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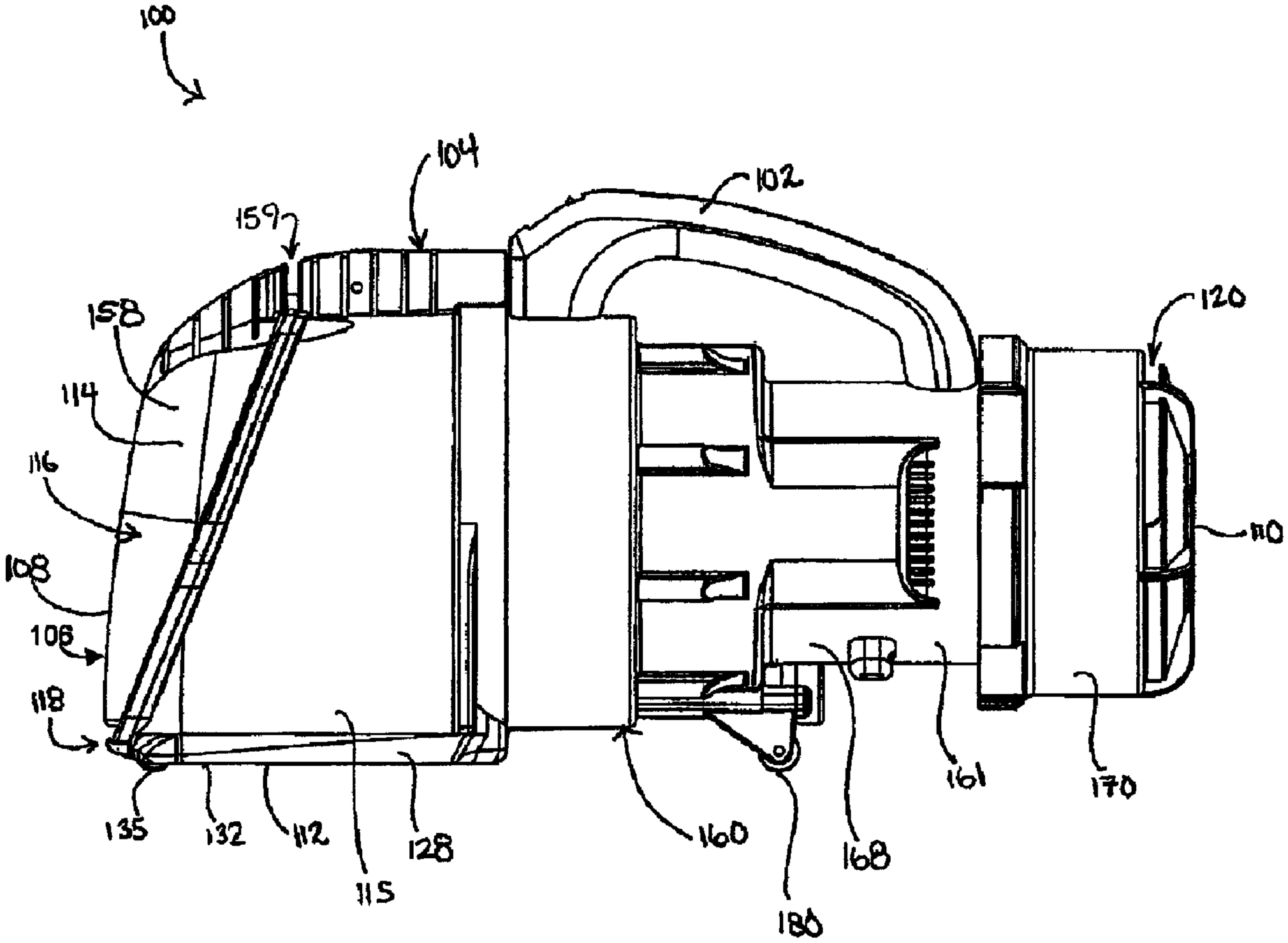
(54) Titre : BUSE POUR UN ASPIRATEUR CYCLONIQUE A MAIN
(54) Title: NOZZLE FOR A CYCLONIC HAND VACUUM CLEANER



(57) Abrégé/Abstract:
A hand vacuum cleaner has a front, an upper portion and a lower portion. The hand vacuum cleaner comprises an air flow passage extending from a nozzle having a dirty air inlet to a clean air outlet. A cyclone unit comprises at least one cyclone having a

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(57) Abrégé(suite)/Abstract(continued):
cyclone air inlet positioned in the air flow passage. A suction motor is positioned in the air flow passage. The nozzle is positioned at a lower portion of the hand vacuum cleaner.

ABSTRACT

A hand vacuum cleaner has a front, an upper portion and a lower portion. The hand vacuum cleaner comprises an air flow passage extending from a nozzle having a dirty air inlet to a clean air outlet. A cyclone unit comprises at least one cyclone having a cyclone air inlet positioned in the air flow passage. A suction motor is positioned in the air flow passage. The nozzle is positioned at a lower portion of the hand vacuum cleaner.

TITLE: NOZZLE FOR A CYCLONIC HAND VACUUM CLEANER

FIELD

The specification relates to vacuum cleaners, and particularly, to cyclonic hand vacuum cleaners. More specifically, the specification relates to hand vacuum cleaners having a nozzle at a lower portion thereof.

INTRODUCTION

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

PCT publication WO 2008/009890 (Dyson Technology Limited) discloses a handheld cleaning appliance comprising a main body, a dirty air inlet, a clean air outlet and a cyclonic separator for separating dirt and dust from an airflow. The cyclone separator is located in an airflow path leading from the air inlet to the air outlet. The cyclonic separator is arranged in a generally upright orientation (i.e., the air rotates about a generally vertical axis in use). A base surface of the main body and a base surface of the cyclonic separator together form a base surface of the appliance for supporting the appliance on a surface. See also PCT publication WO 2008/009888 (Dyson Technology Limited) and PCT publication WO 2008/009883 (Dyson Technology Limited).

United States patent 7,370,387 (Black & Decker Inc.) discloses a hand-holdable vacuum cleaner that uses one or more filters and/or cyclonic separation device. and means for adjusting an angle of air inlet relative to a main axis of said vacuum cleaner. In particular, the vacuum cleaner further comprises a rigid, elongate nose having the air inlet at one end thereof, the nose being pivotal relative to a main axis of the vacuum cleaner through an angle of at least 135 degrees.

SUMMARY

The following introduction is provided to introduce the reader to the more detailed discussion to follow. The introduction is not intended to limit or define the claims.

According to one broad aspect, a cyclonic vacuum cleaner is provided wherein the inlet nozzle is provided at a lower portion of the vacuum cleaner and preferably adjacent the bottom of the vacuum cleaner. An advantage of this design is that the hand vacuum cleaner may be placed on a floor and may be moved along the floor with the nozzle placed on the floor. Accordingly, for example, the hand vacuum cleaner may be provided with wheels and soled over a surface to be cleaned.

This design may be achieved by positioning the cyclone, or a first stage cyclone, with the air inlet at a lower portion thereof, preferably the bottom thereof. Accordingly, the dirty air may travel from the nozzle upwardly, and preferably generally vertically upwardly, to the cyclone chamber.

In accordance with this aspect, the hand vacuum cleaner may have a front, an upper portion, a lower portion, and an air flow passage extending from a nozzle having a dirty air inlet to a clean air outlet. A cyclone unit comprises at least one cyclone having a cyclone air inlet positioned in the air flow passage. A suction motor is positioned in the air flow passage. The nozzle may be fixedly positioned at the lower portion of the hand vacuum cleaner.

In some examples, the nozzle is positioned at the bottom of the hand vacuum. Further, in some examples, the nozzle is positioned beneath at least a portion of the cyclone unit.

In some examples, the nozzle extends generally horizontally.

