US 20150040342A1

(19) **United States**

(12) **Patent Application Publication**

Henderson

(10) **Pub. No.: US 2015/0040342 A1**

(43) **Pub. Date: Feb. 12, 2015**

(54) **VACUUM CLEANER INCLUDING A REMOVABLE HANDLE ASSEMBLY**

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(21) Appl. No.: **13/963,648**

(22) Filed: **Aug. 9, 2013**

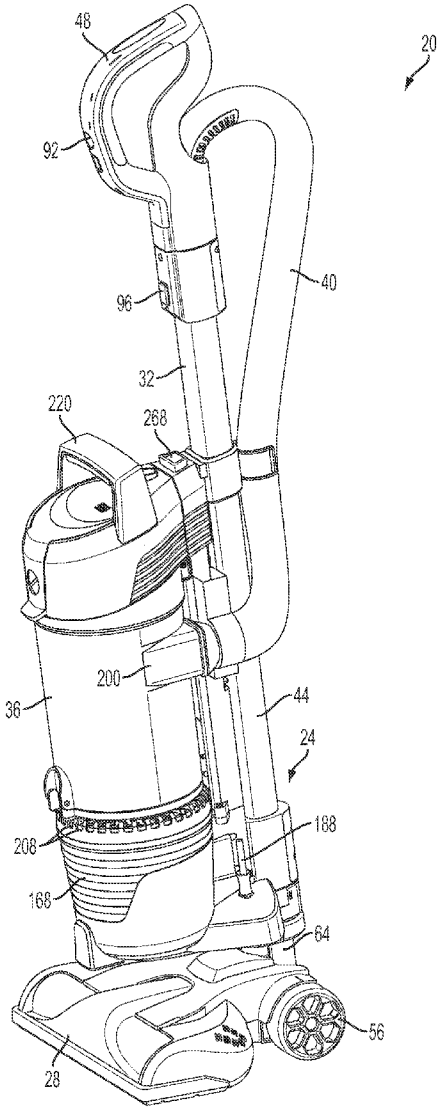
Publication Classification

(51) **Int. Cl.**
A47L 5/28 (2006.01)

(52) **U.S. Cl.**
CPC *A47L 5/28* (2013.01)
USPC **15/347**; 15/415.1; 15/363

(57) **ABSTRACT**

A vacuum cleaner includes a base having a foot with a suction nozzle and a handle assembly removably coupled to the foot. The handle assembly is movable between a first position, in which the handle assembly is connected to the foot, and a second position, in which the handle assembly is disconnected to the foot. The vacuum cleaner also includes a canister assembly supported by the base. The canister assembly is removable from the base. The vacuum cleaner further includes a latch supported by one of the foot and the handle assembly. The latch is engageable with the other of the foot and the handle assembly to selectively secure the handle assembly to the foot. The latch is inaccessible when the canister assembly is supported by the base.



