US010568477B2

(12) **United States Patent**
Conrad

(10) **Patent No.: US 10,568,477 B2**
(45) **Date of Patent: Feb. 25, 2020**

(54) **SURFACE CLEANING APPARATUS**

(71) Applicant: **Omachron Intellectual Property Inc.**, Hampton (CA)

(72) Inventor: **Wayne Ernest Conrad**, Hampton (CA)

(73) Assignee: **Omachron Intellectual Property Inc.**, Hampton, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 245 days.

(21) Appl. No.: **15/685,962**

(22) Filed: **Aug. 24, 2017**

(65) **Prior Publication Data**

US 2018/0055315 A1 Mar. 1, 2018

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/095,714, filed on Apr. 11, 2016, now Pat. No. 9,986,880.

(51) **Int. Cl.**

A47L 9/10	(2006.01)
A47L 5/24	(2006.01)
A47L 9/16	(2006.01)
A47L 9/32	(2006.01)
A47L 9/12	(2006.01)
A47L 9/28	(2006.01)
A47L 9/22	(2006.01)

(Continued)

(52) **U.S. Cl.**

CPC ***A47L 9/106*** (2013.01); ***A47L 5/225*** (2013.01); ***A47L 5/24*** (2013.01); ***A47L 5/28*** (2013.01); ***A47L 9/0072*** (2013.01); ***A47L 9/12*** (2013.01); ***A47L 9/122*** (2013.01); ***A47L 9/165*** (2013.01); ***A47L 9/1608*** (2013.01); ***A47L 9/1666*** (2013.01); ***A47L 9/1683*** (2013.01); ***A47L 9/1691*** (2013.01); ***A47L 9/22*** (2013.01); ***A47L 9/2868*** (2013.01); ***A47L 9/322*** (2013.01)

(58) **Field of Classification Search**

CPC . A47L 9/106; A47L 5/225; A47L 5/24; A47L 5/28; A47L 9/0072; A47L 9/12; A47L 9/122; A47L 9/1608; A47L 9/165; A47L 9/1666; A47L 9/1683; A47L 9/1691; A47L 9/22; A47L 9/2868; A47L 9/9322

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,267,371 A 12/1993 Soler et al.
5,467,835 A 11/1995 Obermeier et al.
(Continued)

FOREIGN PATENT DOCUMENTS

AU 2008200579 A1 8/2008
AU 2008201597 A1 11/2008
(Continued)

OTHER PUBLICATIONS

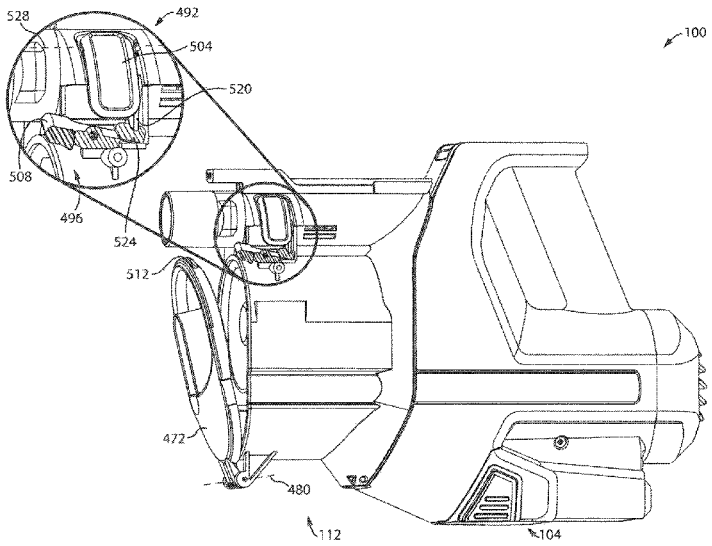
TotalPatent: English machine translation of JP2013086228, published on May 13, 2013.
(Continued)

Primary Examiner — Dung Van Nguyen
(74) *Attorney, Agent, or Firm* — Philip C. Mendes da Costa; Bereskin & Parr LLP/S.E.N.C.R.L., s.r.l.

(57) **ABSTRACT**

A surface cleaning apparatus has a dirty air inlet and an air treatment member. The air treatment member includes a dirt collection region having an openable door. When an accessory is connected to the dirty air inlet, the openable door is inhibited from opening.

20 Claims, 41 Drawing Sheets



(51) **Int. Cl.**

A47L 5/28	(2006.01)
A47L 5/22	(2006.01)
A47L 9/00	(2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,434,785	B1	8/2002	Vandenbelt et al.
6,484,350	B2	11/2002	Yung
6,502,278	B2	1/2003	Oh et al.
6,514,131	B1	2/2003	Reich et al.
6,810,558	B2	11/2004	Lee
7,247,181	B2	7/2007	Hansen et al.
7,370,387	B2	5/2008	Walker et al.
7,640,624	B2	1/2010	Crouch et al.
7,686,861	B2	3/2010	Oh
7,691,161	B2	4/2010	Oh et al.
7,708,789	B2	5/2010	Fester
7,717,973	B2	5/2010	Oh et al.
7,780,753	B2	8/2010	Lang
7,882,593	B2	2/2011	Beskow et al.
7,922,794	B2	4/2011	Morphey
7,958,598	B2	6/2011	Yun et al.
7,996,956	B2	8/2011	Wood et al.
8,028,373	B2	10/2011	Rowntree
8,048,180	B2	11/2011	Oh et al.
8,100,999	B2	1/2012	Ashbee et al.
8,101,001	B2	1/2012	Qian
8,117,712	B2	2/2012	Dyson et al.
8,146,201	B2	4/2012	Conrad
8,150,907	B2	4/2012	Otsuka et al.
8,151,407	B2	4/2012	Conrad
8,156,609	B2	4/2012	Milne et al.
8,347,455	B2	1/2013	Dyson et al.
8,444,731	B2	5/2013	Gomiciaga-Pereda et al.
8,549,703	B2	10/2013	Smith
8,578,555	B2	11/2013	Conrad
8,595,895	B2	12/2013	Smith
8,657,904	B2	2/2014	Smith
8,713,751	B2	5/2014	Conrad
8,813,305	B2	8/2014	Conrad
8,869,345	B2	10/2014	Conrad
8,918,952	B2	12/2014	Rowntree
8,945,258	B2	2/2015	Smith
8,979,960	B2	3/2015	Smith
9,005,324	B2	4/2015	Smith
9,144,358	B2	9/2015	Smith
9,198,551	B2	12/2015	Conrad
9,204,773	B2	12/2015	Conrad
9,211,046	B2	12/2015	Peace
9,516,979	B2	12/2016	Gidwell
9,675,218	B2	6/2017	Kim et al.
9,711,986	B2	7/2017	Sunderland
2002/0134238	A1	9/2002	Conrad et al.
2004/0134022	A1	7/2004	Murphy et al.
2006/0090290	A1	5/2006	Lau
2006/0156508	A1	7/2006	Khalil
2006/0277711	A1	12/2006	Hong
2007/0271724	A1	11/2007	Hakan et al.
2008/0040883	A1	2/2008	Beskow et al.
2008/0178416	A1	7/2008	Conrad
2008/0190080	A1	8/2008	Oh et al.
2008/0196745	A1	8/2008	Conrad
2008/0256744	A1	10/2008	Rowntreer et al.
2009/0019663	A1	1/2009	Rowntree
2009/0282639	A1	11/2009	Dyson et al.
2009/0305862	A1	12/2009	Yoo
2009/0307864	A1	12/2009	Dyson
2010/0229322	A1	9/2010	Conrad
2010/0229324	A1	9/2010	Conrad
2011/0219570	A1	9/2011	Conrad
2011/0289719	A1	12/2011	Han et al.
2011/0308038	A1	12/2011	Rowntree
2012/0079671	A1	4/2012	Stickney et al.
2012/0304417	A1	12/2012	Riley
2013/0091654	A1	4/2013	Smith
2013/0091656	A1	4/2013	Smith
2013/0091657	A1	4/2013	Smith
2013/0091658	A1	4/2013	Smith
2013/0091810	A1	4/2013	Smith
2013/0091812	A1	4/2013	Smith
2013/0091814	A1	4/2013	Smith
2013/0160232	A1	6/2013	Peace
2014/0237768	A1	8/2014	Conrad
2014/0237956	A1	8/2014	Conrad
2015/0135474	A1	5/2015	Gidwell
2015/0230677	A1	8/2015	Andrikanish
2015/0297050	A1	10/2015	Marsh et al.
2016/0113460	A1	4/2016	Williams et al.
2016/0128531	A1	5/2016	Conrad
2016/0174785	A1	6/2016	Conrad
2016/0174786	A1	6/2016	Conrad
2016/0367094	A1	12/2016	Conrad
2017/0079489	A1*	3/2017	Dimbylow A47L 5/24
2017/0112343	A1	4/2017	Innes et al.
2017/0172362	A1	6/2017	Reimer et al.
2017/0188763	A1	7/2017	Hu

FOREIGN PATENT DOCUMENTS

AU	2008200579	B2	10/2011
AU	2008201597	B2	10/2011
AU	2011211368	B2	9/2012
CA	2620703	A1	8/2008
CA	2628573	A1	10/2008
CA	2731525	A1	10/2008
CA	2658014	A1	9/2010
CA	2730437	A1	9/2011
CA	2593950	C	1/2013
CA	2628573	C	8/2013
CA	2620703	C	9/2013
CA	2731525	C	1/2014
CN	1626025	A	6/2005
CN	1895148	A	1/2007
CN	1911151	A	2/2007
CN	101061932	A	10/2007
CN	101095604	A	1/2008
CN	101448447	A	6/2009
CN	101489453	A	7/2009
CN	101489455	A	7/2009
CN	101489457	A	7/2009
CN	101489461	A	7/2009
CN	101657133	A	2/2010
CN	101822506	A	9/2010
CN	201683850	U	12/2010
CN	101243959	B	6/2011
CN	102188208	A	9/2011
CN	102256523	A	11/2011
CN	202173358	U	3/2012
CN	101288572	B	7/2012
CN	202739907	U	2/2013
CN	103169420	A	6/2013
CN	203724037	U	7/2014
CN	101897558	B	9/2014
CN	204363891	U	6/2015
CN	104822301	A	8/2015
CN	105816104	A	8/2016
CN	205671986	U	11/2016
DE	60116336	T2	8/2006
DE	112007003039	T5	10/2009
DE	112007003052	T5	1/2010
DE	112010001135	T5	8/2012
DE	102012211246	A1	1/2014
EP	1955631	A1	8/2008
EP	1955630	A3	10/2009
EP	2012641	B1	8/2010
EP	2223644	A2	9/2010
EP	1955631	B1	11/2010
EP	2223644	A3	3/2013
EP	2581013	A1	4/2013
EP	2220986	B1	3/2014
EP	2223644	B1	3/2014
GB	1436403	A	5/1976
GB	2035787	B	10/1982
GB	2440111	A	1/2008

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP	2002085297	A	3/2002
JP	2005040246	A	2/2005
JP	2006102034	A	4/2006
JP	2006272019	A	10/2006
JP	2008206613	A	9/2008
JP	4352065	B2	10/2009
JP	2009261501	A	11/2009
JP	2013086228	A	5/2013
NZ	565800	A	5/2009
NZ	567297	A	7/2009
WO	2004069021	A1	8/2004
WO	2005084511	A1	9/2005
WO	2006076363	A2	7/2006
WO	2008009883	A1	1/2008
WO	2008009888	A1	1/2008
WO	2008009890	A1	1/2008
WO	2008035032	A3	6/2008
WO	2008070973	A1	6/2008
WO	2010102396	A1	9/2010
WO	2010147247	A1	12/2010
WO	2014131105	A1	9/2014
WO	2015129387	A1	9/2015
WO	2017046557	A1	3/2017
WO	2017046559	A1	3/2017
WO	2017046560	A1	3/2017

OTHER PUBLICATIONS

TotalPatent: English machine translation of JP2008206613; published on Sep. 11, 2008.
TotalPatent: English machine translation of JP2006102034, published on Apr. 20, 2006.
TotalPatent: English machine translation of JP2002085297; published on Mar. 26, 2002.
TotalPatent: English machine translation of CN205671986; published on Nov. 9, 2016.
TotalPatent: English machine translation of CN204363891, published on Jun. 3, 2015.
TotalPatent: English machine translation of CN202739907, Published on Feb. 20, 2017.
International Search Report and Written Opinion, received in connection to PCT/CA2017/050014, dated Apr. 5, 2017.
International Search Report and Written Opinion, received in connection to PCT/CA2017/050436, dated Jul. 21, 2017.
TotalPatent: English machine translation of CN105816104A, published on Aug. 3, 2016.
English machine translation of DE112010001135, as published on Aug. 2, 2012.
English machine translation of DE112007003052, as published on Jan. 14, 2010.
English machine translation of DE102012211246, as published on Jan. 2, 2014.
English machine translation of WO2010147247, as published on Dec. 23, 2010.
English machine translation of JP2006272019, as published on Oct. 12, 2006.
English machine translation of JP2005040246, as published on Feb. 17, 2005.
English machine translation of CN203724037, as published on Jul. 23, 2014.
English machine translation of CN202173358, as published on Mar. 28, 2012.
English machine translation of CN201683850, as published on Dec. 29, 2010.
English machine translation of CN103169420, as published on Jun. 26, 2013.
English machine translation of CN102256523, as published on Nov. 23, 2011.
English machine translation of CN102188208, as published on Sep. 21, 1012.
English machine translation of CN101822506, as published on Sep. 8, 2010.
English machine translation of CN101657133, as published on Feb. 24, 2010.
English machine translation of CN101489461, as published on Jul. 22, 2009.
English machine translation of CN101489457, as published on Jul. 22, 2009.
English machine translation of CN101489455, as published on Jul. 22, 2009.
English machine translation of CN101489453, as published on Jul. 22, 2009.
English machine translation of CN101448447, as published on Jun. 3, 2009.
English machine translation of CN101095604, as published on Jan. 2, 2008.
English machine translation of DE60116336, as published on Aug. 31, 2008.
English machine translation of JP4352065, as published on Oct. 28, 2009.
English machine translation of CN1911151, as published on Feb. 14, 2007.
English machine translation of CN1895148, as published on Jan. 17, 2007.
English machine translation of CN1626025, as published on Jun. 15, 2005.
English machine translation of DE112007003039, as published on Oct. 29, 2009.
English machine translation of JP2009261501, as published on Nov. 12, 2009.

* cited by examiner

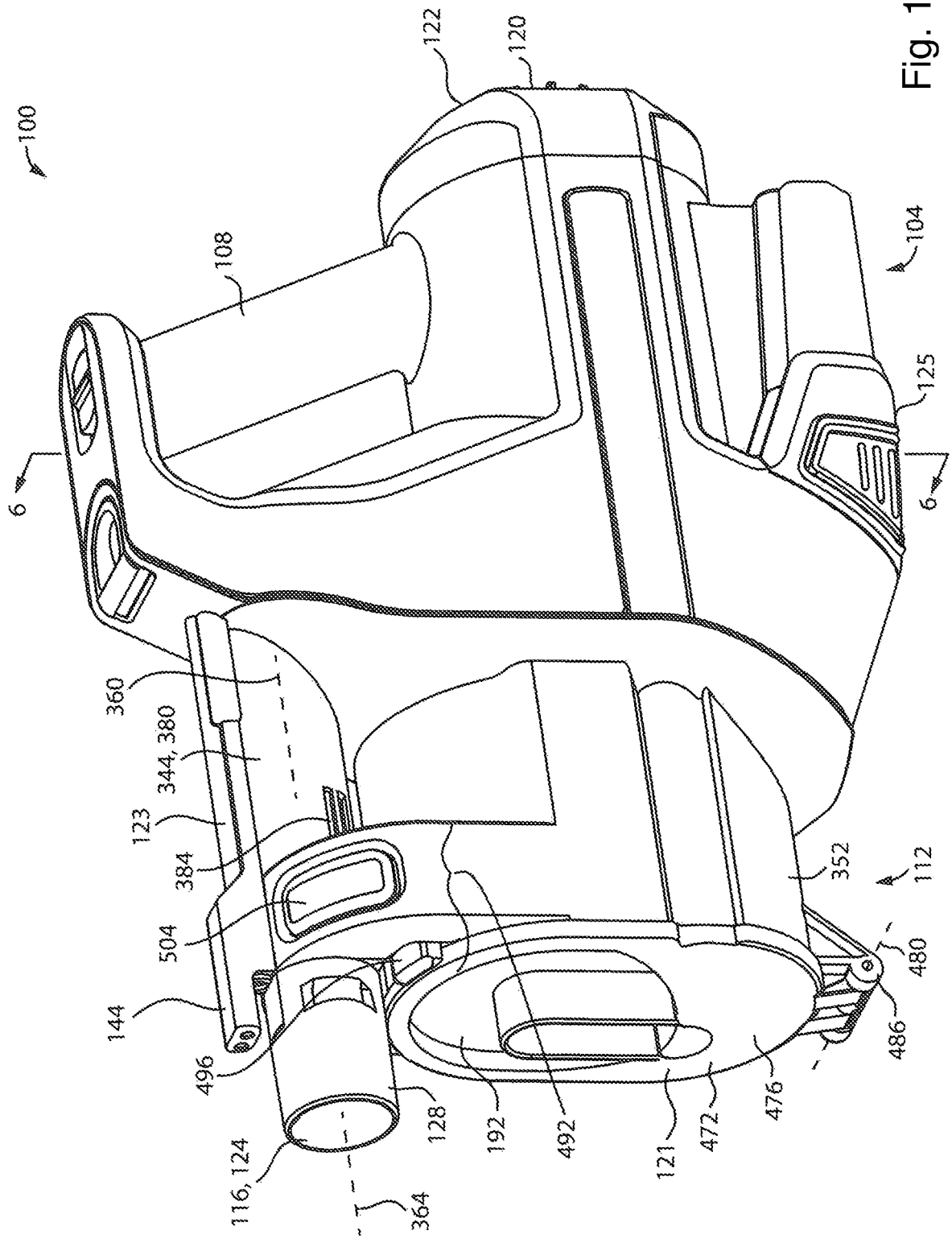

100
122
120
108
104
125
6
6
360
344, 380
123
384
504
144
496
116, 124
364
128
192
492
121
472
476
352
112
480
486

Fig. 1

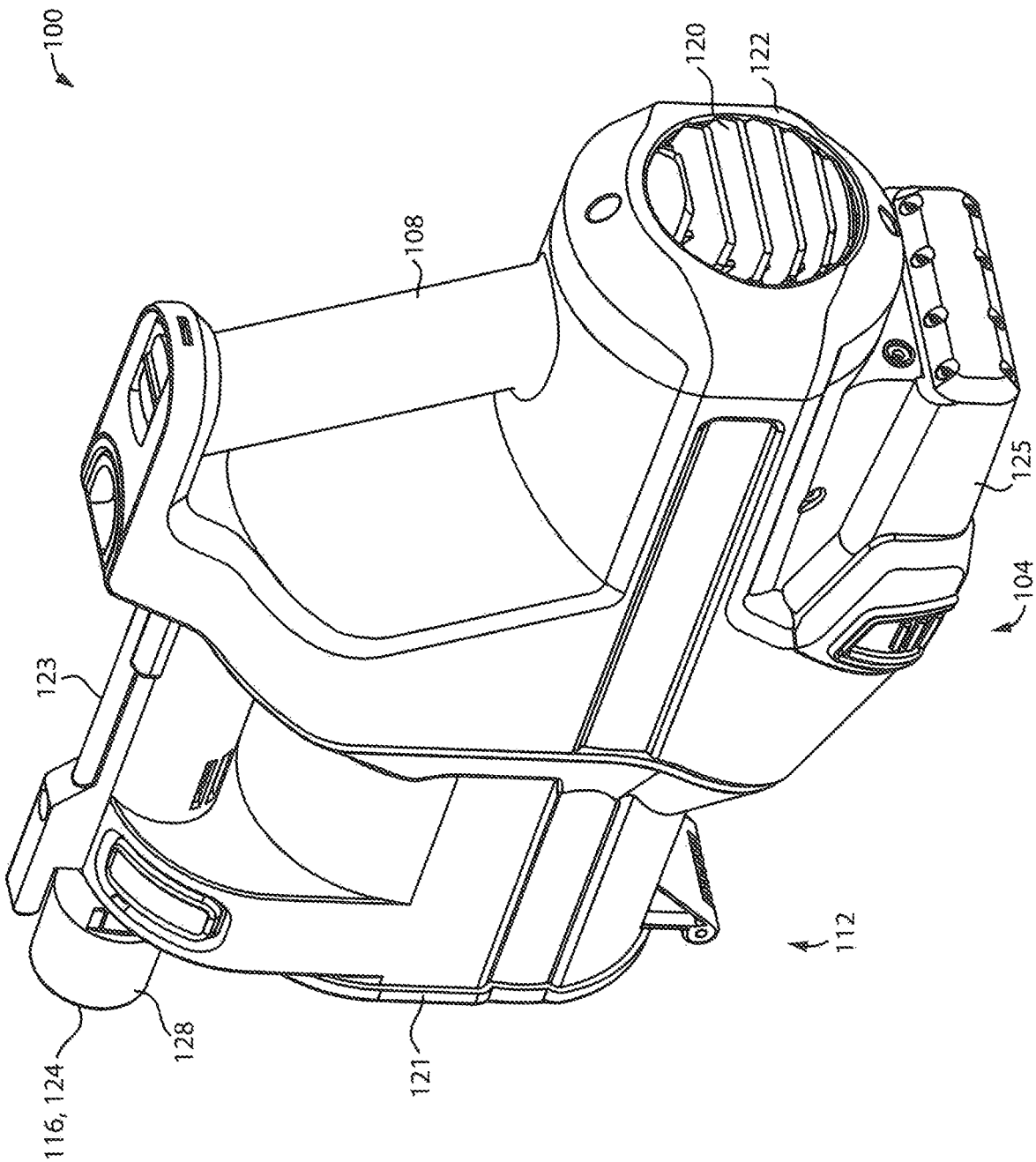


Fig. 2

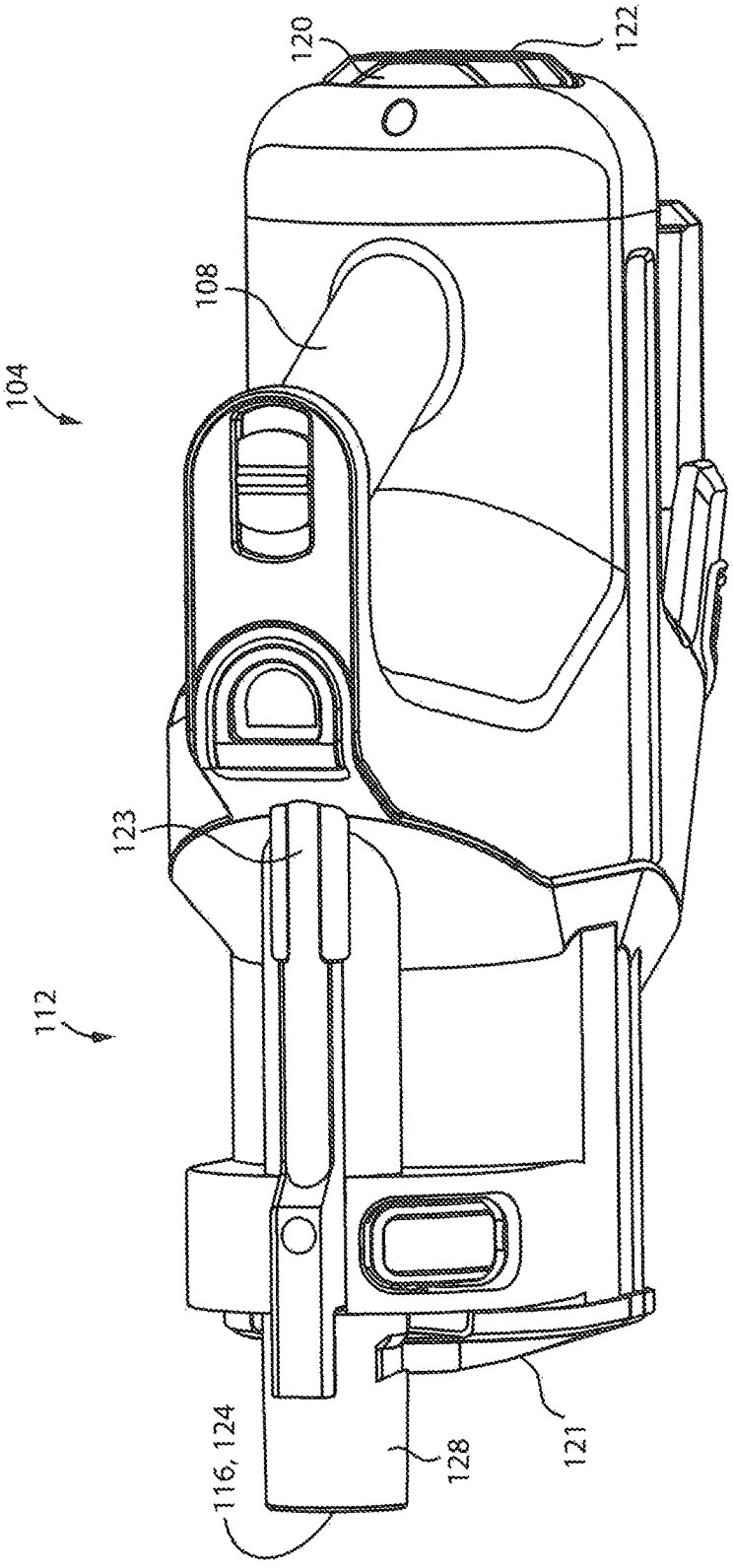


Fig. 3

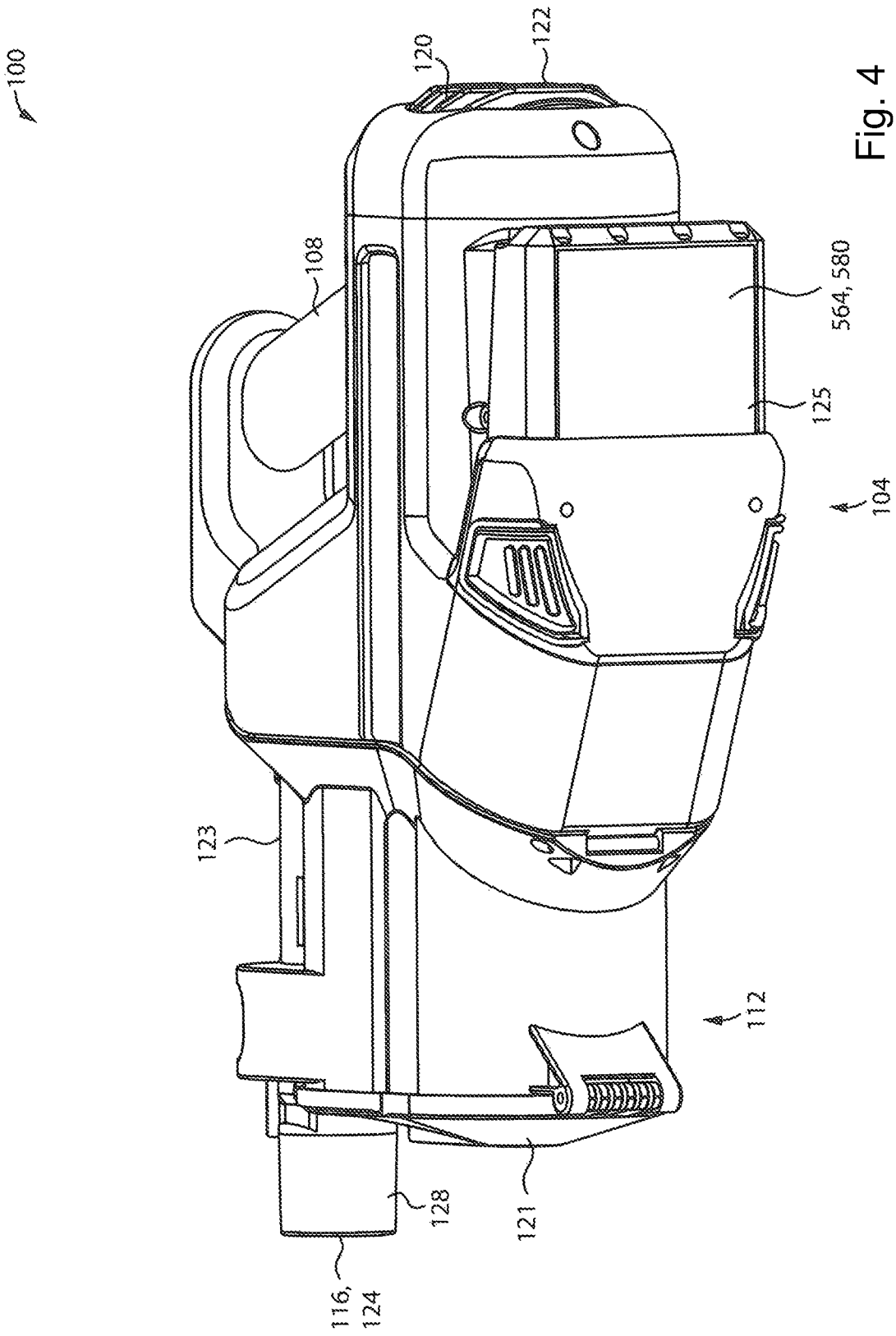


Fig. 4

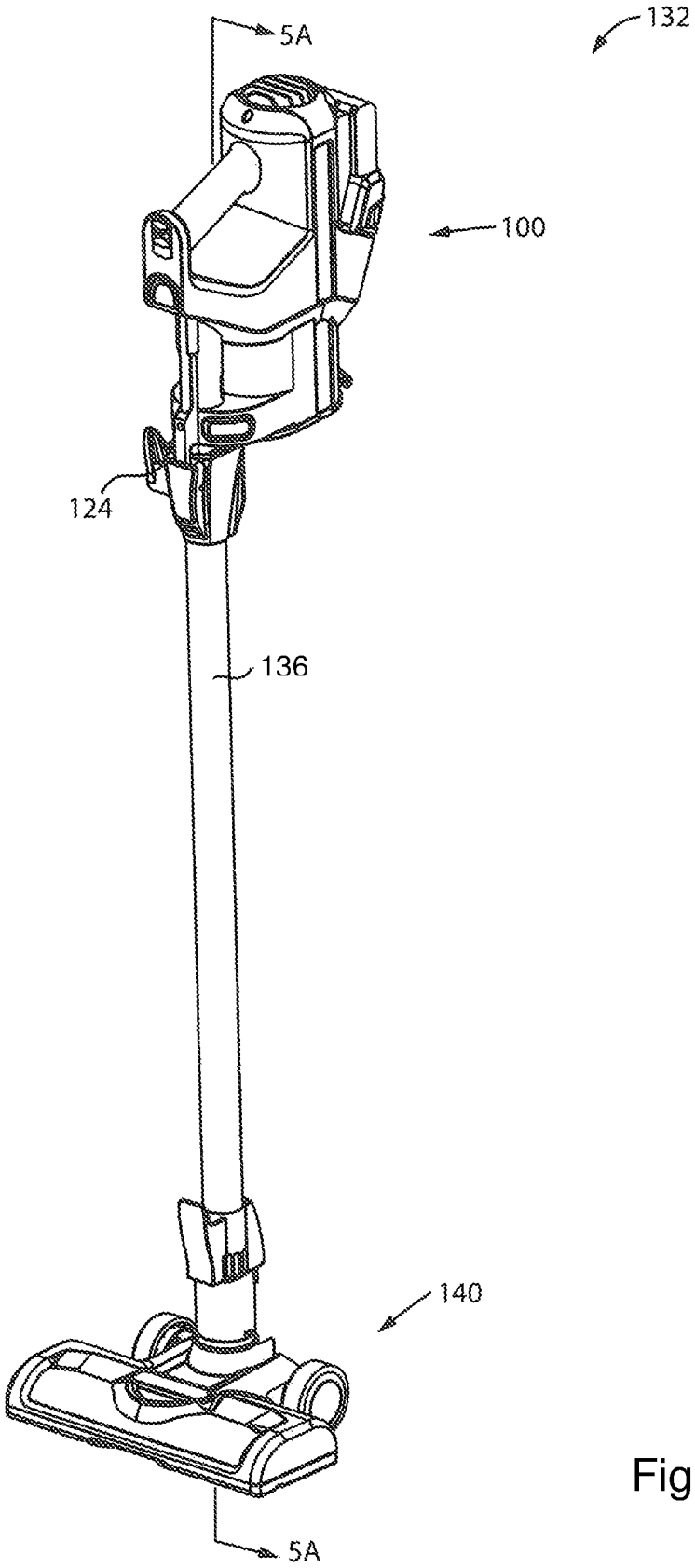


Fig. 5

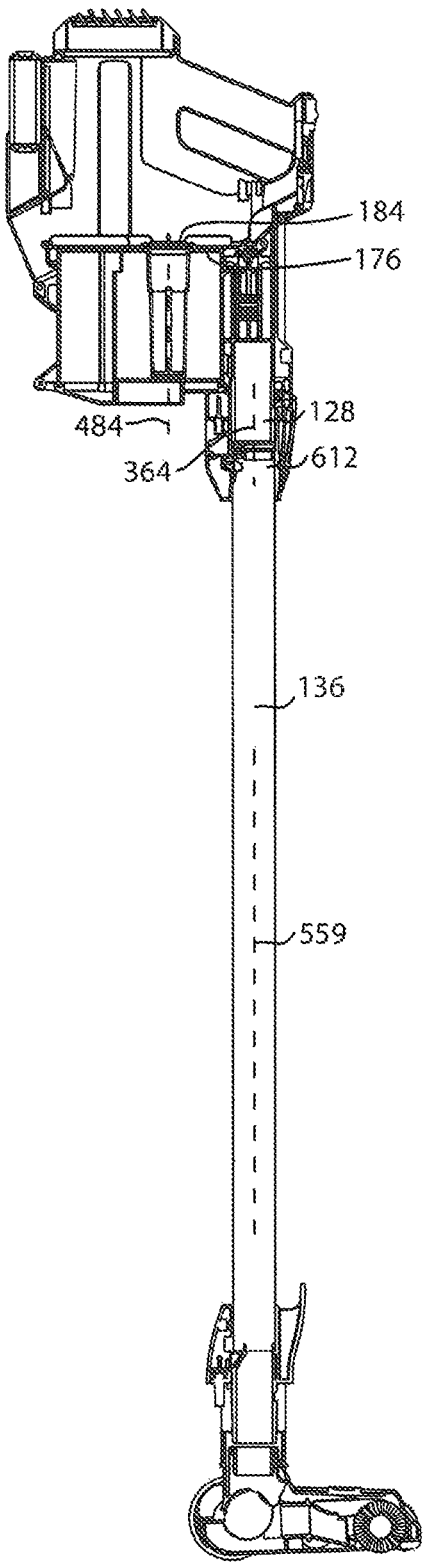


Fig. 5A

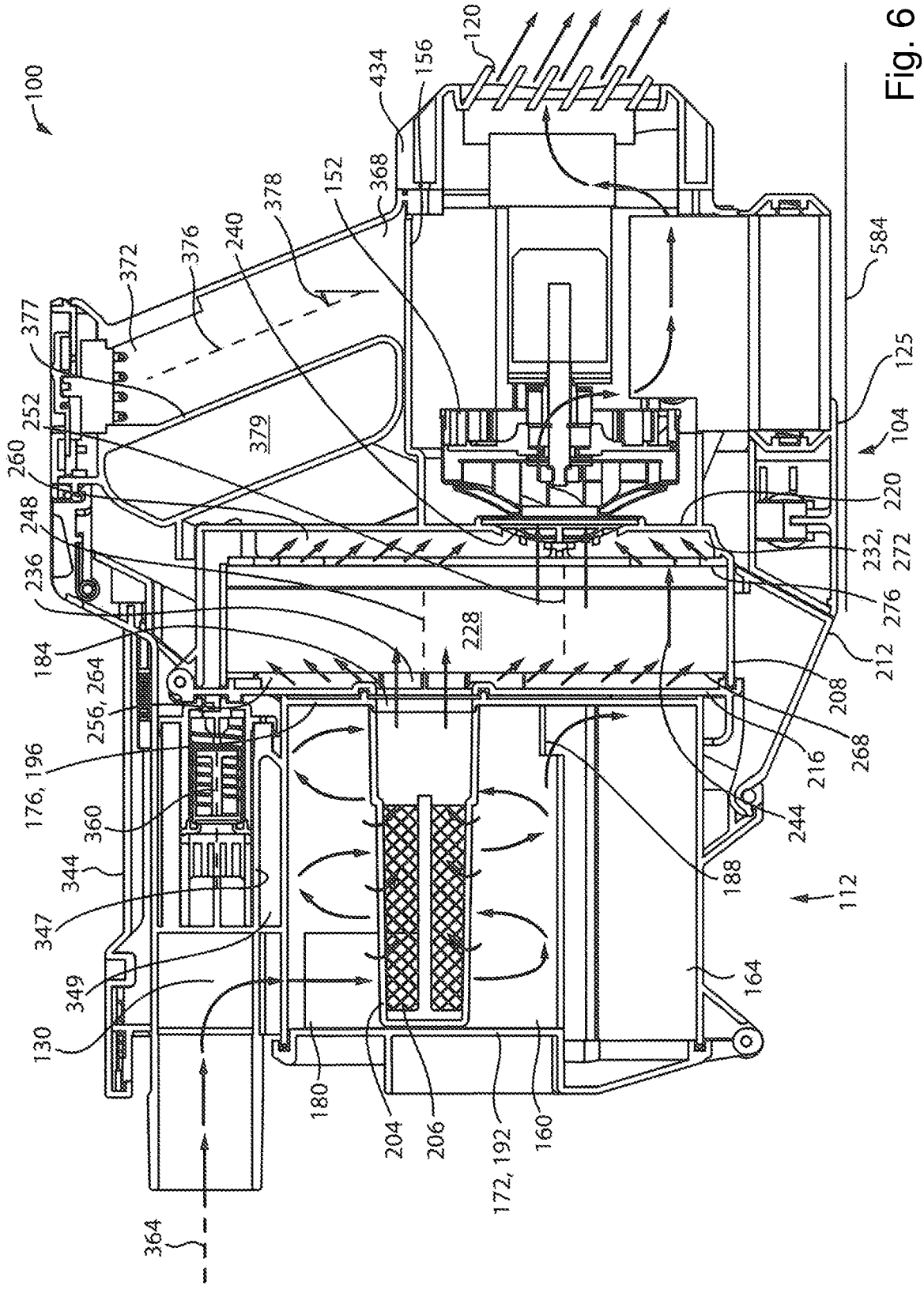

100
120
434
156
152
368
378
240
376
372
377
252
260
248
236
184
256, 264
176, 196
360
344
347
349
130
379
228
584
125
104
220
232, 272
276
212
208
268
216
244
188
112
164
180
204
206
172, 192
160
364