In some examples, the nozzle may be a longitudinally extending enclosed conduit. In other examples, the nozzle may have an open lower surface and comprise an open sides airflow chamber. For example, the nozzle may have

an upper nozzle wall that comprises at least a portion of the lower wall of the cyclone unit and an open side positioned adjacent the surface to be cleaned when the hand vacuum cleaner is in use.

In some examples, the nozzle further comprises a depending wall extending downwardly from the upper nozzle wall. The depending wall may be generally U-shaped.

In some examples, the cyclone inlet is in communication with an opening positioned in the upper nozzle wall. The opening may face a surface to be cleaned.

In some examples, the nozzle has an open lower end and extends to the front of the hand vacuum cleaner.

In some examples, the hand vacuum cleaner further comprises a plurality of wheels, the nozzle has a nozzle axis that extends generally horizontally when the wheels are in contact with a horizontal surface to be cleaned, and the nozzle has an open lower end.

In some examples, the motor is positioned rearward of the cyclone.

In some examples, the cyclone unit includes a dirt chamber, at least a portion of the dirt chamber is below at least a portion of the cyclone, and the nozzle is positioned below the dirt chamber.

In some examples, the cyclone unit includes a dirt chamber having at least portion extending around the cyclone.

In some examples, the hand vacuum cleaner further comprises a plurality of wheels, the cyclone unit comprises at least one cyclone and the cyclone has a cyclone axis that extends generally horizontally when the wheels are in contact with a horizontal surface to be cleaned.

In some examples, the cyclone has a cyclone width, and the nozzle has a nozzle width that is about the same as the cyclone width.

In some examples, the cyclone has a cyclone axis, the motor has a motor axis and the cyclone axis and the motor axis extend in the same direction.

It will be appreciated that a hand vacuum cleaner may incorporate one or more of the features of each of these examples.

DRAWINGS

In the detailed description, reference will be made to the following drawings, in which:

Figure 1 is a side plan view of an example of a hand vacuum cleaner;

Figure 2 is a top plan view of the hand vacuum cleaner of Figure 1;

Figure 3 is a front plan view of the hand vacuum cleaner of Figure 1;

Figure 4 is a partially exploded rear perspective view of the hand vacuum cleaner of Figure 1;

Figure 5 is a partially exploded front perspective view of the hand vacuum cleaner of Figure 1;

Figure 6 is a cross section taken along line 6-6 in Figure 2; and

Figure 7 is a bottom perspective view of the hand vacuum cleaner of Figure 1;

Figure 8 is a cross section showing an alternate example of a hand vacuum cleaner.

DESCRIPTION OF VARIOUS EXAMPLES

Various apparatuses or methods will be described below to provide an example of each claimed invention. No example described below limits any claimed invention and any claimed invention may cover processes or apparatuses that are not described below. The claimed inventions are not limited

to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses described below. It is possible that an apparatus or process described below is not an embodiment of any claimed invention.

Referring to Figures 1 to 7, a first example of a vacuum cleaner 100 is shown. The vacuum cleaner 100 is a hand vacuum cleaner, and is movable along a surface to be cleaned by gripping and maneuvering handle 102. The vacuum cleaner includes an upper portion 104, a lower portion 106, a front 108, and a rear 110. In the example shown, handle 102 is provided at the upper portion 104. In alternate examples, handle 102 may be provided elsewhere on the vacuum cleaner 100, for example at the rear 110 and may be of any design. The vacuum cleaner 100 may be of various configurations (e.g., different positioning and orientation of the cyclone unit and the suction motor and differing cyclone units that may comprise one or more cyclones and one or more filters) provided the nozzle is located at all times at a lower portion of the vacuum cleaner 100.

In the example shown, the vacuum cleaner 100 comprises a nozzle 112 and a cyclone unit 114, which together form a surface cleaning head 116 of the vacuum cleaner 100. In the example shown, the surface cleaning head 116 is preferably provided at the front 108 of the vacuum cleaner 100.

Nozzle 112 engages a surface to be cleaned, and comprises a dirty air inlet 118, through which dirty air is drawn into the vacuum cleaner 100. An airflow passage extends from the dirty air inlet 118 to a clean air outlet 120 of the cleaner 100. In the example shown, clean air outlet 120 is at the rear 110 of the cleaner 100.

Cyclone unit 114 is provided in the airflow passage, downstream of the dirty air inlet 118. In the example shown, the cyclone unit 114 comprises one cyclone 122, and one dirt chamber 124. In alternate examples, the cyclone

unit 110 may include more than one cyclonic stage, wherein each cyclonic stage comprising one or more cyclones and one or more dirt chambers. Accordingly, the cyclones may be arranged in parallel and/or in sequence.

In the example shown, the nozzle 112 is positioned at the lower portion 106 of the vacuum cleaner 100. Preferably, as exemplified, nozzle 112 is positioned at the bottom of the vacuum cleaner 100, and, preferably, beneath the cyclone unit 114. Accordingly, as exemplified, nozzle 112 may be on lower surface 117 of cyclone unit 114. In a particularly preferred design, the upper wall of the nozzle may be a lower wall of the cyclone unit 114. As shown in figure 6, dirt chamber 124 surrounds the lower portion of cyclone 122. Accordingly, the upper wall of nozzle 112 may be part of the lower wall of the dirt chamber. It will be appreciated that if dirt chamber 124 does not extend around the lower portion of cyclone 122, then the upper wall of nozzle 112 may be part of a lower wall of cyclone 122.

Preferably, in the example shown, the nozzle 112 is fixedly positioned at the lower portion 106 of the vacuum cleaner 100. That is, the nozzle 112 is not movable (e.g., rotatable) with respect to the remainder of the vacuum cleaner 100, and is fixed at the lower portion 106 of the vacuum cleaner 100.

As shown in Figures 3 and 5, nozzle 112 has a width WN, and cyclone unit 114 has a width WC. In the example shown, WN, and WC are about the same. An advantage of this design is that the hand vacuum may have a cleaning path that is essentially as wide as the hand vacuum itself.

Preferably, nozzle 112 comprises an airflow chamber wherein at least a portion, and preferably a majority, of the lower surface of the chamber is open. In an alternate design as exemplified by Figure 8, nozzle 812 comprises a lower wall 837, which closes lower end 834. Accordingly, nozzle 112 may be of various design and may be an open sided passage or a closed passage.

Nozzle 112 may also share a common wall with another component of cyclone unit 114. As exemplified in Figure 7, nozzle 112 comprises an upper nozzle wall 126, which defines a closed upper end of the airflow chamber 136. In the example shown, the upper nozzle wall 126 comprises a lower portion 119 of a wall 115 of the cyclone unit.

Preferably, one or more depending walls 128 extend downwardly from the upper nozzle wall 126. The depending wall is preferably generally U-shaped. In one embodiment, depending wall is provided rearward of opening 138. In other embodiments, depending walls may alternately or in addition be provided on the lateral sides of opening 138. It is preferred that depending walls are provided on each lateral side of opening 138 and rearward thereof. Further, depending walls 128 may extend a substantial distance to the front end 108 and, preferably, essentially all the way to front end 108. The depending walls may be continuous to define a single wall as shown, or may be discontinuous. The depending walls are preferably rigid (e.g., integrally molded with cyclone unit 114). However, they may be flexible (e.g., bristles or rubber) or moveably mounted to cyclone unit 114 (e.g., hingedly mounted).

Preferably, the lower end 132 of depending wall 128 is spaced above the surface being cleaned when the hand vacuum cleaner is placed on a surface to be cleaned. As exemplified in Figure 6, when vacuum cleaner 100 is placed on floor F, lower end 132 of depending wall 128 is spaced a distance H above the floor. Preferably distance H is from 0.01 to 0.175 inches, more preferably from 0.04 to 0.08 inches.

The height of the depending wall (between upper nozzle wall 126 and lower end 132) may vary. In some examples, the depending wall may have a height of between about 0.05 inches and about 0.875 inches, preferably between about 0.125 inches and about 0.6 inches and more preferably between about 0.2 inches and about 0.4 The height of depending wall may vary but is preferably constant.

