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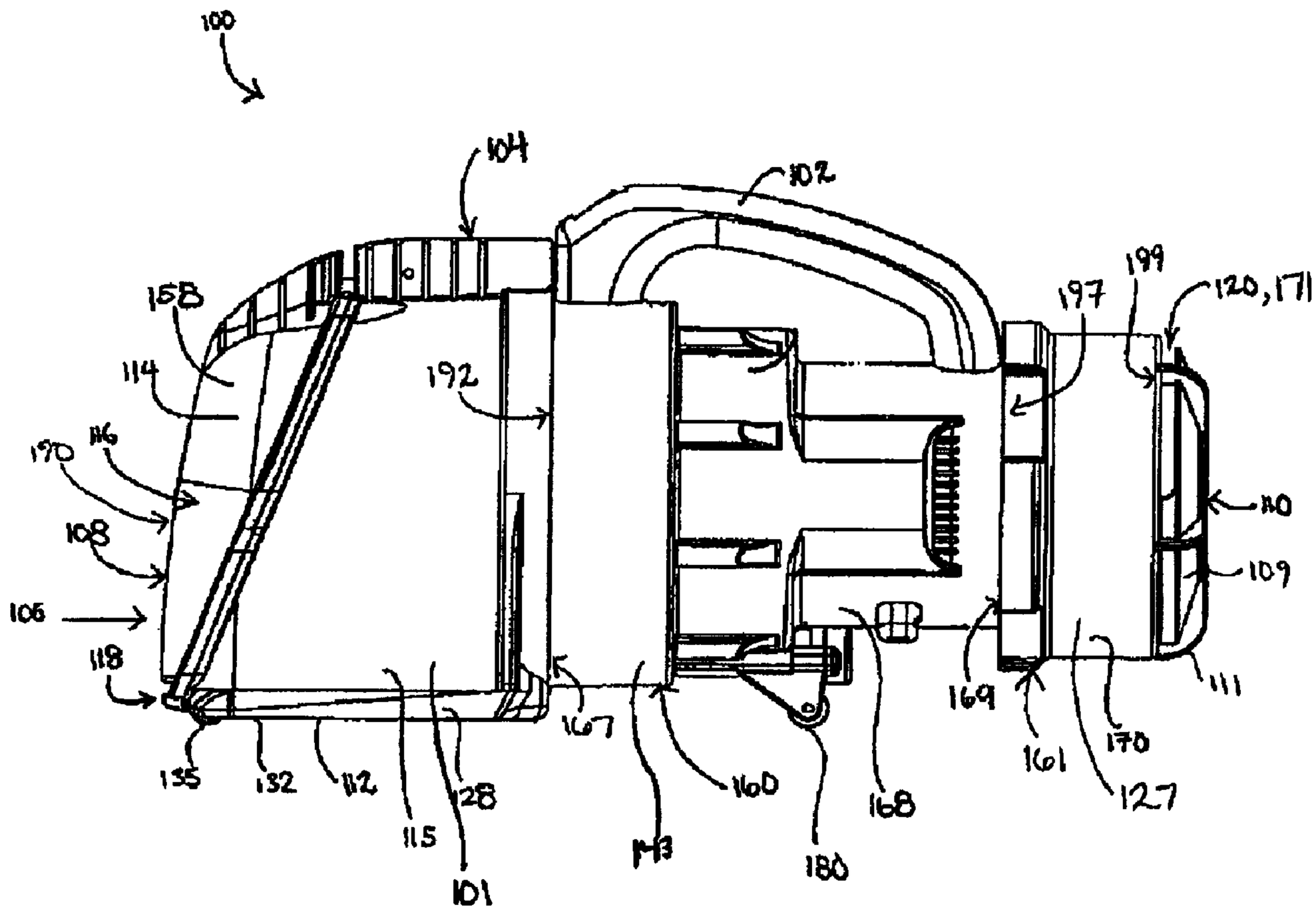
(54) Titre : LOGEMENT DE FILTRE SECONDAIRE SITUE DERRIERE LE MOTEUR POUR UN APPAREIL DE NETTOYAGE DE SURFACES

(54) Title: HOUSING FOR A POST MOTOR FILTER FOR A SURFACE CLEANING APPARATUS



(57) Abrégé/Abstract:
A surface cleaning apparatus comprises an outer wall, a filter comprising filter material secured in a support wherein at least a portion of the support comprises a portion of the outer wall of the surface cleaning apparatus. A surface cleaning apparatus having a clean air exit that is adjustable to direct the air flow exiting the vacuum cleaner in different directions is also disclosed.

ABSTRACT

A surface cleaning apparatus comprises an outer wall, a filter comprising filter material secured in a support wherein at least a portion of the support comprises a portion of the outer wall of the surface cleaning apparatus. A surface cleaning apparatus having a clean air exit that is adjustable to direct the air flow exiting the vacuum cleaner in different directions is also disclosed.

TITLE: HOUSING FOR A POST MOTOR FILTER FOR A SURFACE CLEANING APPARATUS

FIELD

The specification relates to surface cleaning apparatuses. In a preferred embodiment, the specification relates to portable surface cleaning apparatus, such as cyclonic hand vacuum cleaners or other hand or strap carriable vacuum cleaners having a filter and, preferably a HEPA filter.

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.

Vacuum cleaner that utilize a HEPA filter are known. In order to increase the surface area of a HEPA filter, the HEPA filter material is typically pleated and secured, e.g., glued, into a plastic filter holder. This produces a HEPA filter assembly that is then installed in a chamber of a vacuum cleaner.

Various types of vacuum cleaners, including cyclonic vacuum cleaners, are known. Such vacuum cleaners include upright vacuum cleaner, canister vacuum cleaner and, more recently hand vacuum cleaner. See for example, PCT publication WO 2008/009890, PCT publication WO 2008/009888, PCT publication WO 2008/009883 and United States patent 7,370,387.

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 surface cleaning apparatus is provided that uses a filter wherein the filter comprises filter material secured in a housing wherein a portion of the housing forms part of an outer wall of the surface cleaning apparatus. An advantage of this design is that the hand weight of a vacuum cleaner may be reduced. In particular, prior art designs utilize a filter

assembly in which a filter, e.g., a HEPA filter is mounted in a plastic support housing. The plastic support housing is used to secure the filter material in position. For example, the HEPA material may be glued or welded into the plastic support housing. The housing keeps the filter material open and oriented. This assembly is then removaby mounted into a chamber of, e.g., a vacuum cleaner. The vacuum cleaner has an outer wall. Once installed in the chamber, the plastic support housing is interior of the vacuum cleaner. In particular, at least one layer of plastic will be positioned between the filter material and the outside surface of the vacuum cleaner.

In one example, the surface cleaning apparatus may comprise an outer wall and an air flow passage may extend from a dirty air inlet to a clean air outlet. At least one dirt separation unit is positioned in the air flow passage. A suction motor is positioned in the air flow passage. A filter, and preferably a HEPA filter, is positioned in the air flow passage. The filter comprises filter material secured in a support wherein at least a portion of the support comprises a portion of the outer wall of the surface cleaning apparatus.

In some examples, the filter has an air inlet, an air outlet and a side wall extending from the air inlet to the air outlet, and at least a portion of the side wall comprises a portion of the outer wall of the surface cleaning apparatus. In some examples, at least half of the side wall comprises a portion of the outer wall of the surface cleaning apparatus.

In some examples, the support has an upstream end that is removably mounted to the surface cleaning apparatus.

In some examples, the suction motor is positioned in a suction motor housing and the filter is removably mounted to the suction motor housing, preferably at a downstream end thereof.

In some examples, the filter is rotationally mounted to the surface cleaning apparatus, such as by a bayonet mount.

In some examples, the filter material is washable.

In some examples, the surface cleaning apparatus is a hand or strap carriable surface cleaning apparatus, such as a hand vacuum cleaner.

In some examples, the filter is mounted at a rear end of the hand vacuum cleaner.

In some examples, the filter has a downstream end and the downstream end is configured to be placed on a floor.

In some examples, the downstream end is planar.

In some examples, the downstream end has a plurality of feet.

In some examples, the at least one dirt separation unit comprises at least a first cyclone unit.

In some examples, the suction motor is positioned in a suction motor housing and the first cyclone unit is removably mounted to the surface cleaning apparatus.

In some examples, the suction motor housing has an upstream end and a downstream end, the first cyclone unit is removably mounted to the upstream end and the filter is removably mounted to the downstream end.

In another broad aspect a surface cleaning apparatus having an air exit wherein the direction of the air flow exiting the surface cleaning apparatus may be adjusted.

In one example, the surface cleaning apparatus may comprise an air flow passage extending from a dirty air inlet to a clean air outlet, at least one dirt separation unit positioned in the air flow passage; and, a suction motor positioned in the air flow passage, wherein the clean air exit is adjustable to direct air exiting the clean air exit in at least two different positions.

In some examples the clean air exit is repositionable on the surface cleaning apparatus in various orientations.

In some examples surface cleaning apparatus further comprises a filter positioned in the air flow passage, the filter comprising the clean air exit.

In some examples, the air exit and/or grill on the air exit, may be adjustable while mounted to the surface cleaning apparatus.

It will be appreciated that a cleaning apparatus 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;

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

Figure 8 is a rear perspective view of the hand vacuum cleaner of Figure 1, showing a HEPA filter removed from the hand vacuum cleaner;

Figure 9 is a rear perspective view of the hand vacuum cleaner of Figure 1, showing a HEPA filter removed from the hand vacuum cleaner, and showing an interior of the HEPA filter;

Figure 10 is a side plan view of the hand vacuum cleaner of Figure 1, showing the hand vacuum cleaner standing on a HEPA filter; and

Figure 11 is a rear perspective view of the hand vacuum cleaner of Figure 1, showing a cyclone unit removed from the 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.