Fig. 6

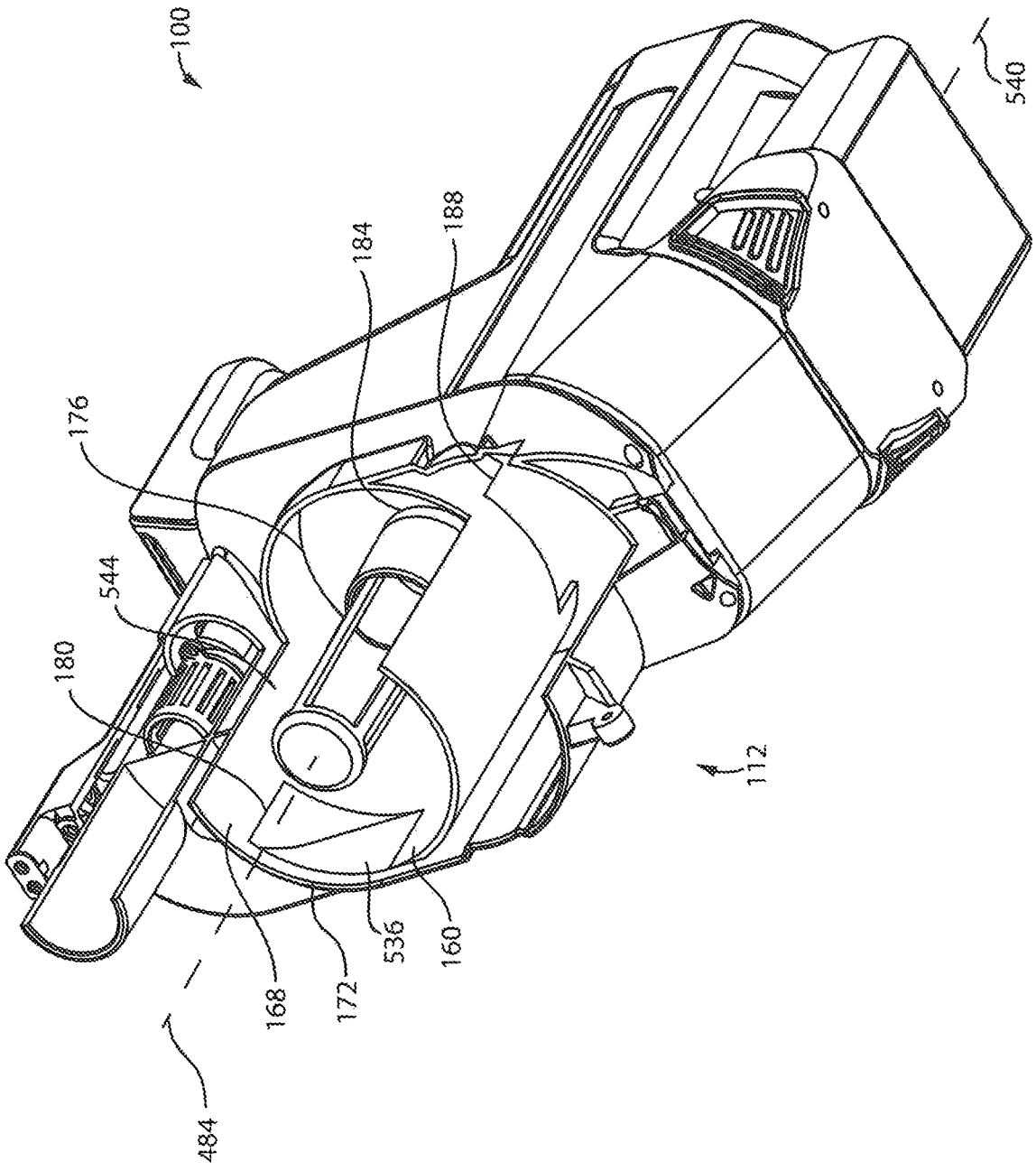


Fig. 7

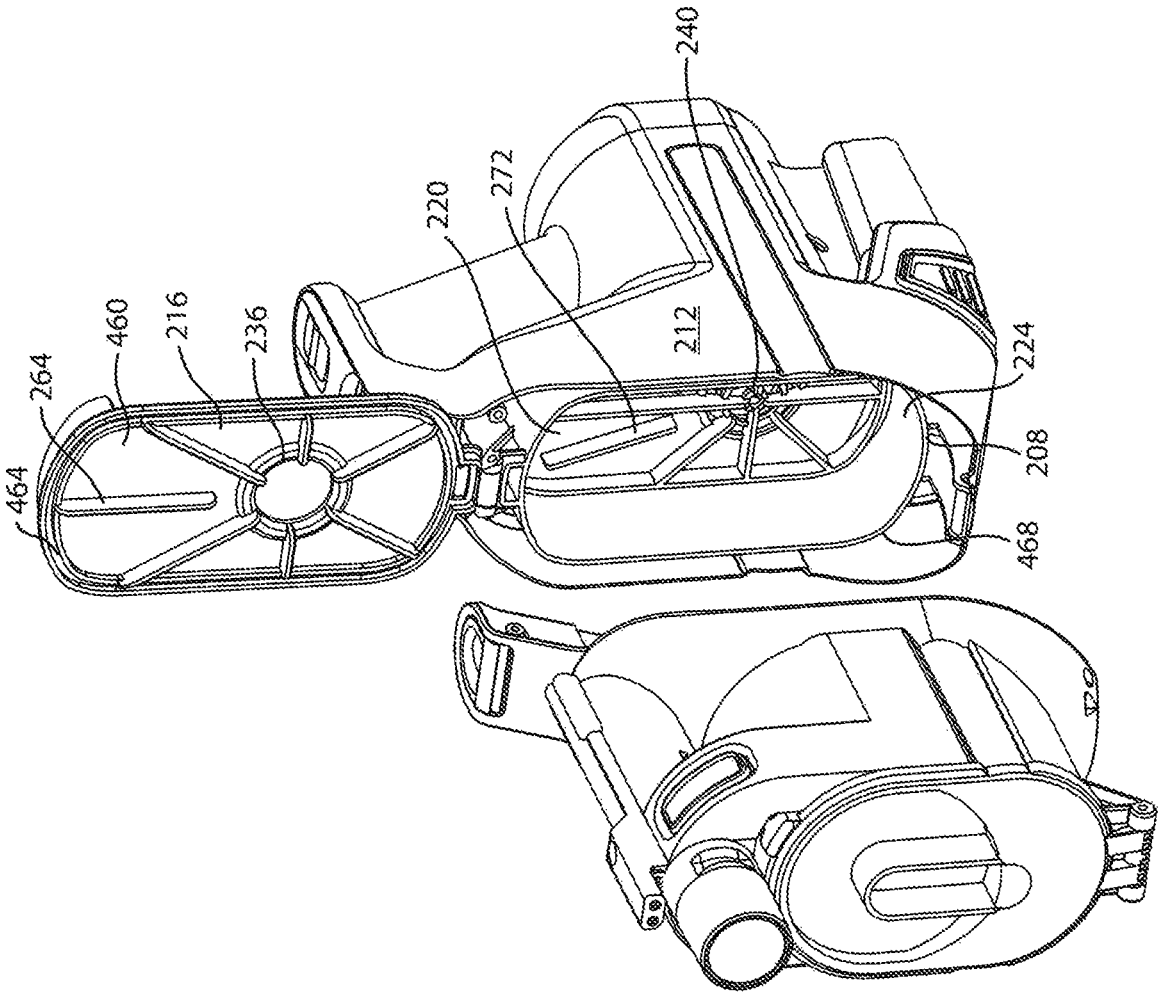


Fig. 8

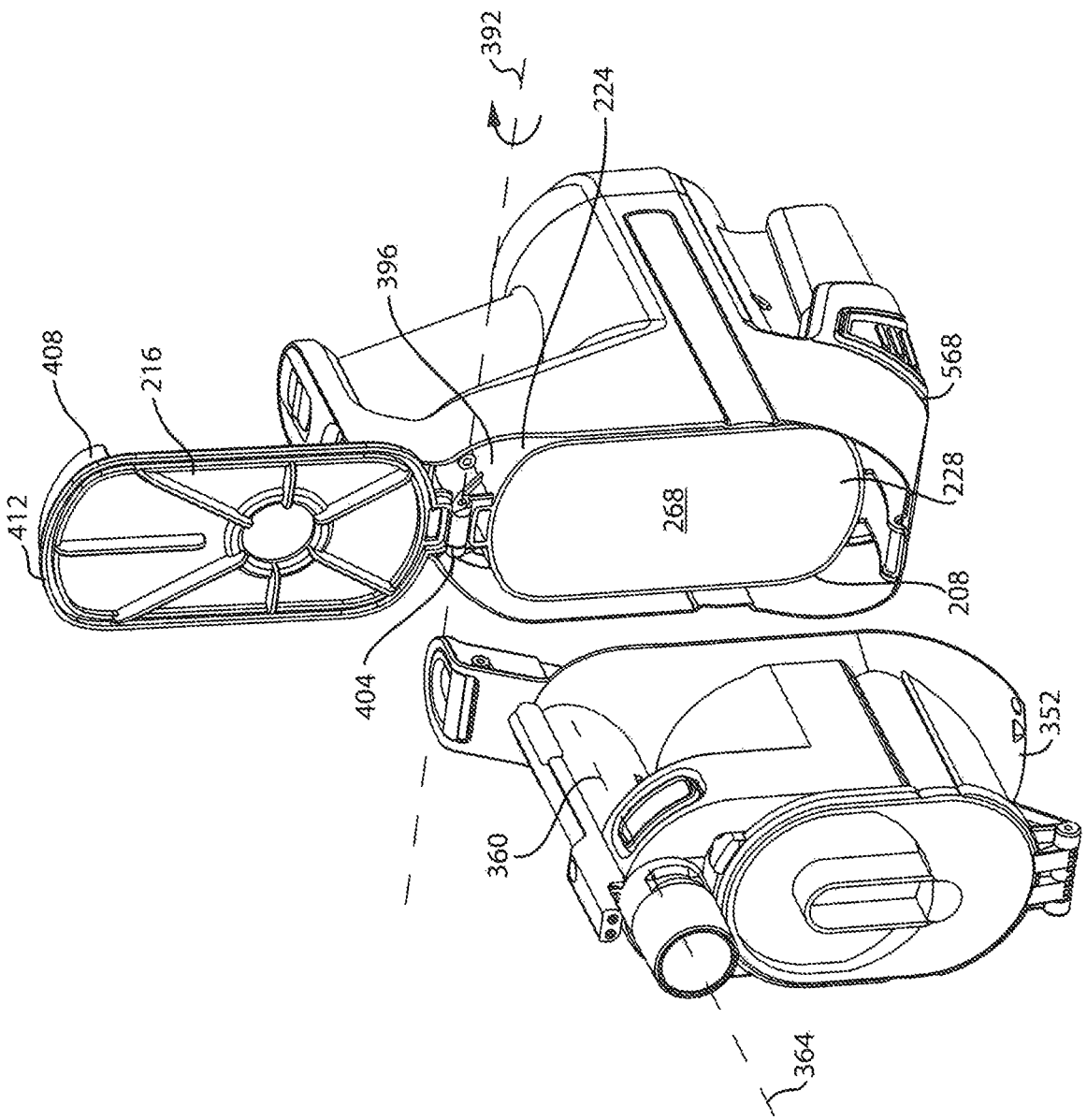


Fig. 8A

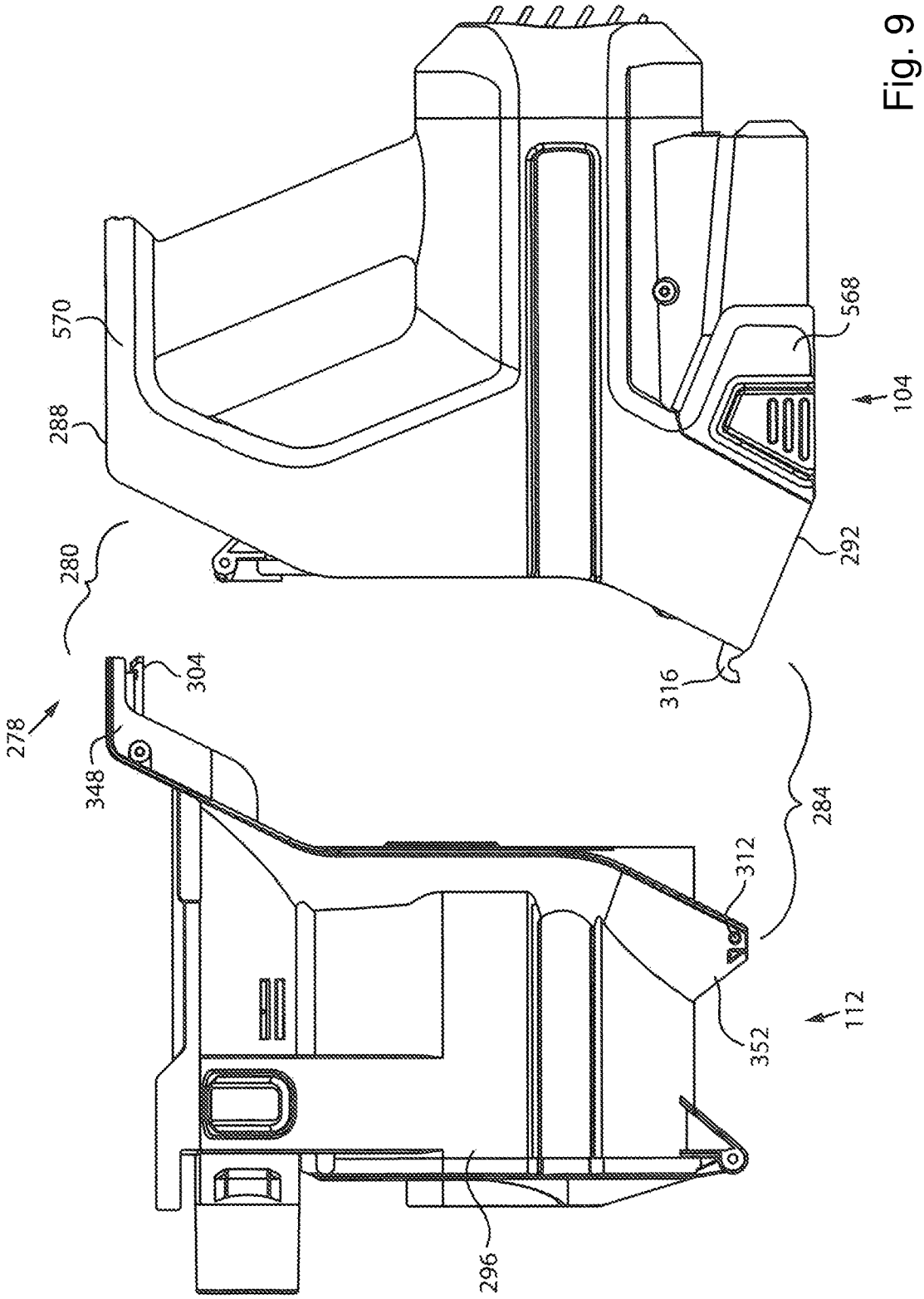


Fig. 9

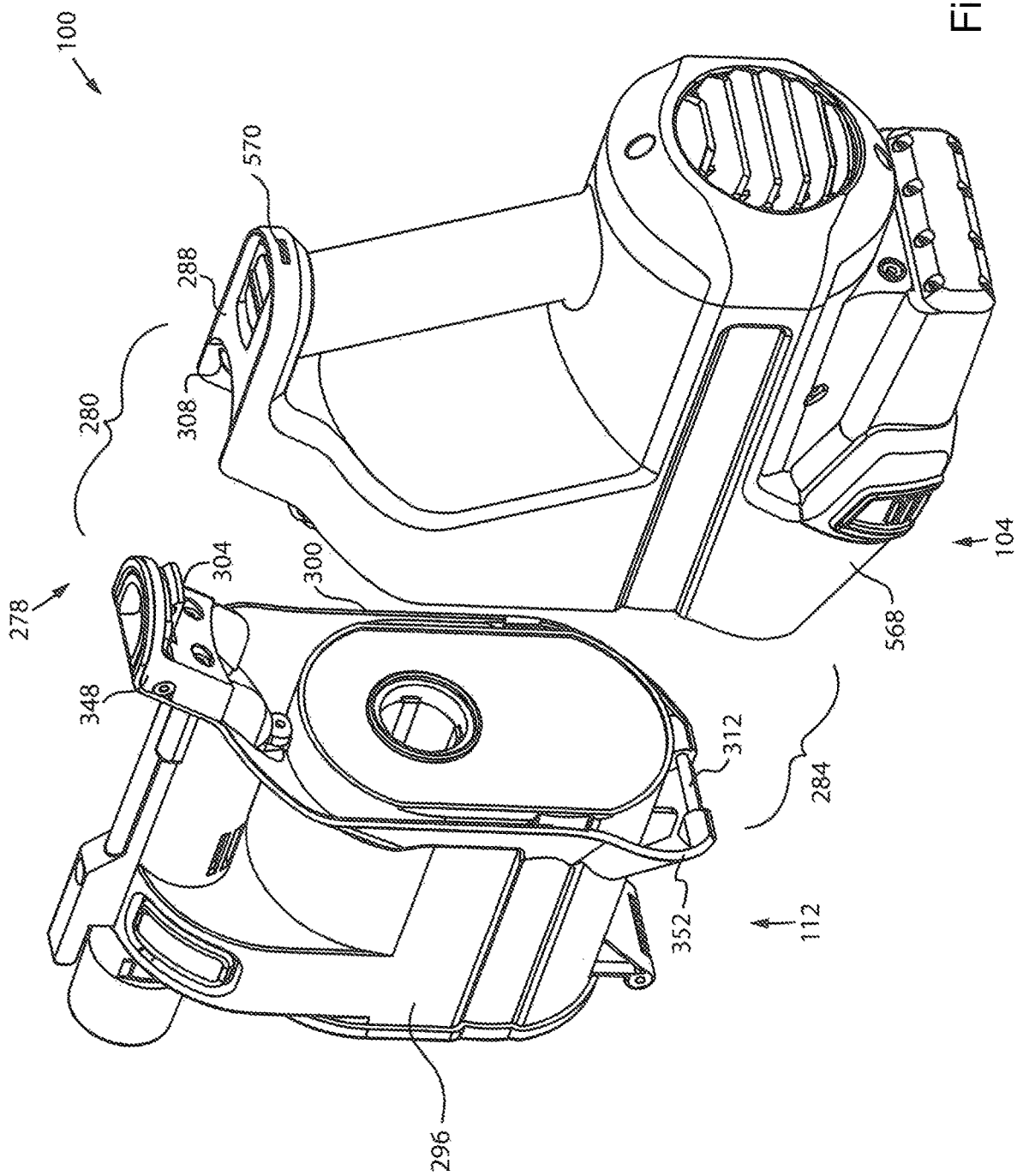


Fig. 10

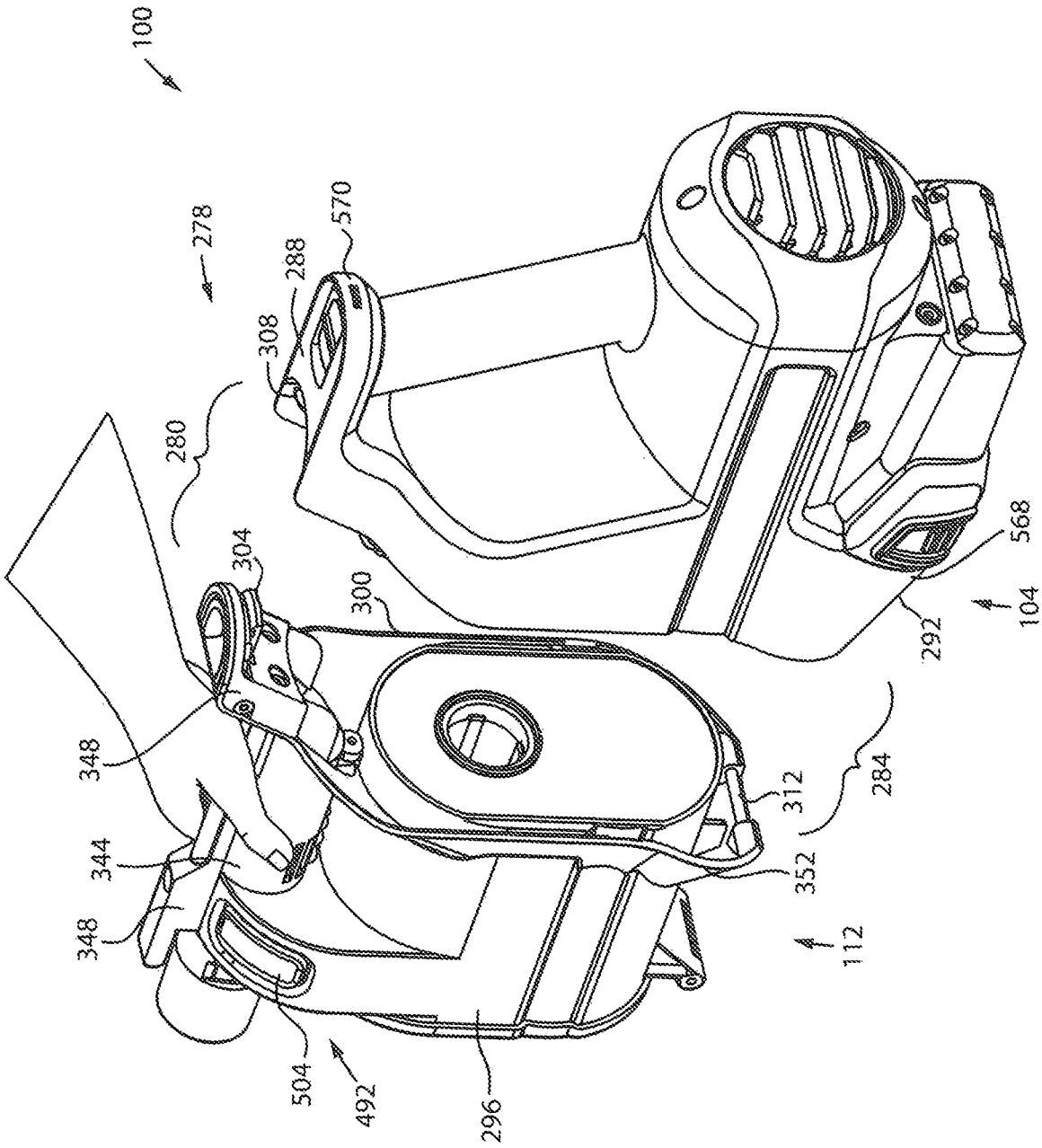

100
278
288
570
308
280
304
300
568
104
292
348
312
284
344
352
348
112
504
492
296

Fig. 10A

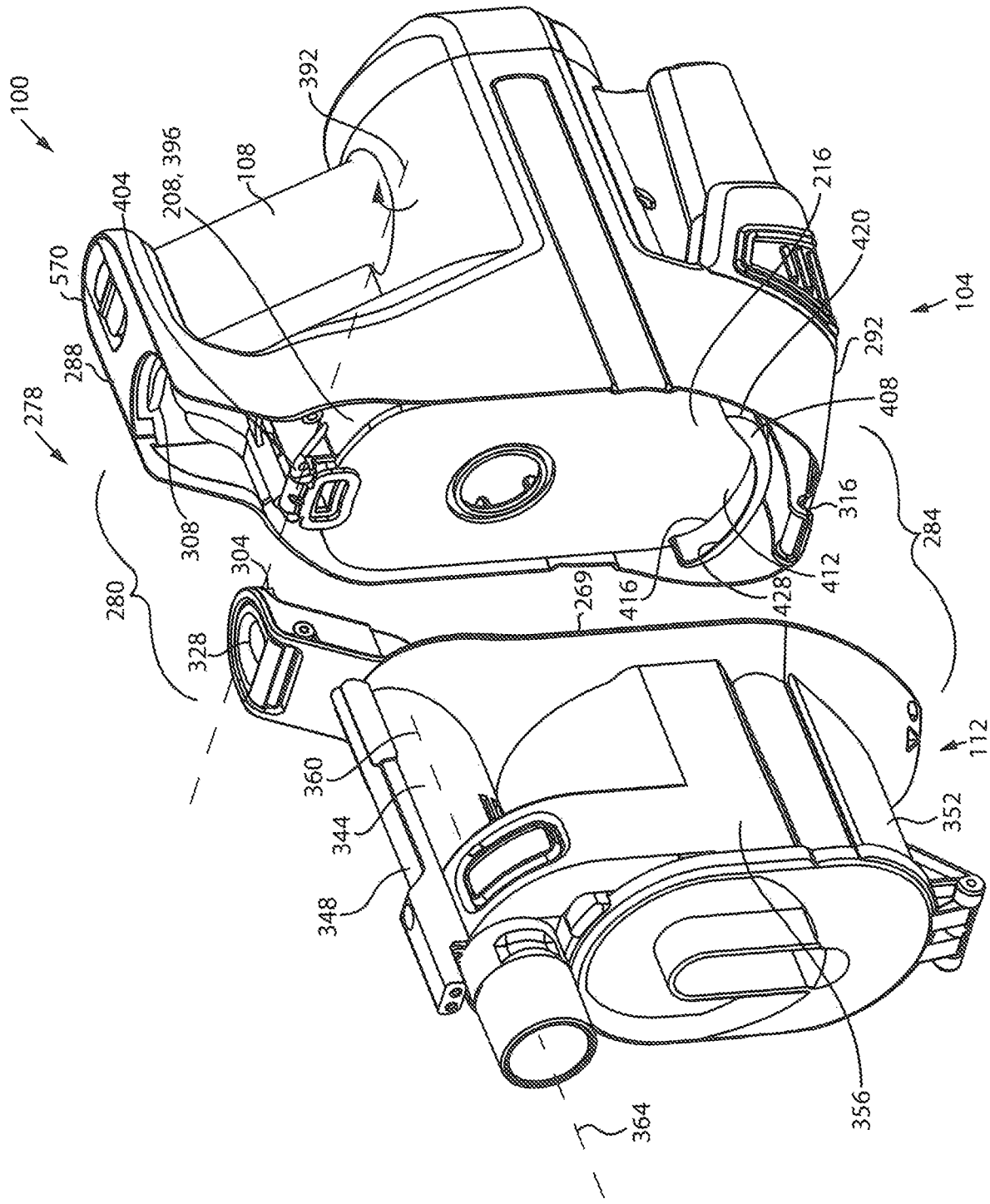

100
392
208, 396
108
404
570
288
278
280
308
304
328
360
344
348
364
356
352
112
284
316
408
292
420
216
104
412
428
416
269

Fig. 11

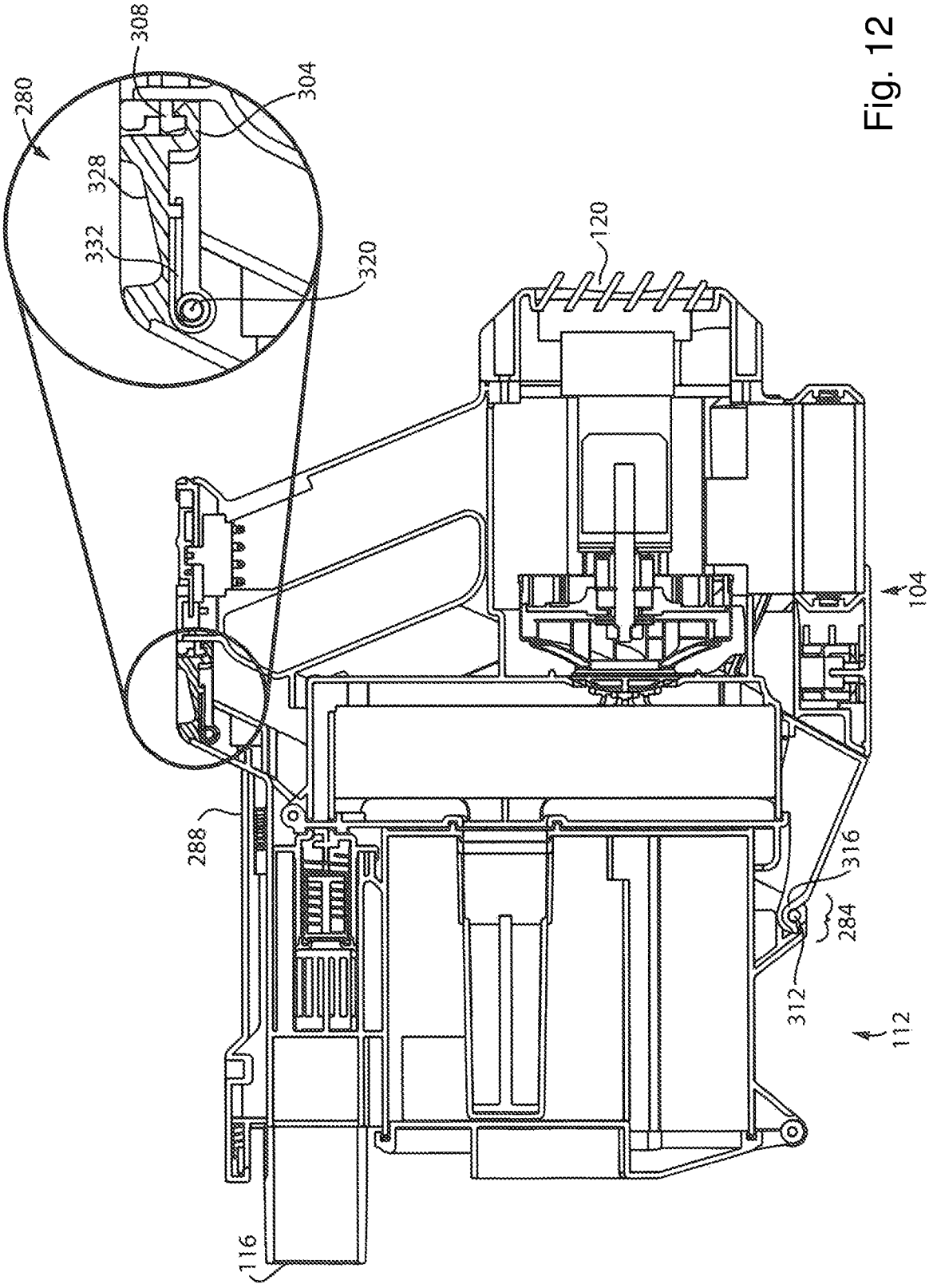


Fig. 12

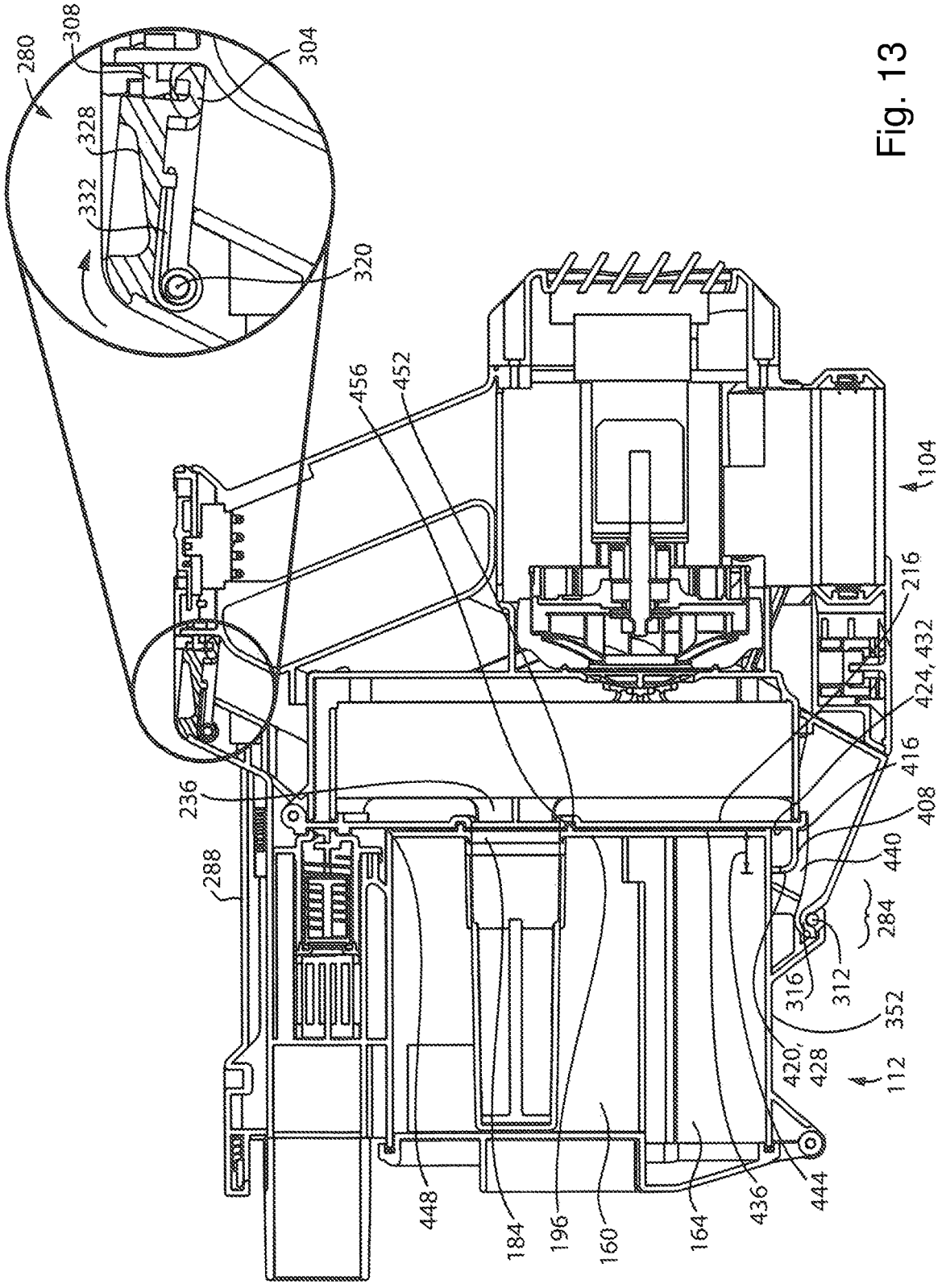

280
308
304
328
332
320
456
452
104
216
424, 432
416
408
440
284
312
316
352
420, 428
112
236
288
448
184
196
160
164
436
444

