(12) UK Patent Application (19) GB (11) 2 454 292 (13) A

(43) Date of A Publication 06.05.2009

(21) Application No: 0815002.1

(22) Date of Filing: 15.08.2008

(30) Priority Data:
(31) 61001887 (32) 05.11.2007 (33) US
(31) 200813556 (32) 14.02.2008 (33) KR

(71) Applicant(s):
Samsung Gwangju Electronics Co., Ltd.
(Incorporated in the Republic of Korea)
271 Oseon-dong, Gwangsan-gu,
Gwangju-city, Republic of Korea

(72) Inventor(s):
Jang-keun Oh
Min-ha Kim

(74) Agent and/or Address for Service:
Withers & Rogers LLP
Goldings House, 2 Hays Lane, LONDON,
SE1 2HW, United Kingdom

(51) INT CL:
A47L 9/16 (2006.01) ***B04C 5/185*** (2006.01)

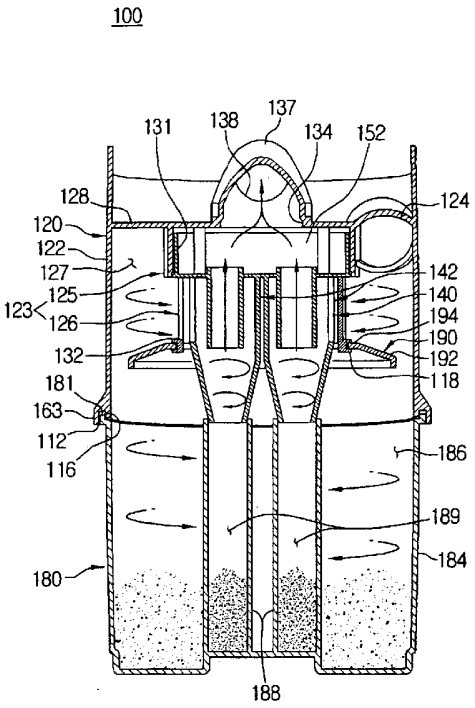
(56) Documents Cited:
GB 2445211 A **GB 2440125 A**
GB 2426474 A **EP 0728435 A1**
WO 2006/026414 A1

(58) Field of Search:
INT CL **A47L, B04C**
Other: **ONLINE: WPI, EPODOC.**

(54) Abstract Title: **Cyclonic dust-separating apparatus with detachable dust collection receptacle**

(57) A multi-cyclonic dust-separating apparatus 100 includes a first cyclone unit 120 having a chamber 127, defined by a first tub 122 and a cylindrical element 123 therein, which is supplied by a first air inlet 124. Air is whirled in the first cyclone unit from the first air inlet to separate dust there from and then passes through a first inlet (133, Fig.3) to a second cyclone unit 140 that includes a plurality of cyclones 142, each having a second air inlet (154, Fig.4) for drawing in dust-carrying air from the first cyclone chamber, to provide a second dust separation. A dust receptacle 180 includes a first dust-collecting chamber 186 for collecting the dust separated by the first cyclone unit 120, and a plurality of second dust-collecting chambers 189 for collecting the dust separated by the second cyclone unit 140. The dust receptacle 180 is detachably connected to the unit that houses the cyclones via complementary groove 112 and insertion part 181 formed in the connecting parts.

