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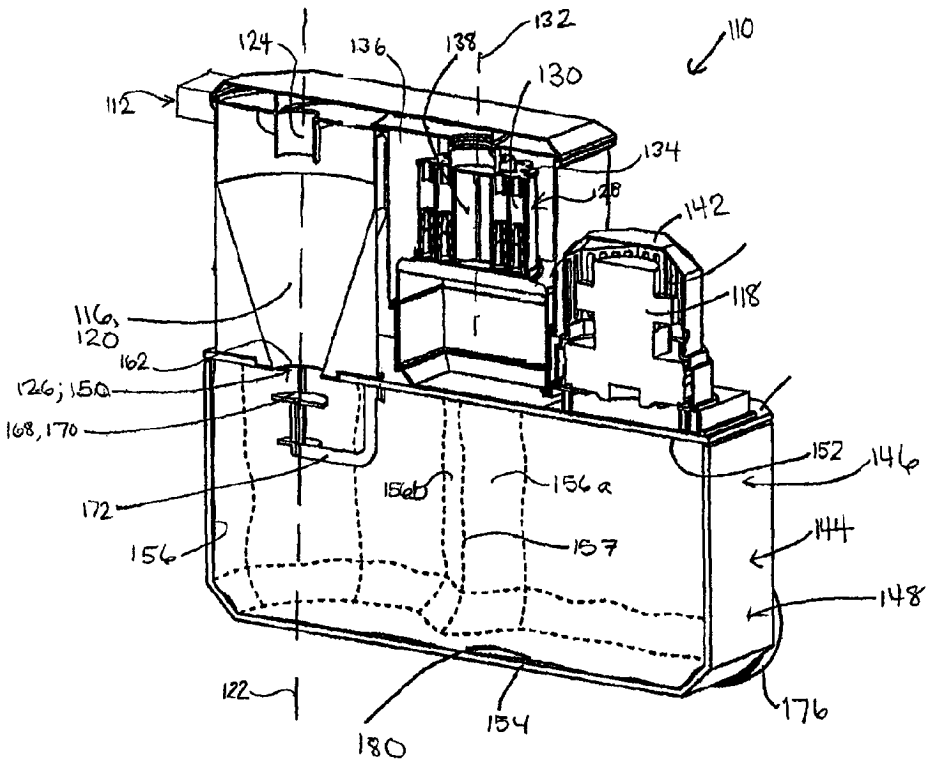
(54) Titre : APPAREIL DE NETTOYAGE DE SURFACES DONT LE BAC A POUSSIERE PRESENTE UNE ENTREE EXCENTREE

(54) Title: SURFACE CLEANING APPARATUS WITH OFF-CENTRE DIRT BIN INLET



(57) Abrégé/Abstract:
A surface cleaning apparatus is provided. The surface cleaning apparatus comprises a fluid flow path extending from a dirt inlet to a clean fluid outlet, and a fluid flow motor positioned in the fluid flow path. The surface cleaning apparatus further comprises a first cyclonic cleaning stage comprising a cyclone chamber. A dirt chamber is in fluid communication with the cyclone chamber and positioned below the cyclone chamber. The dirt chamber has a dirt chamber inlet that is off-centre.

SURFACE CLEANING APPARATUS WITH OFF-CENTRE DIRT BIN INLET

FIELD OF THE INVENTION

The invention relates to surface cleaning apparatuses such as vacuum cleaners, wet/dry vacuum cleaner and carpet extractors. More particularly, the invention relates to surface cleaning apparatuses, which have a dirt bin having an off-centre inlet.

BACKGROUND

Surface cleaning apparatus have been developed which include one or more cyclonic cleaning stages. Each cleaning stage may include a single cyclone, or a plurality of cyclones positioned in parallel. Typically, in cleaning stages comprising a single cyclone, a dirt bin is positioned below the cyclone. The cyclone has an outlet, which is in fluid communication with an inlet of the dirt bin. Typically, the dirt bin and the cyclone are coaxial. The inlet to the dirt bin comprises an opening centrally positioned in an upper surface of the dirt bin.

For example, United States Patent Application Publication 2006/0130448 to Han et al. discloses a cyclone having a cubic dirt bin. The dirt bin is centrally positioned below the cyclone, such that the dirt bin and the cyclone are coaxial. A dirt inlet is positioned at the centre of the upper square surface of the dirt bin, aligned with a dirt outlet of the cyclone.

United States Patent Application Publication 2006/0123590 to Fester et al. discloses a surface cleaning apparatus having a first cleaning stage including a single cyclone, and a second cleaning stage including a plurality of cyclones in parallel. The cyclones of the second cleaning stage are arranged annularly around the cyclone of the first cleaning stage. The dirt bin of the first cleaning stage is coaxial with the cyclone of the first cleaning stage, and extends outwardly such that a portion is positioned underneath the cyclones of the

second cleaning stage. The dirt inlet to the dirt bin is annular, and is centered about the longitudinal axis of the dirt bin.

SUMMARY

In one broad aspect, a surface cleaning apparatus is provided which has a collection chamber having an inlet that is off-centre from the centre of the collection chamber.

For example, the surface cleaning apparatus may comprise a fluid flow path extending from a dirt inlet to a clean fluid outlet, and a fluid flow motor positioned in the fluid flow path. A cyclonic cleaning stage is provided in the fluid flow path and comprises at least one, and preferably one, cyclone chamber. At least one dirt chamber is in fluid communication with the cyclone chamber and is positioned below the cyclone chamber. The dirt chamber has an upper portion proximate the cyclone chamber, a lower portion, a central axis extending vertically between the upper portion and the lower portion, and a dirt chamber inlet spaced from the central axis. The inlet is preferably provided in the top of the dirt chamber.

Embodiments in accordance with this broad aspect may be advantageous because the dirt chamber may have a larger cross sectional area than the cross sectional area of the cyclone chamber. Accordingly, the amount of dirt and/or water that may be collected in the dirt collection bin is increased. Further, the frequency with which the dirt chamber requires emptying is decreased. Further, by positioning the inlet off centre, the part of the dirt chamber distal to the inlet is more isolated from any fluid flow effects at the dirt inlet, thereby enhancing dirt retention in the dirt chamber.

In some embodiments, the upper portion of the dirt chamber has a width, and the dirt chamber inlet is spaced from the central axis by distance of at least 10% of the width. In further embodiments, the dirt chamber inlet is spaced

from the central axis by distance of at least 15% of the width. In yet further embodiments, the dirt chamber inlet is spaced from the central axis by distance of at least 25% of the width.

In some embodiments, the cyclonic cleaning stage comprises a single cyclone having a dirt outlet positioned at the dirt chamber inlet, which is defined in an upper surface of the dirt chamber.

In some embodiments the surface cleaning apparatus comprises a generally transversely extending plate positioned adjacent the dirt chamber inlet. In further embodiments, the plate is positioned in the dirt chamber below the dirt chamber inlet.

In some embodiments, the upper portion has a perimeter, and the dirt chamber inlet is proximate the perimeter.

In some embodiments, the cyclone chamber has a longitudinal axis, and the central axis of the dirt chamber is spaced from the longitudinal axis.

In some embodiments, the dirt chamber is cylindrical.

In some embodiments, the dirt chamber comprises at least two sidewalls that meet at an angle. Such embodiments may be advantageous because the configuration of the sidewalls may prevent cyclonic motion in the dirt chamber. Accordingly, the amount of dirt in the dirt chamber, which becomes re-entrained in air may be reduced.

In some embodiments, the cyclonic cleaning stage has a maximum cross sectional area in a plane transverse to the a longitudinal axis of the cyclonic cleaning stage and the dirt chamber has a maximum cross sectional area in a plane transverse to the central axis that is larger than the maximum cross sectional area of the cyclonic cleaning stage.

In some embodiments, the maximum cross sectional area of the dirt chamber is at least 50% larger than the maximum cross sectional area of the cyclonic cleaning stage.

In another broad aspect, a surface cleaning apparatus is provided. The surface cleaning apparatus comprises a fluid flow path extending from a dirt inlet to a clean fluid outlet, and a fluid flow motor positioned in the fluid flow path. The surface cleaning apparatus further comprises a first cyclonic cleaning stage comprising a cyclone chamber. A dirt chamber is in fluid communication with the cyclone chamber and positioned below the cyclone chamber. The dirt chamber has a dirt chamber inlet that is off-centre.

In some embodiments, the dirt chamber has an upper portion proximate the cyclone chamber, a lower portion, and a central axis extending vertically between the upper portion and the lower portion, and the dirt chamber inlet is spaced from the central axis.

In some embodiments, the dirt chamber has a width, and the dirt chamber inlet is off-centre by a distance of at least 10% of the width. In further embodiments, the dirt chamber inlet is off-centre by a distance of at least 15% of the width. In yet further embodiments, the dirt chamber inlet is off-centre by a distance of at least 25% of the width.

In some embodiments, the surface cleaning apparatus further comprises a generally transversely extending plate positioned adjacent the dirt chamber inlet.

In some embodiments, a plate is provided in a flow path from the cyclone chamber to the dirt chamber. In further embodiments, the plate is provided in the dirt chamber.

In some embodiments, the dirt chamber inlet comprises a dirt outlet of the cyclone chamber.

In some embodiments, the upper portion defines a perimeter, and the dirt chamber inlet is proximate the perimeter.