As exemplified, the open end of the U-shape defines an open side 130 of the nozzle 112, and forms the dirty air inlet 118 of the cleaner 100. In the example shown, the open side 130 is provided at the front of the nozzle 112. In use, when optional wheels 135 are in contact with a surface, the open side 130 sits above and is adjacent a surface to be cleaned (e.g. floor F). Preferably, lower end 132 of depending walls 128 is spaced above floor F. Accordingly, some air may enter nozzle 112 by passing underneath depending wall 132. In such a case, the primary air entry to nozzle 112 is via open side 130 so that dirty air inlet 118 is the primary air inlet, with a secondary air inlet being under depending wall 128. In the example shown, the lower end 132 of the depending wall 128 defines an open lower end 134 of the nozzle 112. The open lower end 134 preferably extends to the front 108 of the cleaner 108, and merges with the open side 130.

In use, the exemplified nozzle has an open lower end 134 that faces a surface to be cleaned. In the example shown, a plurality of wheels 135 are mounted to the depending wall 128, and extend lower than the lower end 132 of the depending wall 128. Accordingly, in use, when wheels 135 are in contact with a surface, the lower end 132 of the depending wall 128 is spaced from a surface to be cleaned, and the space between the lower end of the depending wall 128 and the surface to be cleaned form a secondary dirty air inlet to the vacuum cleaner 100. It will be appreciated that wheels 135 are optional. Preferably, wheels 135 are positioned exterior to the airflow path through nozzle 112, e.g., laterally outwardly from depending wall 128. Preferably a pair of front wheels 135 is provided. Preferably, the wheels are located adjacent front 108. Optionally, one or more rear wheels 108 may be provided. In an alternate embodiment, no wheels may be provided.

The upper nozzle wall 126, depending wall 128, and open lower end 134 of the nozzle 112 define an open sided airflow chamber 136 of the nozzle. In use, when wheels 135 are in contact with a horizontal surface, the

nozzle 112 and the airflow chamber 136 extend generally horizontally, and preferably linearly along a nozzle axis 113 (see Figure 7).

An opening 138 is provided in the upper nozzle wall 126, and is in communication with the airflow chamber 136. Opening 138 may be of any size and configuration and at various locations in upper nozzle wall 126. In use, when wheels 135 are in contact with a surface, the opening 138 faces a surface to be cleaned, air enters the dirty air inlet 118, passes horizontally through the airflow chamber 136, and passes into the opening 138. Opening 138 is in communication with a cyclone inlet passage 139, which is in communication with a cyclone air inlet 140 of cyclone 122.

Cyclone 122 may of any configuration and orientation. Preferably, cyclone 122 comprises a chamber wall 142, which in the example shown, is cylindrical. The cyclone chamber is located inside chamber wall 142. The cyclone 122 extends along an axis 123, which, in the example shown, is preferably parallel to the nozzle axis, and preferably extends generally horizontally when cleaner 100 is in use and wheels 135 are seated on a surface. The cyclone 122 has an air inlet and an air outlet, which, preferably are at the same end of cyclone 122. Preferably the air inlet and the air outlet are distal to front end 108. The cyclone air inlet and cyclone air outlet may be of any configuration known in the art and the cyclone air outlet may be covered by a screen or shroud or filter as is known in the art.

As exemplified, the cyclone air inlet 140 is defined by an aperture in the chamber wall 142. As can be seen in Figure 5, the inlet passage 139 is at configured such that air enters the cyclone 122 in a tangential flow path, e.g., passage 139 may be arcuate. The air travels in a cyclonic path in the cyclone, and dirt in the air is separated from the air. The air exits the cyclone via an outlet passage 144. As exemplified in Figure 6, a plate 174 may be provided adjacent outlet passage 144, spaced from and facing the inlet 176 to outlet passage 144. Plate 174 may be mounted to cyclone 122 via legs 178. In the example shown,

plate 174, and legs 178 form an assembly 182 that is removably mounted in cyclone 122. In some examples, a screen may be mounted around legs 178.

The dirt chamber may be internal or external to the cyclone chamber. Preferably, as exemplified, the dirt chamber is external and the dirt that is separated from the air exits the cyclone via dirt outlet 146, and enters dirt chamber 124. The dirt chamber may be in communication with the cyclone chamber by any means known in the art. Accordingly, one or more dirt outlets may be provided. Preferably, the dirt outlet is at the end opposed to the air inlet and, preferably, the dirt outlet is at the front end 108.

In the example shown, dirt chamber 124 comprises two portions. A first portion 148 is provided immediately adjacent the dirt outlet 146, and is at the front 108 of the cleaner 100. A second portion 150 is concentric with the cyclone 122. A lower portion 152 of the second portion 150 is below the cyclone. As exemplified, nozzle 112 is positioned below first portion 148, and lower portion 152. Accordingly, dirt chamber 124 may comprise an annular chamber surrounding the cyclone 122.

A separation plate 154 may be provided in the dirt chamber 124, adjacent the dirt outlet 146. The separation plate 154 aids in preventing dirt in dirt chamber 124 from re-entering cyclone 122. Preferably, plate 154 is spaced from dirt outlet 146 and faces dirt outlet 146. Plate 154 may be mounted by any means to any component in cyclone unit 114. As exemplified, the separation plate is mounted on an arm 156, which extends from a front wall 158 at the front 108 of the cleaner 100.

Cyclone unit 114 may be emptied by any means known in the art. For example, one of the ends of the cyclone unit 114 may be openable. As exemplified in Figures 4 and 5, front wall 158 is pivotably mounted to the cyclone unit wall 115, such that cyclone unit 114 may be opened, and dirt chamber 124 may be emptied. When front wall 158 is pivoted away from the remainder of the

cyclone unit 114, separation plate 154 and arm 156 also pivot away from the remainder of the cyclone unit. A latch 159 is provided, which secures front wall 158 to wall 115. In alternate examples, front wall 158 may be removable from cyclone unit wall 115 or the opposed end of the cyclone unit 114 may be openable.

The clean air exiting cyclone 122 passes through outlet passage 144, exits surface cleaning head 116, and passes into the cleaner body 160. In the example shown, the cleaner body 160 is positioned rearward of the surface cleaning head 116. The cleaner body comprises a housing 161, which preferably houses an optional pre-motor filter 162, a suction motor 164, and an optional post-motor filter 166.

In the exemplified embodiments, the vacuum cleaner has a linear configuration. Accordingly, pre-motor filter 162 is preferably provided in the airflow path adjacent and downstream of the outlet passage 144. Pre-motor filter 162 serves to remove remaining particulate matter from air exiting the cyclone 122, and may be any type of filter, such as a foam filter. One or more filters may be used. If the vacuum cleaner is of a non-linear configuration, then pre-motor filter 162 need not be located adjacent outlet passage 144.

Suction motor 164 is provided in the airflow path adjacent and downstream of the pre-motor filter 162. The suction motor draws air into the dirty air inlet 118 of the cleaner 100, through the airflow path past the suction motor 164, and out of the clean air outlet 120. The suction motor 164 has a motor axis 165. In the example shown, the motor axis 165 and the cyclone axis 122 extend in the same direction and are generally parallel. The suction motor 164 may be any type of suction motor. If the vacuum cleaner is of a non-linear configuration, then motor 164 need not be located adjacent pre-motor filter 162.

Post motor filter 166 is provided in the airflow path downstream of, and preferably adjacent, the suction motor 164. Post motor filter serves to

remove remaining particulate mater from air exiting the cleaner 100. Post-motor filter 166 may be any type of filter, such as a HEPA filter.

Clean air outlet 120 is provided downstream of post-motor filter 166. Clean air outlet 120 comprises a plurality of apertures preferably formed in housing 161.