In the drawings attached hereto, a hand vacuum cleaner is exemplified comprising one cyclonic stage. It will be appreciated that the vacuum cleaner 100 may be of various configurations (e.g., different types of vacuum cleaner, different positioning and/or orientation of the cleaning or cyclonic stage or stages and the suction motor and differing cleaning or cyclonic stages that may comprise one or more cyclones and/or one or more filters). Preferably, as exemplified, the surface cleaning apparatus is one that is designed to be carried, e.g., by a shoulder strap or by hand, while in use. As such carriable vacuum cleaners may be used for an extended period of time, the surface cleaning apparatus preferably has a reduced weight. This may be achieved by using part of the outer casing of a filter mount as an outer surface of the surface cleaning apparatus.

Referring to Figures 1 to 11, an example of a surface cleaning apparatus 100 is shown. In the example shown, the surface cleaning apparatus 100 is a hand vacuum cleaner 100, and is movable along a surface to be cleaned by gripping and maneuvering handle 102. The vacuum cleaner 100 includes an outer wall 101. The vacuum cleaner 100 further includes an upper portion 104, a lower portion 106, a front end 108, and a rear end 110. A longitudinal axis 125 of the vacuum cleaner 100 extends between the front end 108 and the rear end 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 end 110 and may be of any design.

In the example shown, the vacuum cleaner 100 comprises a nozzle 112 and a dirt separation unit 114, which together preferably form a surface cleaning head 116 of the vacuum cleaner 100. Preferably, as exemplified, the surface cleaning head 116 is provided at the front end 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. Preferably, as in the example shown, clean air outlet 120 is at the rear end 110 of the cleaner 100.

Preferably, as in the example shown, dirt separation unit 114 is a first cyclone unit 114. Cyclone unit 114 is provided in the airflow passage, downstream of the dirty air inlet 118. Cyclone unit 114 has a front end 190, and a rear end 192. In the example shown, the cyclone unit 114 is a one piece assembly comprising one cyclone 122, and one dirt collection chamber 124, which are integrally formed. Cyclone unit 114 has an outer wall 115. Outer wall 115 forms a portion of the outer wall 101 of the hand vacuum cleaner 100.

In alternate examples, the vacuum cleaner 100may include more than one cyclonic stage, wherein each cyclonic stage comprises one or more cyclones and one or more dirt chambers. Accordingly, the cyclones may be arranged in parallel and/or in sequence. Further, in alternate examples, the cyclone 122 and dirt collection chamber 124 may be separately formed. It will be appreciated that a cyclone may not be used in some embodiments.

Preferably, as 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 157 of cyclone unit 114. In a particularly preferred design, the upper wall 126 of the nozzle 112 may be a lower wall 119 of the outer wall 115 of the cyclone unit 114. As shown in Figure 6, dirt chamber 124 surrounds the lower portion of cyclone 122. Accordingly, the upper wall 126 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, as 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 W_N, and cyclone unit 114 has a width W_C. In the example shown, W_N, and W_C are about the same. An advantage of this design is that the nozzle 112 may have a cleaning path that is essentially as wide as the hand vacuum itself.

Preferably, nozzle 112 comprises an airflow chamber 136 wherein at least a portion, and preferably a majority, of the lower surface 134 of the

chamber 136 is open. Such a design is exemplified in Figure 7 wherein, as mentioned hereinabove, nozzle 112 comprises upper nozzle wall 126. Preferably, as in the example shown, as mentioned hereinabove, the upper nozzle wall 126 comprises a portion 119 of the outer wall 115 of the cyclone unit.

Preferably, one or more depending walls 128 extend downwardly from the upper nozzle wall 126. In the example shown, the nozzle includes one depending wall 128. The depending wall is preferably generally U-shaped. The depending wall 128 may be continuous to define a single wall as shown, or may be discontinuous. The depending wall is preferably rigid (e.g., integrally molded with cyclone unit 114). However, it 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. Preferably, as in the example shown, a plurality of optional 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 the surface to be cleaned. As exemplified in Figure 6, when vacuum cleaner 100 is placed on a 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 and about 0.875 inces, preferably between about 0.125 and about 0.6 inchesand more preferably between about 0.2 and about 0.4 inches. 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 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). As mentioned hereinabove, 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 end 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.

It will be appreciated that wheels 135 are optional. Preferably, wheels 135 are positioned exterior to the air flow passage through nozzle 112, e.g., laterally outwardly from depending wall 128. Preferably a pair of front wheels 135 are provided. Preferably, the wheels are located adjacent front end 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 the 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. In other embodiments, as exemplified in Figure 8, nozzle 112 may comprise an enclosed passage. It will be appreciated that any nozzle known in the art may be used.

If a cyclone is used in the air treatment member, then 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 113, and parallel to the cleaner axis 125. Axis 123 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 140 and an air outlet 145, which preferably are at the same end of cyclone 122. 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 may be defined by an aperture in the chamber wall 142. As can be seen in Figure 5, the inlet passage 139 is preferably 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, through outlet 145. As exemplified, outlet 145 is defined in a rear wall 179 of the cyclone unit 114.

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 that is separated from the air exits the cyclone via dirt outlet 146, and enters dirt collection chamber 124. The dirt collection chamber may be internal or external to the cyclone chamber. Preferably, as exemplified, the dirt collection chamber is external. The dirt collection 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 comprises an open end of the cyclone chamber.

Preferably, as in the example shown, dirt collection chamber 124 comprises two portions. A first portion 148 is provided immediately adjacent the dirt outlet 146, and is at the front end 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 collection chamber 124, and is mounted in facing relation to 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. 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 preferably extends from a front wall 158 at the front end 190 of the cyclone unit 114.

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 pivotally mounted, and provides an openable door of the cyclone unit 114. Accordingly, cyclone unit 114 may be opened and dirt chamber 124 may be emptied. The dirt collection chamber is preferably openable both when the dirt collection chamber is mounted to the hand vacuum cleaner, or when it is optionally removed, as will be described

hereinbelow. When front wall 158 is pivoted away from the remainder of the cyclone unit 114, separation plate 154 and arm 156 also preferably pivot away from the remainder of the cyclone unit. A latch 159 is provided, which secures front wall 158 in a closed position. In alternate examples, front wall 158 may be removable from hand vacuum cleaner 100, or the rear wall 179 of the cyclone unit 114 may be openable.

The rear portion of the dirt collection chamber 124 may be closed by wall 179.

The clean air exiting cyclone 122 passes through outlet 145 of 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 suction motor housing 168 that maybe of any design. Suction motor housing 168 has an outer wall 143, which preferably forms part of the outer wall 101 of the hand vacuum cleaner 100. Suction motor housing 168 houses a suction motor 164. The suction motor housing 168 has an upstream end 167, and a downstream end 169. Suction motor 164 is provided in the air flow passage. The suction motor 164 may be any type of suction motor. The suction motor 164 draws air into the dirty air inlet 118 of the cleaner 100, through the air flow passage, past the suction motor 164, and out of the clean air outlet 120. The suction motor 164 has a motor axis 165, which is generally parallel to the axis of rotation of a suction fan (not shown) of the suction motor.

As can be seen in Figure 6, the air flow passage preferably includes a generally linear air flow passage between outlet 145 and suction motor 164. That is, the air flow passage does not comprise bends between outlet 145 and suction motor 164.

Preferably, as in the example shown, a pre-motor filter 162 is provided, preferably in suction motor housing 168. One or more filters may be used. Pre-motor filter 162 is provided in the air flow passage preferably adjacent and downstream of the outlet passage 144, preferably adjacent and upstream of motor 164, and preferably facing the outlet 145. 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. As exemplified in Figure 6, the cyclone unit 114, the pre motor filter 162, and the suction motor 164 are arranged linearly.

The cleaner body 160 further preferably comprises a filter and, preferably, a HEPA filter 161. In the example shown, the HEPA filter 161 is mounted at the rear end 110 of the vacuum cleaner 100. The HEPA filter comprises a HEPA filter housing 170, and a HEPA filter material 166. The HEPA filter 161 is provided in the air flow passage downstream of, and preferably adjacent, the suction motor 164. The HEPA filter 161 has an inlet 172 at an upstream end 197 of housing 170, and an outlet 171 at a downstream end 199 of housing 170. Outlet 171 is preferably at the rear end 110 of cleaner 100, and inlet 172 is preferably adjacent the downstream end 169 of the suction motor housing 168. Outlet 171 is preferably the clean air outlet 120 of the surface cleaning apparatus 100. A sidewall 127 of housing 170 extends between the inlet 172 and outlet 171. It will be appreciated that filter 161 may be located at any position on the vacuum cleaner and in any orientation.

The HEPA filter material 166 is mounted in a support. Preferably, at least a portion of the support comprises a portion of the outer wall 101 of the surface cleaning apparatus 100. For example, as shown, the HEPA filter housing 170, which forms a portion of the outer wall 101 of vacuum cleaner 100, comprises the support. HEPA filter material 166 may be secured in housing 170 by any means known in the art including using an adhesive or welding.