In some embodiments, the surface cleaning apparatus further comprises a second cyclonic cleaning stage downstream from the cyclone. In some such embodiments, the second cyclonic cleaning stage comprises a plurality of cyclone in parallel. In some further embodiments, the first cyclonic cleaning stage comprises a single cyclone.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other advantages of the present invention will be more fully and particularly understood in connection with the following description of the preferred embodiments of the invention in which:

Figure 1A is a perspective illustration of an embodiment of a surface cleaning apparatus of the present invention;

Figure 1B is a perspective illustration of another embodiment of a surface cleaning apparatus of the present invention;

Figure 1C is a perspective illustration of another embodiment of a surface cleaning apparatus of the present invention;

Figure 1D is a perspective illustration of another embodiment of a surface cleaning apparatus of the present invention;

Figure 2A is a cross-sectional view of the embodiment of Figure 1A, taken along line 2A-2A;

Figure 2B is a cross sectional view of the embodiment of Figure 1B, taken along line 2B-2B;

Figure 2C is a cross sectional view of the embodiment of Figure 1C, taken along line 2C-2C;

Figure 2D is an exploded view of the embodiment of Figure 1D;

Figures 3A to 5A are top views of various embodiments of a dirt chamber of the present invention;

Figures 3B to 5B are side views of the embodiments of Figures 3A to 5A;

Figures 3C-5C are perspective views of the embodiments of Figures 3A to 5A;

Figure 6 is a perspective view of the surface cleaning apparatus of Figure 1A, showing a panel in an opened position; and,

Figure 7 is a perspective view of the surface cleaning apparatus of Figure 2A, showing a panel in an opened position.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of a surface cleaning apparatus 110 of the present invention are shown in Figures 1A-1D. As shown in Figure 1A and 1C, the surface cleaning apparatus 110 may be a hand vacuum cleaner, which may be converted to a shoulder strap vacuum cleaner by the addition of a shoulder strap (not shown). Alternatively, as shown in Figure 1B and 1D, the surface cleaning apparatus 110 may be a shop-vac or wet/dry type vacuum cleaner. In other embodiments, the surface cleaning apparatus 110 may be another type of surface cleaning apparatus, for example an upright vacuum cleaner, a canister type vacuum cleaner, a stick vacuum cleaner, a back pack vacuum cleaner, a carpet extractor or the like.

The surface cleaning apparatus 110 comprises a dirty fluid inlet 112, a clean fluid outlet 114, and a fluid flow path extending therebetween. At least one cyclonic cleaning stage 116 is provided in the fluid flow path. A fluid flow motor 118 is positioned in the fluid flow path for drawing a fluid (e.g. air or water) from the dirty fluid inlet 112 to the clean fluid outlet 114. The surface

cleaning apparatus may draw in water and/or air that may have entrained therein dirt through inlet 112 and discharge air through outlet 114. The water and/or dirt will accumulate in dirt chamber 144.

Referring to Figures 2A to 2D, dirty fluid entering dirty fluid inlet 112 is directed to cyclonic cleaning stage 116. As is known in the art, a hose or wand having a distal inlet that may be mounted on a surface cleaning head may be attached to inlet 112. In the embodiments shown, cyclonic cleaning stage 116 comprises a single cyclone chamber 120 extending longitudinally along a first longitudinal axis 122. In other embodiments, cyclonic cleaning stage 116 may comprise a plurality of cyclones. Cyclone chamber 120 comprises a clean air outlet 124, and a dirt and/or water outlet 126. A dirt chamber 144, as will be described further hereinbelow, is positioned below dirt outlet 126. It will be appreciated that other cleaning or treatment stages may be provided upstream of the cyclone inlet.

In some embodiments, air exiting cyclone chamber 120 may be directed past motor 118, and out of clean fluid outlet 114. Alternatively, air exiting cyclone chamber 120 may be directed to one or more additional cleaning stages, such as another component, for example housing a filter prior to flowing to motor 118. The second cleaning 128 stage comprises a plurality of second cyclones 130 in parallel.

The second cleaning stage 128 has, in the examples illustrated, a generally cylindrical configuration with a second longitudinal axis 132. In the embodiments of Figures 2A, 2B, and 2D, the second axis 132 is parallel to, and laterally offset from, first axis 122. In the embodiment of Figure 2C, the second axis 132 is parallel to and aligned with first axis 122. In the embodiments shown in Figures 2A and 2B, each of the second cyclones 130 in the assembly receives air from the clean air outlet 124 of the first cyclone, and discharges air through outlets 134 into a manifold 136. Air is evacuated from the manifold 136 through a conduit 138 disposed centrally of the assembly. From the conduit 138 the air is

drawn towards the motor 118, and expelled from the apparatus 110 through the exhaust 114. In the embodiment of Figure 2C, each of the second cyclones 130 receives air from the clean air outlet 124 of the first cyclone via a conduit 137, and discharges air via outlets 134 into a manifold 139. From manifold 139, the air is drawn through a filter 141, and past motor 118. In the embodiment of Figure 2D, each of the second cyclones 130 receives air from the clean air outlet 124 of the first cyclone via a conduits 127, and discharges air via outlets 134 into a motor housing 142. Alternately or in addition, in some embodiments the additional cleaning stage 128 may include a filter element, such as a pre-motor foam membrane, disposed in the fluid stream between the cleaning stage 128 and the motor 118.

In the embodiments shown in Figures 2A-2C, motor 118 is disposed laterally adjacent the additional cleaning stage 128, in a motor housing 142. In the embodiment of Figure 2D, motor 118 is disposed laterally adjacent the first cleaning stage above the additional cleaning stage, namely filters 141 and second cyclonic cleaning stage 128. In the embodiment of Figure 2A, motor 118 extends transverse to first longitudinal axis 122. In the embodiment of Figures 2B-2D, motor 118 extends parallel to first longitudinal axis 122. The motor 118 is, in the examples illustrated, offset from the second cleaning stage 128, having a portion that abuts or is adjacent at least a portion of the dirt chamber. It will also be appreciated that motor housing may be adjacent both the first and second housings and, thereby defining a generally triangular configuration in top plan view. Motor 118 may alternately be positioned at any other location known in the surface cleaning arts, such as above or below the cyclonic cleaning stage.

As previously mentioned, cyclone chamber 120 is in fluid communication with a dirt chamber 144, which is positioned below the dirt outlet 126. Dirt chamber 144 serves to collect dirt that is removed, e.g., from the air passing through cyclone chamber 120 or water drawn in through inlet 112. Dirt

chamber 144 may be of any configuration known in the art provided the dirt chamber inlet 150 is off centre. As exemplified, dirt chamber 144 comprises an upper portion 146, which is proximate cyclone chamber 120, and a lower portion 148. Dirt chamber 144 is bounded by at least one wall. In the embodiments shown, dirt chamber 144 is bounded by a top wall 152 a bottom wall 154, and at least one sidewall 156.

Dirt chamber 144 further comprises a dirt chamber inlet 150, which is preferably defined in upper portion 146, and more preferably defined in top wall 152. Dirt chamber inlet 150 is in fluid communication with dirt outlet 126 of cyclone chamber 120. In some embodiments, as shown, dirt chamber inlet 150 and dirt outlet 126 may coincide. In other embodiments, dirt chamber inlet 150 and dirt outlet 126 may be separate, and may have a channel or passage providing fluid communication therebetween (not shown).

Dirt chamber inlet 150 may be of a variety of shapes and sizes. In the preferred embodiment, dirt chamber inlet 150 has a circular outer perimeter 162. In further embodiments, wherein surface cleaning apparatus 110 comprises a divider plate, as will be described further hereinbelow, dirt chamber inlet 150 may be substantially annular.

Dirt chamber 144 may be of a variety of shapes and sizes. For example, in the embodiment of Figures 1A, 2A, and 5A-5C, dirt chamber 144 comprises two substantially rounded lobes having curved sidewalls 156. In the embodiment of Figures 1B, 2B, 1C and 2C, dirt chamber 144 comprises two lobes which comprise substantially straight sidewalls 156. In the embodiment of Figures 1D, 2D, and 3A-3C, dirt chamber 144 comprises a single rectangular chamber. In the embodiment of Figures 4A-4C, dirt chamber 144 comprises a single trapezoidal chamber.

In some embodiments shown, dirt chamber 144 comprises at least two sidewalls which meet at an angle. For example, in the embodiment of

Figures 2B-2D, sidewalls 156a and 156b meet at a corner 157. Such embodiments may be advantageous because cyclonic action in the dirt chamber may be minimized or reduced by providing the dirt chamber with sidewalls, which meet at an angle. Accordingly, dirt in the dirt chamber may be prevented from being re-entrained the circulating air. In other embodiments, dirt chamber 144 may be of another shape. For example dirt chamber 144 may be cylindrical.

In the embodiments shown, dirt chamber 144 extends laterally beyond the cyclone chamber 120. That is, if cyclonic cleaning stage 116 has a maximum cross sectional area in a plane transverse to axis 122 (e.g. parallel to bottom wall 154), and dirt chamber 144 has a maximum cross sectional area in a plane transverse to axis 122 (e.g. parallel to bottom wall 154), the maximum cross sectional area of dirt chamber 144 is greater than the maximum cross sectional area of cyclonic cleaning stage 116. In some particular embodiments, the maximum cross sectional area of dirt chamber 144 is at least 25% larger, more preferably at least 50% larger and most preferably at least 75% larger than the maximum cross sectional area of cyclonic cleaning stage 116. Such embodiments may be advantageous because the overall volume of the dirt chamber may be increased without increasing the footprint of surface cleaning apparatus 110. In the embodiment of Figure 1A, 1C and 1D, dirt chamber 128 extends laterally such that a portion thereof is positioned beneath second cleaning stage 128. In the embodiment of Figure 2A, dirt chamber 128 extends laterally such that a portion thereof is positioned beneath second cleaning stage 128, and motor 118.

It will be appreciated that in an alternate embodiment, dirt chamber 144 may have a cross sectional area in a plane transverse to axis 122 that is essentially the same as the cross sectional area of the cyclone 116 in a plane transverse to axis 122. This may be achieved by placing inlet 150 below inlet 126 but at adjacent sidewall 156. Thus the inlet 150 is off centre and dirt chamber 144 may be underneath only a portion of cyclone 116.

