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(71) Applicant (for all designated States except US): **ROYAL APPLIANCE MFG.CO.D/B/A** [—/US]; Tti Floorcare North America, 7005 Cochran Road, Glenwillow, OH 44139 (US).

(71) Applicants and

(72) Inventors (for all designated States except US): **KHALIL, David** [US/US]; 6151 Highland Road, Highland Heights, OH 44143 (US). **PONIKVAR, Suzanne** [US/US]; 4028 Charlton Road, South Euclid, OH 44121 (US). **GEE, Jack, W.** [US/US]; 37635 Bar Harbour, Willoughby, OH 44094 (US). **COLLINS, David, Matthew** [US/US]; 4939 Edsel Drive, Lyndhurst, OH 44124 (US). **MULLINS, Mike** [US/US]; 33587 Blanche Ave., Eastlake, OH 44095 (US). **PAJAK, Greg** [US/US]; 1232 Giel Avenue, Lakewood, OH 44107 (US). **REINDLE, Mark** [US/US]; 865 Nesbitt Road, Sagamore Hills, OH 44067 (US).(74) Agent: **STACHEL, Kenneth, J.**; Royal Appliance Mfg.-co. D/b/a, Tti Floorcare North America, 7005 Cochran Road, Glenwillow, OH 44139 (US).

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(54) Title: CORDLESS HAND-HELD RECHARGEABLE VACUUM CLEANER AND CHARGER UNIT THEREFOR

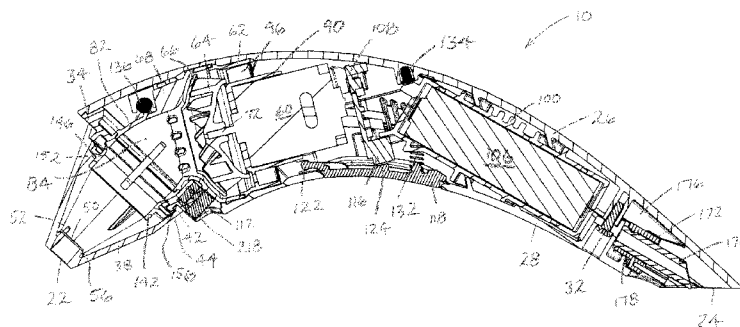


FIG. 6

(57) Abstract: The disclosure is related to a cordless hand-held rechargeable vacuum cleaner useful for cleaning around computers and other electrical equipment, and a charging base unit for the vacuum cleaner. The charging unit is configured to receive electrical power from a USB port.

CORDLESS HAND-HELD RECHARGEABLE VACUUM CLEANER AND CHARGER UNIT THEREFOR

This disclosure is related to the vacuum cleaner arts, and more particularly to a cordless hand-held rechargeable vacuum cleaner, hereinafter also referred to simply as a vacuum cleaner, and a charging base unit for the vacuum cleaner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0001] FIGURE 1 is a front perspective view of a cordless hand-held rechargeable vacuum cleaner received by a charging unit.

[0002] FIGURE 2 is a rear perspective view of the vacuum cleaner shown in FIGURE 1 received in the charging unit.

[0003] FIGURE 3 is an exploded perspective view of the vacuum cleaner and the charging unit depicted in FIGURE 1, along with an external power supply for providing power to the charging unit.

[0004] FIGURE 4 is a front perspective view of the vacuum cleaner shown in FIGURE 1.

[0005] FIGURE 5 is rear perspective view of the vacuum cleaner shown in FIGURE 4.

[0006] FIGURE 6 is a cross-sectional view of the vacuum cleaner shown in FIGURE 4. FIGURE 6 is a cross-sectional view taken along lines A-A of FIGURE 16.

[0007] FIGURE 7 is an enlarged lower perspective view of a filter assembly found in the vacuum cleaner shown in FIGURE 4.

[0008] FIGURE 8 is a front perspective view of the charging unit shown in FIGURE 1.

[0009] FIGURE 9 is an upper rear perspective view of the charging unit shown in FIGURE 8.

[0010] FIGURE 10 is a reduced top plan view of the vacuum cleaner and charging unit shown in FIGURE 1.

[0011] FIGURE 11 is a reduced front end view of the vacuum cleaner and charging unit shown in FIGURE 1.

[0012] FIGURE 12 is a reduced cross-sectional view taken along lines A-A in FIGURE 10.

[0013] FIGURE 13 is a reduced rear end elevation view of the vacuum cleaner and charging unit shown in FIGURE 1.

[0014] FIGURE 14 is a reduced side elevation view of the vacuum cleaner and charging unit shown in FIGURE 1.

[0015] FIGURE 15 is a reduced bottom plan view of the vacuum cleaner and charging unit shown in FIGURE 1.

[0016] FIGURE 16 is a reduced top plan view of the vacuum cleaner shown in FIGURES 1 and 4.

[0017] FIGURE 17 is a reduced front end view of the vacuum cleaner shown in FIGURES 1 and 4.

[0018] FIGURE 18 is a reduced rear end view of the vacuum cleaner shown in FIGURES 1 and 4.

[0019] FIGURE 19 is a reduced side elevation view of the vacuum cleaner shown in FIGURES 1 and 4.

[0020] FIGURE 20 is a reduced bottom plan view of the vacuum cleaner shown in FIGURES 1 and 4.

[0021] FIGURE 21 is a cross-sectional view similar to FIGURE 6 depicting the suction path through the vacuum cleaner.

[0022] FIGURE 22 is a top plan view of the vacuum cleaner with an upper housing half removed from a lower housing half to show internal components of the vacuum cleaner.

DETAILED DESCRIPTION

[0023] With reference to FIGURES 1 and 2, a cordless hand-held rechargeable vacuum cleaner 10, hereinafter referred to as a vacuum cleaner, is shown received in a charging unit 12 (also referred to as a charging base). The vacuum cleaner is useful for cleaning around computers and other electrical equipment. Of course, the

vacuum cleaner 10 can be used in a variety of other environments as well. The charging unit 12 is configured to receive electrical power from a USB port, for example a USB port located on a computer. The charging unit 12 is also configured to receive power from an external power supply 14 (FIGURE 3) that includes a USB port which allows the base unit to be charged from a standard electrical outlet via the external power supply.

[0024] With reference to FIGURES 4 and 5, the vacuum cleaner 10 includes a contoured housing 20 that is shaped to be easily gripped by a person's hand. Accordingly, the housing 20 can provide a handle for the vacuum cleaner 10. The vacuum cleaner 10 includes a suction inlet 22 at one end of the housing 20 and an exhaust 24 at an opposite end. Having the exhaust 24 located adjacent an end of the housing 20 allows an operator to use the vacuum cleaner as a blower. When used as a blower, the vacuum cleaner can be used to clean keyboards or other equipment that is typically cleaned using a can of compressed air. In other words, by simply reversing the orientation of the vacuum cleaner 10 as held in the hand of the user, either the suction end or the exhaust end of the vacuum cleaner can be employed for the desired purpose.

