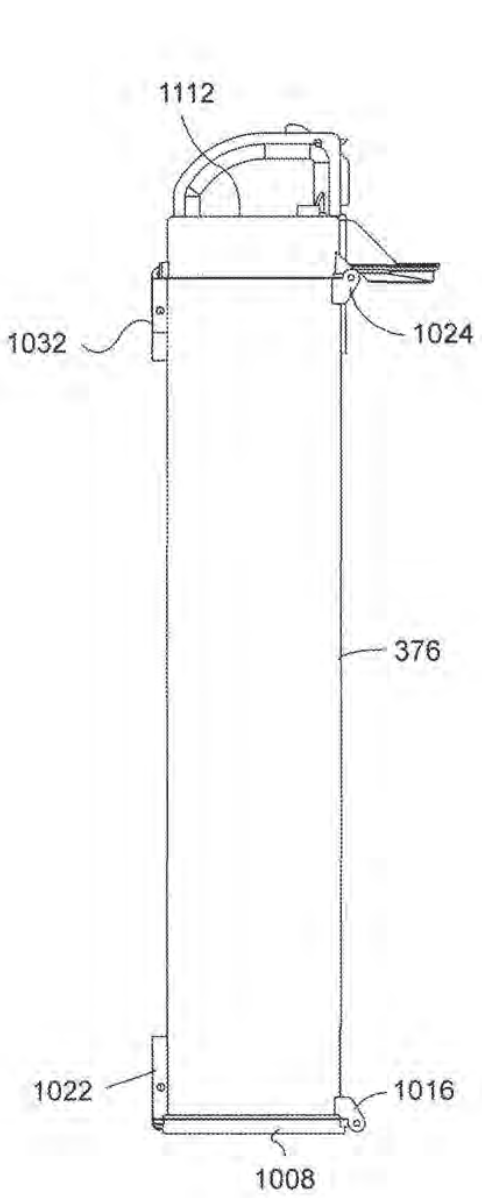


FIG. 93

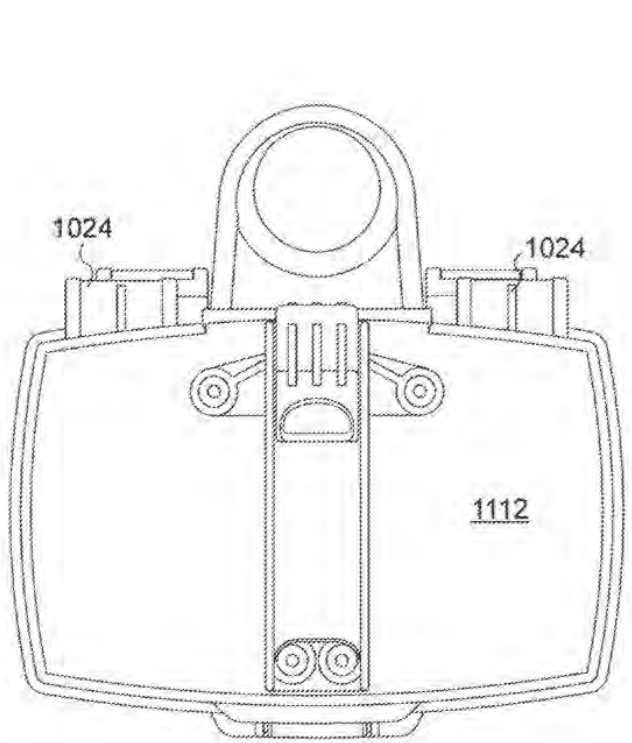


FIG. 94

FIG. 95

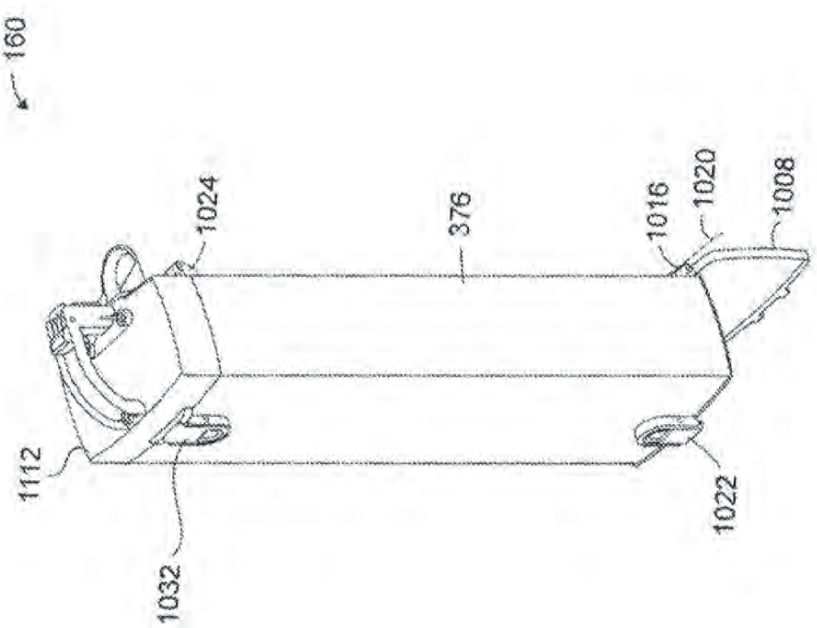


FIG. 95b

FIG. 95c

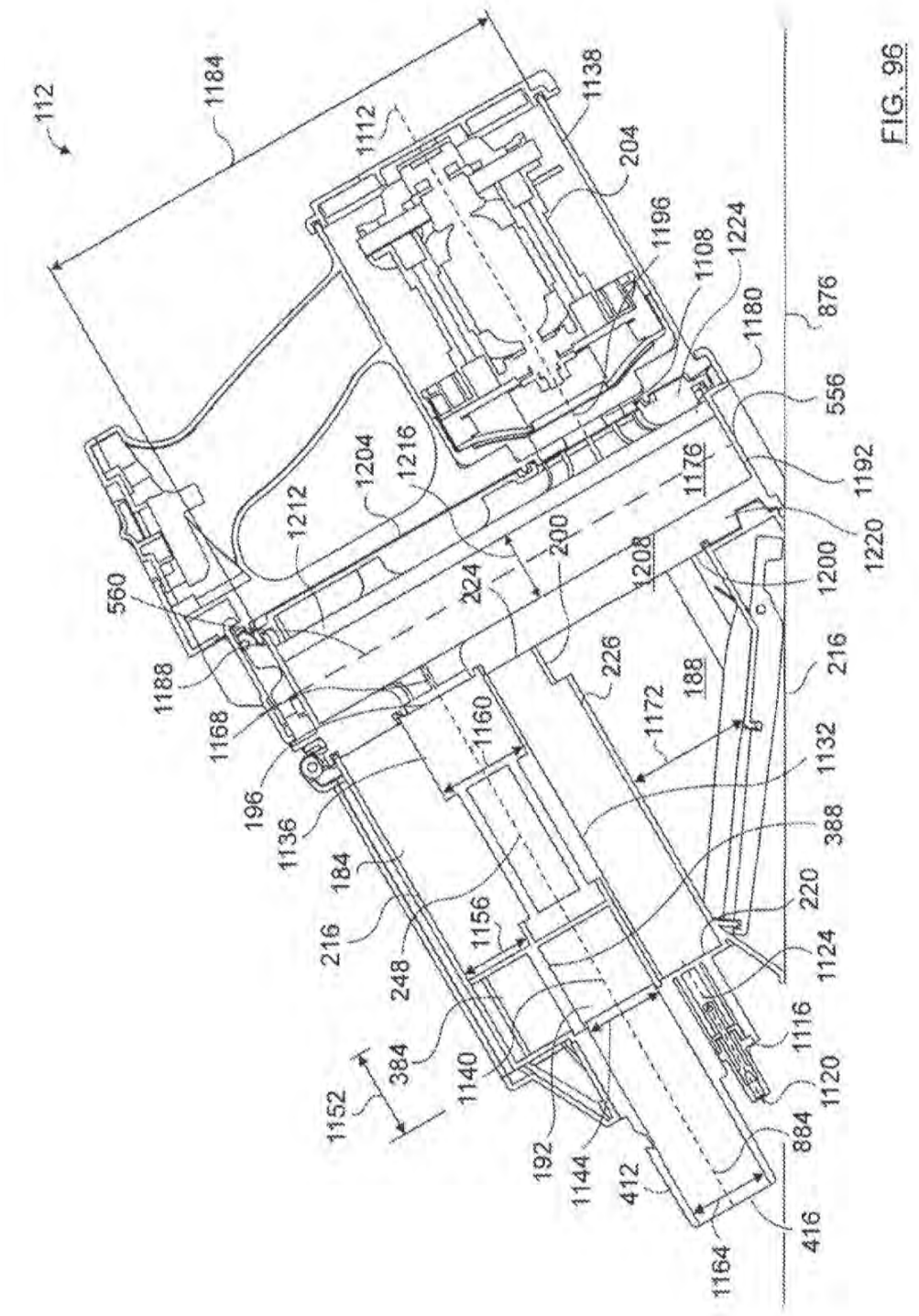

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FIG. 96

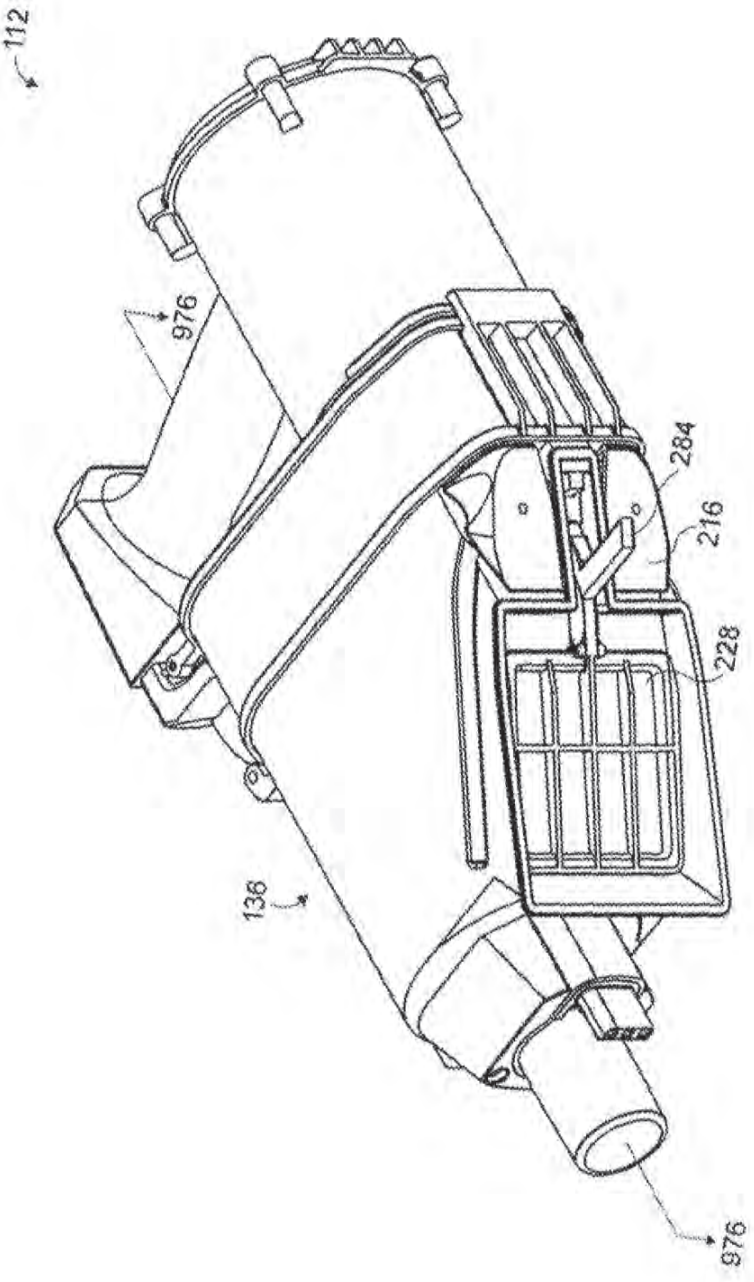


FIG. 97a

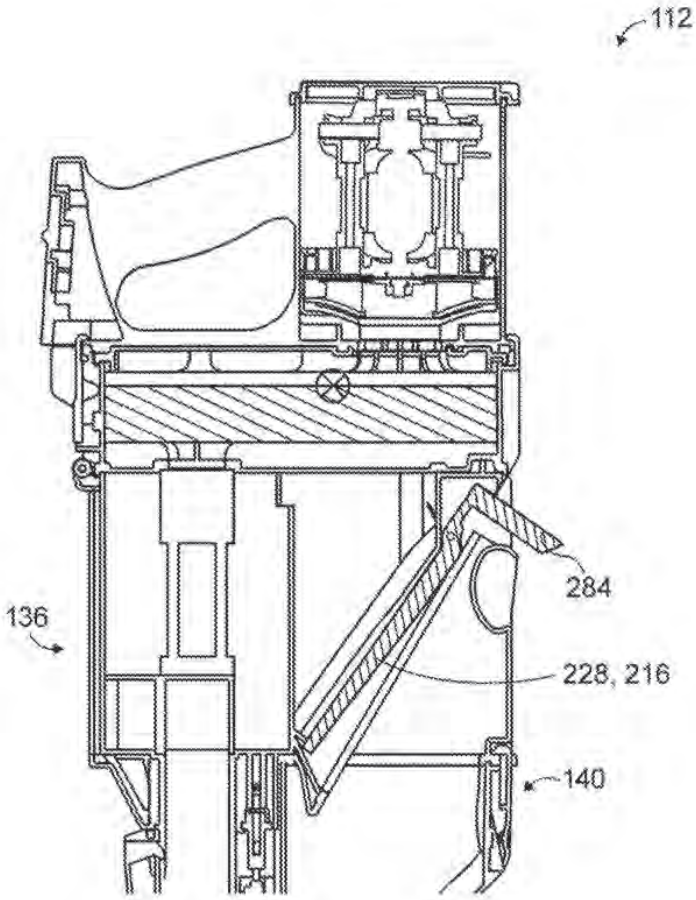


FIG. 97b

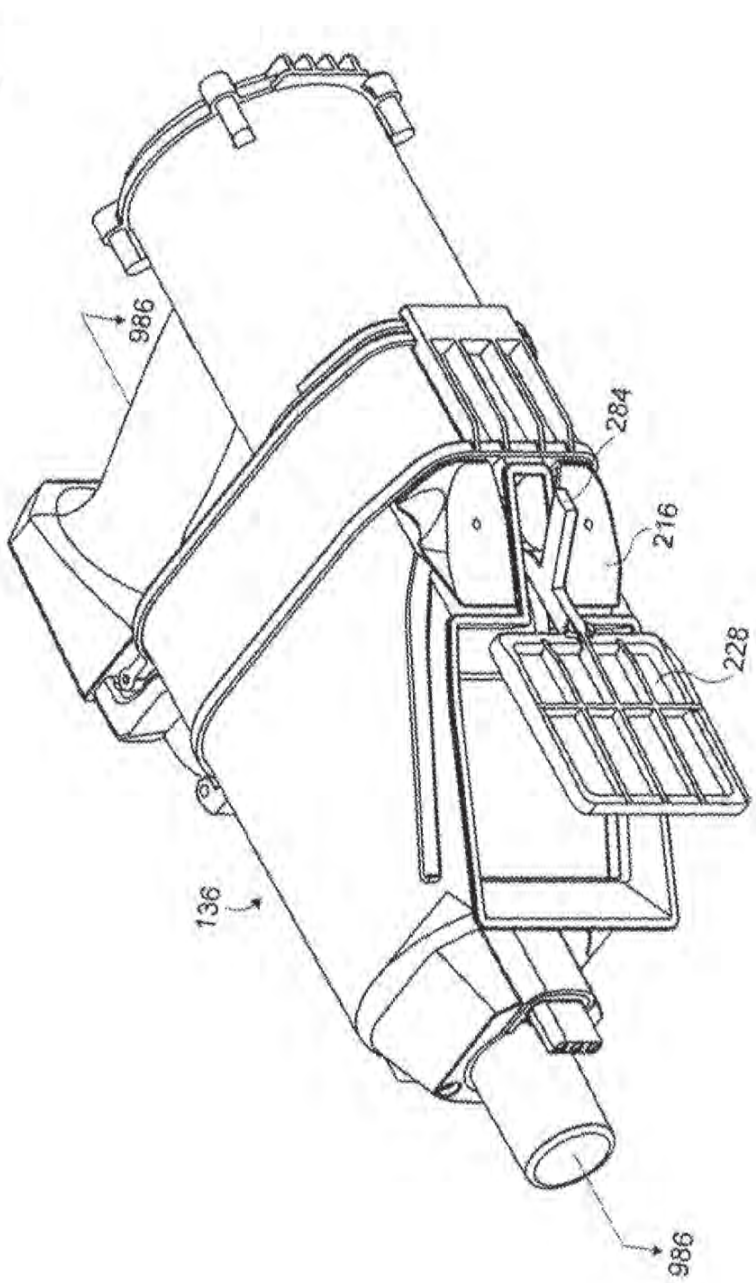


FIG. 98a

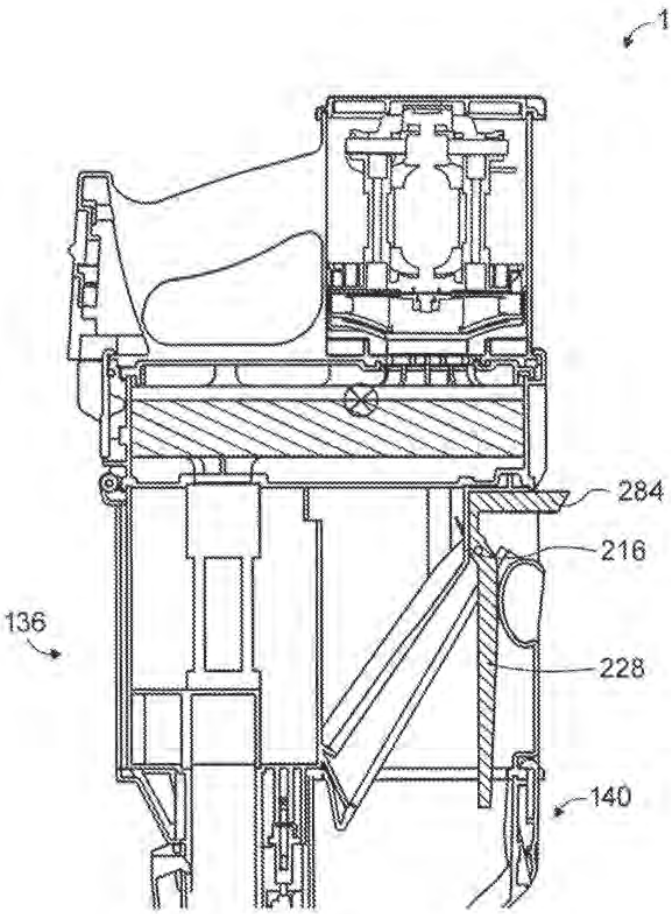


FIG. 98b

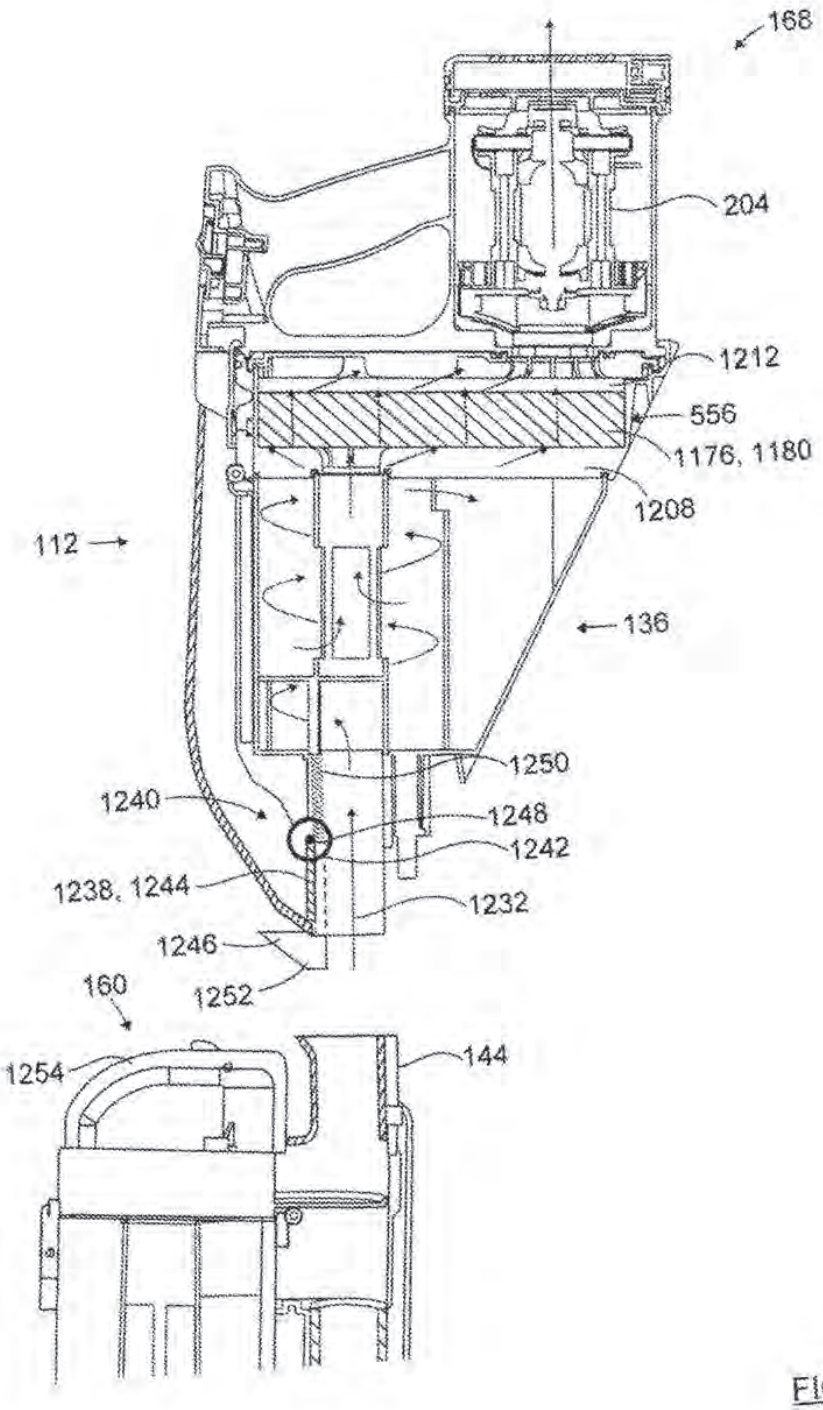

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FIG. 99

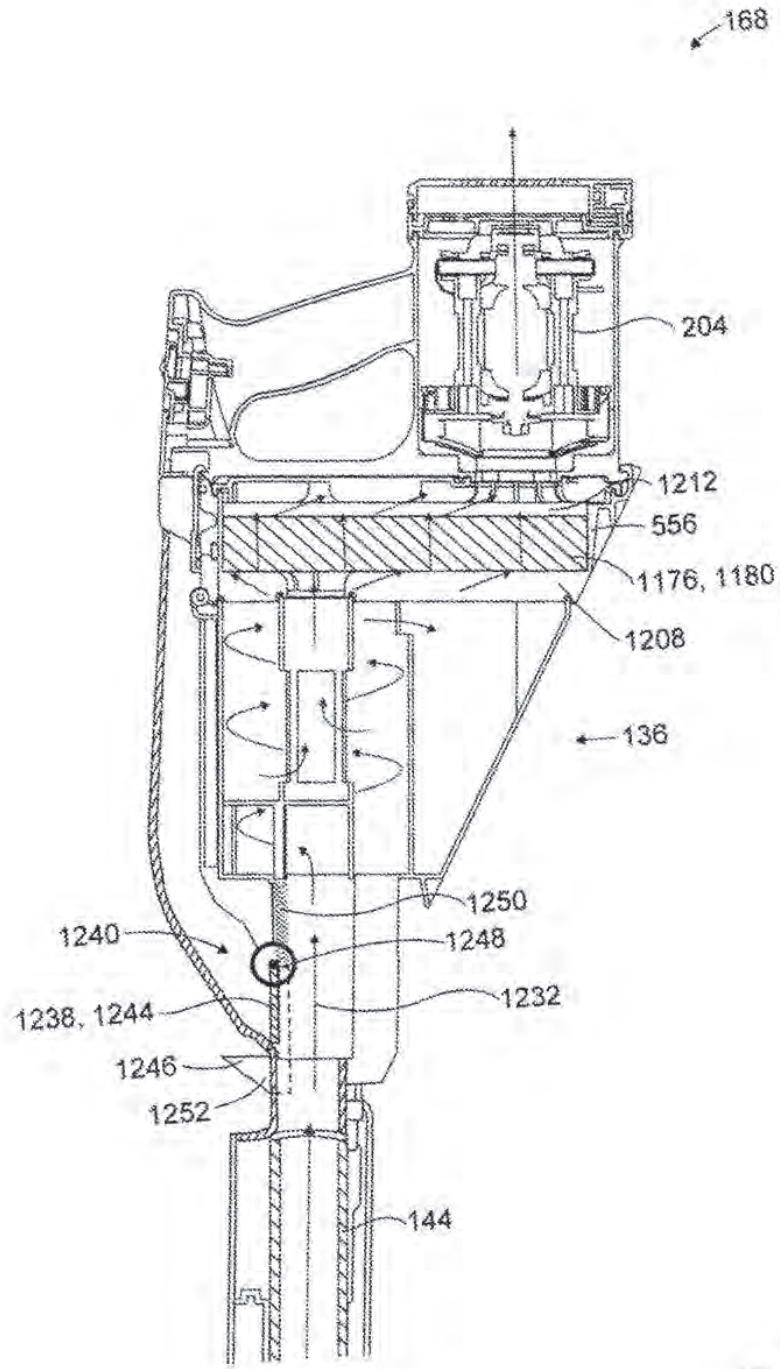

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FIG. 100

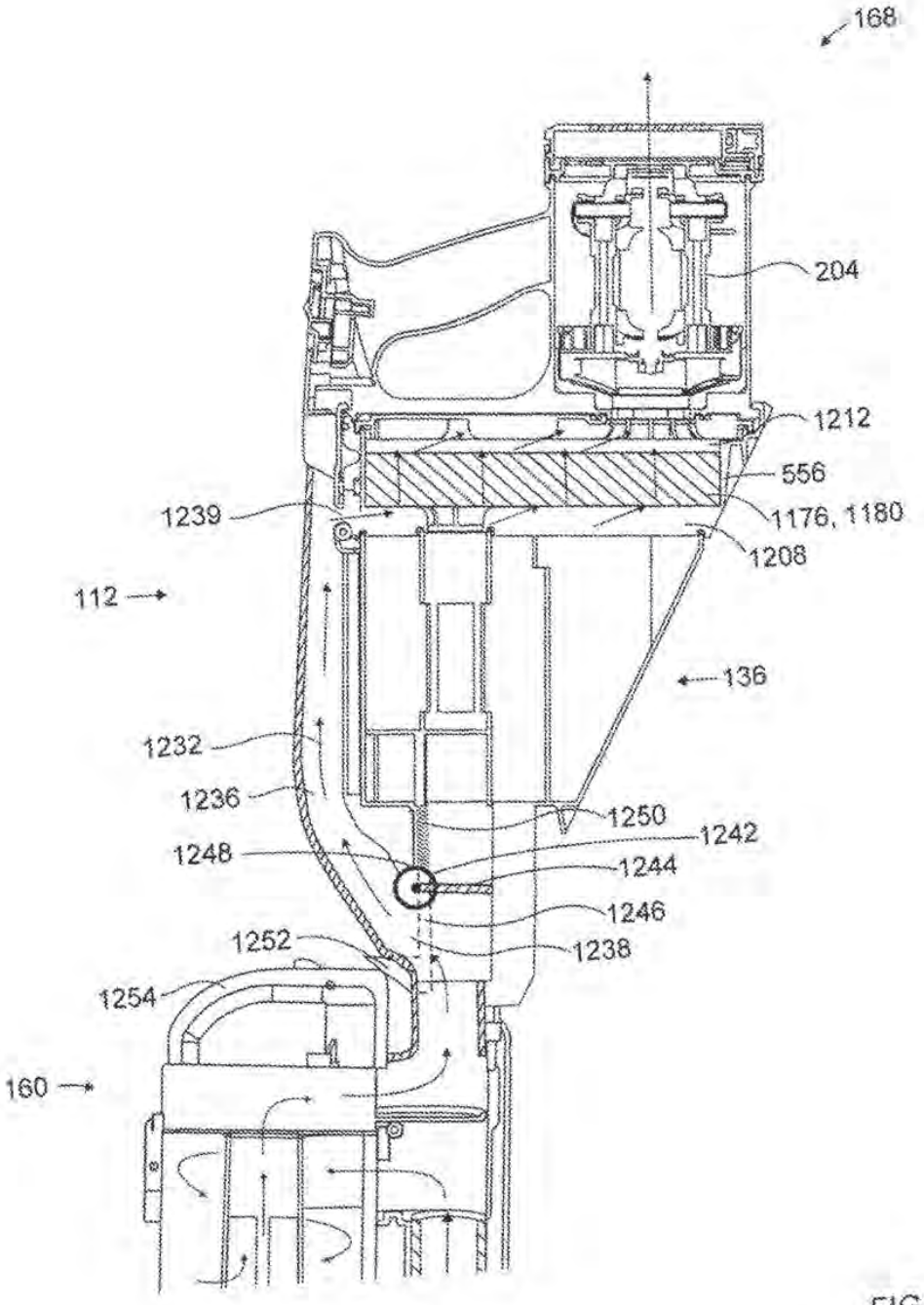