Referring to Figures 3A – 3C, in some embodiments, dirt chamber 128 comprises a central axis 158 extending between upper portion 146, and lower portion 148. When surface cleaning apparatus 110 is positioned such that axis 122 extends vertically, central axis 158 may extend vertically between top wall 152 and bottom wall 154. Central axis 158 is positioned such that it extends through a centroid 160 of top wall 152. As used herein, the centroid of top wall 152 is defined as the point located centrally in the area A defined by dirt chamber 144 when viewed from above. For example, in the embodiment of Figures 3A-3C dirt chamber 144 is rectangular. When viewed from above, dirt chamber 130 has a Length L_1 and a width W_1, and centroid 160 is positioned at a point corresponding to ½ L_1 and ½ W_1. In another example, as shown in Figures 4A – 4C, dirt chamber is substantially trapezoidal when viewed from the front. Accordingly, top wall 152 of dirt chamber 144 has a length L_2, bottom wall 154 of dirt chamber 144 has a length L_3, and dirt chamber 144 has a width W_2. When viewed from above, area A is defined by L_3 and W_2. Therefore, in this embodiment, centroid 160 is positioned at a point corresponding to ½ L_3 and ½ W_2. In another example, as shown in Figures 5A-5C, dirt chamber has two elongate and rounded lobes. When viewed from above, dirt chamber 144 has an overall width W_3, and an overall length L_4. The centroid 160 is positioned at a point corresponding to ½ W_3 and ½ L_4.

Dirt chamber inlet 150 is off centre with respect to dirt chamber 144. That is, dirt chamber inlet 150 is spaced from central axis. In further embodiments, central axis 158 is spaced from longitudinal axis 122. Such embodiments may allow for the volume of dirt chamber 144 to be increased, without substantially increasing the footprint of surface cleaning apparatus 110.

Referring to Figures 3A – 5C, dirt chamber inlet 150 may be spaced from central axis 158 by a distance X, which is defined as the shortest distance between a perimeter 162 of dirt inlet 150, and central axis 158. Distance X may vary depending on a variety of factors. Dirt chamber inlet 150 may be spaced

from the central axis by a distance of at least 10% of the maximum length, L_{max}. In a preferred embodiment, dirt chamber inlet 150 is spaced from central axis 158 by a distance of at least 15% of L_{max}. In a more preferred embodiment, dirt chamber inlet 150 is spaced from central axis 158 by a distance of at least 25% of L_{max}.

In some particular embodiments, as shown in Figures 5A – 5C, the upper portion 146 of dirt chamber 144 has a perimeter 164, and dirt chamber inlet 150 is adjacent the perimeter.

Referring to Figures 6 and 7, the dirt chamber 144 preferably has an openable panel 166 to facilitate emptying debris collected therein. In the embodiment of Figure 6, panel 166 comprises bottom wall 15, which is movable between open and closed positions. The bottom wall is preferably pivotally mounted to at least one sidewall 156. In the embodiment of Figure 7, panel 166 comprises top wall 152 of dirt chamber 132. In this embodiment, when panel 166 is opened, cyclonic cleaning stage 116, motor 118, and second cleaning stage 128 pivot together with panel 166. In other embodiments, dirt collection chamber 144 may be emptyable by any means known in the vacuum cleaner art. For example, dirt collection chamber 144 may be removably mounted to the surface cleaning apparatus or otherwise openable.

The apparatus 110 may also include a divider plate 168 positioned adjacent the dirt outlet 126 of the first cyclone chamber 120. In the example illustrated in Figures 2A-2C, the divider plate 168 is positioned within the dirt chamber 144, adjacent to but spaced below the dirt outlet 126. In other embodiments, divider palate 168 may be positioned within dirt outlet 126. In such an embodiment, dirt chamber inlet 150 may be defined between top wall 152 and divider plate 168, and may be substantially annular. The divider plate 168 may generally comprises a disc 170 that, when positioned below the dirt outlet 126, has a diameter slightly greater than the diameter of the dirt outlet 126, and disposed in facing relation to the dirt outlet 126. The disc 170 is, in the

example illustrated, supported by a pedestal 172. In the embodiment of Figures 2A and 2C, pedestal 172 extends upwardly from bottom wall 154 of the dirt chamber 144. In the embodiment of Figure 2B pedestal 172 extends downwardly from top wall 152 of dirt chamber 144. Alternately, plate 168 may be mounted to a sidewall 156 of the dirt collection chamber 144.

In the embodiment of Figures 1A and 1C, the surface cleaning apparatus may be carried by a strap (not shown) or by using handle 174. In the embodiments of Figures 1B and 1D, the surface cleaning apparatus comprises one or more wheels 176, glides, or the like, for moving surface cleaning apparatus 110 along a surface.

In some embodiments, dirt chamber 144 preferably forms a portion of a casing member 177 for the apparatus 110 that is of a unitary, integral construction. For example, casing member 177 may comprise dirt chamber 144, the outer wall of cyclone chamber 120, a housing for the second cleaning stage 128, motor housing 142, and handle 174.

In some embodiments, dirt chamber 144 may comprise one or more liner bags 180, for example as shown in Figure 2B, for lining dirt chamber 144 and aiding in emptying dirt chamber 144.

It will be appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments or separate aspects, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment or aspect, may also be provided separately or in any suitable sub-combination.

Although the invention has been described in conjunction with specific embodiments thereof, if is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall

within the spirit and broad scope of the appended claims. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention.

1. A surface cleaning apparatus comprising:

a) a fluid flow path extending from a dirt inlet to a clean fluid outlet and a fluid flow motor positioned in the fluid flow path;

b) a cyclonic cleaning stage provided in the fluid flow path and comprising a cyclone chamber and a dirt outlet;

c) at least one dirt chamber in fluid communication with the cyclone chamber and positioned below the cyclone chamber, the dirt chamber having an upper portion proximate the cyclone chamber, a lower portion, a central axis extending vertically between the upper portion and the lower portion, and a dirt chamber inlet spaced from the central axis; and,

d) a generally transversely extending plate positioned in the at least one dirt chamber and facing the dirt outlet the dirt outlet of the cyclone chamber

wherein the fluid flow motor is downstream from the cyclone chamber.

2. The surface cleaning apparatus of claim 1, wherein the plate is a disc.

3. The surface cleaning apparatus of claim 2, wherein the outlet of the cyclone chamber has a diameter and the disc has a diameter greater than the diameter of the dirt outlet.

4. The surface cleaning apparatus of any of claims 1 - 3, wherein the dirt chamber extends under all of the cyclone chamber.

5. The surface cleaning apparatus of any of claims 1 - 4, wherein the dirt chamber inlet is substantially annular.

6. The surface cleaning apparatus of any of claims 1 - 5 wherein the cyclone chamber extends to an upper wall of the dirt chamber and the dirt outlet comprises an opening in the upper wall of the dirt chamber.

7. The surface cleaning apparatus of claim 1, wherein the upper portion of the dirt chamber has a maximum width, and the dirt chamber inlet is spaced from the central axis by distance of at least 10% of the maximum width.

8. The surface cleaning apparatus of claim 7, wherein the dirt chamber inlet is spaced from the central axis by distance of at least 15% of the maximum width.

9. The surface cleaning apparatus of claim 8, the dirt chamber inlet is spaced from the central axis by distance of at least 25% of the maximum width.

10. The surface cleaning apparatus of any of claims 1 - 9, wherein the cyclonic cleaning stage comprises a single cyclone.

11. The surface cleaning apparatus of claim 1, wherein the plate is positioned in the dirt chamber below the dirt chamber inlet.

12. The surface cleaning apparatus of any of claims 1 - 11, wherein the upper portion has a perimeter, and the dirt chamber inlet is proximate the perimeter.

13. The surface cleaning apparatus of any of claims 1 - 12, wherein the cyclone chamber has a longitudinal axis, and the central axis of the dirt chamber is spaced from the longitudinal axis.

14. The surface cleaning apparatus of any of claims 1 - 13, wherein the dirt chamber is cylindrical.

15. The surface cleaning apparatus of any of claims 1 - 14, wherein the dirt chamber comprises at least two sidewalls that meet at an angle.

16. The surface cleaning apparatus of any of claims 1 - 15 wherein the cyclonic cleaning stage has a maximum cross sectional area in a plane transverse to the a longitudinal axis of the cyclonic cleaning stage and the dirt chamber has a maximum cross sectional area in a plane transverse to the central axis that is larger than the maximum cross sectional area of the cyclonic cleaning stage.

17. The surface cleaning apparatus of claim 16 wherein the maximum cross sectional area of the dirt chamber is at least 50% larger than the maximum cross sectional area of the cyclonic cleaning stage.

18. The surface cleaning apparatus of any of claims 1 - 17, wherein the plate is supported by a portion of the at least one dirt chamber.

19. The surface cleaning apparatus of claim 18, wherein the plate is supported by a member extending between the plate and the portion of the at least one dirt chamber.

20. The surface cleaning apparatus of any of claims 1 - 19, wherein a portion of the cyclone chamber proximate the dirt outlet is unobstructed.

21. The surface cleaning apparatus of any of claims 1 - 20, wherein the cyclone chamber has a side wall that extends to the upper portion of the at least one dirt chamber.

22. The surface cleaning apparatus of any of claims 1 - 21, wherein the dirt out is centrally located with respect to the cyclone chamber.

23. A surface cleaning apparatus comprising:

a) a fluid flow path extending from a dirt inlet to a clean fluid outlet and a fluid flow motor positioned in the fluid flow path;

b) a first cyclonic cleaning stage comprising a cyclone chamber, a dirt outlet and a dirt outlet end;

c) a dirt chamber in fluid communication with the cyclone chamber and positioned at the dirt outlet end, the dirt chamber having a dirt chamber inlet that is off-centre; and,

d) a generally transversely extending plate positioned in the dirt chamber and facing the dirt outlet

wherein the fluid flow motor is downstream from the cyclone chamber.

24. The surface cleaning apparatus of claim 23, wherein the dirt chamber has a first portion proximate the cyclone chamber, a second portion, and a central axis extending vertically between the first portion and the second portion, and the dirt chamber inlet is spaced from the central axis.

25. The surface cleaning apparatus of claim 23, wherein the dirt chamber has a maximum width, and the dirt chamber inlet is off-centre by a distance of at least 10% of the maximum width.