In the preferred embodiment that is exemplified, the HEPA filter housing 170 forms a portion of the outer wall 101 of the vacuum cleaner 100. Preferably, at least a portion of sidewall 127 comprises a portion of the outer wall 101 of the vacuum cleaner 100. More preferably, at least half of the sidewall 127 comprises a portion of the outer wall 101 of the surface cleaning apparatus. For example, as shown, essentially all of sidewall 127 comprises a portion of the outer wall 101 of the vacuum cleaner 100. Accordingly, the support for the filter material itself forms part of the outer wall of the surface cleaning apparatus.

Referring now to Figures 8 and 9, in the exemplified embodiment, HEPA filter 161 is removably mounted to the hand vacuum cleaner 100. Preferably, an upstream end 197 of the HEPA filter housing 170 is removably mounted to the vacuum cleaner 100. Preferably, the upstream 197 end of the HEPA filter housing 170 is removably mounted to the suction motor housing 168, and more preferably, to downstream end 169 of motor housing 168. Preferably, HEPA filter 161 is rotationally mounted to the hand vacuum cleaner 100, for example by a bayonet mount as shown or a screw thread. Alternately, a mechanical fastener, such as one or more latches may be used.

Removably mounting the HEPA filter 161 to the surface cleaning apparatus 100 may be advantageous because when the HEPA filter 161 is removed, the HEPA filter material 166 may be accessed. In some examples, the HEPA filter material 166 is removable from the HEPA filter housing 170. Accordingly, the HEPA filter material 166 may be changed. Alternately, in some examples, the HEPA filter material 166 may be washable or merely replaced. The filter itself, namely the filter material and the support, may be repaced..

Referring to Figure 10, preferably, the HEPA filter 161 is configured to be placed on a floor, and more preferably, the downstream end 199 of the HEPA filter housing 170 is configured to be placed on a floor. Accordingly, the HEPA filter may be used as a stable platform that may be placed on the ground so that the vacuum cleaner may be stood on the filter. That is, e.g., the

downstream end 199 is configured to support the vacuum cleaner 100 (e.g., it may stand upright). It will be appreciated that filter 161 may have a flat or planar portion that forms the support. Alternately, or in addition, feet may be provided. For example, as shown, downstream end 199 is substantially planar and comprises a planar surface 109, and feet 111. In the example shown, feet 111 of downstream end 199 are in contact with floor F when downstream end 107 is used to support vacuum cleaner 100. In alternate examples, feet 111 may be omitted, and planar surface 109 may be used to support vacuum cleaner 100. In alternate examples, feet 11 may be provided and end 107 need not be planar. In alternate examples another portion of downstream end 199 may be used to support vacuum cleaner 100.

Preferably, as in the example shown, the air outlet 120 is provided in the sidewall 127 of housing 170, preferably slightly upstream of the downstream end 199. Accordingly, when the downstream end 199 is used to support the vacuum cleaner 100, the air outlet 120 is not obstructed or occluded. As shown, air exiting the air outlet 120 flows transverse to a direction of flow through the HEPA filter material 166. It will be appreciated that the air outlet may be in end 107. In such a case, feet 111 preferably support end 107 sufficiently off the floor such that the vacuum cleaner may be operated when stood on feet 111.

Preferably, the direction of the air flow out of the vacuum cleaner may be redirectable. For example, if the air outlet is the outlet of HEPA filter 161, then the direction of the side air outlet 120 may be adjusted. For example, the housing of outlet 120 may be rotatably mounted with respect to the vacuum cleaner. Alternately, or in addition, the filter 161 may be mountable at various orientations such that air outlet 120 may face alternate directions. If the outlet is in rear end 107, then grills that are rotatable mounted may be provided and/or the vanes of the grill may be pivotally mounted to filter 161. In any such case, the air may be directed away from a user. For example, if a user is right handed, and a side outlet 120 is used, then the outlet 120 may be positioned to direct the air

to the right, away from the user. If a user is left handed, and a side outlet 120 is used, then the outlet 120 may be positioned to direct the air to the left, away from the user.

In some embodiments, HEPA filter 161 may be rotatably repositionable with respect to vacuum cleaner 100. For example, in the embodiment shown, air outlet 120 extends partially circumferentially around housing 170, at the top portion 104 of surface cleaning apparatus. Accordingly, in use, if a user is standing or leaning over the vacuum cleaner, for example when vacuuming stairs, the air exiting air outlet 120 may be directed at the user. This may be uncomfortable for the user, and the user may wish to reposition air outlet 120, such that the air is directed away from the user. For example, when vacuuming stairs, a user may wish to rotate housing HEPA filter 161 such that air outlet 120 directs air downwardly. Alternately, if a user is left-handed, the user may wish to rotate HEPA filter housing 161 such that air outlet 120 is at the left hand side of the user, so that air exiting outlet 120 is directed away from the user.

HEPA filter 161 may be rotatably repositionable with respect to vacuum cleaner 100 in any suitable way. For example, HEPA filter may be removably mountable to suction motor housing at a variety of rotational positions. For example, in embodiments where HEPA filter 161 is removably mounted to suction motor housing 168 by a bayonet mount, the HEPA filter 161 may be mountable at a plurality of rotational positions. Alternately, EPA filter 161 may be rotatably repositionable after it is already mounted to suction motor housing 168, e.g., by being rotatable on a shaft extending out of the motor housing.

It will be appreciated that a rotatably repositionable air exit, and preferably a rotatably repositionable HEPA air exit, may be used in accordance with any embodiment herein or in a surface cleaning apparatus that does not include any feature disclosed herein. Accordingly, such a design may be used in a hand vacuum cleaner with a filter support forming part of the outer wall of the

vacuum cleaner or in any hand vacuum cleaner wherein no filter support forms part of the outer wall of the vacuum cleaner.

Referring to Figure 11, the first cyclone unit 114 is preferably removably mounted to the hand vacuum cleaner 100. More particularly, in the exemplified embodiment, cyclone unit 114 is removably mounted at the front end 108 of the vacuum cleaner 100, to the upstream end 167 of the suction motor housing 168. In the example shown, the cyclone unit 114 comprises the dirt collection chamber 124. Accordingly, the cyclone unit 114 may be removed in order to empty dirt collection chamber 124. For example, cyclone unit 114 may be removed from vacuum cleaner 100, may be held over a garbage bin, the front wall 158 may be opened, and the dirt may be emptied from dirt chamber 124.

In order to remove cyclone unit 114 from the surface cleaning apparatus, the cyclone unit comprises a first mounting member 173, and the suction motor housing 168 has a second mounting member 175. The first 173 and second 175 mounting members are releasably engageable with each other. Preferably, the first 173 and second 175 mounting members are rotatably engageable with each other. For example, as shown, the first 173 and second 175 mounting members comprisea bayonet mount. In alternate examples, the first and second mounting members may be another type of mounting member, such as mating screw threads, magnets, or any other type of mounting members.

Referring back to Figure 10, in examples wherein the first 173 and second 175 mounting members are rotatably engageable with each other, a user may wish to stand vacuum cleaner 100 on downstream end199 of HEPA filter housing 170 (i.e. use downstream end 199 to support vacuum cleaner 100) in order to remove cyclone unit 114 from surface cleaning apparatus 100. This may allow cyclone unit 114 to be relatively easily rotated with respect to motor housing 168.

As mentioned hereinabove, cyclone unit 114 and motor 164 are preferably generally aligned. Accordingly, when vacuum cleaner 100 is supported by downstream end 199, cyclone unit 114 and motor 164 may be generally vertically aligned. That is, the first cyclone unit 114 may be directly above the motor 164. This may allow vacuum cleaner 100 to balance on downstream end 199 of HEPA filter housing 170, without any additional support.

One or more additional wheels 180 may be mounted to motor housing 168, 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.

In alternate examples (not shown), hand vacuum cleaner 100 may further comprise a second cyclone unit downstream of the first cyclone unit 114. The second cyclone unit may be provided in motor housing 168, or in a separate housing. Preferably, the second cyclone unit is linearly arranged with one or more of the first cyclone unit 114, suction motor 164, and HEPA filter 161.

CLAIMS:

1. A surface cleaning apparatus comprising:

a) an outer wall;

b) an air flow passage extending from a dirty air inlet to a clean air outlet;

c) at least one dirt separation unit positioned in the air flow passage;

d) a suction motor positioned in the air flow passage; and,

e) a filter positioned in the air flow passage, the filter comprising filter material secured in a support wherein at least a portion of the support comprises a portion of the outer wall of the surface cleaning apparatus.

2. The surface cleaning apparatus of claim 1 wherein the filter comprises a HEPA filter.

3. The surface cleaning apparatus of any of claims 1-2 wherein the filter has an air inlet, an air outlet and a side wall extending from the air inlet to the air outlet and at least a portion of the side wall comprises a portion of the outer wall of the surface cleaning apparatus.

4. The surface cleaning apparatus of any of claims 1-3 wherein the filter has an air inlet, an air outlet and a side wall extending from the air inlet to the air outlet and at least half of the side wall comprises a portion of the outer wall of the surface cleaning apparatus.

5. The surface cleaning apparatus of any of claims 1-4 wherein the support has an upstream end that is removably mounted to the surface cleaning apparatus.

6. The surface cleaning apparatus of any of claims 1-5 wherein the suction motor is positioned in a suction motor housing and the filter is removably mounted to the suction motor housing.

7. The surface cleaning apparatus of any of claims 1-6 wherein the filter is rotationally mounted to the surface cleaning apparatus.

8. The hand vacuum cleaner of claim 7 wherein the filter is rotationally mounted to the surface cleaning apparatus by a bayonet mount.

9. The surface cleaning apparatus of any of claims 1-8 wherein the filter material is washable.

10. The surface cleaning apparatus of any of claims 1-9 wherein the surface cleaning apparatus is hand or strap carriable.