Fig. 13

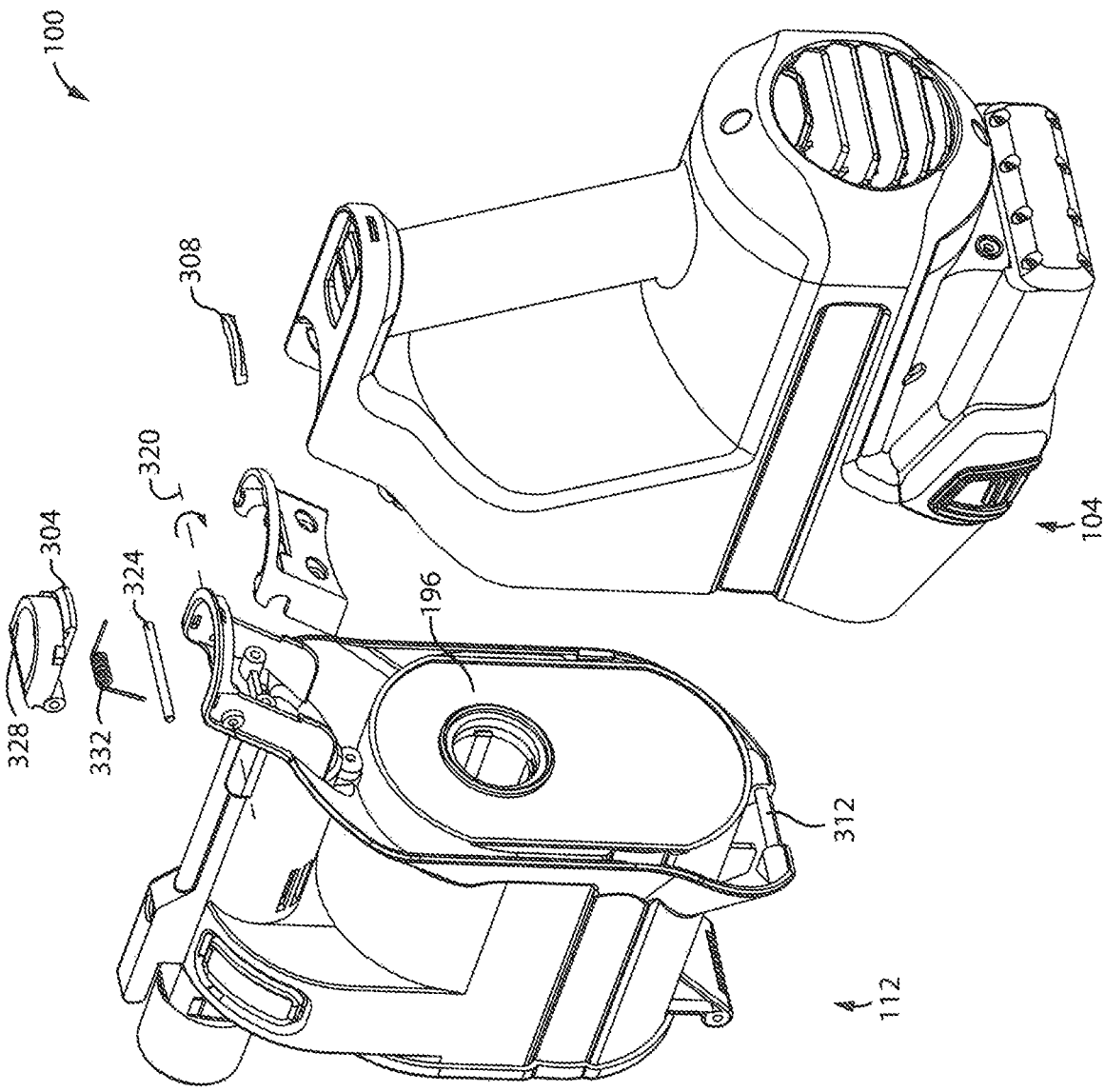


Fig. 14

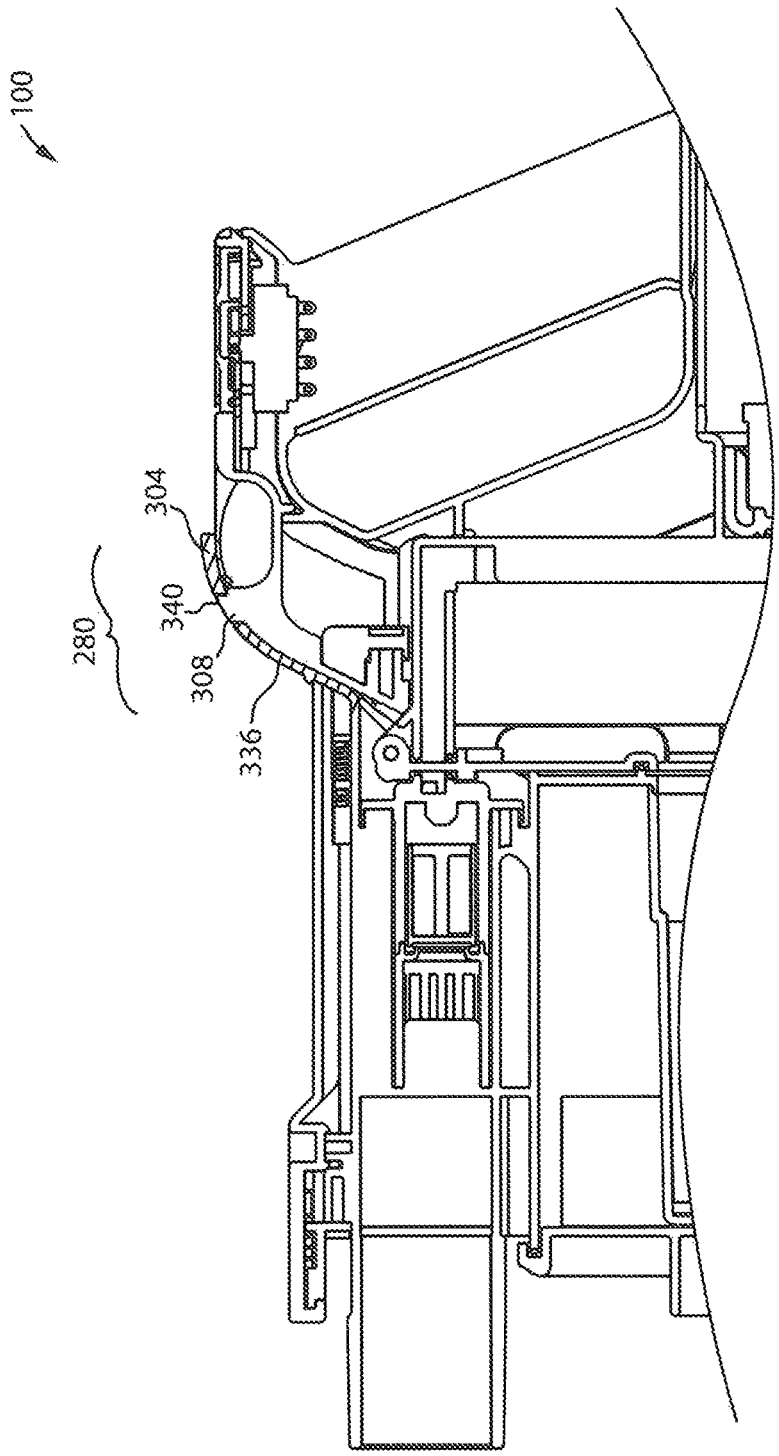


Fig. 15

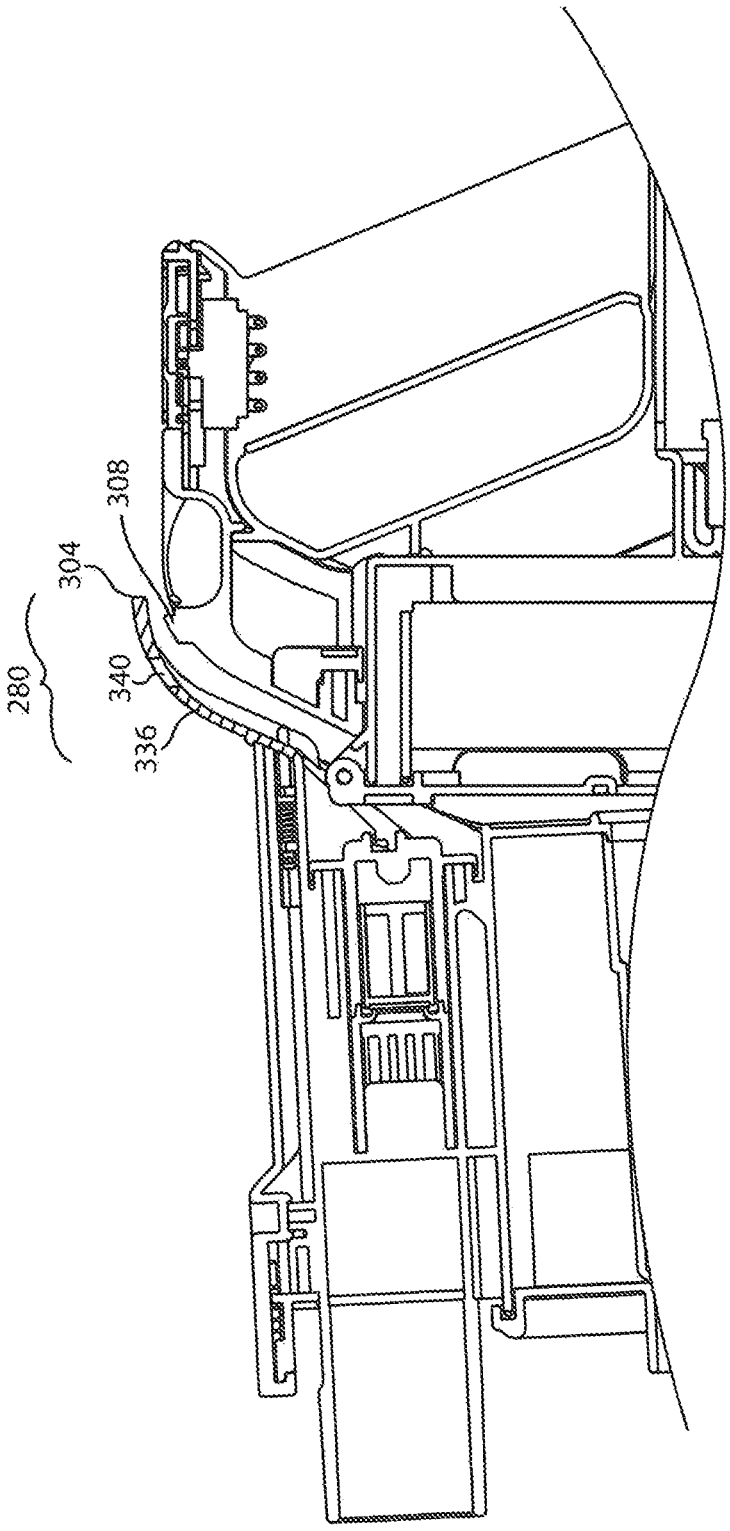


Fig. 16

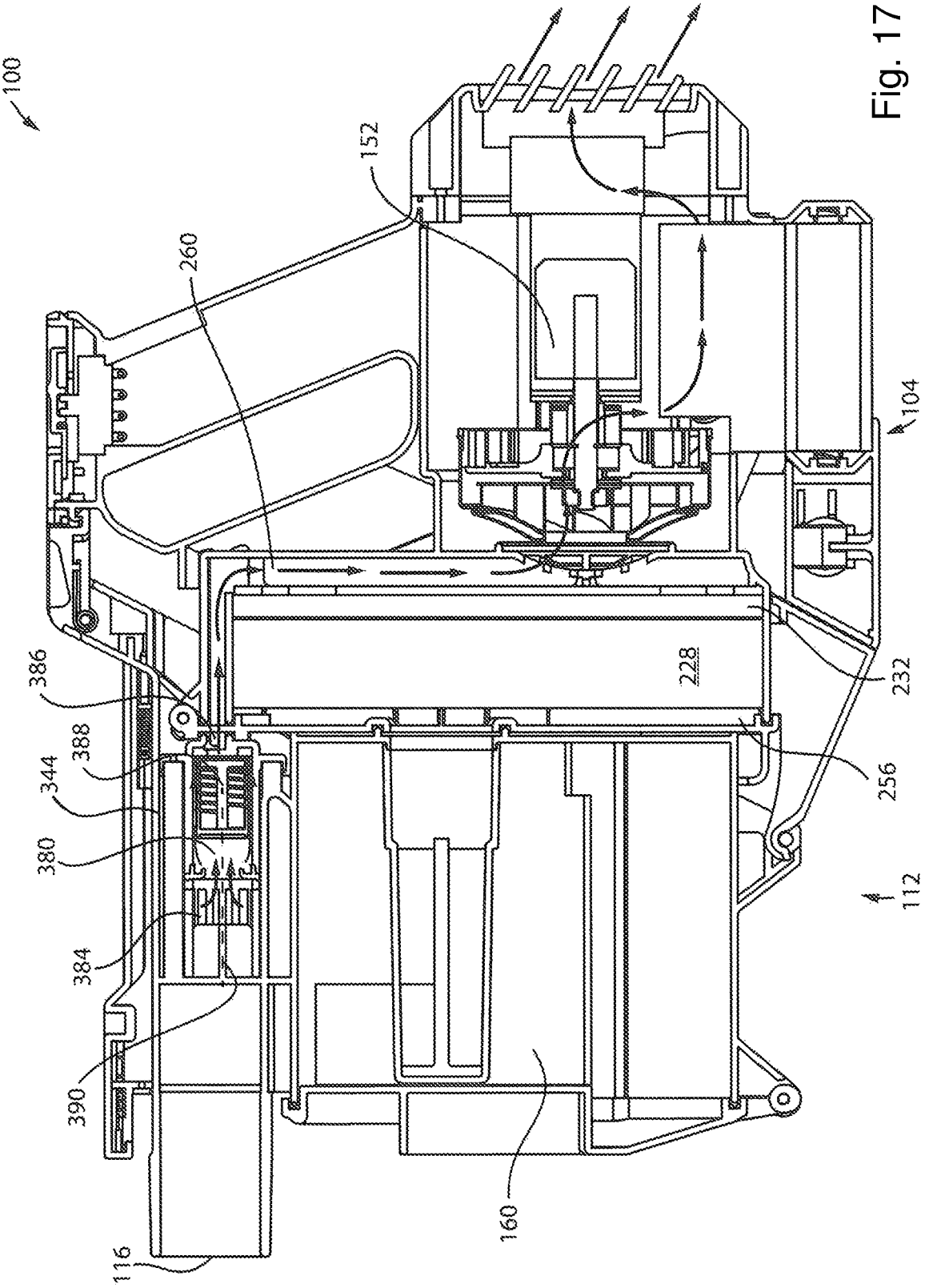


Fig. 17

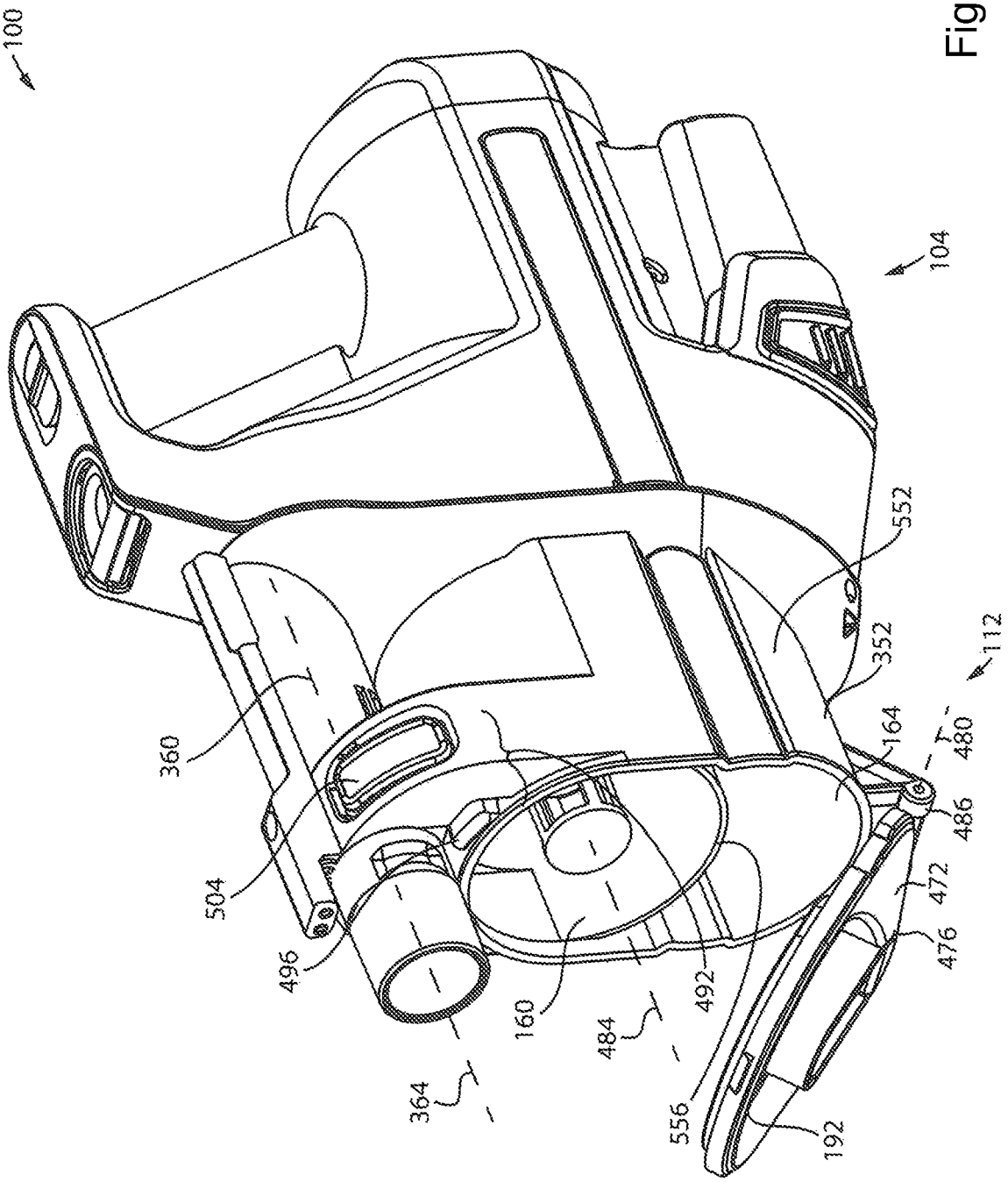

100
104
552
352
112
164
480
486
472
476
360
504
496
160
484
492
364
556
192

Fig. 18

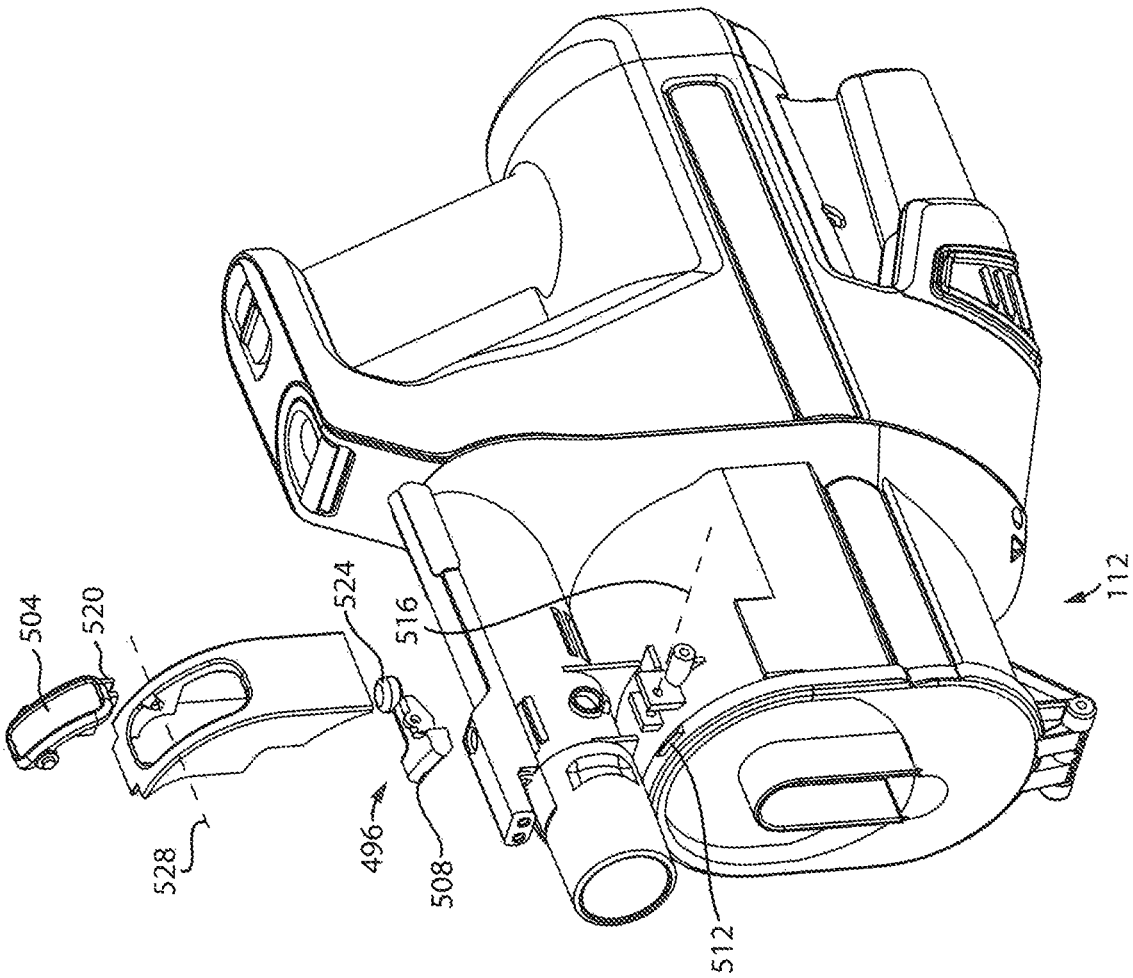


Fig. 19

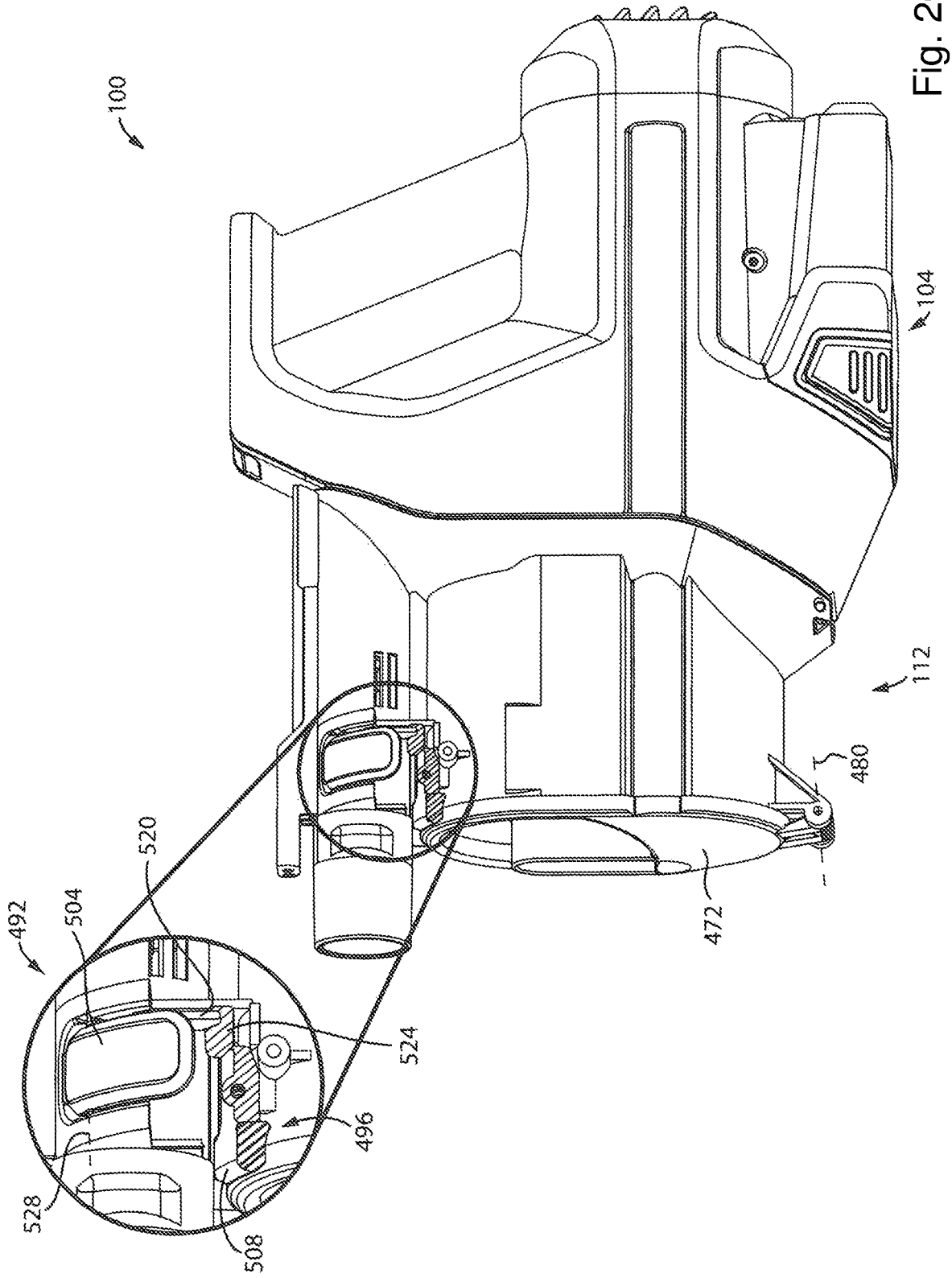


Fig. 20

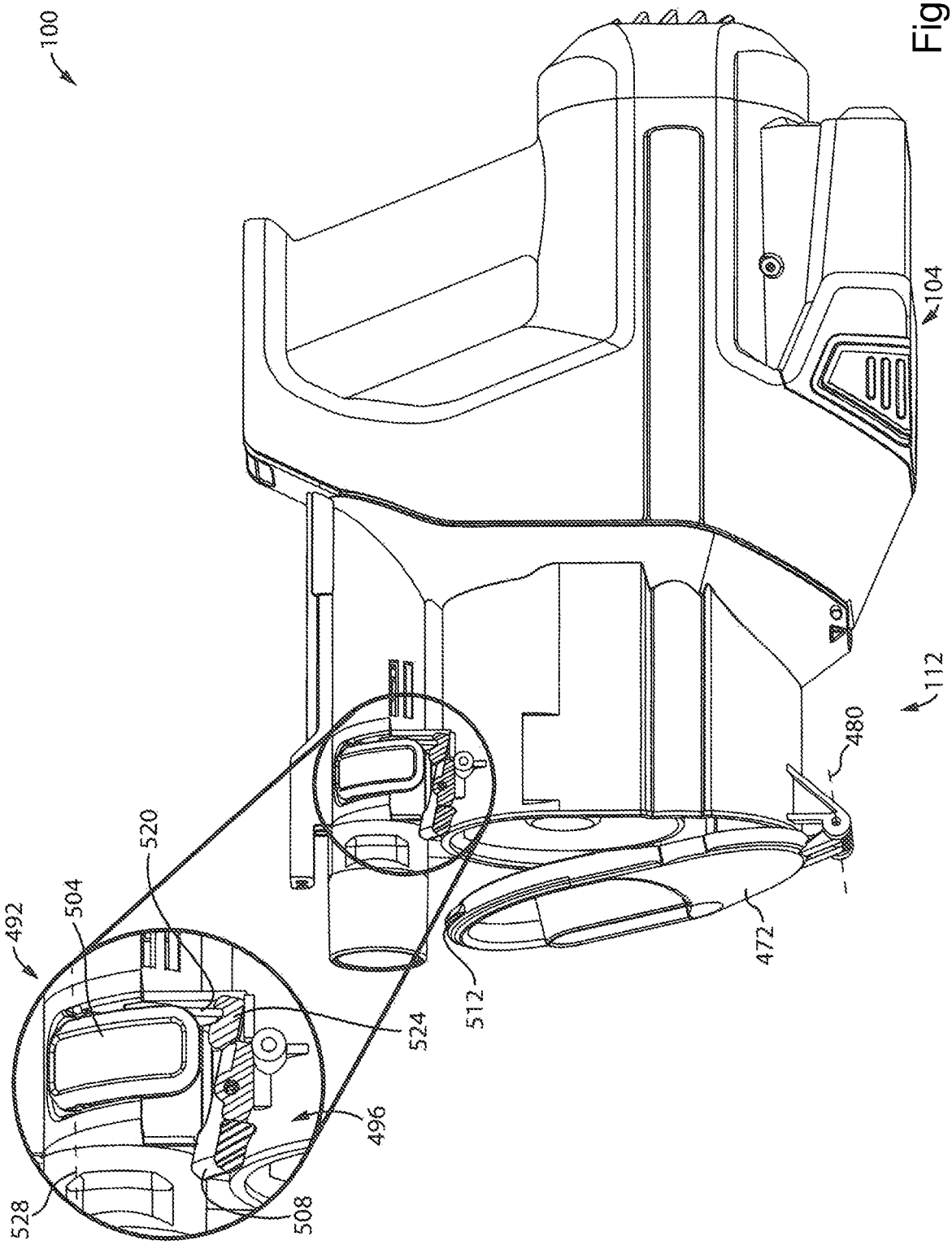


Fig. 21

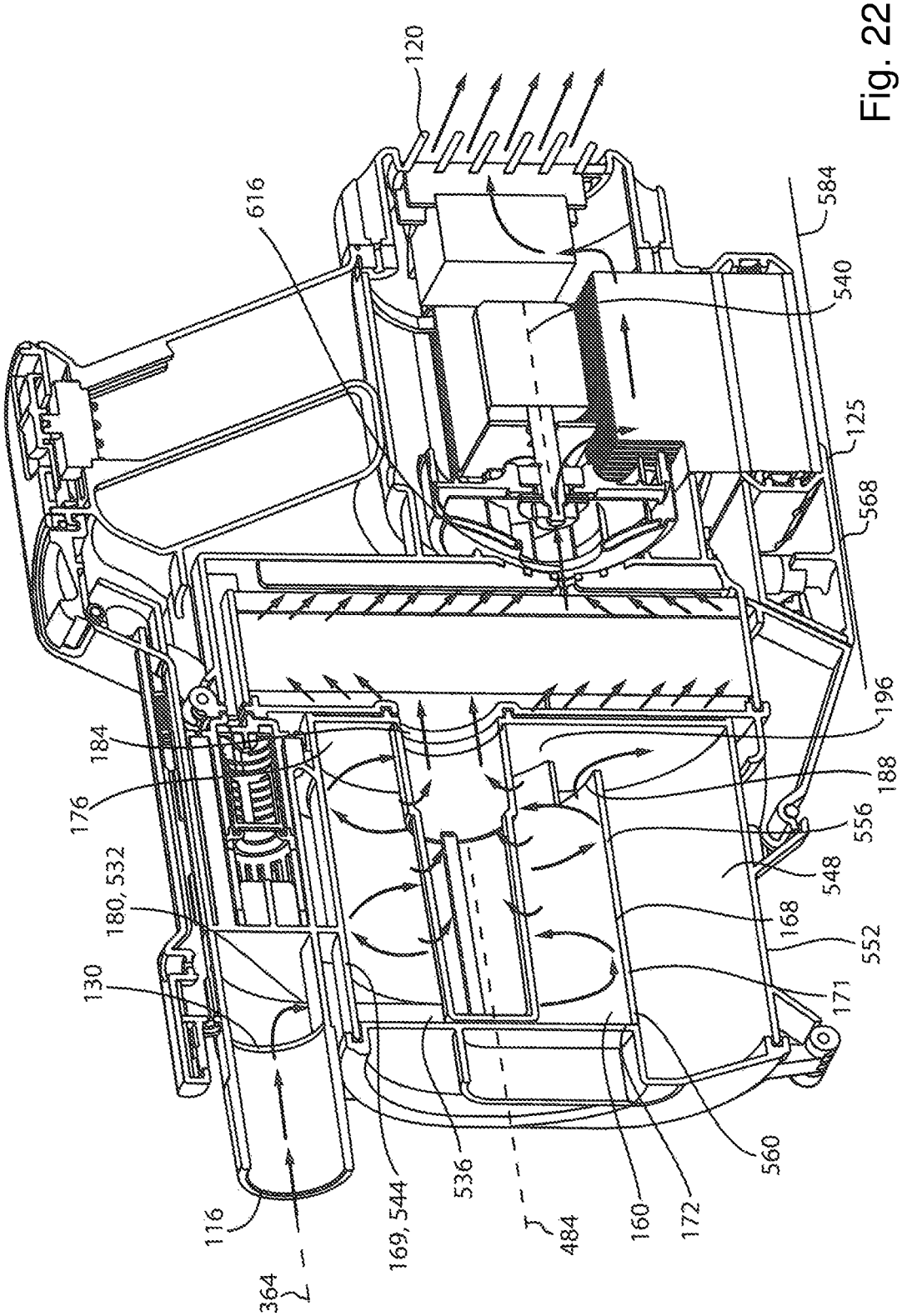

100
120
616
584
540
125
568
196
184
188
176
556
180, 532
548
168
552
130
171
560
536
116
169, 544
484
160
172
364