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FIG. 101

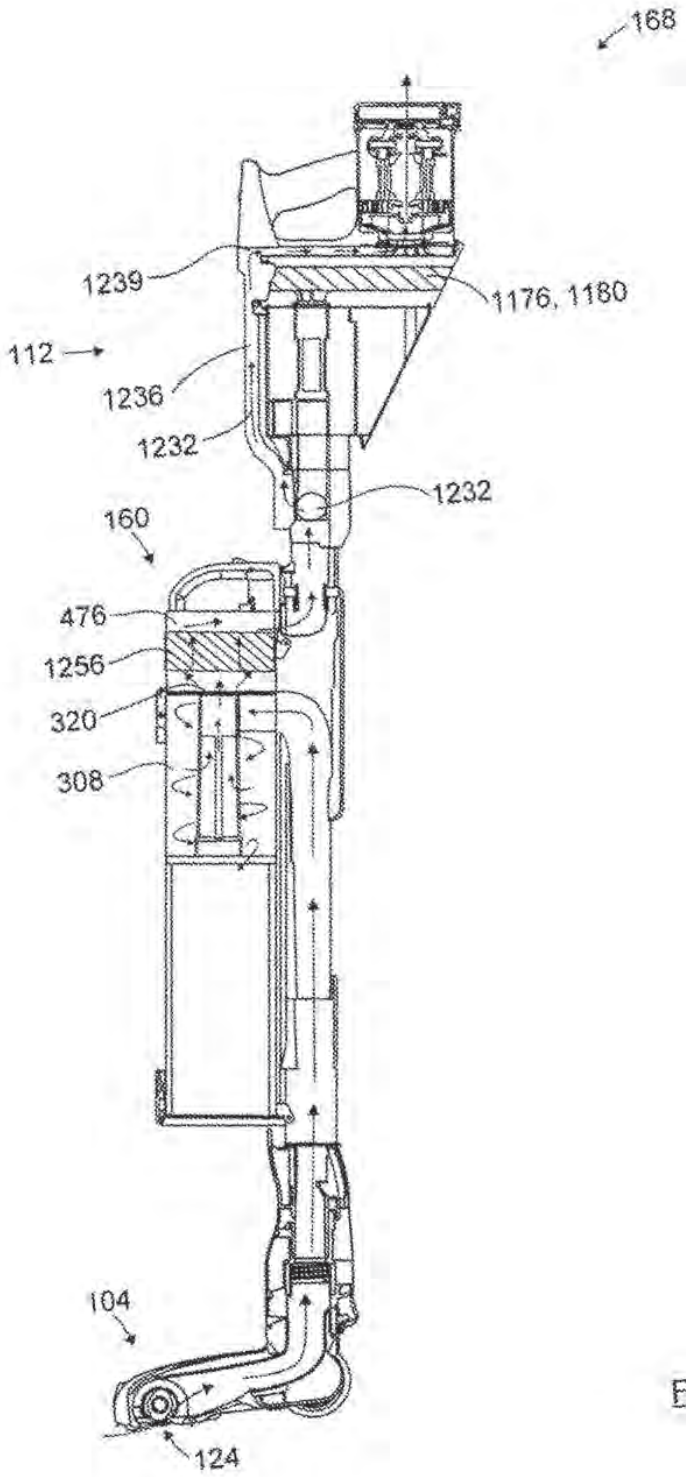

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FIG. 102

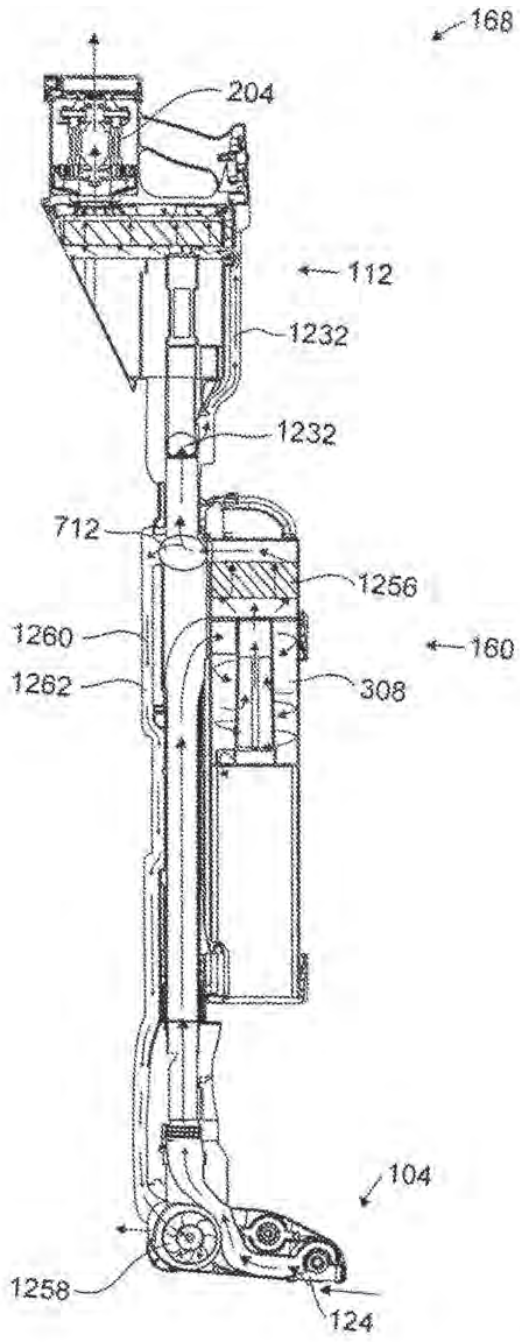


FIG. 103

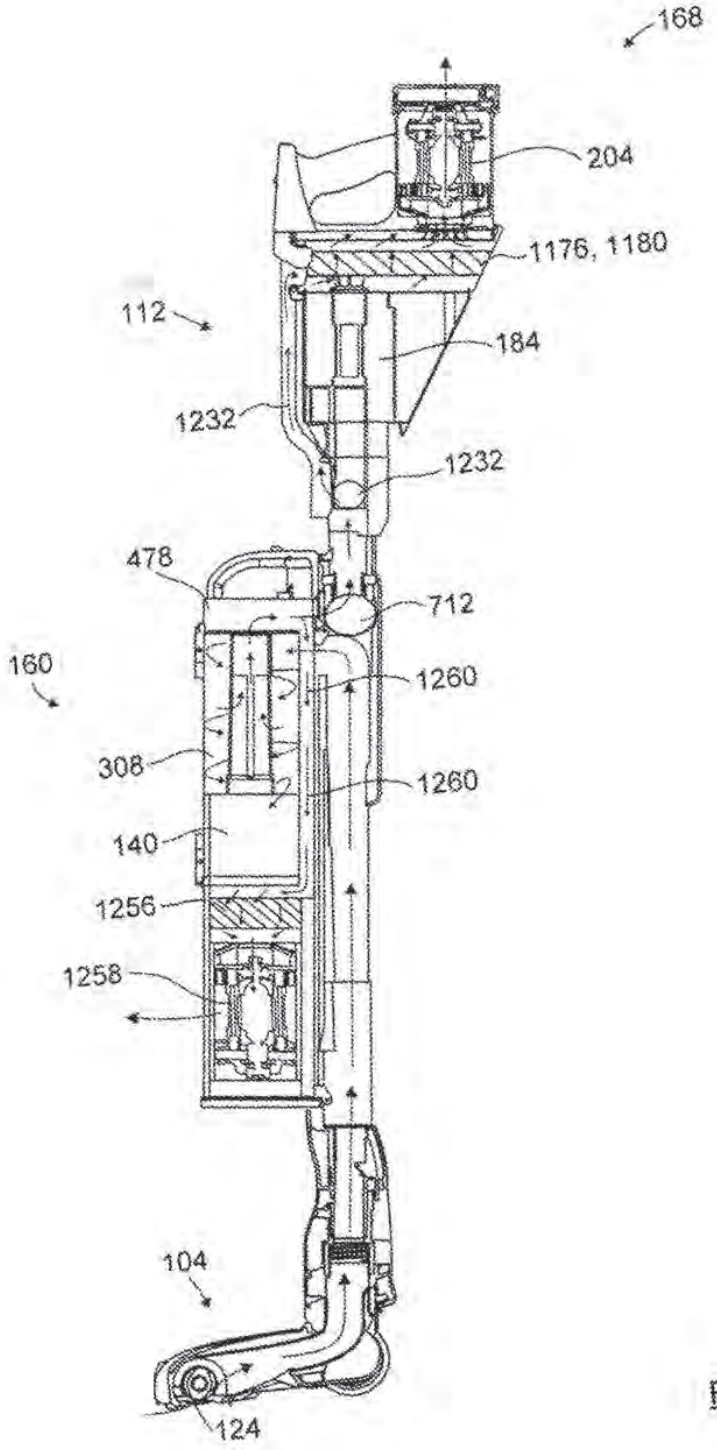

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FIG. 104a

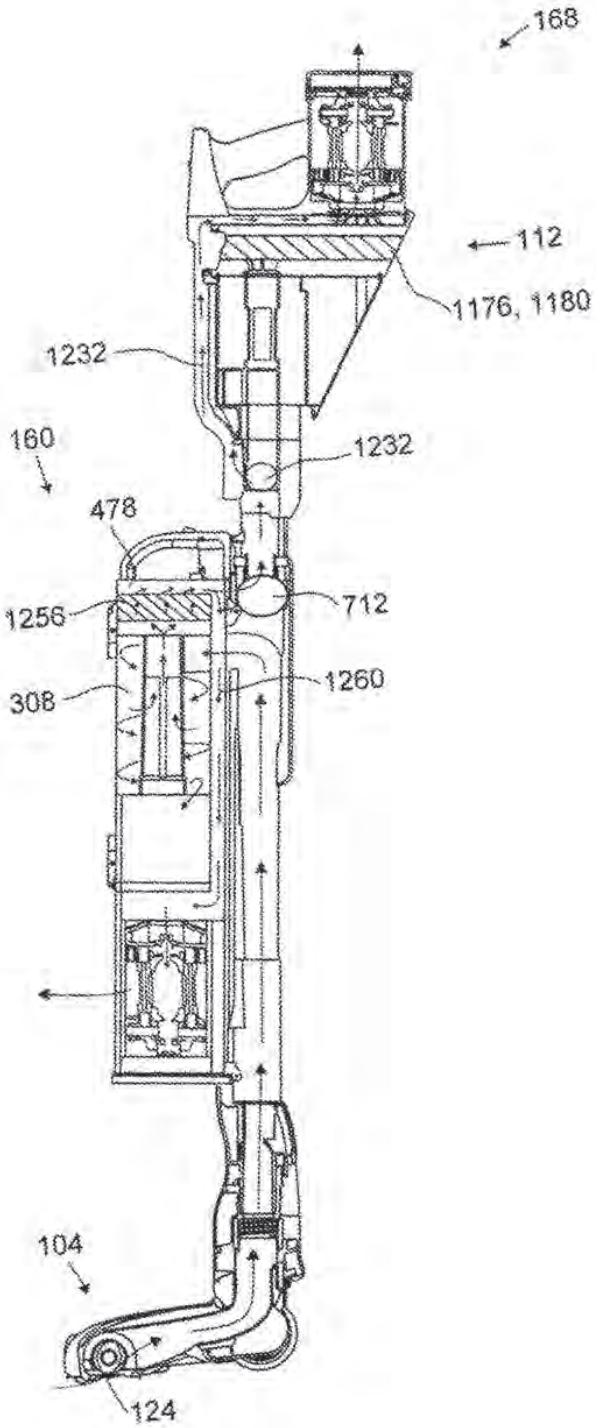


FIG. 104b

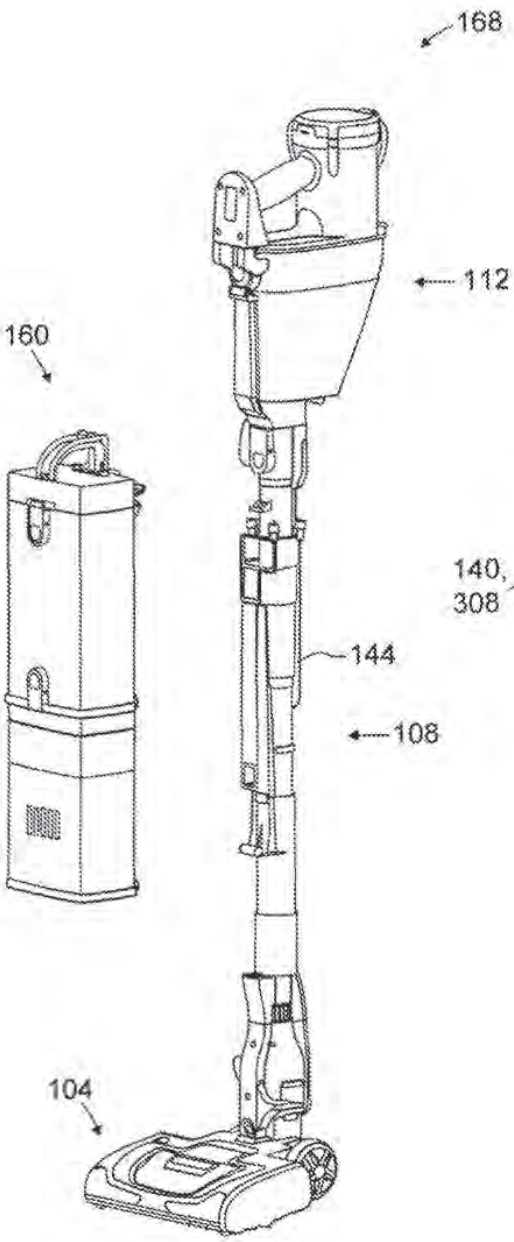


FIG. 105a

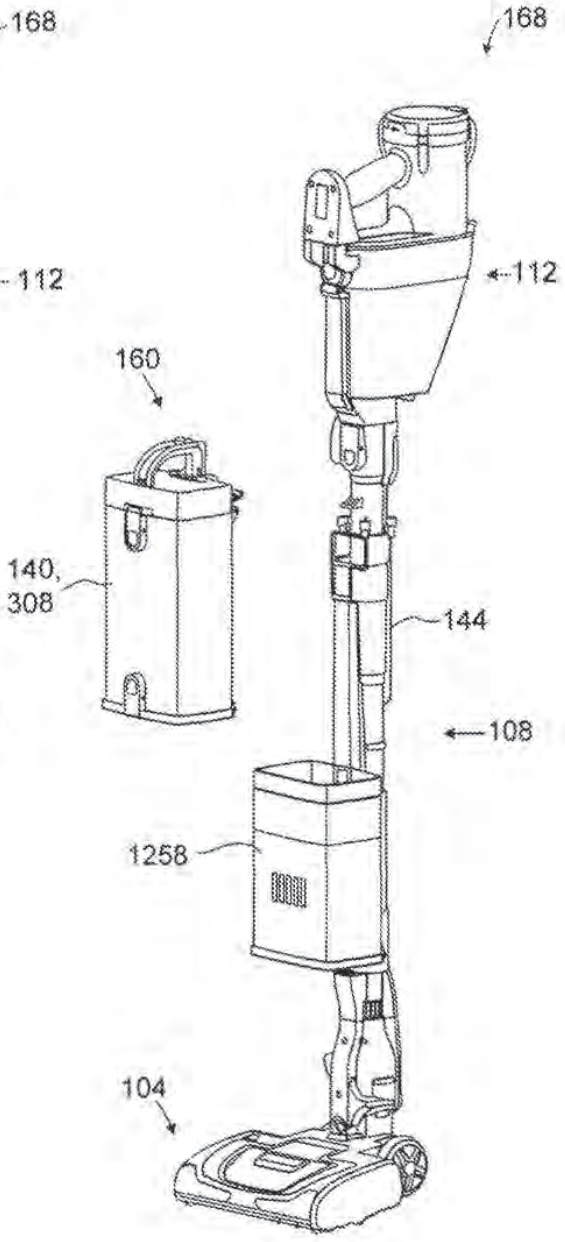


FIG. 105b

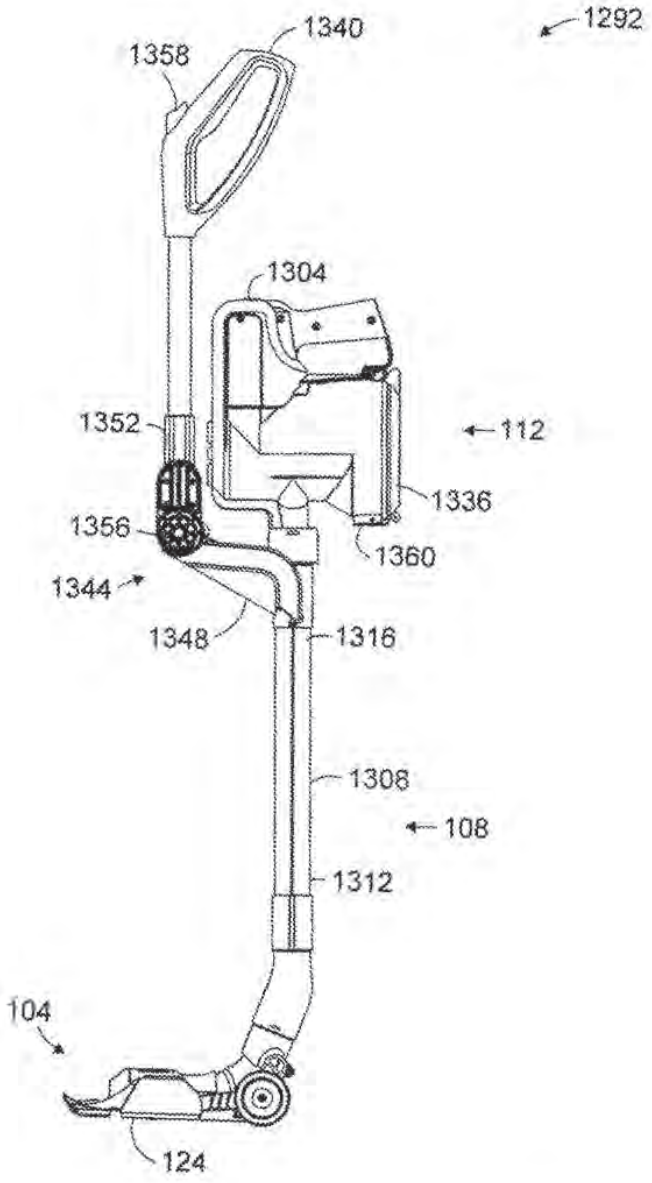

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FIG. 106

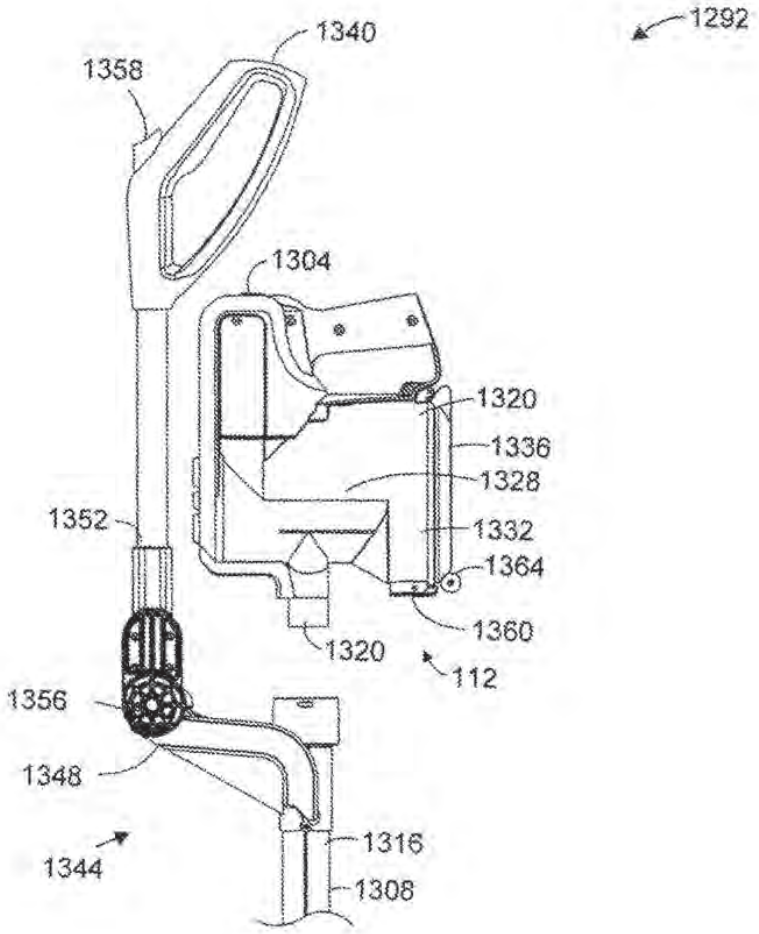

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FIG. 107

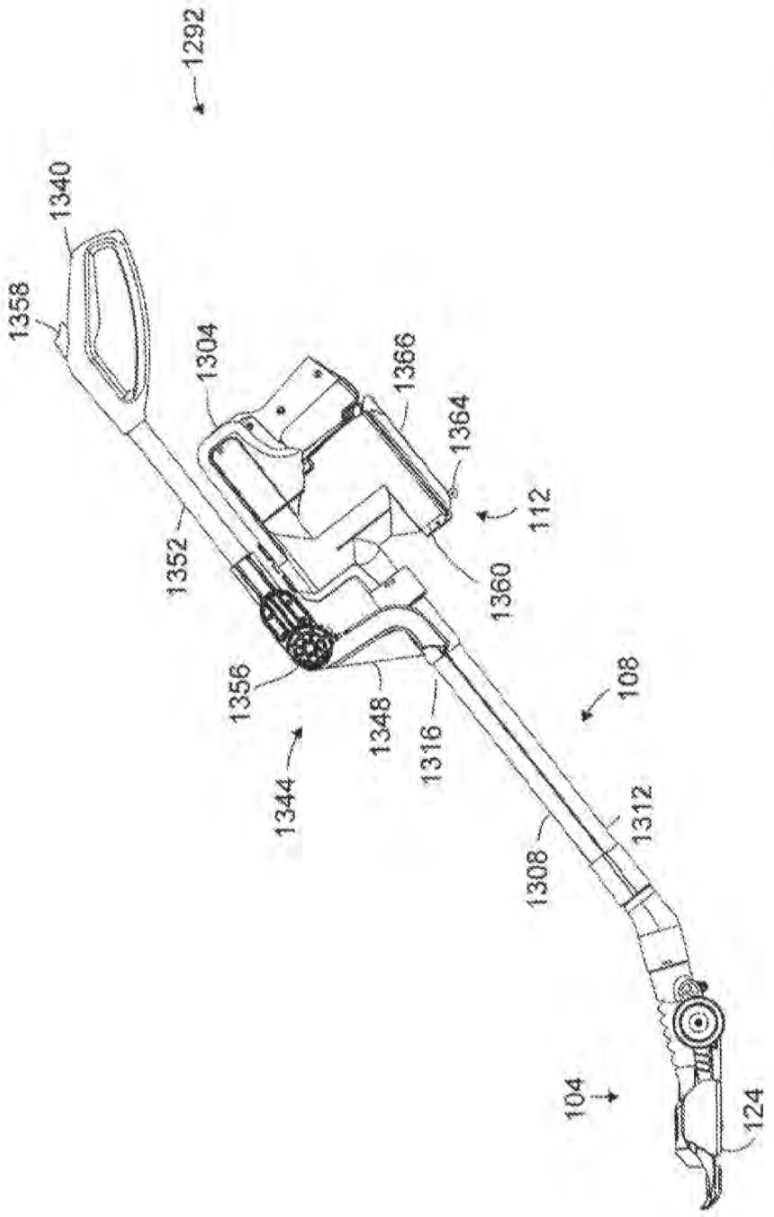

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FIG. 108