11. The hand vacuum cleaner of claim 10 wherein the surface cleaning apparatus is a hand vacuum cleaner.

12. The surface cleaning apparatus of claim 11 wherein the filter is mounted at a rear end of the hand vacuum cleaner.

13. The surface cleaning apparatus of any of claims 1-12 wherein the filter has a downstream end and the downstream end is configured to be placed on a floor.

14. The surface cleaning apparatus of claim 13 wherein the downstream end is planar.

15. The surface cleaning apparatus of any of claims 13-14 wherein the downstream end has a plurality of feet.

16. The surface cleaning apparatus of any of claims 1-15 wherein the at least one dirt separation unit comprises at least a first cyclone unit.

17. The surface cleaning apparatus of any of claims 1-16 wherein the suction motor is positioned in a suction motor housing and the first cyclone unit is removably mounted to the surface cleaning apparatus.

18. The surface cleaning apparatus of claim 17 wherein the suction motor housing has an upstream end and a downstream end, the first cyclone unit is removably mounted to the upstream end and the filter is removably mounted to the downstream end.

19. A surface cleaning apparatus comprising:

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

b) at least one dirt separation unit positioned in the air flow passage;

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

d) the clean air exit is adjustable to direct air exiting the clean air exit in at least two different positions.

20. The surface cleaning apparatus of claim 19 wherein the clean air exit is repositionable on the surface cleaning apparatus in various orientations.

21. The surface cleaning apparatus of any of claims 19-20 further comprising a filter positioned in the air flow passage, the filter comprising the clean air exit.

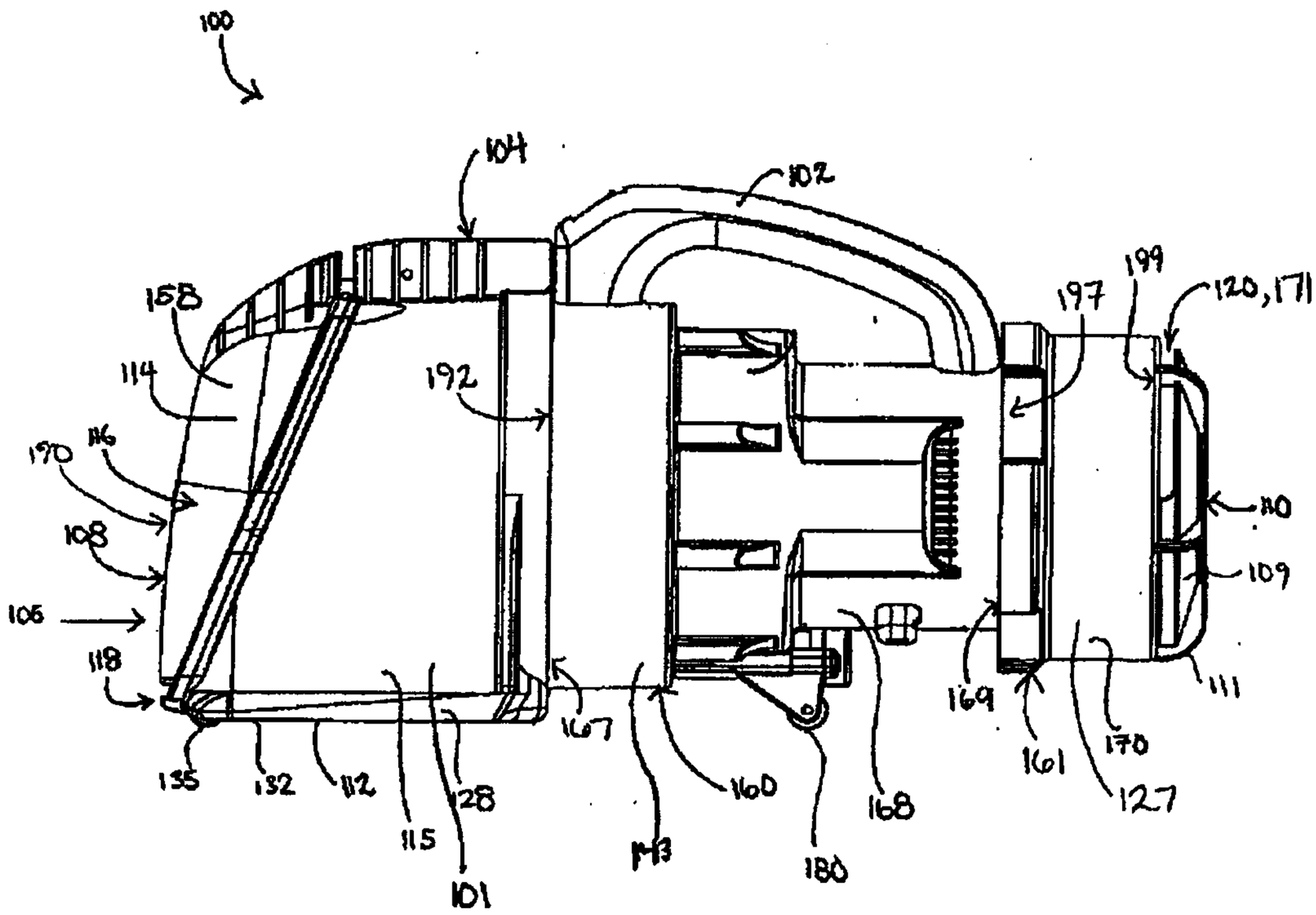

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FIG. 1

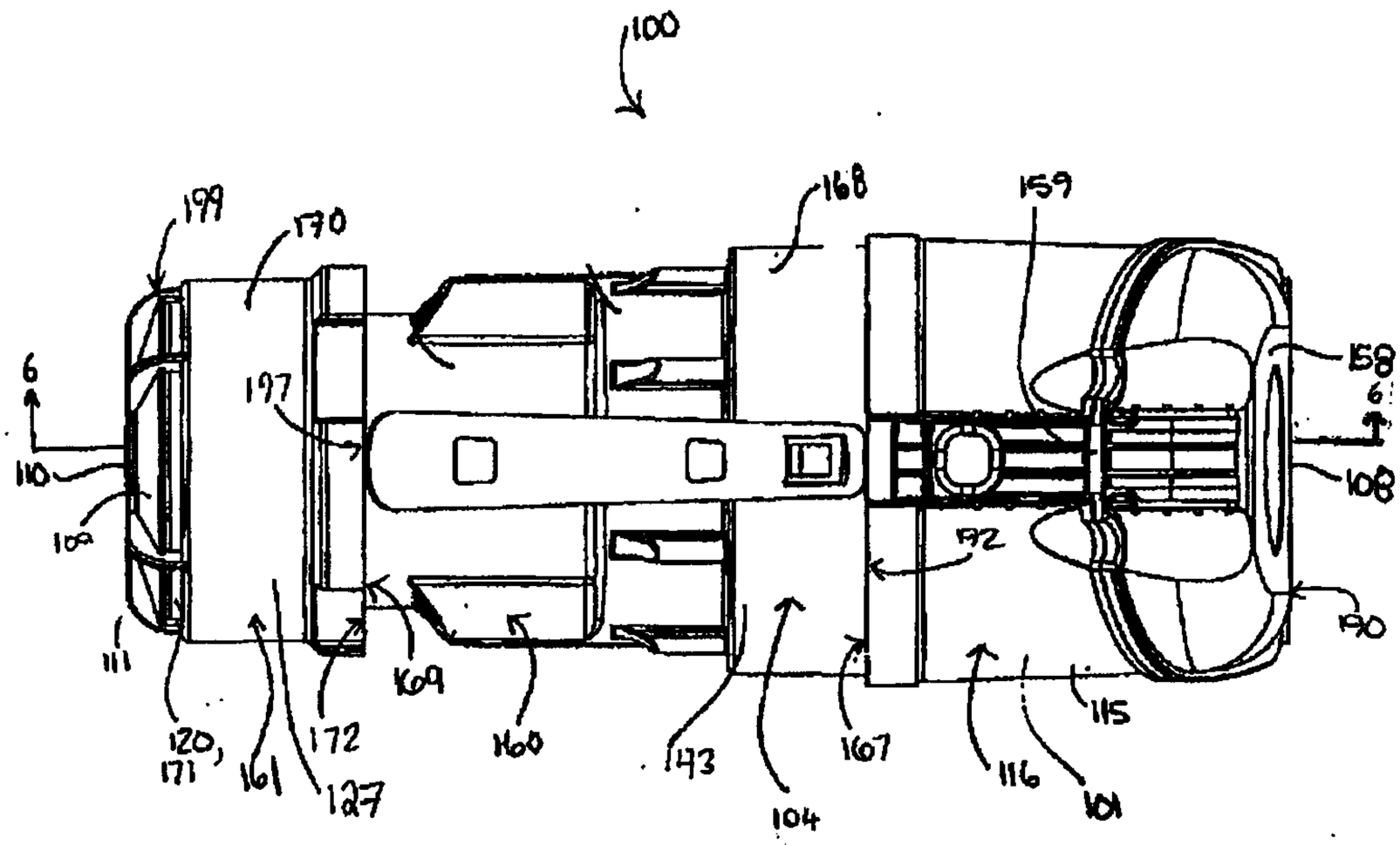
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FIG. 2