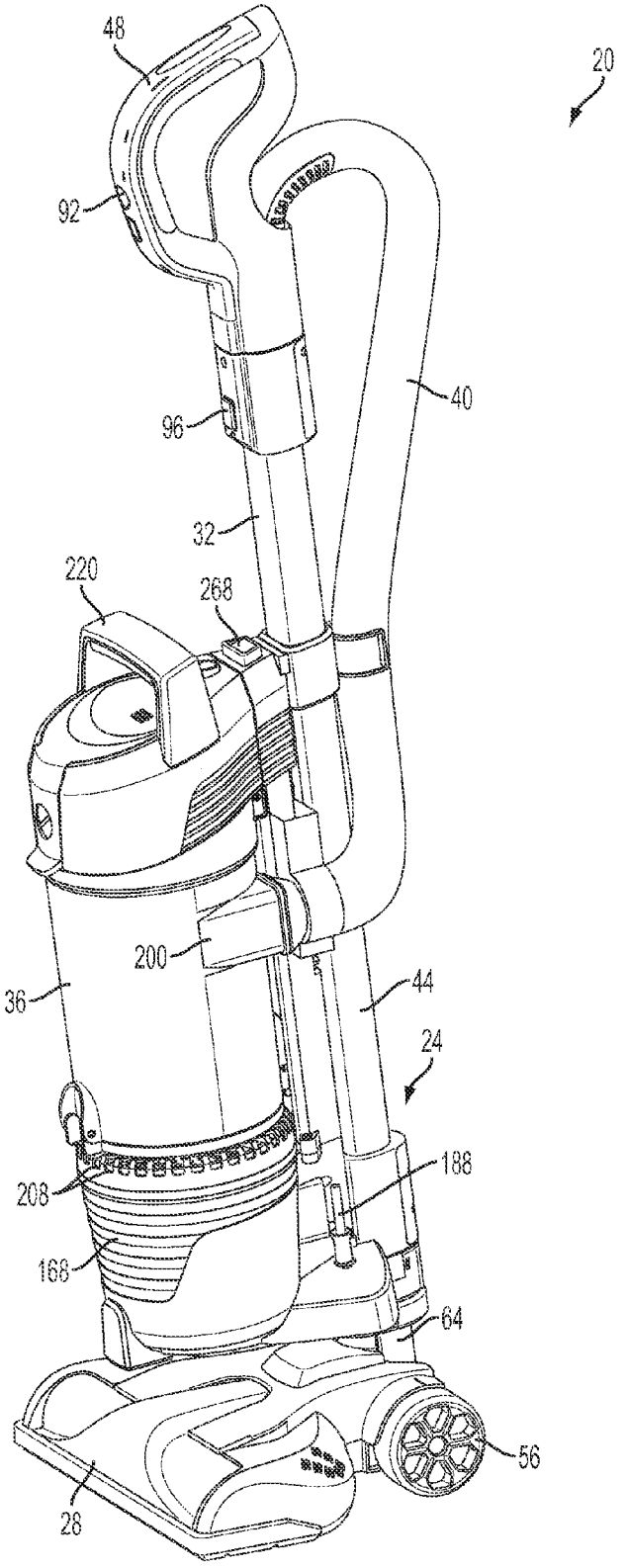


FIG. 1A

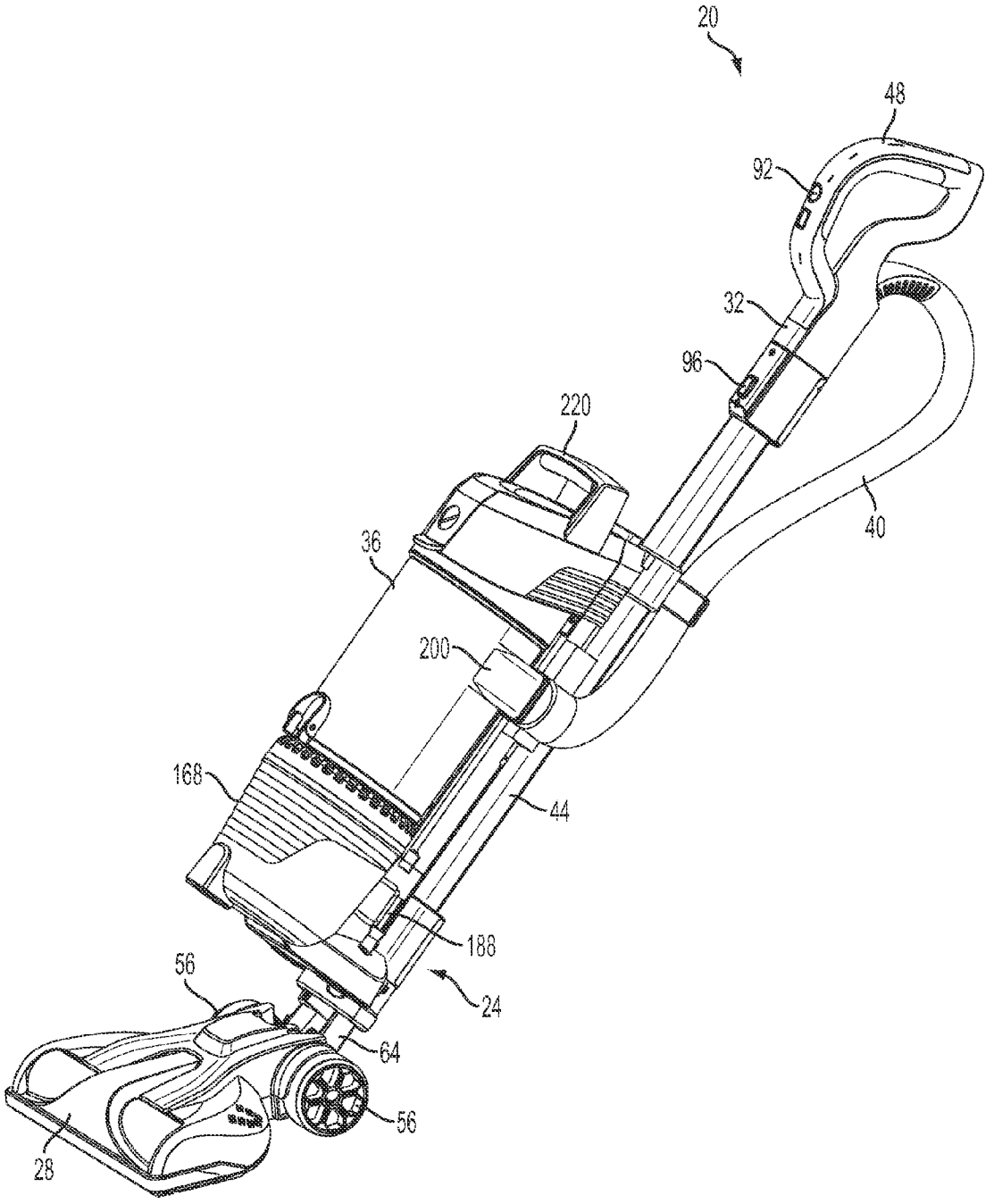


FIG. 1B

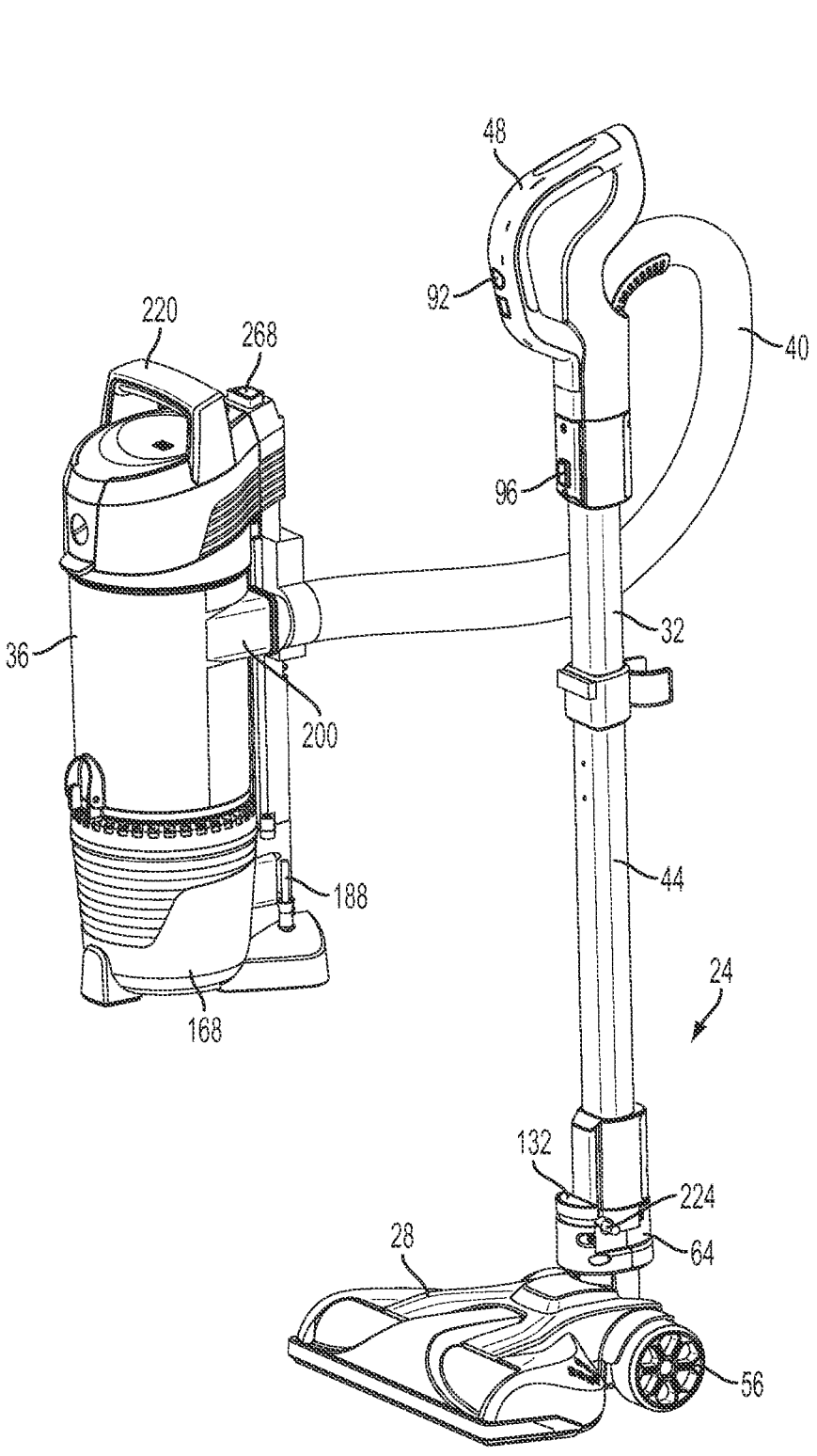


FIG. 2

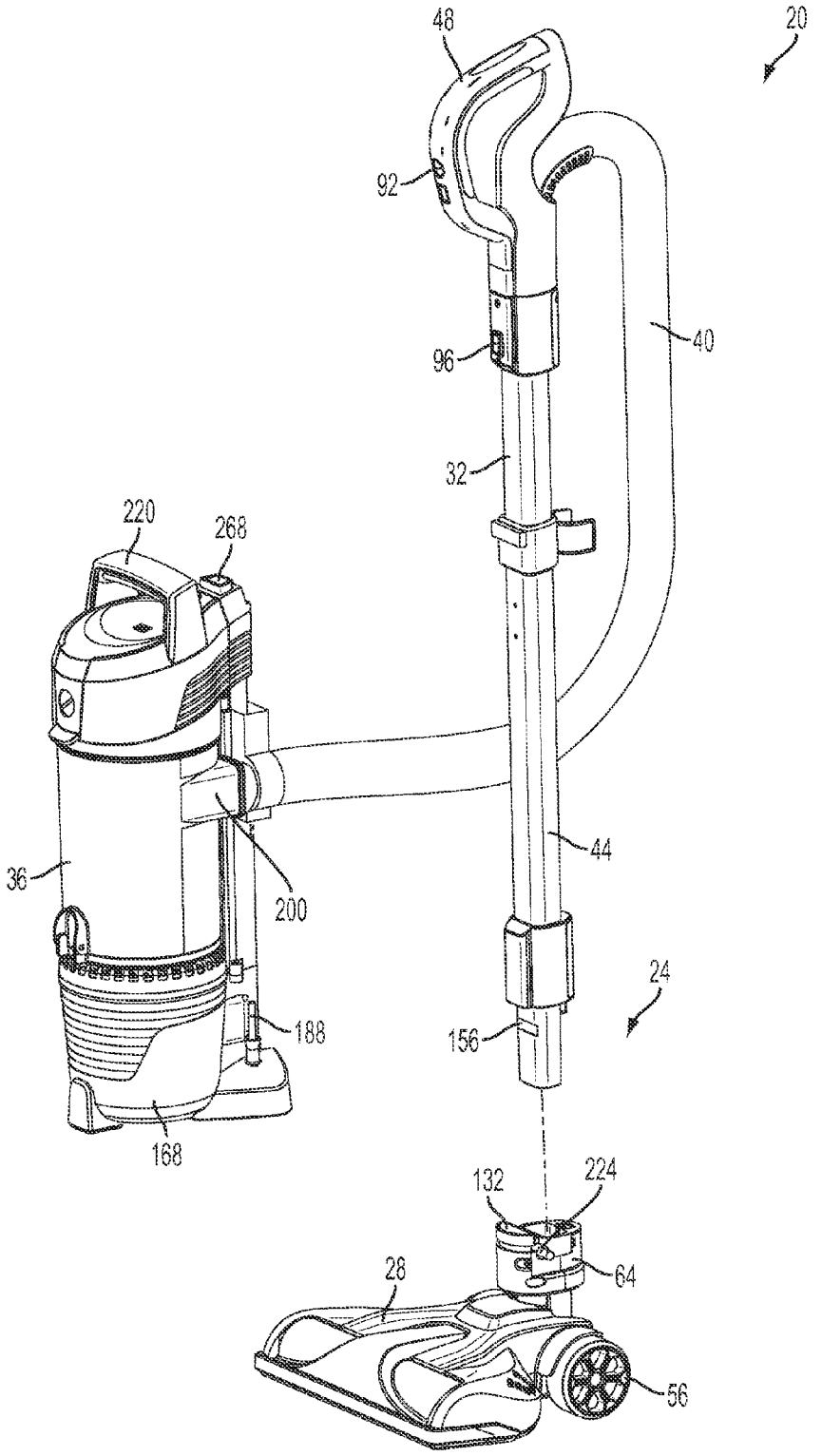


FIG. 3

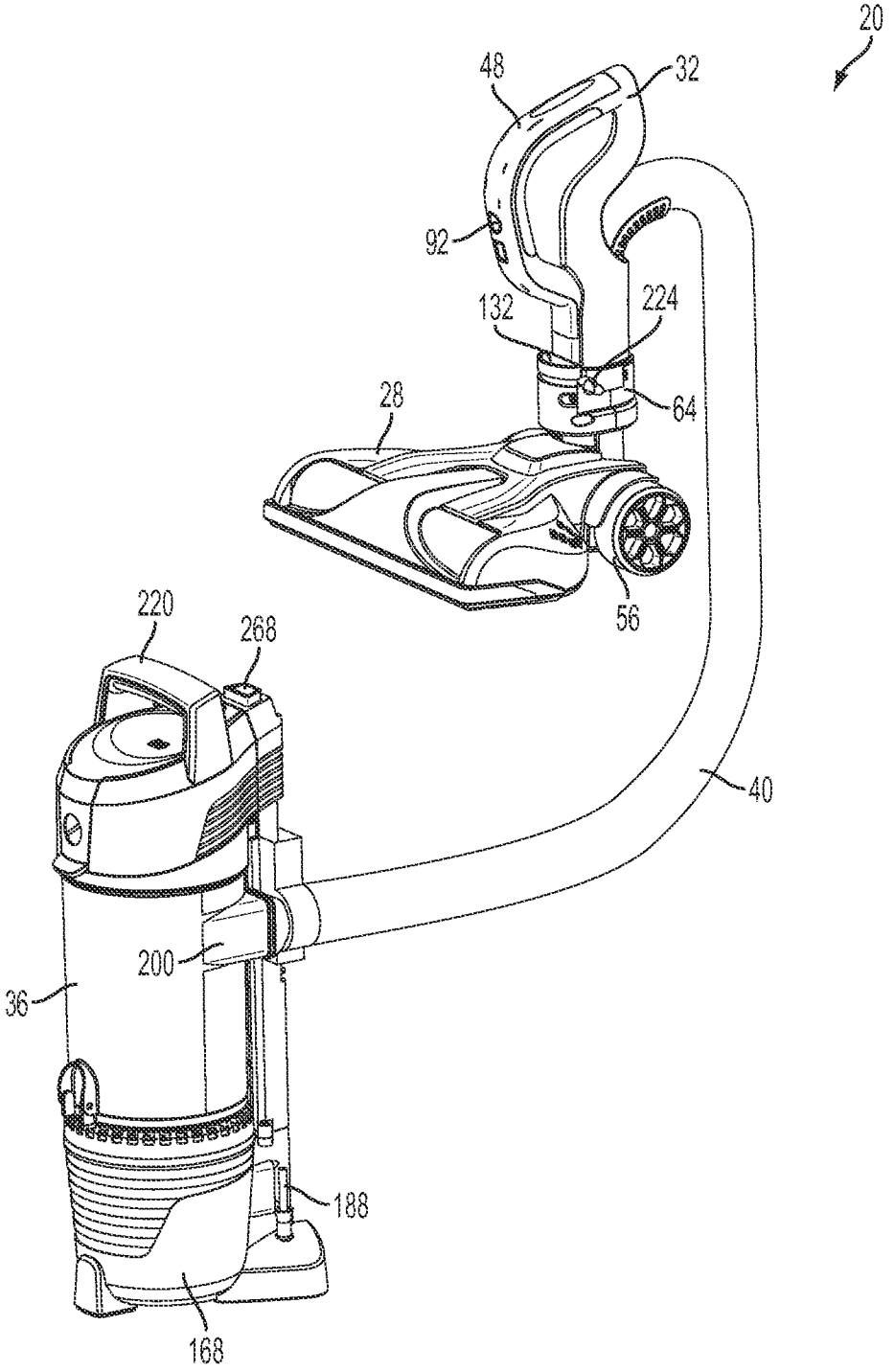
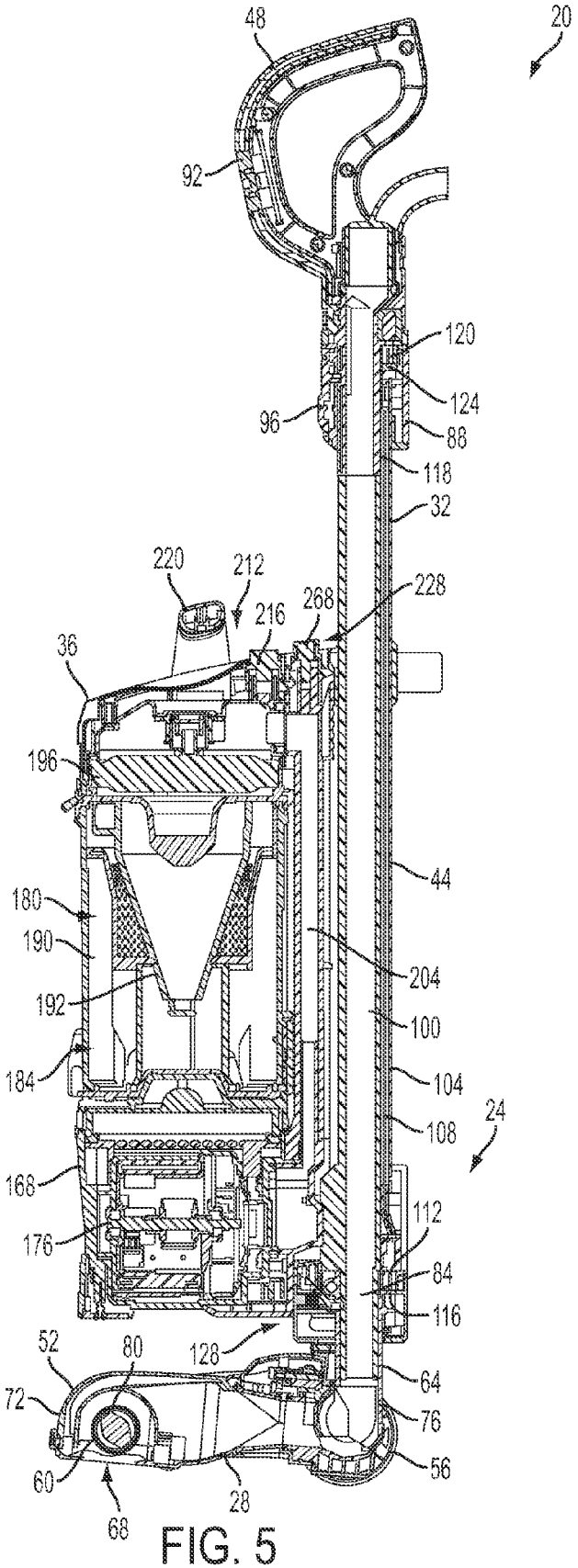