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FIG. 109

FIG. 110a

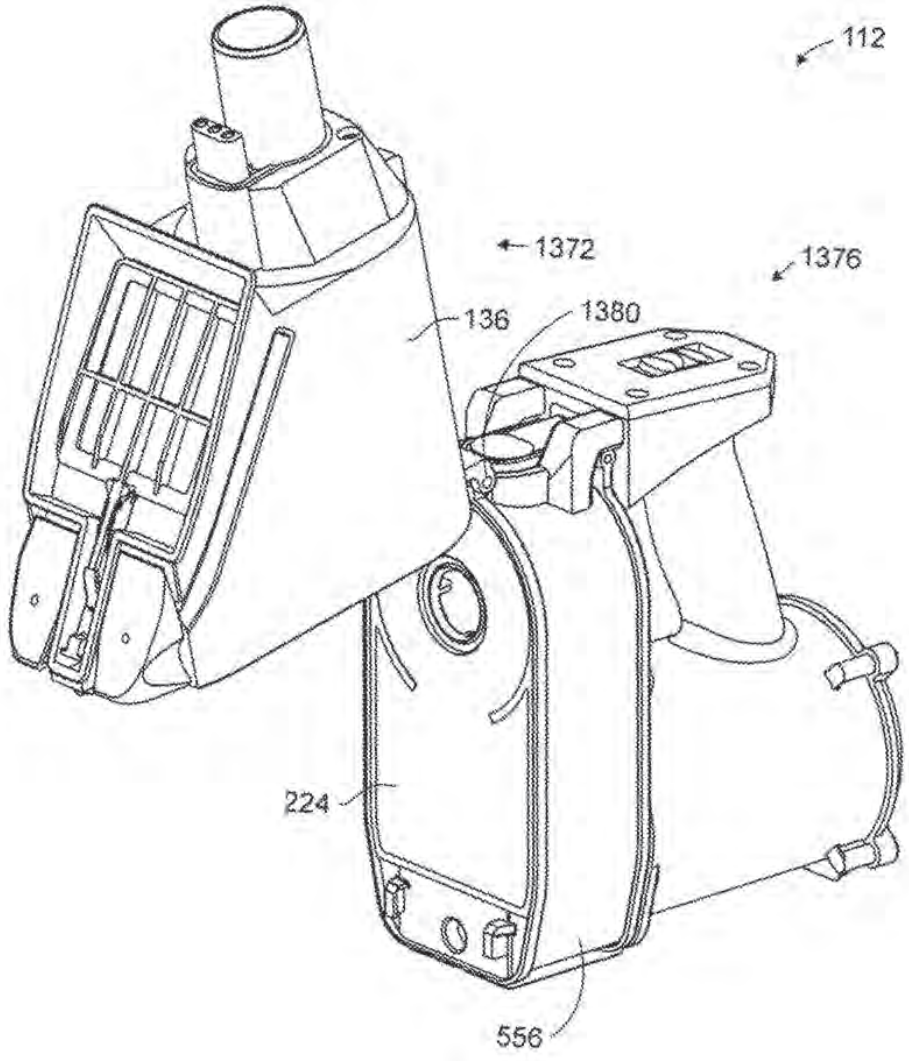


FIG. 110b

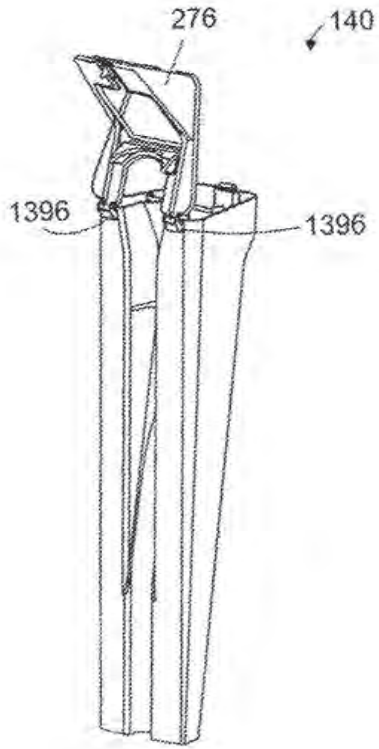


FIG. 111

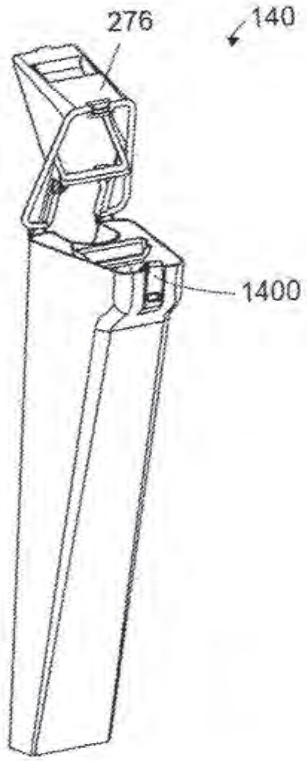


FIG. 112

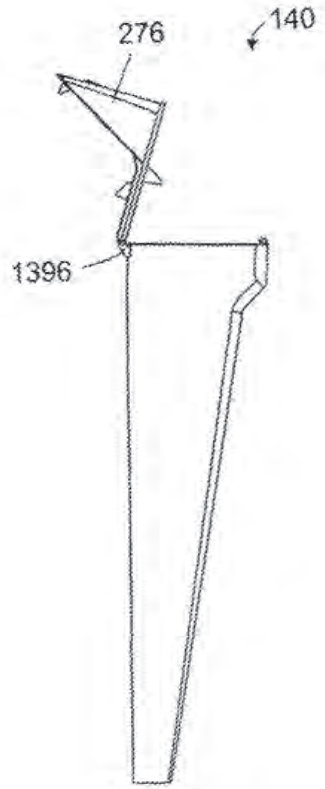


FIG. 113

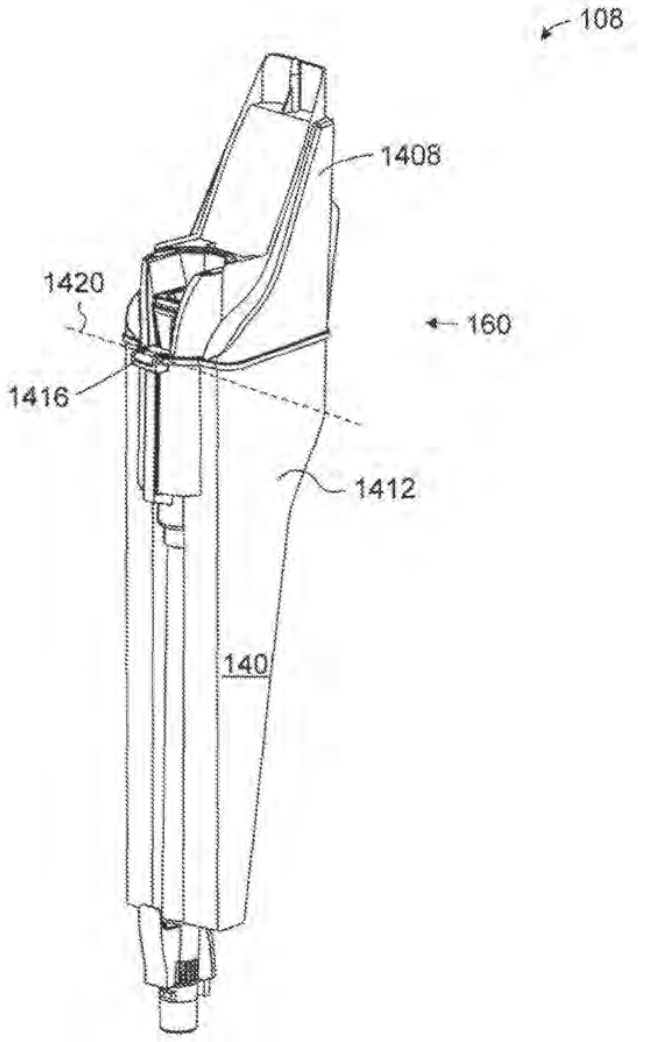


FIG. 114

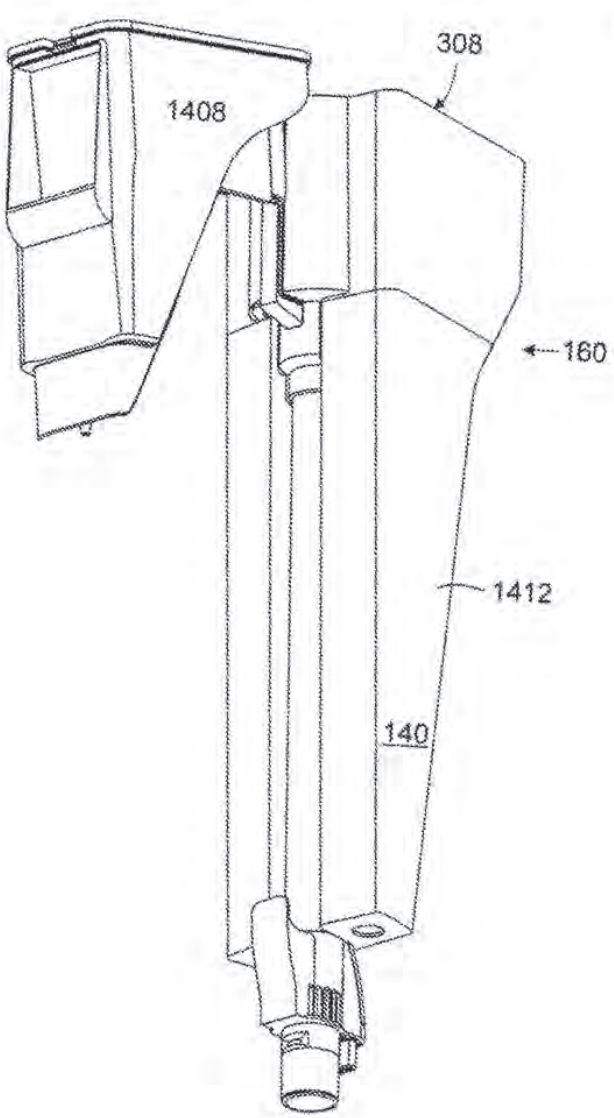


FIG. 115

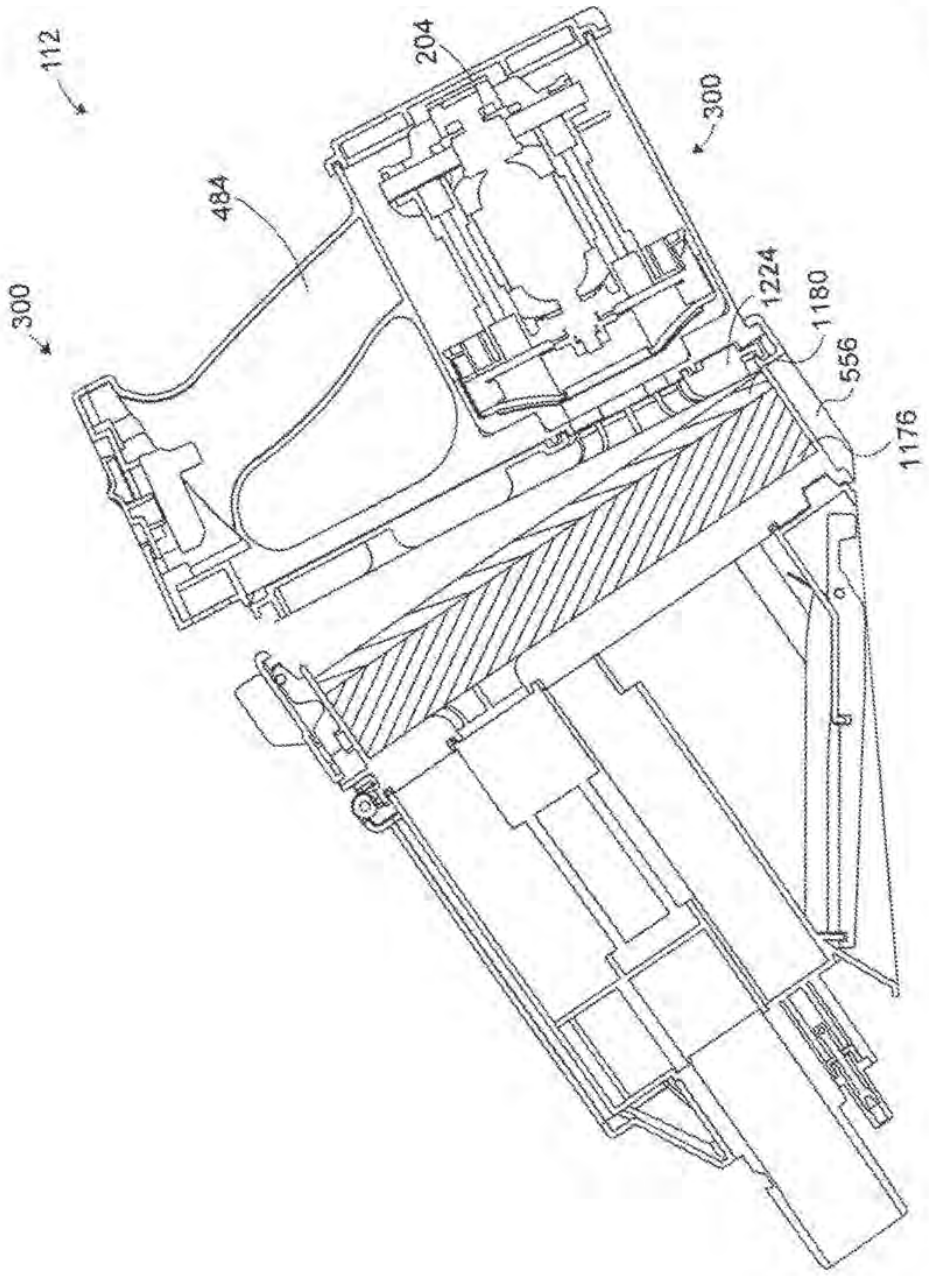


FIG. 116

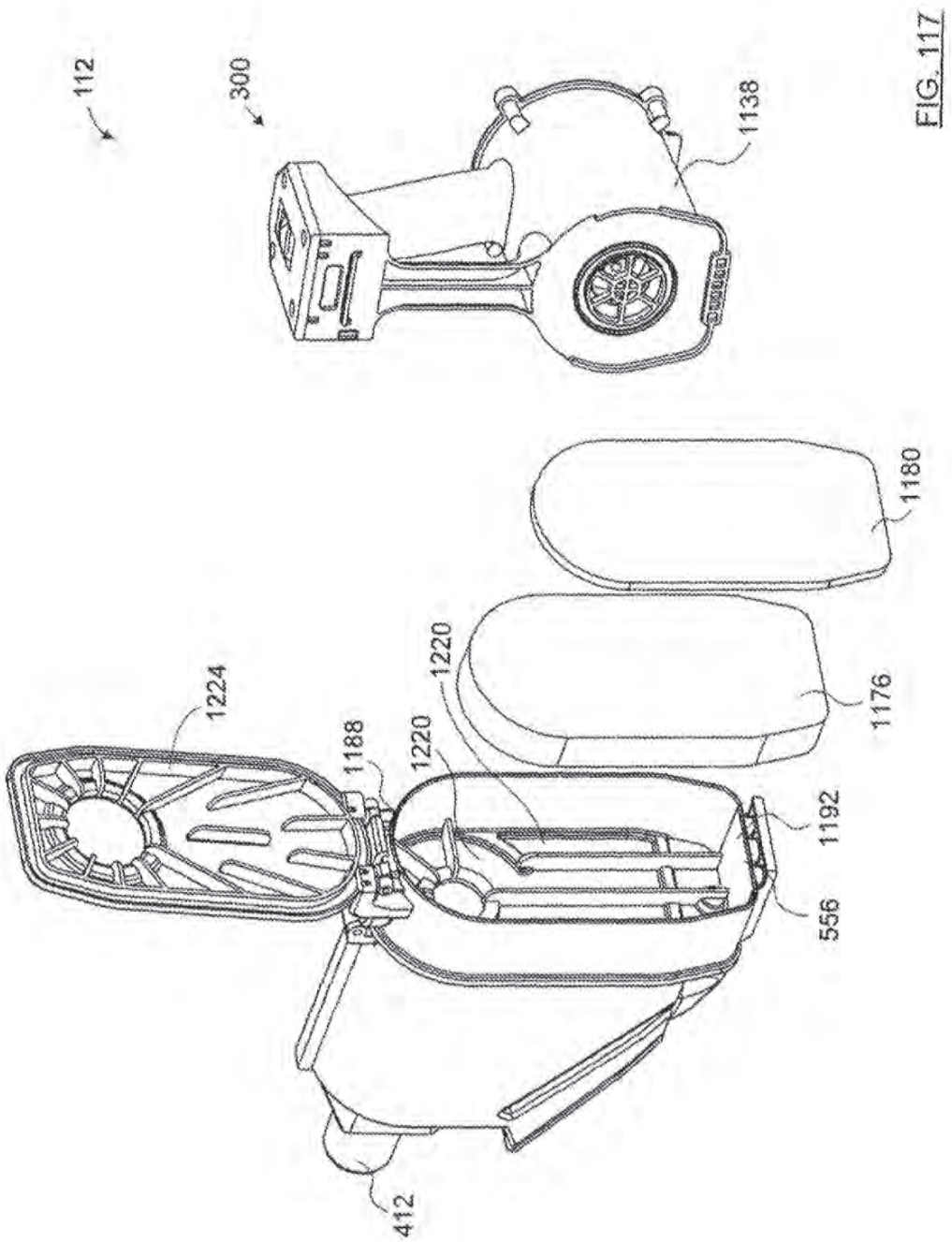


FIG. 117

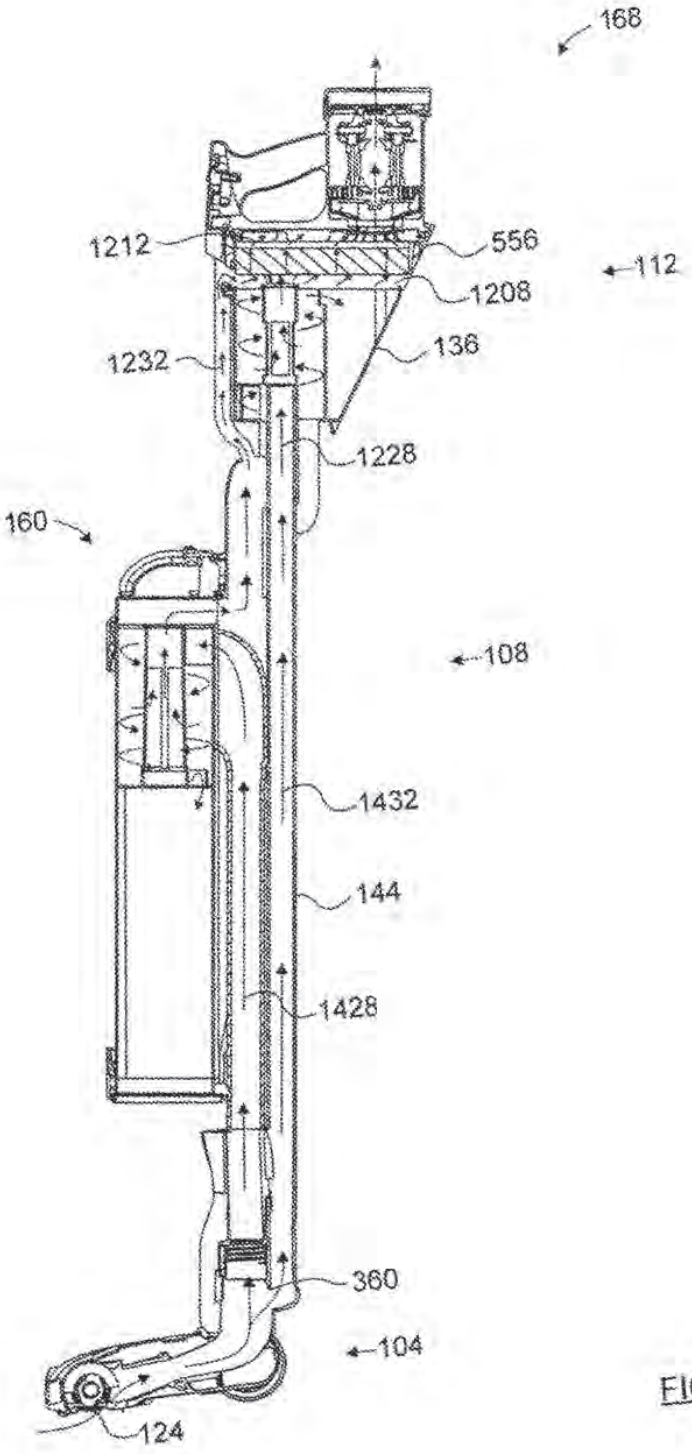

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FIG. 118

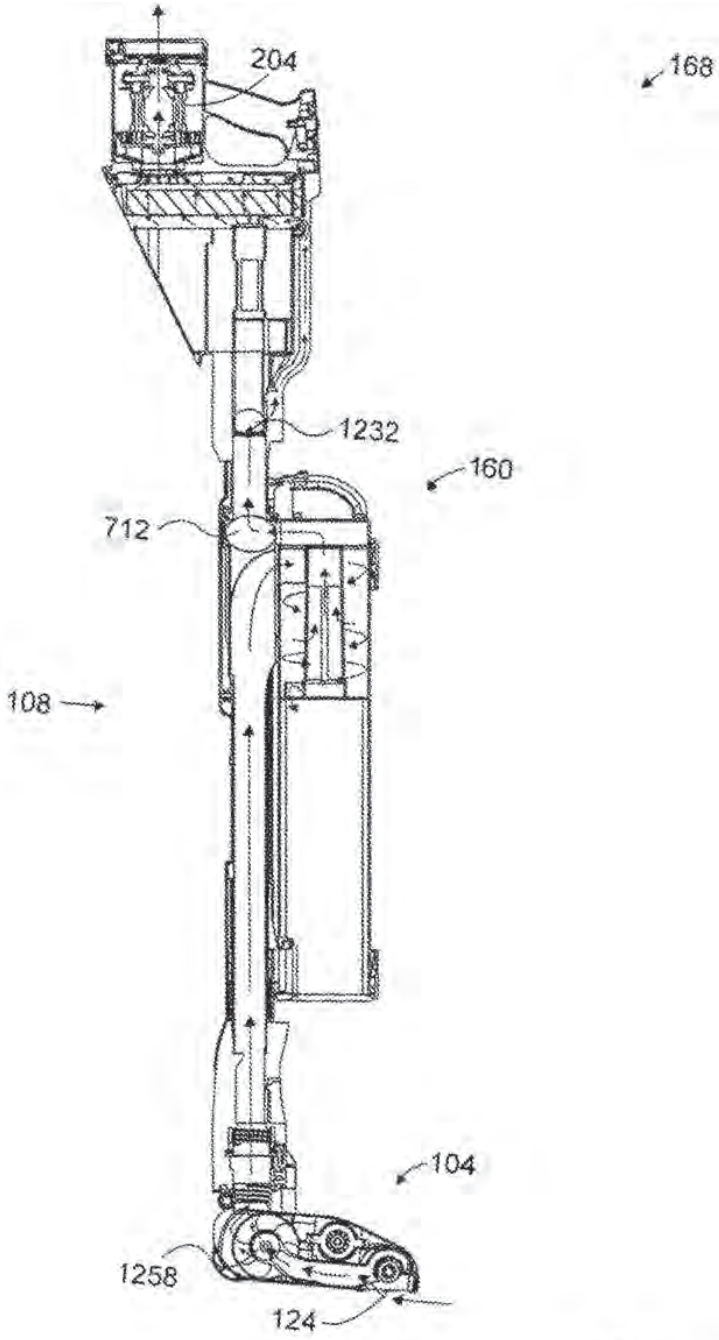


FIG. 119a

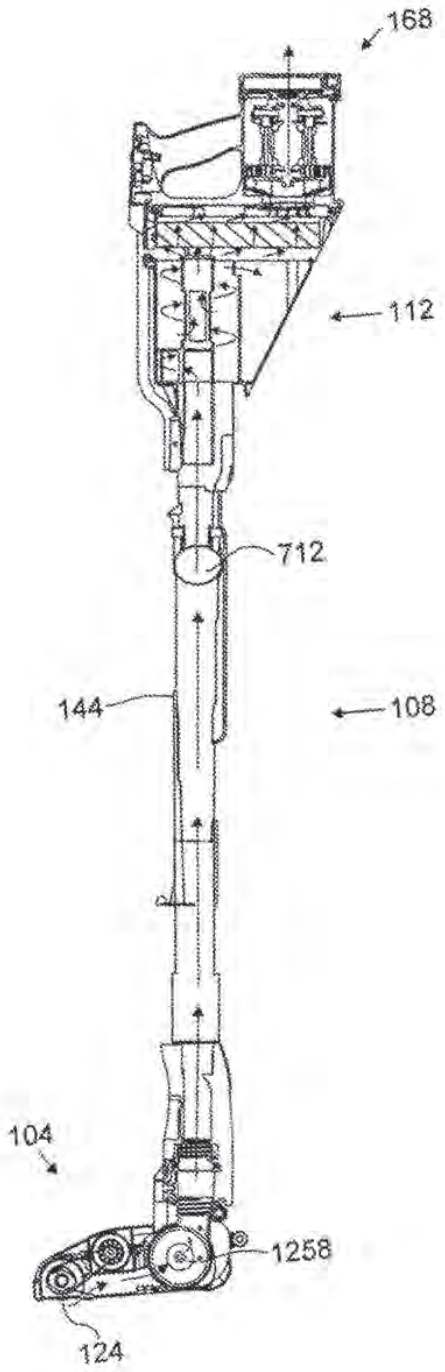


FIG. 119b

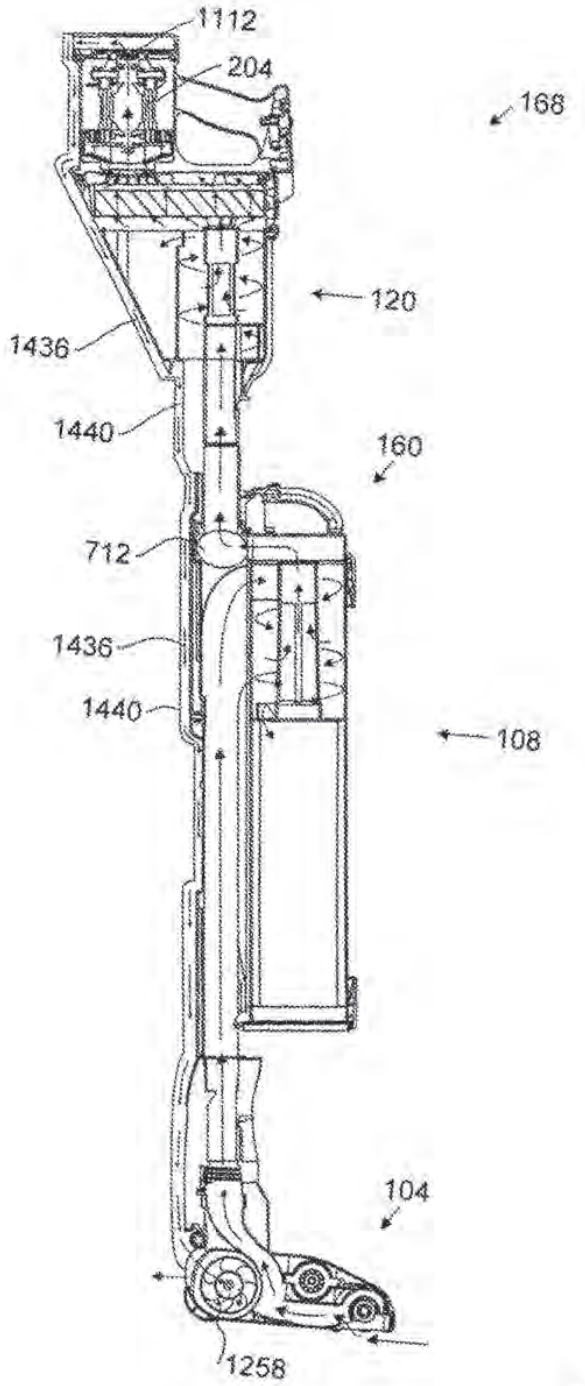