[0025] With reference back to FIGURE 3, the housing 20 in the depicted embodiment comprises an upper housing half 26 that fastens to a lower housing half 28 using fasteners 32. Of course, the upper housing half 26 and the lower housing half 28 can be attached to one another in other conventional manners, e.g. sonic welding.

[0026] With continued reference to FIGURE 3, a front inlet 34 is trapped between the upper housing half 26 and the lower housing half 28 (see also FIGURE 6). The front inlet 34 includes an opening 36, which defines a portion of a suction path of the vacuum cleaner. The suction path will be described in more detail below. A dust cup 38 attaches to the front inlet 34 upstream (forward towards the suction inlet 22) from the opening 36. With reference to FIGURE 6, the dust cup 38 includes at least one flange 42 that cooperates with a flange 44 formed on the front inlet 34 to retain the dust cup 38 to the front inlet. An operator of the vacuum cleaner 10 can remove the dust cup 38 by rotating the dust cup so that the flange 42 of the dust cup no

longer contacts the flange 44 of the front inlet 34, which allows the dust cup to be removed from the front inlet. The dust cup 38 defines the suction inlet 22 for the vacuum cleaner 10.

[0027] A flapper or inlet valve 50 is received in the dust cup 38 and blocks the suction path just downstream from the suction inlet 22. With reference to FIGURE 6, stakes 52 are provided in the dust cup 38 and the flapper 50 includes openings 54 (FIGURE 3) for receiving the stakes 52 to attach the flapper inside the dust cup. The flapper 50 is drawn in to the dust cup 38, unblocking the suction path, in response to air being drawn into the dust cup 38. When no suction is exerted on the dust cup, the flapper 50 will revert back to its closed position. The dust cup 38 also includes a ledge 56 against which the flapper 50 rests when air is not being drawn into the dust cup 38.

[0028] A fan assembly is provided in the housing 20 of the vacuum cleaner 10 to draw air through the suction path. As seen in FIGURE 3, the fan assembly includes a motor 60, a diffuser 62, an impeller 64, a fan top 66, and a fan cover 68. An output shaft 72 of the motor 60 is inserted through a central opening 74 of the diffuser 62 to be received in a central opening 76 of the impeller 64 to connect the motor to the impeller. The fan top 66 includes a central opening 78 that defines a portion of the suction path. The fan cover 68 includes a forwardly extending tubular projection 82 that bends (see FIGURE 6) and defines a passage 84 through the fan cover to further define the suction path.

[0029] As more clearly seen in FIGURE 6, the diffuser 62 includes a rearwardly extending bore 90 that is configured to receive the motor 60. The diffuser 62 is trapped between the upper housing half 26 and the lower housing half 28. The diffuser 62 includes radial vanes 94 (FIGURE 3) that define passages 96 that define a portion of the suction path to enable air drawn through the vacuum cleaner to bypass the motor 60. The design of the suction path also provides a means for cooling the motor and other electrical components in the vacuum cleaner.

[0030] In the embodiment shown, the fan cover 68 engages the diffuser 62 and is also trapped between the upper housing half 26 and the lower housing half 28. The fan top 66 is received in the fan cover 68 to cover the impeller 64. Due to the

contoured shape of the housing 20, the tubular extension 82 of the fan cover 68 is smoothly bent to direct air along the curved suction path through the vacuum cleaner. The fan cover 82 engages the front inlet 34 and is trapped between the upper housing half 26 and the lower housing half 28. Accordingly, the motor 60, the fan diffuser 62, the fan top 66, and the fan cover 68 are all fixed in the housing 20 between the upper housing half 26 and the lower housing half 28.

[0031] In the depicted embodiment, the motor 60 is electrically driven. A battery housing 100 is received in the housing 20 between the upper housing half 26 and the lower housing half 28. Electrical contacts 102 and 104 are disposed at opposite ends of the battery housing 100. A battery 106, which in the depicted embodiment is a rechargeable lithium battery, is received in the battery housing 100 to provide electrical power to the motor 60. The battery contacts 102 and 104 are electrically connected to a printed circuit board (PCB) assembly 108, which is electrically connected to vacuum cleaner charging contacts 112 and the electrical motor 60. The vacuum cleaner contacts 112 connect to a lower portion of the fan cover 68 and extend through a notch 114 formed at a forward edge of the lower housing half 28. A switch 116 (FIGURE 6) is found on the printed circuit board assembly 108 to control the delivery of electrical energy from the battery 106 to the motor 60.

[0032] A button cover 118 including an integrally formed axle 122 and a protuberance 124 covers an opening 126 formed through the lower housing half 28. The axle 122 is received by inwardly extending catches 128 formed on an inner surface of the lower housing half 28. The button cover 118 pivots about a rotational axis of the axle 122. A spring 132 engages against a lower surface of the battery housing 100 to urge the button cover 118 away from the switch 116. An indicator light 134 is connected to the PCB assembly 108. A fuse 136 is also in electrical communication with the PCB assembly 108. The fuse 136 protects the motor 60 from power surges.

[0033] With reference to FIGURE 21, air is drawn through the suction inlet 22 and out the exhaust 24. An operator grips the housing 20 (the housing being small enough so that a person's hand can surround or nearly surround the housing) and presses the button cover 118, which results in electrical power being delivered from

the battery 106 to the motor 60. This results in the impeller 64 turning drawing air through the suction inlet 22, which displaces the flapper 50 so that it no longer blocks the suction path. Air is drawn in to the dust cup 38 and through a filter assembly 140, which includes a filter frame 142 and a filter 144 (depicted in phantom in FIGURE 7) which will be described in more detail below. The air then passes through the passage 84 of the fan cover 68 and the opening 78 (FIGURE 3) of the fan top 66. As the impeller 64 rotates filtered air is pushed through the passages 96 between the vanes 94 of the diffuser 62 and around the motor 60 traveling through the housing 20 between the upper housing 26 and the lower housing 28 towards and the exhaust 24. As mentioned above, the vacuum cleaner 10 can also be used as a blower to remove dust between crevices and other hard to reach places.