In the example shown, cleaner body 160 is removably mounted to surface cleaning head 116. For example, cleaner body 160 may be entirely removable from surface cleaning head 116, or pivotably mounted to surface cleaning head 116. Accordingly, cleaner body 160 and surface cleaning head 116 may be separated in order to provide access to the interior of cleaner body 160 or surface cleaning head 116. This may allow pre-motor filter 162 to be cleaned, changed, or serviced, or motor 164 to be cleaned, changed or serviced. Alternately, or in addition, surface cleaning head 116 may be cleaned or serviced. For example, any dirt stuck in outlet passage 144 may be removed. Alternately, a replacement cleaner body 160 or surface cleaning head 116 may be provided, and may be mounted to an existing surface cleaning head 116 or cleaner body 160, respectively. If no filter element is fixedly mounted to cleaning head 116, then cleaning head 116 may be removed and washed with water.

As can be seen in Figure 6, housing 161 preferably comprises a first portion 168 housing pre-motor filter 162, and suction motor 164, and a second portion 170 housing post-motor filter 166. Second portion 170 is openable, such as by being removably mounted to first portion 168, such that post-motor filter 166 may be cleaned, changed, or serviced.

One or more additional rear wheels 180 may alternately, or in addition, be mounted to housing 161, preferably at lower portion 106, and may be used in conjunction with wheels 135. Preferably, a single rear wheel 180 is provided. Preferably, rear wheel 180 is located on a centre line of the vacuum cleaner and rearward of the depending wall 128.

Referring now to Figure 8, in which like numerals refer to like features, with the first digit incremented to 8 to refer to the figure number, an alternate example of a hand vacuum cleaner 800 is shown. In this example, front wall 858 is not pivotally mounted to wall 815. Rather, wall surface cleaning head 816 is pivotally mounted to body 860.

CLAIMS:

1. A hand vacuum cleaner having a front, an upper portion and a lower portion, the hand vacuum cleaner comprising:

(a) an air flow passage extending from a nozzle having a dirty air inlet to a clean air outlet;

(b) a cyclone unit comprising at least one cyclone having a cyclone air inlet positioned in the air flow passage; and,

(c) a suction motor positioned in the air flow passage;

wherein the nozzle is fixedly positioned at the lower portion of the hand vacuum cleaner.

2. The hand vacuum cleaner of claim 1 wherein the nozzle is positioned at the bottom of the hand vacuum.

3. The hand vacuum cleaner of claim 1 wherein the nozzle is positioned beneath at least a portion of the cyclone unit.

4. The hand vacuum cleaner of any of claims 1-3 wherein the nozzle extends generally horizontally.

5. The hand vacuum cleaner of any of claims 1-4 wherein the nozzle has an upper nozzle wall that comprises at least a portion of the lower wall of the cyclone unit and the nozzle has an open side positioned adjacent the surface to be cleaned when the hand vacuum cleaner is in use.

6. The hand vacuum cleaner of claim 5 wherein the nozzle further comprises a depending wall extending downwardly from the upper nozzle wall.

7. The hand vacuum cleaner of claim 6 wherein the depending wall is generally U-shaped.

8. The hand vacuum cleaner of any of claims 5-7 wherein the cyclone inlet is in communication with an opening positioned in the upper nozzle wall.

9. The hand vacuum cleaner of any of claims 1-3 wherein the nozzle has an open lower end and extends to the front of the hand vacuum cleaner.

10. The hand vacuum cleaner of any of claims 1-3 further comprising a plurality of wheels, the nozzle has a nozzle axis that extends generally horizontally when the wheels are in contact with a horizontal surface to be cleaned and the nozzle has an open lower end.

11. The hand vacuum cleaner of claim 8 wherein the opening faces a surface to be cleaned.

12. The hand vacuum cleaner of claim 1 wherein the motor is positioned rearward of the cyclone.

13. The hand vacuum cleaner of claim 1 wherein the cyclone unit includes a dirt chamber, at least a portion of the dirt chamber is below at least a portion of the cyclone and the nozzle is positioned below the dirt chamber.

14. The hand vacuum cleaner of claim 1 wherein the cyclone unit includes a dirt chamber having at least portion extending around the cyclone.

15. The hand vacuum cleaner of any of claims 1-14 further comprising a plurality of wheels, the cyclone unit comprises at least one cyclone and the

cyclone has a cyclone axis that extends generally horizontally when the wheels are in contact with a horizontal surface to be cleaned.

16. The hand vacuum cleaner of any of claims 1-15 wherein the cyclone has a cyclone width, and the nozzle has a nozzle width that is about the same as the cyclone width.

17. The hand vacuum cleaner of claim 16 wherein the cyclone has a cyclone axis, the motor has a motor axis and the cyclone axis and the motor axis extend in the same direction.

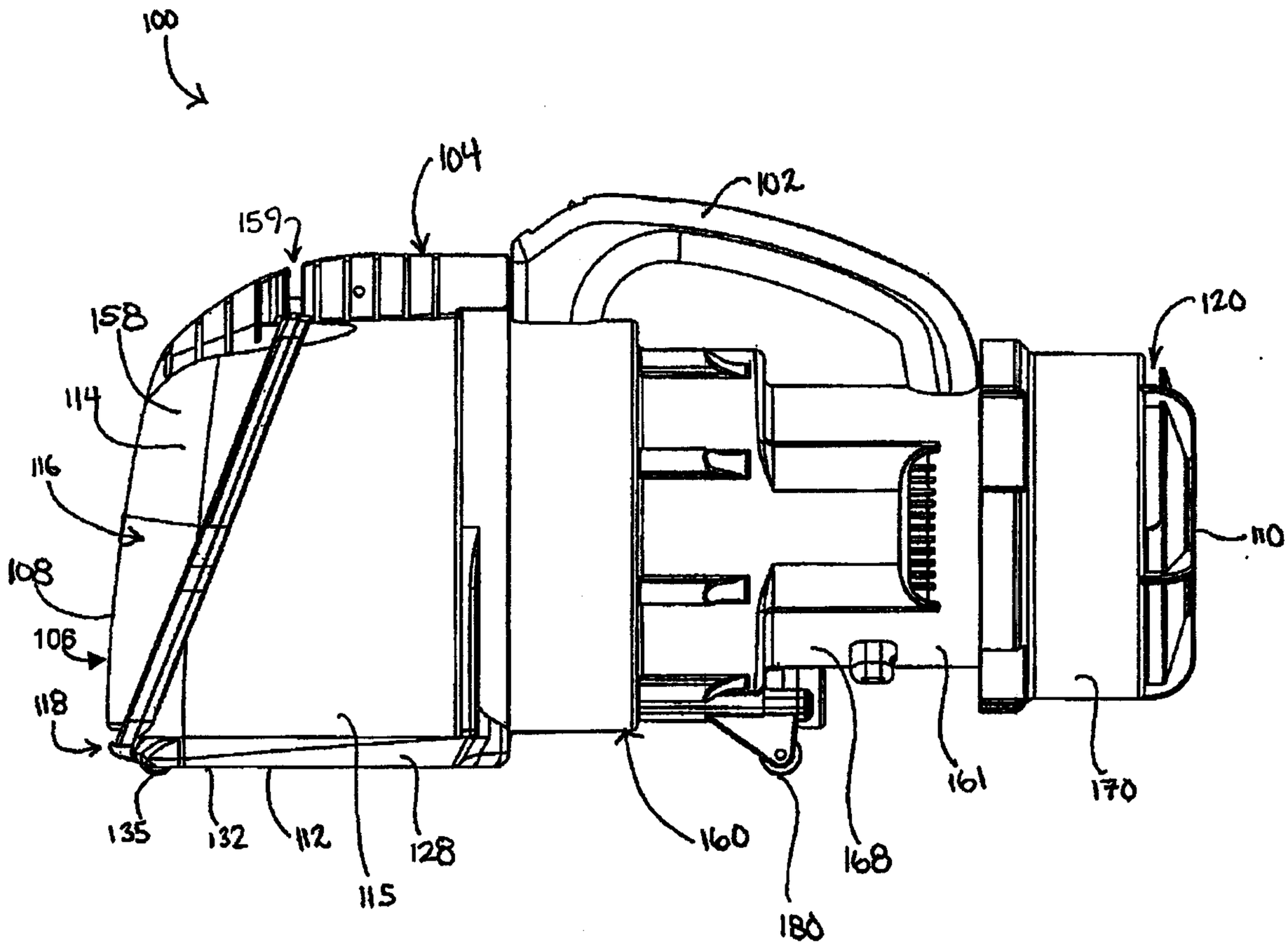
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FIG. 1