FIG. 2



GB 2 454 292 A

FIG. 1

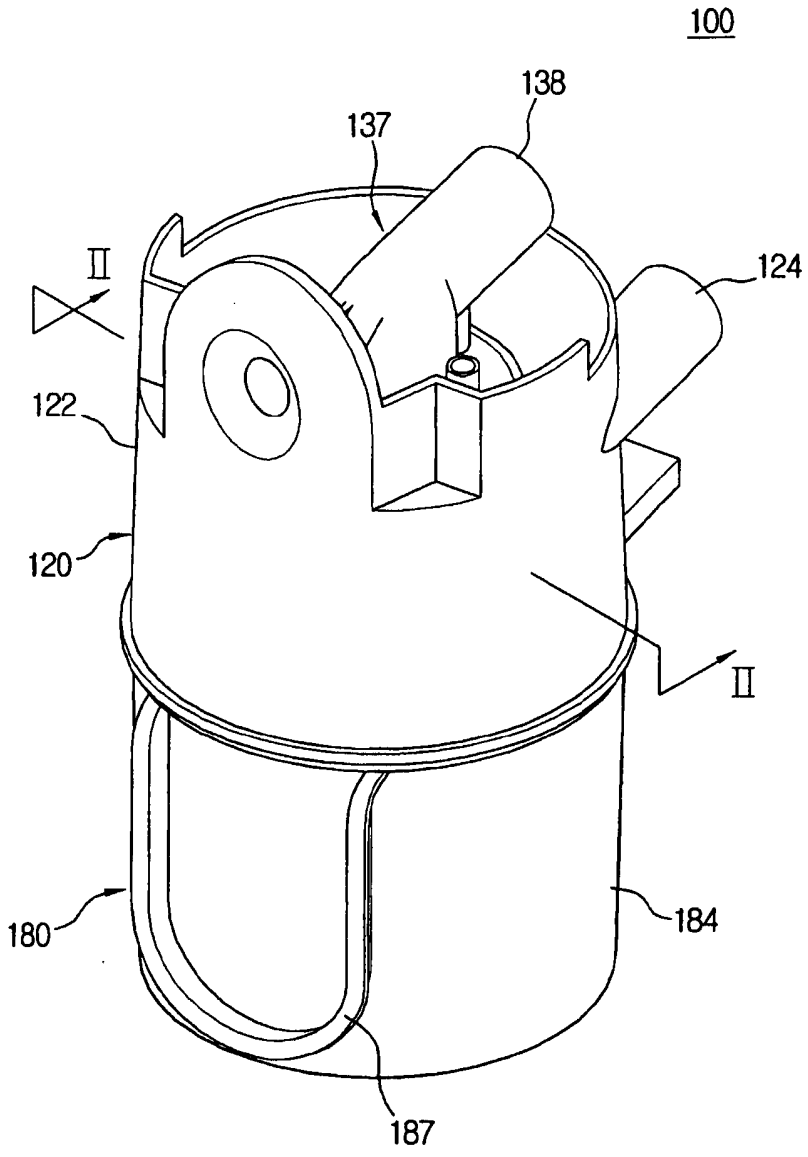


FIG. 2

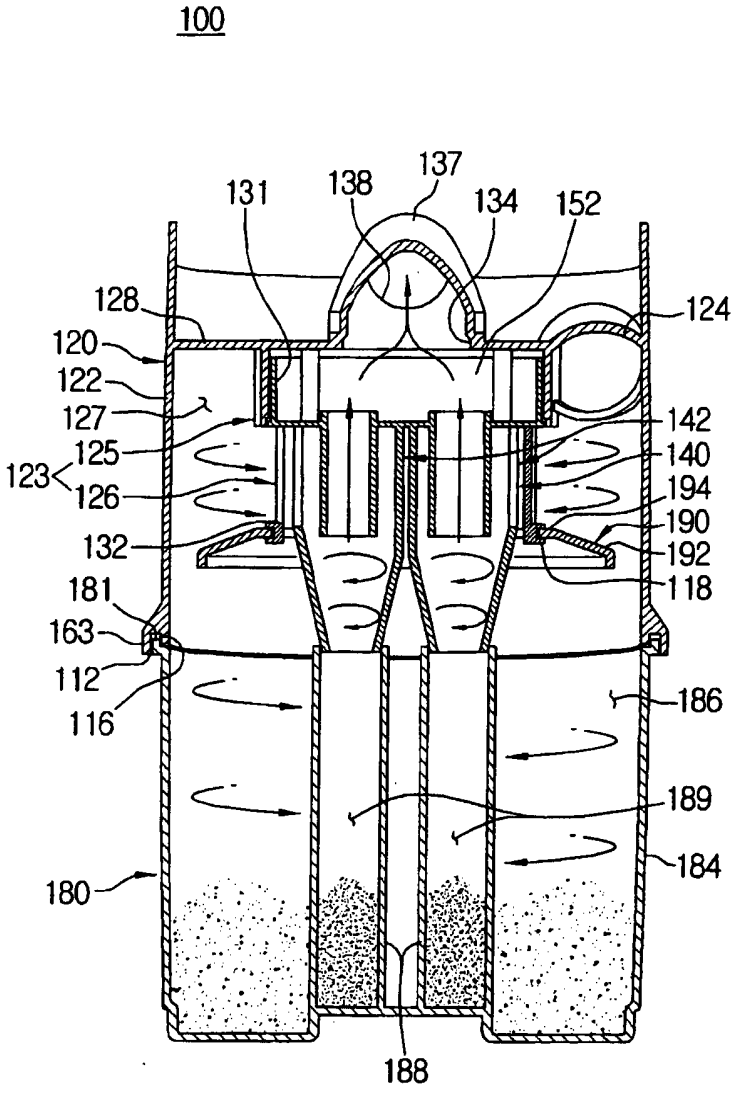

100
131
138
137
134
152
128
124
120
122
127
142
125
140
123
126
194
190
132
192
118
181
163
112
116
186
189
184
180
188