Fig. 22

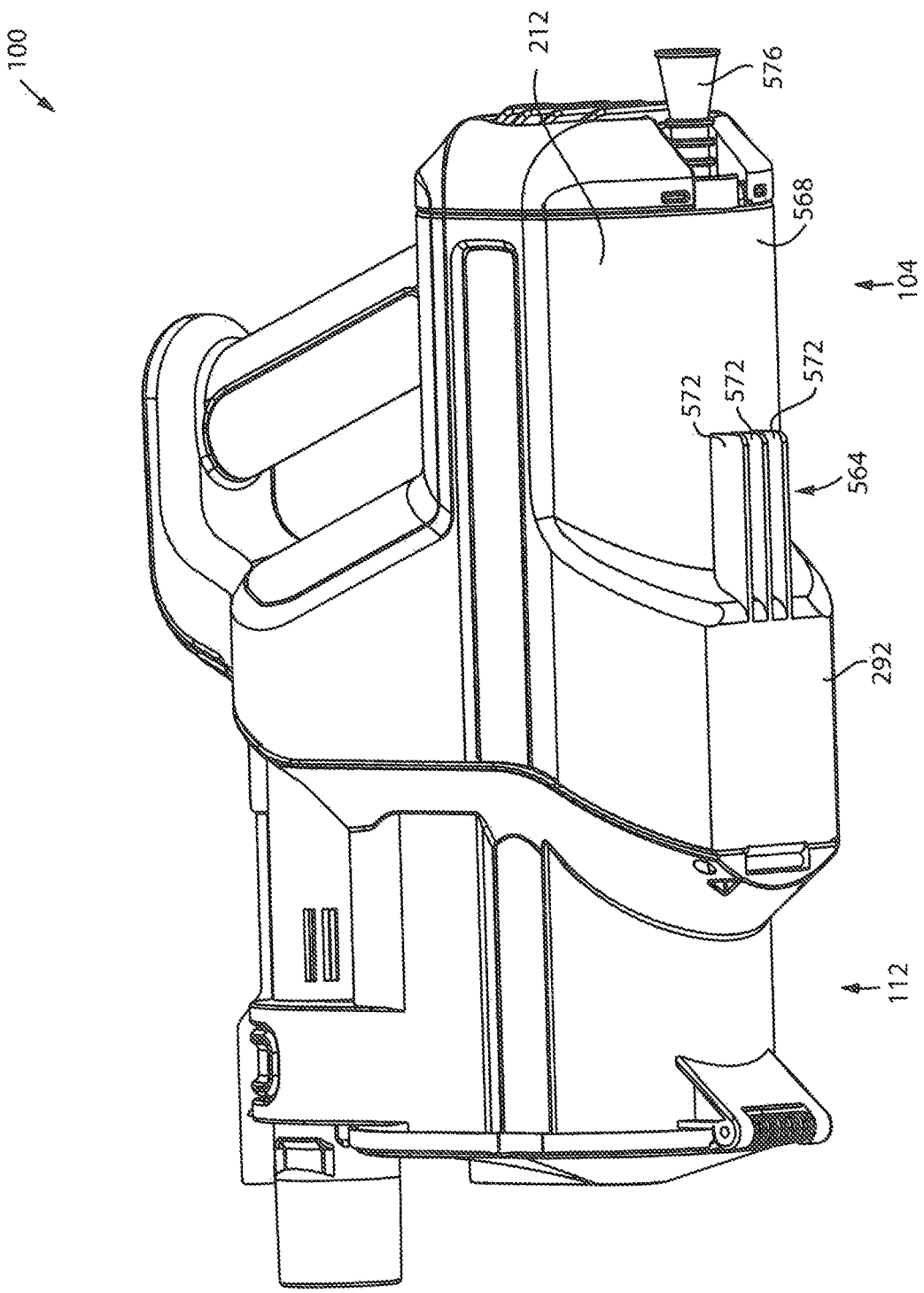


Fig. 23

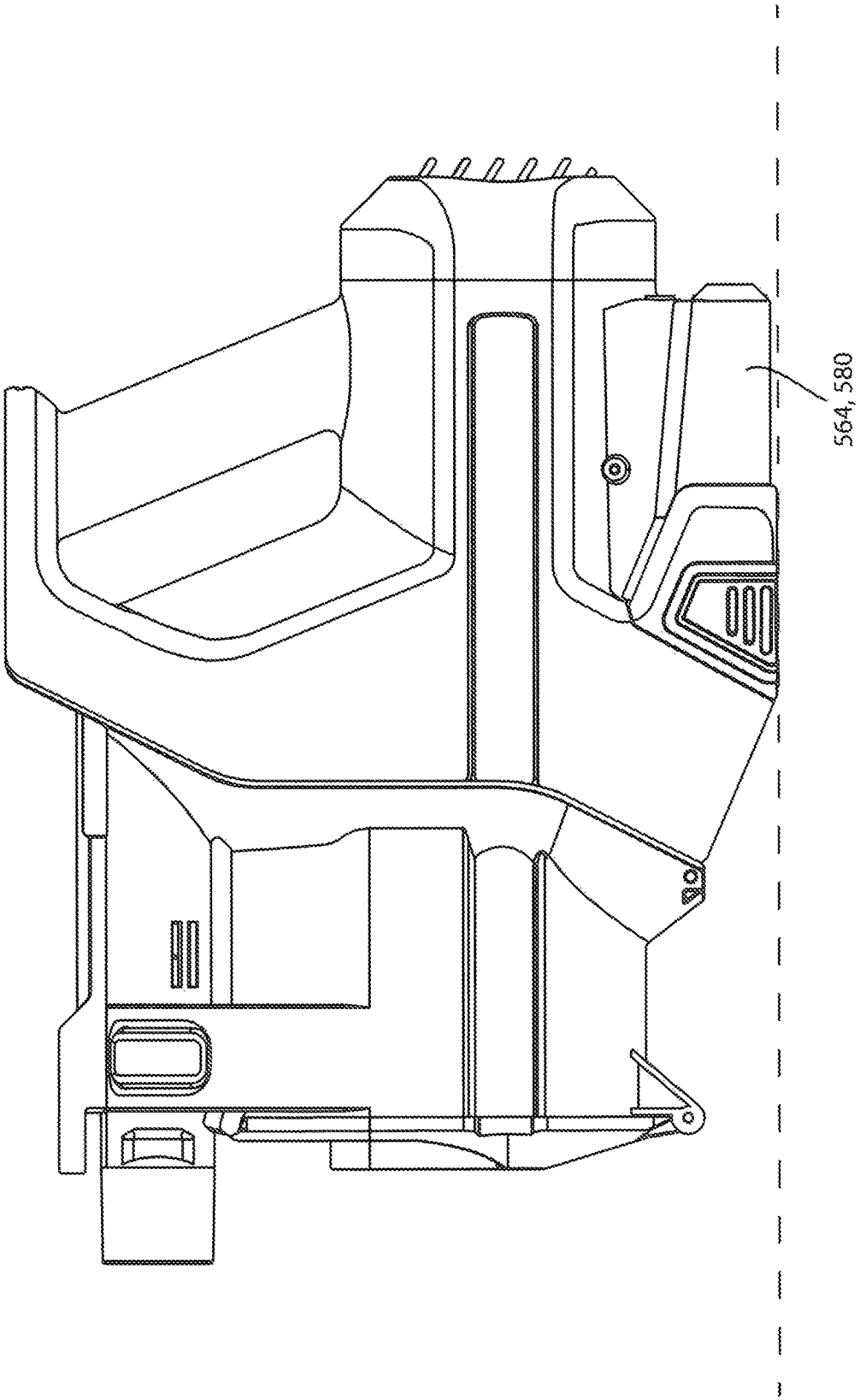


Fig. 24

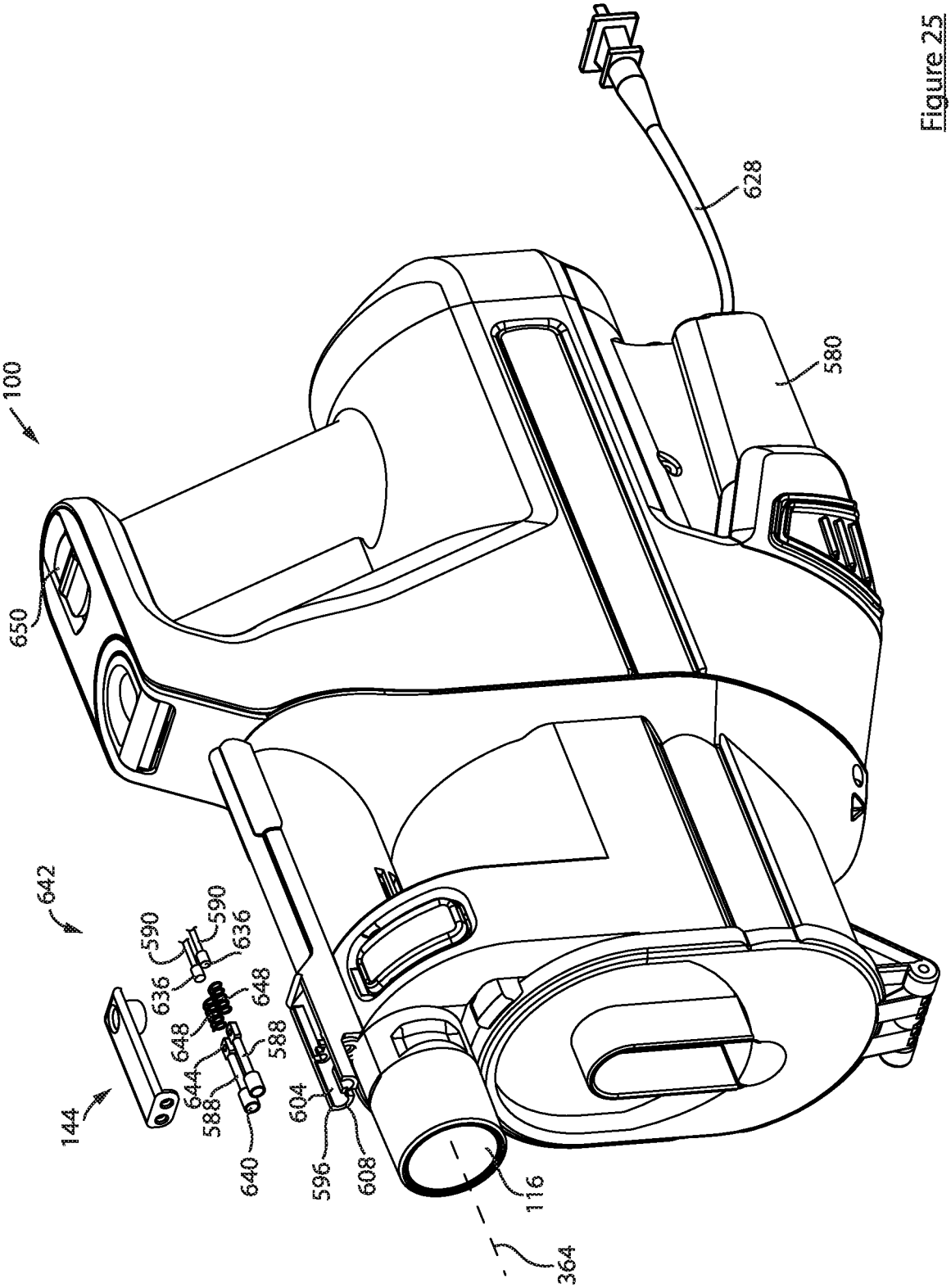

100
650
642
590
636
590
636
648
648
588
644
588
604
640
596
608
144
116
364
580
628