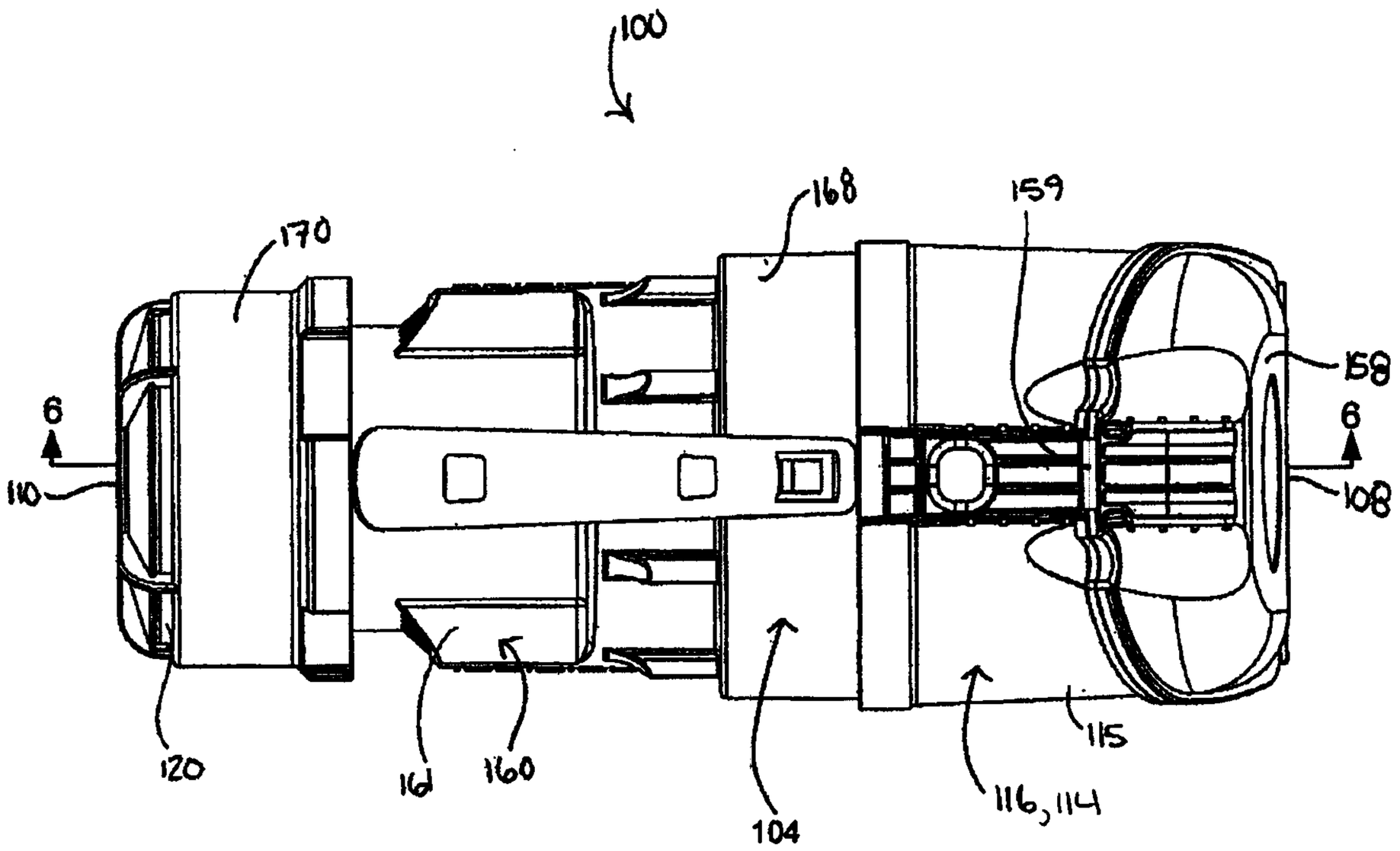

FIG. 2

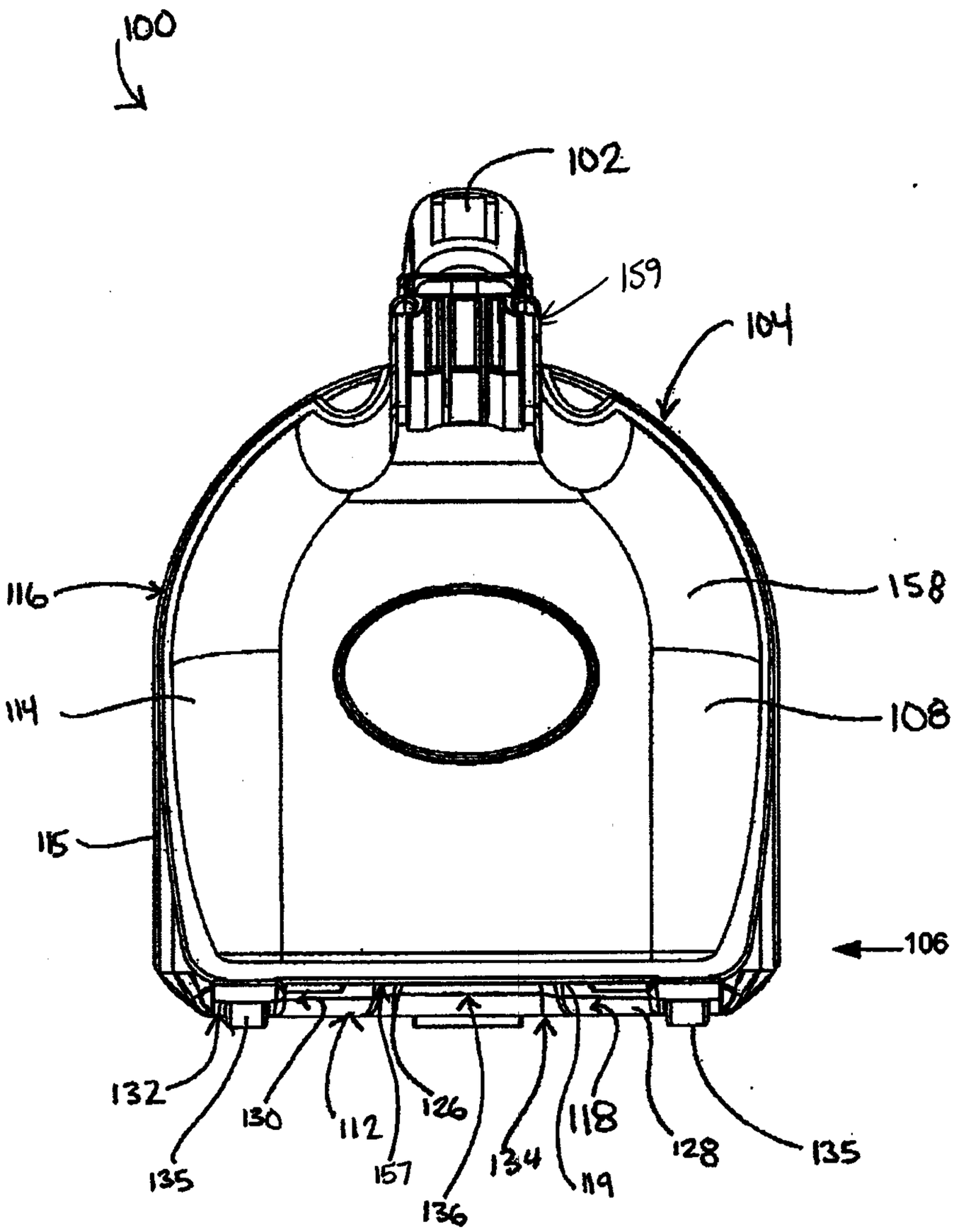
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FIG. 3