FIG. 4


48
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92
120
124
96
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118
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220
212
228
268
216
36
196
44
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204
192
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184
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176
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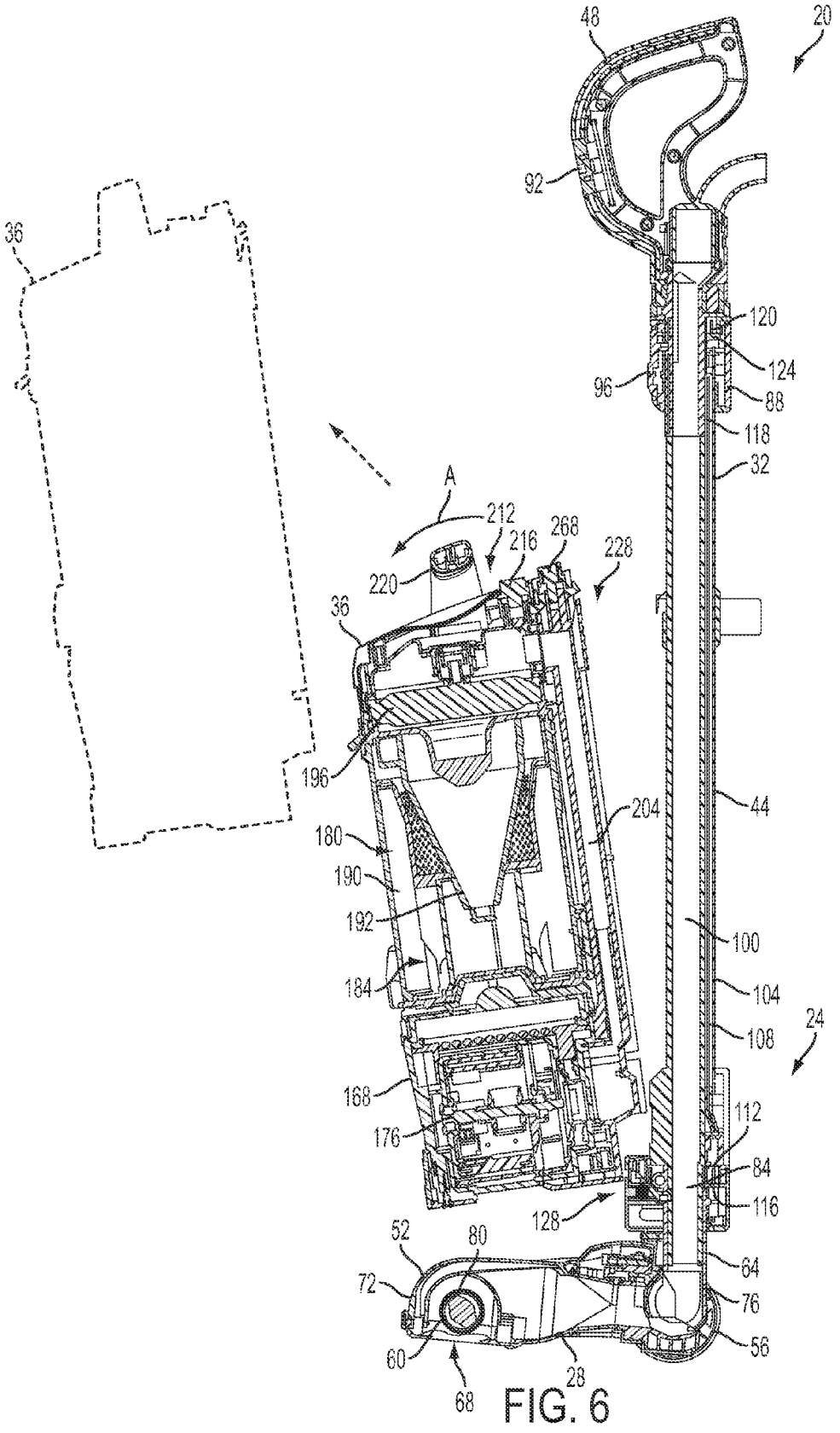
68

FIG. 5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28

FIG. 6

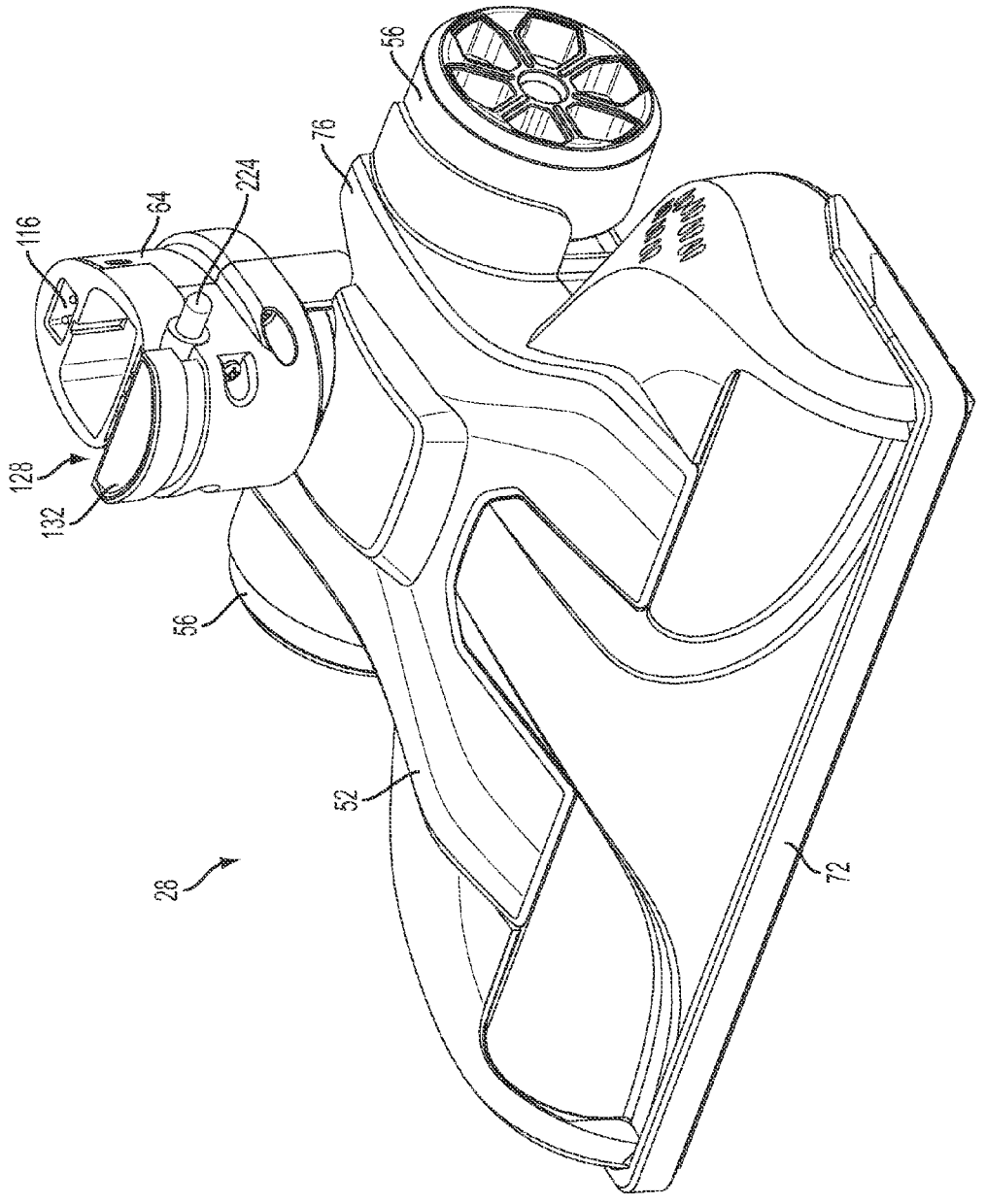


FIG. 7

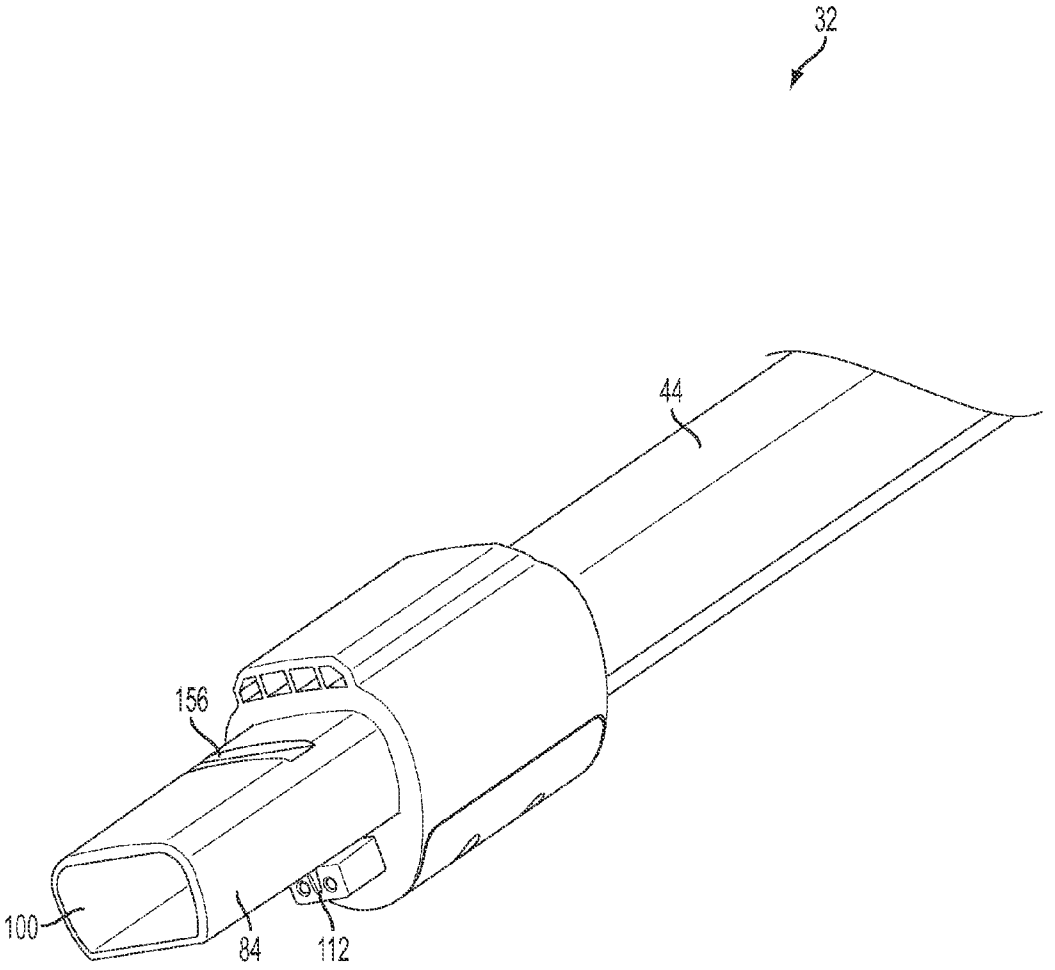
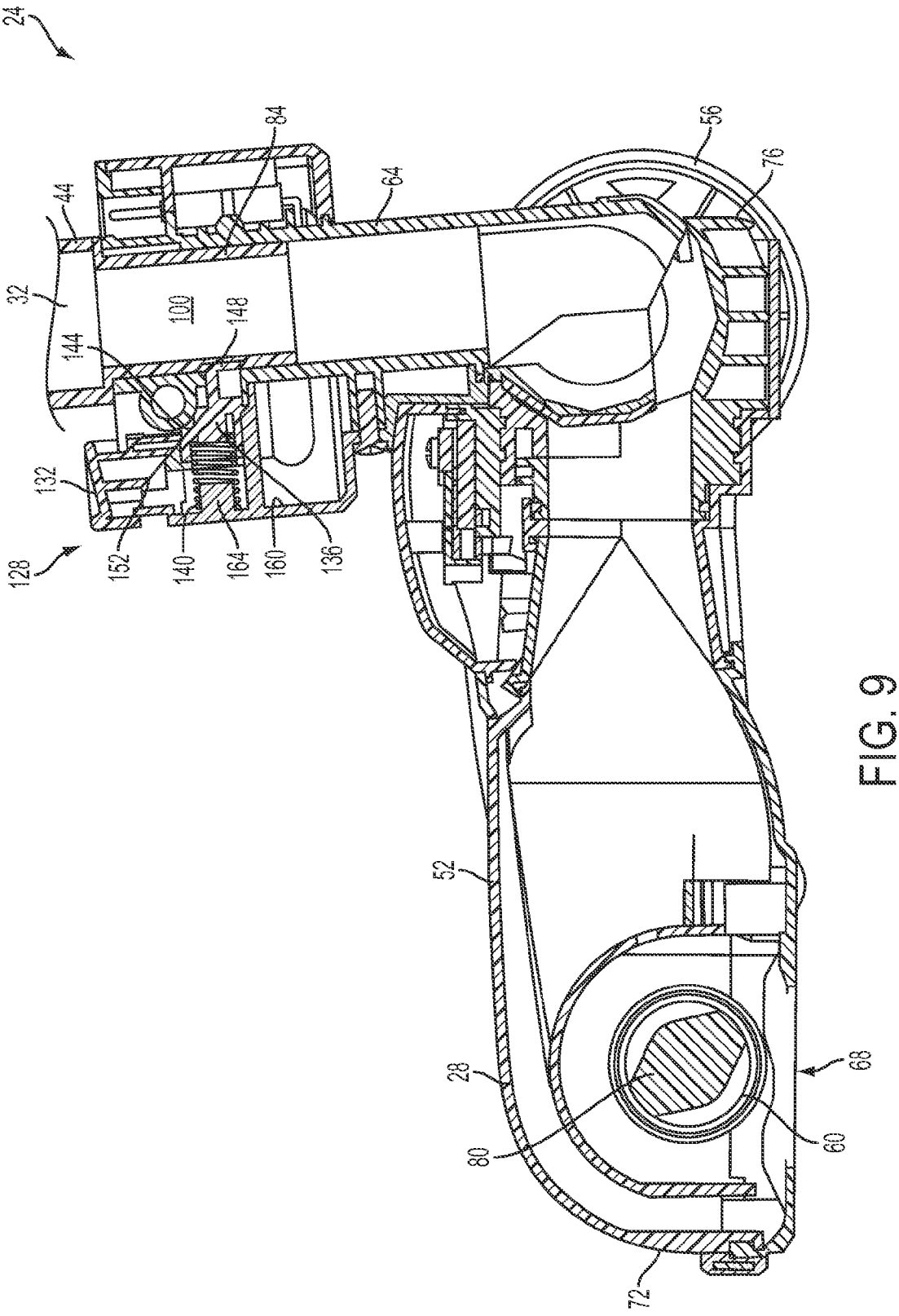