FIG. 3

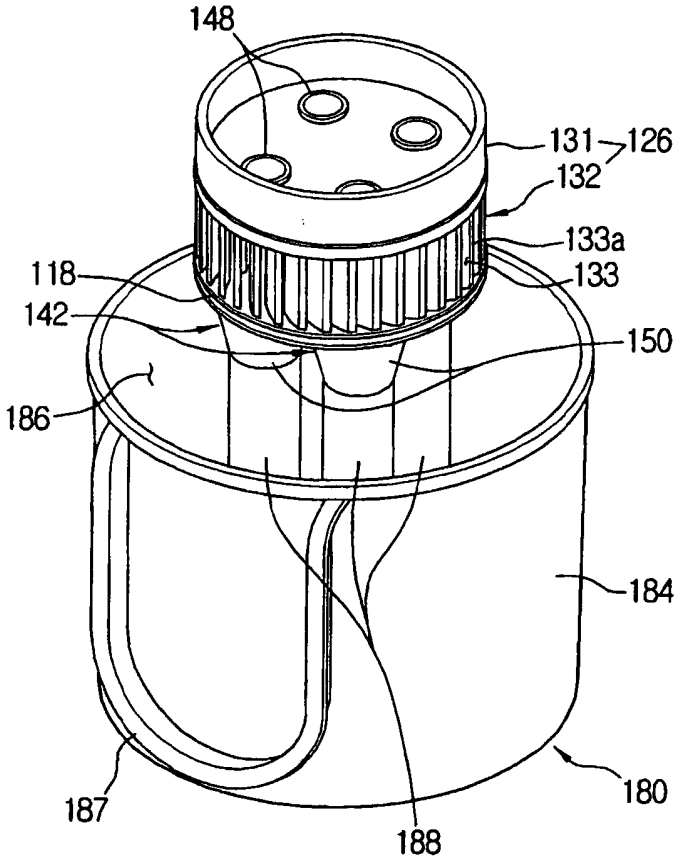


FIG. 4

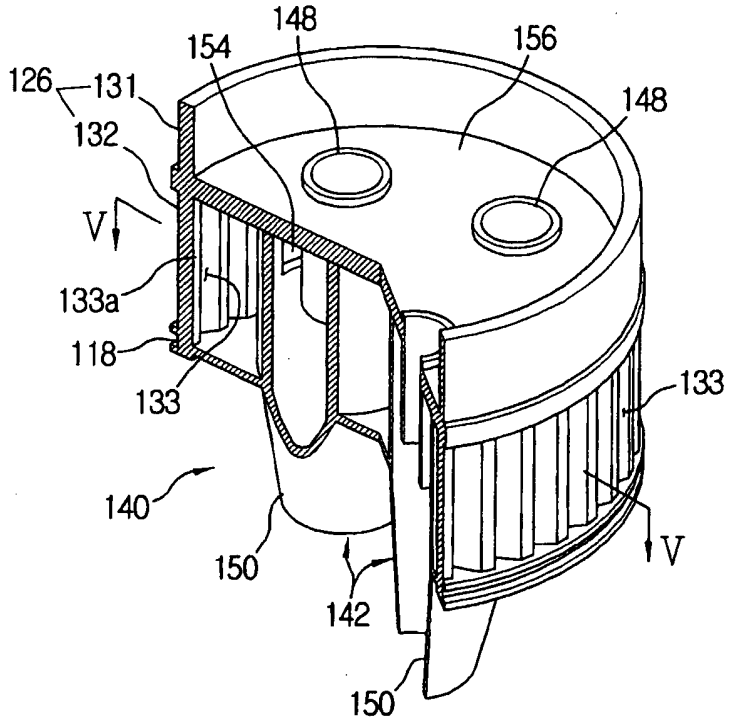

148
154
156
126
131
148
132
V
133a
118
133
133
140
V
150
142
150

FIG. 5

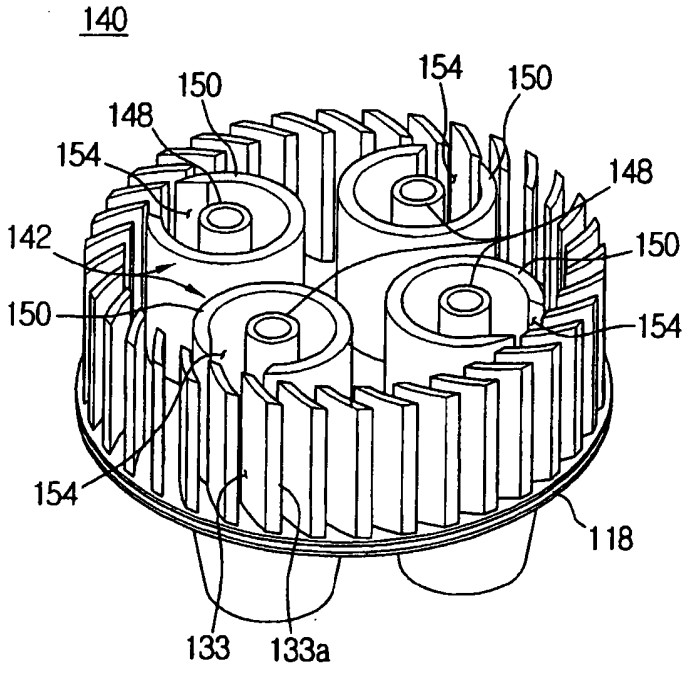

140
150
154
150
148
154
148
142
150
150
154
154
118
133
133a

FIG. 6

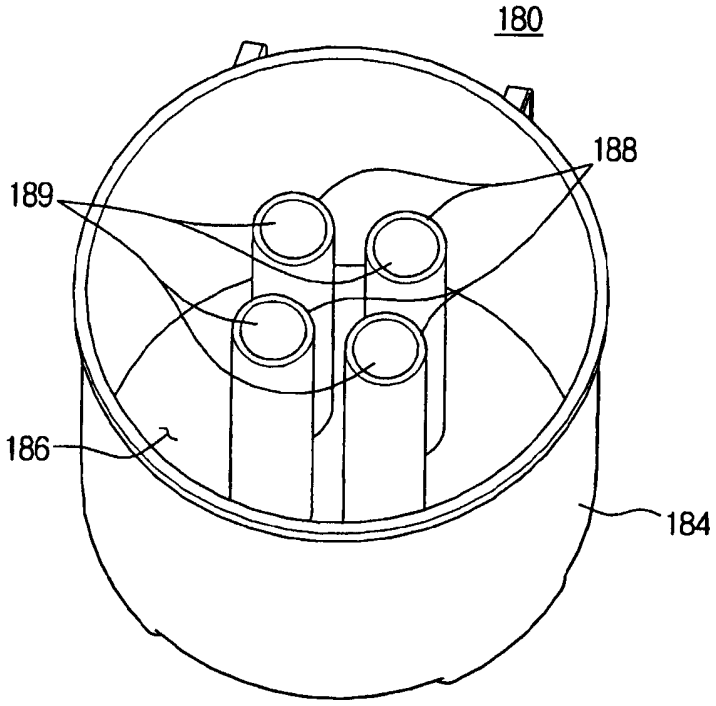