FIG. 120

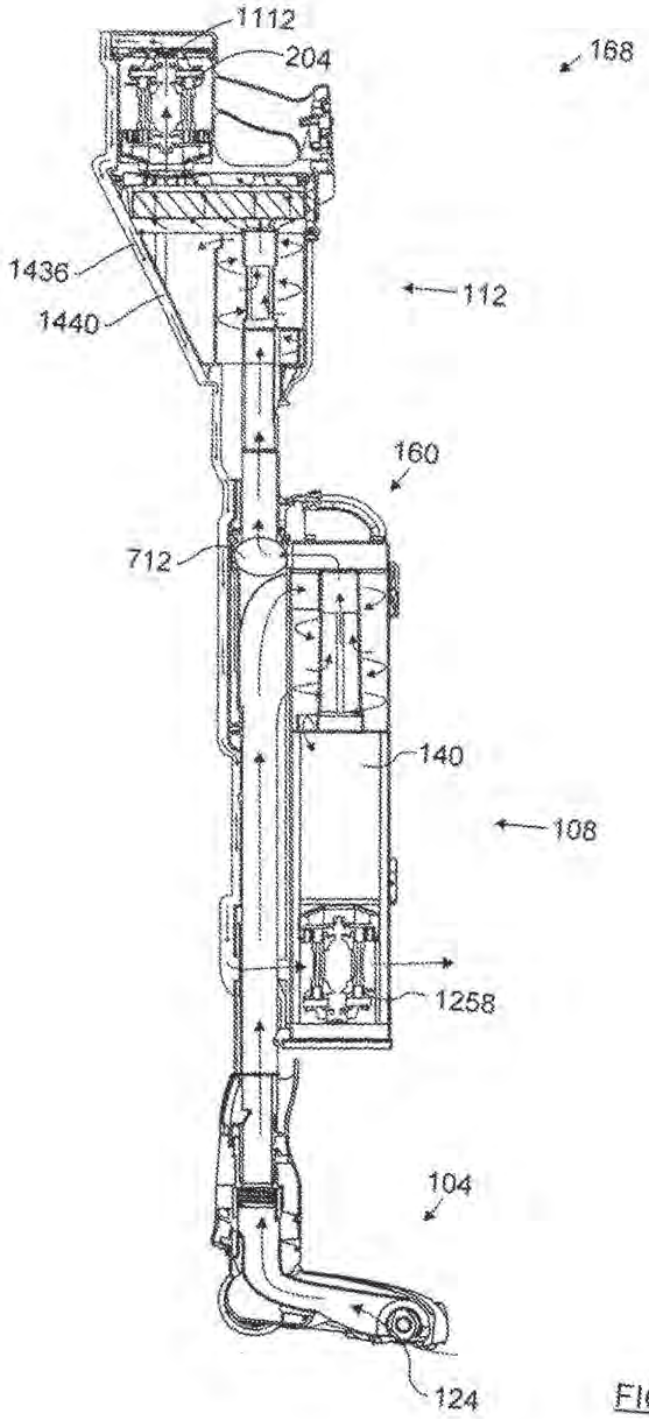


FIG. 121a

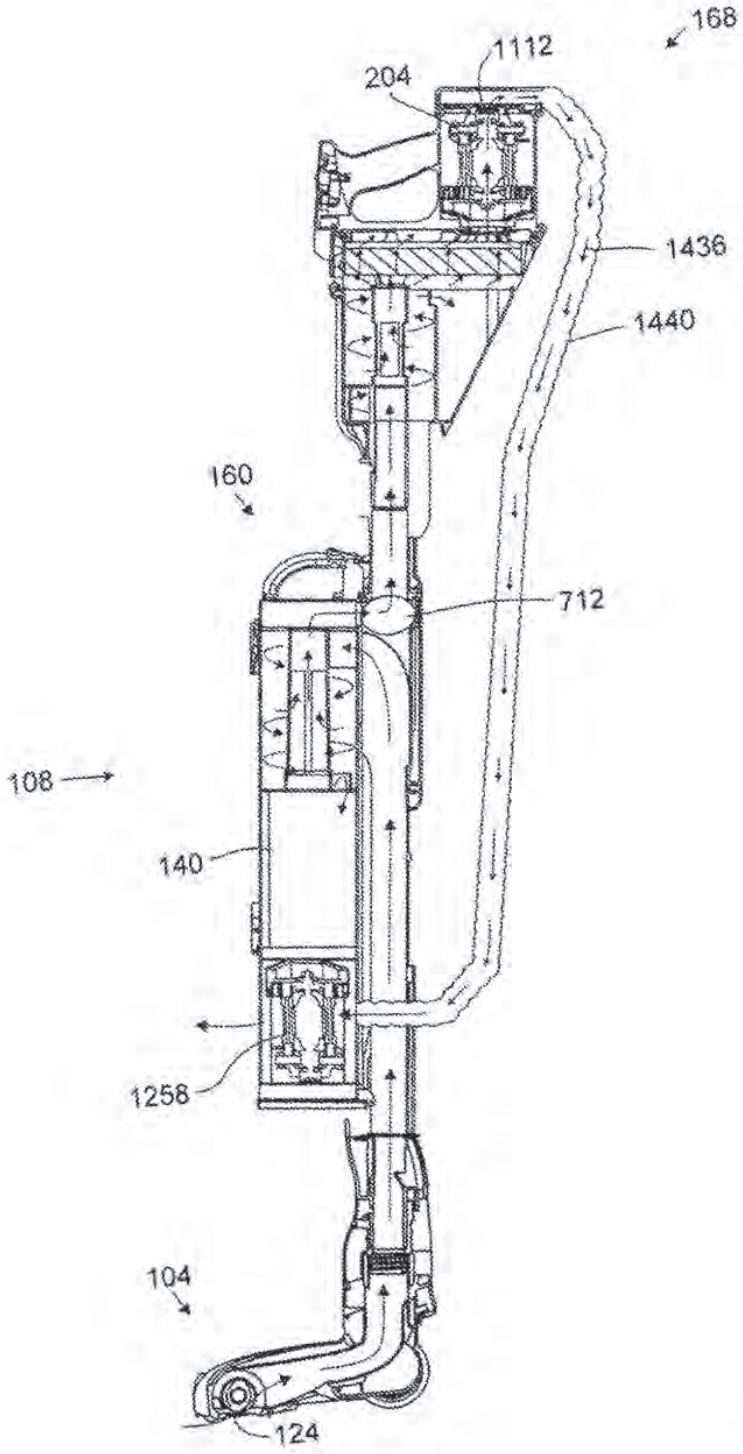


FIG. 121b

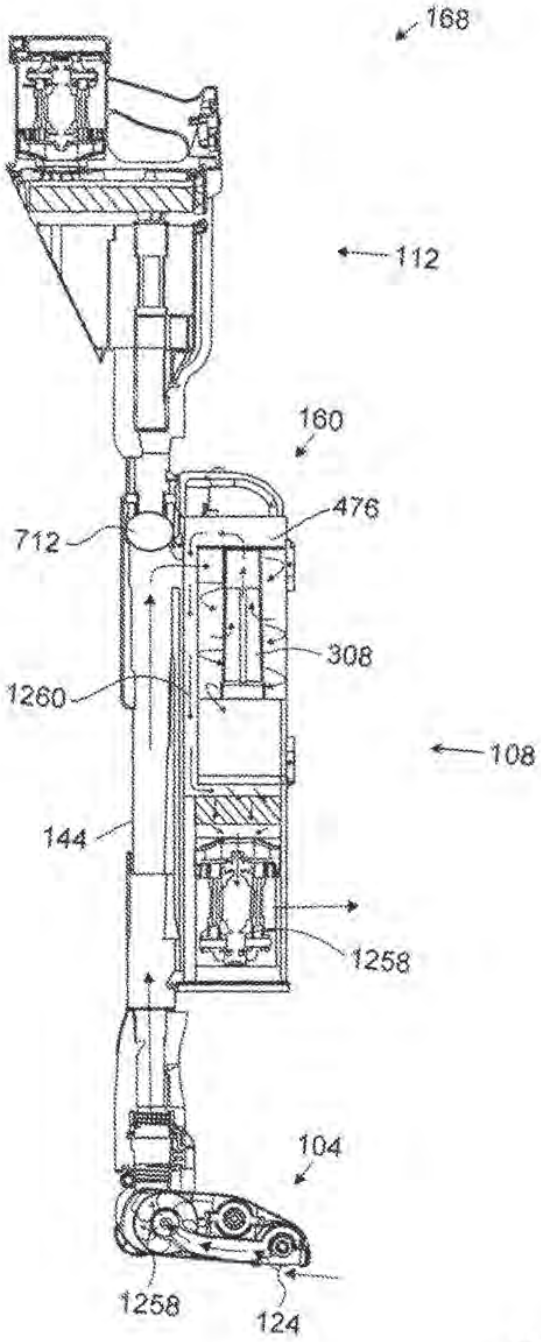


FIG. 122

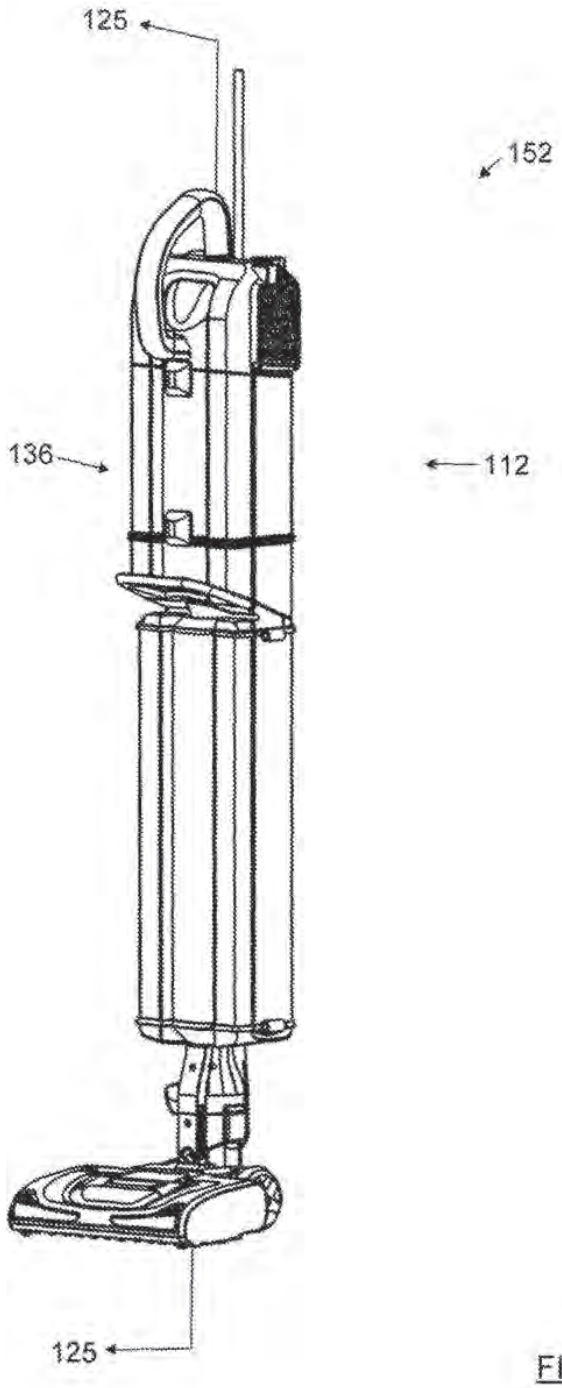


FIG. 123

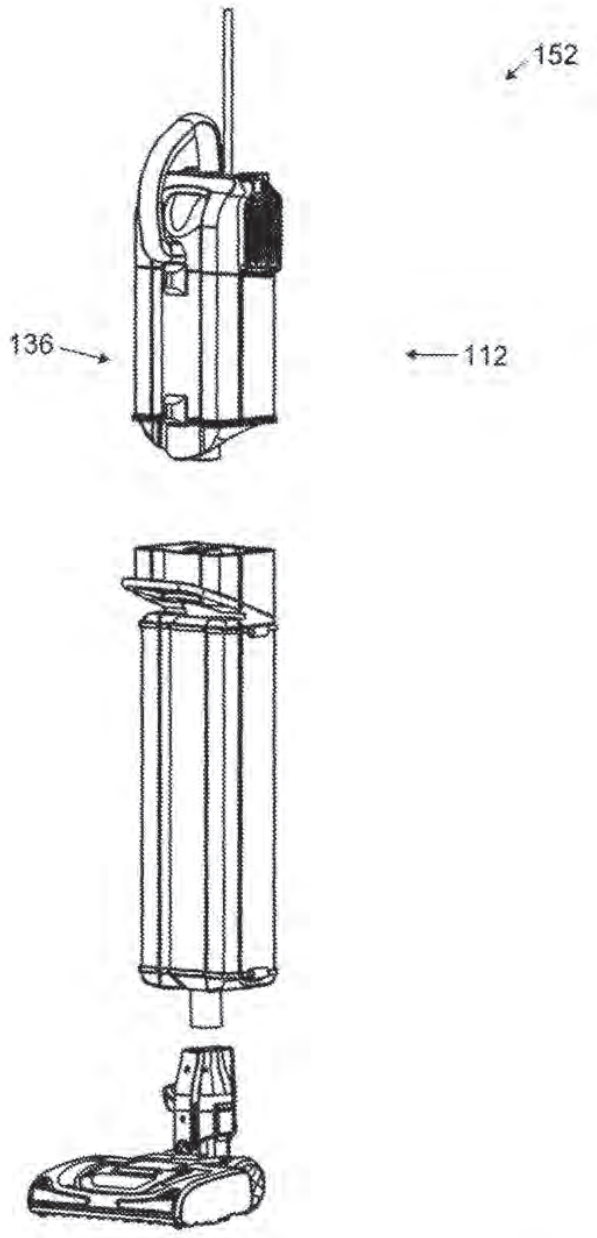


FIG. 124

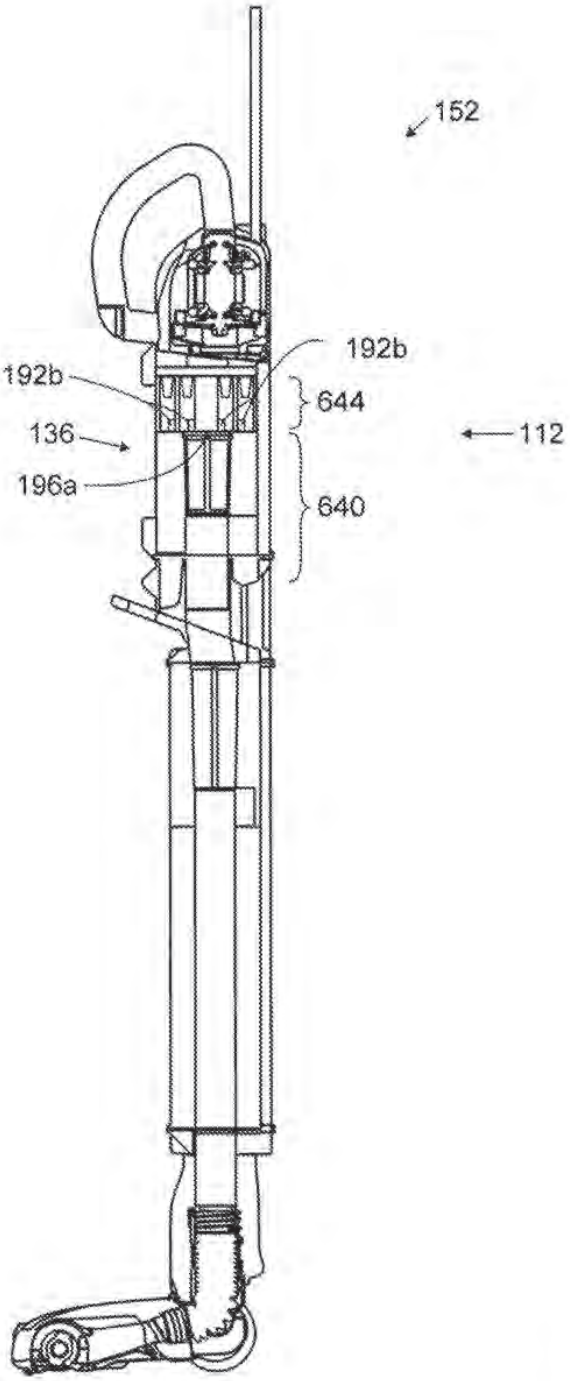


FIG. 125

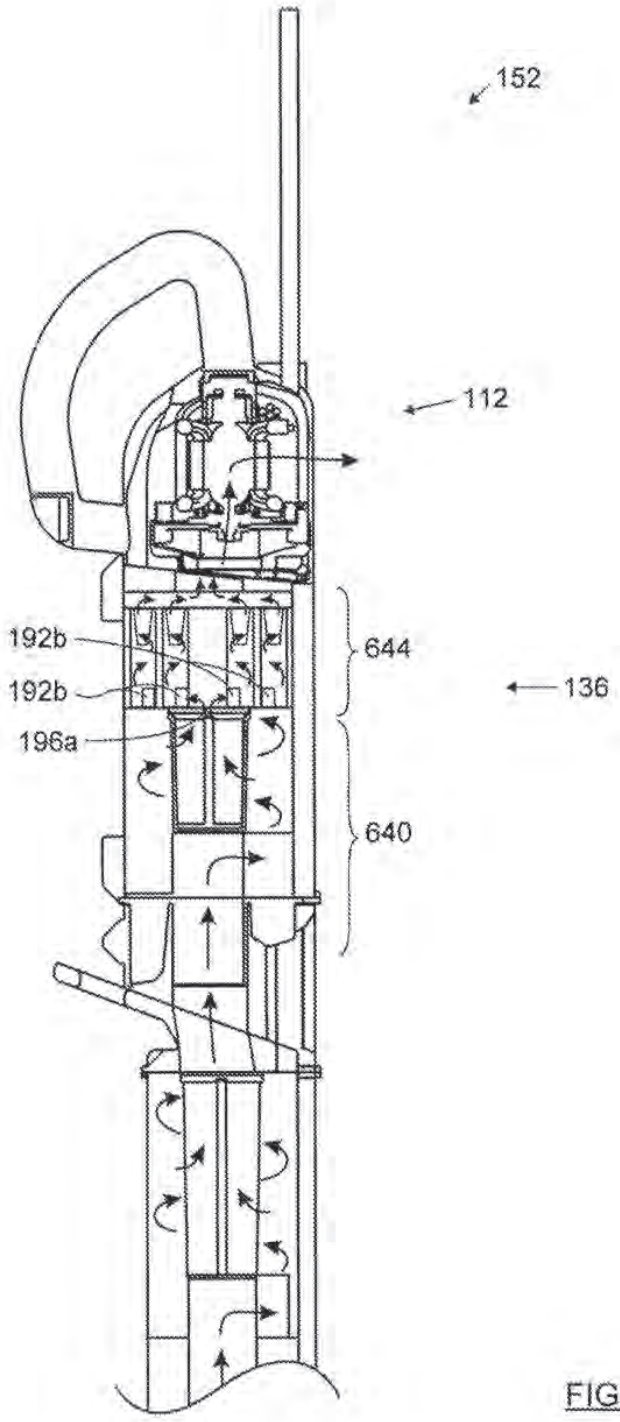


FIG. 126

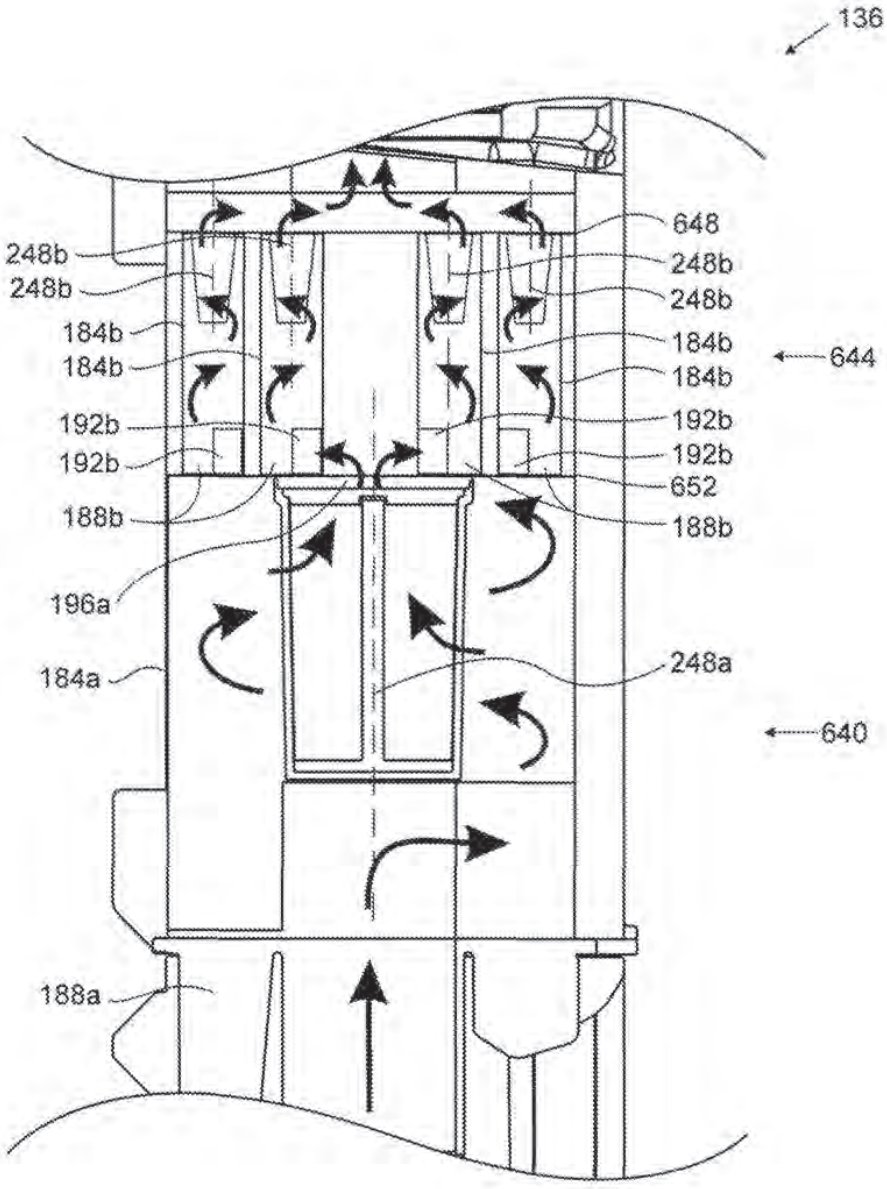

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FIG. 127

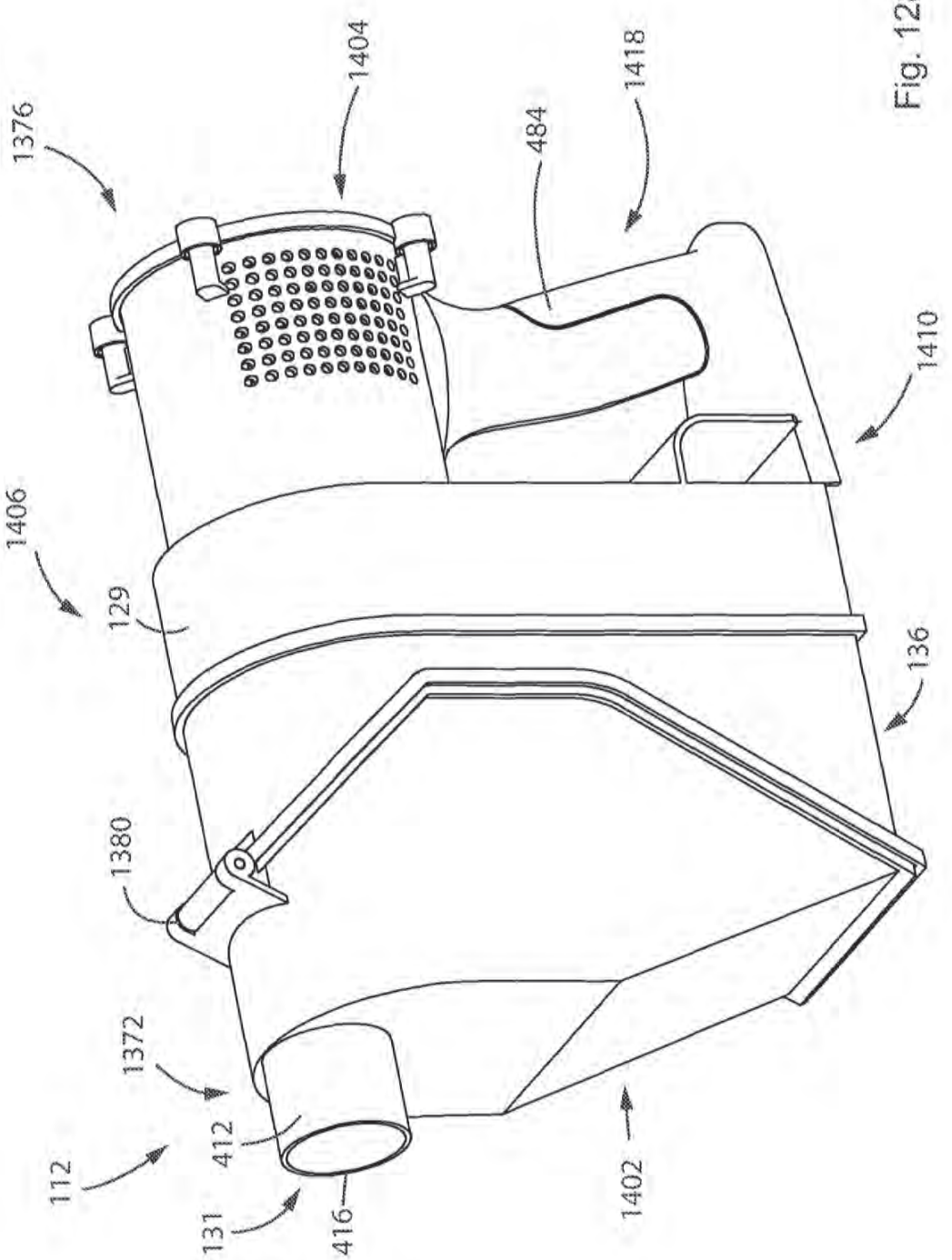

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Fig. 128

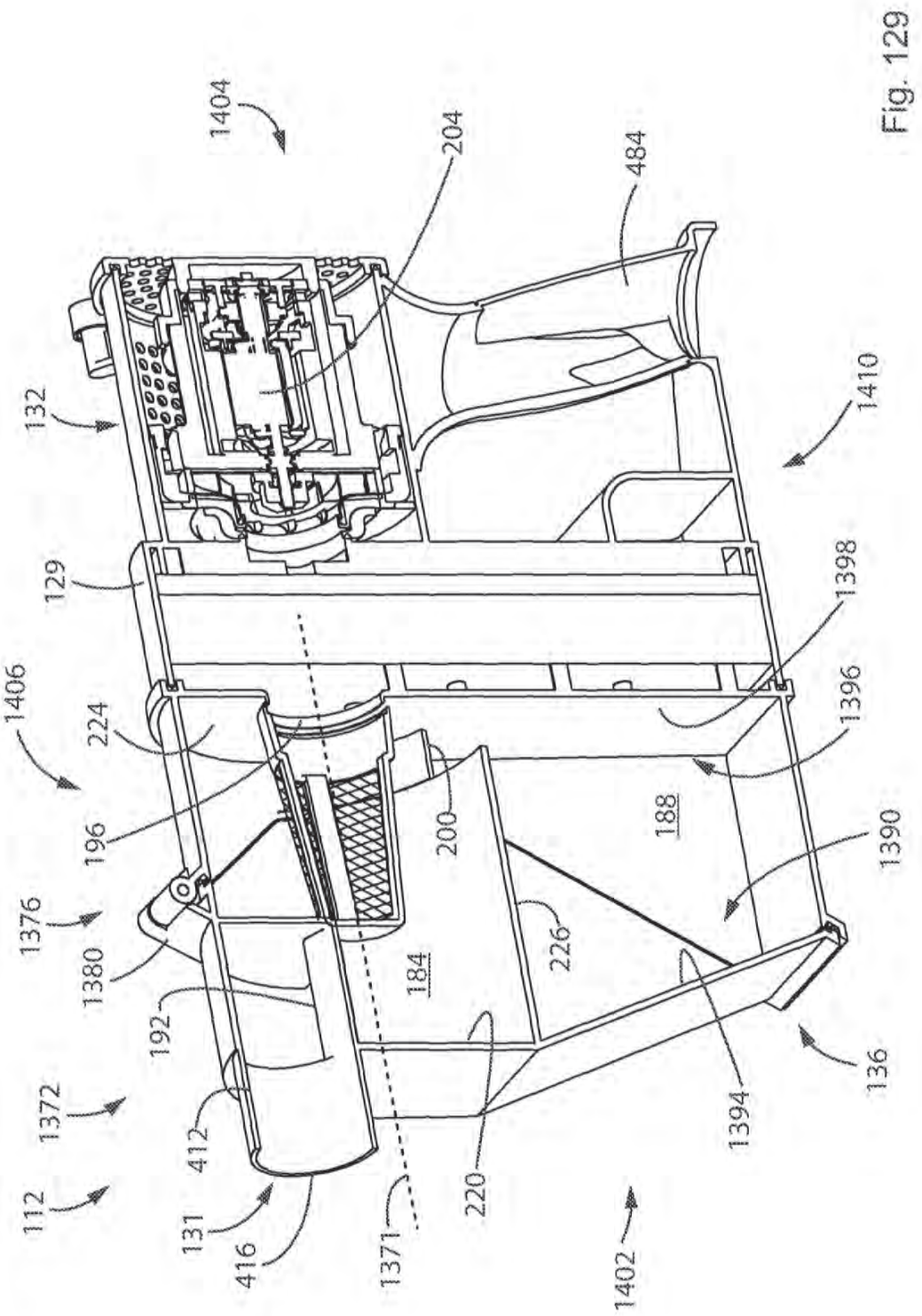

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Fig. 129

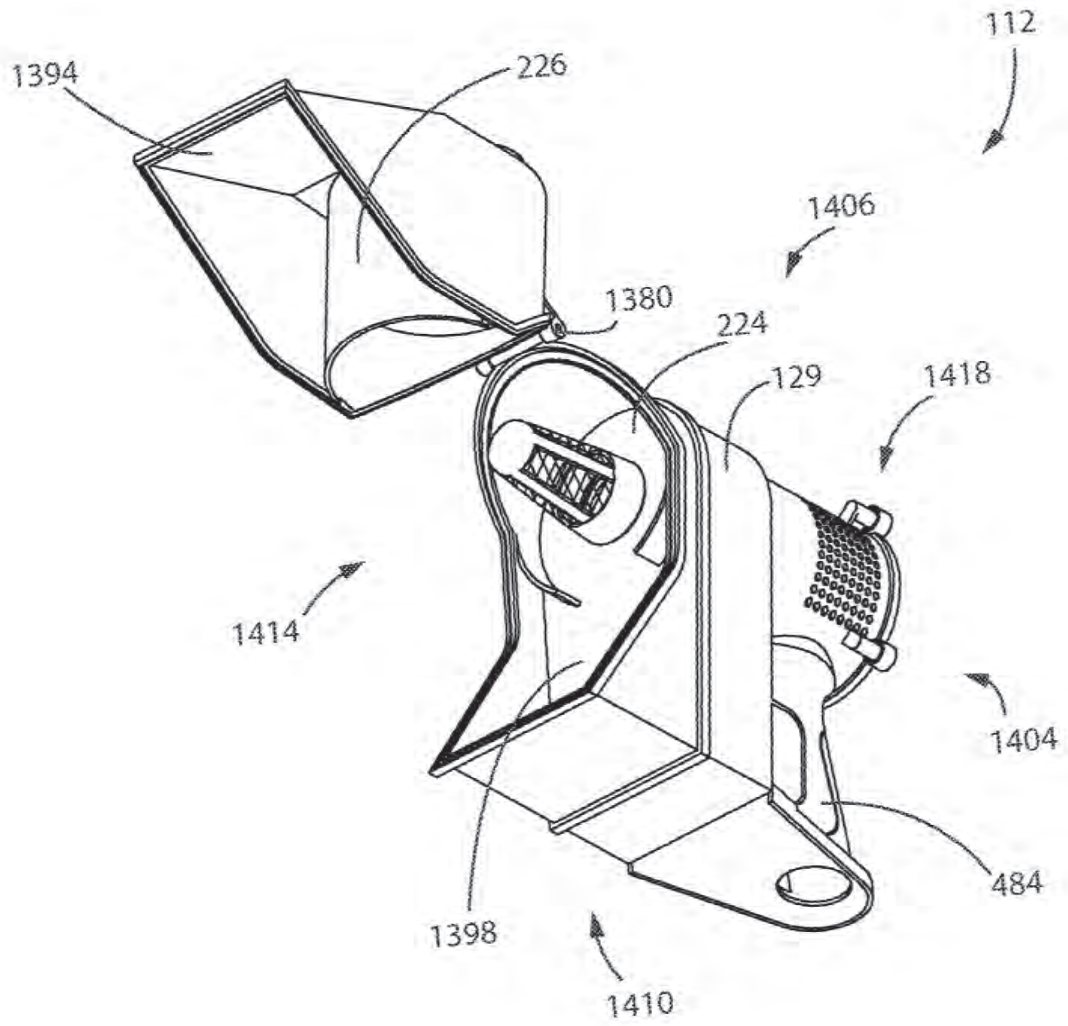