[0034] With reference to FIGURE 7, the filter assembly 140 is shown with the filter 144 attached to the filter frame 142. The filter 144 can be made from cellulosic materials like paper, and polymeric materials like nylon, polypropylene and the like for a filter material form of discontinuous fibers or continuous woven fibers. The filter 144 can heat bonded or glued to the filter frame 142. The filter frame 142 includes a circular peripheral ledge 146 that extends outwardly from a cylindrical tubular section 148. With reference to FIGURE 6, the peripheral ledge 146 is trapped between an internal shoulder 152 formed in the dust cup 38 and the front inlet 34 when the dust cup 38 is attached to the front inlet. A notch 154 is formed in the peripheral ledge 146 and cooperates with the shoulder 152 formed in the dust cup 38 to properly align the filter assembly 140 in the vacuum cleaner 10. An upper circular flared edge 156 of an annular flange 158 that extends upwardly from the ledge 146 also engages the dust cup 38 (see FIGURE 6) to retain the filter assembly 140 in the vacuum cleaner. The tubular section 148 defines a passage 160 that also defines a portion of the suction path. An upper (downstream) edge 162 of the tubular section 146 is flared outwardly to engage the front inlet 34. A U-shaped strut 164 extends upwardly (downstream) from the upper flared edge 162 of the tubular section 148 and substantially bisects the suction path. The filter 144 attaches to an external surface of an upstream section, with respect to the ledge 148, of the tubular section

148. The filter 144 folds over an upstream circular edge of the tubular section 146 and extends into and through the passage 160. The filter attaches to the U-shaped strut 164. Alternatively, the filter 144 could be attached over the upper edge 162 of the tubular section 148 and draped over the U-shaped 164 with the filter being secured to both of them if so desired.

[0035] In this embodiment, the filter 144 is disposed downstream from the dust cup 38 and resides in the curved passage 84 of the fan cover 68. The filter assembly 140 is also removable from the vacuum cleaner 10. When the dust cup 38 is detached from the front inlet 34, the filter assembly 140 is removed with the dust cup. The filter assembly 140 can then be detached from the dust cup (so that the dust cup can be emptied) and cleaned as desired. Also, the filter assembly 140 can be sold as a separate unit from the vacuum cleaner 10 as a replacement part.

[0036] With reference back to FIGURE 3, a crevice tool 170 and a dusting brush assembly 172 can also be provided with the vacuum cleaner 10. With reference to FIGURE 6, the crevice tool 170 can be received inside the dusting brush assembly 172 and the dusting brush assembly can engage an upper flange 176 that depends downwardly from the upper housing half 26 and a lower flange 178 that extends upwardly from the lower housing half 28. Accordingly, the crevice tool 170 and the dusting brush assembly 172 can be stored adjacent the exhaust 24 of the vacuum cleaner. The crevice tool 170 and the dusting brush assembly 172 can be removed from the housing 20 and each can be inserted into the inlet 22.

[0037] With reference to FIGURES 8 and 9, the charging unit 12 includes a housing 200 that defines a receptacle 202 to receive the dust cup end of the vacuum cleaner 10. When the dust cup end of the vacuum cleaner 10 is received in the receptacle 202 (see FIGURES 1 and 2), the battery 106 can be recharged.

[0038] With reference back to FIGURE 3, in this embodiment, the charging unit housing 200 includes an upper housing half 210 that attaches to a lower housing half 212 via conventional fasteners 214. Charging base feet 216 cover the fasteners 214. A charging base inner housing 218 is trapped between the upper housing 210 and a lower housing 212 and defines the receptacle 202 (FIGURE 9).

[0039] Charging base contacts 218 are received in slots 222 defined between upwardly extending flanges 224 formed in the lower base unit housing 212. These contacts 218 are electrically connected to a charging base printed circuit board assembly 226 that attaches to the lower charging unit housing 212 using fasteners 228. A USB cable 232 connects to the PCB assembly 226 and extends outwardly from the housing 200 (FIGURE 9) through aligned notches 234 and 236 formed in the upper charging unit housing 210 and the lower charging unit housing 212, respectively. The USB cable 232 can be inserted into a USB port found on a computer to charge the battery 106. Alternatively, the USB cable 232 can be received in the USB port (not visible) found in the external power supply 14 so that the vacuum cleaner can be charged directly from a standard wall outlet.

[0040] A cordless hand-held rechargeable vacuum cleaner and a charging unit have been described with particularity. Modifications and alternations will occur to those upon reading and understanding the preceding detailed description. The invention is not limited to only those embodiments disclosed above. Instead, the invention is defined by the appended claims and the equivalents thereof.

What is claimed is:

1. A hand-held rechargeable cordless vacuum cleaner.
2. A charging unit for a hand-held rechargeable cordless vacuum cleaner, wherein the charging unit includes a USB cable.
3. A cordless vacuum cleaner that can be also used as a blower.

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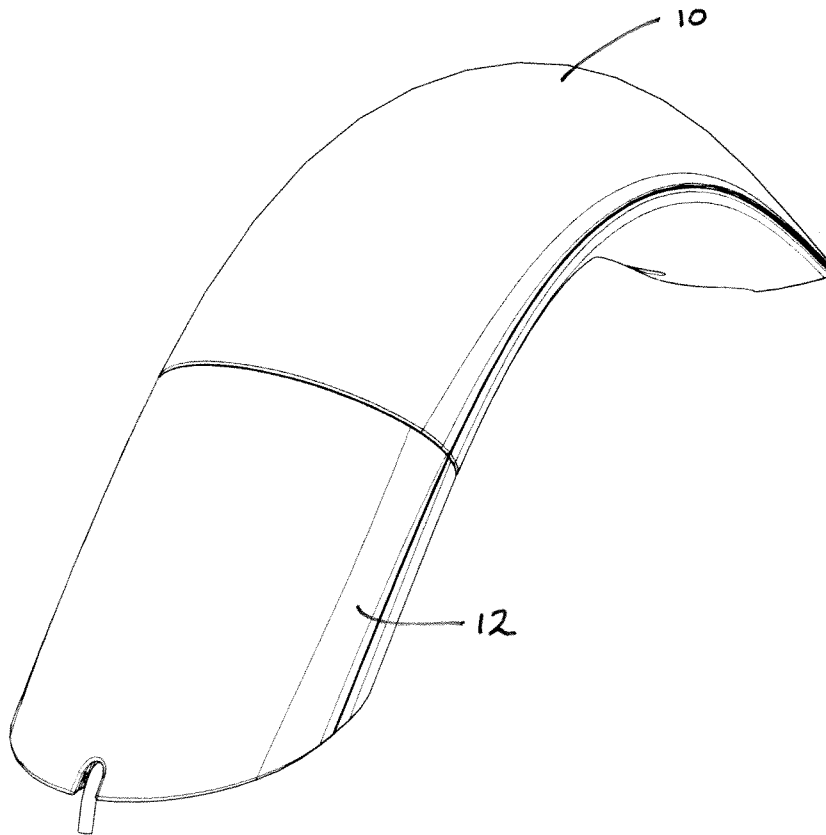