26. The surface cleaning apparatus of claim 25, wherein the dirt chamber inlet is off-centre by a distance of at least 15% of the maximum width.

27. The surface cleaning apparatus of claim 26, wherein the dirt chamber inlet is off-centre by a distance of at least 25% of the maximum width.

28. The surface cleaning apparatus of claim 23, wherein the dirt chamber inlet comprises the dirt outlet of the cyclone chamber.

29. The surface cleaning apparatus of claim 24, wherein the first portion defines a perimeter, and the dirt chamber inlet is proximate the perimeter.

30. The surface cleaning apparatus of claim 23, further comprising a second cyclonic cleaning stage downstream from the cyclone.

31. The surface cleaning apparatus of claim 30, wherein the second cyclonic cleaning stage comprises a plurality of cyclones in parallel.

32. The surface cleaning apparatus of claim 31, wherein the first cyclonic cleaning stage comprises a single cyclone.

33. The surface cleaning apparatus of claim 23, wherein the plate is supported by a portion of the dirt chamber.

34. The surface cleaning apparatus of claim 33, wherein the plate is supported by a member extending between the plate and the portion of the dirt chamber.

35. The surface cleaning apparatus of claim 23, wherein the dirt outlet has a diameter and the plate has a diameter greater than the diameter of the dirt outlet.

36. The surface cleaning apparatus of claim 23, wherein a portion of the cyclone chamber proximate the dirt outlet is unobstructed.

37. The surface cleaning apparatus of claim 23, wherein the dirt chamber has an end wall in which the dirt chamber inlet is provided and the cyclone chamber has a side wall that extends to the end wall.

38. The surface cleaning apparatus of any of claims 23 - 37, wherein the dirt out is centrally located with respect to the cyclone chamber.