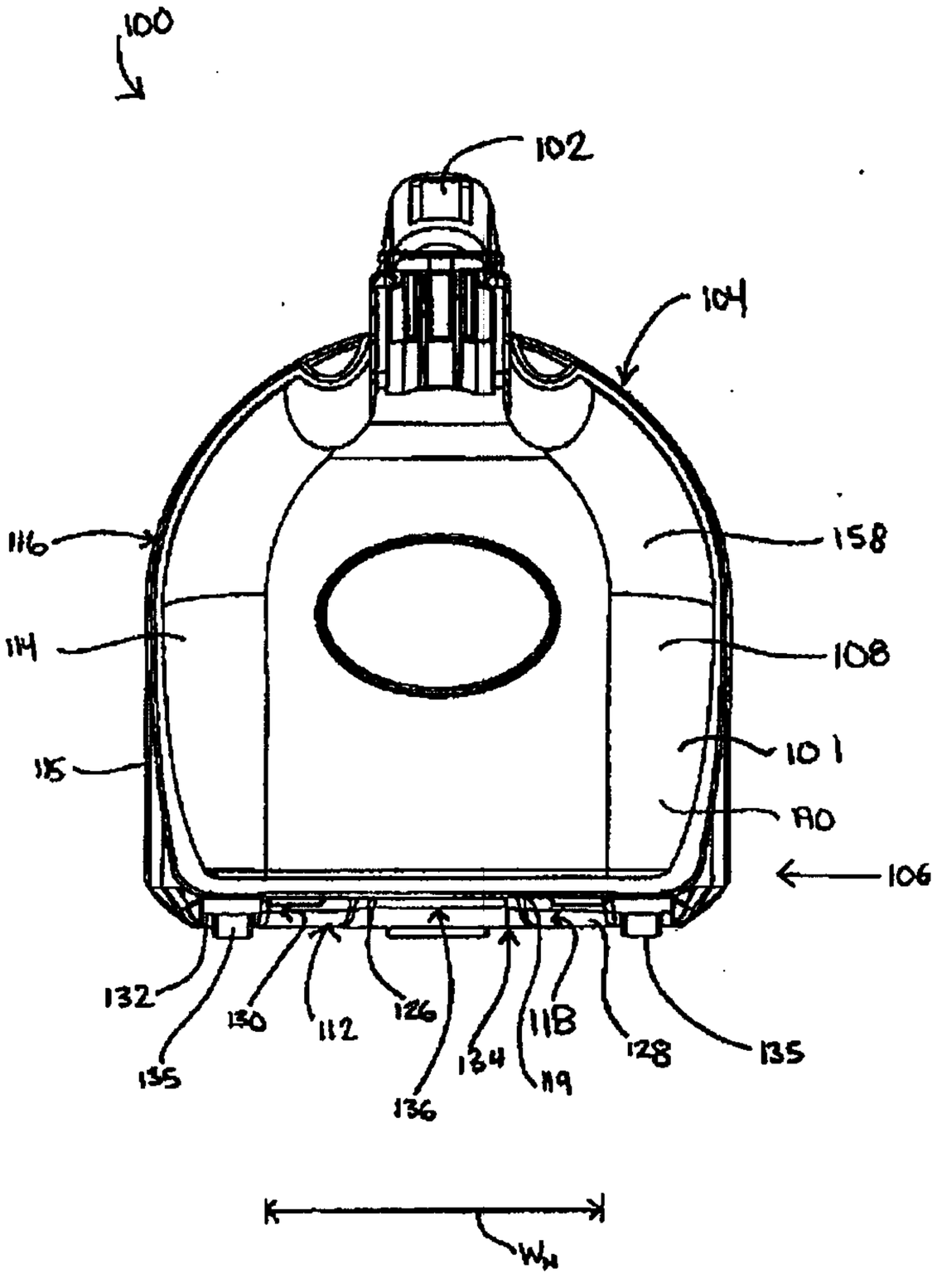
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FIG. 3

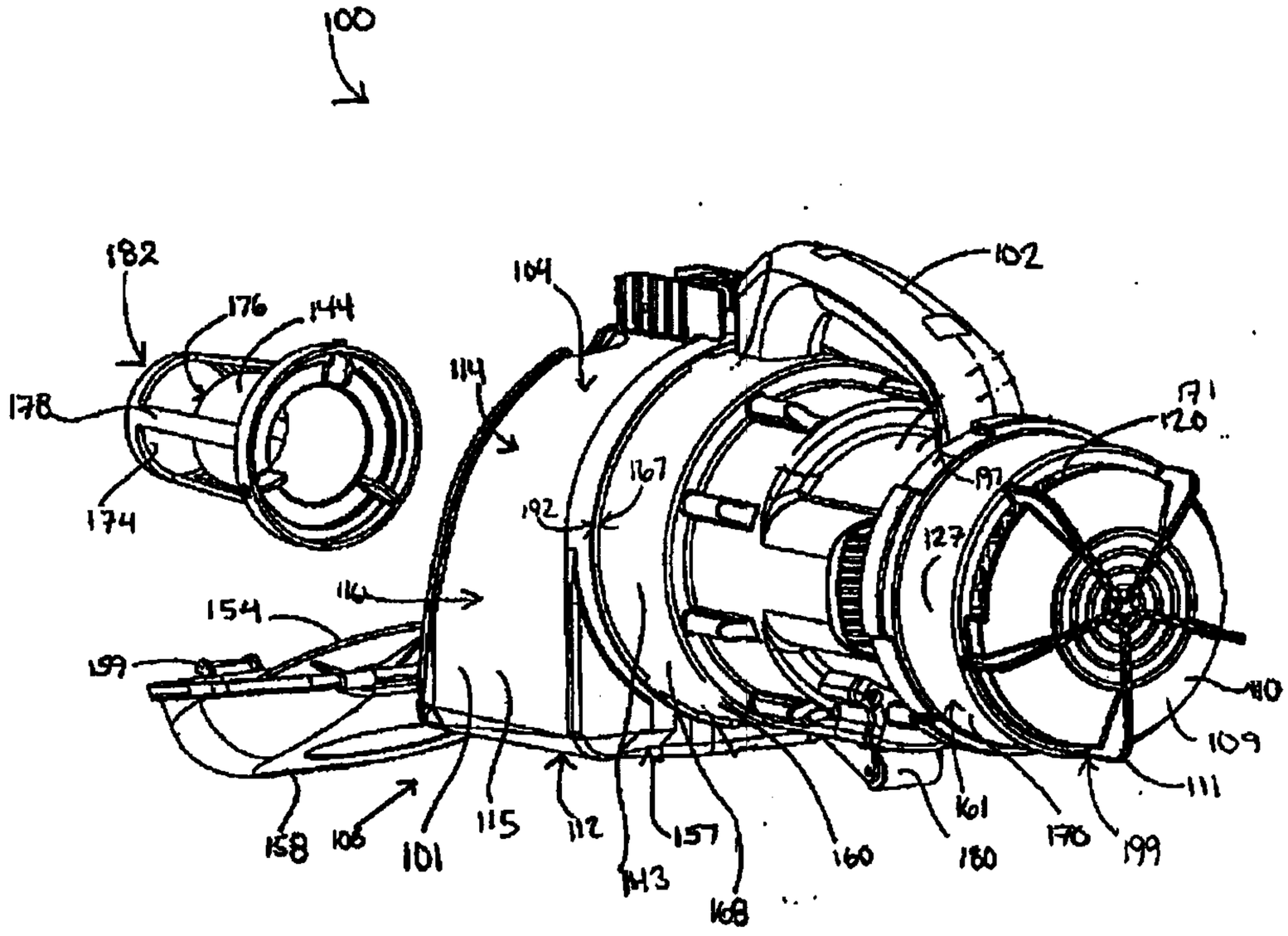
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FIG.4

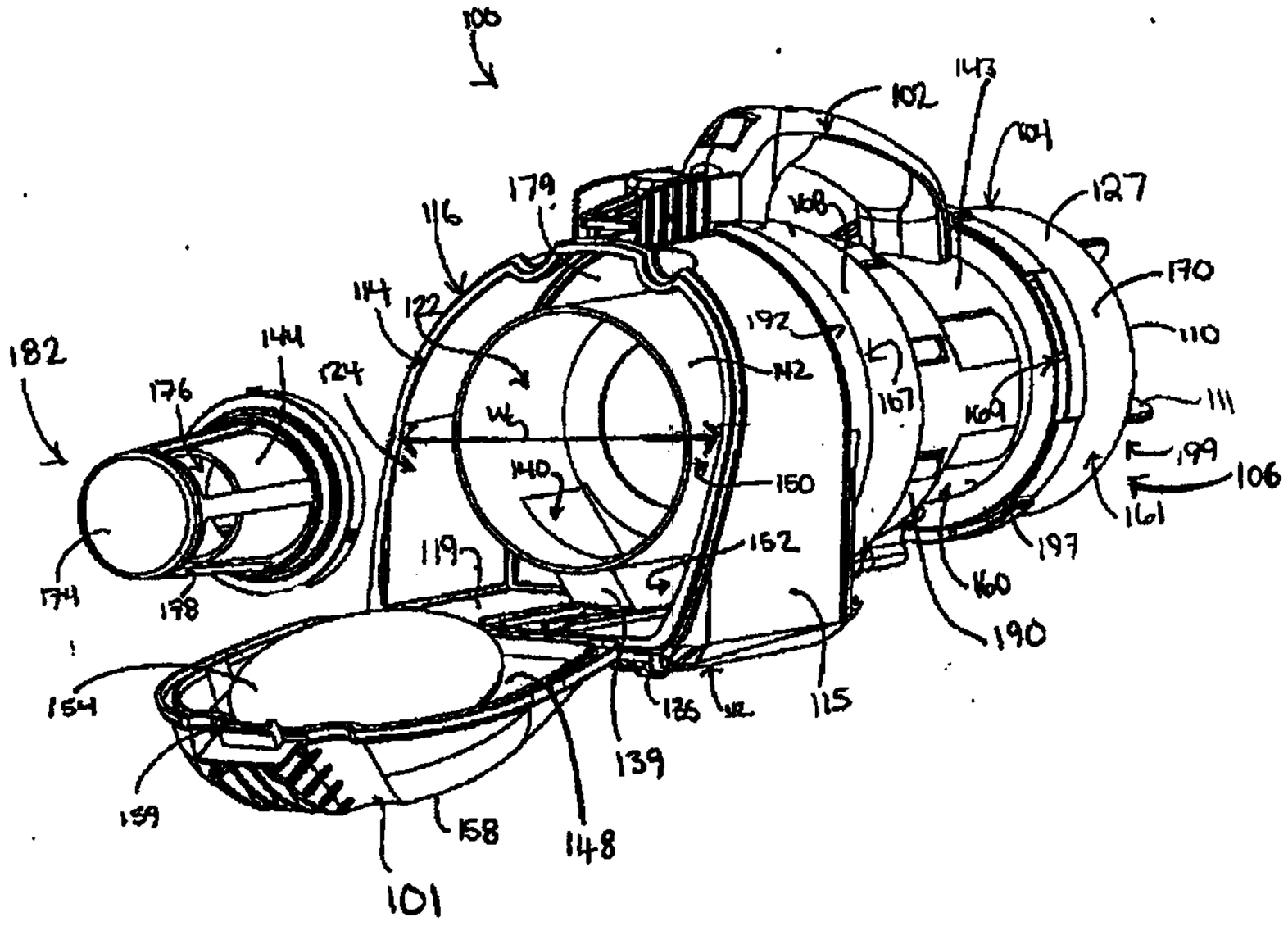
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Fig. 5