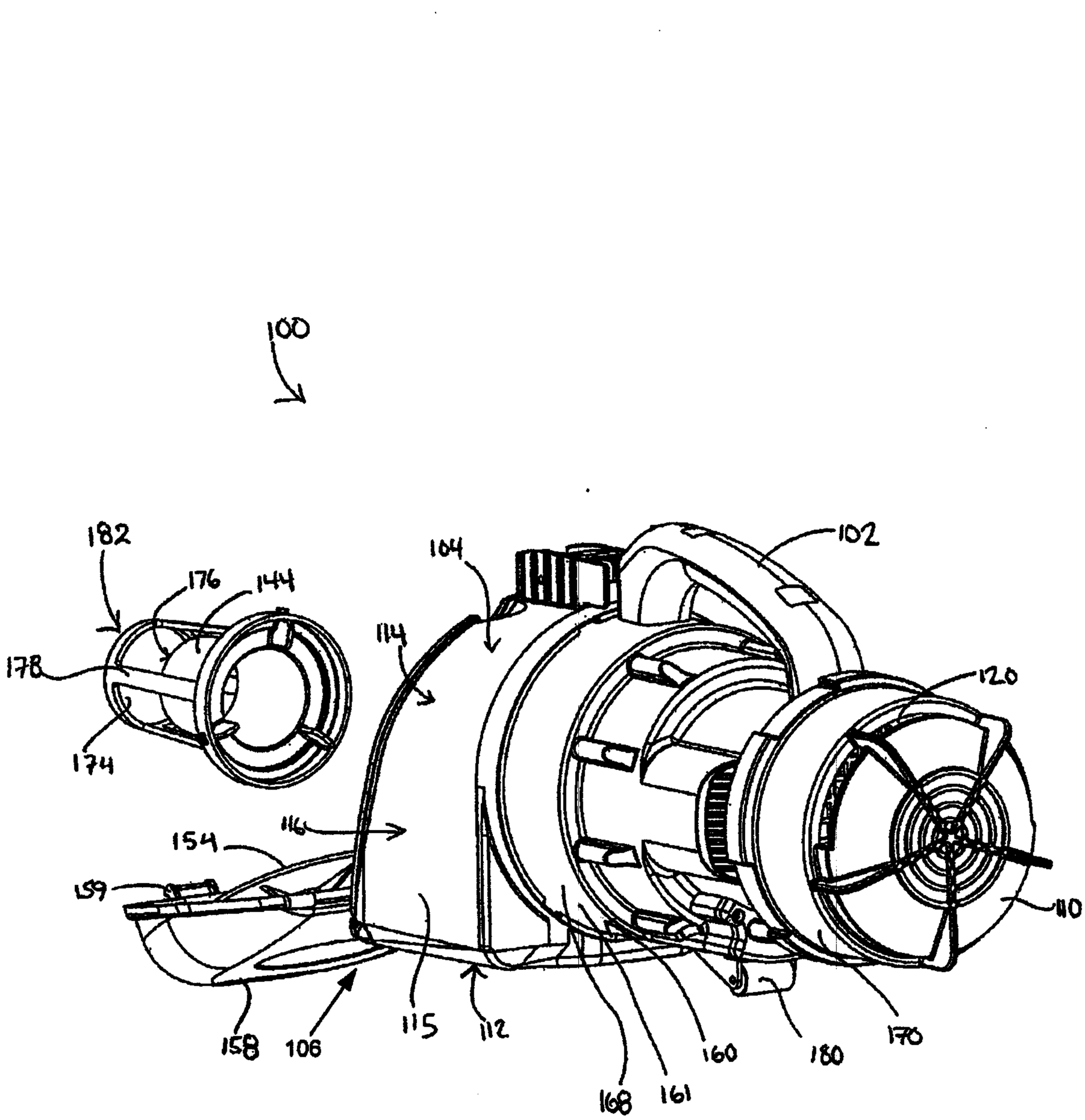
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FIG. 4

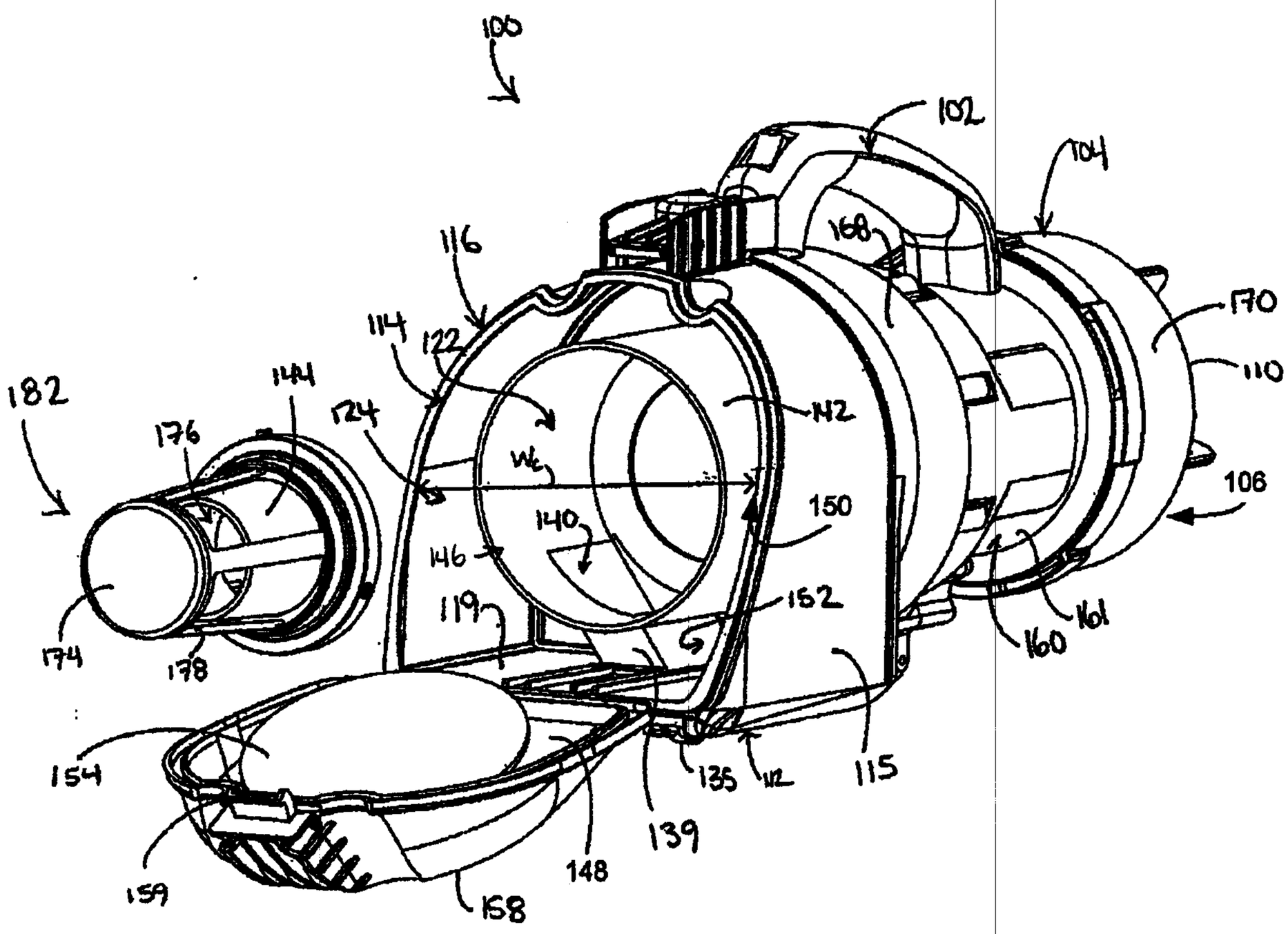
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FIG. 5