FIG. 8


24
84
56
44
64
76
32
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152
140
164
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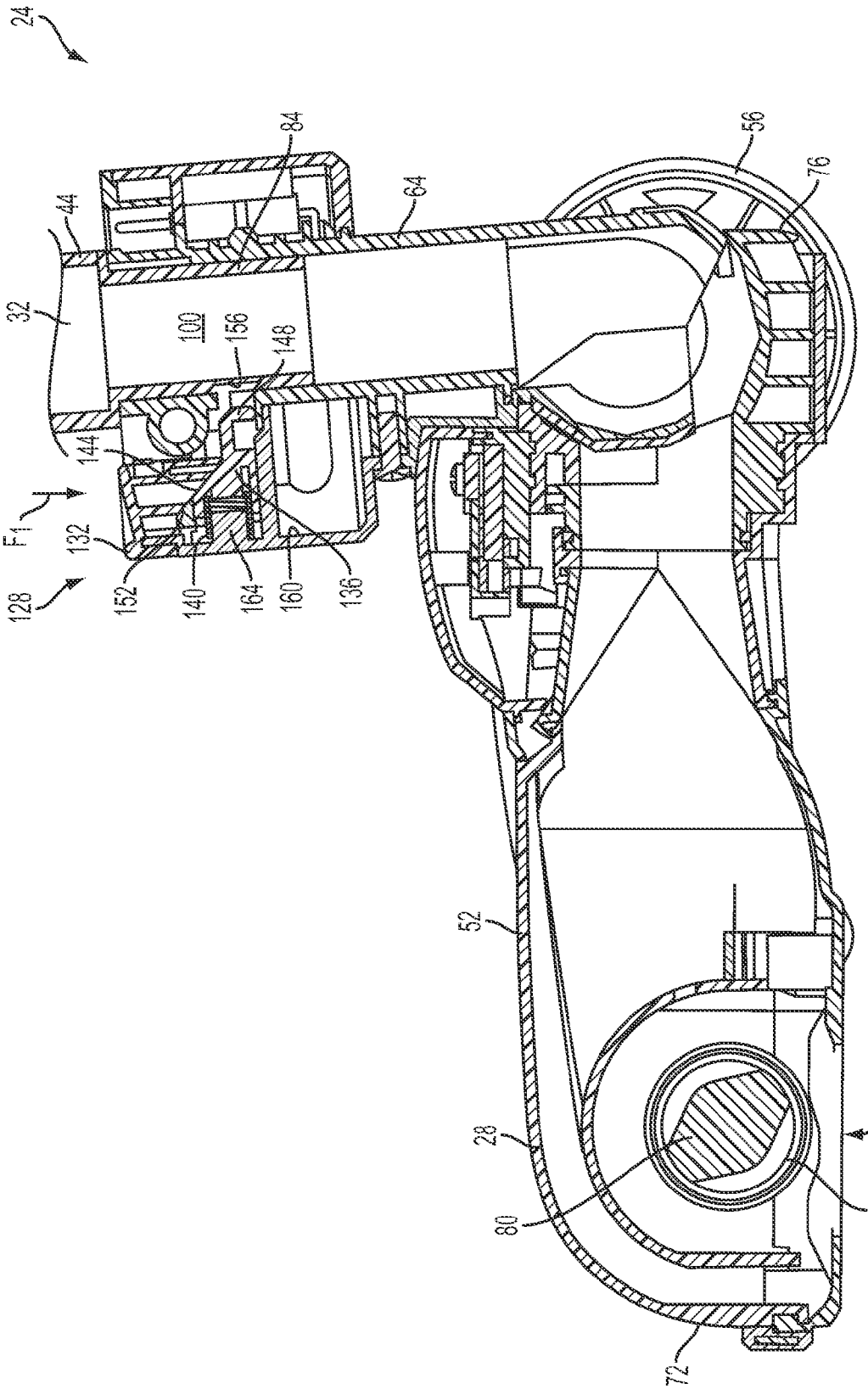
60
72

FIG. 9


24
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76
64
44
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144
F1
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128
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140
164
160
136
52
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68
80
60
72