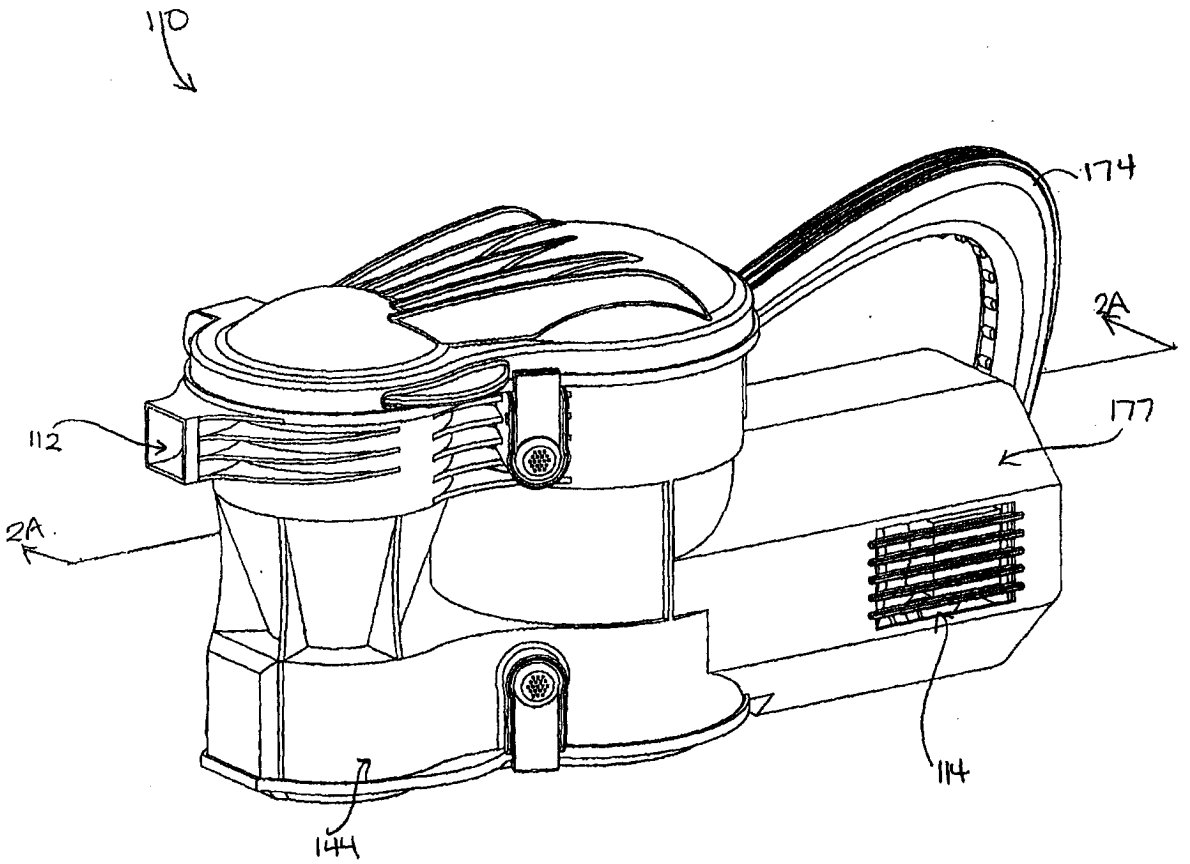


FIG 1A

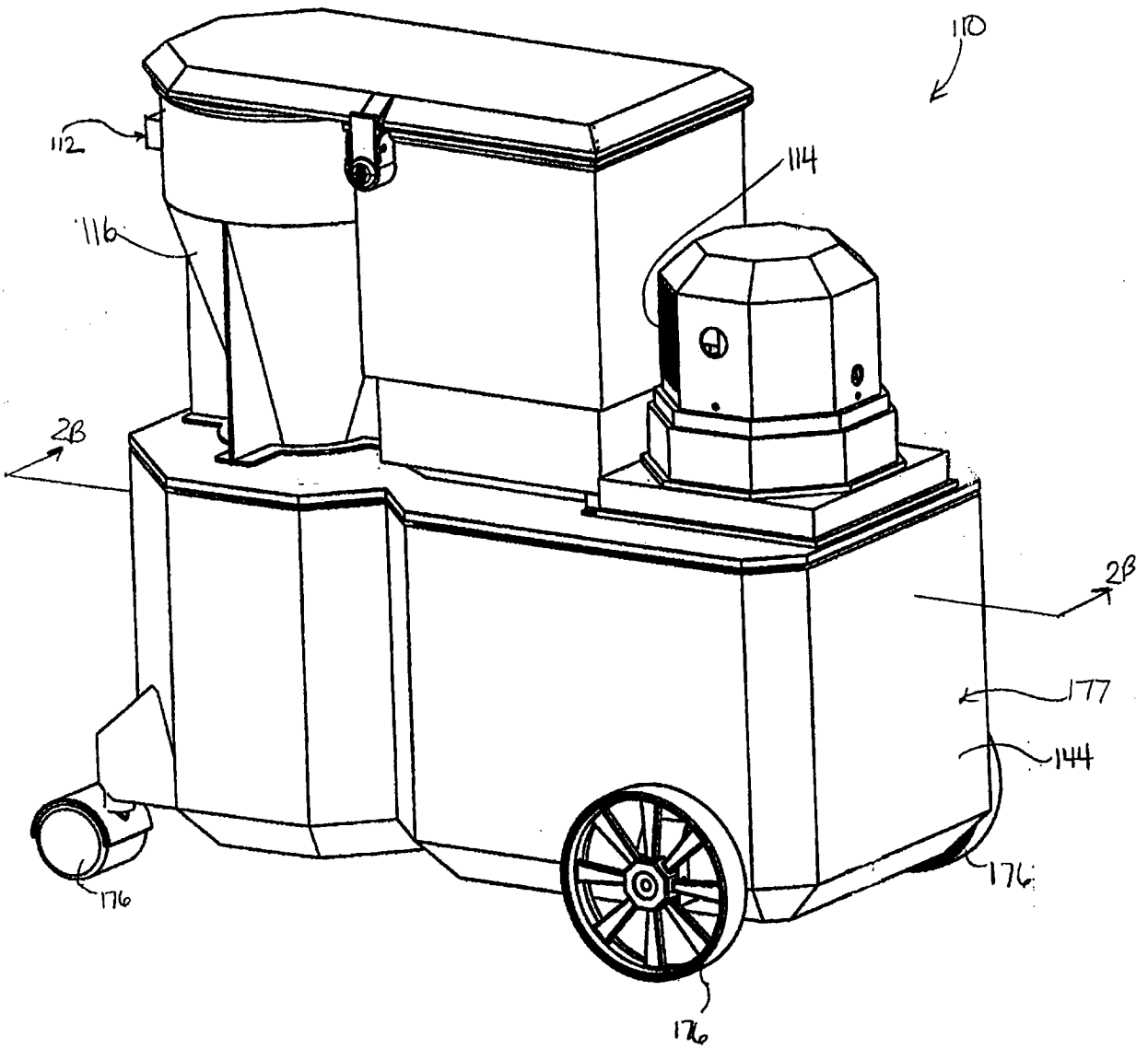


FIG. 1B

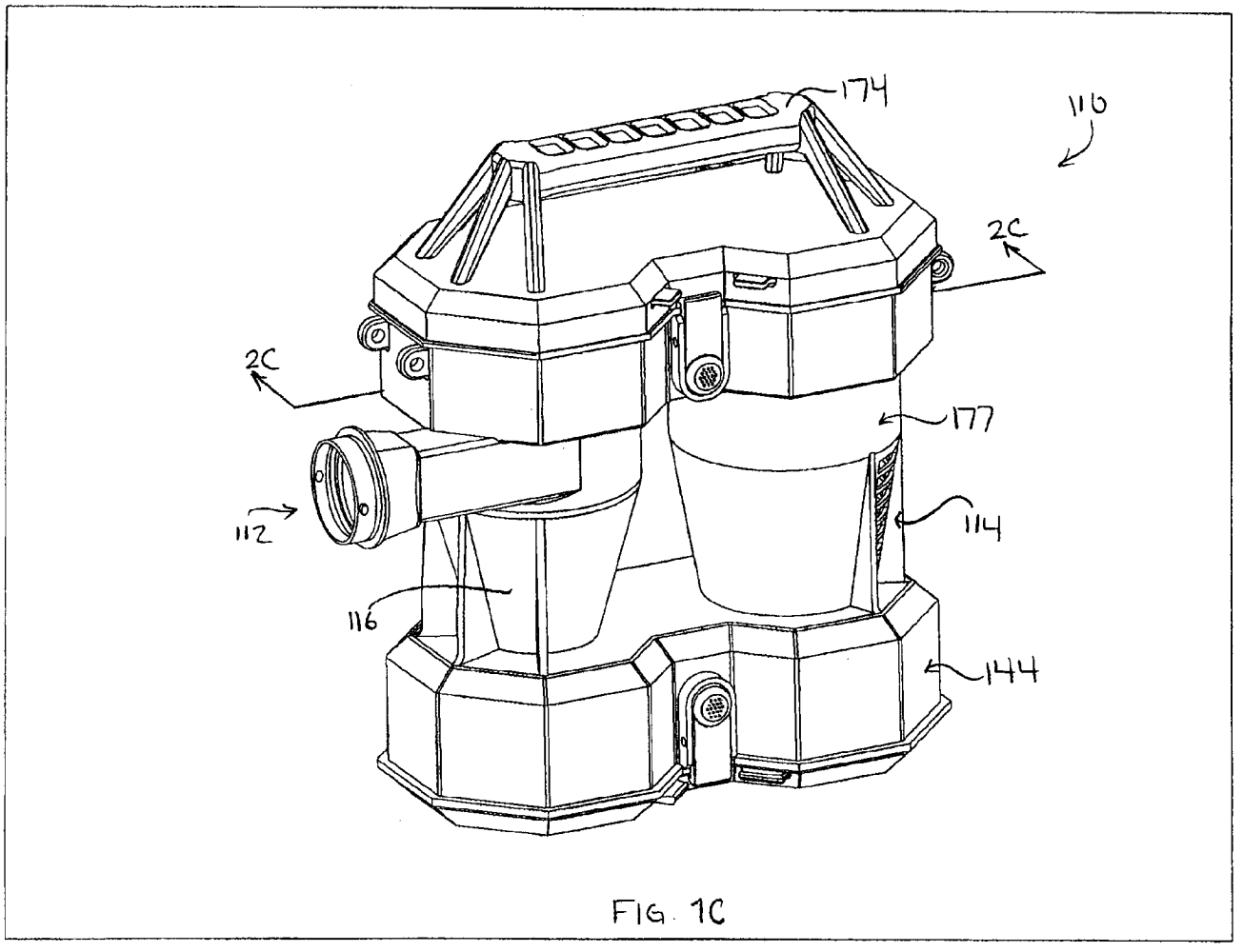


FIG. 1C

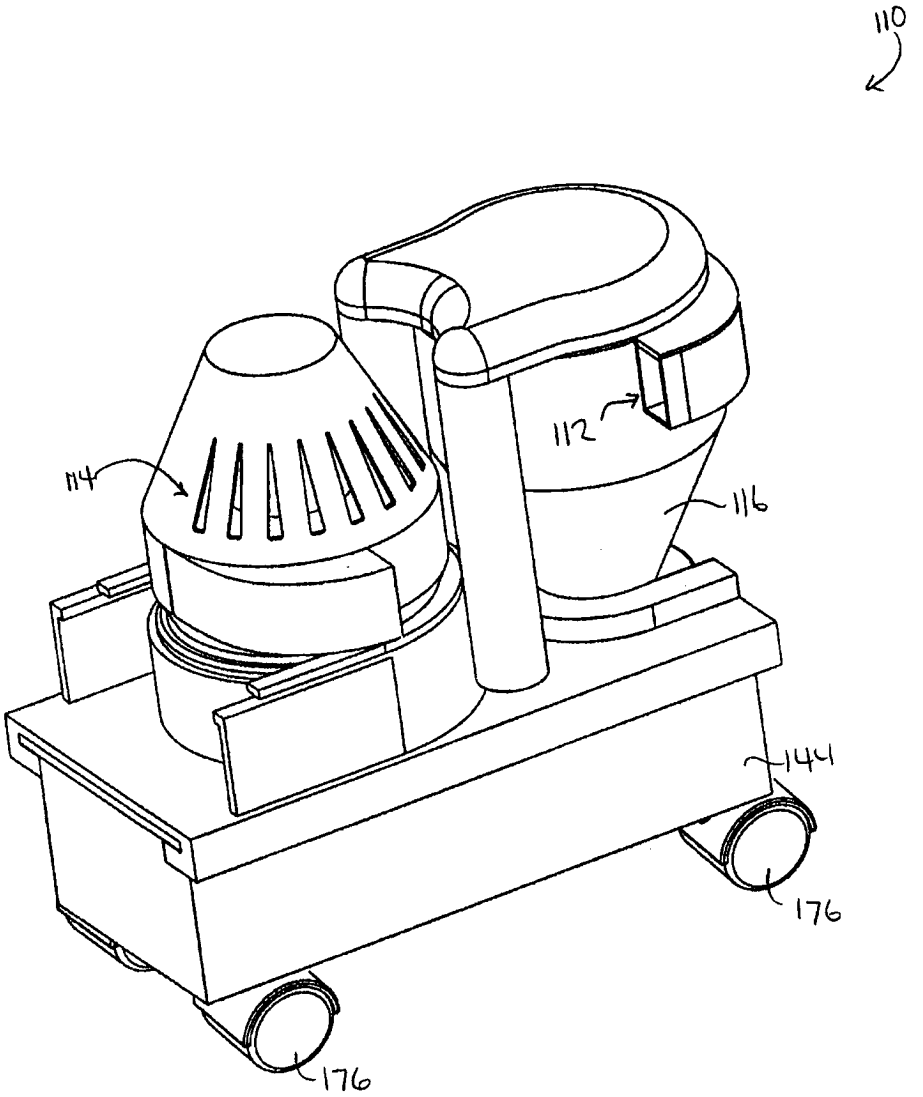
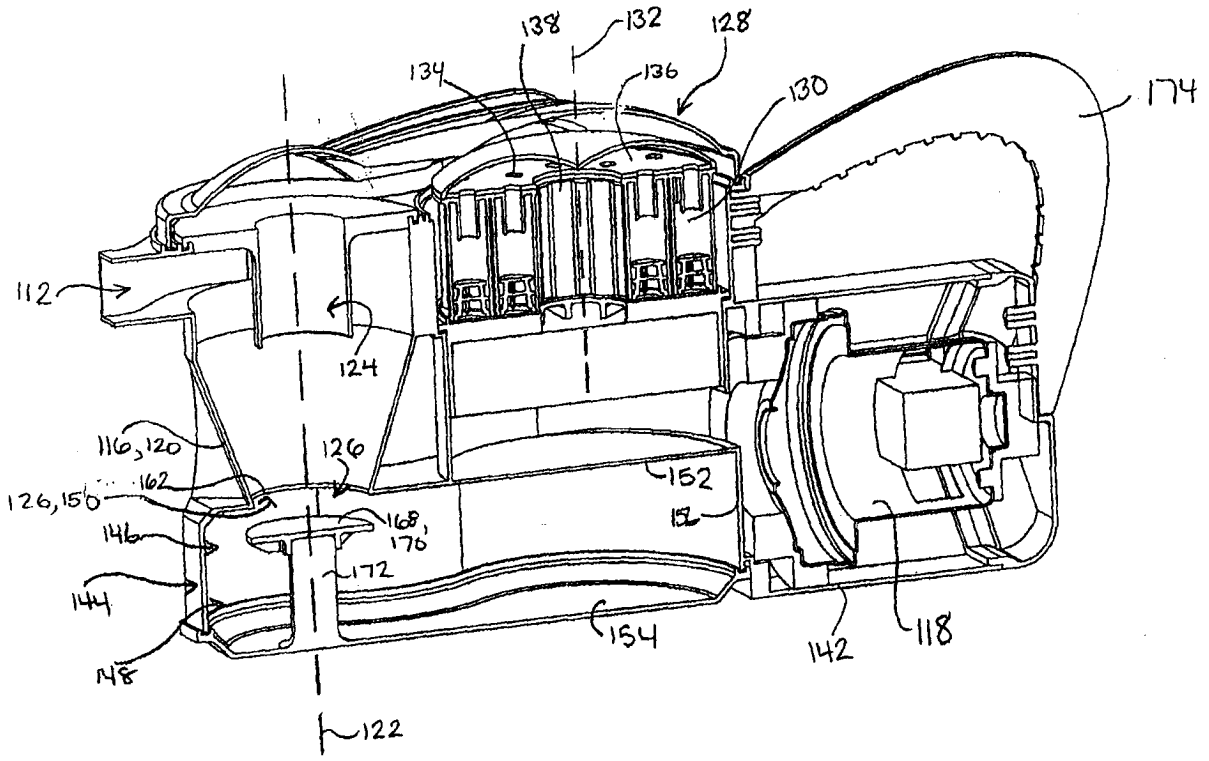