FIG. 7

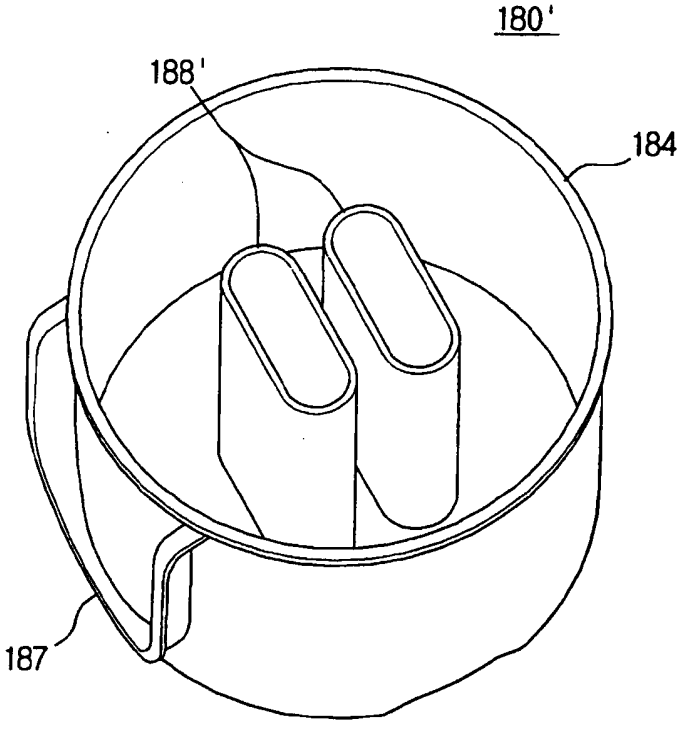


FIG. 8

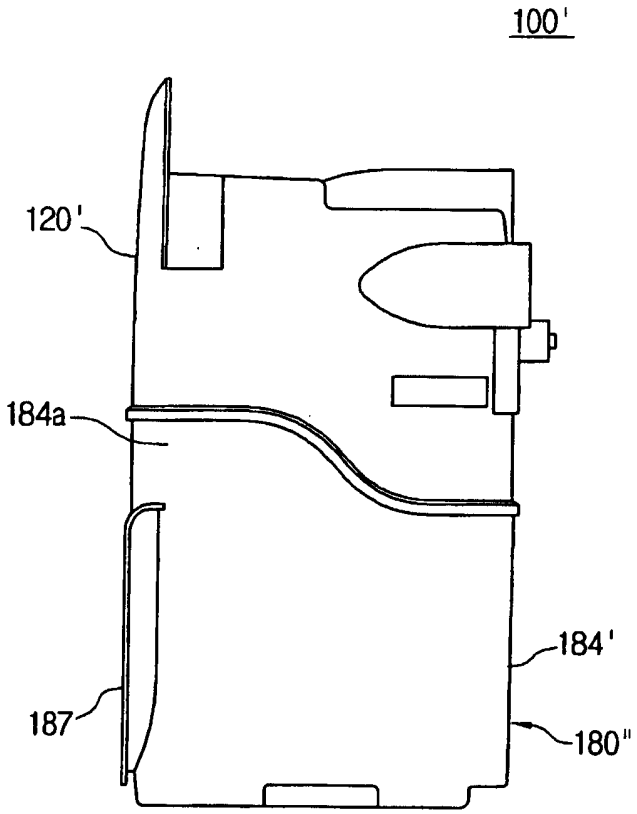
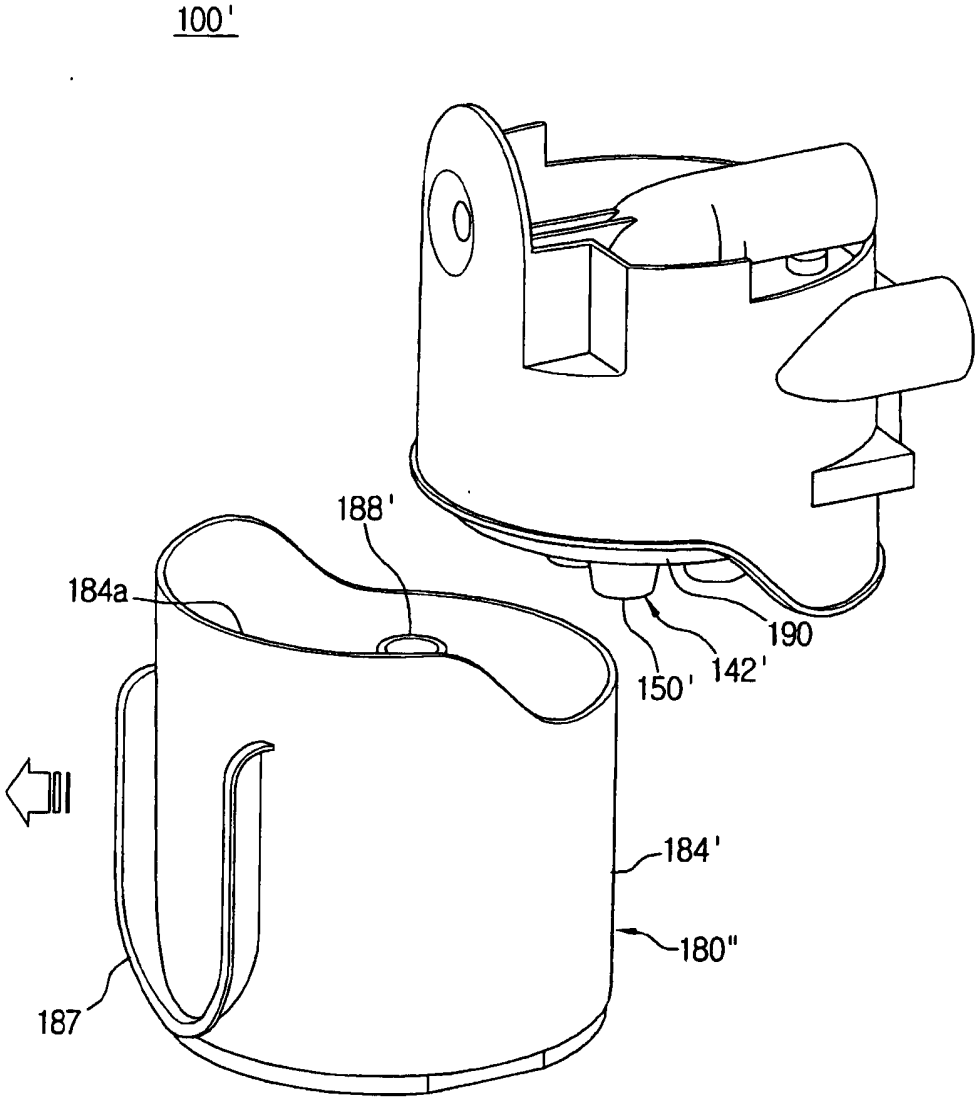


FIG. 9



Dust-Separating Apparatus

This invention relates to a dust-separating apparatus, and in particular to a multi-cyclonic dust-separating apparatus of a vacuum cleaner.