Fig. 130

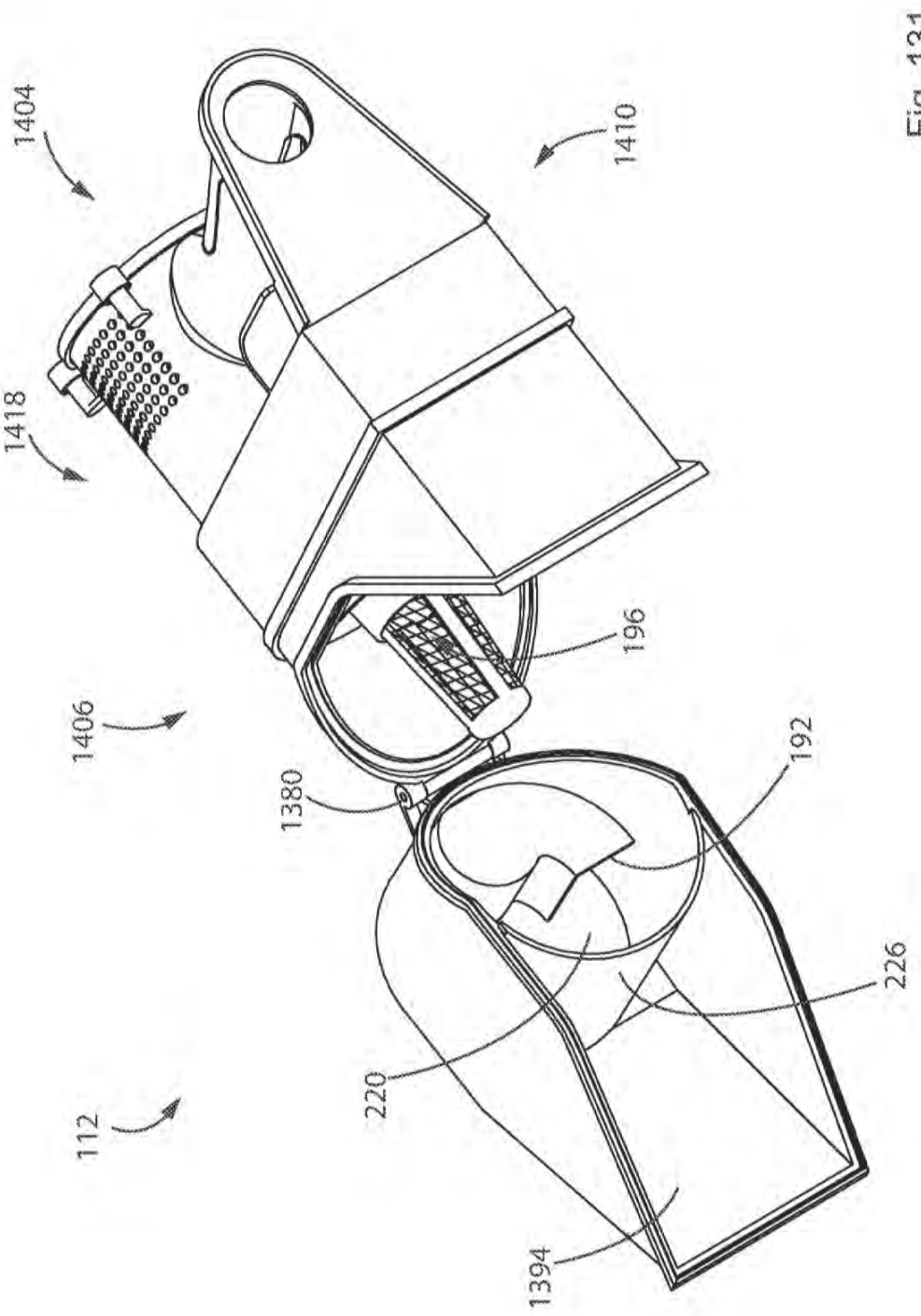


Fig. 131

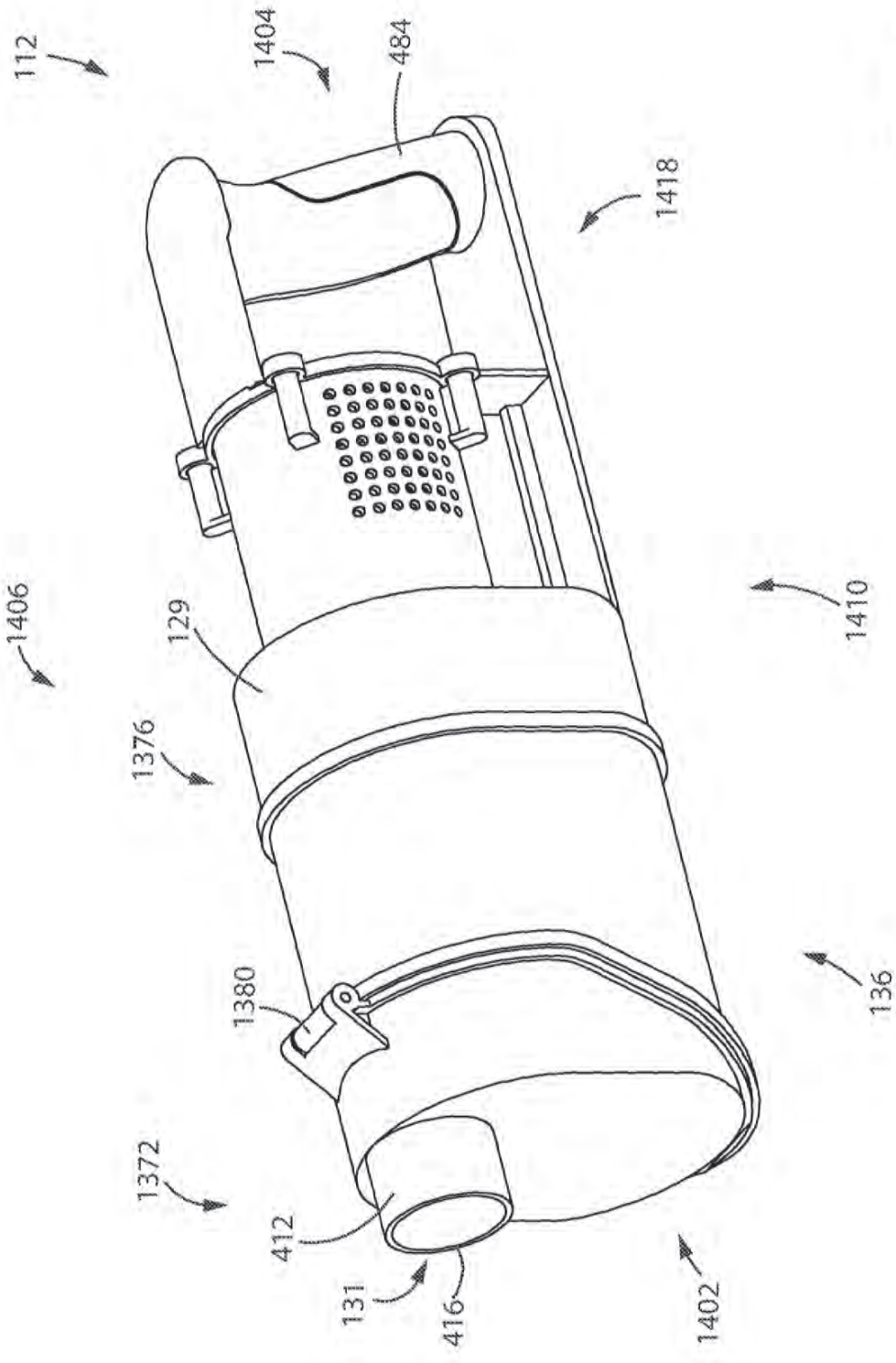

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Fig. 132

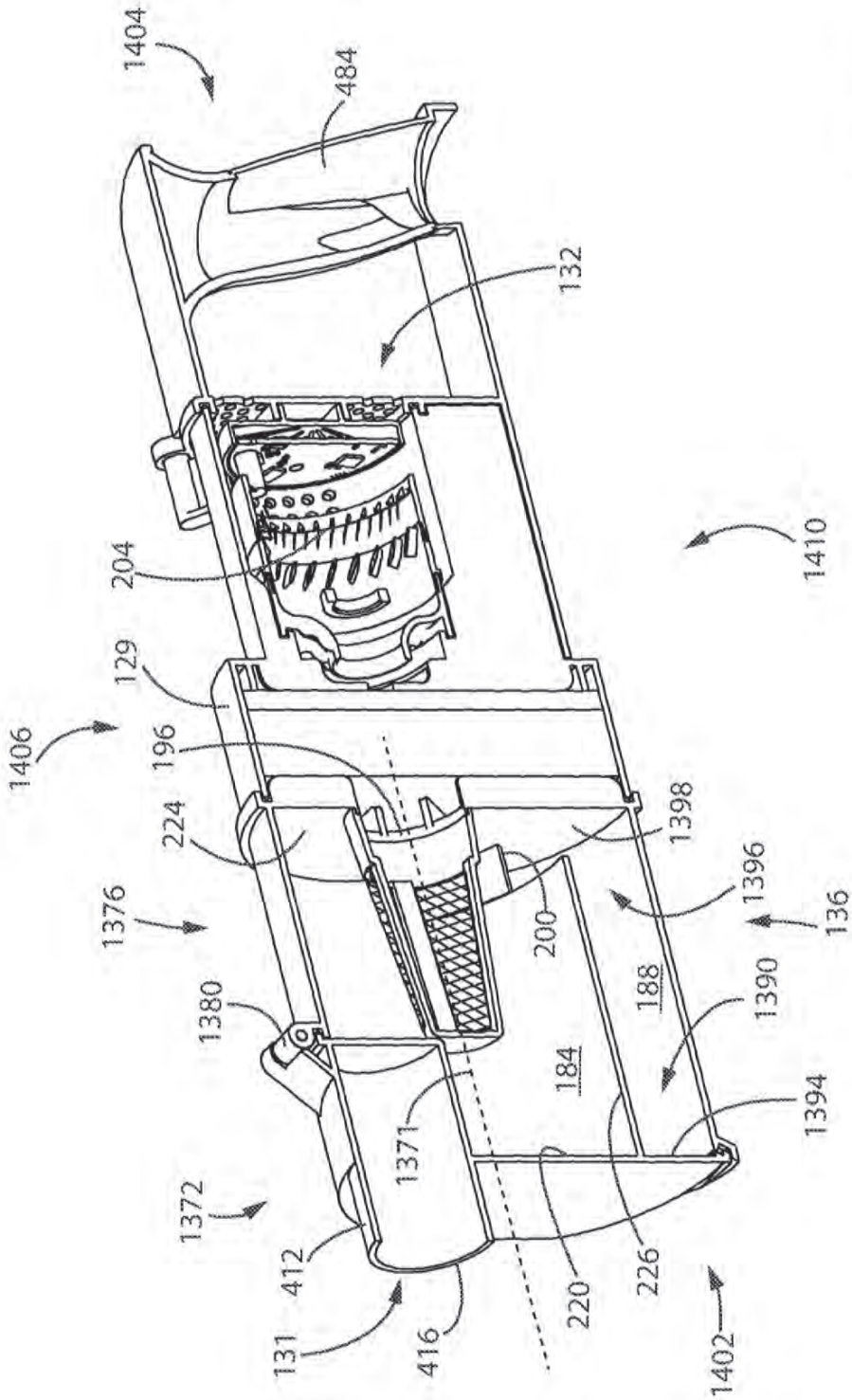

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Fig. 133

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Fig. 134

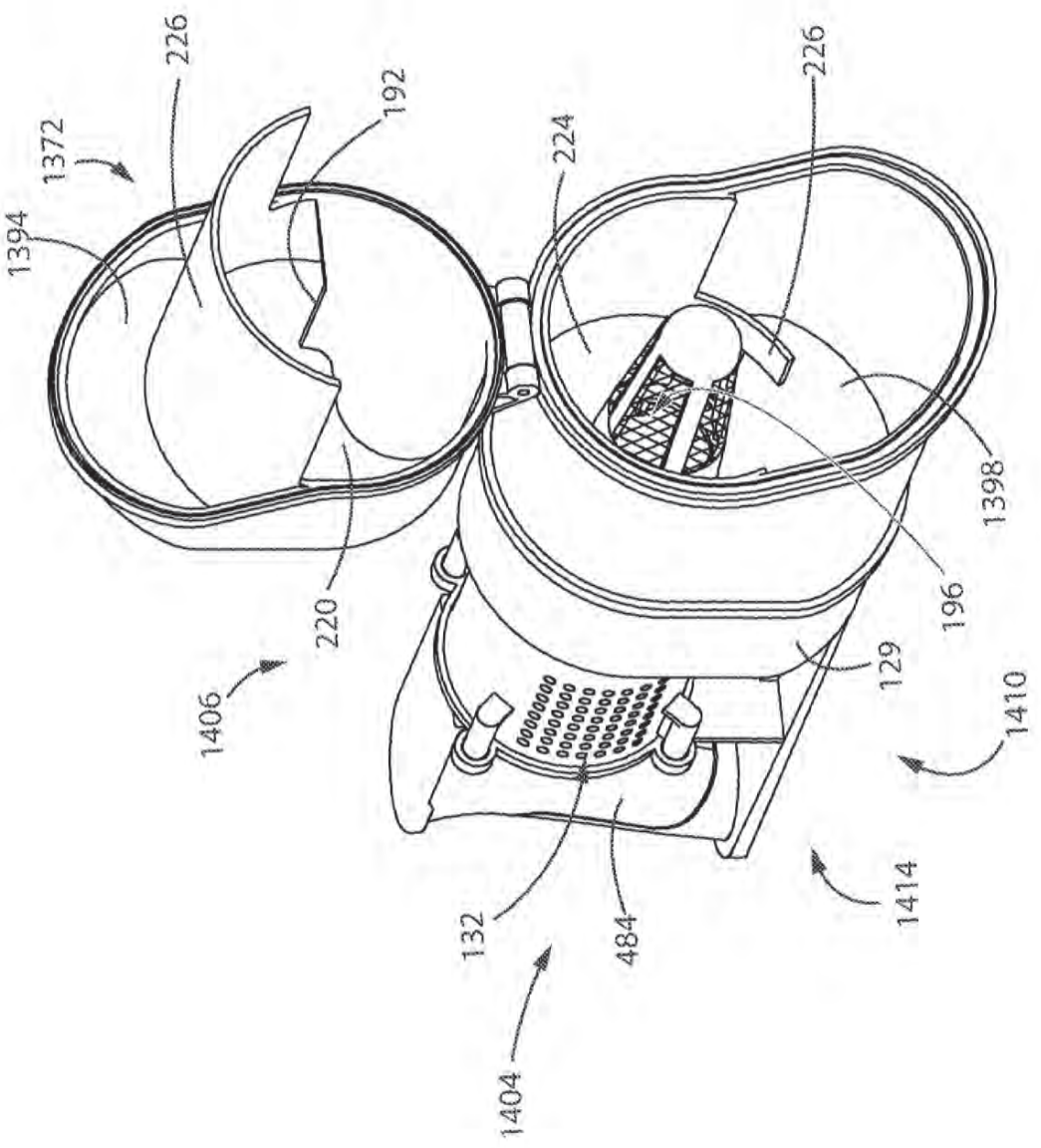

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Fig. 135

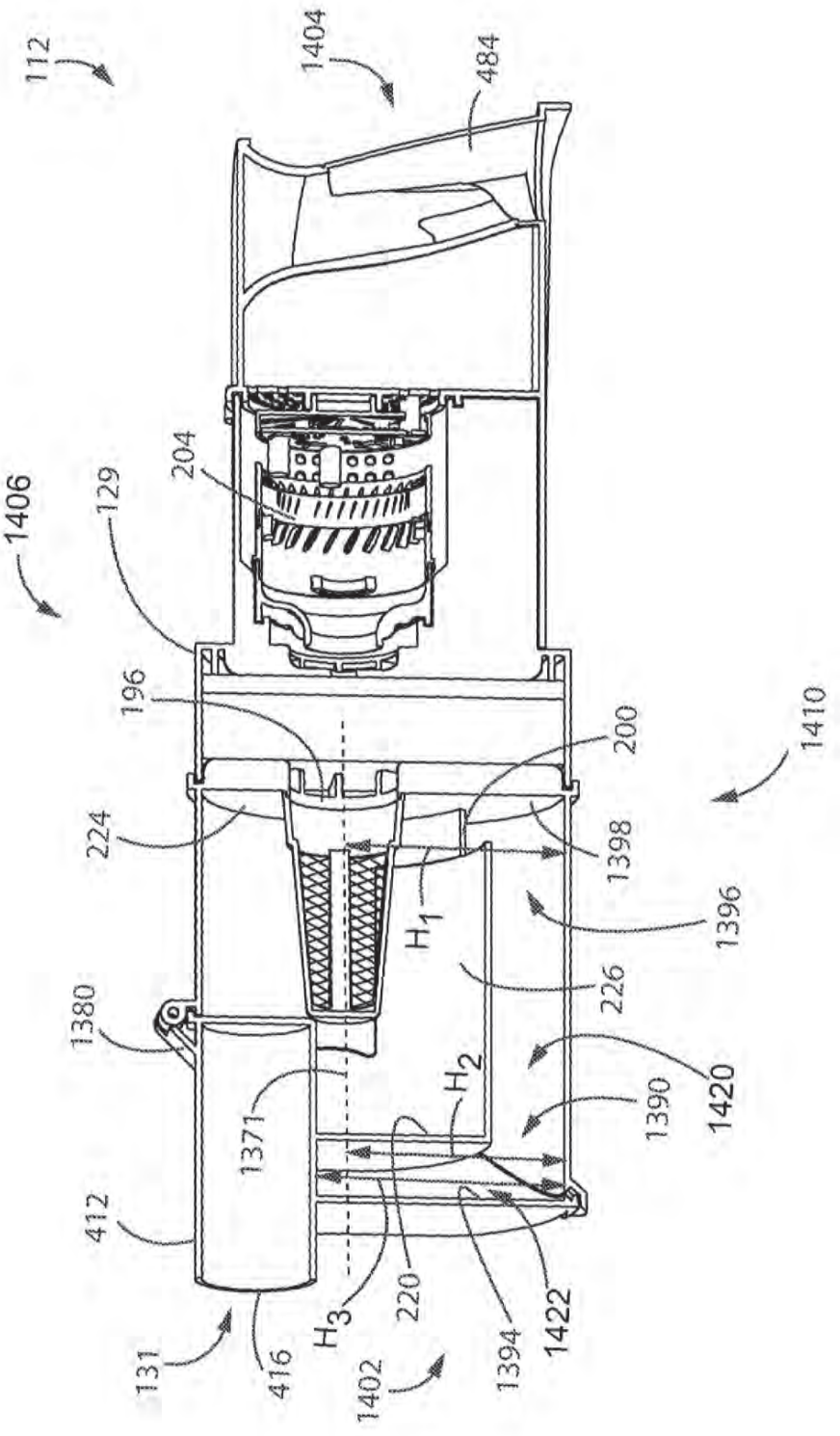

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Fig. 136

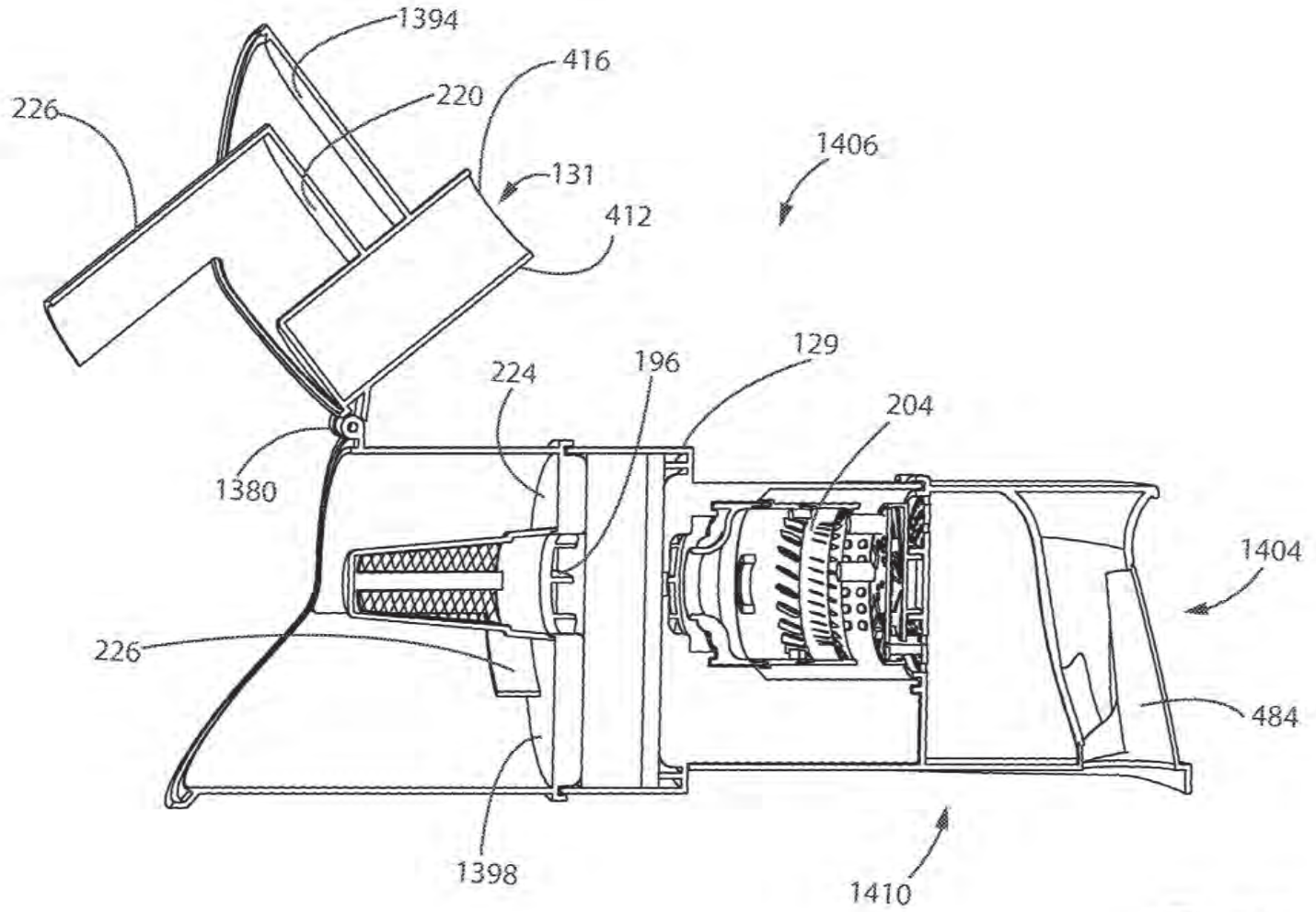

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Fig. 137

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16

CONFIRMATION NO. 5858

IMPROPER CPOA LETTER

1059
BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
40TH FLOOR
TORONTO, ON M5H 3Y2
CANADA

OC000000134393824

Date Mailed: 06/09/2022

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 06/02/2022. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney has not been accepted because the party who is giving power has not been identified. Power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A party who is not the applicant must become the applicant in accordance with 37 CFR 1.46(c) and appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. For a reissue application, reexamination proceeding, or supplemental examination proceeding, a patent owner who was not the applicant under 37 CFR 1.46 must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).