Figure 25

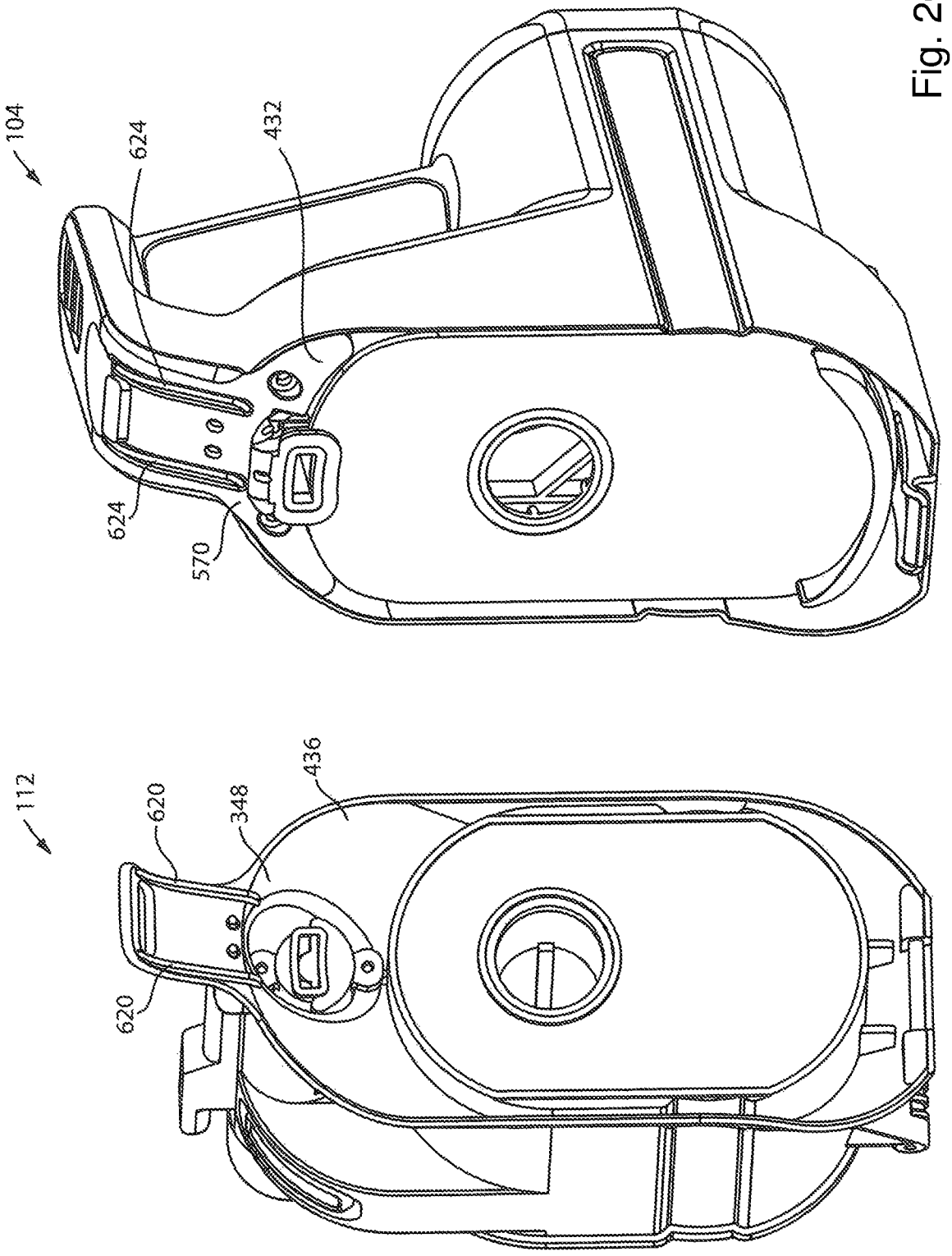


Fig. 26

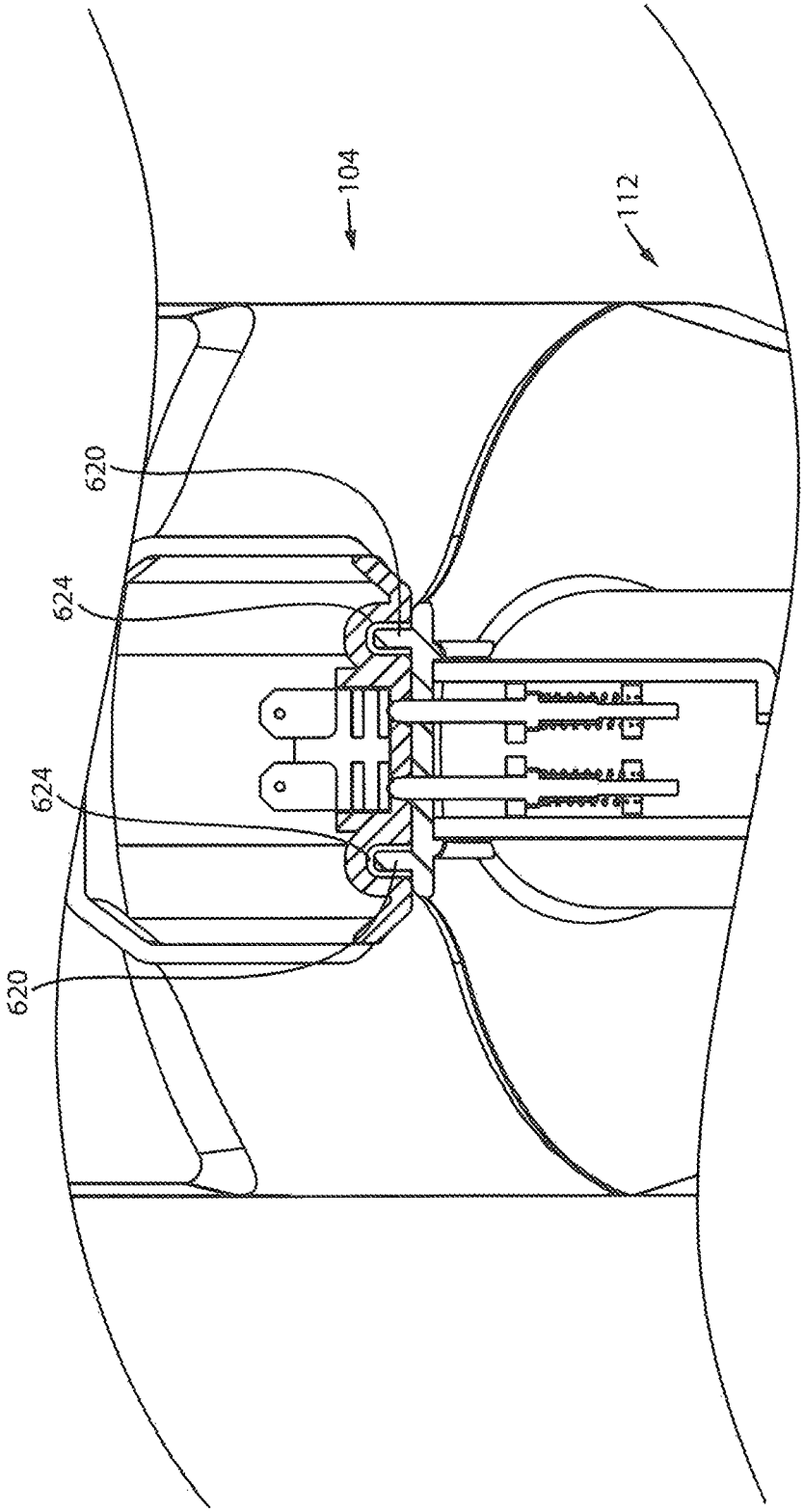


Fig. 27

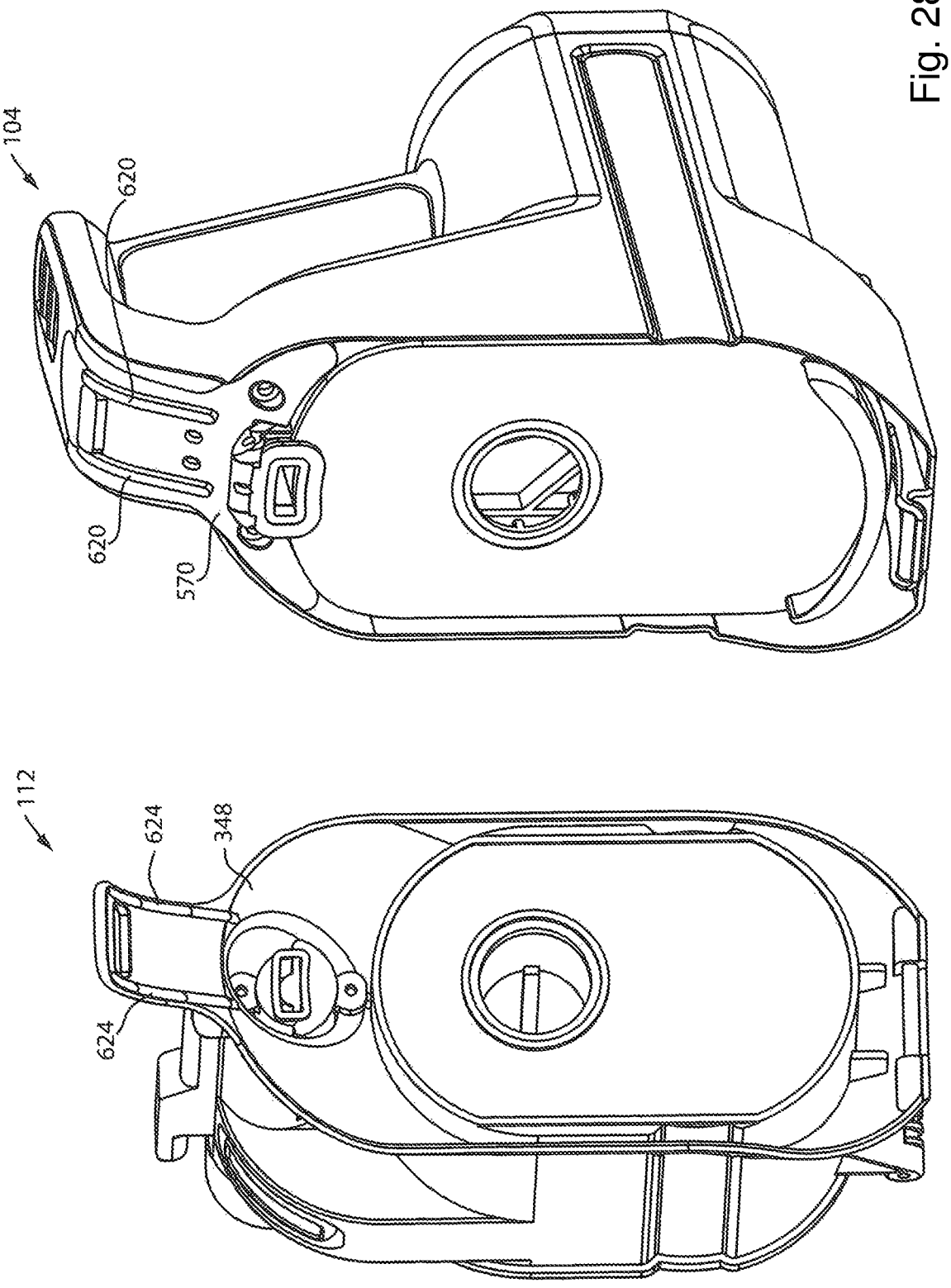


Fig. 28

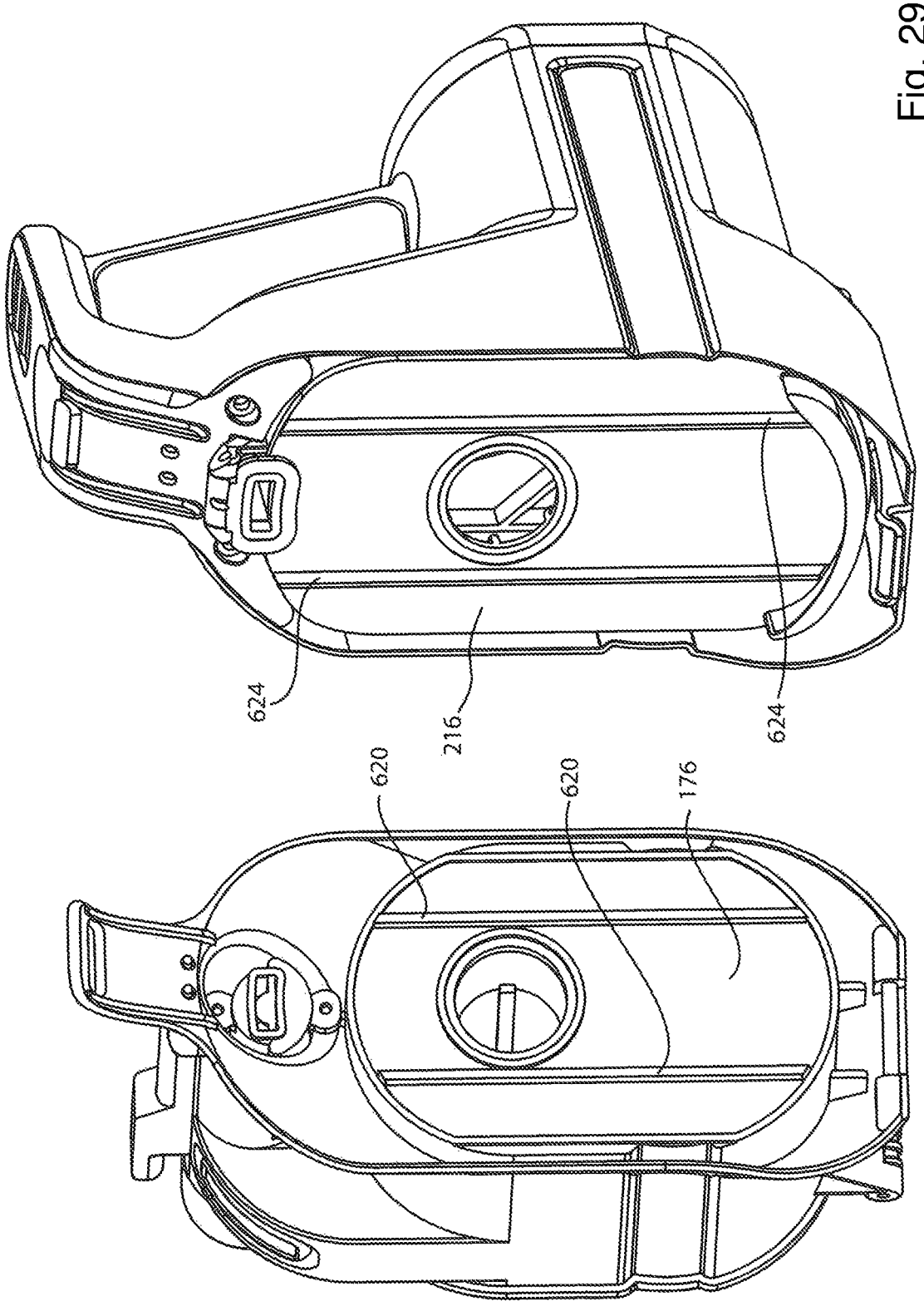


Fig. 29

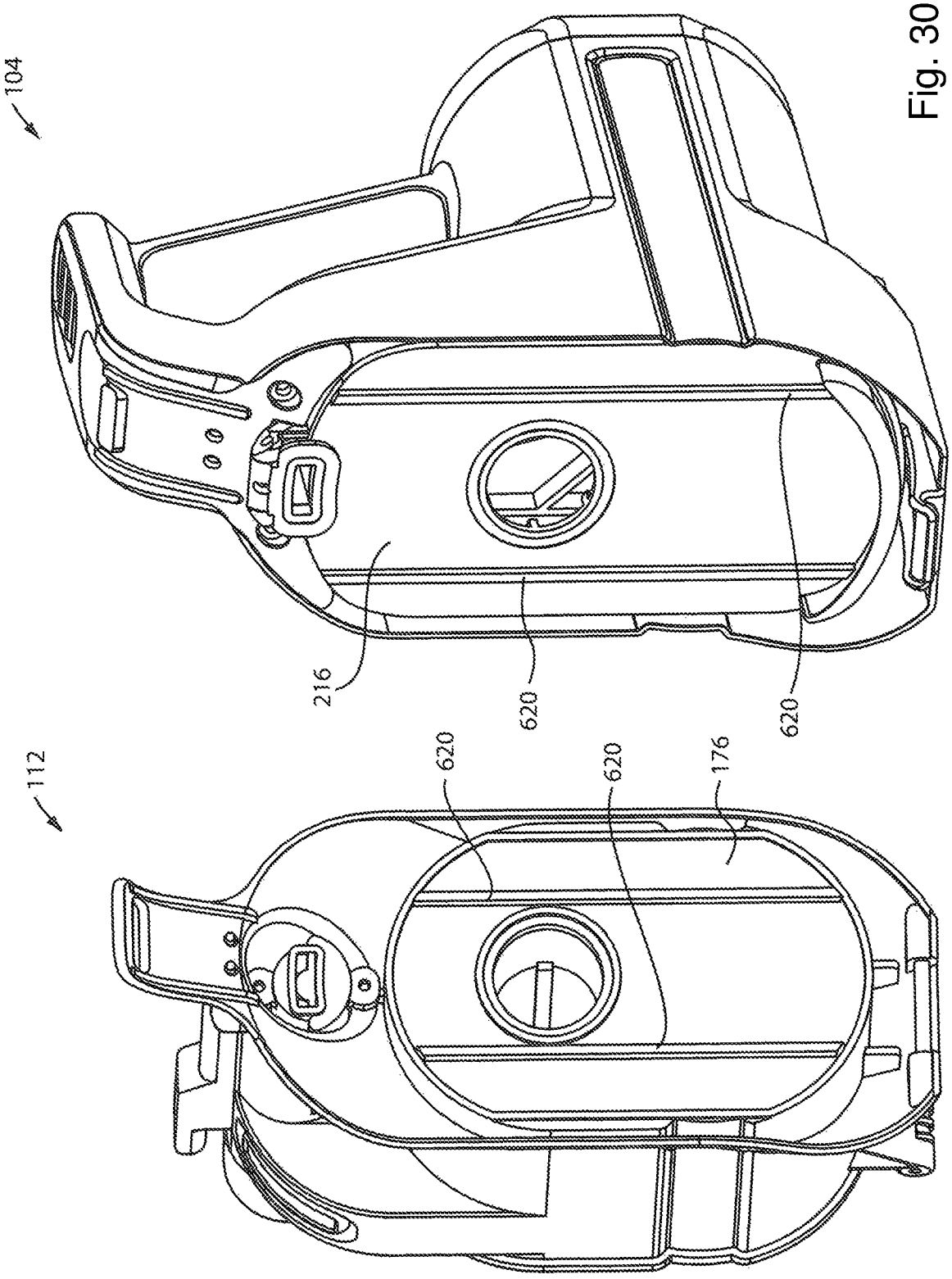


Fig. 30

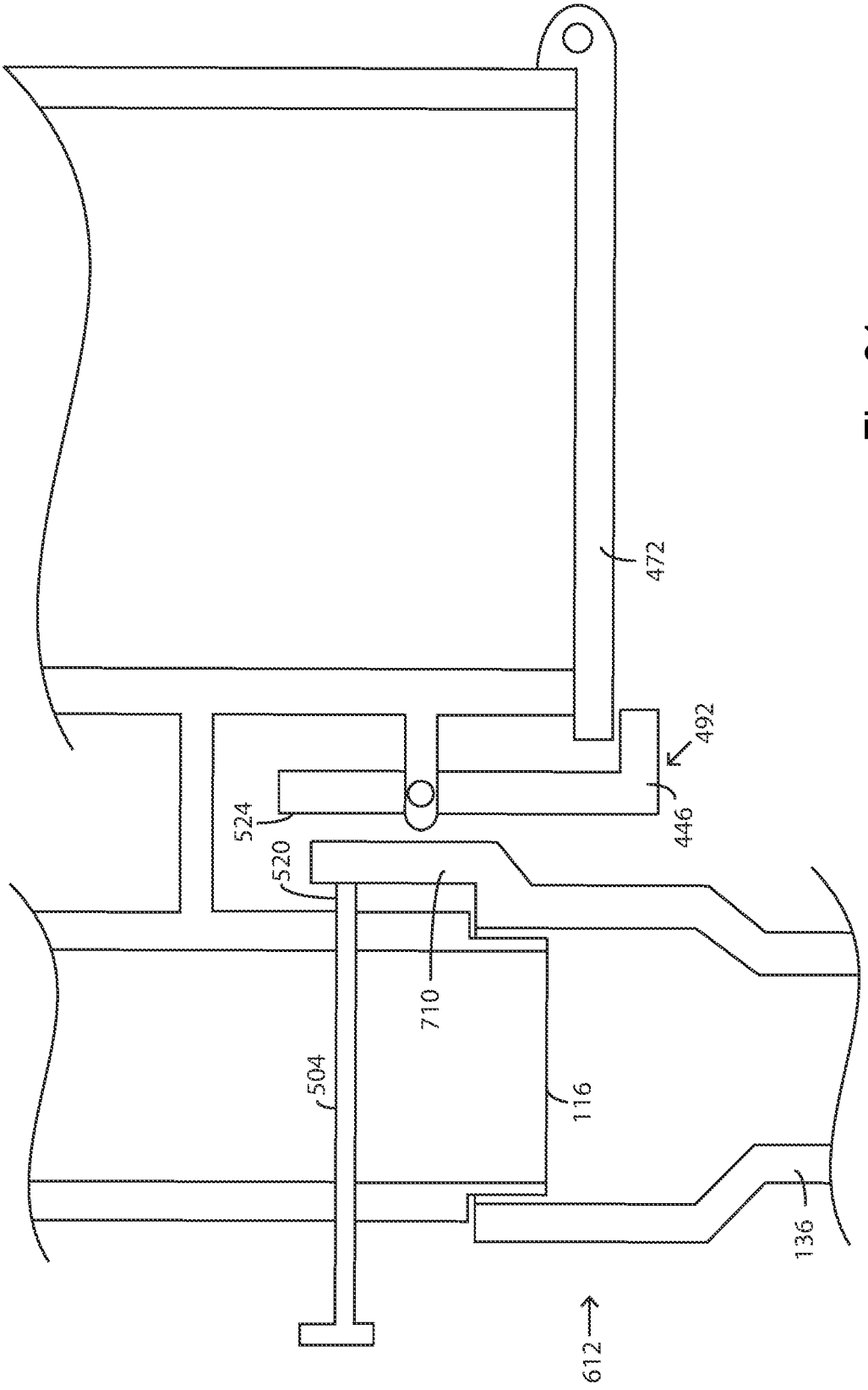


Fig. 31

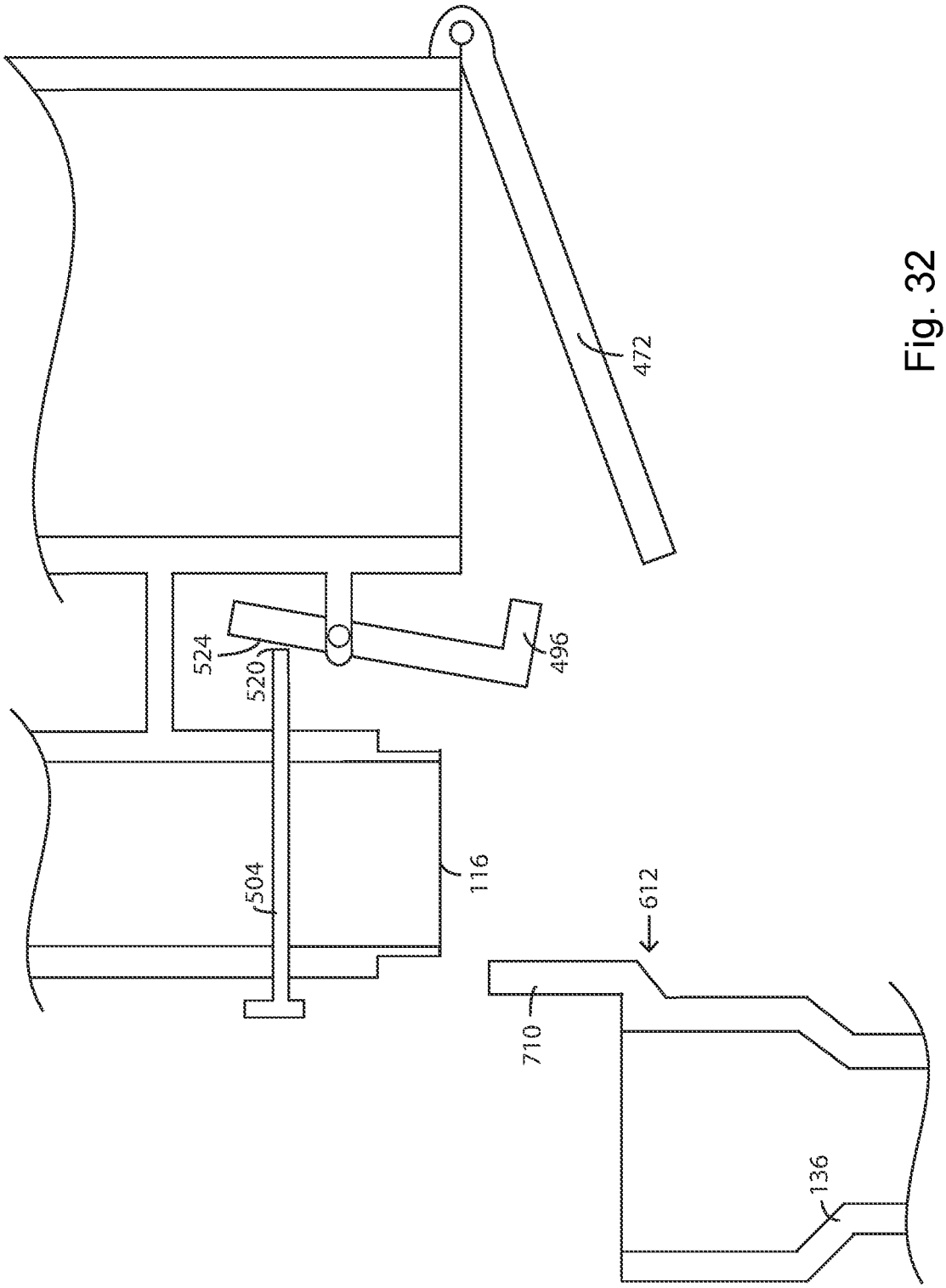


Fig. 32

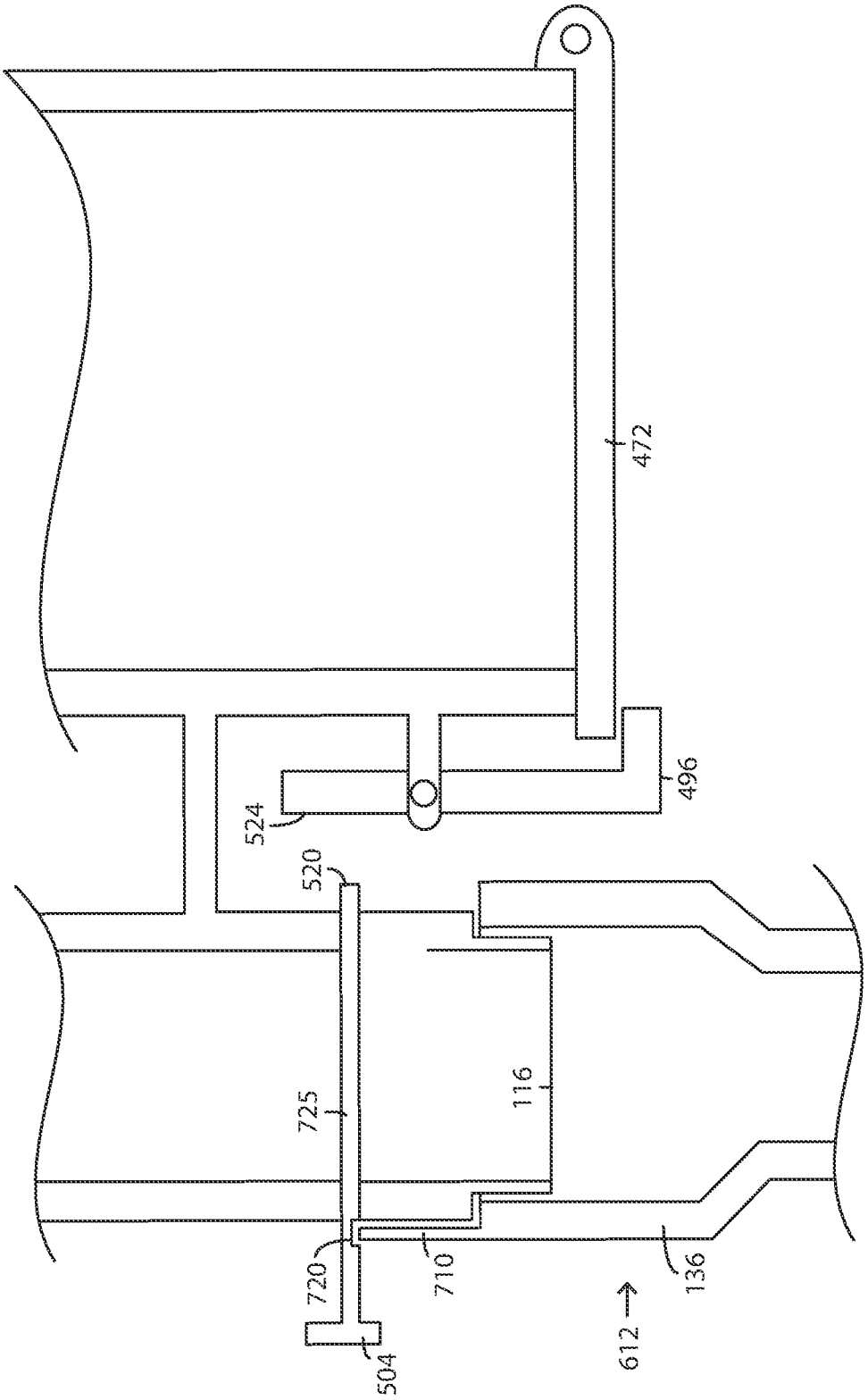


Fig. 33

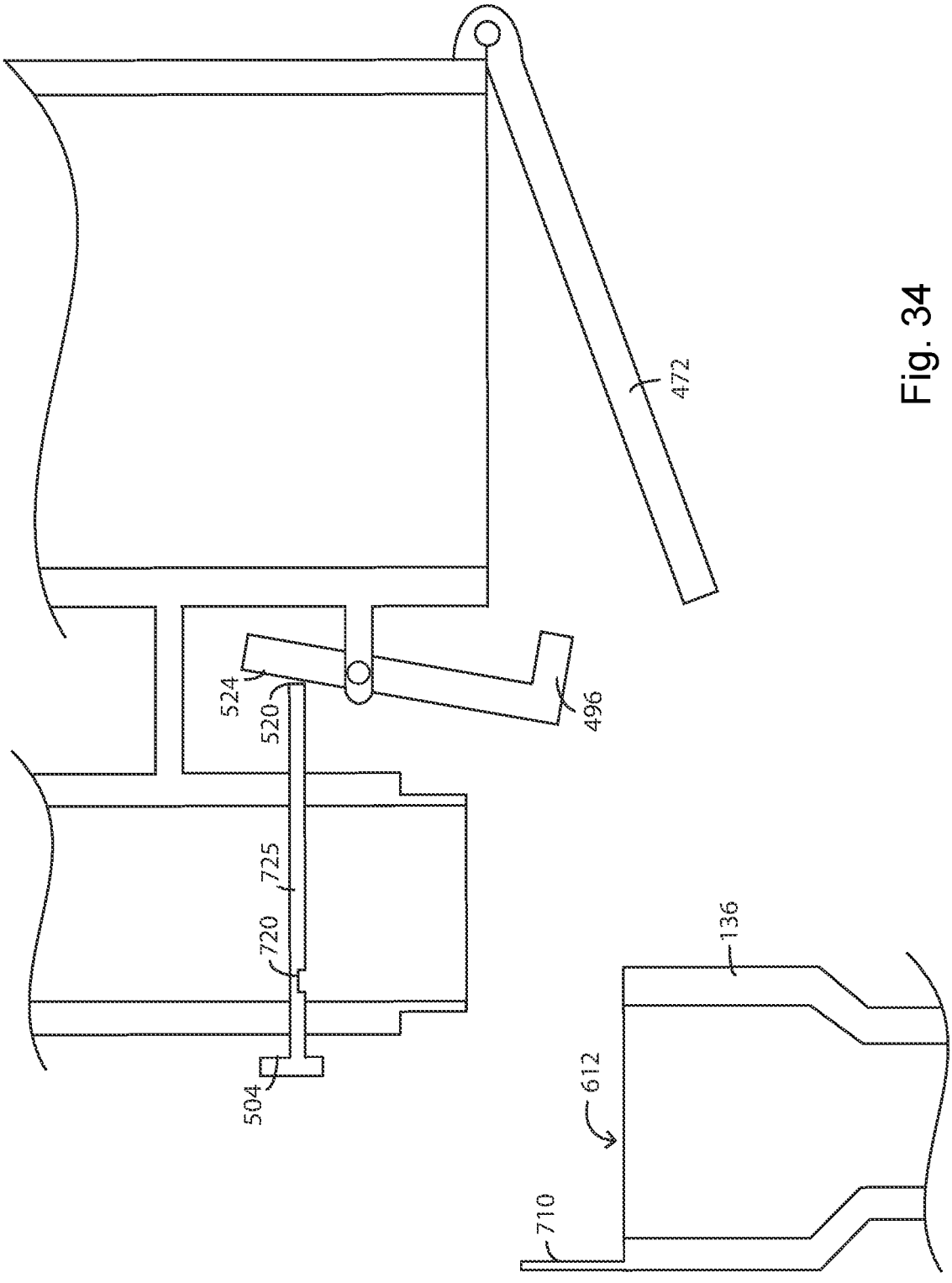


Fig. 34

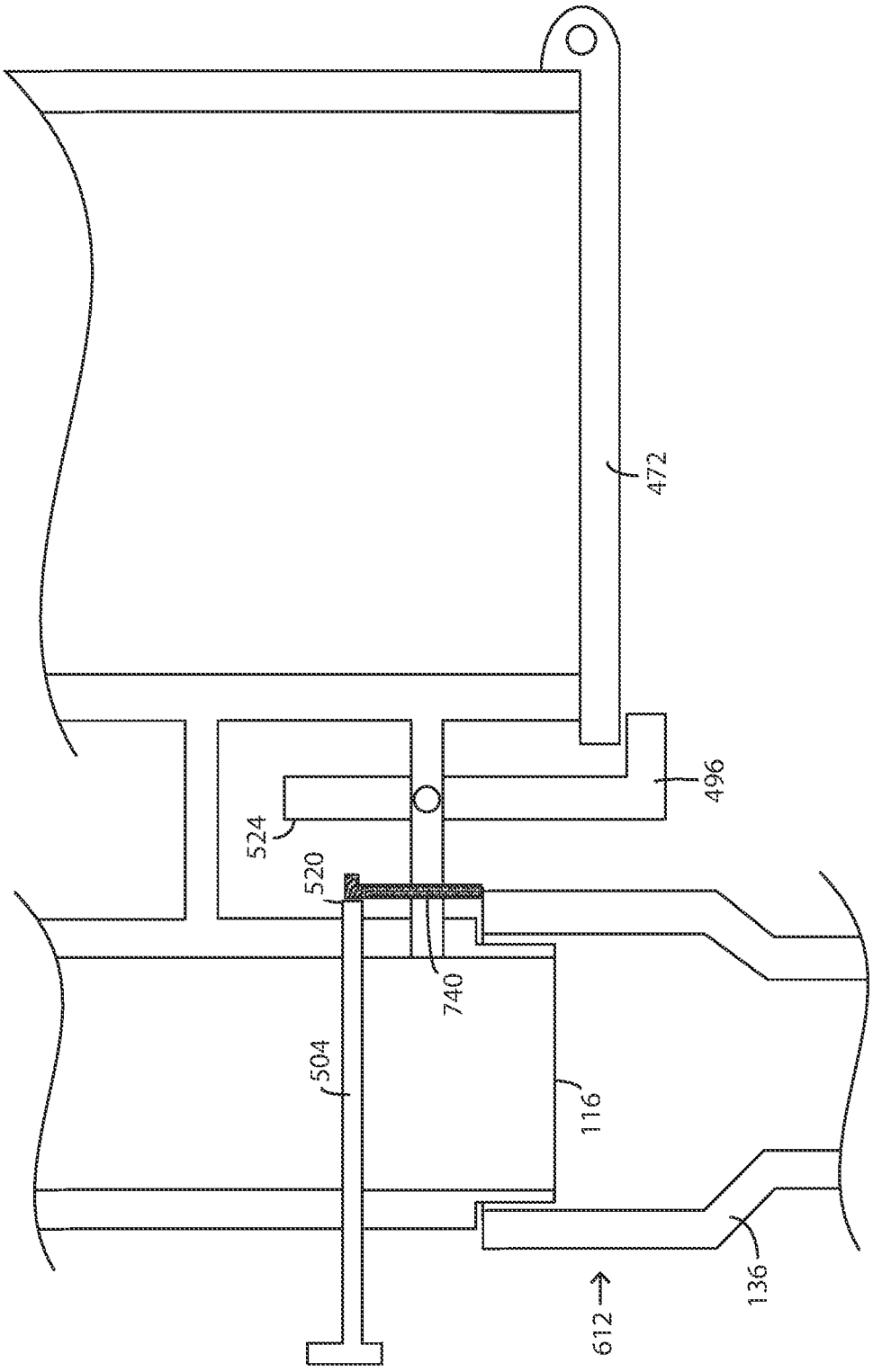


Fig. 35

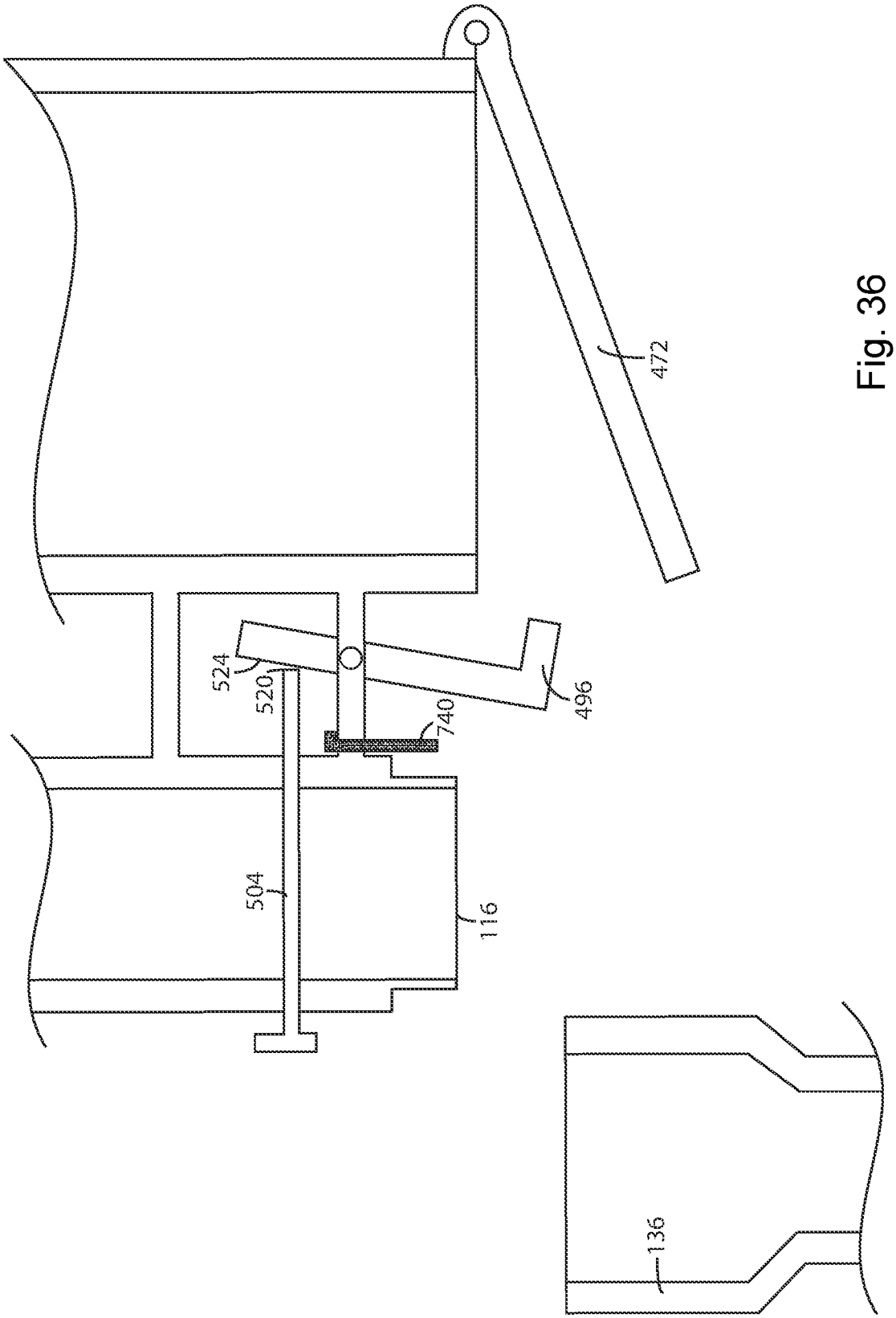


Fig. 36

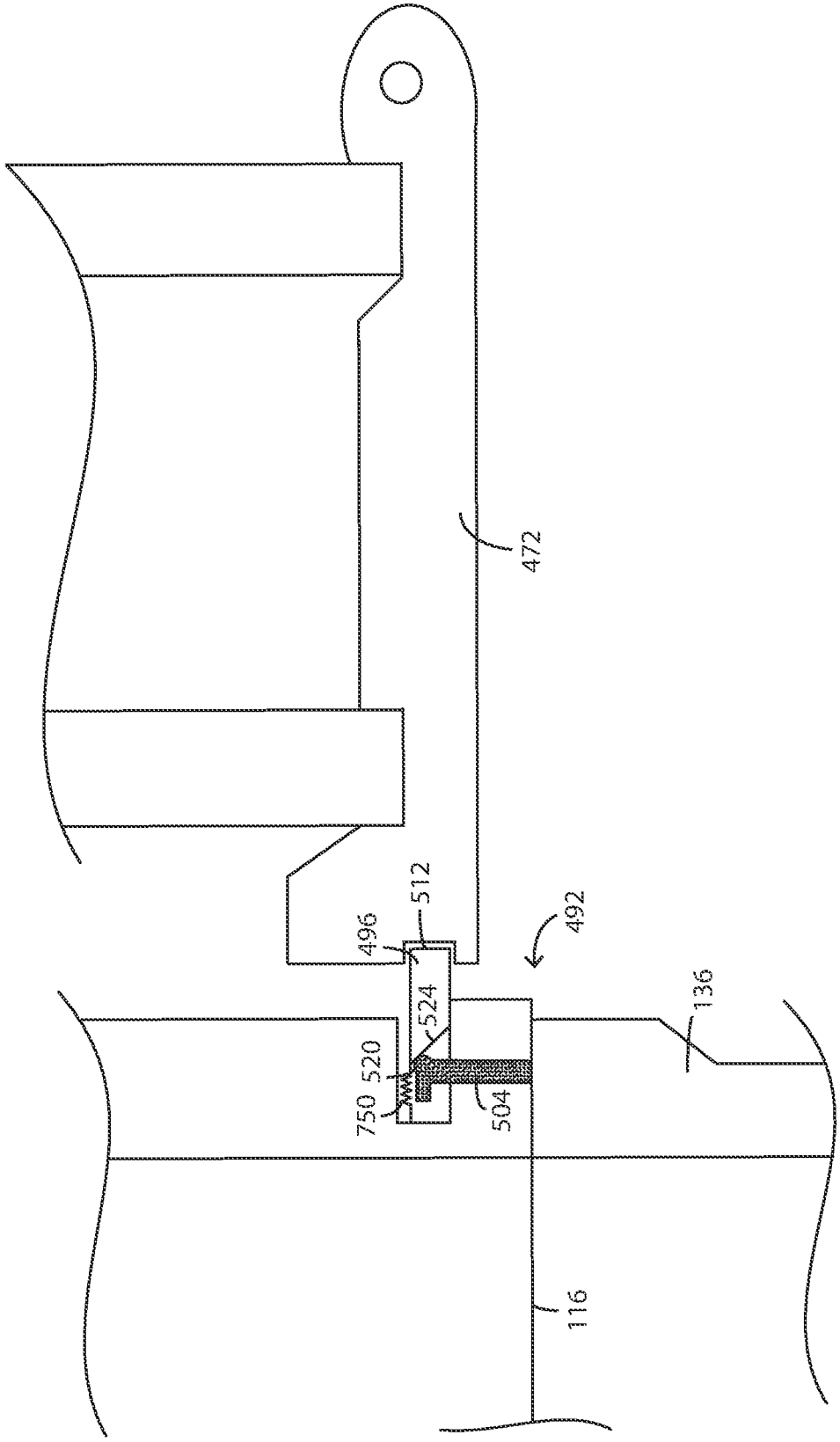


Fig. 37

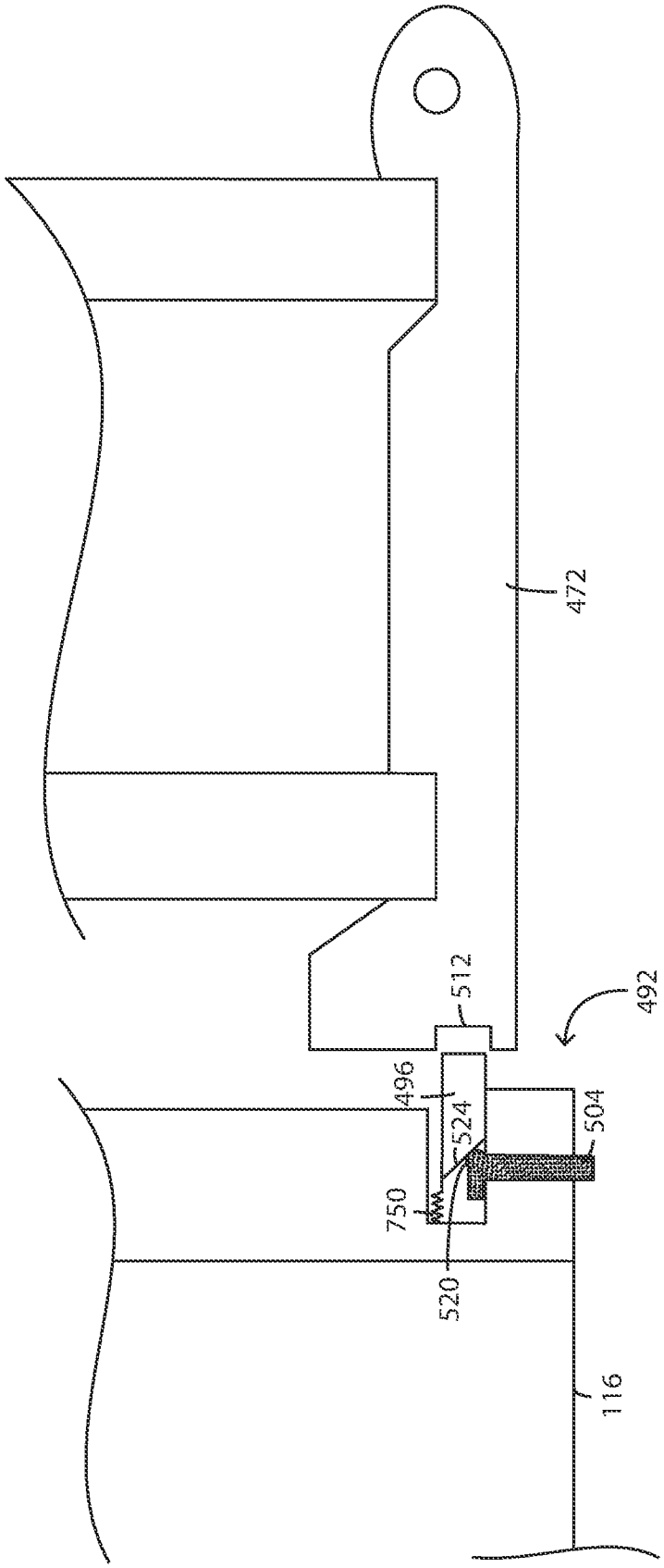


Fig. 38

SURFACE CLEANING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation in part of co-pending U.S. patent application Ser. No. 15/095,714, which was filed Apr. 11, 2016 and is incorporated herein in its entirety by reference.

FIELD

The specification relates to surface cleaning apparatus. In a preferred embodiment, the surface cleaning apparatus comprises a portable surface cleaning apparatus, such as a hand vacuum cleaner or a pod.

INTRODUCTION

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

Various types of surface cleaning apparatus are known. Surface cleaning apparatus include vacuum cleaners. Currently, a vacuum cleaner typically uses at least one cyclonic cleaning stage. More recently, cyclonic hand vacuum cleaners have been developed. See for example, U.S. Pat. No. 7,931,716 and US 2010/0229328. Each of these discloses a hand vacuum cleaner which includes a cyclonic cleaning stage. U.S. Pat. No. 7,931,716 discloses a cyclonic cleaning stage utilizing two cyclonic cleaning stages wherein both cyclonic stages have cyclone axis of rotation that extends vertically. US 2010/0229328 discloses a cyclonic hand vacuum cleaner wherein the cyclone axis of rotation extends horizontally and is coaxial with the suction motor. In addition, hand carriable cyclonic vacuum cleaners are also known (see U.S. Pat. Nos. 8,146,201 and 8,549,703).

SUMMARY

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

In accordance with one aspect of this disclosure, a hand vacuum cleaner has a uniflow cyclone with a front cyclone air inlet and a rear air cyclone outlet. Accordingly, the cyclone axis extends rearwardly from the front end of the cyclone. The cyclone air inlet may be in an upper portion of the cyclone and may be in an upper portion of the sidewall (e.g., most and preferably essentially all of the inlet opening may be in the sidewall of the cyclone above the axis of rotation of the cyclone). The dirt collection area may be a dirt collection chamber that is external to the cyclone chamber and may be provided below the cyclone chamber. The dirt outlet of the cyclone chamber may be provided in a lower portion of the sidewall of the cyclone near or at the rear end of the cyclone.

In accordance with this aspect, there is provided a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end having a dirty air inlet, 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; and,

(b) a cyclone unit comprising a cyclone having a cyclone axis of rotation, a front end having a cyclone air inlet and a longitudinally spaced apart rear end having a cyclone air outlet, wherein the cyclone air inlet is in an upper portion of the cyclone;

wherein when the hand vacuum cleaner is oriented with the cyclone underneath the upper end, the cyclone axis of rotation is generally horizontal.

In some embodiments, when the hand vacuum cleaner is positioned with the bottom on a horizontal surface, the cyclone axis of rotation may be generally horizontal.

In some embodiments, when the hand vacuum cleaner is oriented with the cyclone underneath the upper end, the suction motor axis of rotation may be generally horizontal.

In some embodiments, when the hand vacuum cleaner is oriented with the cyclone underneath the upper end, the suction motor axis of rotation may be positioned below the cyclone axis of rotation.

In some embodiments, the cyclone has a sidewall having an upper portion and a lower portion and a dirt outlet may be provided in the lower portion and is in communication with a dirt collection chamber that is exterior to the cyclone. Optionally, the cyclone air inlet may be provided in the upper portion of the sidewall of the cyclone.

In some embodiments, the cyclone axis of rotation may be generally parallel to the suction motor axis of rotation.

In some embodiments, the main body may be provided with a handle.

In some embodiments, the hand vacuum cleaner further comprises a handle having a hand grip portion that may extend upwardly and forwardly when the hand vacuum cleaner is oriented with the cyclone underneath the upper end.

In some embodiments, the lower end of the main body may comprise the bottom.

In some embodiments, the cyclone unit may be provided on the front end of the main body. Alternately, or in addition, the cyclone unit may be removably mounted to the main body.

In some embodiments, the dirty air inlet may be provided on a front end of the cyclone unit.

In some embodiments, the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end and an outlet end and has a longitudinal passage axis, the outlet end of the inlet passage communicates with the cyclone air inlet and the inlet passage axis may be positioned between an upper and a lower end of a handle of the hand vacuum cleaner.

In some embodiments, the handle may comprise a hand grip portion that extends upwardly and forwardly when the hand vacuum cleaner is oriented with the cyclone underneath the upper end. In some of these embodiments, the suction motor axis of rotation may be positioned below the cyclone axis of rotation when the hand vacuum cleaner is oriented with the cyclone underneath the upper end.

In some embodiments, the inlet passage may have a longitudinal passage axis that is linear and all of the longitudinal passage may be positioned above the cyclone axis of rotation when the hand vacuum cleaner is oriented with the cyclone underneath the upper end.

In accordance with this aspect, there is also provided a surface cleaning apparatus comprising the hand vacuum cleaner discussed herein, a surface cleaning head and a rigid air flow conduit extending between the surface cleaning head and the hand vacuum cleaner wherein an outlet end of

the rigid air flow conduit is removable connectable in air flow communication with the inlet passage.

In accordance with this aspect, there is also provided a hand vacuum cleaner having a front end, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) 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; and,

(b) an air treatment member having a front end having an air treatment member air inlet and a longitudinally rearwardly spaced apart rear end having an air treatment member air outlet, wherein the air treatment member air inlet is in a longitudinally extending sidewall of the air treatment member; and,

(c) a dirty air inlet comprising an inlet passage that extends longitudinally between an inlet end and an outlet end and has a longitudinal passage axis, the outlet end of the inlet passage communicates with the air treatment member air inlet.

In some embodiments, air travels through the air treatment member air outlet in a flow direction and the flow direction may be generally parallel to the suction motor axis of rotation.

In accordance with another aspect of this disclosure, a hand vacuum cleaner has an air treatment member with an air flow conduit or passage wherein the conduit is also a handle of the air treatment member.

In accordance with this aspect, there is provided a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation;

(b) an air treatment member comprising an air treatment member handle, a dirt collection region having an openable door and an openable door lock comprising a door release actuator wherein the door is moveable to an open position when the door release actuator is actuated; and,

(c) an air inlet comprises an inlet passage that extends longitudinally between an inlet end and an outlet end and has a longitudinal passage axis and the inlet passage comprises the air treatment member handle.

In some embodiments, the driving handle may comprise a portion spaced from the main body whereby a finger receiving area is provided between the driving handle and the main body.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the air treatment member handle may comprise a portion spaced from the air treatment member whereby a finger receiving area is provided between the air treatment member handle and the air treatment member.

The In some embodiments, the air treatment member handle may be provided above the air treatment member.

In some embodiments, the openable door may be provided at the front end of the hand vacuum cleaner.

In some embodiments, the openable door may have a lower end that is moveably mounted to the air treatment member and an upper end that may be engaged by the door lock.

In some embodiments, the door release actuator may be positioned proximate the air treatment member handle.

In some embodiments, the inlet passage may extend generally rearwardly.

In some embodiments, the door release actuator may be positioned at a forward end of the inlet passage.