In general, a dust-separating apparatus of a vacuum cleaner can use either a filter or a cyclonic apparatus, which separates dust from incoming air by centrifugal force. The term "dust" is used herein to refer collectively to dust, dirt, particulates, debris, and other similar matter that can be entrained with the air suctioned in by a vacuum cleaner. A cyclonic dust-separating apparatus can be either a single cyclone apparatus, which separates the dust by using a single cyclone, or a multi-cyclonic apparatus, which separates the dust in two or more steps, by using more than one cyclone.

Conventional cyclonic dust-separating apparatuses are disclosed in EP 1688184 and GB 2362341, and in International Patent Publication No. WO 02/067750. The cyclonic dust-separating apparatus disclosed in EP 1688184 includes a first cyclone and a plurality of second cyclones disposed adjacent to an outer circumferential surface of the first cyclone. This dust-separating apparatus has a reduced height, but a relatively larger outer diameter, due to the cyclones being disposed adjacent to the outer circumferential surface of the first cyclone.

The cyclonic dust-separating apparatus disclosed in GB 2362341 has a second cyclone that is disposed within a first cyclone, and has a reduced outer diameter. However, because the air to the second cyclone is drawn in through a single air inlet, the whirling force in the second cyclone is weakened. In addition, in order to dump collected dust, a user has to move the entire dust-separating apparatus to a trash can. Also, because the first and the second cyclones are neither separated nor subdivided into respective components, cleaning the inner parts of this dust-separating apparatus, maintaining the apparatus, and repairing the apparatus is difficult.

The cyclonic dust-separating apparatus disclosed in International Patent Publication No. WO 02/067750 has a height that prevents it from being used in a canister vacuum

cleaner. In addition, to dump the collected dust, the user has to move the entire cleaner to a trash can.

An aim of the present invention is to provide a multi-cyclonic dust-separating apparatus that is capable of easily dumping dust collected therein, while being compact with a small outer diameter. Another aim is to provide a multi-cyclonic dust-separating apparatus having an improved separating efficiency for fine dust particles in a second cyclone unit, while being compact. Yet another aim is to provide a multi-cyclonic dust-separating apparatus that facilitates cleaning, maintenance, and repair of its components.

The present invention provides a multi-cyclonic dust-separating apparatus comprising: a first cyclone unit having a first tub provided with a first air inlet, and a cylindrical element provided with a first air outlet, the first cyclone unit being arranged to whirl air from the first air inlet to separate dust therefrom to effect a first separation of dust, the cylindrical element being disposed in the first tub to form a first cyclone chamber, with the first outer tub, which defines a space for whirling the air; a second cyclone unit having a plurality of cyclones, each of which has a second air inlet for drawing in the air from the first cyclone chamber, to effect a second separation of dust from the air; and a dust receptacle having a first dust-collecting chamber for collecting the dust separated by the first cyclone unit, and a plurality of second dust-collecting chambers for collecting the dust separated by the second cyclone unit, wherein the second cyclone unit is disposed in the cylindrical element of the first cyclone unit, and the second dust-collecting chambers are separately formed, and connected to, respective cyclones of the second cyclone unit.

Preferably, the first cyclone unit and the second cyclone unit are substantially concentric.

The first air outlet of the cylindrical element of the first cyclone unit may be disposed to face the second air inlets of the cyclones of the second cyclone unit.

The first cyclone unit may further comprise a grille disposed in the first air outlet of

the cylindrical element, for restraining the air from which the dust is separated in the first cyclone chamber from being drawn directly into the second air inlets of the cyclones of the second cyclone unit.

The first cyclone unit may further comprise a skirt disposed below the first air outlet of the cylindrical element thereof. Preferably, the skirt is made of a resilient material, so that it can be curved or bent by an external force.

The second cyclone unit may further comprise an air-stagnating space formed above its cyclones, so that the air discharged from said cyclones is mixed. With the air-stagnating space, separating efficiency for fine dust particles can be improved, and any swirling which is generated at places where respective discharge passages meet, can be reduced.

The dust receptacle may comprise a second tub forming the first dust-collecting chamber, and a plurality of cylindrical members disposed in the second tub to form the second dust-collecting chambers. In this case, the second tub may be formed so that at least a portion of its top end is located at the same height as, or below, the skirt. The cylindrical members may comprise more than two cylindrical members, each of which detachably coupled to a lower part of a respective cyclone of the second cyclone unit.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a first form of multi-cyclonic dust-separating apparatus constructed according to the present invention;

Figure 2 is a cross-section taken on the line II-II of FIG. 1;

Figure 3 is a partial perspective view of the multi-cyclonic dust-separating apparatus of Figure 1, from which a first outer tub of a first cyclone unit is omitted;

Figure 4 is a partial cut-away perspective view showing only a second cyclone unit of

the apparatus of Figure 1;

Figure 5 is a partial cut-away perspective view of the second cyclone unit taken on the line V-V of Figure 4;

Figure 6 is a perspective view of a dust receptacle of the apparatus of Figure 1;

Figure 7 is a perspective view of a modified form of the dust receptacle of Figure 1;

Figure 8 is a perspective view of a second form of multi-cyclonic dust-separating apparatus constructed according to the invention; and

Figure 9 is an exploded perspective view of the apparatus of Figure 8.

In the figures, it should be understood that like reference numerals refer to like features.

Referring to the drawings, Figures 1 and 2 show a multi-cyclonic dust-separating apparatus having a first cyclone unit 120, a second cyclone unit 140 and a dust receptacle 180.