/lkchi/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Bereskin & Parr

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	17/830,507
Title	:	SURFACE CLEANING APPARATUS
Applicant	:	Omachron Intellectual Property Inc.
Filed	:	June 2, 2022
Art Unit	:	OPAP
Examiner	:	n/a
Docket No.	:	10452-P46958US16
Conf. No.	:	5858
Cust. No.	:	01059

June 13, 2022

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313–1450

POWER OF ATTORNEY

Commissioner:

In response to the Notice Regarding Power or Attorney, the Applicant submits herewith the POA form SB/80 along with a Statement under 37 CFR 3.73(c). A copy of the Application Data Sheet is enclosed.

The enclosed Power of Attorney, appointing Bereskin & Parr Representatives under Customer No. 01059, has been executed by the undersigned, who is also a Vice-President of Omachron Intellectual Property Inc. It is respectfully submitted that the Assignment from the inventor to Omachron Intellectual Property Inc., was recorded on June 2, 2022 under Reel/Frame No. 060086/0577.

Bereskin & Parr LLP
Scotia Plaza, 40 King Street West, 40th Floor, Toronto, ON M5H 3Y2 Canada
Tel: 416.364.7311 Fax: 416.361.1398 bereskinparr.com

7583193

Acknowledgement of the Power of Attorney is respectfully requested.

Any questions regarding this submission or this application should be directed to the undersigned at 416.957.1695 or pmdcosta@bereskinparr.com.

Respectfully submitted,

BERESKIN & PAR LLP/S.E.N.C.R.L., s.r.l.
Agent for the Applicant

/Philip C. Mendes da Costa/
By _____
Philip C. Mendes da Costa
Reg. No 33,106
Tel: 416.957.1695

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16

CONFIRMATION NO. 5858

POA ACCEPTANCE LETTER

1059
BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
40TH FLOOR
TORONTO, ON M5H 3Y2
CANADA



Date Mailed: 06/17/2022

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/13/2022.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sibrahim/

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16	5858

1059 7590 05/31/2023

BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
40TH FLOOR
TORONTO, ONTARIO M5H 3Y2
CANADA

EXAMINER	
REDDING, DAVID A	

ART UNIT	PAPER NUMBER
3723	

NOTIFICATION DATE	DELIVERY MODE
05/31/2023	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipprocessingcentre@bereskinparr.com

Office Action Summary	Application No. 17/830,507	Applicant(s) Conrad, Wayne Ernest	
	Examiner DAVID A REDDING	Art Unit 3723	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-23 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-23 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 6/2/2022 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

/David Redding/
Primary Examiner, Art Unit 3723

DETAILED ACTION

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Interpretation

The following is a quotation of 35 U.S.C. 112(f):

> (f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The claims in this application are given their broadest reasonable interpretation using the plain meaning of the claim language in light of the specification as it would be understood by one of ordinary skill in the art. The broadest reasonable interpretation of a claim element (also commonly referred to as a claim limitation) is limited by the description in the specification when 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is invoked.

As explained in MPEP § 2181, subsection I, claim limitations that meet the following three-prong test will be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph:

(A) the claim limitation uses the term "means" or "step" or a term used as a substitute for "means" that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function;

(B) the term "means" or "step" or the generic placeholder is modified by functional language, typically, but not always linked by the transition word "for" (e.g., "means for") or another linking word or phrase, such as "configured to" or "so that"; and

(C) the term "means" or "step" or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Use of the word "means" (or "step") in a claim with functional language creates a rebuttable presumption that the claim limitation is to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites sufficient structure, material, or acts to entirely perform the recited function.

Absence of the word "means" (or "step") in a claim creates a rebuttable presumption that the claim limitation is not to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is not interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth

paragraph, is rebutted when the claim limitation recites function without reciting sufficient structure, material or acts to entirely perform the recited function.

Claim limitations in this application that use the word "means" (or "step") are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action. Conversely, claim limitations in this application that do not use the word "means" (or "step") are not being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action.

Claim Rejections - 35 USC § 112

> The following is a quotation of 35 U.S.C. 112(b):
> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.
>
> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 3 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Claim 3 recites the limitation "front and rear walls" in 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

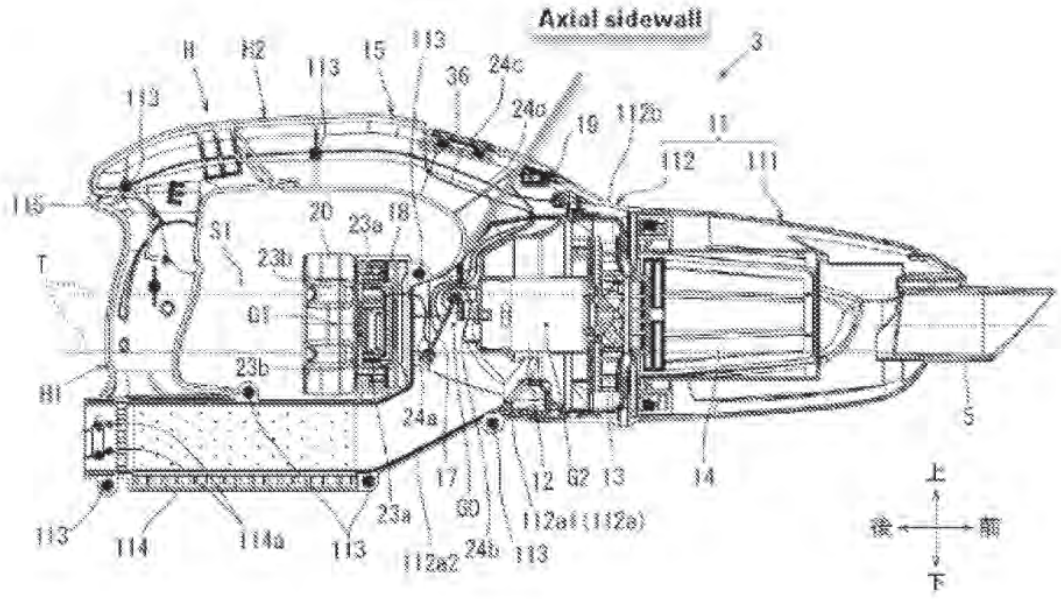
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim(s) 1-23 are rejected under 35 U.S.C. 103 as being unpatentable over Mori et al. (JP2014083241) in view of Lau (US 2006/0090290 A1) or Conrad (USP 9,204,769).

Mori et al. disclose a surface cleaning apparatus 100 comprising: (a) a hand vacuum cleaner 1 having a front end having a dirty air inlet 5, a rear end, a clean air outlet 114, an upper end, a lower end and a pistol grip handle H1, the hand vacuum cleaner 1 comprising: (i) a main body 1 comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor 12 and fan assembly 13, the suction motor 12 and fan assembly 13 having a suction motor axis of rotation, the main body 1 having an axially extending sidewall wherein an end of the pistol grip handle is mounted to the sidewall (see image below); and, (b) a surface cleaning head

22 having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet 221; and, (c) a rigid air flow conduit 21 extending between the surface cleaning head air outlet 221 and the dirty air inlet 5 of the hand vacuum cleaner 1, the rigid air flow conduit 21 is removably mounted to the surface cleaning head 22, wherein the dirty air inlet 5 of the hand vacuum cleaner 1 is removably drivingly mounted to a downstream end of the rigid air flow conduit 21 whereby when the hand vacuum cleaner 1 is mounted to the downstream end of the rigid air flow conduit 21, the pistol grip handle H is a driving handle for the surface cleaning apparatus 100, and wherein when the hand vacuum cleaner 1 is positioned with the front end of the hand vacuum cleaner 1 in front of the rear end of the hand vacuum cleaner 1.



Mori et al. disclose a filter 14 for separating dust particles from the dirty air and not a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet

provided at the rear end of the cyclone unit; the cyclone axis of rotation is generally horizontal.

Lau discloses a hand vacuum cleaner comprising a cyclone chamber 11 having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet 19, and a cyclone air outlet provided at the rear end of the cyclone unit through the filter (see figure 3) and the cyclone axis of rotation is generally horizontal.

Accordingly, it would have been obvious to one skilled in the art at the time of the invention to substitute the cyclone unit in Lau for the separation assembly in the hand vacuum cleaner in Mori et al. since the cyclone unit in Lau is used for the same purpose of separating dust particles from air as the separation assembly in Mori et al.

Claim 1

Conrad disclose a hand vacuum 100 comprising a cyclone unit 114 comprising a cyclone chamber located in wall 142 having a cyclone axis of rotation, a front end 188, an axially spaced apart rear end 190, a cyclone air inlet 140, and a cyclone air outlet 145 provided at the rear end of the cyclone unit; the cyclone axis of rotation is generally horizontal (shown in fig.6 and 10).

Accordingly, it would have been obvious to one skilled in the art at the time of the invention to substitute the cyclone unit in Conrad for the separation assembly in the hand vacuum cleaner in Mori et al. since the cyclone unit in Conrad is used for the same purpose of separating dust particles from air as the separation assembly in Mori et al. **Claim 1**

Lau discloses that the cyclone chamber 11 is designed to be removable (para. 0040). **Claim 2**

Conrad discloses the cyclone chamber has a sidewall 142 extending between the front 158 and rear walls 190 and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall 142 extends generally horizontally and a dirt outlet 146 is provided in a lower portion of the sidewall 142 and is in communication with a dirt collection chamber 124 that is exterior to the cyclone chamber (inside of sidewall 142). **Claim 3**

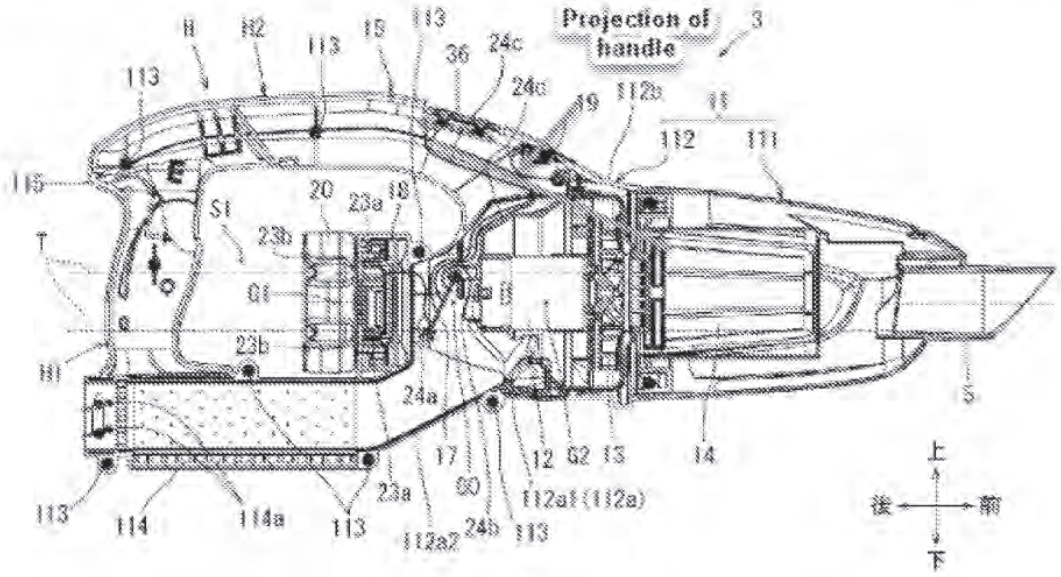
Fig. 6 in Conrad shows the cyclone axis of rotation is generally parallel to the suction motor 164 axis of rotation. **Claim 4**

The hand vacuum cleaner 1 is positioned with the front end of the hand vacuum cleaner 1 in front of the rear end of the hand vacuum cleaner 1, the pistol grip handle H1 extends upwardly and forwardly. See figures 2 and 3 in Mori et al. **Claim 5**

An enclosed finger grip area is provided on a forward side of the pistol grip handle H1 in Mori et al. See figure 2 and 3. **Claim 6**

Mori et al. disclose a projection of the pistol grip handle intersects the suction motor and fan assembly (see image below). **Claim 7**

Mori et al. shows a projection of the pistol grip handle intersects a housing of the suction motor and fan assembly (see image below). **Claim 8**



Lau discloses a pre-motor filter 28, wherein the pre-motor filter is accessible when the cyclone unit is removed from the main body (shown in fig.4). **Claim 9**

Conrad discloses a pre-motor filter 162, wherein the pre-motor filter 162 is accessible when the cyclone unit is removed from the main body (col.8, lns. 22-26). **Claim 9**

Conrad shows the pre-motor filter 162 has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone 142 (shown in fig.10). **Claim 10**

Conrad shows the dirt collection chamber 124 that is exterior to the cyclone chamber 142 and a line that is parallel to the cyclone axis extends through the dirt collection chamber 142 and the pre-motor filter 162 (shown in fig.6). **Claim 11**

Mori et al. disclose a surface cleaning apparatus 100 comprising: (a) a hand vacuum cleaner 1 comprising: (i) a main body 1 comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle H, the main body 1 housing a suction

motor 12 and fan assembly 13, the suction motor 12 and fan assembly 13 having a suction motor axis of rotation, the pistol grip handle H1 extends upwardly and forwardly when the hand vacuum cleaner is positioned with the front end forward of the rear end (shown in fig.2); and; (b) a surface cleaning head 22 having a front end, a rear end, a dirty air inlet and a cleaning head air outlet 221; and, (c) a rigid air flow conduit 21 extending between the cleaning head air outlet 221 and a hand vacuum cleaner air inlet 5, the rigid air flow conduit 21 having a longitudinally extending conduit axis, and the rigid air flow conduit 21 is removably mounted to the surface cleaning head 22, wherein the hand vacuum cleaner 1 is removably mountable to a downstream end of the rigid air flow conduit 21 and, when the hand vacuum cleaner 1 is mounted to the downstream end of the rigid air flow conduit 21, the handle H1 is a driving handle for the surface cleaning apparatus 100.

Mori et al. disclose a filter 14 for separating dust particles from the dirty air and not a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation, and the longitudinally extending conduit axis of the rigid air flow conduit 21 is parallel to the cyclone axis of rotation.

Lau discloses a hand vacuum cleaner comprising a cyclone unit 11 comprising a cyclone chamber 11 having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber through filter 37, wherein the suction motor 9 axis of rotation is generally parallel to the cyclone axis of rotation (shown in fig.3)

Accordingly, it would have been obvious to one skilled in the art at the time of the invention to substitute the cyclone unit in Lau for the separation assembly in the hand vacuum cleaner in Mori et al. since the cyclone unit in Lau is used for the same purpose of separating dust particles from air as the separation assembly in Mori et al. The longitudinally extending conduit axis of the rigid air flow conduit 21 is parallel to the cyclone 11 axis of rotation when the hand vacuum in Mori et al. is modified with the cyclone unit 11 in Lau. **Claim 12**

Conrad disclose a hand vacuum 100 comprising a cyclone unit 114 comprising a cyclone chamber 142 having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber 142 at the rear end 145 of the cyclone chamber, wherein the suction motor 164 axis of rotation is generally parallel to the cyclone axis of rotation (shown in fig.10).

Accordingly, it would have been obvious to one skilled in the art at the time of the invention to substitute the cyclone unit in Conrad for the separation assembly in the hand vacuum cleaner in Mori et al. since the cyclone unit in Conrad is used for the same purpose of separating dust particles from air as the separation assembly in Mori et al. The longitudinally extending conduit axis of the rigid air flow conduit 21 is parallel to the cyclone 11 axis of rotation when the hand vacuum in Mori et al. is modified with the cyclone unit 11 in Conrad. **Claim 12**

Lau discloses a pre-motor filter 37, wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit 21, a projection of the longitudinally extending conduit axis J5 intersects the pre-motor filter 37 when the hand cleaner 1 in Mori et al. is modified with the cyclone unit 114 in Conrad. **Claim 13**

Lau discloses that the cyclone chamber 11 is designed to be removable (para. 0040). **Claim 14**

Mori et al. show the hand vacuum cleaner 1 is mounted to the downstream end of the rigid air flow conduit 21 and when the hand vacuum cleaner 1 is positioned with the front end of the hand vacuum cleaner 1 in front of the rear end of the hand vacuum cleaner 1, the suction motor 12 axis of rotation is vertically spaced from the longitudinally extending conduit axis J5 (shown in fig.1 of Mori et al.). **Claim 15**

Conrad discloses the cyclone chamber has a sidewall 142 extending between the front 158 and rear walls 190 and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall 142 extends generally horizontally and a dirt outlet 146 is provided in a lower portion of the sidewall 142 and is in communication with a dirt collection chamber 124 that is exterior to the cyclone chamber (inside of sidewall 142). **Claim 16**

An enclosed finger grip area is provided on a forward side of the pistol grip handle H1 in Mori et al. See figure 2 and 3. **Claim 17**

Mori et al. disclose a projection of the pistol grip handle intersects the suction motor and fan assembly (see image page 9). **Claim 18**

Mori et al. shows a projection of the pistol grip handle intersects a housing of the suction motor and fan assembly (see image page 9). **Claim 19**

Conrad discloses a pre-motor filter 162, wherein the pre-motor filter 162 is accessible when the cyclone unit is removed from the main body (col.8, lns. 22-26). **Claim 20**

Conrad shows the pre-motor filter 162 has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone 142 (shown in fig.10). **Claim 21**

Conrad shows the dirt collection chamber 124 that is exterior to the cyclone chamber 142 and a line that is parallel to the cyclone axis extends through the dirt collection chamber 142 and the pre-motor filter 162 (shown in fig.6). **Claim 22**

Mori et al. disclose the main body 1 has an axially extending sidewall, wherein an end of the pistol grip handle H1 is mounted to the sidewall (shown in image page 7). **Claim 23**

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID A REDDING whose telephone number is (571)272-1276. The examiner can normally be reached M-F 6:00-2:00 est.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Orlando E Aviles can be reached on 571-270-5531. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center,

visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David Redding/
Primary Examiner, Art Unit 3723

Bereskin & Parr

Appl. No	:	17/830,507
Applicant	:	Omachron Intellectual Property Inc.
Filed	:	June 2, 2022
Title	:	SURFACE CLEANING APPARATUS
Conf. No.	:	5858
TC./A.U.	:	3723
Examiner	:	REDDING, DAVID A.
Docket No.	:	10452-P46958US16
Customer No.:		01059

August 29 2023

Mail Stop Amendment
Honorable Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313–1450

AMENDMENT / RESPONSE

Commissioner:

This paper is responsive to the non-final Office Action of May 31, 2023. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks/Arguments begin on page 8 of this paper.

Bereskin & Parr LLP
Scotia Plaza, 40 King Street West, 40th Floor, Toronto, ON M5H 3Y2 Canada
Tel: 416.364.7311 Fax: 416.361.1398 bereskinparr.com

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A surface cleaning apparatus comprising:

(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end, a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation that extends in a forward/rearward direction, a suction motor and fan assembly having a suction motor axis of rotation and a pistol grip handle; ~~, the hand vacuum cleaner comprising:~~

~~(i) a main body comprising an upper end, a lower end, a front end and a rear end, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the main body having an axially extending sidewall wherein an end of the pistol grip handle is mounted to the sidewall; and,~~

~~(ii) a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end, an axially spaced apart rear end, a cyclone air inlet, and a cyclone air outlet provided at the rear end of the cyclone unit;~~

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,

(c) a rigid air flow conduit extending between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner, the rigid air flow conduit is removably mounted to the surface cleaning head,

wherein the pistol grip handle has a pistol grip portion and an end that is mounted to an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor and a plane that is transverse to the cyclone

axis of rotation extends through the pistol grip portion and the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor,

wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mounted to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and

wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is generally horizontal.

2. (Currently Amended) The surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mounted ~~to the main body~~.

3. (Currently Amended) The surface cleaning apparatus of claim 1 wherein the cyclone chamber has a sidewall extending between [[the]] front and rear walls of the cyclone chamber and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in communication with a dirt collection chamber that is exterior to the cyclone chamber.

4. (Previously Presented) The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation is generally parallel to the suction motor axis of rotation.

5. (Currently Amended) The surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the pistol grip handle extends upwardly and forwardly from the location.

6. (Previously Presented) The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

7. (Currently Amended) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects the suction motor and fan assembly.

8. (Currently Amended) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects a housing of the suction motor and fan assembly.

9. (Currently Amended) The surface cleaning apparatus of claim 2 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed ~~from the main body~~.