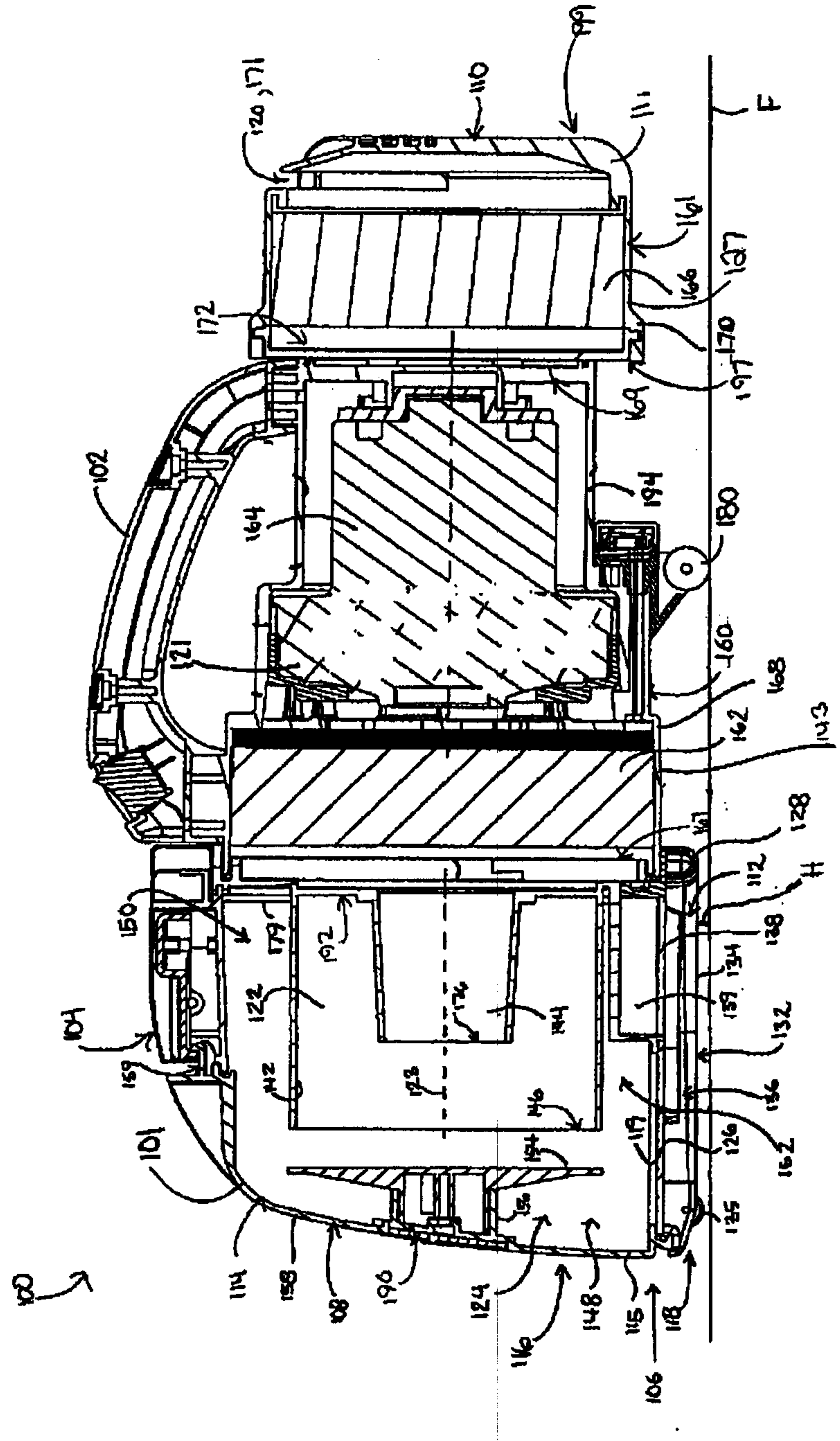
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FIG. 6