In accordance with this aspect, there is also provided a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,

(b) a cyclone unit comprising a cyclone having a cyclone axis of rotation, a cyclone unit handle, a dirt collection region having an openable door and an openable door lock comprising a door release actuator wherein the door is moveable to an open position when the actuator is actuated;

wherein when a user's hand is holding the cyclone unit by the cyclone unit handle, the door release actuator is operable by the same hand.

In some embodiments, the driving handle may comprise a portion spaced from the main body whereby a finger receiving area is provided between the driving handle and the main body.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the cyclone unit handle may comprise a portion spaced from the cyclone unit whereby a finger receiving area is provided between the cyclone unit handle and the cyclone unit.

In some embodiments, the cyclone unit handle may be provided above the cyclone unit.

In some embodiments, the openable door may be provided at the front end of the hand vacuum cleaner.

In some embodiments, the air inlet may comprise an inlet passage that extends longitudinally between an inlet end and an outlet end and the inlet passage comprises the cyclone unit handle.

In some embodiments, when the hand vacuum cleaner is positioned with the bottom on a horizontal surface, the cyclone axis of rotation may be generally horizontal.

In accordance with another aspect of this disclosure, the air treatment member, e.g., a cyclone unit, may be removably mounted to the rest of the hand vacuum cleaner. The air treatment member may include a dirty air inlet that is connectable to an upper end of a longitudinally extending rigid member (e.g., which may be hollow to enable airflow therethrough) and a surface cleaning head may be provided (preferably removably connected) to a lower end of the longitudinally extending rigid member. When assembled as an upright or stick vacuum cleaner with the hand vacuum cleaner drivingly connected to the surface cleaning head by the longitudinally extending rigid member (e.g., a rigid wand), the handle of the hand vacuum cleaner may be used to steer the surface cleaning head. An advantage of this configuration is that the hand vacuum cleaner may be easily converted to an upright or stick vacuum cleaner.

In such a configuration, lateral stresses (i.e., stresses transverse to the longitudinal forward/rearward axis of the

hand vacuum cleaner) may occur as the handle of the hand vacuum cleaner is used to steer the surface cleaning head. In order to assist in stabilizing the joint of the air treatment member and the rest of the hand vacuum cleaner, lateral stability members may be provided at the interface of the air treatment member and the rest of the hand vacuum cleaner. For example, one or more pairs of inter-engagement members may be provided which extend in a direction that extends generally between the lower end and the upper end of the hand vacuum cleaner. These lateral stability members may extend continuously or they may have discontinuities and they may extend linearly or otherwise. As the lateral stresses are exerted in a direction that is at an angle between 0-90°, 25-90°, 45-90° or 70-90° to the lateral stability members, and may be generally perpendicular (90°) thereto, the lateral stability members will strengthen the joint of the air treatment member and the rest of the hand vacuum cleaner. Preferably, at least one pair is provided on either lateral side of a center line extending in the longitudinal forward/rearward direction of the hand vacuum cleaner. The lateral stability members may be any members that have sides that abut to resist the lateral stresses and may comprise a longitudinally extending protrusion or spline and a mating groove or abutting longitudinally extending protrusions or splines.

In accordance with this aspect, there is provided a surface cleaning apparatus comprising:

(a) a hand vacuum cleaner having a front end having a dirty air inlet, a longitudinally spaced apart rear end, a clean air outlet, an upper end and a bottom, 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;
  (ii) an air treatment member removably mounted at the front end of the main body, the air treatment member comprising an upper end, a lower end, a front end and a rear end, the lower end of the air treatment member is rotationally mounted to the lower end of the main body; and,
  (III) an air treatment member release lock comprising a release actuator and first and second engagement members wherein the first engagement member is provided on the upper end of the air treatment member and the second engagement member is provided on the upper end of the main body and the release actuator is provided on one of the air treatment member and the main body,
(b) a surface cleaning head; and,
(c) a rigid air flow conduit extending between the surface cleaning head and the hand vacuum cleaner wherein an outlet end of the rigid air flow conduit is removably connectable in air flow communication with the inlet passage.

In some embodiments, the lower end of one of the air treatment member and the main body may be provided with a transversely extending rod and the lower end of the other of the air treatment member and the main body may be provided with a hook removably connectable with the rod.

In some embodiments, the lower end of the air treatment member may be rotationally mounted to the lower end of the main body at a position longitudinally spaced from the first and second engagement members.

In some embodiments, the lower end of the air treatment member may be rotationally mounted to the lower end of the main body at a position longitudinally spaced from a position at which the upper end of the air treatment member abuts the upper end of the main body.

In some embodiments, one of the air treatment member and the main body may be provided with an outwardly extending protrusion and the other of the air treatment member and the main body may be provided with a groove in which the outwardly extending protrusion is received when the air treatment member is secured to the main body.

In some embodiments, the main body may have a driving handle and the dirty air inlet is part of the air treatment member.

In some embodiments, the air treatment member may comprise a cyclone unit and the driving handle may be provided at the rear end of the main body and the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end provided at a front end of the cyclone unit and an outlet end, and the inlet end may be adapted to receive an accessory cleaning tool. The accessory cleaning tool may comprise a rigid air flow conduit.

In some embodiments, the air treatment member may comprise a cyclone unit and the driving handle may be provided at the rear end of the main body and the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end provided at a front end of the cyclone unit and an outlet end, and the inlet end may be positioned forward of the cyclone unit.

In some embodiments, dirty air inlet may be provided above the air treatment member.

In some embodiments, the air treatment member may comprise a dirt collection region having an openable door and the openable door may be provided at the front end of the air treatment member.

In some embodiments, when the hand vacuum cleaner is oriented with the air treatment member below the upper end, the cyclone axis of rotation may be generally horizontal.

In accordance with this aspect, there is also provided a hand vacuum cleaner having a front end having a dirty air inlet, a longitudinally spaced apart rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) 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;
(b) a cyclone unit removably mounted at the front end of the main body, the cyclone unit comprising an upper end, a lower end, a front end, a rear end and a cyclone axis of rotation, the lower end of the cyclone unit is rotationally mounted to the lower end of the main body; and,
(c) a cyclone unit release lock comprising a release actuator and first and second engagement members wherein the first engagement member is provided on the upper end of the cyclone unit and the second engagement member is provided on the upper end of the main body and the release actuator is provided on one of the cyclone unit and the main body.

In some embodiments, the lower end of one of the cyclone unit and the main body may be provided with a transversely extending rod and the lower end of the other of the cyclone unit and the main body may be provided with a hook removably connectable with the rod.

In some embodiments, the lower end of the cyclone unit may be rotationally mounted to the lower end of the main body at a position longitudinally spaced from the first and second engagement members.

In some embodiments, the lower end of the cyclone unit may be rotationally mounted to the lower end of the main body at a position longitudinally spaced from a position at which the upper end of the cyclone unit abuts the upper end of the main body.

In some embodiments, one of the cyclone unit and the main body may be provided with an outwardly extending protrusion and the other of the cyclone unit and the main body is provided with a groove in which the outwardly extending protrusion is received when the cyclone unit is secured to the main body.

In some embodiments, the main body may have a driving handle and the dirty air inlet is part of the cyclone unit.

In some embodiments, the driving handle may be provided at the rear end of the main body and the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end provided at a front end of the cyclone unit and an outlet end, and the inlet end may be adapted to receive an accessory cleaning tool. The accessory cleaning tool may comprise a rigid air flow conduit.

In some embodiments, the driving handle may be provided at the rear end of the main body and the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end provided at a front end of the cyclone unit and an outlet end, and the inlet end may be positioned forward of the cyclone unit.

In some embodiments, the dirty air inlet may be provided above the cyclone unit.

In some embodiments, the cyclone unit may comprise a dirt collection region having an openable door and the openable door may be provided at the front end of the cyclone unit.

In some embodiments, when the hand vacuum cleaner is oriented with the cyclone below the upper end, the cyclone axis of rotation may be generally horizontal.

In accordance with another aspect of this disclosure an air treatment member includes an air flow passage which functions as a handle of the air treatment member. An advantage of this design is that the air treatment member may be provided with a handle that is not an additional part. The air flow passage may be part of the air flow path from a dirty air inlet to the air treatment member air inlet. Alternately or in addition, the air flow passage may be part of an air flow path for a bleed stream and a bleed valve may be provided in the air flow passage.

In accordance with this aspect of the disclosure, there is provided a hand vacuum cleaner having a front end, a rear end, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,

(b) an air treatment member, the air treatment member comprising an air treatment member axis and an air treatment member handle wherein the air treatment member handle comprises an air flow passage.

In some embodiments, the air flow passage may comprise an inlet passage of the air treatment member.

In some embodiments, the inlet passage may extend longitudinally between a dirty air inlet end and an outlet end.

In some embodiments, the air treatment member handle may comprise a portion spaced from the air treatment member whereby a finger receiving area is provided between the air treatment member handle and the air treatment member.

In some embodiments, the air treatment member handle may be provided above the air treatment member.

In some embodiments, the passage may extend generally axially in the direction of the air treatment member axis.

In some embodiments, the driving handle may comprise a portion spaced from the main body whereby a finger receiving area is provided between the driving handle and the main body.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the air treatment member may be removable from the main body and the air treatment member handle may be removable with the air treatment member.

In some embodiments, a bleed valve may be positioned in the air treatment member handle.

In accordance with this aspect, there is also provided a hand vacuum cleaner having a front end, a rear end, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation; and,

(b) a cyclone unit, the cyclone unit comprising a cyclone having a cyclone axis of rotation, a cyclone unit handle, wherein the cyclone unit handle comprises an air flow passage.

In some embodiments, the cyclone unit handle may comprise an inlet passage of the cyclone unit.

In some embodiments, the inlet passage may extend longitudinally between a dirty air inlet end and an outlet end.

In some embodiments, the cyclone unit handle may comprise a portion spaced from the cyclone unit whereby a finger receiving area is provided between the cyclone unit handle and the cyclone unit.

In some embodiments, the cyclone unit handle may be provided above the cyclone unit.

In some embodiments, the passage may extend generally parallel to the cyclone axis.

In some embodiments, the driving handle may comprise a portion spaced from the main body whereby a finger receiving area is provided between the driving handle and the main body.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the cyclone unit may be removable from the main body and the cyclone unit handle may be removable with the cyclone unit.

In some embodiments, when the hand vacuum cleaner is oriented with the upper end positioned above the lower end, the cyclone axis of rotation may be generally horizontal.

In some embodiments, a bleed valve may be positioned in the cyclone unit handle.

In accordance with another aspect of this disclosure, a surface cleaning apparatus is electrically connectable with an accessory cleaning tool (e.g., a rigid air flow conduit, a crevice tool, a brush or the like) and a circuit electrically connecting the accessory tool with a source or power provided for the surface cleaning apparatus (e.g., AC power from a wall outlet or an on board energy storage member such as one or more batteries) is moved from a circuit open position to a circuit closed position when the accessory tool is mounted in air flow communication with the surface cleaning apparatus. An advantage of this design is that the terminal ends of the electrical outlet of the surface cleaning apparatus are de-energized when they are exposed. In one embodiment, an electrical conductor element of the acces-

sory cleaning tool drives an electrical conductor element of the surface cleaning apparatus to a circuit closed position when the accessory tool is mounted in air flow communication with the surface cleaning apparatus. Accordingly, one or more of the electrical conductor elements of the surface cleaning apparatus may be biased to a circuit open position and may be moveable (e.g., linearly moveable, by contact with the electrical conductor element of the accessory tool). In alternate embodiments, the driving member provided on the accessory cleaning tool may be a non-conductive (e.g., plastic) engagement member (e.g., finger), that engages a member (e.g., a slideable tab of a housing of the electrical conductor elements of the surface cleaning apparatus) to move the electrical conductor elements of the surface cleaning apparatus to a circuit closed position.

In accordance with this aspect, there is provided a surface cleaning apparatus comprising:

(a) an air flow passage extending between a dirty air inlet and a clean air outlet;

(b) a main body housing a suction motor and fan assembly that is positioned in the air flow passage;

(c) an air treatment member positioned in the air flow passage;

(d) an electrical outlet electrically connectable with an accessory cleaning tool; and,

(e) a circuit extending between a source of power and the electrical outlet, the circuit comprising first and second electrical conductor elements, at least the first electrical conductor element is biased to a circuit open position wherein the first electrical conductor element is moved to a circuit closed position when an accessory cleaning tool is connected to the dirty air inlet.

In some embodiments, the first and second electrical conductor elements may engage electrical conductors of the accessory tool whereby the first and second electrical conductor elements are electrically connectable with the accessory cleaning tool and at least the first electrical connector conductor may be biased to a circuit open position.

In some embodiments, the first and second electrical conductor elements may comprise first and second electrical connector conductors, each of the electrical conductor elements may have an accessory tool contact end and a terminal end contact end, at least the first electrical connector conductor may be biased to a circuit open position and at least one of the accessory tool contact ends may be recessed in the electrical outlet when in the circuit open position.

In some embodiments, the circuit may comprise electrical conductive members, each of which extends from the source of power to a terminal end, at least the first electrical conductor element may be moveably mounted from a position in which it contacts one of the terminal ends to a position in which it is spaced from the terminal end.

In some embodiments, each of the electrical conductor elements may be moveably mounted from a position in which each of the electrical conductor elements contacts one of the terminal ends to a position in which the electrical conductor elements contacts are spaced from the terminal ends.

In some embodiments, the circuit may comprise electrical conductive members, each of which may extend from the source of power to a terminal end, the first and second electrical conductor elements may comprise first and second electrical connector conductors, each of the electrical conductor elements may have an accessory tool contact end and a terminal end contact end, at least the first electrical conductor element may be moveably mounted from a position in which it contacts one of the terminal ends to a position in which it is spaced from the terminal end.

In some embodiments, surface cleaning apparatus may further comprise a compression spring positioned between the first electrical conductor element and one of the terminal ends.

In some embodiments, the compression spring may be non-conductive.

The In some embodiments, the source of power may comprise a power cord.

In some embodiments, the circuit further may comprise a main power switch.

In some embodiments, the accessory cleaning tool may comprise a rigid air flow conduit.

In some embodiments, the surface cleaning apparatus may comprise a hand vacuum cleaner and the electrical outlet is provided adjacent the dirty air inlet.

In accordance with this aspect, there is also provided a surface cleaning apparatus comprising

(a) a suction motor and fan assembly operable on a source of power;

(b) an electrical outlet housing having first and second electrical conductor elements, each of the electrical conductor elements has a first contact end and a second contact end; and,

(c) a circuit including the electrical conductor elements and a main power switch operable between a circuit closed position and a circuit open position, at least the first electrical conductor element is moveable between a circuit closed position and a circuit open position and is biased to the circuit open position wherein the first electrical conductor element is moved to a circuit closed position upon mechanical engagement of a part having an air flow conduit with the electrical outlet housing.

In some embodiments, the circuit may comprise electrical conductive members, each of which may extend from the source of power to a terminal end, at least the first electrical conductor element may be moveably mounted from a position in which it contacts one of the terminal ends to a position in which it is spaced from the terminal end.

In some embodiments, each of the electrical conductor elements may be moveably mounted from a position in which each of the electrical conductor elements contacts one of the terminal ends to a position in which the electrical conductor elements contacts are spaced from the terminal ends.

In some embodiments, the surface cleaning apparatus may further comprise a compression spring positioned between the first electrical conductor element and the one of the terminal ends.

In some embodiments, the compression spring may be non-conductive.

In some embodiments, the source of power may comprise a power cord.

In some embodiments, the first electrical conductor element may be longitudinally moveable in the electrical outlet housing

In some embodiments, the surface cleaning apparatus may comprise a hand vacuum cleaner and the electrical outlet housing is provided adjacent a dirty air inlet.

In accordance with another aspect of this disclosure, a hand vacuum cleaner is provided with a front openable door of a dirt collection area and the hand vacuum cleaner has a handle that extends upwardly and forwardly when the hand vacuum cleaner is oriented with the upper end above the lower end (e.g., when the hand vacuum cleaner is seated on

a horizontal surface). An advantage of this design is that the handle is oriented to permit the user to point the hand vacuum cleaner downwardly to empty the dirt collection area when the door is opened.

In accordance with this aspect, there is provided a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation wherein the driving handle has a hand grip portion that extends upwardly and forwardly when the hand vacuum cleaner is oriented with the upper end above the lower end; and,

(b) an air treatment member comprising a dirt collection region having an openable door provided on a front end of the air treatment member and an openable door lock comprising a door release actuator wherein the door is moveable to an open position when the door release actuator is actuated.

In some embodiments, the hand grip portion may be spaced from the main body whereby a finger receiving area is provided between the hand grip portion and the main body.

In some embodiments, at least a portion of the finger receiving area may be positioned linearly rearwardly from the air treatment member.

In some embodiments, the main body may comprise a suction motor housing and the driving handle has an end that may extend from the suction motor housing.

In some embodiments, the main body may comprise a suction motor housing and the driving handle may have an end that extends upwardly and forwardly from the suction motor housing.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the inlet passage may extend generally rearwardly.

In some embodiments, the inlet passage may be positioned above the openable door.

In some embodiments, the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end and an outlet end and has a longitudinal passage axis and the longitudinal passage axis intersects the driving handle.

In some embodiments, the air treatment member may have a front end having an air treatment member air inlet and a longitudinally rearwardly spaced apart rear end having an air treatment member air outlet.

In some embodiments, the inlet passage may be positioned above the openable door.

In accordance with this aspect, there is also provided a hand vacuum cleaner having a front end having a dirty air inlet, a rear end, a clean air outlet, an upper end and a bottom, the hand vacuum cleaner comprising:

(a) a main body comprising an upper end, a lower end, a front end, a rear end and a driving handle, the main body housing a suction motor and fan assembly, the suction motor and fan assembly having a suction motor axis of rotation wherein the driving handle has a hand grip portion that extends upwardly and forwardly when the hand vacuum cleaner is oriented with the upper end above the lower end; and,

(b) a cyclone unit comprising a cyclone having a cyclone axis of rotation, a dirt collection region having an openable door provided on a front end of the cyclone unit and an openable door lock comprising a door release actuator wherein the door is moveable to an open position when the actuator is actuated.

In some embodiments, the hand grip portion may be spaced from the main body whereby a finger receiving area is provided between the hand grip portion and the main body.

In some embodiments, at least a portion of the finger receiving area may be positioned linearly rearwardly from the cyclone unit.

In some embodiments, the main body may comprise a suction motor housing and the driving handle has an end that extends from the suction motor housing.

In some embodiments, the main body may comprise a suction motor housing and the driving handle has an end that extends upwardly and forwardly from the suction motor housing.

In some embodiments, the driving handle may be provided at the rear end of the main body.

In some embodiments, the inlet passage may extend generally rearwardly.

In some embodiments, the inlet passage may be positioned above the openable door.

In some embodiments, the dirty air inlet may comprise an inlet passage that extends longitudinally between an inlet end and an outlet end and has a longitudinal passage axis and the longitudinal passage axis intersects the driving handle.

In some embodiments, the inlet passage may be positioned above the openable door.

In some embodiments, when the hand vacuum cleaner may be oriented with the upper end above the lower end, the cyclone axis of rotation is generally horizontal.

In accordance with another aspect of this disclosure, a surface cleaning apparatus has an air treatment member that includes a dirt collection region having an openable door. The openable door provides access to empty and/or clean the air treatment member. For example, if the air treatment member is a cyclone assembly which comprises a cyclone chamber and a dirt collection chamber exterior to the cyclone chamber, the door may provide access to the cyclone chamber and/or the dirt collection chamber. When an accessory (e.g. a wand, crevice tool, or brush) is connected to the dirty air inlet of the surface cleaning apparatus, the openable door is inhibited from opening. An advantage of this design is that the presence of a connected accessory may inhibit or prevent a user from inadvertently opening the dirt collection region of the air treatment member if, e.g., the door open actuator is located on or proximate to a handle of the surface cleaning apparatus.

For example, it may be unlikely that a user would try and empty the dirt collection region when an accessory tool is connected. Accordingly, if a user tries to actuate a release actuator for the openable door when an accessory is connected, it may be desirable to inhibit the door from opening, as the presence of the connected accessory may indicate that the user may not have intended to actuate a door release actuator, and may have instead intended to actuate a different actuator, button, or mechanism of the surface cleaning apparatus.

Also, the presence of a connected accessory may indicate that it is more likely that the surface cleaning apparatus is being used to clean a surface, as the accessory may typically be disconnected after a surface cleaning operation has been performed. Accordingly, it may be desirable to inhibit or prevent opening of the dirt collection region when an accessory is connected, in the event that a user inadvertently

bumps a door release actuator against furniture or another object when manipulating the surface cleaning apparatus with a connected accessory.

In accordance with this aspect, there is provided a surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door; and,

(c) an accessory removably connectable to the dirty air inlet wherein, when the accessory is connected to the dirty air inlet, the openable door is inhibited from opening.

In some embodiments, the surface cleaning apparatus may further comprise a front end having the dirty air inlet and the openable door may be provided on the front end.

In some embodiments, the accessory may be removably mounted to the dirty air inlet.

In some embodiments, when the accessory is connected to the dirty air inlet, the accessory may physically inhibit the openable door from opening.

In some embodiments, when the accessory is connected to the dirty air inlet, the accessory may overlie a portion of the openable door.

In some embodiments, when the accessory is connected to the dirty air inlet, the accessory may abut a portion of the openable door.

In some embodiments, the openable door may have first and second opposed sides, the first side having a hinge for the openable door and, when the accessory is connected to the dirty air inlet, the accessory may interact with the second opposed side thereby inhibiting the openable door from opening.

In some embodiments, the surface cleaning apparatus may further comprise an openable door lock comprising a lock engaging member and a door release actuator drivingly connected to the lock engaging member, the lock engaging member may be moveable between an engaged position in which the lock engaging member secures the openable door in a closed position and a disengaged position in which the openable door is openable wherein the lock engaging member is inhibited from moving to the disengaged position when the accessory is connected to the dirty air inlet.

In some embodiments, the accessory may have a blocking portion that inhibits the lock engaging member moving to the disengaged position when the accessory is connected to the dirty air inlet.

In some embodiments, the openable door lock may include a moveable portion that moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion having an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

In some embodiments, the moveable portion may be part of a drive member drivingly connecting the door release actuator to the lock engaging member.

In some embodiments, the surface cleaning apparatus may further comprise a lock deactivation member and the accessory may have a blocking portion that activates the lock deactivation member when the accessory is connected to the dirty air inlet.

In some embodiments, the lock deactivation member may include a moveable portion that moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion having an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

In some embodiments, the surface cleaning apparatus may further comprise an openable door lock wherein the openable door may be moveable to an open position when the openable door lock is moved to an open position and wherein the openable door lock may be inhibited from moving to the open position when the accessory is connected to the dirty air inlet.

In some embodiments, the accessory may be a longitudinally extending rigid member air flow member, an accessory cleaning tool, or a flexible hose.

Also in accordance with this broad aspect, there is also provided a surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable in air flow communication with the dirty air inlet; and,

(d) an openable door lock comprising a lock engaging member and a door release actuator drivingly connected to the lock engaging member, the lock engaging member is moveable between an engaged position in which the lock engaging member secures the openable door in a closed position and a disengaged position in which the openable door is openable wherein the lock engaging member is inhibited from moving to the disengaged position when the accessory is connected in air flow communication with the dirty air inlet.

In some embodiments, the accessory may have a blocking portion that inhibits the lock engaging member moving to the disengaged position when the accessory is connected to the dirty air inlet.

In some embodiments, the openable door lock may include a moveable portion that moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion having an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

In some embodiments, the moveable portion may be part of a drive member drivingly connecting the door release actuator to the lock engaging member.

Also in accordance with this broad aspect, there is also provided a surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable in air flow communication with the dirty air inlet; and,

(d) a lock deactivation member and the accessory has a blocking portion which activates the lock deactivation member when the accessory is connected in air flow communication with the dirty air inlet.

In some embodiments, the lock deactivation member may include a moveable portion that moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion having an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

Also in accordance with this broad aspect, there is also provided a surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable in air flow communication with the dirty air inlet wherein, when the accessory is connected to the dirty air inlet, the accessory physically inhibits the openable door from opening.

In some embodiments, when the accessory is connected in air flow communication with the dirty air inlet, the accessory may overlie a portion of the openable door.

In some embodiments, when the accessory is connected in air flow communication with the dirty air inlet, the accessory may abut a portion of the openable door.

In some embodiments, the openable door may have first and second opposed sides, the first side having a hinge for the openable door and, when the accessory is connected in air flow communication with the dirty air inlet, the accessory may interact with the second opposed side thereby inhibiting the door from opening.

It will be appreciated that the aspects and embodiments may be used in any combination or sub-combination.

DRAWINGS

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

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

FIG. **2** is a rear perspective view of the surface cleaning apparatus of FIG. **1**;

FIG. **3** is a top perspective view of the surface cleaning apparatus of FIG. **1**;

FIG. **4** is a bottom perspective view of the surface cleaning apparatus of FIG. **1**;

FIG. **5** is a perspective view of the surface cleaning apparatus of FIG. **1** mounted to a wand and surface cleaning head in a stickvac configuration;

FIG. **5**A is a cross-sectional view taken along line **5**A-**5**A in FIG. **5**, showing an accessory connected to the surface cleaning apparatus inhibiting an openable door of an air treatment member from opening;

FIG. **6** is a cross-sectional view taken along line **6-6** in FIG. **1**, showing an air flow path;

FIG. **7** is a front perspective view of the surface cleaning apparatus of FIG. **1**, with a cyclone unit partially cutaway;

FIG. **8** is a front perspective view of the surface cleaning apparatus of FIG. **1** with the cyclone unit separated from a main body and a pre-motor filter chamber in an open position;

FIG. **8**A is the front perspective view of FIG. **8** with a pre-motor filter in the pre-motor filter chamber;

FIG. **9** is a side elevation view of the surface cleaning apparatus of FIG. **1** with the cyclone unit separated from the main body;

FIG. **10** is a rear perspective view of the surface cleaning apparatus of FIG. **1** with the cyclone unit separated from the main body;

FIG. **10**A is the rear perspective view of FIG. **10** showing the cyclone unit being held by the cyclone unit handle;

FIG. **11** is a front perspective view of the surface cleaning apparatus of FIG. **1** with the cyclone unit separated from the main body;

FIG. **12** is a cross-sectional view taken along line **6-6** in FIG. **1**, with an enlargement of a first connector pair in a locked position;

FIG. **13** is the cross-sectional view of FIG. **12**, with the first connector pair in an unlocked position;

FIG. **14** is the rear perspective view of FIG. **10**, with the first connector pair exploded;

FIG. **15** is a partial cross-sectional view taken along line **6-6** in FIG. **1**, showing an alternative first connector pair in a locked position;

FIG. **16** is the partial cross-sectional view of FIG. **15** showing the alternative first connector pair in an unlocked position;

FIG. **17** is a cross-sectional view taken along line **6-6** in FIG. **1**, showing an airflow path through a bleed valve;

FIG. **18** is a front perspective view of the surface cleaning apparatus of FIG. **1**, with a front cyclone unit wall in an open position;

FIG. **19** is the front perspective view of FIG. **1**, with an exploded cyclone unit lock and lock actuator;

FIG. **20** is the front perspective view of FIG. **1**, with an enlarged and partially cutaway cyclone unit lock in an engaged position;

FIG. **21** is the front perspective view of FIG. **20**, with the cyclone unit lock in a disengaged position;

FIG. **22** is a cross-sectional perspective view taken along line **6-6** in FIG. **1**,

FIG. **23** is a bottom perspective view of a surface cleaning apparatus with a counterweight stand, in accordance with at least one embodiment;

FIG. **24** is a side-elevation view of the surface cleaning apparatus of FIG. **1** supported on a horizontal surface;

FIG. **25** is the front perspective view of FIG. **20**, with an exploded electrical coupling;

FIG. **26** is a perspective view of a surface cleaning apparatus with the cyclone unit separated from the main body, in accordance with another embodiment;

FIG. **27** is a partial cross-sectional view of the surface cleaning apparatus of FIG. **26** with the cyclone unit connected to the main body;

FIG. **28** is a perspective view of a surface cleaning apparatus with the cyclone unit separated from the main body, in accordance with another embodiment;

FIG. **29** is a perspective view of a surface cleaning apparatus with the cyclone unit separated from the main body, in accordance with another embodiment;

FIG. **30** is a perspective view of a surface cleaning apparatus with the cyclone unit separated from the main body, in accordance with another embodiment;

FIG. **31** is a schematic cross-sectional view of an openable door and a dirty air inlet of a surface cleaning apparatus in accordance with another embodiment, with an accessory connected to the surface cleaning apparatus inhibiting the door from opening;

FIG. **32** is the schematic cross-sectional view of FIG. **31**, with the accessory disconnected from the surface cleaning apparatus and the door in an open position;

FIG. **33** is a schematic cross-sectional view of an openable door and a dirty air inlet of a surface cleaning apparatus in accordance with another embodiment, with an accessory connected to the surface cleaning apparatus inhibiting the door from opening;

FIG. **34** is the schematic cross-sectional view of FIG. **33**, with the accessory disconnected from the surface cleaning apparatus and the door in an open position;

FIG. **35** is a schematic cross-sectional view of an openable door and a dirty air inlet of a surface cleaning apparatus in accordance with another embodiment, with an accessory connected to the surface cleaning apparatus inhibiting the door from opening;

FIG. **36** is the schematic cross-sectional view of FIG. **35**, with the accessory disconnected from the surface cleaning apparatus and the door in an open position;

FIG. **37** is a schematic cross-sectional view of an openable door and a dirty air inlet of a surface cleaning apparatus in accordance with another embodiment, with an accessory connected to the surface cleaning apparatus inhibiting the door from opening; and,

FIG. **38** is the schematic cross-sectional view of FIG. **37**, with the accessory disconnected from the surface cleaning apparatus.

DESCRIPTION OF VARIOUS EMBODIMENTS

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.

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.

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.

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 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.

Referring to FIG. **1**, an embodiment of a surface cleaning apparatus **100** is shown. The following is a general discussion of this embodiment which provides a basis for understanding each of the features which is discussed herein. As discussed in detail subsequently, each of the features may be used in other embodiments.

In the embodiment illustrated, the surface cleaning apparatus **100** is a hand-held vacuum cleaner, which is commonly referred to as a "hand vacuum cleaner" or a "handvac". As used herein and in the claims, a hand-held vacuum cleaner or hand vacuum cleaner or handvac is a vacuum cleaner that can be operated one-handedly to clean a surface while its weight is held by the same one hand. This is contrasted with upright and canister vacuum cleaners, the weight of which is supported by a surface (e.g. floor below) during use. Optionally, surface cleaning apparatus **100** could be removably mountable on a base so as to form, for example, an upright vacuum cleaner, a canister vacuum cleaner, a stick vac, a wet-dry vacuum cleaner and the like. Power can be supplied to the surface cleaning apparatus **100** by an electrical cord (not shown) that can be connected to a standard wall electrical outlet. Alternatively, or in addition, the power source for the surface cleaning apparatus can be an onboard energy storage device, including, for example, one or more batteries.

As exemplified in FIGS. **1-4**, the surface cleaning apparatus **100** may comprise a main body **104** having a handle **108**, an air treatment member **112** connected to the main body **104**, a dirty air inlet **116**, a clean air outlet **120**, and an air flow path extending between the inlet **116** and outlet **120**. Surface cleaning apparatus **100** includes a front end **121**, a rear end **122**, an upper end **123**, and a bottom **125**. In the embodiment shown, the dirty air inlet **116** is at the front end **121**. As exemplified, dirty air inlet **116** is the inlet end **124** of an inlet passage **128**. Dirty air inlet **116** may be positioned forward of air treatment member **112** as shown. Optionally, the inlet end **124** can be used as a nozzle to directly clean a surface. Alternatively, the inlet end **124** can be connected or directly connected to the downstream end of any suitable accessory tool such as a rigid air flow conduit (e.g. wand, crevice tool, mini brush or the like) for example. For example, FIGS. **5** and **5A** show an exemplary surface cleaning apparatus **132** (e.g. a stickvac) including surface cleaning apparatus **100** with connector inlet end **124** directly connected to a wand **136** (e.g., wand outlet end **612** may be removably connectable in air flow communication with inlet connector **128**) that is pivotally connected to a surface cleaning head **140**. Wand may be securable to connector **128** by any means known in the art such as a locking member or a friction fit. In the illustrated configuration of FIG. **5**, the surface cleaning apparatus **100** can be used to clean a floor or other surface in a manner analogous to conventional upright-style vacuum cleaners.

From the dirty air inlet **116**, the air flow path may extend through an air treatment member **112**. The air treatment member **112** may be any suitable member that can treat the air in a desired manner, including, for example, removing dirt particles and debris from the air. In the illustrated example, the air treatment member is a cyclone unit **112**, which may be of any design. Alternatively or in addition, the air treatment member may comprise one or more of a bag, a filter or other air treating means.

Cyclone unit **112** may include one or a plurality of cyclones for separating dirt from the air flow, and one or a plurality of dirt collection regions for receiving dirt separated in the cyclone(s). As exemplified in FIG. **6**, cyclone unit **112** includes a cyclone or cyclone chamber **160** and an external dirt collection chamber **164**. The cyclone **160** and dirt collection chamber **164** may be of any configuration suitable for separating dirt from an air stream and collecting

the separated dirt, respectively. For example, it will be appreciated that in some dirt collection area may be internal of the cyclone chamber, e.g., a dirt collection area may be provided at a longitudinal end of the cyclone chamber. Cyclone **160** may be oriented in any direction. For example, when surface cleaning apparatus **100** is positioned with bottom **125** on a horizontal surface **584**, cyclone axis of rotation **484** may be oriented horizontally as exemplified, vertically, or at any angle between horizontal and vertical.

As also exemplified in FIG. **6**, a suction motor and fan assembly **152** may be mounted within a motor housing portion **156** of the main body **104**. In this configuration, the suction motor and fan assembly **152** is downstream from the cyclone unit **112**, and the clean air outlet **120** is downstream from the suction motor and fan assembly **152**.

Optionally, one or more pre-motor filters may be placed in the air flow path between the air treatment member and the suction motor and fan assembly. Alternatively, or in addition, one or more post-motor filters may be provided downstream from the suction motor and fan assembly.

As exemplified in FIG. **6**, main body **104** is shown including a pre-motor filter housing portion **208** that is positioned in the air flow path downstream of cyclone unit **112**. Pre-motor filter housing **208** may be of any construction known in the vacuum cleaner art. As exemplified, filter housing **208** may be bounded by one or more walls, which may be integral with or discrete from the main body exterior walls **212**. Turning to FIG. **8**, pre-motor filter housing **208** is shown including a filter housing first wall **216** axially opposite a filter housing second wall **220**, and a filter housing sidewall **224** that extends in the direction of the cyclone axis of rotation between the first and second walls **216** and **220**. It will be appreciated that first wall **216** is optional and second wall **220** may be in the form of ribs to hold the filter in place. In the illustrated example, filter housing sidewall **224** is discrete from main body exterior walls **212**, which may provide enhanced sound insulation for air passing through the pre-motor filter housing **208**. In alternative embodiments, filter housing sidewall **224** may be defined in whole or in part by main body exterior walls **212** for a more compact design.