FIG. 10

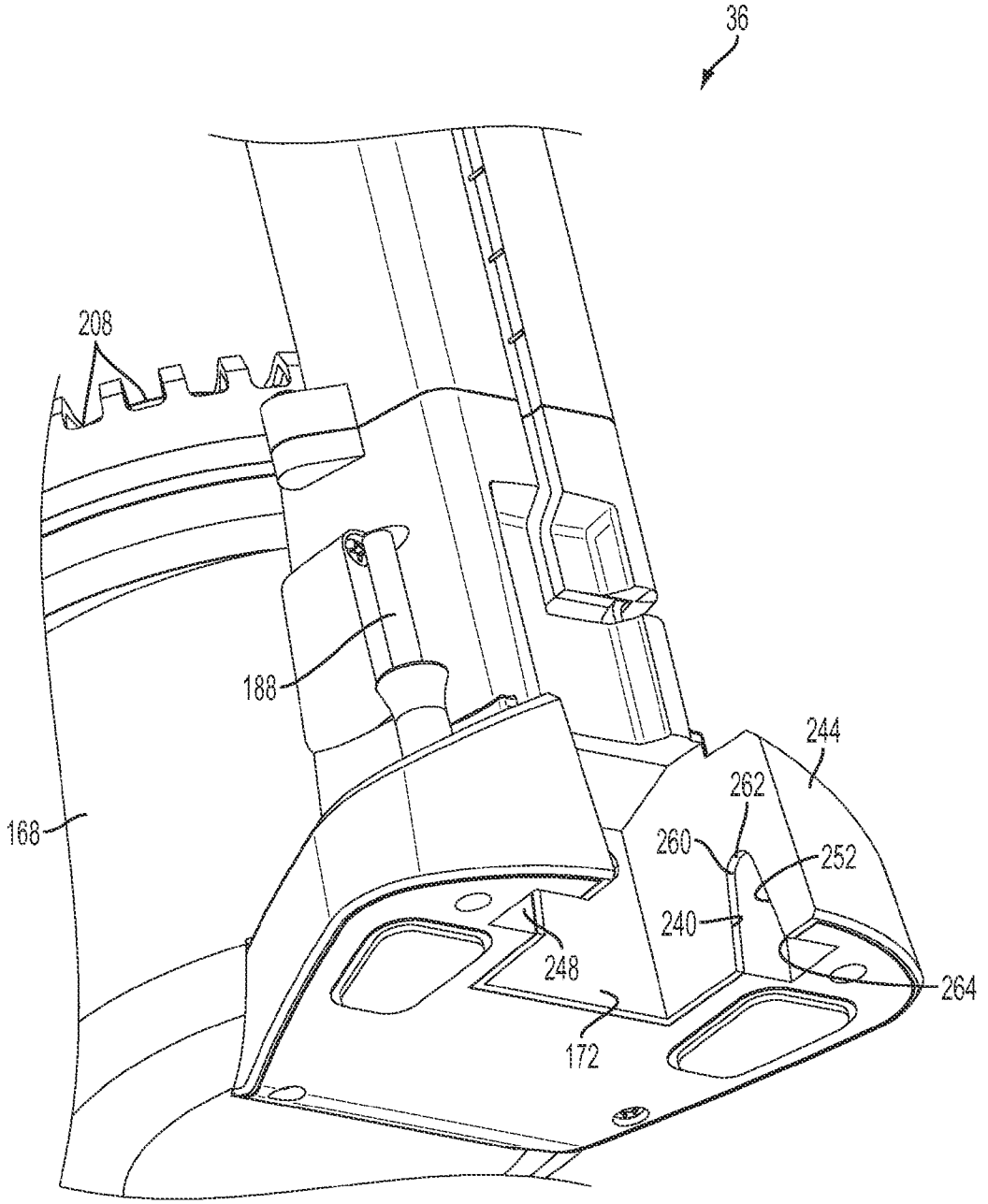

FIG. 11

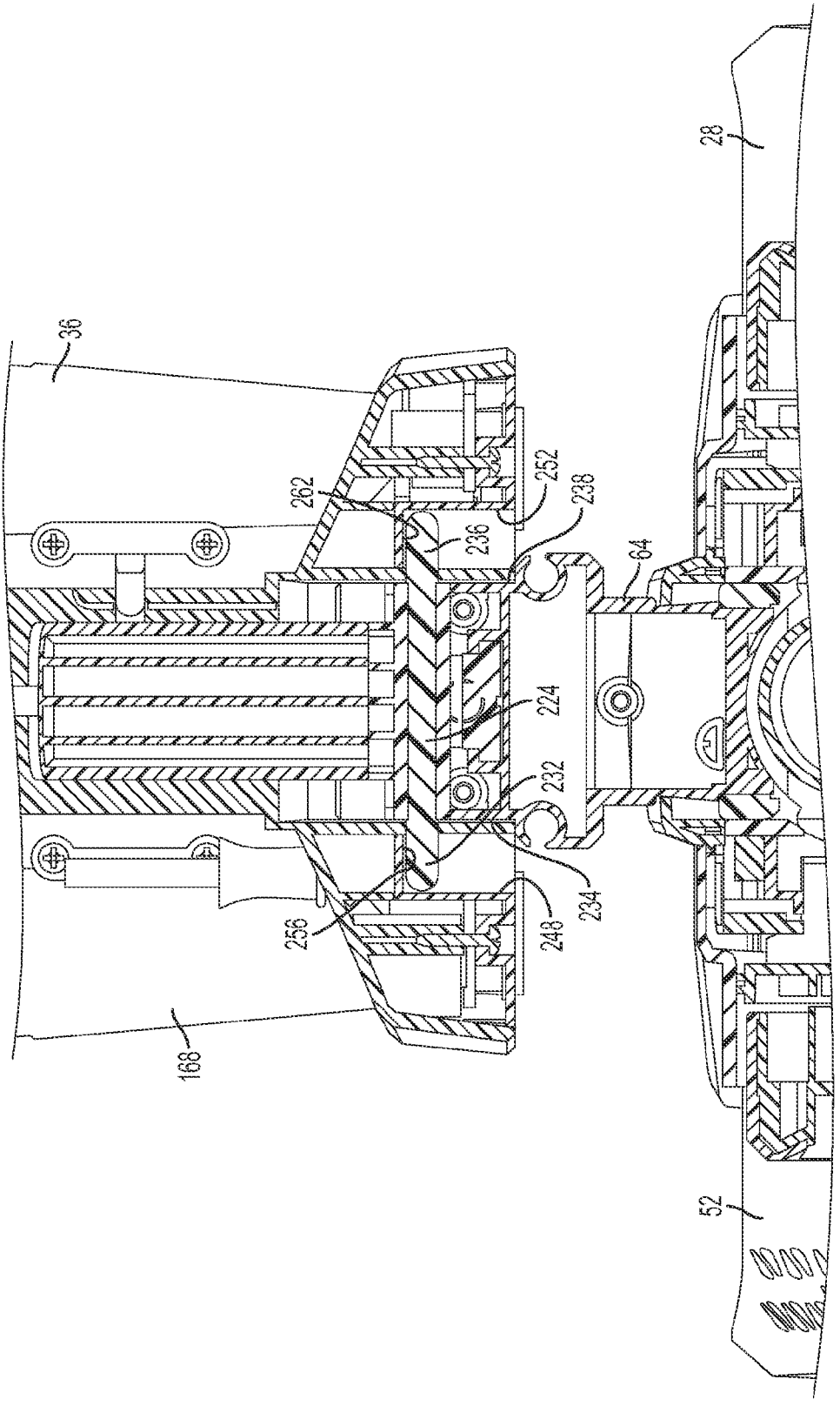

FIG. 12

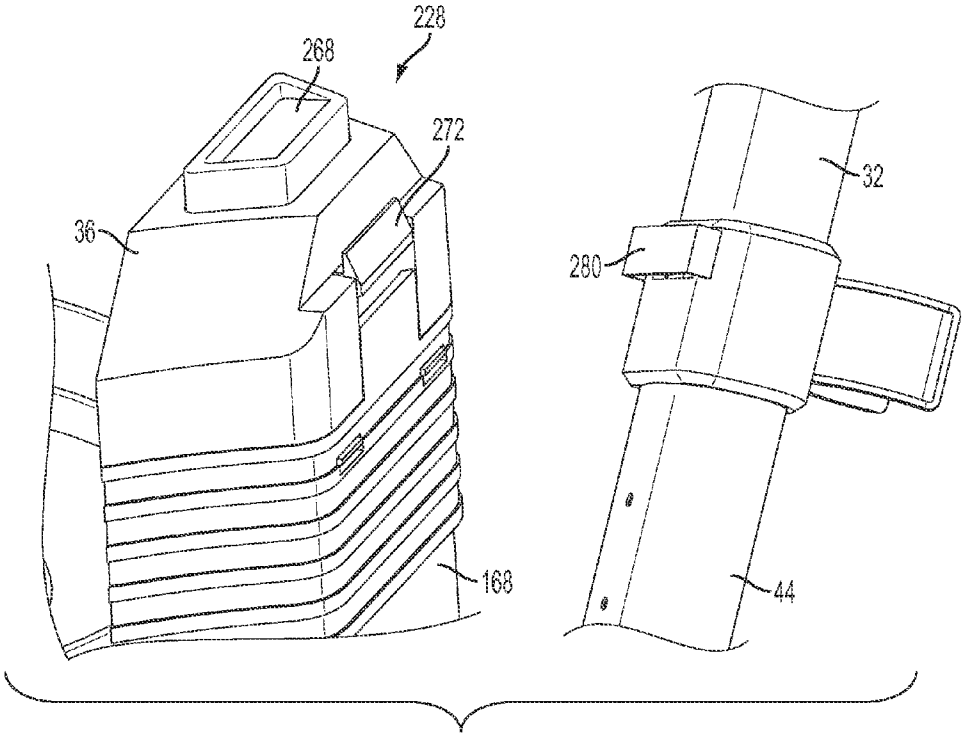

FIG. 13

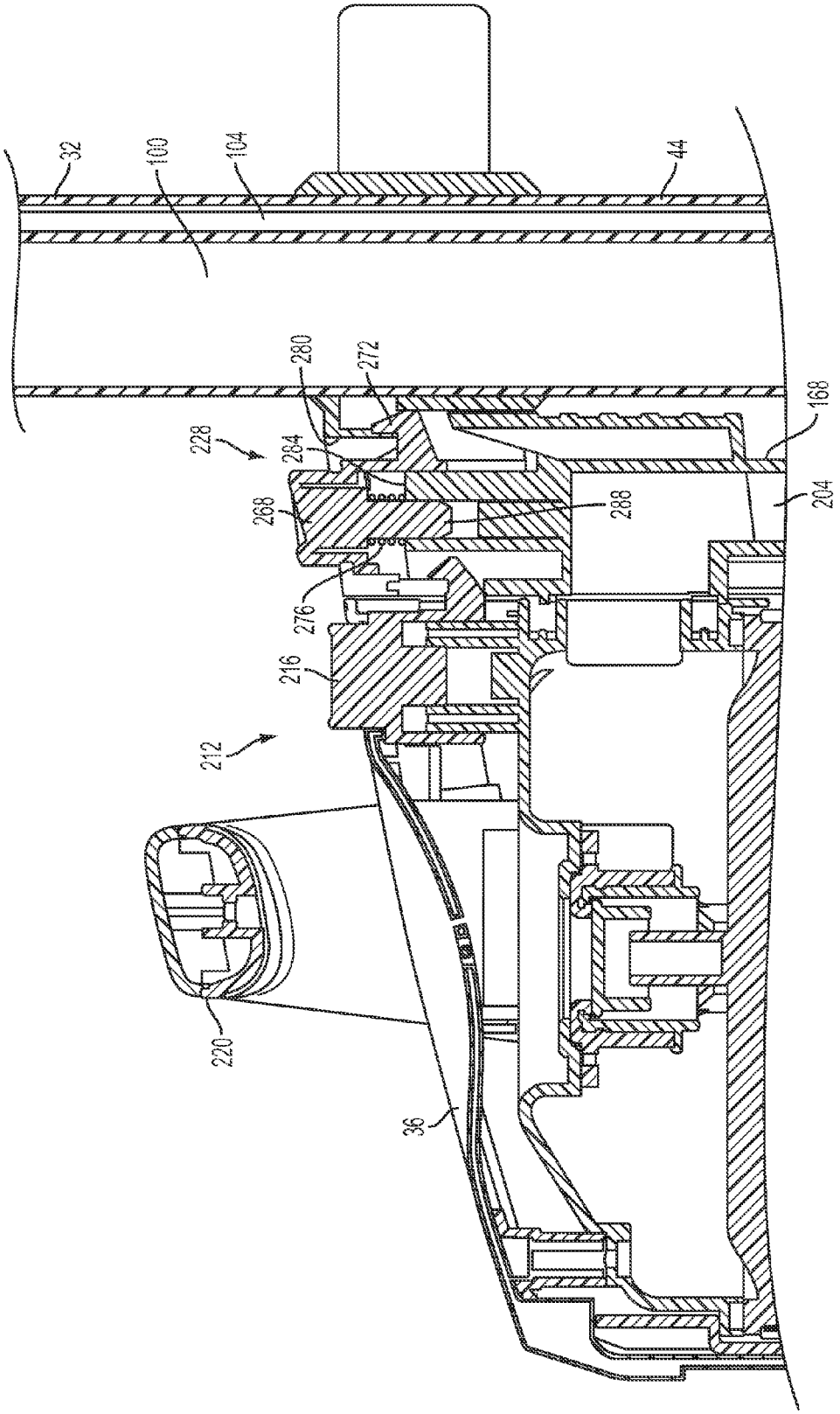

FIG. 14

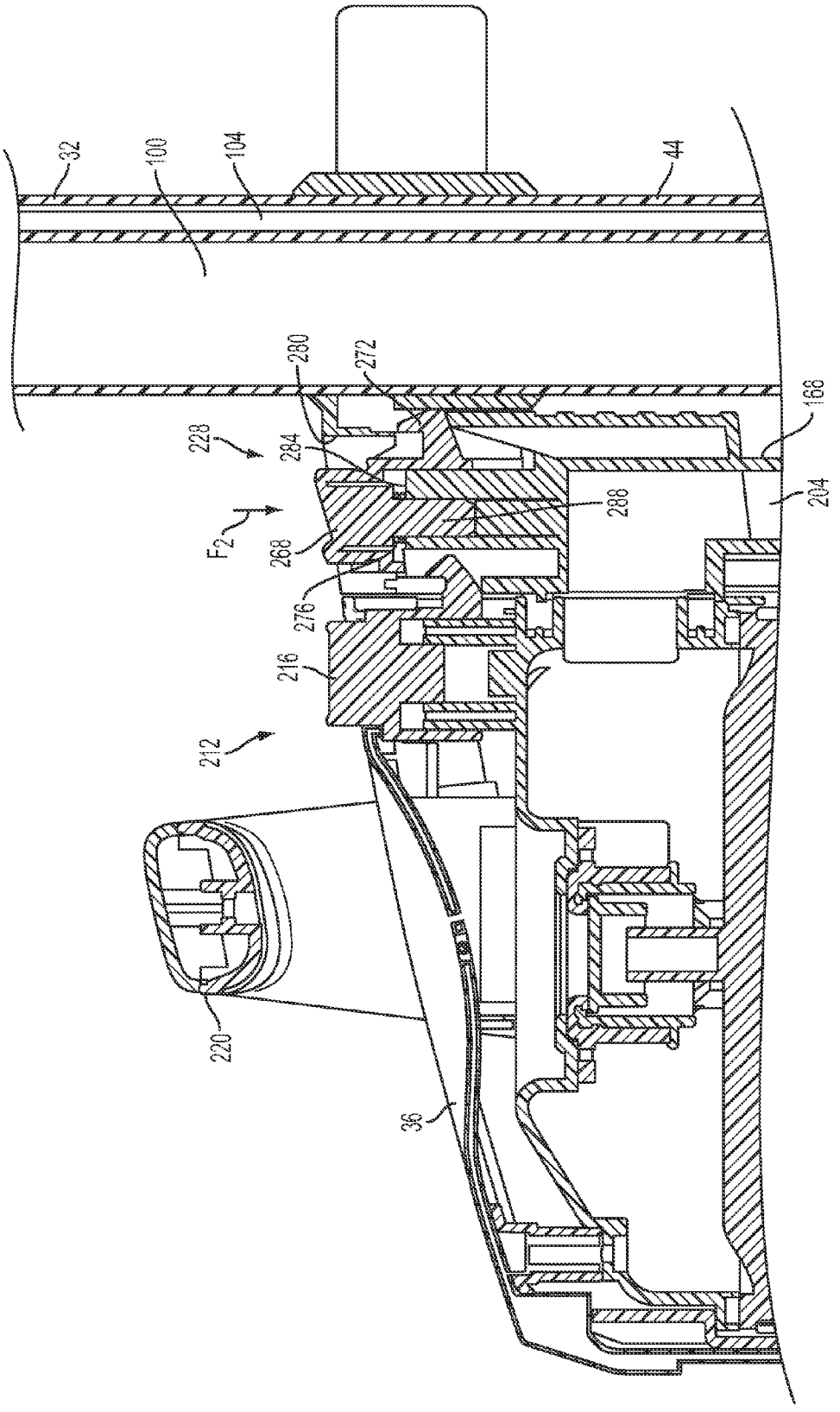
32
100
104
44
280
272
168
228
284
204
288
F2
268
276
216
212
220
36

FIG. 15

VACUUM CLEANER INCLUDING A REMOVABLE HANDLE ASSEMBLY

BACKGROUND

[0001] The present invention relates to vacuum cleaners and, more particularly, to upright vacuum cleaners.