FIG. 1D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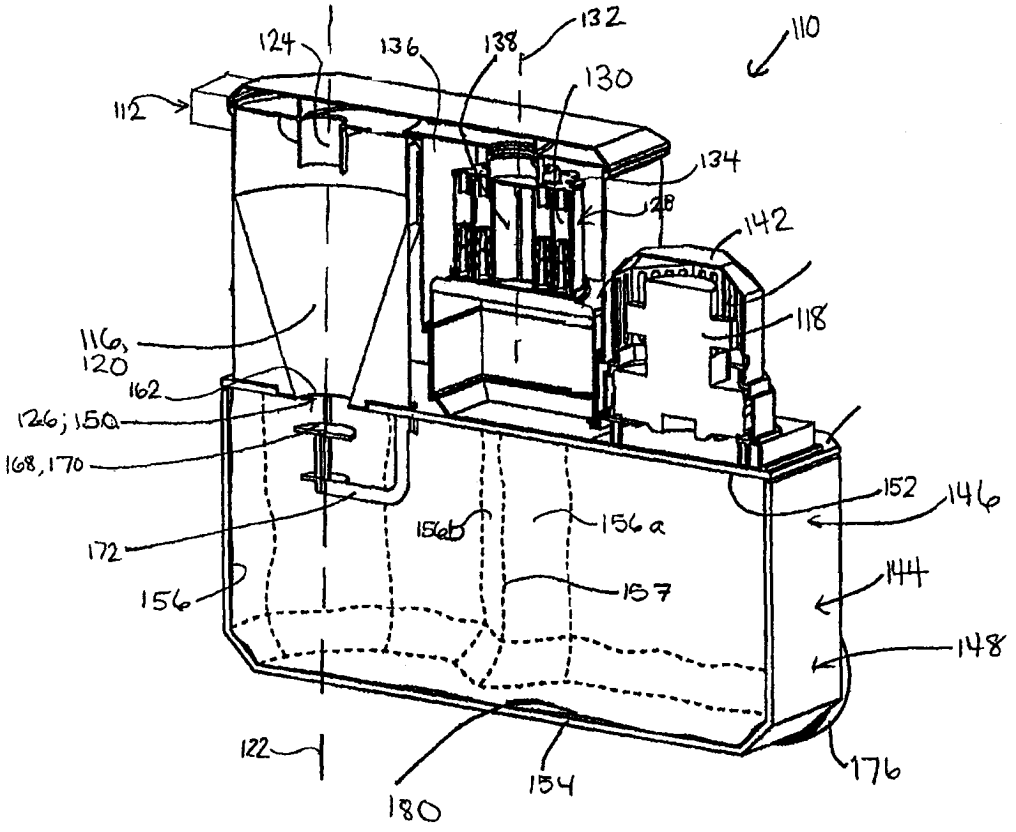
126,150
162
152
146
168,
170
172
144
154
142
118
148
122

FIG 2A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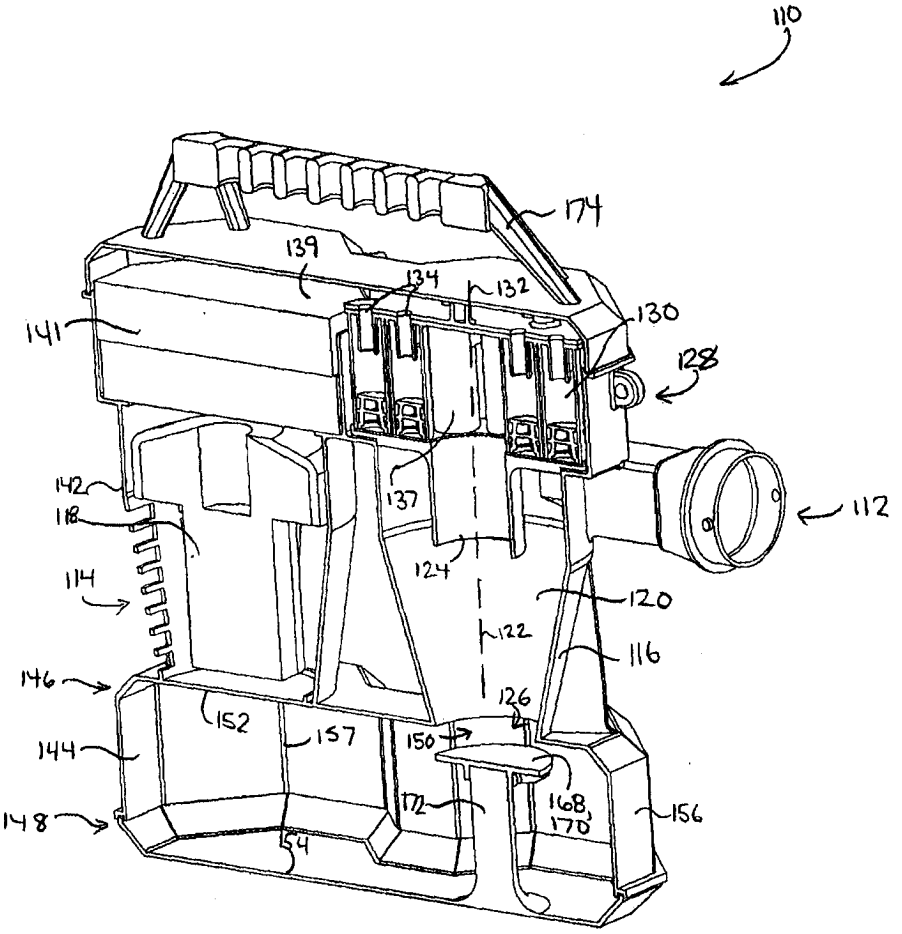
156
156b
156a
157
152
146
144
148
176
122
180
154

FIGURE 2B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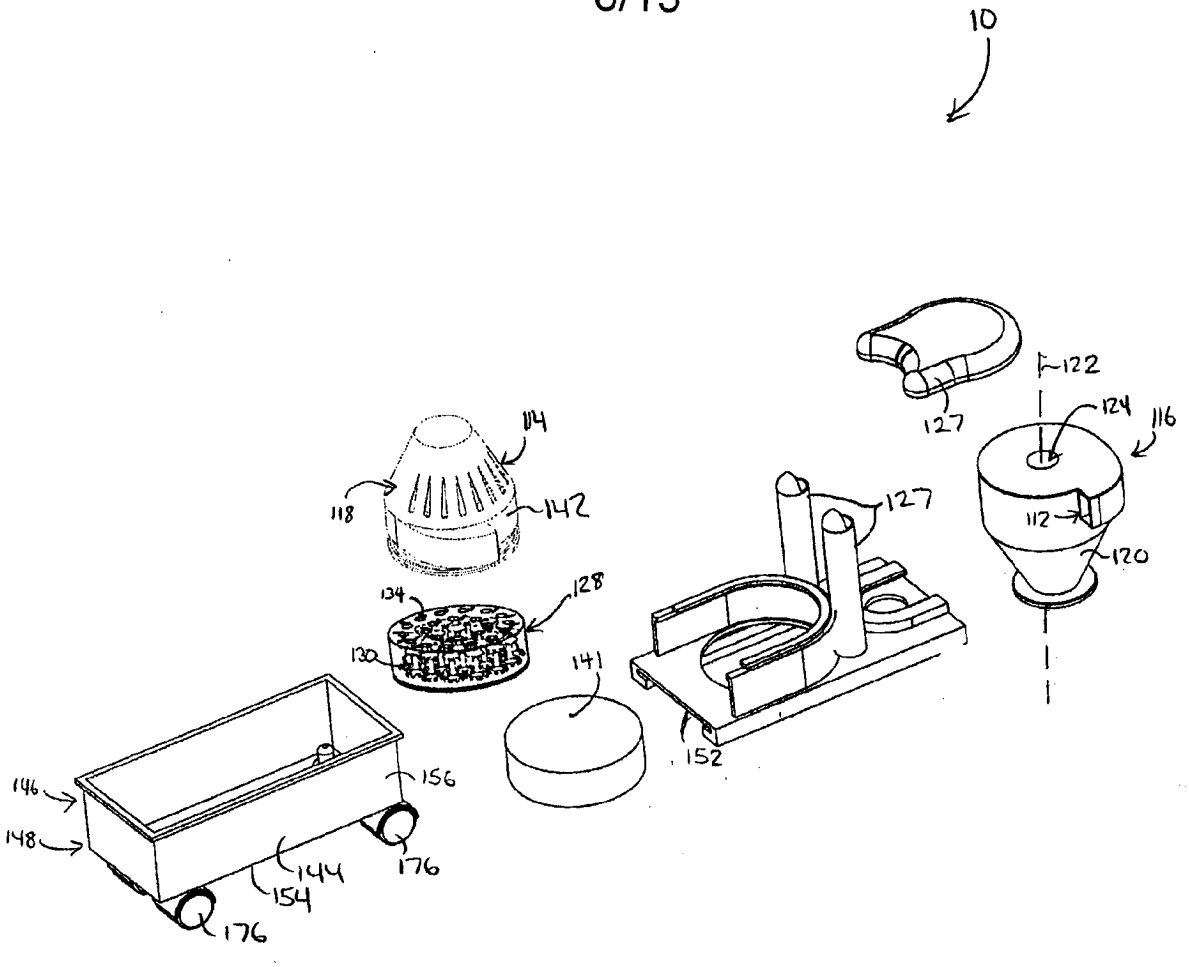
168,
170
172
156
148
54

FIG 2C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124
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146
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154
176
176