Referring back to FIG. **6**, one or more filters made of or comprising a porous filter media may be positioned within the pre-motor filter housing **208** to filter particles remaining in the air flow exiting the cyclone air outlet **184**, before the air flow passes through the suction motor and fan assembly **152**. In the illustrated embodiments, pre-motor filter housing **208** contains an upstream filter **228** and a downstream filter **232**. The pre-motor filters **228** and **232** may be of any suitable configuration and formed from any suitable materials. Preferably, the pre-motor filters **228** and **232** are made of porous media such as foam, felt, or filter paper. Preferably a foam pre-motor filter is provided upstream of a felt pre-motor filter.

Pre-motor filter housing **208** may include a filter housing air inlet and a filter housing air outlet of any suitable design and arrangement within the housing **208**. In the illustrated embodiment, pre-motor filter housing **208** includes a filter housing air inlet **236** formed in filter housing first wall **216**, and a filter housing air outlet **240** formed in filter housing second wall **220**.

Still referring to FIG. **6**, pre-motor filter housing **208** may promote the air flow to broadly distribute across the pre-motor filters **228** and **232** inside. This allows the collected dust particles to be more evenly distributed throughout pre-motor filters **228** and **232** instead of concentrating in a narrow air flow path. An advantage of this design is that the pre-motor filters **228** and **232** will have a greater effective dirt capacity, which allows the pre-motor filters **228** and **232** to be cleaned or replaced less frequently. To this end, pre-motor filter housing **208** may have any structure suitable for broadly distributing the air flow across pre-motor filters **228** and **232**. For example, pre-motor filter housing **208** may provide an upstream header **256**, a downstream header **260**, or both as shown. Headers **256** and **260** may be provided by spacing the pre-motor filters from the filter housing end walls **216** and **220** respectively. In some embodiments, pre-motor filter housing **208** includes spacing members positioned to hold the pre-motor filters **228** and **232** away from the filter housing end walls **216** and **220**. For example, referring to FIGS. **6** and **8**, filter housing first wall **216** may include upstanding ribs **264** that hold the upstream side **268** of pre-motor filter **228** spaced apart from filter housing first wall **216** to allow air from filter housing air inlet **236** to flow laterally between pre-motor filter **228** and filter housing first wall **216** before penetrating pre-motor filter **228**. The illustrated example also shows filter housing second wall **220** including upstanding ribs **272** that hold the downstream side **276** of pre-motor filter **232** spaced apart from filter housing second wall **220** to allow air exiting pre-motor filter **232** to flow laterally between pre-motor filter **232** and filter housing second wall **220**, to filter housing air outlet **240**.

Cyclone with a Unidirectional Flow of Air

The following is a description of a cyclone that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed including uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, pre-motor filter housing door, air treatment member door actuator, air treatment member door control, counterweight stand, and electrical coupling members.

In accordance with this aspect a cyclone comprises a cyclone with a unidirectional flow of air or a "uniflow" cyclone. As discussed in more detail, the uniflow cyclone may be horizontally disposed as opposed to being vertically disposed which is typical in the art. In other words, when held by hand and used to clean a surface, the axis of the cyclone chamber may be closer to horizontal than vertical.

In accordance with this aspect, the cyclone air inlet may be at the front end and the cyclone air outlet may be at the rear end. An advantage of this design is that the cyclone inlet may be used to redirect the air from the inlet passage **124** to the cyclone chamber and the air may exit the cyclone and travel linearly to the pre-motor filter. Accordingly, dirty air may travel from the dirty air inlet to the pre-motor filter without passing through any bends, thereby reducing the backpressure created by flow through the vacuum cleaner.

Alternately or in addition, in accordance with this aspect, the cyclone air inlet may be in an upper portion of the sidewall **168** of the cyclone. An advantage of this design is that it inhibits dirt that may remain in cyclone chamber **160** from exiting or blocking the air inlet when the apparatus is moved to various operating angles.

Alternately or in addition, in accordance with this aspect, the dirt collection chamber **164** may be external to the cyclone chamber **160**. Further, the dirt outlet **188** of the cyclone chamber **160** may be at a rear end of the cyclone chamber and/or may be in a lower portion of the cyclone chamber, such as in a lower part of sidewall **168** of the cyclone chamber. An advantage of placing the dirt outlet **188** in a lower portion of the rear end of the cyclone chamber **160** is that, when the handvac is in use with inlet **116** pointed

downwardly, dirt will enter the dirt collection chamber **164** and fall forwardly due to gravity thereby preventing outlet **188** from becoming blocked until the dirt collection chamber **164** is full.

FIG. **7** exemplifies a cyclone unit including these aspects. As exemplified, cyclone **160** comprises a cyclone sidewall **168** extending axially from a cyclone first end **172** (e.g. front end comprising first end wall **192**) to a cyclone second end **176** (e.g. rear end comprising second end wall **196**), a cyclone air inlet **180** which enters cyclone **160** at a front portion of sidewall **168**, a cyclone air outlet **184** provided in cyclone second end wall **196**, and a cyclone dirt outlet **188**. Cyclone sidewall **168** includes an upper wall **169** and a lower wall **171**. As exemplified in FIG. **6**, dirty air may enter cyclone **160** tangentially at cyclone air inlet **180** (which may be provided in the upper wall **169**), and swirl (e.g. move cyclonically) through cyclone **160** to separate dirt from the air flow, and then exit cyclone **160** through cyclone air outlet **184**. The separated dirt may exit cyclone **160** through cyclone dirt outlet **188** and deposit into dirt collection chamber **164**.

As exemplified a vortex finder **204** may extend axially between cyclone first and second ends **172** and **176**. Vortex finder **204** may have any configuration known in the art. For example, vortex finder **204** may be connected to cyclone second end wall **196** and extend axially towards cyclone first end **172**. Vortex finder **204** may surround cyclone air outlet **184**, so that air exiting cyclone **160** travels downstream through vortex finder **204** to cyclone air outlet **184**. Vortex finder **204** may include filter media **206** (e.g. mesh) to capture large dirt particles (e.g. hair and coarse dust) that remains in the air flow exiting cyclone **160**.

It will be appreciated that if cyclone air inlet **180** is located at an upper end of the cyclone **160**, then inlet passage **128** may be located above the central longitudinal axis of cyclone **160** and preferably is located above cyclone **160**. For example, as exemplified in FIGS. **1**, **6** and **7**, cyclone air inlet **180** may be a tangential air inlet so that air entering the cyclone **160** will tend to rotate as the air travels axially through the cyclone **160**, thereby dis-entraining dirt and debris from the air flow, before leaving the cyclone via the air outlet **184**. Further, inlet passage **128** extends longitudinally between passage inlet end **124** (i.e., the dirty air inlet **116**) and passage outlet end **130** along a longitudinal passage axis **364**, and passage outlet end **130** communicates (e.g. is positioned upstream) of cyclone air inlet **180**. Passage axis **364** may be linear, and all of the longitudinal passage axis **364** may be positioned above cyclone axis of rotation **484** when surface cleaning apparatus **100** is positioned with bottom **125** on a horizontal surface **584**.

Cyclone air inlet **180** may be positioned and constructed in any manner suitable for directing air tangentially into cyclone **160**. In the illustrated example of FIG. **22**, cyclone air inlet **180** is formed as a curved passage extending from a cyclone air inlet upstream end **532** to a cyclone air inlet downstream end **536**. The cyclone air inlet downstream end **536** may be oriented to direct air substantially tangentially to the inner surface of sidewall **168**. As exemplified, cyclone air inlet **180** may be positioned above cyclone axis of rotation **484** and suction motor axis of rotation **540**. For example, cyclone air inlet **180** may be positioned at an upper end **544** of cyclone **160**. This allows gravity to assist with inhibiting dirt inside cyclone **160** from blocking or exiting cyclone air inlet **180**. This is because at least a portion of the cyclone **160** will be positioned below the cyclone air inlet **180** when apparatus **100** is held at various operating angles, so that the dirt inside will tend to fall away from cyclone air inlet **180**.

Still referring to FIG. **22**, cyclone air inlet **180** is formed in cyclone sidewall **168** at cyclone first end **172**, and cyclone air outlet **184** is formed in cyclone second end wall **196** at cyclone second end **176**. As exemplified, air may exit cyclone air outlet **184** in a flow direction **616** that is generally parallel to the suction motor axis of rotation **540**.

As exemplified in FIG. **6**, main body lower end **568** may comprise bottom **125**. In the illustrated example, when bottom **125** is placed on a horizontal surface, cyclone **160** may be oriented horizontally if bottom or base **125** is parallel to the cyclone axis. It will be appreciated that if bottom **125** is oriented at an angle to the horizontal, e.g., so that dirty air inlet **116** points downwardly when bottom **125** is on a horizontal surface, cyclone **160** may be not be oriented horizontally when bottom **125** is on a horizontal surface. It will be appreciated that, as referred to herein, cyclone **160** being horizontal relates to the orientation if bottom **125** is parallel to the cyclone axis of rotation **484**.

As exemplified in FIG. **5**A, when inlet connector **128** is mounted to a wand **557** (i.e. rigid air flow conduit), the wand axis **559**, the inlet connector axis **364**, and the cyclone axis of rotation **484** may be parallel. An advantage of this embodiment is that this reduces bends in the air flow for improved air efficiency. It will be appreciated that only some of these axes may be parallel. For example, only the inlet connector axis **364** and the cyclone axis of rotation **484** may be parallel.

Positioning of the Dirt Collection Chamber

The following is a description of a dirt collection chamber that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, pre-motor filter housing door, air treatment member door actuator, air treatment member door control, counterweight stand, and electrical coupling members.

In accordance with this aspect of the disclosure, a dirt collection chamber for a cyclone chamber may be provided external to and below the cyclone chamber. An advantage of this design is that a cyclone dirt outlet **188** may be provided in a lower portion of the cyclone chamber (e.g., cyclone dirt outlet **188** is provided in lower wall **171**) such that dirt which remains in the cyclone chamber after termination of operation of the vacuum cleaner may fall into the dirt collection chamber when the vacuum cleaner is held with the cyclone extending horizontally and slightly upwardly. A further advantage is that the width of the vacuum cleaner may be narrower as the dirt collection chamber is not located on the lateral sides of the cyclone chamber. Therefore, as exemplified in FIG. **18**, the maximum width of a handvac may be determined by the width of the suction motor housing or the width of the cyclone **160**.

As exemplified in FIG. **18**, dirt collection chamber **164** extends around approximately one-half of cyclone **160**. As exemplified, partition wall **556** may circumscribe approximately one-half of cyclone **160**. In other embodiments, dirt collection chamber **164** may extend around less than or greater than one-half of cyclone **160**, and partition wall **556** may similarly circumscribe less than or greater than one-half of cyclone **160**. In alternative embodiments, dirt collection chamber **164** may not surround cyclone **160**.

It will be appreciated that cyclone sidewall **168** and dirt collection chamber sidewall **548** may have any construction suitable for separating the cyclone **160** from dirt collection chamber **164** and allowing the passage of dis-entrained dirt therebetween. For example, cyclone sidewall **168** and dirt collection chamber sidewall **548** may be discrete walls that are spaced apart and connected by a dirt outlet passage. As exemplified in FIG. **18**, dirt collection chamber sidewall **548** is formed at least in part by portions of cyclone sidewall **168** and portions of cyclone unit exterior wall **552**. Similarly, cyclone sidewall **168** as shown is formed at least in part by portions of dirt collection chamber sidewall **548** and cyclone unit exterior wall **552**. Accordingly, the wall portion **556** in common between cyclone **160** and dirt collection chamber **164** may operate as a dividing wall. Sharing a common dividing wall may help reduce the overall size of the cyclone unit **112**, for a more compact design.

Returning to FIG. **22**, cyclone **160** may include any dirt outlet **188** suitable for directing dis-entrained dirt from cyclone **160** to dirt collection chamber **164**. For example, dirt outlet **188** may be formed in or connected to one or more (or all) of cyclone sidewall **168** and cyclone end walls **192** and **196**. In the illustrated embodiment, dirt outlet **188** is formed in cyclone sidewall **168**. Dirt outlet **188** may have any shape and size suitable for allowing dirt particles to pass into dirt collection chamber **164**. In the illustrated embodiment, dirt outlet **188** is formed as a rectangular aperture in wall portion **556**. In alternative embodiment, dirt outlet **188** may be circular, triangular, or another regular or irregularly shaped aperture. As exemplified, cyclone dirt outlet **188** may be bounded in part by cyclone second end wall **196**.

It will be appreciated that cyclone dirt outlet **188** may be positioned anywhere at or between cyclone first and second ends **172** and **176**. In the illustrated embodiment, cyclone **160** is a uniflow cyclone and accordingly cyclone dirt outlet **188** is positioned at cyclone second end **176** proximate cyclone air outlet **184**. This allows the dirt and air to travel towards the same end of the cyclone **160** before parting ways—the air exiting through air outlet **184** and the dirt exiting through dirt outlet **188**.

In use, the air stream inside cyclone **160** swirls towards cyclone air outlet **184** at cyclone second end **176**, which dis-entrains dirt particles against cyclone sidewall **168**. Under the influence of the rearward air stream, the dirt particles travel towards cyclone second end **176** and exit through cyclone dirt outlet **188** to dirt collection chamber **164**.

Referring to FIG. **18**, dirt collection chamber **164** may have any size and shape suitable to accommodate dirt separated by cyclone **160** during one or more uses. A larger dirt collection chamber **164** can store more dirt to allow apparatus **100** to run longer before emptying dirt collection chamber **164**, but will add bulk and weight to the apparatus **100**. A smaller dirt collection chamber **164** is smaller and lighter, but must be emptied more frequently.

Orientation of the Suction Motor

The following is a description of the orientation of a suction motor that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, pre-motor filter housing door, air treatment member door actuator, air treatment member door control, counterweight stand, and electrical coupling members.

As exemplified in FIG. **22**, in accordance with this aspect, the axis of rotation of the suction motor may be generally parallel to the cyclone axis of rotation and/or the inlet conduit axis. An advantage of this design is that the air may travel generally rearwardly from the cyclone air outlet to the suction motor air inlet, thereby reducing the backpressure through this portion of the vacuum cleaner due to a reduction in the number of bends in the air flow path.

As exemplified in FIG. **22**, when surface cleaning apparatus **100** is positioned with bottom **125** on a horizontal surface **584**, the suction motor axis of rotation **540** may be generally horizontal. For example, cyclone sidewall **168** may extend generally horizontally between longitudinally spaced apart cyclone end walls **172** and **176**, when surface cleaning apparatus **100** is positioned with bottom **125** on a horizontal surface **584**. As exemplified, suction motor axis of rotation **540** may be generally parallel with cyclone axis of rotation **484**. This allows for fewer bends in the air flow between dirty air inlet **116** and clean air outlet **120**, which can result in reduced backpressure, all other elements remaining the same.

As exemplified, the suction motor axis of rotation **540** may be positioned below cyclone axis of rotation **484**. This may provide surface cleaning apparatus **100** with a relatively lower center of gravity for greater stability when surface cleaning apparatus **100** is positioned with bottom **125** on a horizontal surface **584**. In such a case, the pre-motor filter air inlet and outlet **236** and **240** may be axially offset as shown. In the illustrated example, filter housing air inlet axis **248** is located above and spaced apart from filter housing air outlet axis **252**. An advantage of this design is that one or both of the headers may be used to change to elevation at which the air travels reawardly with without using a conduit with bends. For example, air may travel generally rearwardly (linearly) into the pre-motor filter housing and air may travel generally rearwardly (linearly) out of the pre-motor filter housing, but at a lower elevation.

In alternate embodiments, filter housing air inlet and outlet axes **248** and **252** may not be spaced apart (e.g. they may be collinear).

In alternate embodiments, it will be appreciated that suction motor and fan assembly **152** may be positioned in main body **104** with its axis of rotation **540** oriented in any direction.

Lateral Stability Members

The following is a description of the lateral stability members that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the air treatment member handle, the position and orientation of a driving handle, pre-motor filter housing door, air treatment member door actuator, air treatment member door control, counterweight stand, and electrical coupling members.

Optionally, the air treatment member may be separable from the main body, such as for emptying, cleaning, or replacing the air treatment member or other internal components of the apparatus, such as the pre-motor filters.

In accordance with this aspect the air treatment member **112** is removable mountable to the main body **104** and is provided with lateral stability members. For example, the air treatment member **112** may abut against a front face of the main body **104** (see for example FIG. **1**). Optionally, one of the air treatment member **112** and the main body may be receivable in the other. Accordingly, when unlocked, the air treatment member **112** may be removed from the main body

104 by moving it forwardly. During use, a transverse force may be applied to the air treatment member **112**. As exemplified, inlet **116** is provided on the removable air treatment member **112**. Therefore, when used as part of a stickvac and handle **108** is driving connected to a surface cleaning head (see for example FIG. **5**), a force may be provided transverse to wand axis **559**. If sufficient pressure is applied, then the air treatment member may break off of the main body or the air tight seal between the air treatment member and the main body may be broken allowing air to bypass the surface cleaning head. The provision of the lateral stability members reinforces the joint of the air treatment member and the main body to resist such transverse forces.

The lateral stability members are provided internal of the handvac and may be provided on opposed facing faces of the air treatment member and the main body. The lateral stability members may comprise generally vertically extending inter-engagement members

Cyclone unit **112** may be securable to main body **104** in any manner that allows the cyclone unit **112** to be selectively separated and reconnected to main body **104**. For example, cyclone unit **112** and main body **104** may collectively include any releasable engagement members (e.g. latches, snaps, magnets, straps, etc.) suitable for releasably joining the cyclone unit **112** and main body **104**. Further, cyclone unit **112** and main body **104** may collectively include any actuators that allow selective manual release (i.e. by hand) of the releasable engagement member(s). The releasable engagement member(s) and the actuator(s) may be mechanical, electrical, and/or electro-mechanical in nature.

As exemplified in FIGS. **9-11**, main body **104** and cyclone unit **112** are separably connected by a cyclone unit release lock **278**. As exemplified, cyclone unit release lock **278** includes a pair **280** of engagement members **304** and **308**, and a release actuator **328**. The release actuator **328** may be manually user operable (e.g. by hand) for selectably unlocking cyclone unit release lock **278** to allow main body **104** and cyclone unit **112** to separate.

In the illustrated example, cyclone unit **112** is also rotationally mounted to main body **104**. For example, cyclone unit **112** may be rotationally mounted to main body **104** at a position longitudinally spaced apart from cyclone unit release lock **278**. This allows cyclone unit **112** to rotationally separate from main body **104** when cyclone unit release lock **278** is unlocked (e.g. by operation of release actuator **328**). In some embodiments, cyclone unit **112** may be rotationally mounted to main body **104** by a detachable pair **284** of engagement members **312** and **316**. This allows for the option of fully detaching cyclone unit **112** from main body **104**, such as to carry cyclone unit **112** to a garbage bin for emptying or cleaning for example. In alternative embodiments, second pair **284** of engagement members **312** and **316** may provide a permanent rotational connection that is not detachable. It will be appreciated that an alternate connection mechanism may be provided to secure the lower end of the air treatment member **112** and the main body **104** together when cyclone unit release lock **278** is engaged.

Cyclone unit release lock **278** and engagement member pair **284** may be positioned at any location on apparatus **100** suitable for securely joining the main body **104** and cyclone unit **112**. For example cyclone unit release lock **278** and engagement member pair **284** may be positioned at opposite ends of apparatus **100**, such as longitudinally spaced at apparatus upper end **288** and lower end **292** as shown. In the illustrated example, first cyclone unit engagement member **304** is positioned on cyclone unit upper end **348** and first main body engagement member is positioned on main body upper end **570**. In alternate embodiments, the lock positions may be reversed.

Cyclone unit release lock **278** and engagement member pair **284** may take any form suitable for separably joining main body **104** and cyclone unit **112**. For example, one or both engagement member pairs **280** and **284** may include a first engagement member removably receivable in a second engagement member. As exemplified, first engagement member pair **280** includes a first cyclone unit engagement member **304** and a first main body engagement member **308**, and second engagement member pair **284** includes a second cyclone unit engagement member **312** and a second main body engagement member **316**.

Referring to FIG. **12**, first cyclone unit engagement member **304** and first main body engagement member **308** are shown formed as hooks which are sized and positioned to interlock when the cyclone unit **112** and main body **104** are brought together. Second cyclone unit engagement member **312** is shown formed as a transversely extending rod which is received in hook-like second main body engagement member **316** when the cyclone unit **112** and main body **104** are brought together. As exemplified, cyclone unit lower end **352** is rotationally mounted to main body lower end **568** when second engagement member pair **284** is connected. When connected, cyclone unit release lock **278** and engagement member pair **284** hold cyclone unit **112** in fluid communication with main body **104**, so that an air flow path is formed from dirty air inlet **116** to clean air outlet **120**. A gasket or the like may be provided to form an air tight seal.

As exemplified in FIGS. **12-14**, one or more of engagement members **304**, **308**, **312**, and **316** may be movable to facilitate manual disconnection of the cyclone unit **112** from main body **104**. For example, one or more of engagement members **304**, **308**, **312**, and **316** may be movable away from the other engagement member of its respective engagement member pair **280** or **284** from a locked position to an unlocked position for disconnecting that engagement member pair **280** or **284**. It will be appreciated that an engagement member **304**, **308**, **312**, or **316** may be moveable in any direction. For example, it may be translatable in a linear direction or along a curved path, rotatable about any one or more axes, or combinations thereof.

As shown in FIG. **13**, first cyclone unit engagement member **304** is in the open or unlocked position wherein it has been moved away from the closed or locked position shown in FIG. **12** in which it engages first main body engagement member **308**, thereby disengaging the first engagement member pair **280**. As exemplified, first cyclone unit engagement member **304** is pivotally mounted to a first engagement member axle **324** for rotation about the first engagement member axis **320** that extends laterally and first cyclone unit engagement member **304** extends substantially rearwardly whereby rotation of first cyclone unit engagement member **304** about first engagement member axis **320** moves the first cyclone unit engagement member **304** substantially vertically. In this example, first cyclone unit engagement member **304** is formed as a lower upwardly facing hook, first main body engagement member **308** is formed as an upper downwardly facing hook, and first cyclone unit engagement member **304** is pivotal about first engagement member axis **320** to move first cyclone unit engagement member **304** downwardly away from first main body engagement member **308** from the locked position (FIG. **12**) to the unlocked position (FIG. **13**), thereby disconnecting the first engagement member pair **280**.

Once the first engagement member pair **280** is disconnected, the cyclone unit **112** and main body **104** may be separated at the apparatus upper end **288**, and then the cyclone unit **112** may be moved relative to the main body **104** to disconnect the second engagement member pair **284** thereby completing the disconnection of the cyclone unit **112** from the main body **104**.

Apparatus **100** may include any actuator **328** suitable for disengaging engagement member **304** and **308** to unlock cyclone unit release lock **278**. Actuator **328** may be provided on either of cyclone unit **112** or main body **104**. Preferably, the actuator **328** is manually operable (i.e. by hand) to allow selective disconnection of the engagement members **304** and **308**. In the illustrated embodiment, first main body engagement member **308** is connected to an actuator **328**. Actuator **328** may take any form such as a button as shown, a switch, or a slider for example. Actuator **328** may be connected to first main body engagement member **308** in manner suitable for directing the movement of first main body engagement member **308**. In the illustrated example, first main body engagement member **308** is integrally formed with a distal end of actuator **328**. In alternative embodiments, actuator **328** may be a discrete component that is rigidly or movably connected to first main body engagement member **308** directly or indirectly by way of one or more intermediary components.

As exemplified, a proximal end of actuator **328** may be pivotally mounted to cyclone unit **112** by first engagement member axle **324** for rotation about first engagement member axis **320**. In use, a user may depress actuator **328** to rotate actuator **328** and first cyclone unit engagement member **304** downwardly, thereby disconnecting the first engagement member pair **280**.

In some embodiments, first cyclone unit engagement member **304** may be biased to the locked position to mitigate the risk of first engagement member pair **280** becoming unlocked during use of apparatus **100**. In the illustrated example, a bias **332** biases first cyclone unit engagement member **304** to the open position. Bias **332** may be formed as a torsional spring, as shown, which is mounted to first engagement member axle **324**. A user may depress actuator **328** to move the first cyclone unit engagement member **304** against the bias of spring **332** and disconnect first engagement member pair **280**.

Reference is now made to FIGS. **15** and **16**, which show apparatus **100** including an alternative first engagement member pair **280**. As exemplified, first cyclone unit engagement member **304** may include an engagement member arm **336** with an engagement member socket **340**, and first main body engagement member **308** may be formed as a peg. In the locked position (FIG. **15**), peg **308** may be received in engagement member socket **340** to securely join first engagement member pair **280**. In the unlocked position (FIG. **16**) peg **308** may be removed from engagement member socket **340** to disconnect first engagement member pair **280**. As exemplified, engagement member arm **336** may be resiliently bendable (i.e. as a living hinge) for moving first main body engagement member **308** between the locked and unlocked positions. For example, engagement member arm **336** can resiliently bend upwardly to remove peg **308** from engagement member socket **340** (FIG. **16**), and vice versa. Preferably, the resiliency of engagement member arm **336** biases first cyclone unit engagement member **304** towards the locked position.

Exemplary lateral stability members are shown in FIGS. **26-30**. As exemplified, air treatment member **112** and main body **104** may collectively include one or more pairs of protrusions and recesses, which mate at the interface between air treatment member **112** and main body **104** when air treatment member **112** is connected to main body **104**. This helps provide a more robust separable connection between air treatment member **112** and main body **104** with enhanced strength and rigidity. Air treatment member rear end **436** and main body front end **432** may be provided with mating protrusions **620** that are receivable in recesses **624**.

Protrusions **620** and recesses **624** may have any size, shape, and position which allows the protrusions **620** to be received in the recesses **624** when air treatment member **112** and main body **104** are connected. As exemplified, each of protrusions **620** and recesses **624** may be formed as elongate segments which are continuous or have discontinuities. In the illustrated embodiment, each of protrusions **620** and recesses **624** extend longitudinally downwardly.

As exemplified in FIGS. **26** and **27**, protrusions **620** are formed in cyclone unit upper end **348** (engagement member arm **336**) and recesses **624** are formed in surface of main body upper end **570** against which engagement member arm **336** abuts. Protrusions **620** are received in recesses **624** when air treatment member **112** is connected to main body **104**.

FIG. **28** shows an alternate embodiment, in which cyclone unit upper end **348** includes recesses **624** and main body upper end **570** includes protrusions **620**.

FIG. **29** shows another alternate embodiment including protrusions **620** and recesses **624** extending across cyclone rear end wall **176** and filter housing front wall **216**.

FIG. **30** shows another embodiment including protrusions **620** extending across cyclone rear end wall **176** and filter housing front wall **216**. When air treatment member **112** is connected to main body **104**, protrusions **620** on cyclone rear end wall **176** contact filter housing front wall **216**, and protrusions **620** on filter housing front wall **216** contact cyclone rear end wall **176**. In this embodiment, protrusion **620** provide rigid beams at the interface between main body **104** and air treatment member **112** which may increase the rigidity and strength of the separable connection.

Air Treatment Member Handle

The following is a description of an air treatment member handle that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the position and orientation of a driving handle, pre-motor filter housing door, air treatment member door actuator, air treatment member door control, counterweight stand, and electrical coupling members.

In accordance with this aspect, the air treatment member may include a handle in addition to the main body handle ("driving handle"). This allows a user to hold the main body and the air treatment member simultaneously, with different hands before, during, and after disconnecting the main body from the air treatment member.

In one embodiment, the air treatment member handle may for part of an air flow conduit of the air treatment member. Alternately or in addition, the air treatment member handle may extend along the axial direction of the air treatment member and/or may be on an upper portion thereof and/or may provide a gap for receiving fingers of the user.

As exemplified in FIG. **11**, cyclone unit handle **344** is connected to cyclone unit **112** when cyclone unit **112** is disconnected from main body **104**, and driving handle **108** is connected to main body **104** when main body **104** is disconnected from cyclone unit **112**. Cyclone unit handle

344 may have any suitable size, shape, and position on cyclone unit 112 which allows a user to easily grasp the cyclone unit handle 344 by hand to carry the cyclone unit 112 (see FIG. 10A). In the illustrated embodiment, cyclone unit handle 344 is formed as a substantially cylindrical member, which extends rearwardly along cyclone unit upper portion 348. In other embodiments, cyclone unit handle 344 may have a different regular or irregular cross-sectional shape, and may extend along a different portion of cyclone unit 112, such as along lower portion 352, or a lateral side 356 for example. As exemplified in FIG. 6, cyclone unit handle 344 may include a portion or gap 347 spaced from cyclone unit 112 whereby a finger receiving area 349 is provided between the cyclone unit handle 344 and the cyclone unit 112.

Returning to FIG. 11, preferably apparatus 100 is configured to allow the user to take whatever action disconnects the main body 104 from air treatment member 112 while holding air treatment member handle 344 with one hand and holding driving handle 108 with the other hand. For example, cyclone unit handle 344 or driving handle 108 may be positioned proximate (e.g. within finger-reach of) an actuator that releases the connector(s) which hold air treatment member 112 and main body 104 together. This would allow the user to use a finger to operate the actuator while holding the handle 344 or 108 with the remaining fingers of their hand. In the illustrated embodiment, cyclone unit handle 344 and actuator 328 are both located on the cyclone unit upper portion 348 and in close proximity. This allows a user to hold air treatment member 112 by handle 344 while simultaneously operating actuator 328 with the same hand to disconnect air treatment member 112 from main body 104. The user may also use the same hand to open a front door of the air treatment member as discussed subsequently in more detail.

Referring to FIG. 6, cyclone unit handle 344 is shown extending along a cyclone unit handle axis 360. In some embodiments, cyclone unit handle axis 360 may be parallel with and may be coaxial with inlet connector axis 364. This may promote a compact shape for apparatus 100 in contrast with handles with an axis that extends above the inlet connector axis 364.

As exemplified in FIGS. 1 and 17, cyclone unit handle 344 may comprise an air flow passage (e.g. an air flow conduit). This may promote a compact design for apparatus 100 by reducing or eliminating the volume added to apparatus 100 to incorporate cyclone unit handle 344. For example, an existing air flow conduit may be reshaped and/or repositioned to provide handle functionality. As exemplified in FIG. 17, handle 344 is positioned rearward and coaxial with the inlet conduit extending from dirty air inlet 116. It will be appreciated that if the inlet to the air treatment member chamber (e.g., cyclone chamber 160) is rearward of the front of handle 344, then part of handle 344 form part of inlet conduit 124. Alternately, or in addition as exemplified in FIG. 17, handle 344 may provide part or all of a bleed air conduit 380 having a longitudinal passage axis 390. Bleed conduit 380 provides a portion of the air flow path between the bleed air inlet 384 and the suction motor and fan assembly 152 and houses bleed valve 388. The bleed valve 388 may be any suitable valve that is known in the art, which typically open automatically in response to low pressure. For example, bleed valve 388 may be a pressure relief valve. Bleed valve 388 may help maintain adequate volumetric air flow through the suction motor and fan assembly 152 during low pressure events to avoid overheating of the suction motor and fan assembly 152. Low pressure may occur where there is a partial or total blockage in the air flow upstream of the suction motor and fan assembly 152 (e.g. a plastic bag is blocking dirty air inlet 116).

It will be appreciated that cyclone unit handle 344 is grasped primarily when apparatus 100 is turned off (e.g. when separating, reconnecting, or transporting cyclone unit 112) so that there is little or no concern of the bleed air inlet 384 being blocked by a user's hands when apparatus 100 is turned on.

FIG. 17 exemplifies an optional air flow path from bleed air inlet 384 to suction motor and fan assembly 152 which bypasses cyclone 160 and pre-motor filters 228 and 232. As exemplified, the air flow path may extend rearwardly through bleed valve conduit 380 to filter housing downstream header 260 bypassing filter housing upstream header 256 and pre-motor filters 228 and 232. In alternate embodiments, the air flow path may extend through pre-motor filters 228 and 232 to filter fine particulates that may be present in the ambient air drawn into bleed air inlet 384. For example, filter housing upstream header 256 may be positioned downstream of bleed valve 388 in the air flow path from bleed air inlet 384.

Position and Orientation of a Driving Handle

The following is a description of a driving handle that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the pre-motor filter housing door, the air treatment member door actuator, air treatment member door control, the counterweight stand, and the electrical coupling members.

In accordance with this aspect, the driving handle is which extends upwardly and forwardly. Driving handle 108 may extend upwardly from the suction motor housing (e.g., an upper surface of the main body that houses the suction motor). Driving handle 108 may terminate at Or above an upper end of the handvac 100. Accordingly, the inlet conduit axis 364 and/or the handle axis 360 may intersect the driving handle 108. An advantage of this design is that the weight of the motor is below the hand grip. Further, the driving axis of the handvac when connected to a wand (the wand axis) is at an opposite end of the handle to the suction motor. This provides improved hand weight for a user.

As exemplified in FIG. 6, driving handle 108 may extend from its lower end 368 to its upper end 372 along a driving handle axis 376. When surface cleaning apparatus 100 is positioned with bottom 125 on a horizontal surface 584 and the bottom 125 extends horizontally, driving handle axis 376 may extend generally upwardly and forwardly (e.g. at an angle 378 of less than 45 degrees to vertical) to provide a comfortable natural grip during use.

As exemplified, driving handle axis 376 may be at an angle to cyclone unit handle axis 360. For example, axes 360 and 376 may be angularly offset by 30 degrees or more. This reflects that the driving handle 108 and cyclone unit handle 344 may have different functions. For example, the driving handle 108 may be configured to provide a comfortable grip for the user during use, and the cyclone unit handle 344 may be configured with a compact design.

In the illustrated embodiment, driving handle 108 includes a portion 377 spaced from main body 104 whereby a finger receiving area 379 is provided between the driving handle 108 and the main body 104. As exemplified, driving handle 108 may be positioned at main body rear end 434 and longitudinally spaced apart from cyclone unit handle 344.

Pre-Motor Filter Housing Door

The following is a description of a pre-motor filter door that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, the air treatment member door actuator, air treatment member door control, the counterweight stand, and the electrical coupling members.