[0002] Upright vacuum cleaners are typically used to clean floor surfaces, such as carpeting. These types of vacuum cleaners, however, can be difficult to maneuver and operate in relatively confined areas. In addition, it is sometimes desirable to clean elevated surfaces, such as drapes, furniture, or steps, with a vacuum cleaner.

SUMMARY

[0003] In one embodiment, the invention provides a vacuum cleaner including a base having a foot with a suction nozzle and a handle assembly removably coupled to the foot. The handle assembly is movable between a first position, in which the handle assembly is connected to the foot, and a second position, in which the handle assembly is disconnected to the foot. The vacuum cleaner also includes a canister assembly supported by the base. The canister assembly is removable from the base. The vacuum cleaner further includes a latch supported by one of the foot and the handle assembly. The latch is engageable with the other of the foot and the handle assembly to selectively secure the handle assembly to the foot. The latch is inaccessible when the canister assembly is supported by the base.

[0004] In another embodiment, the invention provides a vacuum cleaner including a base having a foot with a suction nozzle and a handle assembly removably coupled to the foot. The handle assembly is movable between a first position, in which the handle assembly is connected to the foot, and a second position, in which the handle assembly is disconnected to the foot. The vacuum cleaner also includes a canister assembly supported by the base. The canister assembly is removable from the base. The vacuum cleaner further includes a foot pedal operable to release the handle assembly from the foot to allow movement of the handle assembly from the first position to the second position. The foot pedal is inoperable when the canister assembly is supported by the base.

[0005] Other aspects of the invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1**A is a perspective view of a vacuum cleaner embodying the invention, the vacuum cleaner including a foot, a handle assembly, and a canister assembly connected in a first operating mode, and the handle assembly being in an upright storage position.

[0007] FIG. **1**B is a perspective view of the vacuum cleaner with the foot, the handle assembly, and the canister assembly connected in the first operating mode, and the handle assembly being in an inclined operating position.

[0008] FIG. **2** is a perspective view of the vacuum cleaner with the foot, the handle assembly, and the canister assembly connected in a second operating mode.

[0009] FIG. **3** is a perspective view of the vacuum cleaner with the foot, the handle assembly, and the canister assembly connected in a third operating mode.

[0010] FIG. **4** is a perspective view of the vacuum cleaner with the foot, the handle assembly, and the canister assembly connected in a fourth operating mode.

[0011] FIG. **5** is a cross-sectional view of the vacuum cleaner.

[0012] FIG. **6** is the cross-sectional view of the vacuum cleaner shown in FIG. **5** with the canister assembly pivoted away from the handle assembly.

[0013] FIG. **7** is a top perspective view of the foot of the vacuum cleaner.

[0014] FIG. **8** is an end perspective view of a portion of the handle assembly.

[0015] FIG. **9** is a cross-sectional view of a portion of the vacuum cleaner illustrating an interface between the handle assembly and the foot, the foot supporting a latch in an engaged position.

[0016] FIG. **10** is the cross-sectional view of the portion of the vacuum cleaner shown in FIG. **9** with the latch in a disengaged position.

[0017] FIG. **11** is a bottom perspective view of a portion of the canister assembly of the vacuum cleaner.

[0018] FIG. **12** is a cross-sectional view of a portion of the vacuum cleaner illustrating an interface between the foot and the canister assembly.

[0019] FIG. **13** is an exploded perspective view of portions of the canister assembly and the handle assembly.

[0020] FIG. **14** is a cross-sectional view of a portion of the vacuum cleaner illustrating an interface between the canister assembly and the handle assembly, the canister assembly supporting a latch in an engaged position.

[0021] FIG. **15** is the cross-sectional view of the portion of the vacuum cleaner shown in FIG. **14** with the latch in a disengaged position.

DETAILED DESCRIPTION

[0022] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways.

[0023] FIGS. **1**A and **1**B illustrate a vacuum cleaner **20**. The illustrated vacuum cleaner **20** is an upright vacuum cleaner including a base **24** having a foot **28** and a handle assembly **32**. The foot **28** is movable along a surface to be cleaned, such as a carpeted or hard-surface floor. The handle assembly **32** extends from the foot **28**. The handle assembly **32** allows a user to move and manipulate the foot **28** along the surface. The handle assembly **32** is also movable relative to the foot **28** between an upright storage position (FIG. **1**A) and an inclined operating position (FIG. **1**B).

[0024] The vacuum cleaner **20** also includes a canister assembly **36** supported by the base **24**. The canister assembly **36** generates a vacuum or suction force in the vacuum cleaner **20**. The canister assembly **36** also removes and collects dirt or other particles from an airflow drawn into the vacuum cleaner **20** by the suction force.

[0025] In the illustrated embodiment, the handle assembly **32** is in fluid communication with the foot **28** such that an airflow drawn into the foot **28** is directed into the handle assembly **32**. The handle assembly **32** is also in fluid communication with the canister assembly **36** through a flexible house **40** such that the airflow from the foot **28** is directed

through the handle assembly **32**, through the hose **40**, and into the canister assembly **36**. After the canister assembly **36** filters or otherwise cleans the airflow, the cleaned airflow is directed out of the vacuum cleaner **20** and back into the environment.

[0026] As shown in FIG. **1**A-**4**, the illustrated vacuum cleaner **20** is operable in a variety of different cleaning modes. FIGS. **1**A and **1**B illustrate the vacuum cleaner **20** in a standard mode. In this mode, the handle assembly **32** is connected to the foot **28**, and the canister assembly **36** is supported by the base **24**. While in the standard mode, the vacuum cleaner **20** can be moved along a floor surface to clean the surface like a conventional vacuum cleaner.

[0027] FIG. **2** illustrates the vacuum cleaner **20** in a carry-along mode. In this mode, the handle assembly **32** is connected to the foot **28**, but the canister assembly **36** is removed or separated from the base **24**. While in the carry-along mode, a user can carry the canister assembly **36** apart from the handle assembly **32** and the foot **28**.

[0028] FIG. **3** illustrates the vacuum cleaner **20** in a first above-the-floor mode. In this mode, the handle assembly **32** is disconnected from the foot **28**, and the canister assembly **36** is removed or separated from both the handle assembly **32** and the foot **28**. An accessory tool (e.g., a crevice tool, an upholstery tool, a pet tool, etc.) is then connectable to a free end of the handle assembly **32** (i.e., the end of the handle assembly **32** that connects to the foot **28**) in place of the foot **28**. While in the first above-the-floor mode, the handle assembly **32** can be used to clean non-floor surfaces (e.g., furniture, drapes, etc.) or steps while carrying the canister assembly **36** apart from the base **24**.

[0029] FIG. **4** illustrates the vacuum cleaner **20** in a second above-the-floor mode. This mode is similar to first above-the-floor mode, except an extension tube **44** of the handle assembly **32** is removed so that an accessory tool (or even the foot **28**, as shown in FIG. **4**) can be connected directly to a grip **48** of the handle assembly **32**. Such an arrangement allows a user to clean non-floor surfaces or steps with a much shorter handle assembly **32** while carrying the canister assembly **36**.

[0030] As shown in FIGS. **5**-**7**, the foot **28** of the vacuum cleaner **20** includes a body **52**, a plurality of wheels **56** coupled to the body **52**, an agitator **60** positioned within the body **52**, and a stem **64** extending from the body **52**. The body **52** defines a suction nozzle **68** of the foot **28**. The illustrated suction nozzle **68** is an opening formed in a bottom surface of the body **52** adjacent a forward end **72** of the foot **28**. The suction nozzle **68** is in fluid communication with the handle assembly **32**, and thereby the canister assembly **36**, to direct air and dirt from the surface being cleaned into the vacuum cleaner **20**.

[0031] The wheels **56** are coupled to the body **52** adjacent a rearward end **76** of the foot **28** (i.e., adjacent the stem **64** and the handle assembly **32**). The wheels **56** facilitate moving the foot **28** along the surface being cleaned. In the illustrated embodiment, the foot **28** includes two wheels **56** positioned on opposing sides of the body **52**. In other embodiments, the foot **28** may include fewer or more wheels. The wheels **56** may be idle wheels or driven wheels.

[0032] The agitator **60** is positioned within the body **52** adjacent the suction nozzle **68**. The agitator **60** is coupled to a motor (not shown) that rotates the agitator **60** relative to the body **52**. In the illustrated embodiment, the agitator **60** includes an elongated bar or shaft **80** that extends along the length of the suction nozzle **68**. The bar **80** supports bristles, beater bars, and/or other suitable structures for agitating carpeting. In other embodiments, other suitable actuators may also or alternatively be employed.

[0033] The stem **64** extends from the rearward end **76** of the foot **28**. The stem **64** receives a portion of the handle assembly **32** to connect the handle assembly **32** to the foot **28**. The illustrated stem **64** is in fluid communication with the suction nozzle **68** such that air drawn into the foot **28** through the suction nozzle **68** is directed through the stem **64** and into the handle assembly **32**. The stem **64** is also movable (e.g., rotatable) relative to the body **52** to move the handle assembly **32** relative to the foot **28** between the upright storage position (FIG. **1**A) and the inclined operating position (FIG. **1**B).

[0034] The illustrated handle assembly **32** includes the extension tube **44** and the grip **48**. The extension tube **44** has a first end **84** and a second end **88**. As shown in FIGS. **5** and **6**, the first, or lower, end **84** is received in the stem **64** of the foot **28** to connect the handle assembly **32** to the foot **28**. The second, or upper, end **88** supports the grip **48**. The grip **48** is configured to be grasped by a user to manipulate and move the vacuum cleaner **20**. The grip **48** also supports an actuator **92** (e.g., a power switch) that controls operation of the vacuum cleaner **20**. The illustrated grip **48** is removably coupled to the extension tube **44** by a latch **96**. The latch **96** is actuatable to disconnect the grip **48** from the extension tube **44** such that the vacuum cleaner **20** can be used without the extension tube **44** (as shown in, for example, FIG. **4**).

[0035] The illustrated extension tube **44** also defines two conduits **100**, **104**. The conduits **100**, **104** generally extend in parallel between the first and second ends **84**, **88** of the extension tube **44**. The illustrated conduits **100**, **104** are isolated from (i.e., not in fluid communication with) each other. The first conduit **100** provides an airflow pathway from the foot **28** to the flexible hose **40** and, ultimately, to the canister assembly **36**. The second conduit **104** provides an electrical pathway from the grip **48** to the foot **28**. In particular, the second conduit **104** supports and encloses wires **108** that extend between the first and second ends **84**, **88** of the extension tube **44**.

[0036] As shown in FIG. **8**, the extension tube **44** includes an electric plug **112** formed at the first end **84** of the tube **44**. The plug **112** is connected to the wires **108** (FIGS. **5** and **6**) in the second conduit **104** of the extension tube **44**. As shown in FIG. **7**, the stem **64** of the foot **28** includes an electric receptacle **116**. The receptacle **116** is shaped and sized to receive the plug **112** (FIG. **8**) of the extension tube **44** when the handle assembly **32** is connected to the foot **28**. The plug **112** and the receptacle **116** electrically couple the foot **28** to the extension tube **44** to provide electrical power to the foot **28**. Electrical power can be used to power components of the foot **28** such as, for example, the motor for the agitator **60** (FIGS. **5** and **6**). When the foot **28** is disconnected from the handle assembly **32**, as shown in FIG. **3**, the plug **112** of the extension tube **44** can be plugged into other powered accessory tools having similarly shaped and sized electric receptacles as the foot **28**.