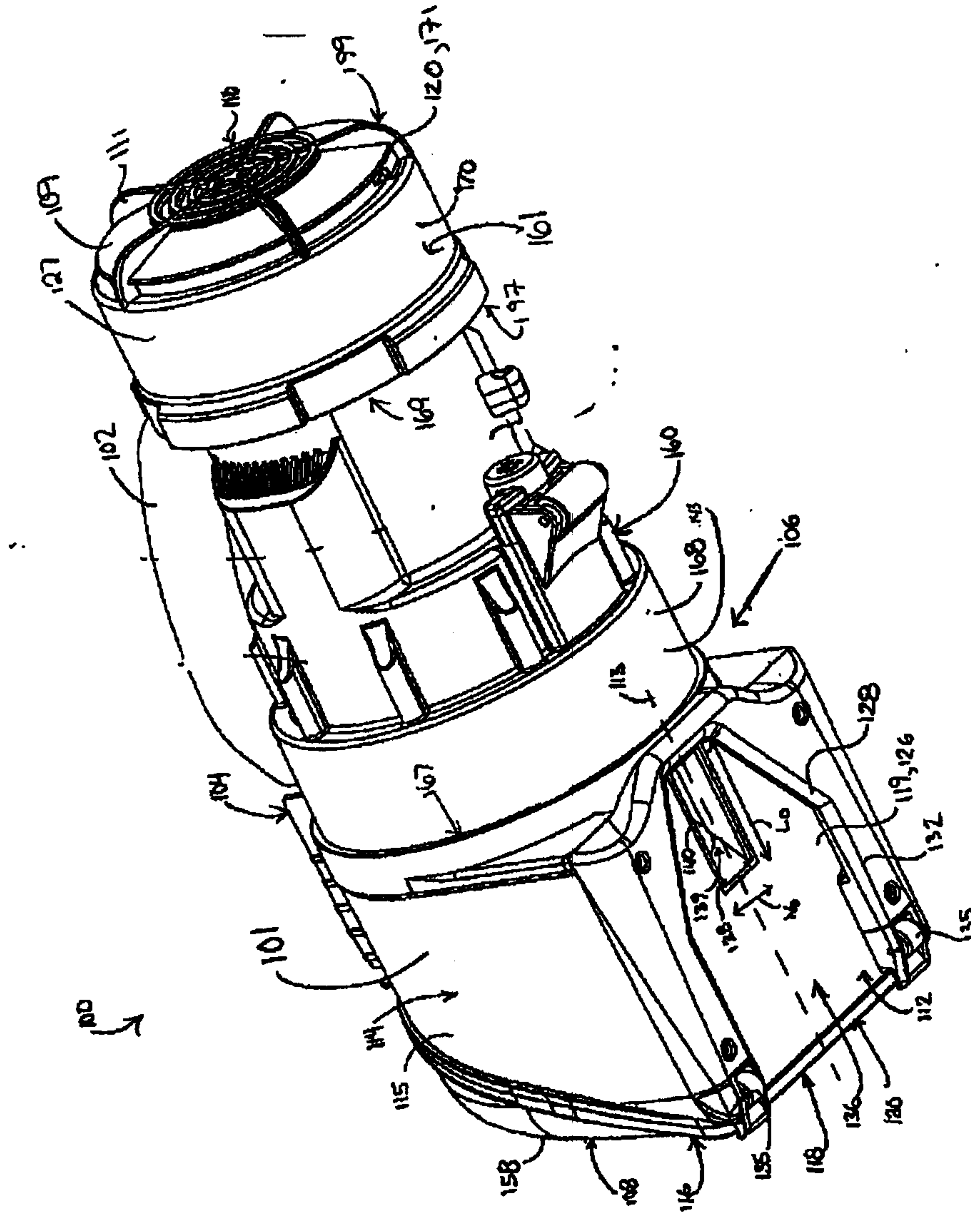

FIG. 7

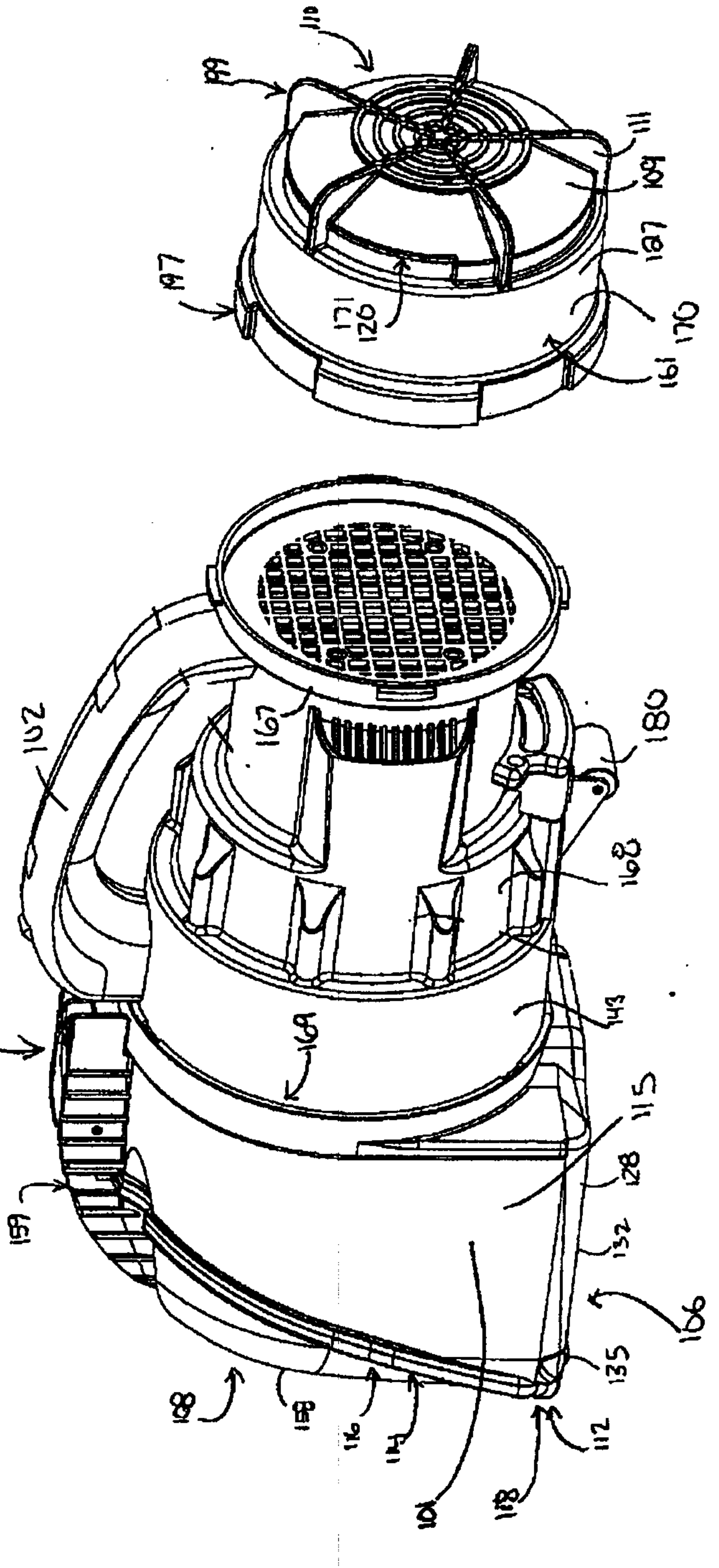
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Fig. 8

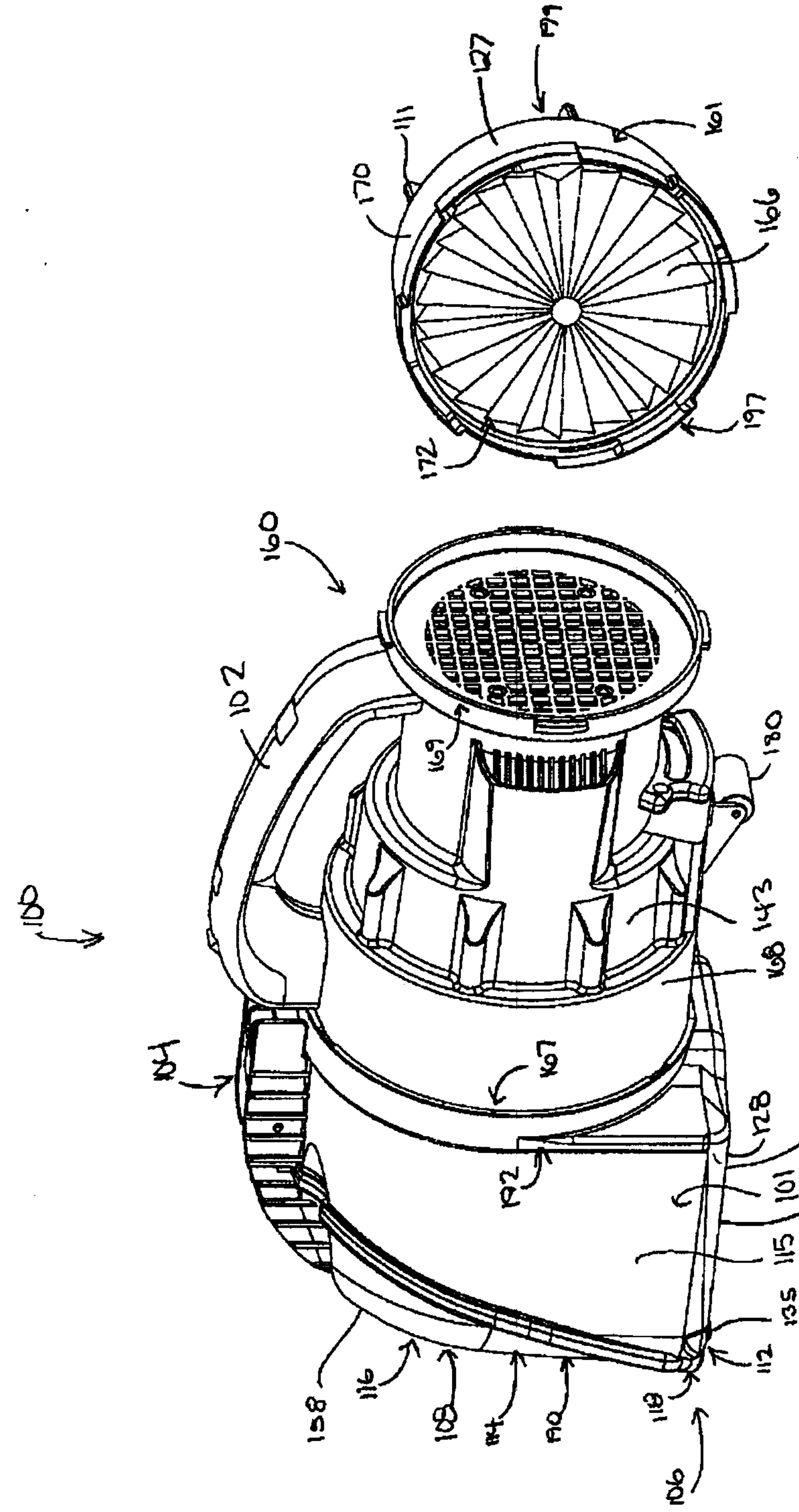
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FIG. 9

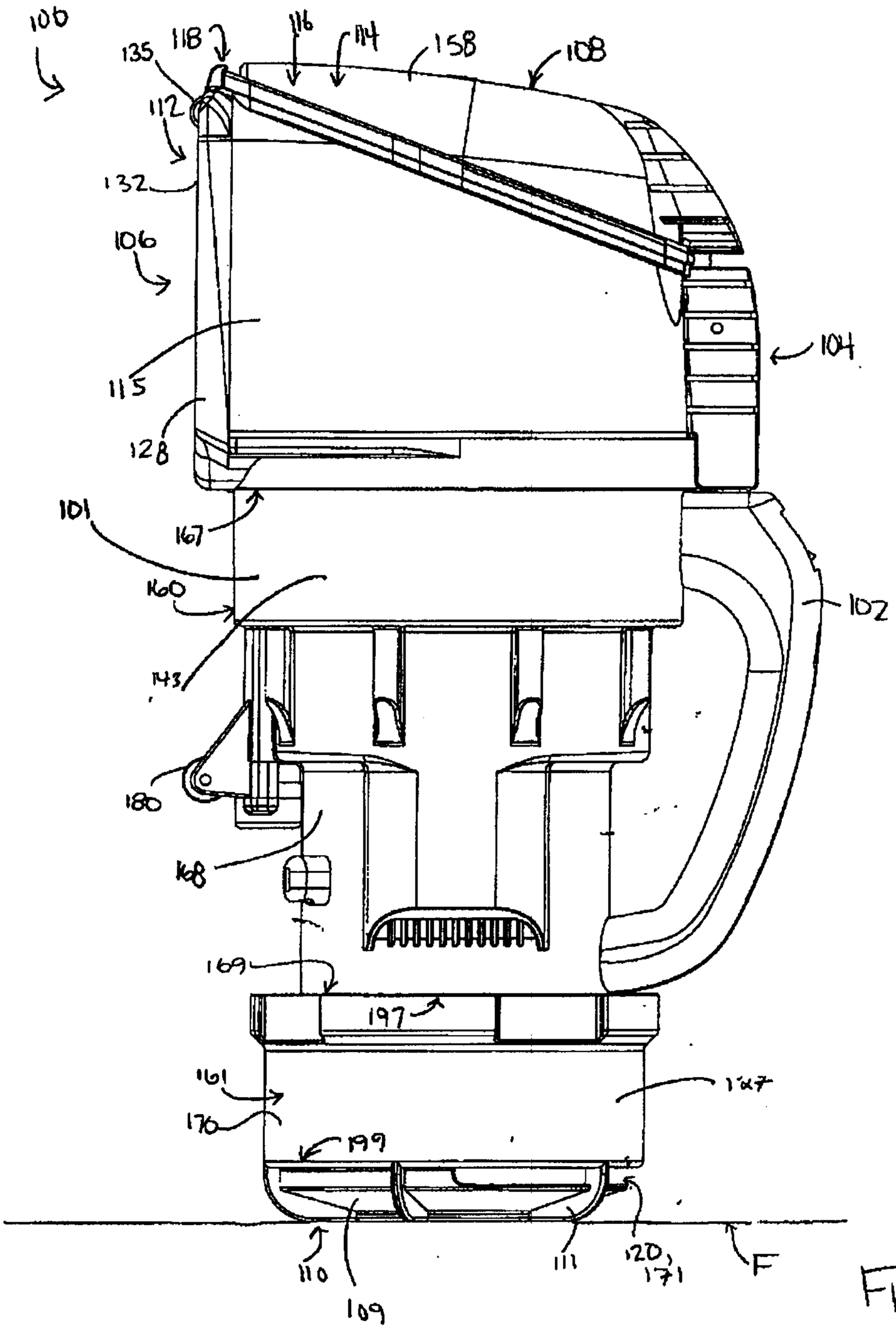
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FIG 10