In accordance with this aspect, a surface cleaning apparatus may have a pre-motor filter chamber which is closed by an openable door that is accessible when the air treatment member is removed from the remainder of the surface cleaning apparatus (as exemplified in FIG. **6**). A pre-motor filter may be accessed for cleaning or replacement when the door is opened. The pre-motor filter door may include a handle for user operation. The pre-motor filter chamber may be provided in the removable air treatment member **112** or the main body **104**. The door may be held in a closed position by a part of the surface cleaning apparatus that does not include the pre-motor filter chamber. For example, if the pre-motor filter chamber is provided in the air treatment member, then the door may be held closed by a part of the main body when the air treatment member is attached to the main body. Conversely, if the pre-motor filter chamber is provided in the main body as exemplified in FIG. **8**, then the door may be held closed by a part of the air treatment member when the air treatment member is attached to the main body. An advantage of this design is that it allows a simpler design for the pre-motor filter door that is free of locking members such as latches. A further advantage is that unintentional user access to the pre-motor filter housing **208** may be prevented while the apparatus **100** is in operation.

FIGS. **8**, **8**A and **11** exemplify an embodiment in which pre-motor filter housing **208** is accessible when air treatment member **112** is disconnected from main body **104**. For example, one of the filter housing walls **216** and **220** (e.g., filter housing upstream wall **216** as exemplified in FIG. **8**) may be exposed when air treatment member **112** is disconnected from main body **104**.

The openable filter housing wall may be openable in any manner suitable for providing access to clean or replace the pre-motor filters inside. For example, the openable wall may be moveably mounted or removably mounted. Accordingly, filter housing wall **216** or **220** may be pivotally attached to the pre-motor filter housing **208**, slideably attached to the pre-motor filter housing **208**, or removable altogether from the pre-motor filter housing **208**. In the illustrated embodiment, filter housing upstream wall **216** is pivotally attached to pre-motor filter housing **208**.

As exemplified in FIGS. **8**A and **11**, filter housing upstream wall **216** is rotatable about a filter-housing wall pivot axis **392** between a closed position (FIG. **11**), and an open position (FIG. **8**A). It will be appreciated that filter housing upstream wall **216** may be rotatable in any manner and direction suitable for moving the filter housing upstream wall **216** generally away from the pre-motor filter housing **208** to provide access to the pre-motor filters **228** and **232** inside. In the illustrated embodiment, filter housing upstream wall **216** is upwardly rotatable about a laterally extending (e.g. horizontal) filter housing wall pivot axis **392** located at an upper end **396** of the pre-motor filter housing **208**. As exemplified, the filter housing wall pivot axis **392** is transverse to (e.g. substantially perpendicular to) the inlet connector axis **364**, the cyclone unit handle axis **360**, and the filter housing air inlet axis **248**.

In alternative embodiments, filter housing upstream wall **216** may rotate in a different direction about a different axis. For example, filter housing upstream wall **216** may move laterally outwardly by rotation about a substantially vertical axis positioned proximate a left or right side of the pre-motor filter housing **208**.

Still referring to FIGS. **8**A and **11**, the filter housing upstream wall **216** may have any construction suitable for allowing the filter housing upstream wall **216** to rotate about the filter housing wall pivot axis **392**. For example, filter housing upstream wall **216** may be connected to filter housing sidewall **224** by a hinge **404** of any suitable type. In some embodiments, filter housing upstream wall **216** may be resiliently bendable to connect with pre-motor filter housing **208** by a living hinge.

Optionally, filter housing upstream wall **216** may be at least partially transparent (e.g., the wall may be made of a transparent material or it may have a window) to provide visibility of the upstream surface **268** (FIG. **8**A) of the pre-motor filter inside. This would allow the user to inspect the pre-motor filter through the filter housing upstream wall **216**, without opening the pre-motor filter housing **208**, in order to assess whether to clean or replace the pre-motor filter. In alternative embodiments, the filter housing upstream wall **216** may be opaque, and the pre-motor filter may not be visible through the filter housing upstream wall **216**.

Still referring to FIGS. **8**A and **11**, the openable filter housing wall is preferably manually user openable (e.g. by hand). This allows the user to selectively open the openable filter housing wall to access the pre-motor filters inside. In the illustrated example, the filter housing upstream wall **216** includes a filter housing handle **408** that is user operable to move the filter housing upstream wall **216** between the open and closed positions. The filter housing handle **408** may have any construction that allows the user to easily grasp and pull the filter housing handle **408** to open the pre-motor filter housing **208**. In the illustrated example, the filter housing handle **408** extends outwardly from an end opposed to the hinged end (in this case lower end **412** of the filter housing upstream wall **216**). Referring to FIGS. **11** and **13**, the filter housing handle **408** extends from a filter housing handle inboard end **416** to a filter housing handle outboard end **420**. As exemplified, the filter housing handle inboard end **416** may be connected to an upstream face **424** of the filter housing upstream wall **216**. The filter housing outboard end **420** may include a gripping feature, which may be of any design such a lip **428**. In the illustrated example, lip **428** is curls approximately 90 degrees.

As exemplified in FIG. **13**, the filter housing handle **408** may extend from filter housing upstream wall **216** outwardly towards cyclone unit **112**. In the illustrated example, a front end **432** of main body **104** is connectable to the rear end **436** of cyclone unit **112**, and filter housing handle **408** extends forwardly from filter housing upstream wall **216** towards cyclone unit **112**. As shown, the filter housing handle outboard end **420** extends into a handle recess **440** of cyclone unit **112** outside of cyclone **160** and dirt collection chamber **164**. In this way, the handle may overlap a portion of the cyclone chamber so as to have a longer length in the direction of the cyclone axis. This construction allows the filter housing handle **408** to have a greater dimension **444** between its inboard and outboard ends **416** and **420**, while permitting the filter housing upstream wall **216** to contact at least a portion of cyclone second wall **196** to fluidly connect

the cyclone air outlet **184** to the filter housing air inlet **236**. In the illustrated example, the filter housing handle **408** extends from filter housing upstream wall lower end **412**, and cyclone unit handle recess **440** is provided in cyclone unit lower portion **352**.

Returning to FIGS. **8**A and **11**, in some embodiments, pre-motor filter housing **208** may be free of locking members, such as latches or clasps, which are operable to secure the openable wall in the closed position. Accordingly, when the main body **104** and cyclone unit **112** are connected together (see, e.g. FIG. **1**) filter housing handle **408** extends forwardly from filter housing upstream wall **216** and abuts a part of air treatment member **112**, e.g., rear end wall **196** of the air treatment member.

As exemplified in FIG. **13**, the openable door of the pre-motor filter housing **208** may be held in its closed position by interaction with cyclone unit **112**, when cyclone unit **112** is connected to main body **104**. For example, at least a portion of cyclone unit rear end **436** may contact filter housing upstream wall **216** to hold the filter housing upstream wall **216** in its closed position. In the illustrated example, cyclone second wall **196** is bordered by a peripheral lip **448** which contacts upstream face **424** of filter housing upstream wall **216**, and cyclone air outlet **184** is bordered by a peripheral lip **452** that contacts a peripheral recess **456** of filter housing air inlet **236**. Peripheral lip **452** and recess **456** may form a substantially air tight connection between cyclone air outlet **184** and filter housing air inlet **236**.

In some embodiments, a gasket, such as an O-ring (not shown) may be provided and compressed when the air treatment member is attached to provide an air tight seal between the openable door and the rest of the pre-motor filter chamber.

Air Treatment Member Door Acutator

The following is a description of an air treatment member door actuator that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, the pre-motor filter housing door, the air treatment member door control, the counterweight stand, and the electrical coupling members.

The air treatment member may include an openable door that provides access to empty or clean the air treatment member (e.g. to empty or clean a dirt collection region of the air treatment member). In accordance with this aspect, the air treatment member door may be openable by an actuator positioned within finger-reach of the air treatment member handle. This allows for one handed operation of the air treatment member door.

Reference is now made to FIGS. **1** and **18**. In some embodiments, air treatment member **112** includes an openable wall (e.g., a door) to provide access to clean or empty the air treatment member (e.g., cyclone **160** and dirt collection chamber **164**). Any portion of air treatment member **112** suitable for emptying air treatment member **112** may be openable.

In the illustrated example, air treatment member **112** includes an openable front end **472** wherein all of the front end is openable. As exemplified, the air treatment member may be a cyclone unit comprising a cyclone and a dirt collection chamber external to the cyclone and may have a front end **472** that includes cyclone first end wall **192**, and dirt collection chamber first end wall **476**. It will be appreciated that, in some embodiments, only a portion of the front end **472** may be openable.

The openable door may be openable in any manner suitable for providing access to clean or empty air treatment member **112**, e.g., cyclone **160** and dirt collection chamber **164**. For example, the door may be pivotally attached to the air treatment member **112** which is exemplified in FIG. **18**, slideably attached to the air treatment member **112**, and/or removable altogether from the air treatment member **112**.

As exemplified, cyclone unit front door **472** is rotatable about a cyclone unit wall pivot axis **480** between a closed position (FIG. **1**), and an open position (FIG. **18**). It will be appreciated that cyclone unit front door **472** may be rotatable in any manner and direction suitable for moving cyclone unit front door **472** generally away from the cyclone unit **112** to provide access to the cyclone **160** and dirt collection chamber **164** inside. In the illustrated embodiment, cyclone unit front door **472** is downwardly rotatable about a laterally extending (e.g. horizontal) cyclone unit wall pivot axis **480** located at a lower portion **352** of the cyclone unit **112**. As exemplified, the cyclone unit wall pivot axis **480** is transverse to (e.g. substantially perpendicular to) the inlet connector axis **364**, the cyclone unit handle axis **360**, and the cyclone axis of rotation **484**.

In alternative embodiments, cyclone unit front door **472** may rotate in a different direction about a different axis. For example, cyclone unit front door **472** may move laterally outwardly by rotation about a substantially vertical axis positioned proximate a left or right side of the cyclone unit **112**. In other embodiments, cyclone unit front door **472** may move upwardly by rotation about a substantially horizontal axis positioned proximate cyclone unit upper portion **348**.

Still referring to FIGS. **1** and **18**, the cyclone unit front door **472** may have any construction suitable for allowing the cyclone unit front door **472** to rotate about the cyclone unit wall pivot axis **480**. For example, cyclone unit front door **472** may be connected to cyclone unit **112** by a hinge **486** of any type known in the art. In some embodiments, cyclone unit front door **472** may be resiliently bendable to connect with cyclone unit **112** by a living hinge.

Still referring to FIGS. **1** and **18**, the openable cyclone unit wall is locked in the closed position, and manually user openable (e.g. by hand). This allows the openable cyclone unit wall to remain closed while the apparatus **100** is operating, and allows the user to selectively open the openable cyclone unit wall to empty the cyclone **160** and dirt collection chamber **164** inside when the apparatus **100** is turned off. In the illustrated example, cyclone unit **112** includes a door lock **492**, which inhibits opening of cyclone unit front door **472** when engaged. Door lock **492** is user operable to disengage door lock **492** to thereby permit cyclone unit front door **472** to move to its open position.

Door lock **492** may be any type of lock suitable for retaining cyclone unit front door **472** in its closed position, and which is user releasable to permit cyclone unit **112** to open. In some embodiments, door lock **492** may have a manually operable actuator for moving the lock between its engaged and disengaged positions. In the illustrated embodiment, door lock **492** includes an engaging member **496** and an actuator **504**.

Preferably, actuator is positioned proximate the air treatment member handle **344** so that a user may operate actuator **504** with the same hand that is used to hold handle **344**. For example, actuator **504** may be located within close proximity (e.g. finger-reach) of handle **344**, e.g., it may be provided on or adjacent handle **344** and may be provided at the end

of handle **344** at which the door is located. Accordingly while holding handle **344**, the user may use their thumb of the same hand to operate actuator **504**, i.e., door release actuator **504** may be operated by the same hand which is holding the cyclone unit **112** for single-handed emptying of cyclone unit **112**. In the illustrated embodiment, unit door release actuator **504** is positioned forward of handle **344** on upper portion **348** (e.g. at a forward end of inlet passage **380**). In other embodiments, door release actuator **504** may be located on handle **344**, or rearwardly of handle **344**.

As exemplified in FIGS. **20** and **21**, the door release actuator **504** is manually user operable (i.e. by hand) to move the engaging member **496** between its engaged position (FIG. **20**) and its disengaged position (FIG. **21**). As exemplified, in the engaged position (FIG. **20**), door release actuator **504** may engage cyclone unit front door **472** to inhibit movement of front door **472** to its open position. This prevents front door **472** from rotating about its cyclone unit wall pivot axis **480** to its open position. In the disengaged position (FIG. **21**), door release actuator **504** releases cyclone unit front door **472** to permit front door **472** to move to its open position.

Referring to FIGS. **19-21**, lock engaging member **496** may be of any construction having an engaged position for retaining the openable cyclone unit wall in its closed position, and a disengaged position for releasing the openable cyclone unit to move to its open position. In the illustrated example, lock engaging member **496** is connected to an exterior of air treatment member **112**. As exemplified, lock engaging member **496** has a front end **508** which is sized and positioned to releasably hook onto a recess **512** formed in cyclone unit front door **472** to retain the front door **472** in its closed position.

Lock engaging member **496** may be movable in any suitable manner between its engaged and disengaged positions. For example, lock engaging member **496** may be rotatable as shown, translatable, or combinations thereof. In the illustrated embodiment, lock engaging member **496** is pivotally connected to air treatment member **112** for rotation about a lock engaging member axis **516** (FIG. **19**) between its engaged and disengaged positions. As exemplified, in the engaged position, lock engaging member **496** may hook onto front wall lock recess **512**. Lock engaging member **496** may then be rotated about its axis **516** away from cyclone unit front door **472** to unhook from front wall lock recess **512**. Optionally, lock engaging member **496** may be biased to the locked position. For example, a biasing member (e.g. torsional spring, not shown) may bias lock engaging member **496** to rotate toward the closed position.

Still referring to FIGS. **19-21**, door lock **492** may have any door release actuator **504** suitable for moving the lock engaging member **496** between its engaged and disengaged positions. In the illustrated example, door release actuator **504** is formed as a button which is operable to rotate lock engaging member **496** to its unlocked position. As exemplified, door release actuator **504** and lock engaging member **496** may both include abutments **520** and **524**, respectively, which make contact to move lock engaging member **496** when door release actuator **504** is depressed. In this example, when door release actuator **504** is depressed, abutment **520** moves abutment **524** downwardly which teeters lock engaging member **496** to rotate about its lock engaging member axis **516** to its disengaged position. It will be appreciated that door release actuator **504** may be movable in any suitable manner. For example, door release actuator **504** may be rotatable (e.g. pivotal) as shown, or translatable (e.g. slidable). In the illustrated example, door release actuator **504** is rotatably connected to cyclone unit **112** about a lock actuator axis **528** between its raised position (FIG. **20**) and its depressed position (FIG. **21**).

Air Treatment Member Door Control

The following is a description of systems and methods for controlling an openable door of an air treatment member that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the air treatment member door actuator, uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, the pre-motor filter housing door, the counterweight stand, and the electrical coupling members.

The air treatment member may include an openable door that provides access to empty or clean the air treatment member (e.g. to empty or clean a dirt collection region of the air treatment member). In accordance with this aspect, the air treatment member door may be inhibited or prevented from opening when an accessory (e.g. a cleaning tool such as a wand (e.g. a rigid airflow conduit), crevice tool, mini brush, or the like) is connected to or in fluid communication with a dirty air inlet.

In some embodiments, an accessory may be removably connectable to a dirty air inlet of the surface cleaning apparatus, and when the accessory is connected to the dirty air inlet, the accessory may itself physically inhibit an openable door from opening. For example, when the openable door is closed and the accessory is connected to the dirty air inlet, the accessory may overlie or abut at least a portion of the openable door.

An example of such an embodiment is illustrated in FIGS. **5** and **5**A. As exemplified a dirty air inlet **116** of surface cleaning apparatus **100** is the inlet end **124** of an inlet passage **128**. In the illustrated example, the dirty air inlet **116** is connected to a wand **136**. As seen in FIG. **5**A, the outlet end **612** of the wand **136** has a collar **702** which is sized to overly a portion of the openable door of the cyclone assembly. Accordingly, when the wand is connected to the dirty air inlet, collar **702** abuts a portion of an openable front end **472** (which may also be referred to as a cyclone unit front door **472**) of air treatment member **112**, thereby inhibiting or preventing the openable door from opening when the wand is connected. When wand **136** is disconnected from dirty air inlet **116**, collar **702** no longer abuts openable door **472**, and thus no longer inhibits door **472** from opening.

In some embodiments, the surface cleaning apparatus may include an openable door lock which is moveable between a closed position which inhibits the opening of an openable door of an air treatment member and an open position in which the door may be opened. The door lock is preferably user operable to disengage the door lock to thereby permit the door to move to its open position. In such embodiments, when an accessory is connected to the dirty air inlet, the door lock may be inhibited or prevented from being disengaged. The accessory may itself inhibit the door lock from moving to the open position or it may actuate a mechanism (a motorized mechanism or a mechanical mechanism) that inhibits the door lock from moving to the open position.

In the example illustrated in FIGS. **31** and **32**, a door lock **492** inhibits opening of cyclone unit front door **472** when engaged. In the illustrated embodiment, door lock **492** includes an engaging member **496** which, when the door lock is in the closed position that is exemplified in FIG. **31**, abuts door **472**. Door lock **492** also comprises an actuator

504. As exemplified, door release actuator **504** and lock engaging member **496** may both include abutments **520** and **524**, respectively, which make contact to move lock engaging member **496** when door release actuator **504** is depressed to move the door lock to the open position (see FIG. **32**).

In the illustrated example, an accessory itself has a blocking member that, when the accessory is connected to the dirty air inlet, inhibits the door lock from being disengaged. As exemplified, an outlet end **612** of a wand **136** includes a flange **710** that, when the wand **136** is connected to the dirty air inlet **116** (as shown in FIG. **31**), is interposed between the abutment **520** of door release actuator **504** and the abutment **524** of lock engaging member **496**. In this position, flange **710** is a physical barrier between the abutments **520** and **524** and thereby inhibits door release actuator **504** from moving lock engaging member **496**, thereby inhibiting door **472** from being moved to an open position. When the accessory is disconnected from the dirty air inlet **116** (as shown in FIG. **32**), flange **710** no longer inhibits door release actuator **504** from moving lock engaging member **496**.

In the example illustrated in FIGS. **33** and **34**, the accessory physically engages the door release actuator **504** to thereby inhibit the door lock from being disengaged. For example, door release actuator **504** may have an engagement portion, and a blocking member of an accessory tool may have a mating engagement portion. The engagement portions may interengage when the accessory is mounted to the inlet. As exemplified, an engagement portion in the form of a notch **720** is provided along shaft **725** of door release actuator **504**.

As shown in FIG. **33**, when the wand **136** is connected to the dirty air inlet **116**, an engagement portion of the wand **136** (e.g., flange **710**) is received in the notch **720**. In this position, flange **710** inhibits door release actuator **504** from moving towards lock engaging member **496**, thereby inhibiting door **472** from being moved to an open position. When the accessory is disconnected from the dirty air inlet **116** (as shown in FIG. **34**), flange **710** no longer engages the engagement portion **720**, and thus no longer inhibits door release actuator **504** from moving lock engaging member **496** to its disengaged position.

FIGS. **35** and **36** exemplify an embodiment wherein the accessory actuates a mechanical mechanism that inhibits the door lock from moving to the open position. As exemplified, the surface cleaning apparatus includes a lock deactivation member that, when an accessory is connected, inhibits the door lock from being disengaged. As exemplified, a lock deactivation member is in the form of a bar **740** that is translatable between a position in which the door lock is inhibited from being disengaged (the closed position of the door lock) and a position in which the door lock is not inhibited from being disengaged (the open position of the door lock).

As shown in FIG. **35**, when the wand **136** is connected to the dirty air inlet **116**, bar **740** is moved to a position in which it is interposed between the abutment **520** of door release actuator **504** and the abutment **524** of lock engaging member **496**. In this position, bar **740** inhibits door release actuator **504** from moving lock engaging member **496**, thereby inhibiting door **472** from being moved to an open position. In FIG. **36**, the accessory is disconnected from the dirty air inlet **116**, and bar **740** has moved so that it no longer inhibits door release actuator **504** from moving lock engaging member **496**. It will be appreciated that bar **740** may be moved to the open position of the door lock shown in FIG. **36** by wand **136** pulling the bar to the open position, bar **740** being biased to the open position, or the like.

In some embodiments, an openable door lock may be moved to an engaged position by connecting an accessory tool to the surface cleaning apparatus, and moved to a disengaged position by disconnecting the accessory tool from the surface cleaning apparatus. That is, instead of inhibiting or preventing a door lock from being released, connection of an accessory to a dirty air inlet may positively engage a door lock to inhibit or prevent the openable door from opening.

In the example illustrated in FIGS. **37** and **38**, a door lock **492** inhibits opening of cyclone unit front door **472** when engaged. In the illustrated embodiment, door lock **492** includes an engaging member **496** and an actuator **504**. As exemplified, door release actuator **504** includes a rounded abutment surface **520**, and lock engaging member **496** includes an angled abutment surface **524**. As exemplified in FIG. **37**, when an accessory is connected to the dirty air inlet **116**, actuator **504** is driven against lock engaging member **496**, and the interaction of the abutment surfaces results in engaging member **496** being driven towards a recess **512** formed in cyclone unit front door **472** to retain the front door **472** in its closed position. When the accessory is disconnected a biasing member such as a spring **750** retracts or draws engaging member **496** towards a disengaged position, as shown in FIG. **38**. In this position, door lock **492** does not inhibit door **472** from being moved to an open position.

Counterweight Stand

The following is a description of a counterweight stand that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, the pre-motor filter housing door, the air treatment member door actuator, the air treatment member door control, and the electrical coupling members.

In accordance with this aspect, the apparatus may include a counterweight positioned to adjust the apparatus center of gravity for reducing user-torque required to orient the apparatus at common operating angles. The counterweight may be located at a lower end of the main body to provide a stand for supporting the apparatus on a horizontal surface. The counterweight may be formed by a removable member (e.g. energy storage member), or a permanently attached or integrally molded member (e.g. ribs).

As exemplified in FIG. **23**, apparatus **100** includes a counterweight stand **564**. The counterweight stand **564** may have any configuration suitable for helping to support apparatus **100** on horizontal surface and for influencing the center of gravity of apparatus **100**. As exemplified, counterweight stand **564** may be connected to apparatus lower end **292** for supporting apparatus **100** when apparatus lower end **292** is placed on a horizontal surface (e.g. for storage). In various embodiments, counterweight stand **564** may be connected to main body **104**, air treatment member **112**, or both. In the illustrated embodiment, counterweight stand **564** is connected to main body lower end **568** to define at least a portion of a lower wall of main body **104** for supporting apparatus **100** on a horizontal surface.

Counterweight stand **564** may be of any size and weight suitable for providing stable support and for influencing the apparatus center of gravity. For example, counterweight stand **564** may be formed of the same material as main body

exterior wall **212** (e.g. plastic), and may be formed as a solid member, a hollow member, a porous member, or a plurality of spaced apart members. In the illustrated embodiment, counterweight stand **564** is formed as a plurality of spaced apart counterweight ribs **572** that are integrally formed with the main body exterior wall **212**. As exemplified, counterweight ribs **572** may be rearwardly extending and laterally spaced apart. This allows the counterweight ribs **572** to be distributed across a large area to form a base that nay itself or with bottom **125** stably support the apparatus **100** on a horizontal surface. The collective weight of ribs **572**, and thus their influence on the apparatus center of gravity, is determined by varying the number, density, spacing, and distribution of the counterweight ribs **572**. In alternative embodiments, counterweight stand **564** may be formed by a hollow member, and the weight of the counterweight stand **564** is determined by the fill density inside the block. In some embodiments, counterweight stand **564** may be formed from a different material than main body exterior wall **212**, such as a material of greater density to provide greater stability and influence on center of gravity.

Still referring to FIG. **23**, the counterweight stand **564** may be integrally formed, permanently connected, or removably connected to apparatus **100**. In the illustrated embodiment, counterweight stand **564** is permanently connected to apparatus **100**. As exemplified, apparatus **100** may be a corded appliance having a power cord connector **576** for permanently or removably receiving a power cord (not shown) that is connectable to an external power source (e.g. wall outlet). Turning to FIGS. **4** and **24**, another embodiment of apparatus **100** is shown including a counterweight stand **564** formed as an energy storage member **580** (e.g. battery). Energy storage member **580** may be permanently or removably connected to apparatus **100**, and may have a size and weight suitable for helping to support apparatus **100** on a horizontal surface **584** and influencing the center of gravity of apparatus **100**.

Electrical Coupling Members

The following is a description of an electrical coupling members that may be used by itself in any surface cleaning apparatus or in any combination or sub-combination with any other feature or features disclosed herein including the uniflow cyclone, the positioning of the dirt collection chamber, the orientation of the suction motor, the lateral stability members, the air treatment member handle, the position and orientation of a driving handle, the pre-motor filter housing door, the air treatment member door actuator, the air treatment member door control, and the counterweight stand.

In accordance with this aspect, the apparatus may include an electrical outlet with electrical conductor element(s) that are movable from a circuit closed position to a circuit open position upon removal of an accessory tool such as a wand, crevice tool, mini brush or the like. The accessory tool which is mounted on the apparatus may have a member which engages a driven member on the apparatus. When engaged, the driven member mechanically moves an element of the circuit to open the circuit so that the electrical conductor elements on the apparatus are not live. This allows the electrical outlet to be safe to touch when the accessory tool is disconnected.

Referring to FIG. **1**, connector **128** may be any suitable connector that is operable to connect to, and preferably detachably connect to, a hose, cleaning tool or other accessory tool. Optionally, in addition to providing an air flow connection, connector **128** may also include an electrical connection. Providing an electrical connection may allow accessory tools that are coupled to the connector **128** to be powered by the surface cleaning apparatus **100**. For example, the surface cleaning unit **100** can be used to provide both power and suction to a surface cleaning head, or other suitable accessory tool. In the illustrated embodiment, the connector **128** includes an electrical outlet **144** in the form of a female socket member, and a corresponding male connector member may be provided on the hose, cleaning tool or other accessory tool that is connected to the connector inlet end **124**. In other embodiments, electrical outlet **144** may include male connectors.

As exemplified in FIG. **25**, apparatus **100** includes an electrical circuit **642** between a source of power and electrical conductor elements **588**. The source of power may be an energy storage member **580** (e.g. battery) or a power cord **628** (connectable to an external power outlet), for example. In accordance with this aspect, electrical conductor elements **588** may be de-energized when not connected with a mating electrical coupling (e.g. of a power accessory). This may prevent user injury from being hurt by inadvertent contact with the electrical conductor elements **588**.

The electrical circuit **642** may include two or more electrical conductor elements **588**, at least one of which, and preferably two of which, may be movable between a circuit closed position and a circuit open position, and biased to the circuit open position. In the circuit closed position, the electrical conductor element **588** is electrically connected to the source of power. In the circuit open position, the electrical conductor **588** is electrically disconnected from the source of power. Accordingly, at least one of the electrical conductor elements **588** is normally electrically disconnected from the source of power, which may prevent accidental electric shock. In use, the electrical conductor element **588** is moved to the circuit closed position upon attaching an accessory tool to dirty air inlet **116**.

In one embodiment, the electrical conductor elements **588** may be moved to the circuit closed position by engagement with the electrical conductor elements of an accessory tool. Accordingly, when the accessory tool is mounted on inlet **116**, the electrical conductor elements of the accessory tool may drive electrical conductor elements **588** to the circuit closed position.

As exemplified, electrical conductor elements **588** may be a rigid rod movably mounted in a housing **596** of electrical outlet **144**. Each electrical conductor element **588** extends from a first contact end **640** to a second contact end **644**. The first contact end **640** may be an accessory tool contact end which makes electrical contact with a mating electrical conductor element of an attached accessory tool. The second contact ends **644** may be a terminal end contact end which makes electrical contact with the terminal ends **636** of electrical conductive members **590** when the electrical conductor elements **588** are in a circuit closed position. Accordingly, when an accessory tool is electrically connected to electrical outlet **144** and electrical conductor elements **588** are in the circuit closed position, the conductor element **588** can conduct electricity from the source of power to the connected accessory tool.

It will be appreciated that electrical conductive members (e.g. wires) **590** extend from the source of power to terminal ends **636**. One or both of electrical conductor elements **588** may be movable between a circuit closed position, in which second contact end **644** contacts terminal end **636** of an electrical conductive member **590**, and a circuit open position, in which second contact end **644** is spaced apart from the terminal ends **636** of electrical conductive members **590**. For example, one or both of electrical conductor elements **588** may be axially slidable in electrical outlet housing

between the circuit open and circuit closed positions. In the illustrated example, electrical conductor elements **588** are rearwardly slideable in rearwardly extending housing channels **604** formed in electrical outlet housing **596**.

In some embodiments, the first end **640** of one or both of electrical conductor elements **588** may be recessed into the electrical outlet **144** when in the circuit open position. For example, first end **640** may be positioned rearwardly of electrical outlet front end **608**.

Electrical conductor element **588** may be biased to the circuit open position in any manner. For example, electrical outlet **144** includes a biasing member **648** that applies a biasing force urging electrical conductor element **588** toward the circuit open position. In the illustrated example, biasing member **648** is a compression spring positioned between the electrical conductor element **588** and the terminal end **636** of electrical conductive member **590** which urges electrical conductor element **588** forwardly. The force of biasing member **648** may be overcome when connecting an accessory tool to dirty air inlet **116** to move the electrical conductor element **588** rearwardly to the circuit closed position. Preferably, biasing member **648** is substantially non-electrically conductive. For example, biasing member **648** may be formed of (or coated with) plastic, rubber, a non-conductive metal or another substantially non-electrically conductive material. This helps to prevent biasing member **648** from short circuiting electrical circuit **642** or electrically connecting electrical conductor element **588** and terminal end **636** when the electrical conductor element **588** is in the closed position.

It will be appreciated that, in an alternate embodiment, electrical conductor elements **588** may be mounted in a moveable (e.g., plastic or other non-conductive material) housing and the housing may have an engagement member that is engaged by, e.g., a protrusion or finger provided on the accessory tool. In this way, the electrical conductor elements of the accessory tool need not be used to drive the circuit **642** to a closed position.

In some embodiments, main power switch **650**, which is movable between a circuit closed position and a circuit open position to energize the suction motor, may be part of electrical circuit **642**. The power switch may be manually user. In the circuit open position, power switch **650** electrically disconnects electrical terminal end **636** from the power source. In the circuit closed position, power switch **650** electrically connects circuit terminal end **636** with the power source.

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.

The invention claimed is:

1. A surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable to the dirty air inlet wherein, when the accessory is connected to the dirty air inlet, the openable door is inhibited from opening; and,

(d) an openable door lock comprising a lock engaging member and a door release actuator drivingly connected to the lock engaging member, the lock engaging member moveable between an engaged position in which the lock engaging member secures the openable door in a closed position and a disengaged position in which the openable door is openable wherein the lock engaging member is inhibited from moving to the disengaged position when the accessory is connected to the dirty air inlet.

2. The surface cleaning apparatus of claim **1** further comprising a front end having the dirty air inlet and the openable door is provided on the front end.

3. The surface cleaning apparatus of claim **1** wherein the accessory is removably mounted to the dirty air inlet.

4. The surface cleaning apparatus of claim **1** wherein, when the accessory is connected to the dirty air inlet, the accessory physically inhibits the openable door from opening.

5. The surface cleaning apparatus of claim **4** wherein, when the accessory is connected to the dirty air inlet, the accessory overlies a portion of the openable door.

6. The surface cleaning apparatus of claim **5** wherein, when the accessory is connected to the dirty air inlet, the accessory abuts a portion of the openable door.

7. The surface cleaning apparatus of claim **1** wherein the accessory has a blocking portion which inhibits the lock engaging member moving to the disengaged position when the accessory is connected to the dirty air inlet.

8. The surface cleaning apparatus of claim **7** wherein the openable door lock includes a moveable portion which moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion has an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

9. The surface cleaning apparatus of claim **8** wherein the moveable portion is part of a drive member drivingly connecting the door release actuator to the lock engaging member.

10. The surface cleaning apparatus of claim **1** further comprising a lock deactivation member and the accessory has a blocking portion which activates the lock deactivation member when the accessory is connected to the dirty air inlet.

11. The surface cleaning apparatus of claim **10** wherein the lock deactivation member includes a moveable portion which moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion has an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

12. The surface cleaning apparatus of claim **1** wherein the accessory is a longitudinally extending rigid member air flow member, an accessory cleaning tool, or a flexible hose.

13. A surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door wherein the dirty air inlet is positioned above the air treatment member;

(c) an accessory removably connectable to the dirty air inlet wherein,

wherein the openable door has first and second opposed sides, the first side having a hinge for the openable door and the second opposed side is positioned adjacent the dirty air inlet such that, when the accessory is connected to the dirty air inlet, the accessory overlies the second opposed side thereby inhibiting the openable door from opening.

14. A surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable in air flow communication with the dirty air inlet; and,

(d) an openable door lock comprising a lock engaging member and a door release actuator drivingly connected to the lock engaging member, the lock engaging member is moveable between an engaged position in which the lock engaging member secures the openable door in a closed position and a disengaged position in which the openable door is openable wherein the lock engaging member is inhibited from moving to the disengaged position when the accessory is connected in air flow communication with the dirty air inlet.

15. The surface cleaning apparatus of claim **14** wherein the accessory has a blocking portion which inhibits the lock engaging member moving to the disengaged position when the accessory is connected to the dirty air inlet.

16. The surface cleaning apparatus of claim **15** wherein the openable door lock includes a moveable portion which moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion has an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

17. The surface cleaning apparatus of claim **16** wherein the moveable portion is part of a drive member drivingly connecting the door release actuator to the lock engaging member.

18. A surface cleaning apparatus comprising:

(a) an air flow path from a dirty air inlet to a clean air outlet and including a suction motor;

(b) an air treatment member comprising a dirt collection region having an openable door;

(c) an accessory removably connectable in air flow communication with the dirty air inlet; and,

(d) an openable door lock securing the openable door in a closed position, a lock deactivation member and the accessory has a blocking portion which moves the lock deactivation member to a blocking position which inhibits the openable door lock moving to a door openable position when the accessory is connected in air flow communication with the dirty air inlet.

19. The surface cleaning apparatus of claim **18** wherein the accessory has a blocking portion which inhibits the lock engaging member moving to the disengaged position when the accessory is connected to the dirty air inlet.

20. The surface cleaning apparatus of claim **19** wherein the openable door lock includes a moveable portion which moves along a path from a first position when the lock engaging member is in the engaged position to a second position when the lock engaging member is in the disengaged position, the moveable portion has an abutment surface and the blocking portion is positioned in the path of the abutment surface when the accessory is connected to the dirty air inlet.

* * * * *