The first cyclone unit 120 provides a first separation of dust from incoming dust-carrying air, and includes a first tub 122 and a cylindrical element 123. The first tub 122 is cylindrical with a constant diameter. However, the first tub 122 could have a varying diameter. An extension 163 extends radially outwards from a lower end of the first tub 122. The extension 163 defines a first groove 112. An O-ring 116 is mounted in the first groove 112. An insertion part 181 is formed on an upper end of a second tub 184 of the dust receptacle 180. The insertion part 181 is received in the first groove 112, so that the first tub 122 and the second tub 184 of the dust receptacle 180 are coupled to each other. The O-ring 116 seals the adjacent portions of the first and the second tubs 122 and 184.

The first tub 122 has a first substantially circular air inlet 124 at one side thereof. The first air inlet 124 is tangential to the one side of the first tub 122, so that air drawn into

a first cyclone chamber 127 can flow along the inner wall of the first tub 122 to form a whirling air current.

The cylindrical element 123 is disposed below the centre of a top wall 128 of the first tub 122. The cylindrical element 123 forms the first cyclone chamber 127 along with the first tub 122. The first cyclone chamber 127 is a space in which air drawn in through the first air inlet 124 whirls. While the drawn-in air whirls in the first cyclone chamber 127, dust is separated from the air by centrifugal force, and then falls downwards under gravity into a first dust-collecting chamber 186 of the second tub 184 of the dust receptacle 180.

The cylindrical element 123 includes a first part 125 and a second part 126. The first part 125 is integrally formed with, and under, the top wall 128 of the first tub 122, and the upper part of the second part 126 is inserted and coupled into the first part.

As illustrated in Figures 3 and 4, the second part 126 includes an upper portion 131 inserted into the first part 125, and a lower portion 132 having a first air inlet 133. A grille 133a is installed in the first air inlet 133, so that the air from which the dust is separated in the first cyclone chamber 127 can be restrained from being directly drawn into second air inlets 154 of cyclones 142, which will be described below.

As illustrated in Figure 2, a skirt 190 is disposed just below the first air outlet 133 in which the grille 133a is installed. The skirt 190 has a connection part 194 inserted into a second groove 118 formed on a lower circumferential surface of the second part 126, and a diagonally-inclined part 192.

The skirt 190 is made of a resilient material, preferably rubber. Because the skirt 190 is downwardly inclined, it can be deformed by a downwardly-pushing force, but is not substantially deformed by an upwardly-pushing force. Thus, large contaminant particles, such as coins, caps or the like, can be collected in the dust receptacle 180 by deflecting the skirt 190 downwards, but the skirt effectively prevents dust from flowing backwards away from the dust receptacle 180. After being deflected, the skirt 190 resiliently returns to its original configuration.

Referring to Figures 2, 4 and 5, the second cyclone unit 140 is substantially concentric with the first cyclone unit 120 within the cylindrical element 123 installed in the centre of the first cyclone chamber 127. The second cyclone unit 140 provides secondary separation of dust from the incoming air, and thus improves dust-separating efficiency. The second cyclone unit 140 includes a plurality of cyclones 142, and an air-stagnating space 152.

The second cyclone unit 140 has four equispaced, parallel cyclones 142. The four cyclones 142 of the second cyclone unit 40 are of similar size and height. The number of cyclones 142 illustrated is exemplary, and is not intended to be limiting. The optimal number of cyclones 142 may be less or more than the four cyclones 142 depicted in Figure 5. Because the second cyclone unit 140 can be inserted into, and disposed within, the cylindrical element 123 of the first cyclone unit 120 to separate the dust in multi-stages, the multi-cyclonic dust-separating apparatus 100 has an improved dust-separating efficiency, but does not have an increased volume, thereby maintaining a compact size.

Each of the cyclones 142 includes a cyclone body 150, a second air inlet 154, and a discharge pipe 148. Each cyclone body 150 has an upper substantially cylindrical part disposed within the lower portion 132 of the second part 123, and a lower frustoconical part projecting downwards from the upper portion. As illustrated in Figure 5, each second air inlet 154 is rectangular and penetrates a portion of the upper part of the cyclone body 150. Four second air inlets 154 are provided, each being formed in a respective cyclone body 150, and being arranged in intervals of 90°. The second air inlets 154 are also arranged to face the grille 133a of the first air outlet 133.

Each discharge pipe 148 is a cylindrical pipe to act as a second air outlet of the respective cyclone 142, and has one end disposed to penetrate an upper wall 156 of the lower portion 132, and another end disposed to penetrate the inside of the respective cyclone body 150. A lower end of each discharge pipe 148 extends to where the shape of the respective cyclone body 150 changes. In particular, each discharge pipe 148 extends to where the cylindrical shape and the frustoconical shape

of the respective cyclone body 150 merge.

Referring again to Figure 2, the air-stagnating space 152 is disposed above the cyclones 142 to provide a space where air discharged from the cyclones can be mixed. The air-stagnating space 152 is defined by the upper portion 131 of the second part 126, and has an outer diameter less than the first part 125. The top part of the upper portion 131 of the second part 126, in which the air-stagnating space 152 is formed, fluidly communicates with a discharge guide 137 through an opening 134 formed in the top wall 128 of the first tub 122. The discharge guide 137 is a semi-cylindrical member in fluid communication with the opening 134, and has a third air outlet 138 to lead the air discharged through the opening 134 from the air-stagnating space 152 to the outside of the multi-cyclonic dust-separating apparatus 100. Accordingly, the air discharged from the cyclones 142 is mixed in the air-stagnating space 152, is moved to the discharge guide 137 through the opening 134, and is discharged to the outside of the apparatus 100 through the third air outlet 138. Because the air has time to stagnate in the large volume of the air-stagnating space 152, the whirling motion of the air decreases, which reduces the noise caused by the whirling motion.