FIG. 2D

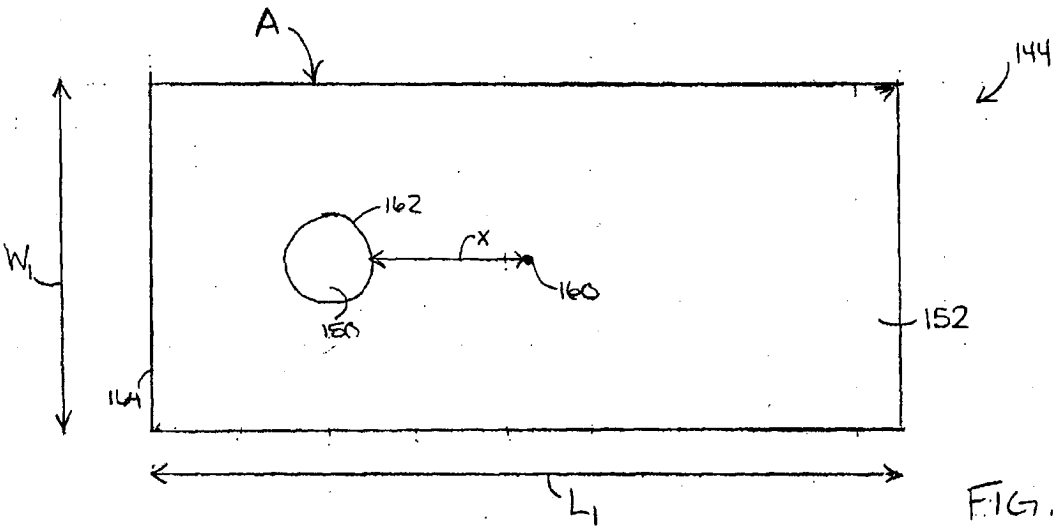

FIG. 3A

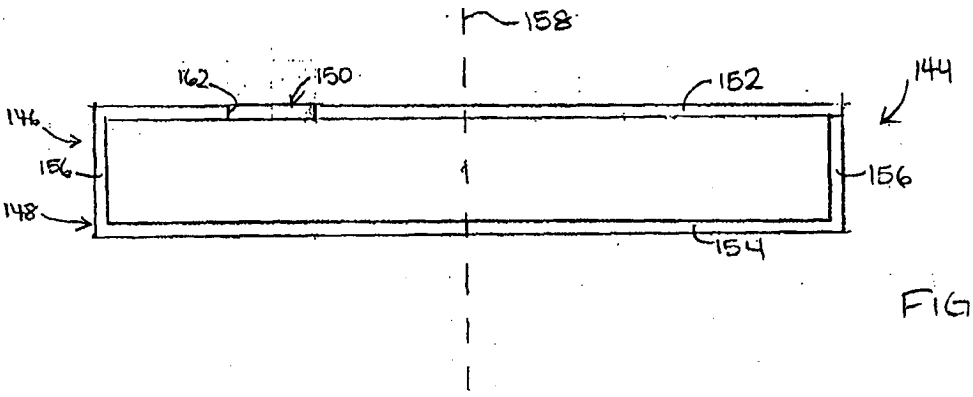

FIG 3B

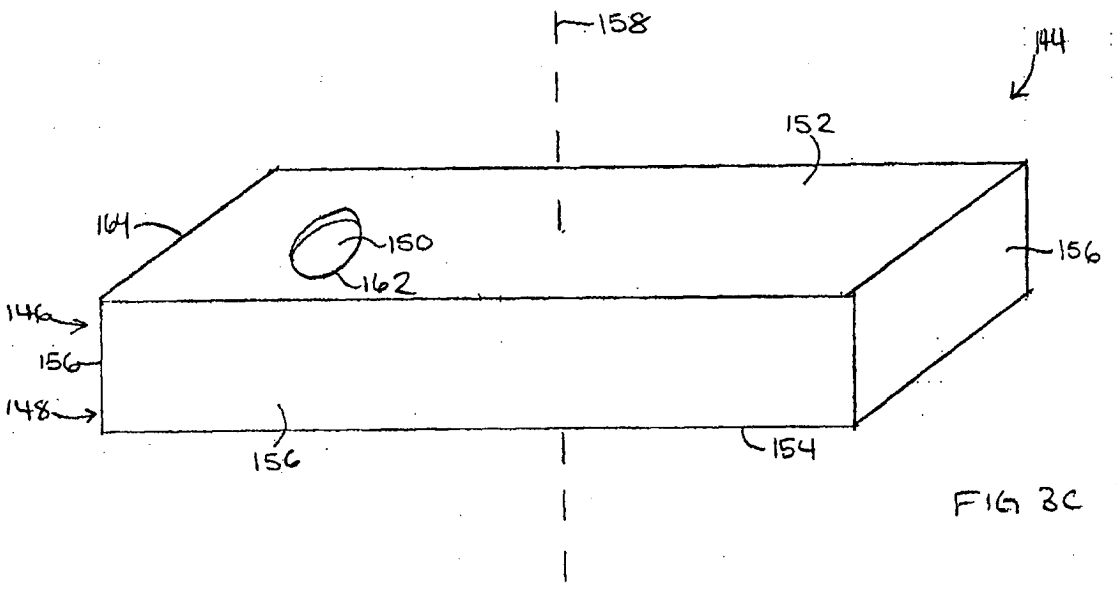

FIG 3C

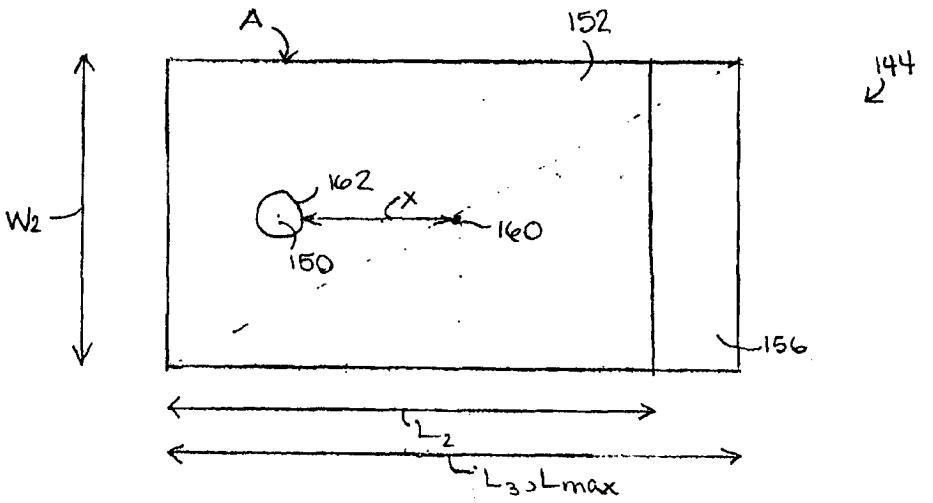

FIG 4A

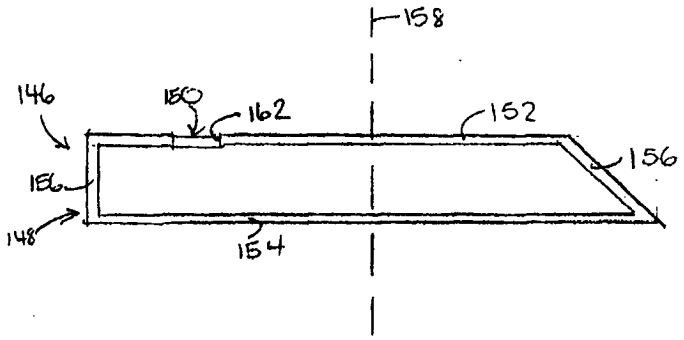

FIG 4B