FIG. 1

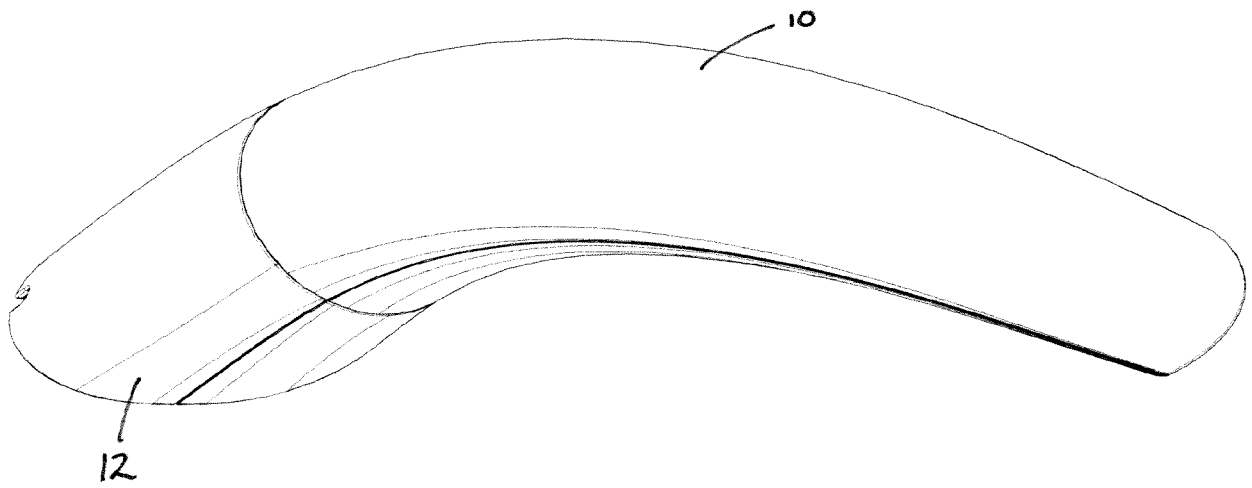


FIG. 2

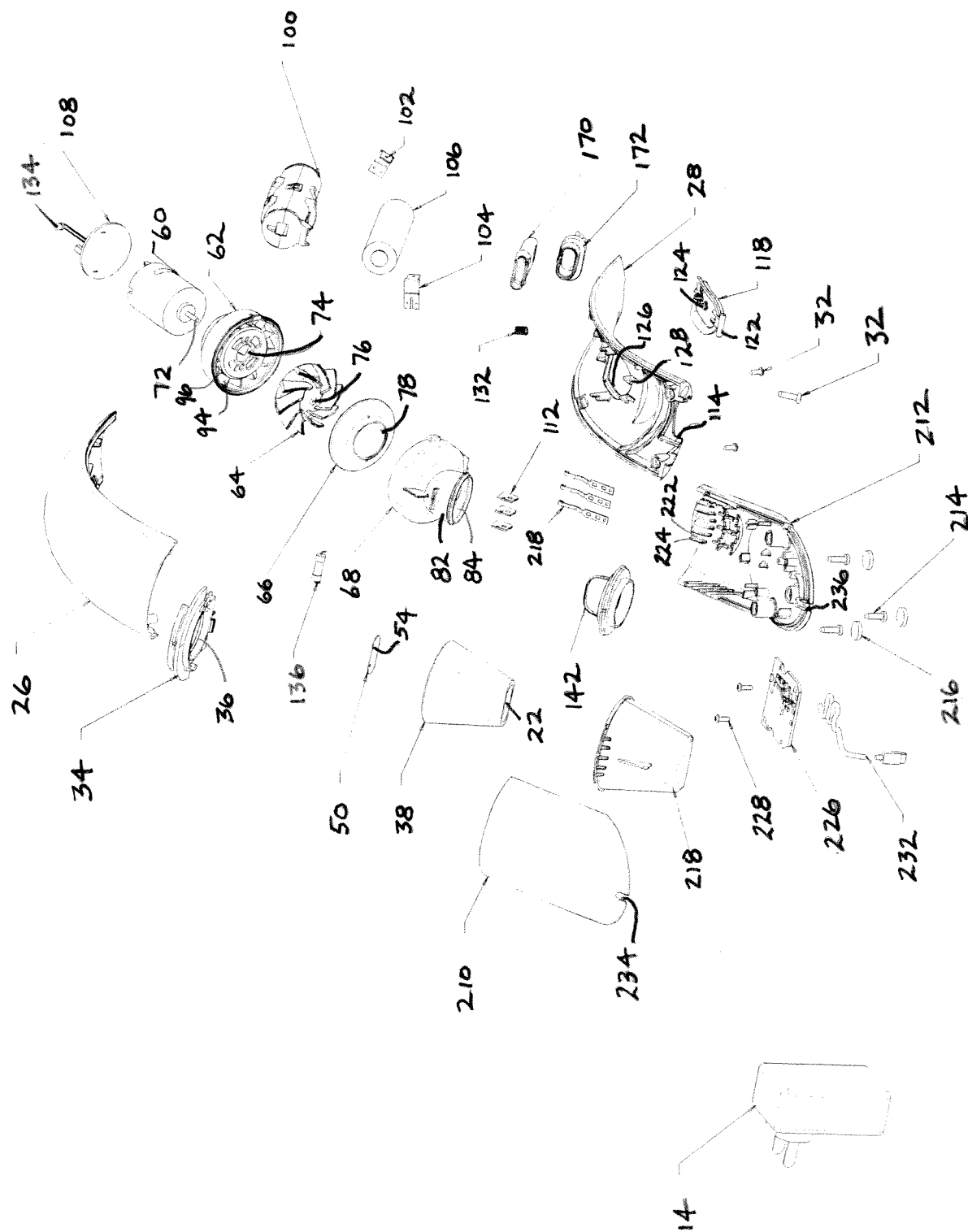


FIG. 3

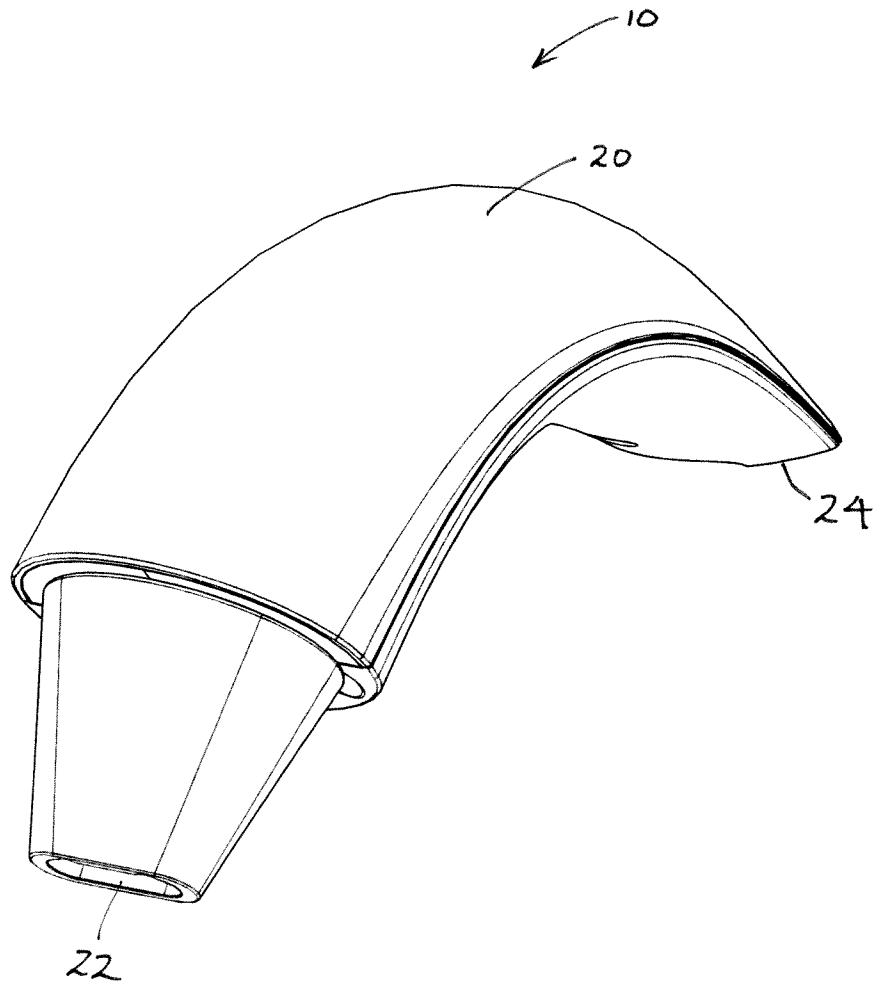


FIG. 4

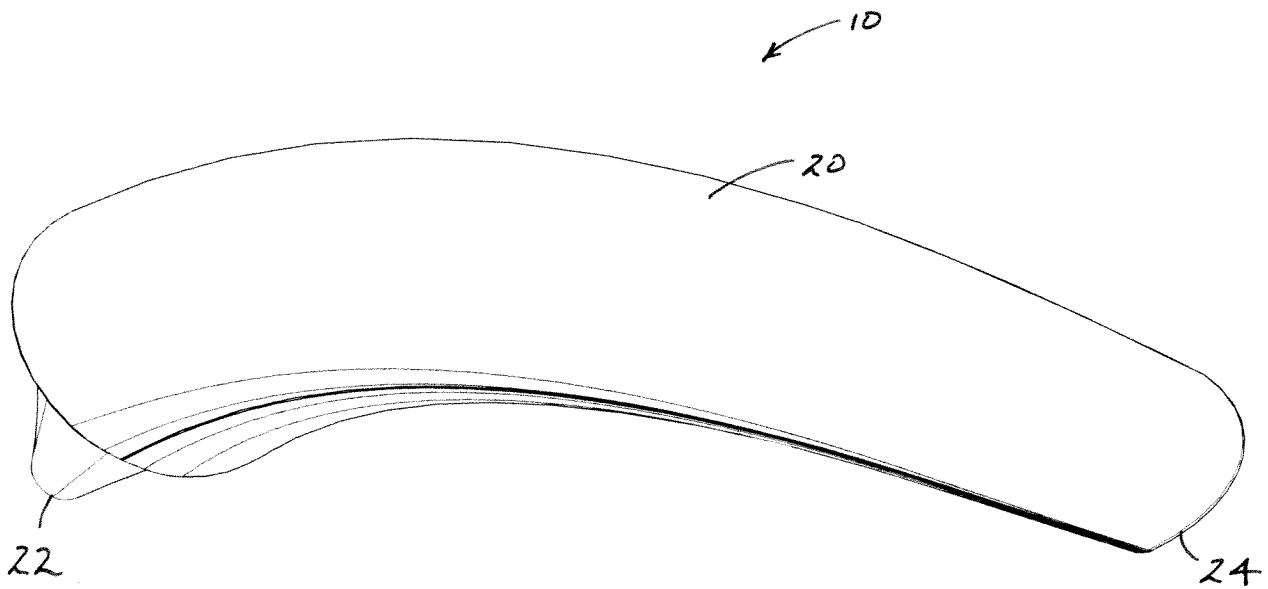


FIG. 5

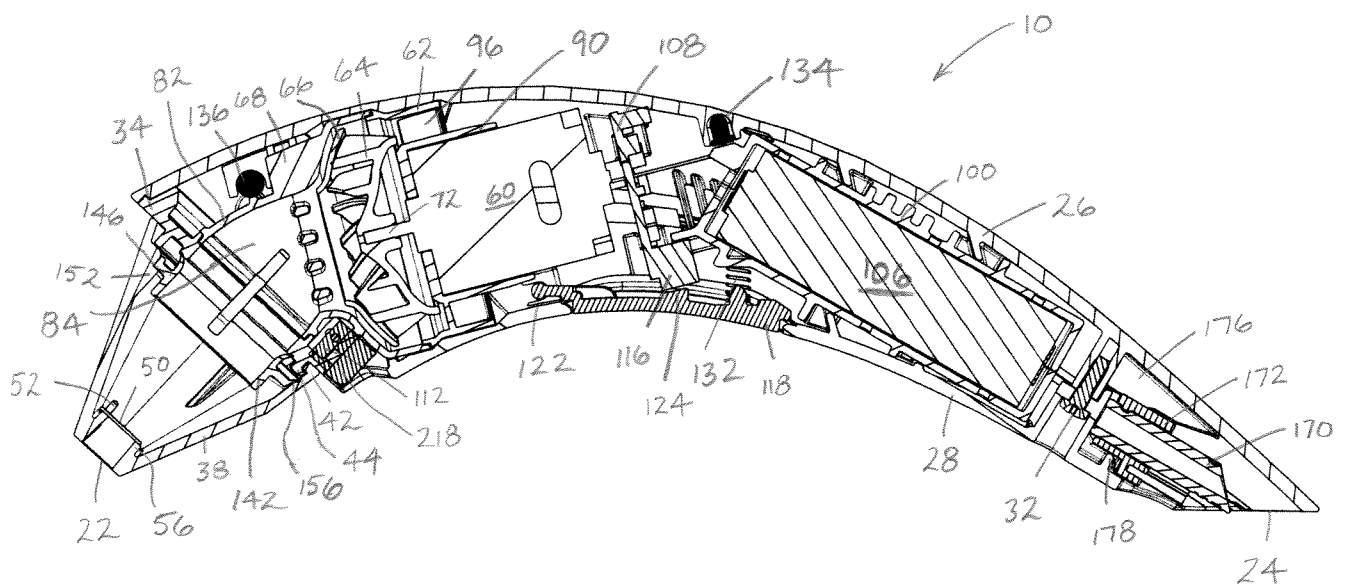


FIG. 6

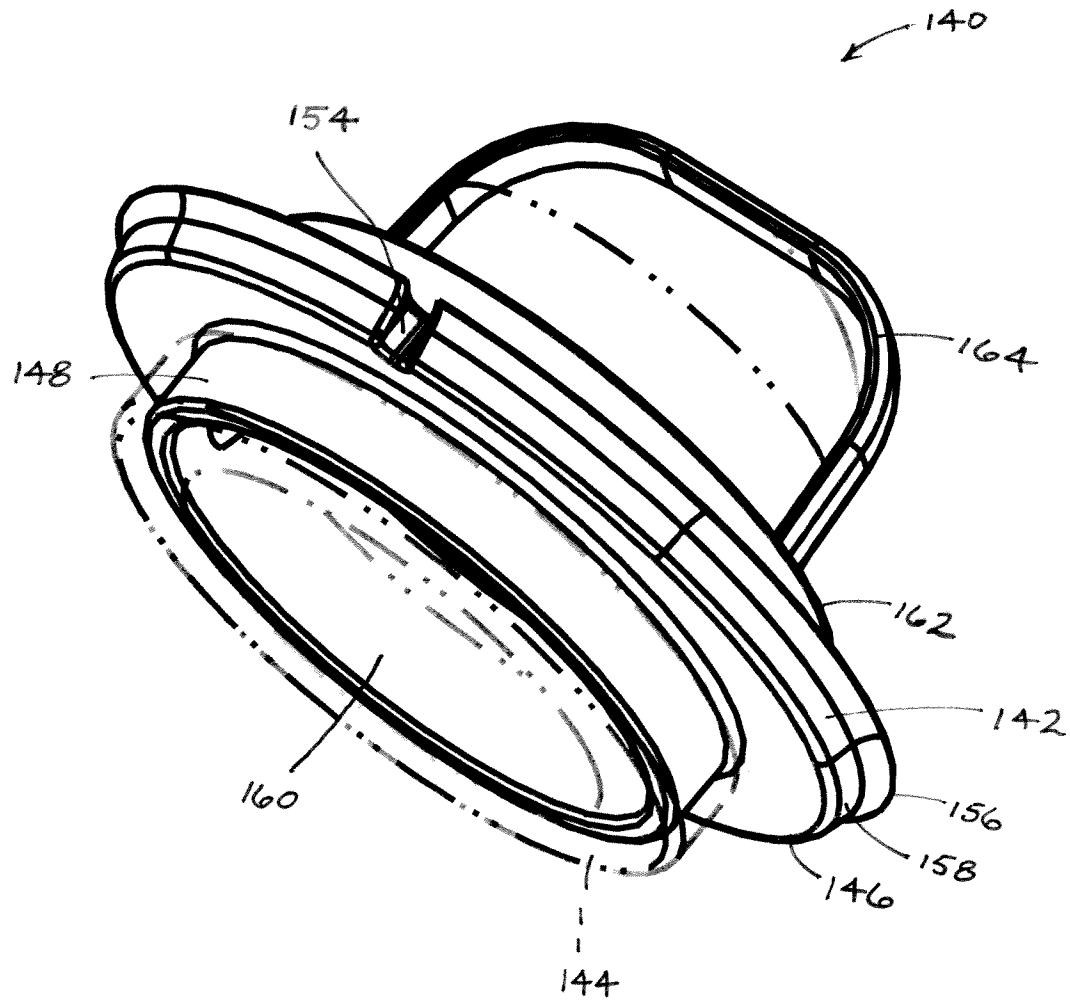


FIG. 7

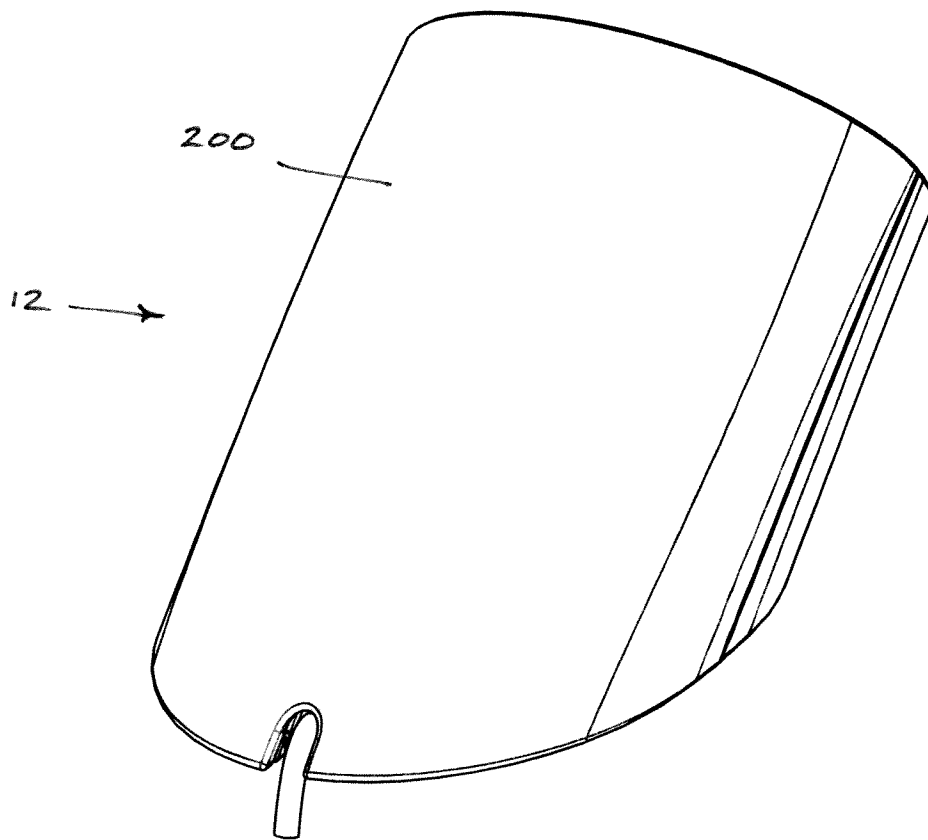


FIG. 8

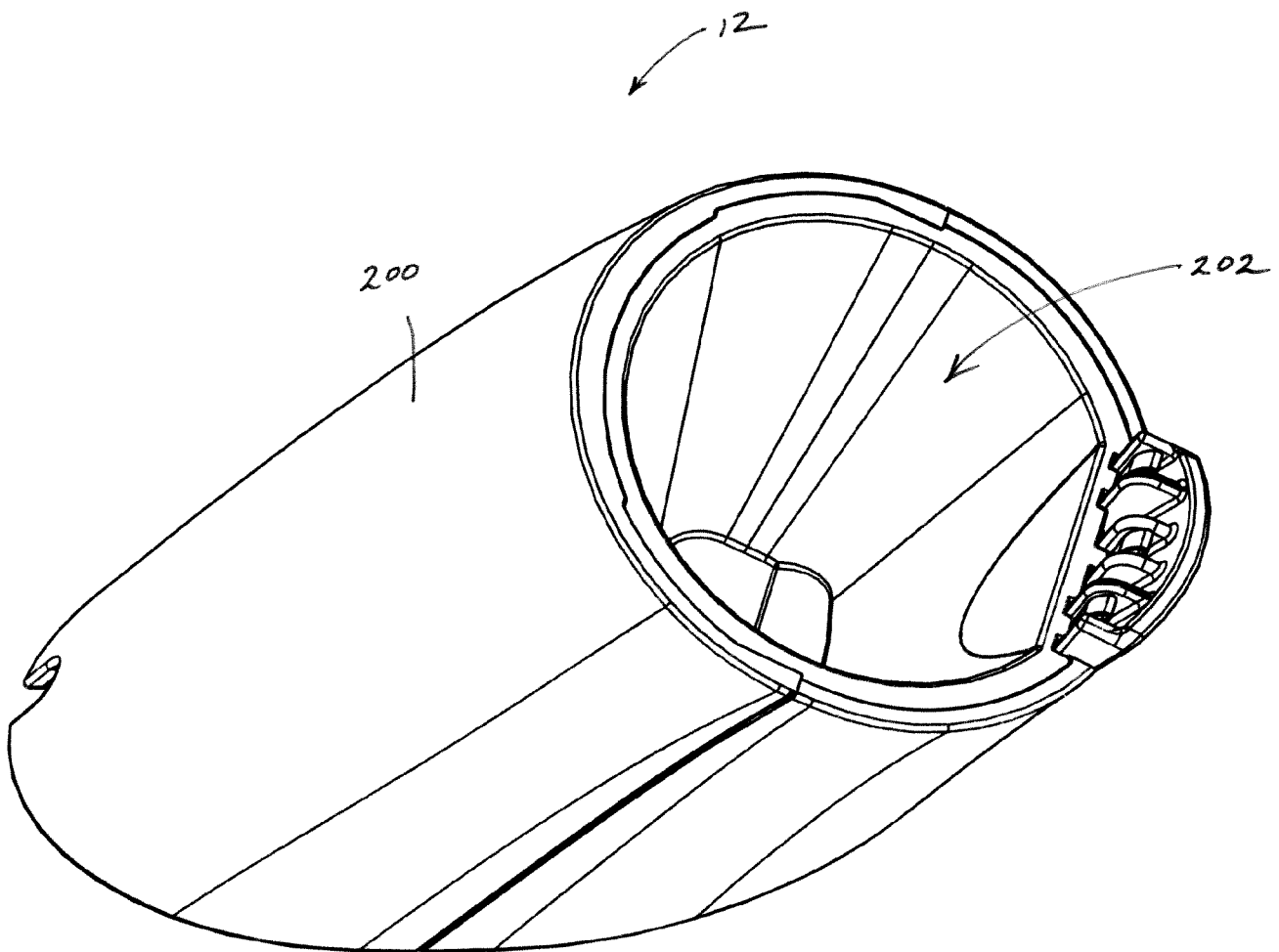