Referring to Figures 2 and 6, the dust receptacle 180 includes the second tub 184 and a plurality of cylindrical members 188. The second tub 184 is a cylindrical member, and includes the insertion part 181 (see Figure 2) with a slightly enlarged outer diameter. The insertion part 181 is inserted into the first groove 112 of the extension part 163 of the first cyclone unit 120, as described above. A handle 187 (see Figures 1 and 3) is provided on an outer circumferential surface of the second tub 184, so that a user can grip the dust receptacle 180 and separate it from the first cyclone unit 120 and from the second cyclone unit 140. The handle 187 has a substantially U-shaped form.

There are four cylindrical members 188 formed opposite to the cyclone bodies 150 of the cyclones 142 within the second tub 184. The top ends of the cylindrical members 188 accommodate the lower parts of the cyclone bodies 150, for fluid communication with the lower parts of the cyclone bodies. The space between the second tub 184 and the cylindrical members 188 forms a first dust-collecting chamber 186, in which the

dust separated in the first cyclone chamber 127 is stored. The spaces formed in the cylindrical members 188 form four second dust-collecting chambers 189 in which fine dust particles separated by the cyclones 142 are stored.

Alternatively, as illustrated in Figure 7, a dust receptacle 180' includes two cylindrical member 188', each of which is disposed to accommodate the lower part of a respective cyclone body 150 of two of the four cyclones 142.

Accordingly, the user can separate the dust receptacle 180 or 180' from the first cyclone unit 120 and from the second cyclone unit 140, and can carry only the dust receptacle using the handle 187 provided on the second tub 184. Thus, the user can more conveniently dump dust, without having to carry the entire multi-cyclonic dust-separating apparatus 100 in order to dump the dust, as was the case with the conventional multi-cyclonic dust-separating apparatus.

Hereinafter, operation of the multi-cyclonic dust-separating apparatus 100 will be explained in detail with reference to Figures 1 to 6.

Referring to Figure 2, external air may be drawn into the first cyclone chamber 127 through the first air inlet 124 formed in the first tub 122 of the first cyclone unit 120. Because the first air inlet 124 is formed tangentially to the first tub 122, so that the air drawn into the first cyclone chamber 127 can flow along an inner wall of the first tub, the air whirls about the cylindrical element 123 in the first cyclone chamber. Dust is then separated from the air by centrifugal force, while the air whirls in the first cyclone chamber 127. Dust may be dashed against the inner surface of the first tub 122, and fall downwards under gravity into the first dust-collecting chamber 186 of the dust receptacle 180. Relatively large dust particles may fall downwards into the first dust-collecting chamber 186. Similarly, large contaminants such as a coin, a cap or the like fall downwards under gravity into the chamber 180. As large contaminants fall downwards, they may deflect the skirt 190 in a downwards direction. Because the skirt 190 is made of a resilient material, it can return to its original configuration afterwards. The air from which large dust particles has been separated is then drawn into the cyclones 142 through the first air outlet 133 of the cylindrical element 123

and the four second air inlets 154 (shown in Figures 4 and 5), arranged in intervals of 90° at the upper parts of the cyclone bodies 150 of the cyclones 142. Fine dust particles are separated from the drawn-in air while whirling about the second discharge pipes 148 in the cyclone bodies 150. The separated fine dust particles fall downwards into the second dust-collecting chambers 189, and the air from which the fine dust particles has been separated is discharged into the air-stagnating space 152 through the discharge pipes 148. Because the air-stagnating space 152 has a volume larger than that of the discharge pipes 148, the velocity of the air rapidly decreases, and thus even a very small amount of fine dust particles riding along in the air flow settles down on the upper wall 156 under gravity. The air discharged from the cyclones 142 is mixed with air in the air-stagnating space 152, and is then discharged to the outside of the apparatus 100 through the opening 134, the discharge guide 137 and the third air outlet 138. When part of the air whirling in the first cyclone chamber 127 flows down to the first dust-collecting chamber 186, the dust collected in the first dust-collecting chamber flows back towards the first cyclone chamber 127 by riding in the whirling air. However, the skirt 190 blocks the first cyclone chamber 127 from the first dust-collecting chamber 186. Moreover, because the lower parts of the cyclone bodies 150 are frustoconical, the lower ends of the second cyclone bodies provide only small openings through which dust can flow. Thus, fine dust particles collected in the second dust-collecting chambers 189 are substantially prevented from flowing backwards through the lower ends of the second cyclone bodies 150.

Also, in a conventional multi-cyclonic dust-separating apparatus, if dust is to be dumped, the user has to transport the entire, heavy apparatus to a trash can to dispose of the dust, because the conventional apparatus is large and has a bottom hatch that must be opened to dump the dust. However, the multi-cyclonic dust-separating apparatus described above with reference to Figures 1 to 7, has a compact structure and the dust receptacle 180 is separable from the first tub 122 and the second cyclone unit 140, so that the user only has to transport the dust receptacle to a trash can to dump the dust, and leave the heavier cyclone units in the vacuum cleaner.

Figures 8 and 9 show the second form of multi-cyclonic dust-separating apparatus 100', this apparatus having the same construction as the apparatus 100 of Figures 1 to

7, except that a portion 184a of a top end of a second tub 184' of a dust receptacle 180" is extended to a height at which the skirt 190 is located, and the top ends of cylindrical members 188' do not accommodate the lower ends of the cyclone bodies 150' of second cyclones 142', but come only into contact with the lower ends of the cyclone bodies. Accordingly, as illustrated in Figure 9, when the dust is to be dumped from the dust receptacle 180", the user can easily separate the dust receptacle from a first cyclone unit 120' and from a second cyclone unit by pulling the second tub 184' in the direction of the arrow shown, while grasping the handle 187 formed on the second tub.