10. (Previously Presented) The surface cleaning apparatus of claim 9 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

11. (Previously Presented) The surface cleaning apparatus of claim 10 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

12. (Currently Amended) A surface cleaning apparatus comprising:

(a) a hand vacuum cleaner ~~comprising:~~ having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end, a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation that extends in a forward/rearward direction, a suction motor and fan assembly having a suction motor axis of rotation and a pistol grip handle

~~(i) a main body comprising a lower end, an upper end, a front end, a rear end and a pistol grip handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation, the pistol grip handle extends upwardly and forwardly~~

~~when the hand vacuum cleaner is positioned with the front end forward of the rear end; and,~~

(ii) ~~a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation, a front end and a rear end wherein air exits the cyclone chamber at the rear end of the cyclone chamber~~, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation;

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,

(c) a rigid air flow conduit extending between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis, and the rigid air flow conduit is removably mounted to the surface cleaning head,

wherein the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and

wherein the pistol grip handle extends generally radially away from an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor.

13. (Previously Presented) The surface cleaning apparatus of claim 12 further comprising a pre-motor filter, wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, a projection of the longitudinally extending conduit axis intersects the pre-motor filter.

14. (Currently Amended) The surface cleaning apparatus of claim 12 wherein the cyclone unit is removably mounted ~~to the main body~~.

15. (Previously Presented) The surface cleaning apparatus of claim 12 wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit and when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the suction motor axis of rotation is vertically spaced from the longitudinally extending conduit axis.

16. (Currently Amended) The surface cleaning apparatus of claim 12 wherein the cyclone chamber has a sidewall extending between [[the]] front and rear walls of the cyclone chamber and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in communication with a dirt collection chamber that is exterior to the cyclone chamber.

17. (Previously Presented) The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

18. (Currently Amended) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects the suction motor and fan assembly.

19. (Currently Amended) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects a housing of the suction motor and fan assembly.

20. (Currently Amended) The surface cleaning apparatus of claim 14 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed ~~from the main body~~.

21. (Previously Presented) The surface cleaning apparatus of claim 20 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

22. (Previously Presented) The surface cleaning apparatus of claim 21 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

23. (Cancelled).

REMARKS/ARGUMENTS

This is a response to the non-final Office Action of May 31, 2023, which is submitted herein in advance of the 3-month statutory deadline of August 31, 2023. Accordingly, this response is timely filed.

It is believed that the following comments represent a complete response to the Examiner's comments and place the present application in condition for allowance. Applicant respectfully requests entry of the amendments and reconsideration of the present application in view of the amendments and remarks set forth below.

Status of the Claims

Claims 1-23 were examined in the non-final Office Action of May 31, 2023. Claims 1-22, of which claims 1 and 12 are independent claims, remain pending in this application. Claim 23 has been cancelled.

Independent claim 1 has been amended, *inter alia*, to recite "wherein the pistol grip handle has a pistol grip portion and an end that is mounted to an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor and a plane that is transverse to the cyclone axis of rotation extends through the pistol grip portion and the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor".

Independent claim 12 has been amended, *inter alia*, to recite, "wherein the pistol grip handle extends generally radially away from an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor."

Support for these amendments can be found, for example, at least with reference to Figures 1-2, 15, 78, and 96 of the application as filed.

Claims 3 and 16 have been amended to recite, "... wherein the cyclone chamber has a sidewall extending between front and rear walls of the cyclone chamber..." to provide antecedent basis for the front and rear walls.

Various additional amendments have been made to the claims for clarity, consistency of language, and/or to ensure proper antecedence.

Applicant submits that no new matter is added by these amendments.

Claim Rejections – 35 U.S.C. § 112

Claim 3 stands rejected under 35 U.S.C. 112(b), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor regards as the invention. Specifically, the Examiner asserts that there is insufficient antecedent basis for the limitation "front and rear walls".

In response, claim 3 has been amended to recite, "... wherein the cyclone chamber has a sidewall extending between front and rear walls of the cyclone chamber..." to provide antecedent basis for the front and rear walls.

Accordingly, Applicant respectfully submits that clam 3 is definite and complies with 35 U.S.C. 112(b).

Withdrawal of the claim rejection under 35 U.S.C. 112(b) is respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 1-23 stand rejected under 35 U.S.C. 103 as being unpatentable over JP 2014-083241 A to Mori et al. ("Mori") in view of US 2006/0090290 A to Lau ("Lau") or US 9,204,769 B2 to Conrad ("Conrad").

Discussion of the Patentability of Independent Claim 1

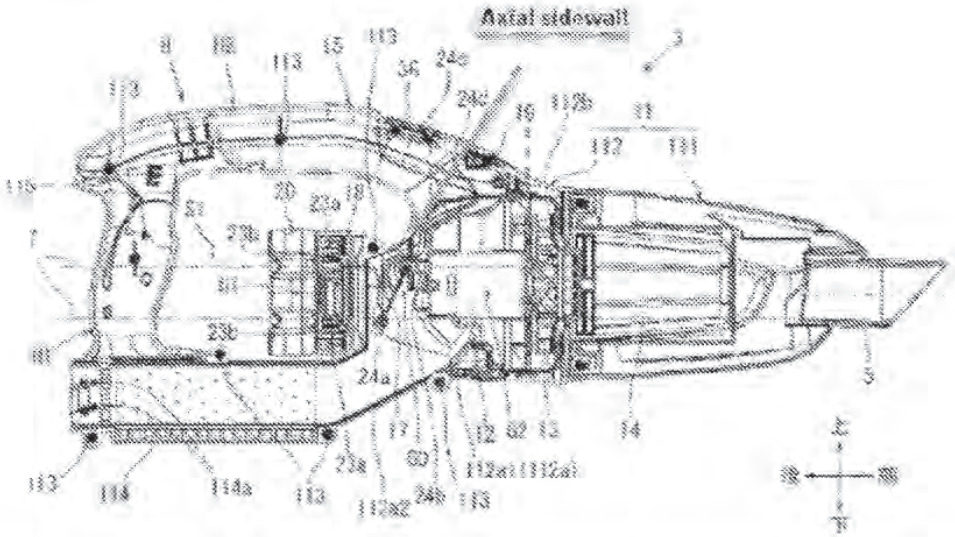
By this response, claim 1 has been amended to recite:

> a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation that extends in a forward/rearward direction...
>
> wherein the pistol grip handle has a pistol grip portion and an end that is mounted to an outer wall of the hand vacuum cleaner at a location rearward of the front end

and forward of a rear end of the suction motor and a plane that is transverse to the cyclone axis of rotation extends through the pistol grip portion and the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor.

Applicant submits that the cited art, taken alone or in combination, fails to teach, suggest, or otherwise imply the above-noted limitations.

Referring to Examiner's annotated Figure 3 (further annotated copy provided below), Mori teaches that a rear portion of a rearwardly extending second grip portion H2 and a rear portion of an exhaust pipe 114 are connected to each other via a first grip portion H1. The first grip portion H1, which the Examiner asserts discloses the claimed pistol grip handle, is therefore mounted to the second grip portion H2 and exhaust pipe 114. Mori therefore does not disclose a pistol grip handle has an end that is mounted to an outer wall of the hand vacuum cleaner since the first grip portion H1is mounted to the second grip portion H2 and exhaust pipe 114, which are themselves mounted to an outer wall of the hand vacuum cleaner.



In view of the foregoing, Applicant respectfully submits that amended independent claim 1 is not obvious over the cited art and is therefore allowable.

Withdrawal of the rejections under 35 U.S.C. 103 is respectfully requested.

Discussion of the Patentability of Independent Claim 12

By this response, claim 12 has been amended to recite:

> wherein the pistol grip handle extends generally radially away from an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor.

The Examiner asserts that the first grip portion H1 is the claimed pistol grip handle. In accordance with this position, it is clear that in Mori, the first grip portion H1 extends generally radially away from an outer wall of the hand vacuum cleaner.

Accordingly, Applicant respectfully submits that amended independent claim 12 is not obvious over the cited art and is therefore allowable.

Withdrawal of the rejections under 35 U.S.C. 103 is respectfully requested.

Discussion of the Patentability of the Dependent Claims

The rest of the rejected claims depend from claims 1 and 12 and further define additional technical features of the present invention. In view of the patentability of claims 1 and 12 and in further view of the additional technical features, Applicant respectfully submits that the dependent claims are patentable over the prior art.

Although Applicant has not addressed all the issues of the dependent claims, Applicant respectfully submits that Applicant does not necessarily agree with the characterization and assessments of the dependent claims made by the Examiner, and Applicant believes that each claim is patentable on its own merits. Applicant respectfully submits that the dependent claims incorporate by reference all the limitations of the claim to which they refer and include their own patentable features, and are therefore in condition for allowance. Therefore, Applicant respectfully requests the withdrawal of all claim rejections and prompts allowance of the claims.

Conclusion

In light of Applicant's amendments to the claims and the foregoing Remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to peruse at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present specification.

Applicant believes that no fees are due with the submission of the present response. However, if Applicant is mistaken, the Commissioner is hereby authorized to charge any deficiency in fees required to keep the present application in good standing (including any extension of time fees, excess claim fees, and request for continued examination fees) or credit any overpayment to our Deposit Account No. 02-2095.

Should the Examiner deem it beneficial to discuss the application in greater detail, the Examiner is kindly requested to contact Philip C. Mendes da Costa by telephone at 416-957-1695 at the Examiner's convenience.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.

/Philip C. Mendes da Costa/
By _____
Name: Philip C. Mendes da Costa
Reg. No. 33,106
Tel:416.957.16

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

1059 7590 10/23/2023

BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
40TH FLOOR
TORONTO, ONTARIO M5H 3Y2
CANADA

EXAMINER	
REDDING, DAVID A	
ART UNIT	PAPER NUMBER
3723	

DATE MAILED: 10/23/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16	5858

TITLE OF INVENTION: SURFACE CLEANING APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	01/23/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

1059 7590 10/23/2023
BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
40TH FLOOR
TORONTO, ONTARIO M5H 3Y2
CANADA

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16	5858

TITLE OF INVENTION: SURFACE CLEANING APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	01/23/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
REDDING, DAVID A	3723	015-344000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via Patent Center or EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Dyson Ex1004
Page 283

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16	5858

1059 7590 10/23/2023

BERESKIN & PARR LLP/S.E.N.C.R.L., s.r.l.
40 KING STREET WEST
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TORONTO, ONTARIO M5H 3Y2
CANADA

EXAMINER	
REDDING, DAVID A	
ART UNIT	PAPER NUMBER
3723	

DATE MAILED: 10/23/2023

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 17/830,507	Applicant(s) Conrad, Wayne Ernest	
	Examiner DAVID A REDDING	Art Unit 3723	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to amendment filed 8/29/23.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-22 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/David Redding/
Primary Examiner, Art Unit 3723

Bereskin & Parr

Appl. No	:	17/830,507
Applicant	:	Omachron Intellectual Property Inc.
Filed	:	June 2, 2022
Title	:	SURFACE CLEANING APPARATUS
TC./A.U.	:	3723
Confirmation No.:		5858
Examiner	:	DAVID A REDDING
Docket No.	:	10452-P46958US16
Customer No.	:	01059

Mail Stop Publication
Honorable Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313–1450

December 27, 2023

AMENDMENT UNDER 37 CFR 1.312

Sir:

Further to Notice of Allowance of October 23,2023, please amend the application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 7 of this paper.

Bereskin & Parr LLP
Scotia Plaza, 40 King Street West, 40th Floor, Toronto, ON M5H 3Y2 Canada
Tel: 416.364.7311 Fax: 416.361.1398 bereskinparr.com

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A surface cleaning apparatus comprising:

(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end, a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation that extends in a forward/rearward direction, a suction motor and fan assembly having a suction motor axis of rotation and a pistol grip handle;-

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a surface cleaning head air outlet; and,

(c) a rigid air flow conduit which, when mounted to the surface cleaning head and the hand vacuum cleaner, extends ~~extending~~ between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner, ~~the rigid air flow conduit is removably mounted to the surface cleaning head,~~

wherein the pistol grip handle has a pistol grip portion and an end that is mounted to an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor and wherein a plane that is transverse to the cyclone axis of rotation extends through the pistol grip portion and the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor,

wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mountable ~~mounted~~ to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow

conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and

wherein when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner and the dirty air inlet faces forwardly, the cyclone axis of rotation is generally horizontal.

2. (Currently Amended) The surface cleaning apparatus of claim 1 wherein the cyclone unit is removably mountable as part of the hand vacuum cleaner ~~mounted~~.

3. (Previously Presented) The surface cleaning apparatus of claim 1 wherein the cyclone chamber has a sidewall extending between front and rear walls of the cyclone chamber and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation positioned horizontally, and the dirty air inlet faces forwardly, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in communication with a dirt collection chamber that is exterior to the cyclone chamber.

4. (Previously Presented) The surface cleaning apparatus of claim 1 wherein the cyclone axis of rotation is generally parallel to the suction motor axis of rotation.

5. (Previously Presented) The surface cleaning apparatus of claim 1 wherein, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner the cyclone axis of rotation is positioned horizontally, the pistol grip handle extends upwardly and forwardly from the location.

6. (Previously Presented) The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

7. (Previously Presented) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects the suction motor and fan assembly.

8. (Previously Presented) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects a housing of the suction motor and fan assembly.

9. (Previously Presented) The surface cleaning apparatus of claim 2 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed.

10. (Previously Presented) The surface cleaning apparatus of claim 9 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

11. (Previously Presented) The surface cleaning apparatus of claim 10 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

12. (Currently Amended) A surface cleaning apparatus comprising:

(a) a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end, a lower end, a cyclone unit comprising a cyclone chamber having a cyclone axis of rotation that extends in a forward/rearward direction <u>when the dirty air inlet faces forwardly</u>, a suction motor and fan assembly having a suction motor axis of rotation and a pistol grip handle, wherein the suction motor axis of rotation is generally parallel to the cyclone axis of rotation;

(b) a surface cleaning head having a front end, a rear end, a dirty air inlet and a cleaning head air outlet; and,

(c) a rigid air flow conduit <u>which is mountable</u> ~~extends~~ ~~extending~~ between the cleaning head air outlet and a hand vacuum cleaner air inlet, the rigid air flow conduit having a longitudinally extending conduit axis~~, and the rigid air flow conduit is removably mounted to the surface cleaning head~~,

wherein ~~the hand vacuum cleaner is removably mountable to a downstream end of the rigid air flow conduit and~~, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, the handle is a driving handle for the surface cleaning apparatus and the longitudinally extending conduit axis of the rigid air flow conduit is parallel to the cyclone axis of rotation, and

wherein the pistol grip handle extends generally radially away from an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor.

13. (Previously Presented) The surface cleaning apparatus of claim 12 further comprising a pre-motor filter, wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit, a projection of the longitudinally extending conduit axis intersects the pre-motor filter.

14. (Currently Amended) The surface cleaning apparatus of claim 12 wherein the cyclone unit is removably mountable as part of the hand vacuum cleaner ~~mounted~~.

15. (Previously Presented) The surface cleaning apparatus of claim 12 wherein, when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow conduit and when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the suction motor axis of rotation is vertically spaced from the longitudinally extending conduit axis.

16. (Previously Presented) The surface cleaning apparatus of claim 12 wherein the cyclone chamber has a sidewall extending between front and rear walls of the cyclone chamber and, when the hand vacuum cleaner is positioned with the front end of the hand vacuum cleaner in front of the rear end of the hand vacuum cleaner, the cyclone axis of rotation is positioned horizontally, and the dirty air inlet faces forwardly, the sidewall extends generally horizontally and a dirt outlet is provided in a lower portion of the sidewall and is in communication with a dirt collection chamber that is exterior to the cyclone chamber.

17. (Previously Presented) The surface cleaning apparatus of claim 1 wherein an enclosed finger grip area is provided on a forward side of the pistol grip handle.

18. (Previously Presented) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects the suction motor and fan assembly.

19. (Previously Presented) The surface cleaning apparatus of claim 1 wherein a projection of the pistol grip handle in a direction transverse to the cyclone axis of rotation intersects a housing of the suction motor and fan assembly.

20. (Previously Presented) The surface cleaning apparatus of claim 14 further comprising a pre-motor filter, wherein the pre-motor filter is accessible when the cyclone unit is removed.

21. (Previously Presented) The surface cleaning apparatus of claim 20 wherein the pre-motor filter has a height in a direction transverse to the cyclone axis and the height is larger than a diameter of the cyclone.

22. (Previously Presented) The surface cleaning apparatus of claim 21 further comprising a dirt collection chamber that is exterior to the cyclone chamber and a line that is parallel to the cyclone axis extends through the dirt collection chamber and the pre-motor filter.

23. (Cancelled).

REMARKS/ARGUMENTS

Pursuant to Notice of Allowance of October 23, 2023, claims 1-22 are allowed. Upon review of the allowed claims, the Applicant requests herein entry of the amendment under 1.312.

By this amendment, the paragraph (c) of claim 1 has been amended as follows since the dirty air inlet of the hand vacuum cleaner is not always mounted to a downstream end of the rigid air flow conduit.

> "a rigid air flow conduit which, when mounted to the surface cleaning head and the hand vacuum cleaner, extends between the surface cleaning head air outlet and the dirty air inlet of the hand vacuum cleaner".

In claim 1, the word "wherein" was missing from the following paragraph and has been added for clarity.

> "wherein the pistol grip handle has a pistol grip portion and an end that is mounted to an outer wall of the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor and wherein a plane that is transverse to the cyclone axis of rotation extends through the pistol grip portion and the hand vacuum cleaner at a location rearward of the front end and forward of a rear end of the suction motor".

In claim 1, the limitation "removably drivingly mounted" has been amended to "removably drivingly mountable" for clarity since the dirty air inlet of the hand vacuum cleaner is not always mounted to a downstream end of the rigid air flow conduit.

> "wherein the dirty air inlet of the hand vacuum cleaner is removably drivingly mountable ~~mounted~~ to a downstream end of the rigid air flow conduit whereby when the hand vacuum cleaner is mounted to the downstream end of the rigid air flow

conduit, the pistol grip handle is a driving handle for the surface cleaning apparatus, and".

In claims 1, 3, 5, 12 and 16, the limitation "the dirty air inlet faces forwardly" clarifies, as may be needed, the orientation of the hand vacuum cleaner for the orientation that is claimed.

In claims 2 and 14, the word "mounted" has been replaced by "mountable as part of the hand vacuum cleaner" to be grammatically correct.

Support for these amendments is found within the claims and specification as originally filed. It is believed that no new matter has been introduced by these amendments. It is believed that this amendment merely brings clarity to the formal language of the claims which neither have changed the scope of the claims nor raised new issues for consideration with respect to the allowability of the claimed invention.

The Applicant respectfully submits that the noted amendment is in compliance with 37 CFR 1.121. No new matter has been added by this amendment. Entry of the amendment is respectfully requested.

Date: December 27, 2023

Respectfully submitted,

BERESKIN & PARR LLP/
S.E.N.C.R.L., s.r.l.

By /Philip C. Mendes da Costa/
Philip C. Mendes da Costa
Reg. No. 33,106
Tel: 416-957-1695

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P46958US16	5858

1059 7590 01/08/2024

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TORONTO, ONTARIO M5H 3Y2
CANADA

EXAMINER	
REDDING, DAVID A	

ART UNIT	PAPER NUMBER
3723	

NOTIFICATION DATE	DELIVERY MODE
01/08/2024	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipprocessingcentre@bereskinparr.com

Response to Rule 312 Communication	Application No.	Applicant(s)	
	17/830,507	Conrad, Wayne Ernest	
	Examiner	Art Unit	AIA (FITF) Status
	DAVID A REDDING	3723	Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ The amendment filed on 27 December 2023 under 37 CFR 1.312 has been considered, and has been:
   a) ☑ entered.
   b) ☐ entered as directed to matters of form not affecting the scope of the invention.
   c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
      Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.
   d) ☐ disapproved. See explanation below.
   e) ☐ entered in part. See explanation below.
   f) ☐ not entered because the supplemental or corrected Application Data sheet (ADS)
      ☐ was not accompanied by a petition to accept an unintentionally delayed claim under 37 CFR 1.55 or 27 CFR 1.78;
      ☐ did not identify the information being changed in accordance with 37 CFR 1.76(c)(2);
      ☐ was not properly signed in accordance with 37 CFR 1.76(e) (or 37 CFR 1.33(b) for applications filed prior to September 16, 2012).

/David Redding/ Primary Examiner, Art Unit 3723	

Bereskin & Parr

Appl. No	:	17/830,507
Applicant	:	Omachron Intellectual Property Inc.
Filed	:	June 2, 2022
Title	:	SURFACE CLEANING APPARATUS
TC./A.U.	:	3723
Confirmation No.	:	5858
Examiner	:	DAVID A REDDING
Docket No.	:	10452-P46958US16
Customer No.	:	01059

OK TO ENTER
DAR
1/2/24

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Honorable Commissioner for Patents
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Alexandria, Virginia 22313–1450

December 27, 2023

AMENDMENT UNDER 37 CFR 1.312

Sir:

Further to Notice of Allowance of October 23,2023, please amend the application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 7 of this paper.

Bereskin & Parr LLP
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Tel: 416.364.7311 Fax: 416.361.1398 bereskinparr.com

Bereskin&Parr

Appl. No	: 17/830,507	Confirmation No.:	5858
Applicant	: Omachron Intellectual Property Inc.		
Filed	: June 2, 2022		
Title	: SURFACE CLEANING APPARATUS		
TC./A.U.	: 3723		
Examiner	: REDDING, David A.		
Docket No.	: 10452-P46958US16		
Customer No.	: 01059		

Mail Stop Issue Fee
Honorable Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313–1450

January 8, 2024

ISSUE FEES

This correspondence is responsive to the Notice of Allowance and Issue Fee Due dated October 23, 2023, which issued in the above-identified patent application. As required, we enclose herewith the Issue Fee transmittal form.

The government fee of $1200 is included. Please charge any deficiency or credit any overpayment to our deposit account no. 02-2095.

Respectfully submitted,

BERESKIN & PARR LLP/ S.E.N.C.R.L., s.r.l.

/Philip C. Mendes da Costa/

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9061426

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
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By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	06/02/2022	Wayne Ernest Conrad	10452-P36958US16	5858

TITLE OF INVENTION: SURFACE CLEANING APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/23/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
REDDING, DAVID A	3723	015-344000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Philip C. Mendes da Costa
2 BERESKIN & PARR LLP/ S.E.N.C.R.L., s.r.l.
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Omachron Intellectual Property Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Hampton, Ontario, Canada

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☒ Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via Patent Center or EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 022095

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Philip c. Mendes da Costa/ Date 2024/01/08

Typed or printed name /Philip C. Mendes da Costa/ Registration No. 33106

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/830,507	02/27/2024	11910983	10452-P46958US16	5858

1059 7590 02/07/2024

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ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at https://patentcenter.uspto.gov/. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at https://certifiedcopycenter.uspto.gov/index.html. The Certified Copy Center may be reached at (800)972-6382.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (https://patentcenter.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional inventors):

Wayne Ernest Conrad, Hampton, CANADA;

APPLICANT(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional applicants):

Omachron Intellectual Property Inc., Hampton, CANADA;

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