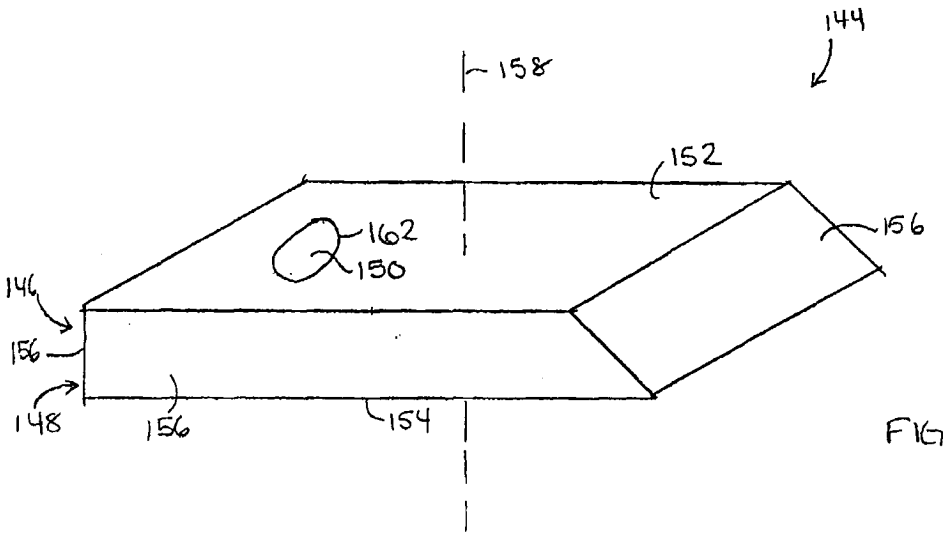

FIG 4C

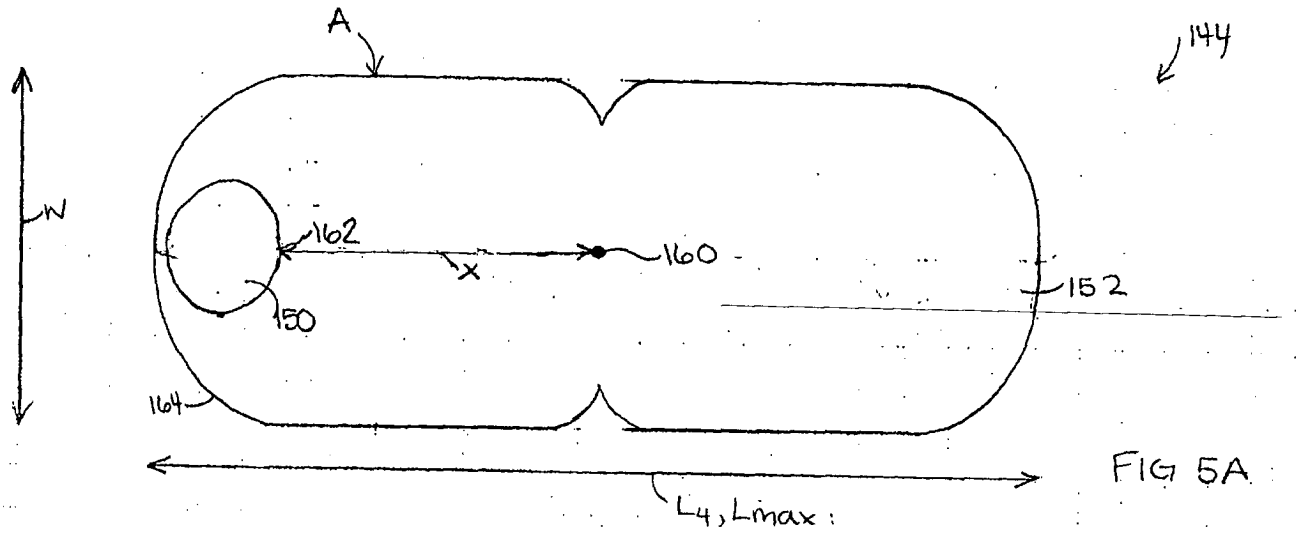

FIG 5A

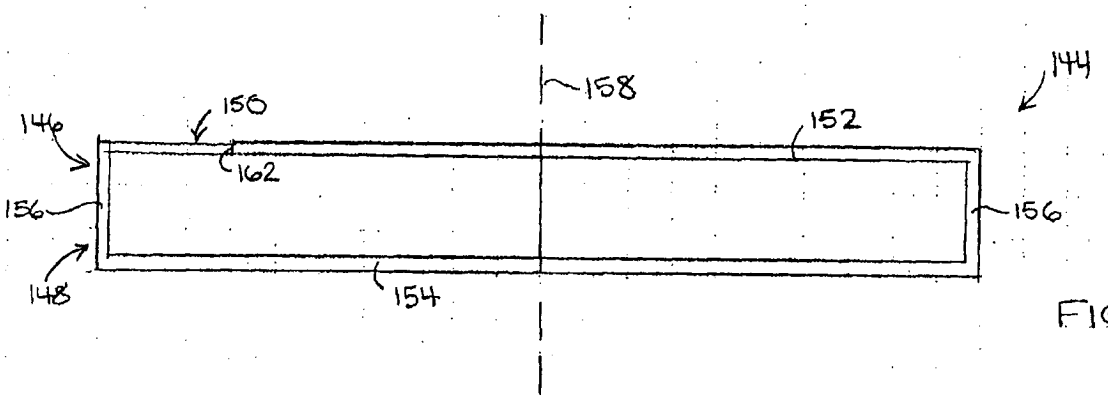

FIG 5B

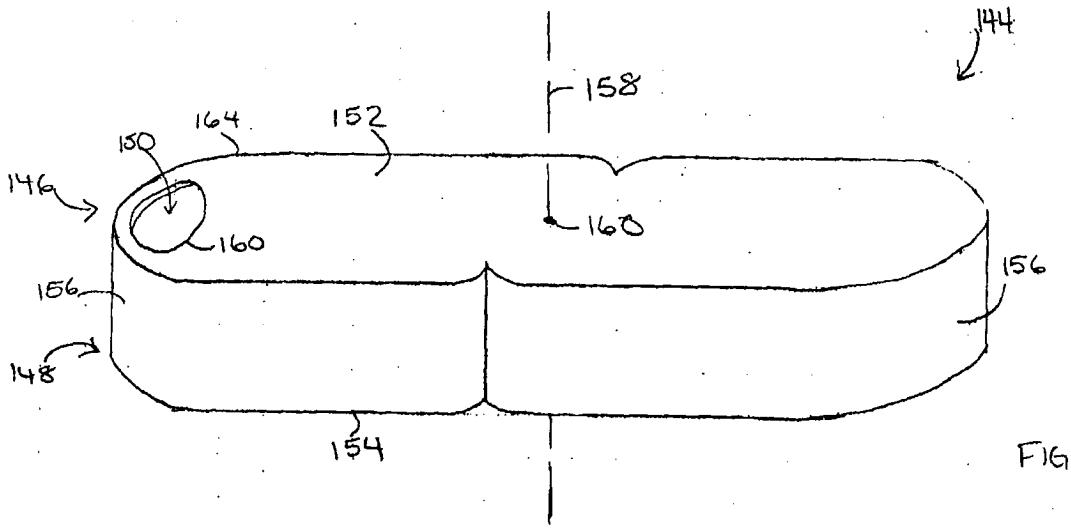

FIG 5C

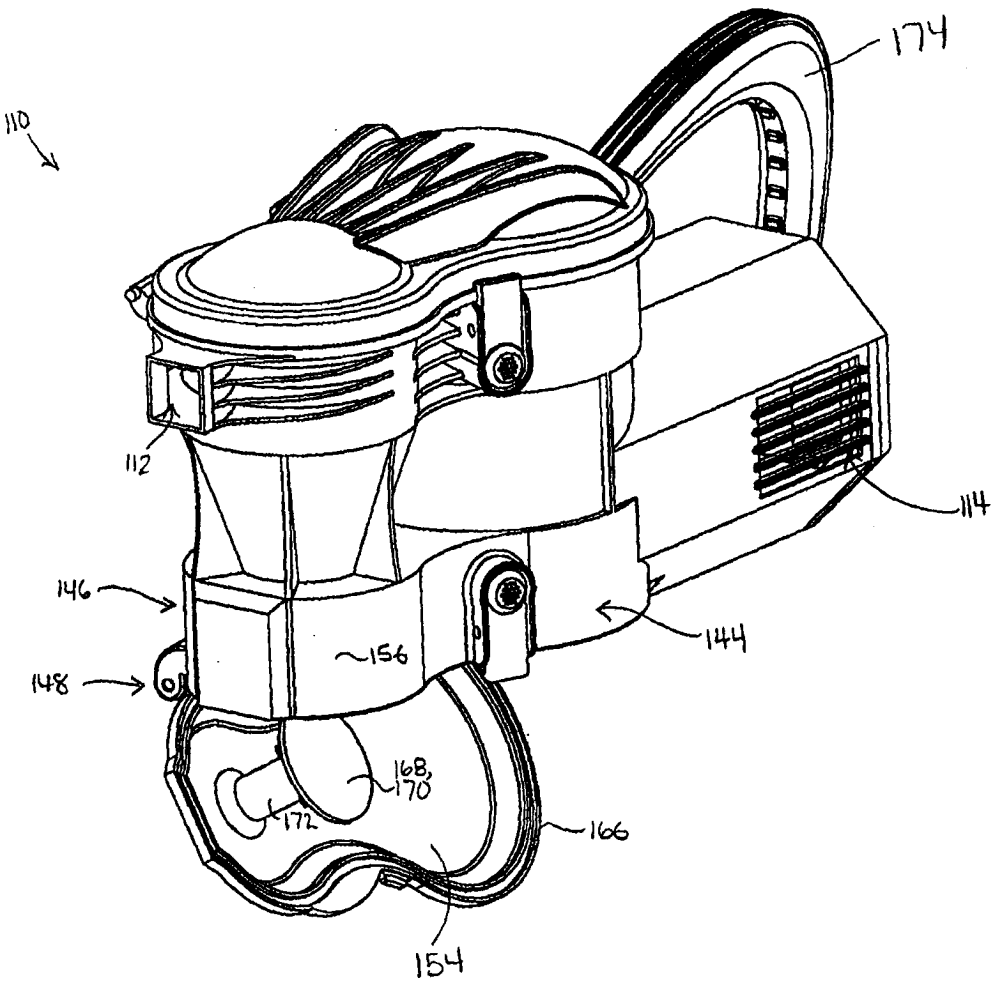

FIGURE 6

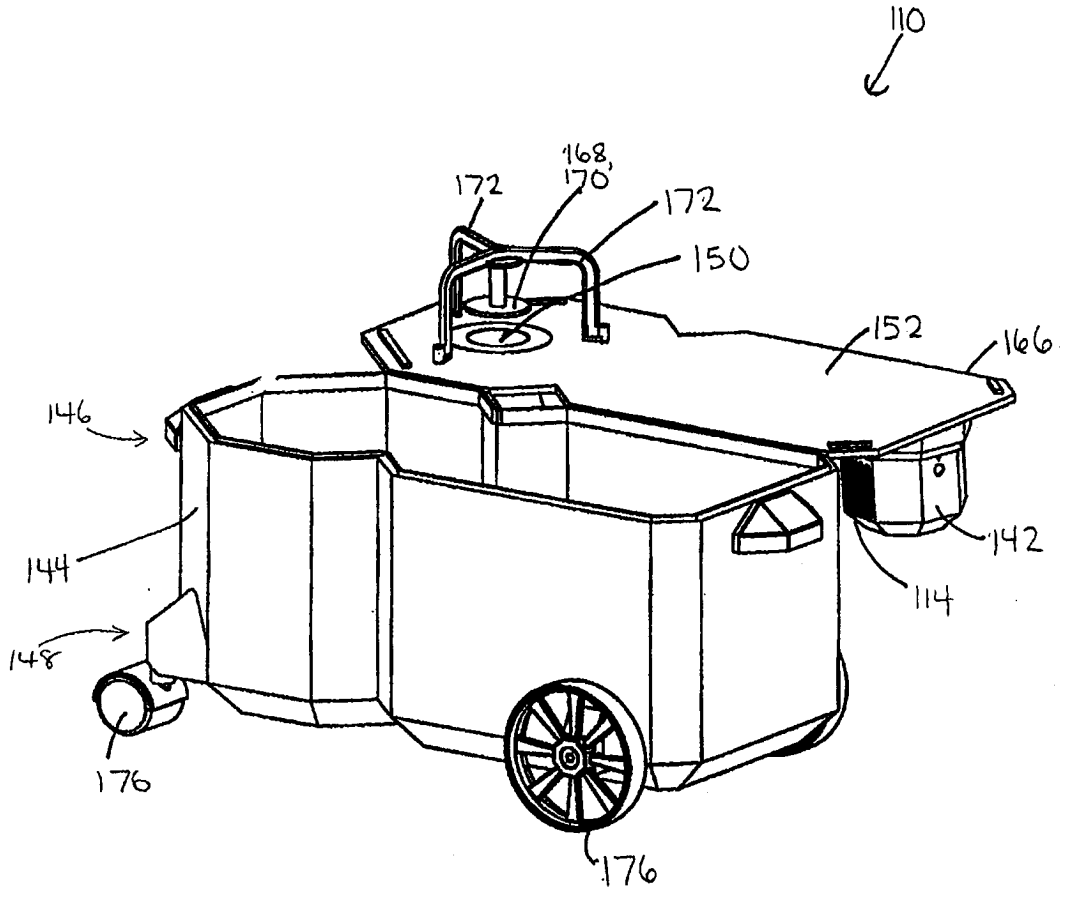

FIGURE 7