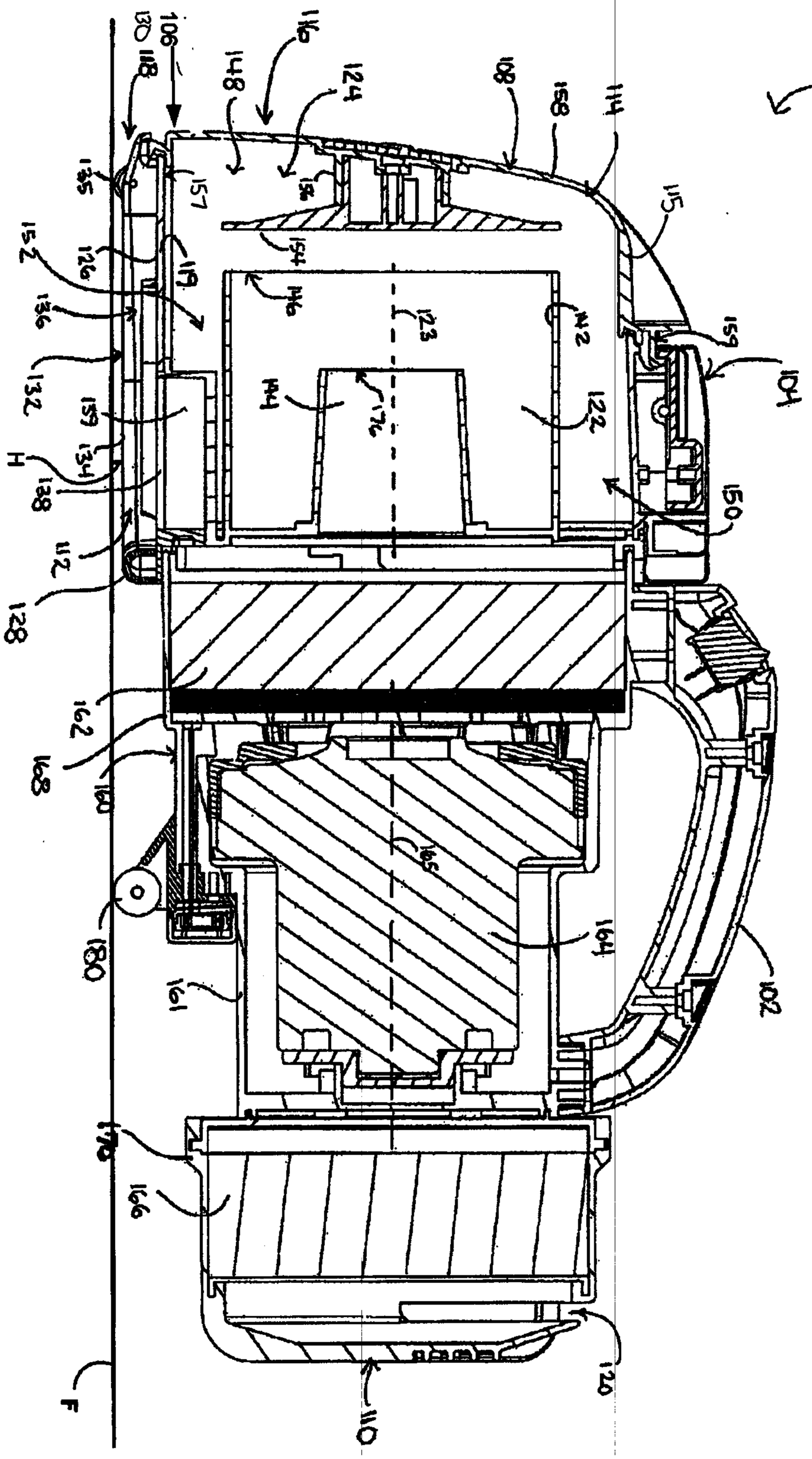
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FIG. 6

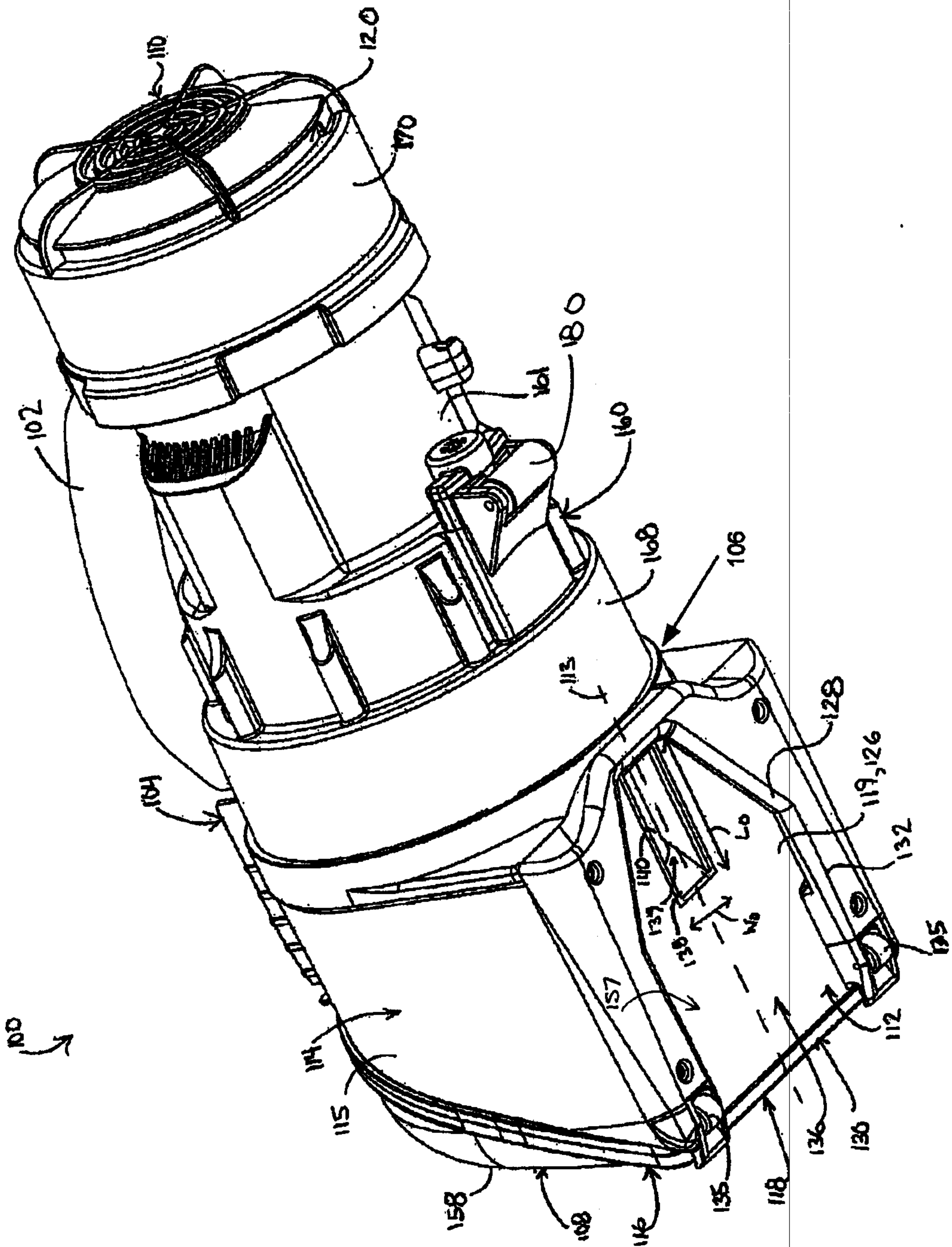
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FIG. 7