[0037] Referring back to FIGS. **5** and **6**, although not shown in detail, the grip **48** includes a male attachment end **118** and an electric plug **120** that are shaped and sized similar to the first end **84** and the electric plug **112** (FIG. **8**) of the extension tube **44**. In addition, the extension tube **44** includes an electric receptacle **124** at the second end **88** that is shaped and sized similar to the electric receptacle **116** in the foot **28**. The attachment end **118** of the grip **48** is insertable into the second end **88** of the extension tube **44** to physically couple the grip

48 to the extension tube 44. The plug 120 and the receptacle 124 electrically couple the grip 48 to the extension tube 44 and, ultimately, to the foot 28. Furthermore, the male attachment end 118 and the plug 120 allow the grip 48 to be plugged directly into the foot 28 (or other powered accessory tool) when the extension tube 44 is removed, as shown in FIG. 4. Such an arrangement provides universal, modular connections between the grip 48, the extension tube 44, the foot 28, and other accessory tools.

[0038] As discussed above, the handle assembly 32 is movable relative to the foot 28 between a first position (FIGS. 1A-2), in which the handle assembly 32 is connected to the foot 28, and a second position (FIG. 3), in which the handle assembly 32 is disconnected from the foot 28. As shown in FIGS. 7, 9, and 10, the vacuum cleaner 20 includes a latch 128 to releasably secure the handle assembly 32 to the foot 28. In the illustrated embodiment, the latch 128 is supported by the stem 64 of the foot 28 and engages the extension tube 44 of the handle assembly 32 to selectively secure the handle assembly 32 to the foot 28. In other embodiments, the latch 128 may be supported by the handle assembly 32 and may engage a portion of the foot 28 to selectively secure the handle assembly 32 to the foot 28.

[0039] The illustrated latch 128 includes a foot pedal 132, a wedge 136, and a biasing member 140. The foot pedal 132 extends outwardly from the stem 64 for actuation by a user. In particular, the foot pedal 132 is configured to be depressed by a foot of the user stepping on the foot pedal 132. As shown in FIGS. 9 and 10, the wedge 136 is positioned within the stem 64. The wedge 136 includes a ramped surface 144 and a projection 148. The ramped surface 144 of the wedge 136 engages a corresponding ramped surface 152 of the foot pedal 152. The projection 148 is configured to fit within a groove 156 (FIG. 8) formed in the first end 84 of the extension tube 44. The biasing member 140 is positioned between the wedge 136 and an inner surface 160 of the stem 64. The biasing member 140 biases the wedge 136 toward and into engagement with the handle assembly 32. In the illustrated embodiment, the biasing member 140 is a coil spring mounted on a boss 164 that extends from the inner surface 160 of the stem 64. In other embodiments, other suitable biasing members may also or alternatively be employed.

[0040] FIG. 9 illustrates the latch 128 in an engaged position. In this position, the foot pedal 132 is fully extended from the stem 64, and the projection 148 extends into the groove 156 (FIG. 8) of the extension tube 44 to secure the handle assembly 32 within the stem 64. When a force F_1 is applied to the foot pedal 132 to actuate (e.g., depress) the foot pedal 132, as shown in FIG. 10, the ramped surface 152 of the foot pedal 132 slides along the ramped surface 144 of the wedge 136 to move the wedge 136 against the bias of the biasing member 140. The projection 148 of the wedge 136 slides out of the groove 156 (FIG. 8) in the extension tube 44 to release the handle assembly 32. The handle assembly 32 can then be disconnected from the foot 28 by pulling the extension tube 44 out of the stem 64.

[0041] The latch 128 is positioned on the vacuum cleaner 20 so that the foot pedal 132 is inoperable when the canister assembly 36 is supported by the base 24. That is, the foot pedal 132 cannot be actuated by a user to release the handle assembly 32 from the foot 28 while the canister assembly 36 is connected to the base 24 in the first cleaning mode, as shown in FIGS. 1A and 1B. Such an arrangement inhibits the handle assembly 32 from being disconnected from the foot 28 before the canister assembly 36 is removed from the base 24. Furthermore, such an arrangement inhibits the foot pedal 132 from being unintentionally actuated when the vacuum cleaner 20 is being operated in the first cleaning mode.

[0042] In the illustrated embodiment, the latch 128 is substantially covered by the canister assembly 36 when the canister assembly 36 is supported by the base 24 such that the latch 128 is inaccessible to a user. As shown in FIG. 11, a body 168 of the canister assembly 36 defines a recess 172. The recess 172 is shaped and sized to provide sufficient clearance for the latch 128 (specifically, the foot pedal 132) when the canister assembly 36 is on the base 24. The latch 128 is received in the recess 172 of the canister assembly 36 when the canister assembly 36 is supported by the base 24 so that the body 168 of the canister assembly 36 does not contact or interfere with the foot pedal 132. In the illustrated embodiment, the canister assembly 36 and the foot pedal 132 are located on a forward side of the base 24 so that the canister assembly 36 overhangs a portion of the foot 28. In other embodiments, the canister assembly 36 and/or the foot pedal 132 may be located on a rearward side of the base 24.

[0043] Referring back to FIGS. 5 and 6, the illustrated canister assembly 36 includes the body 168, a suction motor 176 positioned within the body 168, a separator unit 180 supported by the body 168, and a dirt collection unit 184 supported by the body 168. The suction motor 176 is housed within a lower portion of the body 168 and includes an electric motor and a fan. The suction motor 176 is operable to generate a vacuum or suction force in the canister assembly 36. When the canister assembly 36 is connected to the handle assembly 32 and the handle assembly 32 is connected to the foot 28, the suction motor generates the suction force through the first conduit 100 of the handle assembly 32 and the suction nozzle 68 of the foot 28. A power cord 188 (only a portion of which is shown in FIGS. 1A-4) extends into the canister assembly 36 to provide power to the suction motor 176. The power cord 188 is also electrically connected to the grip 48 through the flexible hose 40 (FIGS. 1A-4) to provide electrical power to the handle assembly 32 and the foot 28.

[0044] The separator unit 180 and the dirt collection unit 184 are supported by the body 168 generally above the suction motor 176. In the illustrated embodiment, the separator unit 180 is a cyclonic separator unit. The cyclonic separator unit 180 includes a two-stage cyclone system including a first, upstream cyclone 190 and a second, downstream cyclone 192 positioned within the first cyclone 190. The cyclones 190, 192 are operable to separate dirt particles from an airflow. The cyclonic separator unit also includes a filter 196 to separate additional dirt particles from the airflow. The illustrated filter 196 is positioned downstream of (above in FIGS. 5 and 6) the second cyclone 192. The separator unit 180 further includes an inlet 200 (FIGS. 1A-4) connected to the flexible hose 40 to receive the airflow from the handle assembly 32. The dirt collection unit 184 is in fluid communication with the cyclone 192 to collect the dirt particles that are separated from the airflow by the separator unit 180. In other embodiments, other suitable separator units and/or dirt collection units may also or alternatively be employed. For example, in some embodiments, the canister assembly 36 may be a bag unit such that the separator unit 180 is omitted and the dirt collection unit 184 includes a bag positioned within the body 168.

[0045] In operation, when the suction motor 176 is energized, an airflow is drawn by the suction motor 176 into the vacuum cleaner 20 through the suction nozzle 68 in the foot

28. The foot 28 directs the airflow into the first conduit 100 of the handle assembly 32, which directs the airflow into the flexible hose 40 (FIGS. 1A-4). The flexible hose 40 directs the airflow into the separator unit 180 of the canister assembly 36. The airflow then circulates sequentially within the first and second cyclone 190, 192 to remove relatively large dirt and particles from the airflow. The airflow also passes through the filter 196 of the separator unit 180 to remove relatively small dirt and particles from the airflow. After passing through the filter 196, the airflow is directed through a conduit 204 in the body 168 toward the suction motor 176. The cleaned airflow is then exhausted out of the body 168 through vents 208 (FIG. 1A) formed in an upper surface of the body 168 that supports the separator and dirt collection units 180, 184.

[0046] The illustrated separator and dirt collection units 180, 184, or dirt cup, are manufactured and assembled together as a subassembly of the canister assembly 36. The separator and dirt collection units 180, 184 are removable from the body 168 to facilitate changing or cleaning the filter 196 and emptying the dirt collection unit 184. In the illustrated embodiment, the canister assembly 36 includes a latch 212 having a manual actuator 216 to selectively secure the units 180, 184 to the body 168. The actuator 216 is actuatable (e.g., depressible) by a user to release the separator and dirt collection units 180, 184 from the body 168. When released, the units 180, 184 can be lifted away from the body 168 and the suction motor 176.

[0047] As shown in FIGS. 1A-4, the canister assembly 36 also includes a handle 220 extending from the separator unit 180. The handle 220 is configured to be grasped by a user to facilitate carrying the canister assembly 36. For example, the handle 220 can be used to carry the separator unit 180 and the dirt collection unit 184 apart from the body 168 and the suction motor 176 of the canister assembly 36. In addition, when the separator and dirt collection units 180, 184 are secured to the body 168 by the latch 212, the handle 220 can be used to carry the entire canister assembly 36 apart from the handle assembly 32.

[0048] Referring to FIG. 2, the canister assembly 36 is removable from the base 24 to be carried along by a user separately from the handle assembly 32 and the foot 28. When the canister assembly 36 is not supported by the base 24, the canister assembly 36 remains in fluid communication with the handle assembly 32 and the foot 28 through the flexible hose 40. In the illustrated embodiment, the vacuum cleaner 20 includes a mounting post 224 and a latch 228 to mount and secure the canister assembly 36 to the base 24. In other embodiments, other suitable structures may also or alternatively be employed for connecting the canister assembly 36 to the base 24.

[0049] As shown in FIGS. 7 and 12, the mounting post 224 extends from the stem 64 of the foot 28 adjacent the latch 128 that releasably secures the handle assembly 32 to the foot 28. The mounting post 224 engages a portion of the canister assembly 36 to support the canister assembly 36 on the foot 28. In some embodiments, the mounting post 224 may extend from the extension tube 44 of the handle assembly 32 to engage the canister assembly 36. In other embodiments, the mounting post 224 may extend from the canister assembly 36 and engage the handle assembly 32 and/or the foot 28 to support the canister assembly 36 on the base 24.

[0050] The illustrated mounting post 224 is located adjacent the first end 84 of the handle assembly 32 so that a lower portion of the canister assembly 36 is engaged by the mounting post 224. The illustrated mounting post 224 is a pin that extends through the stem 64 of the foot 28. As shown in FIG. 12, a first end portion 232 of the post 224 extends outwardly from a first side 234 of the stem 64 in one direction, and a second end portion 236 of the post 224 extends outwardly from a second side 236 the stem 64 that is opposite the first side 234 in an opposite direction. The end portions 232, or engagement members, form bosses that extend outwardly from the stem 64. The two end portions 232, 236 engage the canister assembly 36 at two discrete locations to inhibit the canister assembly 36 from rotating around or about the handle assembly 32 when supported by the mounting post 224. In other embodiments, the mounting post 224 may include two separate pins that extend outwardly from the foot 28. In still other embodiments, the mounting post 224 may be a single ledge or surface on the base 24 that is configured to support the canister assembly 36.

[0051] The mounting post 224 is configured to be received in a groove 240 of the canister assembly 36 to support the canister assembly 36. As shown in FIG. 11, the groove 240 is formed in a rear surface 244 of the body 168 of the canister assembly 36 adjacent the recess 172 that receives the foot pedal 132. The illustrated groove 240 is divided by the recess 172 into two discrete groove portions 248, 252. The first groove portion 248 receives the first end portion 232 of the mounting post 224, while the second groove portion 252 receives the second end portion 236 of the mounting post 224. Surfaces 256, 260 of the body 168 that define the groove portions 248, 252 rest on the end portions 232, 236 of the mounting post 224 such that the canister assembly 36 is pivotable relative to the handle assembly 32 while being supported by the mounting post 224. In addition, each groove portion 248, 252 increases in cross-sectional area from a closed end 262 to an open end 264. The open ends 264 of the groove portions 248, 252 are thereby larger to facilitate inserting the mounting post 224 into the groove 240 when connecting the canister assembly 36 to the foot 28. Such an arrangement allows a user to be less exact when aligning the canister assembly 36 on the base 24.