FIG. 9

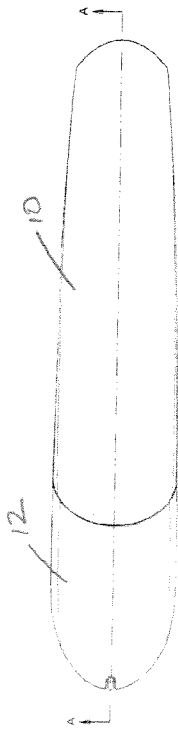


FIG. 10

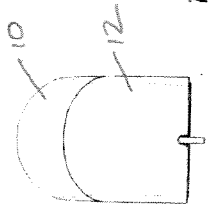


FIG. 11

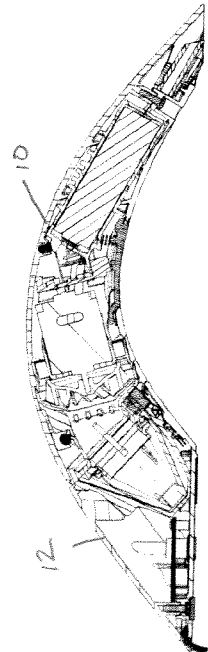


FIG. 12

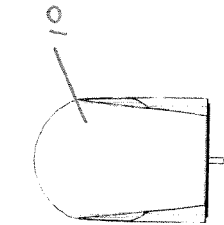


FIG. 13

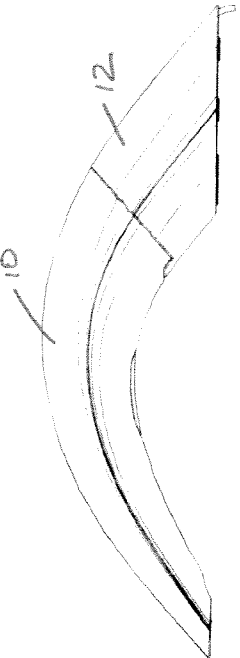


FIG. 14

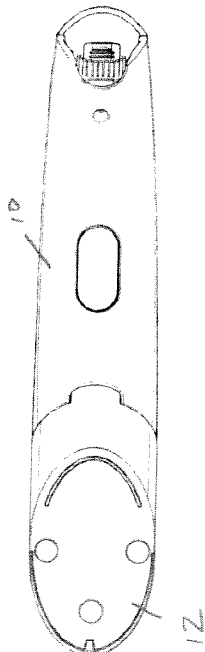


FIG. 15

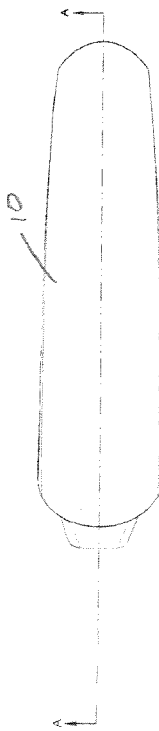


FIG. 16