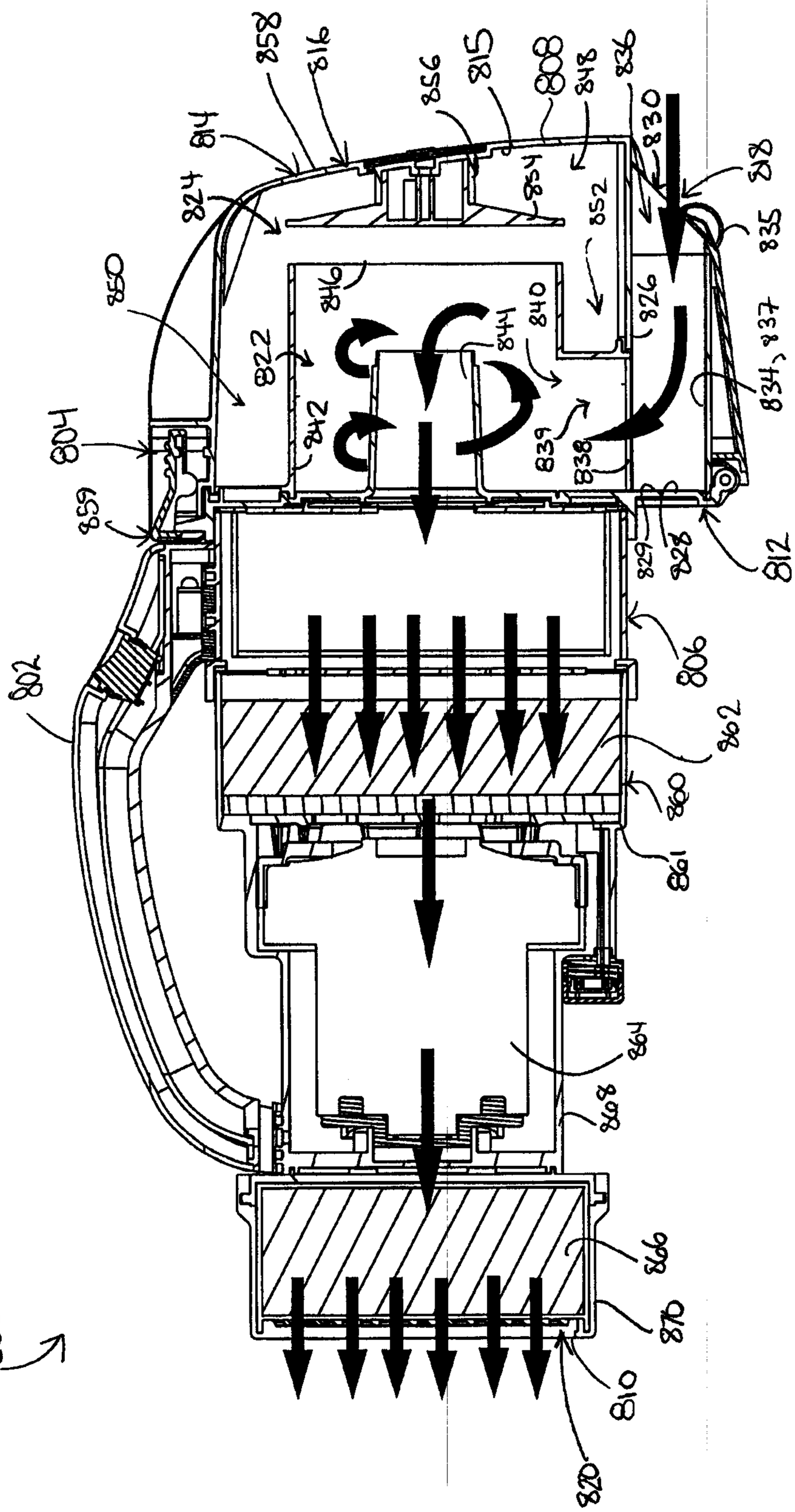
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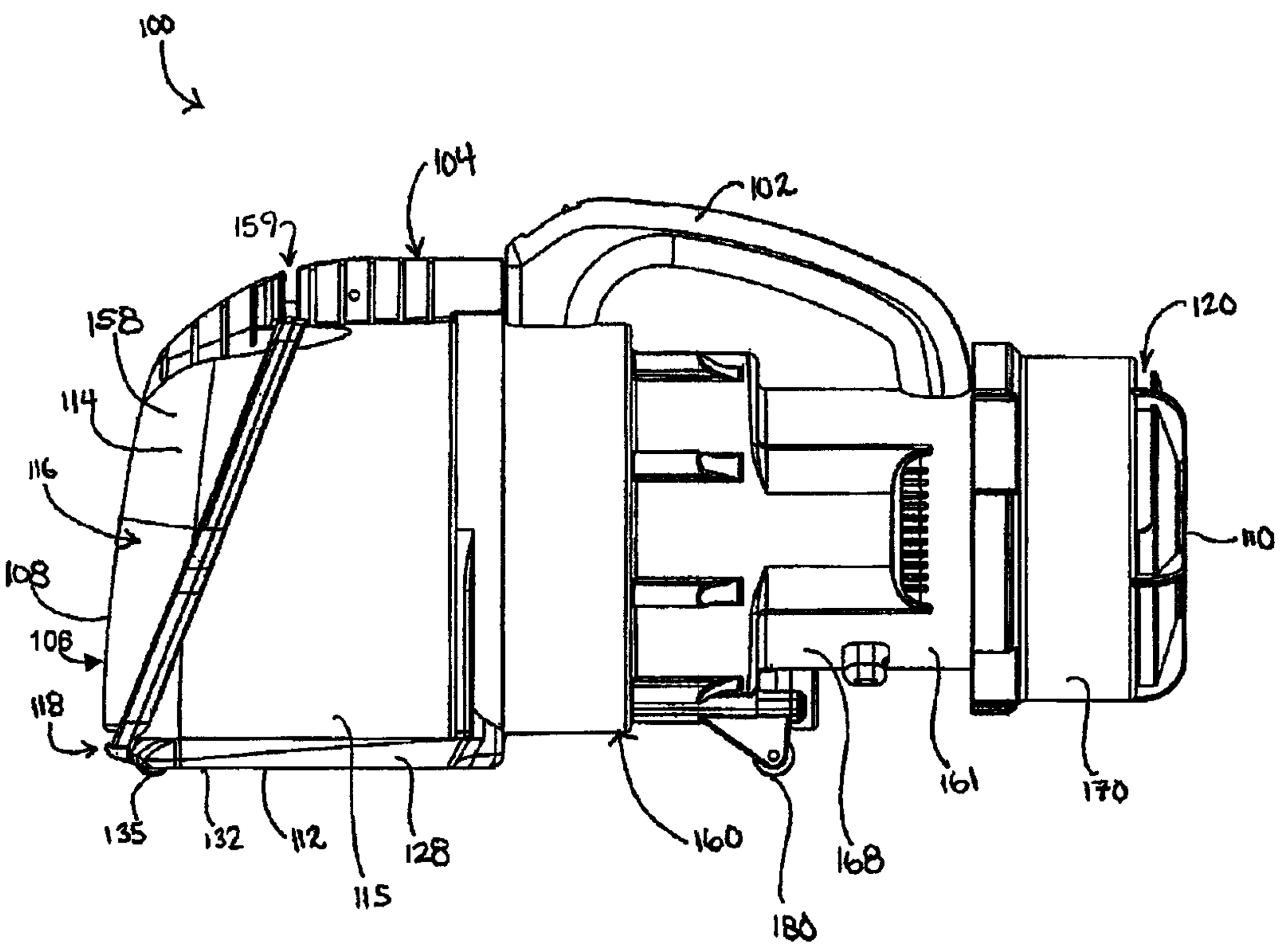
FIG. 8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