Since the operation of the multi-cyclonic dust-separating apparatus 100' is similar to that of the multi-cyclonic dust-separating apparatus 100, detailed description thereof will be omitted.

As will be apparent from the foregoing description, the multi-cyclonic dust-separating apparatus may be configured so that the second cyclone unit is disposed in the cylindrical element of the first cyclone unit. Accordingly, the outer diameter of the multi-cyclonic dust-separating apparatus is smaller, thereby allowing the apparatus to have an overall compact size, even though the second cyclone unit includes a plurality of cyclones to increase the dust-separating efficiency. Also, because each of the multi-cyclonic dust-separating apparatuses described above allows the dust receptacle to be separated easily from the first and the second cyclone units, unlike with a conventional multi-cyclonic dust-separating apparatus, the user can separate only the dust receptacle to dump the collected dust.

Moreover each of the multi-cyclonic dust-separating apparatuses described above is configured so that the second air inlets formed in the cyclones of the second cyclone unit are disposed in parallel, thereby allowing the air to maintain a strong whirling force even in the second cyclone unit, thereby improving the dust-separating efficiency for fine dust particles.

Furthermore each of the multi-cyclonic dust-separating apparatuses described above is configured to include an air-stagnating space above the cyclones of the second

cyclone unit, thereby reducing the whirling of the air and minimising the associated noise.

Although representative embodiments of the present invention have been shown and described in order to exemplify the principles of the present invention, the present invention is not limited to the specific exemplary embodiments. It will be understood that various modifications and changes can be made by one skilled in the art, without departing from the scope of the invention as defined by the claims. Therefore, it should be considered that such modifications, changes, and equivalents thereof are all included within the scope of the present invention.

Claims

1. A multi-cyclonic dust-separating apparatus comprising:

a first cyclone unit having a first tub provided with a first air inlet, and a cylindrical element provided with a first air outlet, the first cyclone unit being arranged to whirl air from the first air inlet to separate dust therefrom to effect a first separation of dust, the cylindrical element being disposed in the first tub to form a first cyclone chamber, with the first outer tub, which defines a space for whirling the air;

a second cyclone unit having a plurality of cyclones, each of which has a second air inlet for drawing in the air from the first cyclone chamber, to effect a second separation of dust from the air; and

a dust receptacle having a first dust-collecting chamber for collecting the dust separated by the first cyclone unit, and a plurality of second dust-collecting chambers for collecting the dust separated by the second cyclone unit,

wherein the second cyclone unit is disposed in the cylindrical element of the first cyclone unit, and the second dust-collecting chambers are separately formed, and connected to, respective cyclones of the second cyclone unit.

2. Apparatus as claimed in claim 1, wherein the first cyclone unit and the second cyclone unit are substantially concentric.

3. Apparatus as claimed in claim 1 or claim 2, wherein the first air outlet of the cylindrical element of the first cyclone unit is disposed to face the second air inlets of the cyclones of the second cyclone unit.

4. Apparatus as claimed in any one of claims 1 to 3, wherein the first cyclone unit further comprises a grille disposed in the first air outlet of the cylindrical element, for restraining the air from which the dust is separated in the first cyclone chamber from being drawn directly into the second air inlets of the cyclones of the second cyclone unit.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the first cyclone unit further comprises a skirt disposed below the first air outlet of the cylindrical element thereof.

6. Apparatus as claimed in claim 6, wherein the skirt is made of a resilient material.

7. Apparatus as claimed in any one of claims 1 to 6, wherein the second cyclone unit further comprises an air-stagnating space formed above its cyclones, so that the air discharged from said cyclones is mixed.

8. Apparatus as claimed in any one of claims 1 to 7, wherein the dust receptacle further comprises:
a second tub forming the first dust-collecting chamber; and
a plurality of cylindrical members disposed in the second tub to form the second dust-collecting chambers.

9. Apparatus as claimed in claim 8 when appendant to claim 5, wherein the second tub is formed so that at least a portion of its top end is located at the same height as, or below, the skirt.

10. Apparatus as claimed in claim 8 or claim 9, wherein the cylindrical members comprises more than two cylinder members, each of which is detachably coupled to a lower part of a respective cyclone of the second cyclone unit.

11. A multi-cyclonic dust-separating apparatus substantially as hereinbefore described with reference to, and as illustrated by, Figures 1 to 7 or Figures 1 to 7 as modified by Figures 8 and 9 of the drawings.

12. A vacuum cleaner substantially as hereinbefore described with reference to, and as illustrated by, Figures 1 to 7 or Figures 1 to 7 as modified by Figures 8 and 9 of the drawings.

INTELLECTUAL PROPERTY OFFICE

14

Application No: GB0815002.1 **Examiner:** Mr Pablo Cappellini

Claims searched: 1-12 **Date of search:** 7 December 2008

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
Y	1, 2 & 5-9	GB 2445211 A (SAMSUNG GWANGJU ELECTRONICS CO) - See Fig.3. Note resilient skirt 90.
Y	1, 2 & 5-9	GB 2426474 A (DYSON TECHNOLOGY LIMITED) - See Figs. Note cyclones 130, 154, within cylinder 112 of first cyclone unit, and dust collecting chambers 114, 156 & 142.
A	-	GB 2440125 A (DYSON TECHNOLOGY LIMITED) - See Figs. 2 & 3.
A	-	EP 0728435 A1 (BLACK & DECKER INC)
	-	WO 2006/026414 A1 (EURO-PRO OPERATING, LLC)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

A47L; B04C

The following online and other databases have been used in the preparation of this search report

ONLINE: WPI, EPODOC.

International Classification:

Subclass	Subgroup	Valid From

15

Subclass	Subgroup	Valid From
A47L	0009/16	01/01/2006
B04C	0005/185	01/01/2006