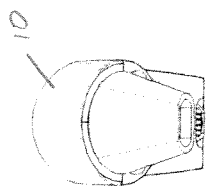


FIG. 17

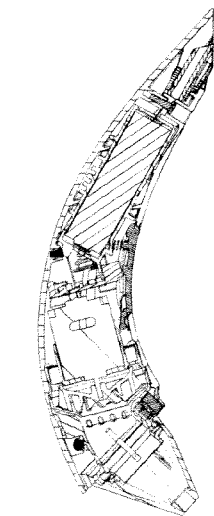


FIG. 18

Smaller version of FIG. 6



FIG. 19

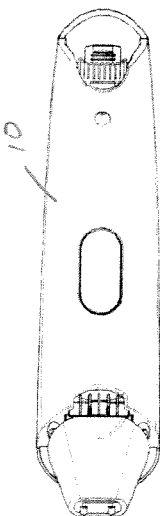
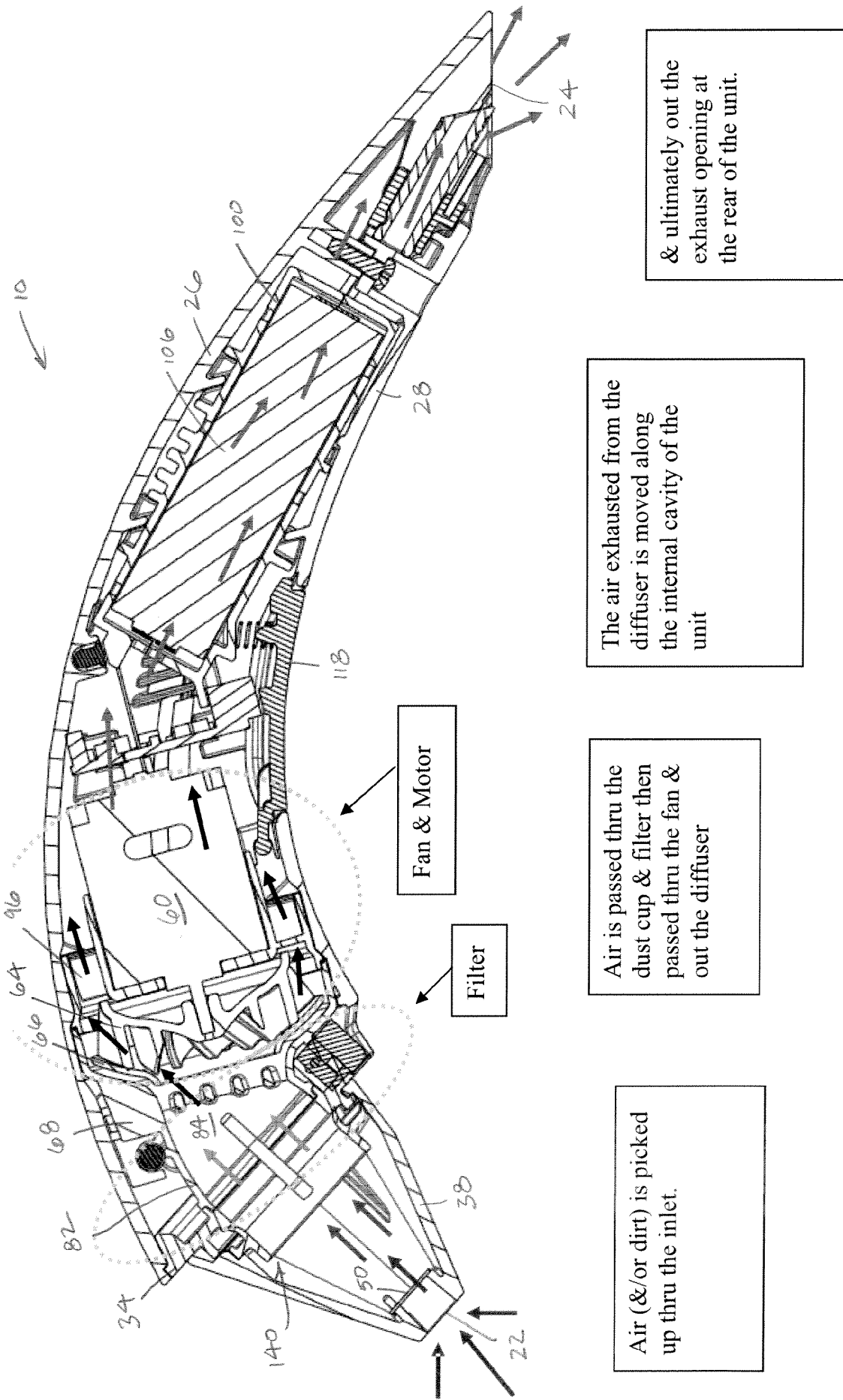


FIG. 20



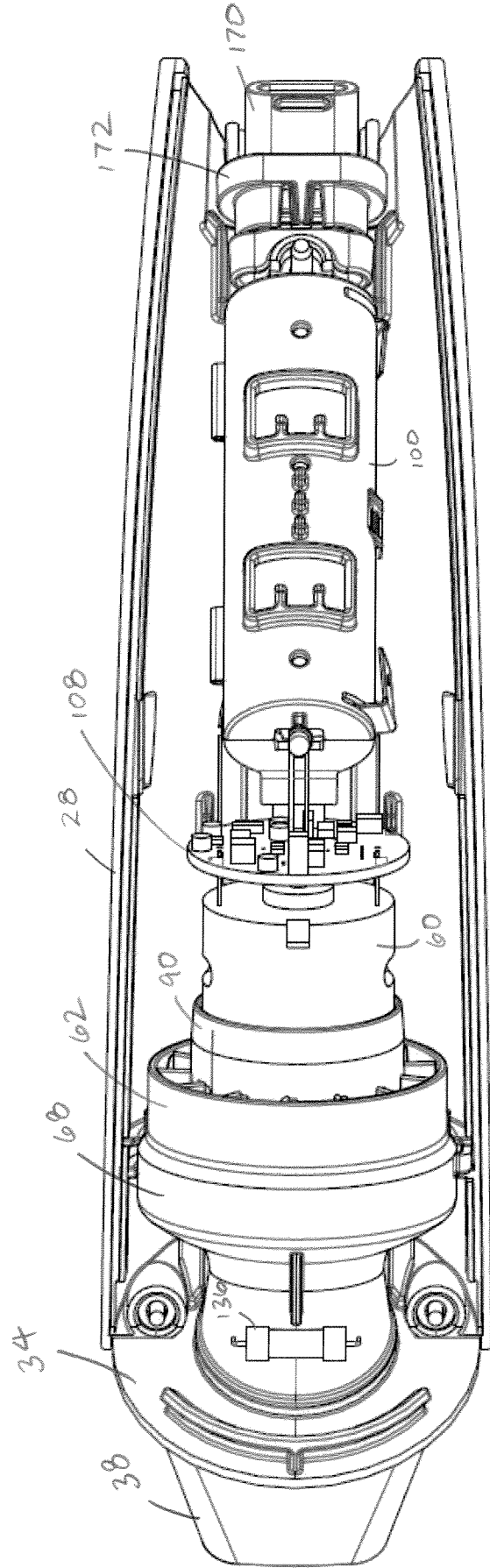


FIG. 22

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/037314

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - H02J 7/00 (2009.01) USPC - 320/115 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) - H02J 7/00; H01M 10/46 (2009.01) USPC - 15/300.1; 320/111, 114, 115 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 4,670,701 A (SAKO et al) 02 June 1987 (02.06.1987) entire document	1 ----- 2
X	US 4,644,606 A (LUERKEN et al) 24 February 1987 (24.02.1987) entire document	3
Y	US 6,614,206 B1 (WONG et al) 02 September 2003 (02.09.2003) entire document	2
A	US 4,225,814 A (GANTZ et al) 30 September 1980 (30.09.1980) entire document	1-3
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Date of the actual completion of the international search 01 May 2009		Date of mailing of the international search report 08 MAY 2009
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