[0052] The recess 172 and the groove 240 are formed in the rear surface 214 of the canister assembly 36 such that a portion of the stem 64 is received within the recess 172 when the canister assembly 36 is supported by the mounting post 224. In particular, a portion of the body 168 of the canister assembly 36 extends over portions of the first and second sides 234, 238 (FIG. 12) of the stem 64 such that the canister assembly 36 straddles the stem 64. Such an arrangement inhibits the canister assembly 36 from sliding, rocking, shifting, or otherwise moving side-to-side relative to the handle assembly 32 when supported by the mounting post 224. In addition, such an arrangement helps position the canister assembly 36 on the base 24 so that the latch 228 on the canister assembly 36 properly aligns with a corresponding structure of the handle assembly 32.

[0053] As shown in FIGS. 13-15, the latch 228 is supported by the canister assembly 36. The illustrated latch 228, or engagement member, is supported at an upper end of the canister assembly 36 opposite from the suction motor 176. The latch 228 is operable to engage a portion of the handle assembly 32 to releasably secure the canister assembly 36 to the handle assembly 32. The latch 228 is located on the canister assembly 36 between the first and second ends 84, 88 of the extension tube 44. In particular, the latch 228 is located between the grip 48 of the handle assembly 32 and the mount-

ing post **224**. With the mounting post **224**, the latch **228** provides a three-point connection (two points on the mounting post **224** and one point on the latch **228**) for connecting the canister assembly **36** to the handle assembly **32** and the foot **28**.

[0054] In the illustrated embodiment, the latch **228** includes a manual actuator **268**, a hook **272**, and a biasing member **276** (FIGS. **14** and **15**). The manual actuator **268** extends outwardly from the body **168** of the canister assembly **36** to be actuated (e.g., depressed) by a user. The hook **272** is configured to engage a flange **280** of the handle assembly **32** to secure the latch **228** to the handle assembly **32**. The illustrated hook **272** is integrally formed as a single piece with the actuator **268**. In other embodiments, the actuator **268** and the hook **272** may be separate elements that are coupled together. Additionally or alternatively, in some embodiments, the latch **228** may be supported by the handle assembly **32**, and the flange **280** may be formed on the canister assembly **36**.

[0055] As shown in FIGS. **14** and **15**, the biasing member **276** is positioned between the actuator **268** and an inner surface **284** of the body **168**. The biasing member **276** biases the hook **272** into engagement with the flange **280**. In the illustrated embodiment, the biasing member **276** is a coil spring that surrounds a boss **288** of the actuator **268**. In other embodiments, other suitable biasing members may also or alternatively be employed.

[0056] FIG. **14** illustrates the latch **228** in an engaged position. In this position, the manual actuator **268** is fully extended from the body **168** of the canister assembly **36**, and the hook **272** extends behind the flange **280** to engage the flange **280** and secure the canister assembly **36** to the handle assembly **32**. When a force F_2 is applied to the actuator **268** to move the actuator **268** against the bias of the biasing member **276**, as shown in FIG. **15**, the hook **272** moves (e.g., slides) away from the flange **280**. Once the hook **272** clears the flange **280**, the canister assembly **36** is released from the handle assembly **32**. The canister assembly **36** can then be removed from the base **24**.

[0057] Referring to FIGS. **5** and **6**, the canister assembly **36** is removable from the handle assembly **32** and the foot **28** using a rocking or pivoting motion and a lifting motion. Initially, the canister assembly **36** is supported by the mounting post **224** and secured to the handle assembly **32** by the latch **228**. When the latch **228** is actuated to disengage the flange **280**, the canister assembly **36** can be pivoted about the mounting post **224** relative to the handle assembly **32** and the foot **28**. As shown in FIG. **6**, the canister assembly **36** is pivotable in a first direction A (counterclockwise in FIG. **6**) away from the handle assembly **32** when the latch **228** disengages the flange **280** on the handle assembly **32**. After being pivoted a sufficient distance away from the handle assembly **32**, the canister assembly **36** (which includes the suction motor **176**, the separator unit **180**, and the dirt collection unit **184**) can be lifted as a single assembly off of the mounting post **224** to operate the vacuum cleaner **20** in the second, third, or fourth cleaning modes, as shown in FIGS. **2-4**. Separating the canister assembly **36** from the handle assembly **32** and the foot **28** also allows the foot pedal **132** (FIG. **7**) to be actuated to disconnect the handle assembly **32** from the foot **28**.

[0058] The canister assembly **36** can be reconnected to the handle assembly **32** and the foot **28** using a substantially opposite set of motions. First, the groove **240** (FIG. **11**) in the canister assembly **36** is generally aligned with the mounting post **224**. Once aligned, the canister assembly **36** is lowered onto the mounting post **224** such that the mounting post **224** is received in the groove **240** and the canister assembly **36** is supported by the foot **28**. The canister assembly **36** is then pivoted in a second direction (clockwise in FIG. **6**) opposite the first direction A and toward the handle assembly **32**. As the canister assembly **36** is pivoted toward the handle assembly **32**, the hook **272** of the latch **228** engages the flange **280** of the handle assembly **32**. The hook **272** is configured to automatically move against the bias of the biasing member **276** and out of the way of the flange **280** as the canister assembly **36** is being connected to the handle assembly **32** without requiring a user to actuate the manual actuator **268**. Once the hook **272** clears the flange **280**, the biasing member **276** biases the hook **272** back into engagement behind the flange **280** to secure the canister assembly **36** to the handle assembly **32**. Biasing the latch **228** into engagement with the flange **280** also provides an audible "click" to notify the user that the canister assembly **36** is properly connected to the handle assembly **32**.

[0059] In some embodiments, the relative locations of the mounting post **224** and the latch **228** may be reversed. For example, the latch **228** may be located adjacent the first end **84** of the handle assembly **32**, and the mounting post **224** may be located between the grip **48** of the handle assembly **32** and the latch **228**. In such embodiments, the canister assembly **36** may still be removed from and reconnected to the handle assembly **32** and the foot **17** in a similar manner as described above. However, a bottom portion of the canister assembly **36** (rather than an upper portion) may be pivoted toward and away from the handle assembly **32** when the canister assembly **36** is installed on and removed from the base **24**.

[0060] Various features and advantages of the invention are set forth in the following claims.

What is claimed is:

1. A vacuum cleaner comprising:

a base including

a foot having a suction nozzle, and

a handle assembly removably coupled to the foot, the handle assembly movable between a first position, in which the handle assembly is connected to the foot, and a second position, in which the handle assembly is disconnected to the foot;

a canister assembly supported by base, the canister assembly being removable from the base; and

a latch supported by one of the foot and the handle assembly, the latch engageable with the other of the foot and the handle assembly to selectively secure the handle assembly to the foot, the latch being inaccessible when the canister assembly is supported by the base.

2. The vacuum cleaner of claim **1**, wherein the latch is substantially covered by the canister assembly when the canister assembly is supported by the base.

3. The vacuum cleaner of claim **2**, wherein the canister assembly includes a body that defines a recess, and wherein the latch is received in the recess when the canister assembly is supported by the base.

4. The vacuum cleaner of claim **3**, wherein the canister assembly also includes a suction motor positioned within the body, and wherein the suction motor is operable to generate a suction force through the suction nozzle.

5. The vacuum cleaner of claim **4**, wherein the canister assembly further includes a separator unit and a dirt collection unit supported by the body, wherein the separator unit receives an airflow from the suction nozzle when the handle assembly is in the first position and is operable to separate dirt

particles from the airflow, and wherein the dirt collection unit is configured to collect the dirt particles that are separated from the airflow by the separator unit.

6. The vacuum cleaner of claim **1**, wherein the latch is supported by the foot, wherein the handle assembly defines a groove, and wherein a portion of the latch extends into the groove to selectively secure the handle assembly to the foot.

7. The vacuum cleaner of claim **1**, wherein the latch includes a foot pedal, and wherein the foot pedal is actuatable to disengage the latch from the other of the foot and the handle assembly.

8. The vacuum cleaner of claim **7**, wherein the latch also includes a wedge, wherein the wedge engages the other of the foot and the handle assembly to selectively secure the handle assembly to the foot, and wherein the foot pedal is actuatable to move the wedge out of engagement with the other of the foot and the handle assembly.

9. The vacuum cleaner of claim **8**, wherein the latch further includes a biasing member, wherein the biasing member biases the wedge into engagement with the other of the foot and the handle assembly, and wherein the foot pedal is actuatable to move the wedge against the bias of the biasing member.

10. The vacuum cleaner of claim **1**, wherein the handle assembly includes an extension tube having a first end and a second end, wherein the first end of the extension tube connects to the foot, and wherein the second end of the extension tube supports a grip.

11. The vacuum cleaner of claim **10**, wherein the foot includes a body and a stem extending from the body, wherein the body defines the suction nozzle, and wherein the stem receives the first end of the extension tube to connect the handle assembly to the foot.

12. The vacuum cleaner of claim **11**, wherein the stem is movable relative to body so that the handle assembly is pivotable relative to the foot between an upright storage position and an inclined operating position when the handle assembly is connected to the stem.

13. The vacuum cleaner of claim **10**, wherein the extension tube defines a first conduit and a second conduit, wherein the first conduit provides an airflow pathway between the suction nozzle and the canister assembly when the handle assembly is connected to the foot, and wherein the second conduit provides an electrical pathway to the foot when the handle assembly is connected to the foot.

14. The vacuum cleaner of claim **1**, wherein the foot includes a plurality of wheels and an agitator.

15. A vacuum cleaner comprising:

a base including

a foot having a suction nozzle, and

a handle assembly removably coupled to the foot, the handle assembly movable between a first position, in which the handle assembly is connected to the foot, and a second position, in which the handle assembly is disconnected to the foot;

a canister assembly supported by the base, the canister assembly being removable from the base; and

a foot pedal operable to release the handle assembly from the foot to allow movement of the handle assembly from the first position to the second position, the foot pedal being inoperable when the canister assembly is supported by the base.

16. The vacuum cleaner of claim **15**, wherein the foot pedal is substantially covered by the canister assembly when the canister assembly is supported by the base.

17. The vacuum cleaner of claim **16**, wherein the canister assembly includes a body that defines a recess, and wherein the foot pedal is received in the recess when the canister assembly is supported by the handle assembly.

18. The vacuum cleaner of claim **17**, wherein the canister assembly also includes

a suction motor positioned within the body, the suction motor operable to generate a suction force through the suction nozzle,

a separator unit supported by the body to receive an airflow from the suction nozzle when the handle assembly is in the first position, the separator unit operable to separate dirt particles from the airflow, and

a dirt collection unit supported by the body, the dirt collection unit configured to collect the dirt particles that are separated from the airflow by the separator unit.

19. The vacuum cleaner of claim **15**, wherein the foot pedal is supported by the foot.

20. The vacuum cleaner of claim **15**, further comprising:

a wedge coupled to the foot pedal, the wedge engageable with one of the foot and the handle assembly to selectively secure the handle assembly to the foot; and

a biasing member coupled to the wedge to bias the wedge into engagement with the one of the foot and the handle assembly;

wherein the foot pedal is actuatable to move the wedge out of engagement with the one of the foot and the handle assembly against the bias of the biasing member.

21. The vacuum cleaner of claim **20**, wherein the handle assembly defines a groove, and wherein a portion of the wedge extends into the groove to selectively secure the handle assembly to the foot.

22. The vacuum cleaner of claim **15**, wherein the handle assembly includes an extension tube having a first end and a second end, wherein the first end of the extension tube connects to the foot, and wherein the second end of the extension tube supports a grip.

23. The vacuum cleaner of claim **22**, wherein the foot includes a body and a stem extending from the body, wherein the body defines the suction nozzle, and wherein the stem receives the first end of the extension tube to connect the handle assembly to the foot.

24. The vacuum cleaner of claim **23**, wherein the stem is movable relative to body so that the handle assembly is pivotable relative to the foot between an upright storage position and an inclined operating position when the handle assembly is connected to the stem.

25. The vacuum cleaner of claim **22**, wherein the extension tube defines a first conduit and a second conduit, wherein the first conduit provides an airflow pathway between the suction nozzle and the canister assembly when the handle assembly is connected to the foot, and wherein the second conduit provides an electrical pathway to the foot when the handle assembly is connected to the foot.

26. The vacuum cleaner of claim **15**, wherein the foot includes a plurality of wheels and an agitator.

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