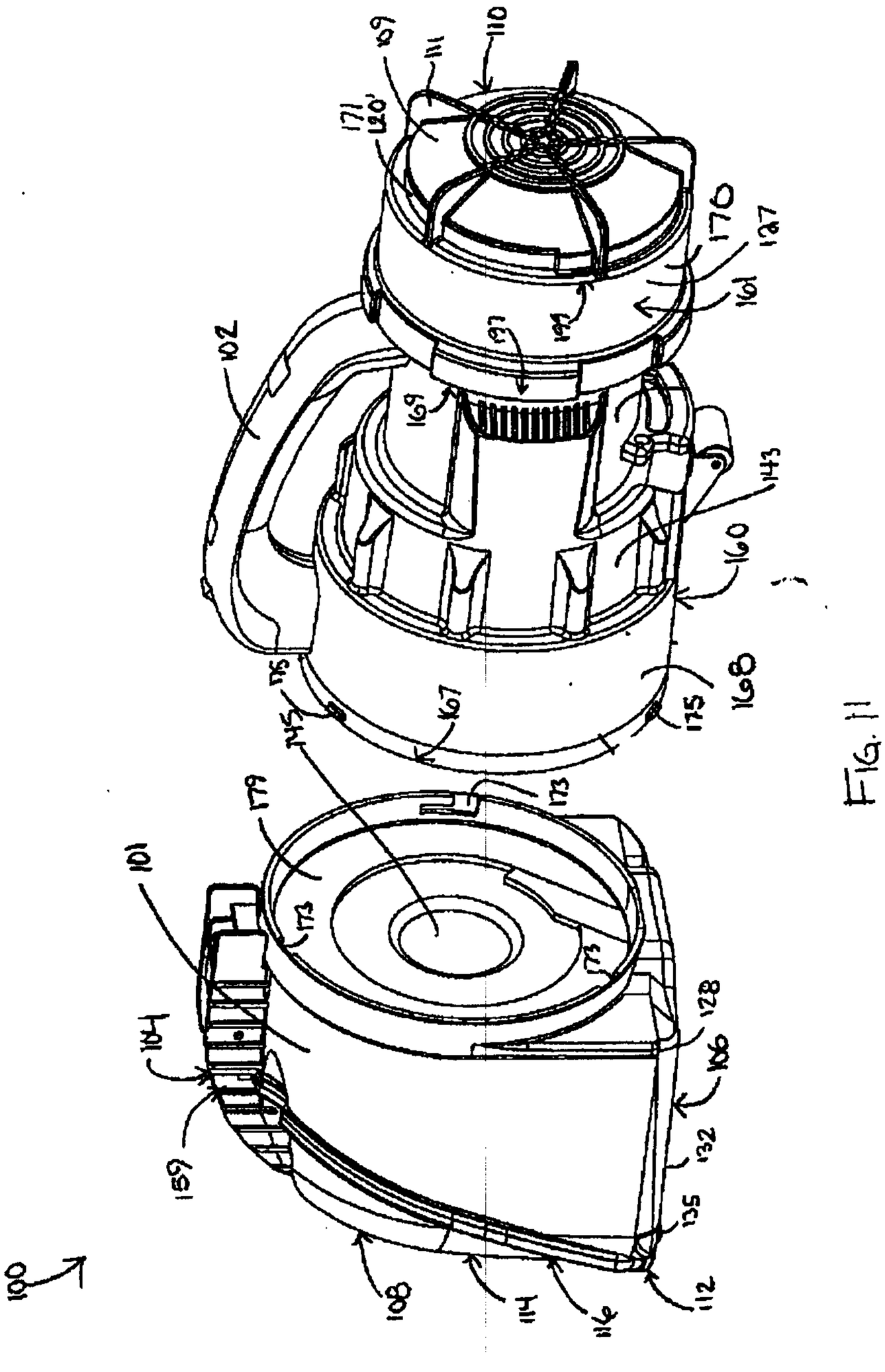
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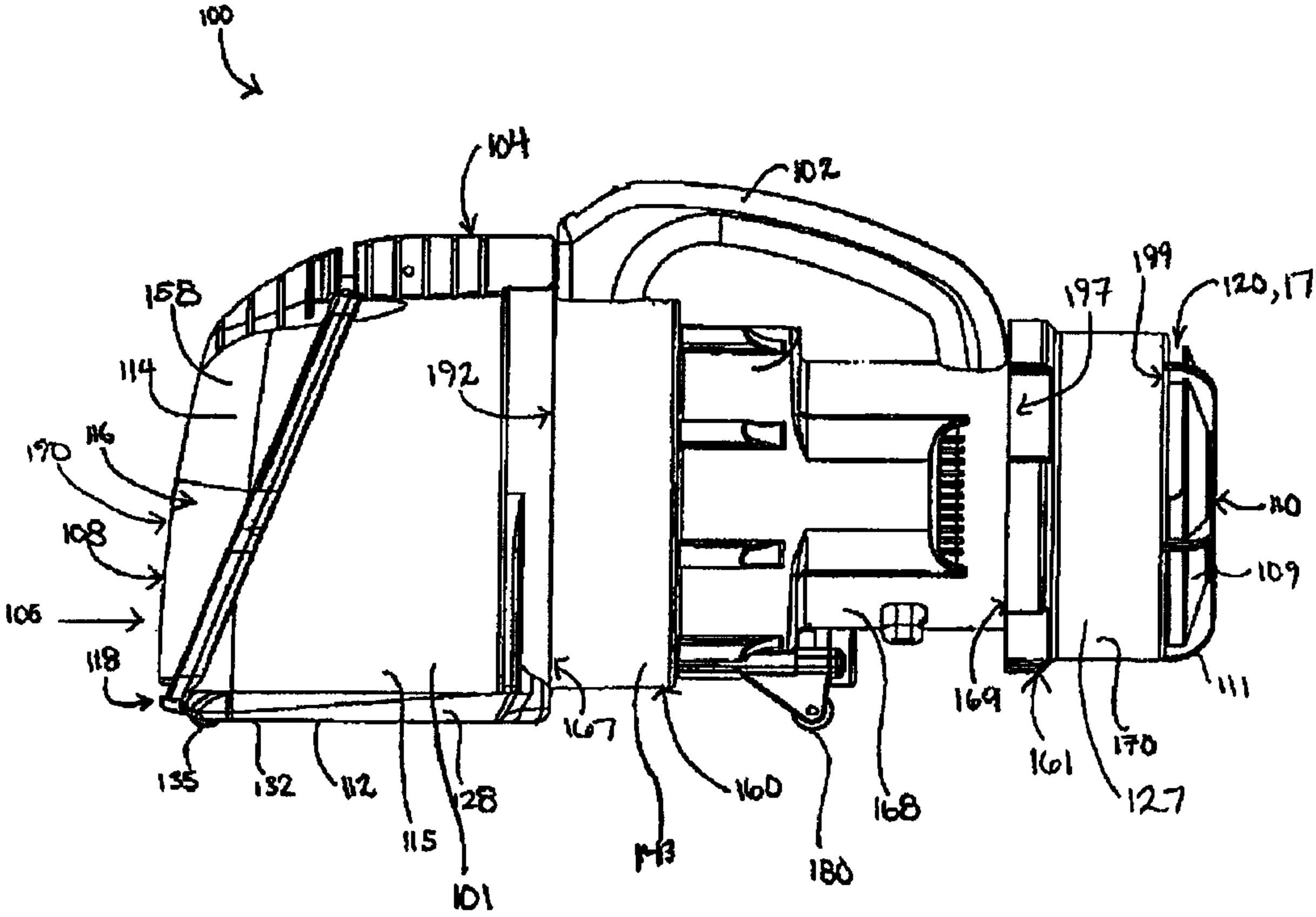
Fig. 11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