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(54) **A DUST COLLECTOR**

(57) A dust collector includes a body, which includes a vacuum chamber and a motor chamber holding the motor; and a detachable dust-collecting unit arranged in the vacuum chamber. Said dust-collecting unit includes an upstream cyclone separator (1) and several downstream cyclone separators (2) connected with said upstream cyclone separator (1). Said downstream cyclone separators (2) are arranged side by side around said upstream cyclone separator (1) and connected to each other to form a first dust cup (3). The air outlet port of said upstream cyclone separator (1) is communicated with the air inlet ports of said several downstream separators (2). The bottom cover (21) and the dust cover (22) can be opened successively, so that the dust in the upstream cyclone separator (1) and the downstream cyclone separators (2) can be poured out separately and successively.

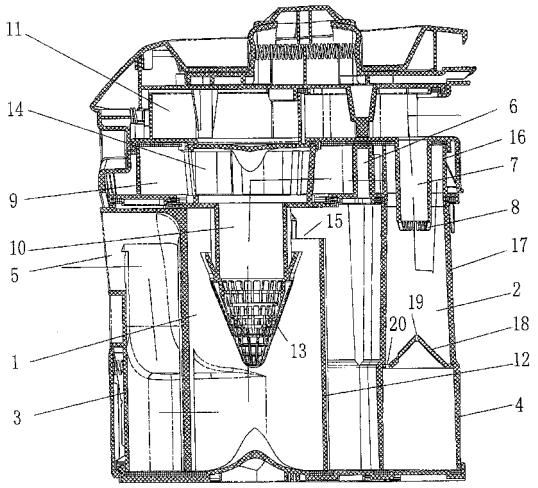

Fig. 4

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a dust collector.

BACKGROUND OF THE INVENTION

[0002] A traditional dust collector is provided with a filter, so as to filter the inhaled dirty air and leave the dust grain in a dust collector. Therefore, the filter of such a dust collector should be cleaned or replaced after being used for a period of time. Otherwise, resistance of the vacuum motor will be increased after the filtering hole of the filter is blocked by thin dust, and even worse the motor will be burnt, which will not only bring trouble to the customer, but also affect performance and life of the vacuum cleaner.

[0003] In recent years, the manufacturers substitute a cyclone dust remover for the filter according to the principle of cyclone separation, and obtain a better dust removal result, the cyclone dust remover having therefore been widely applied to the vacuum cleaners. The cyclone dust remover is provided in a dust cup with a conical tube body with a big upper end and a small lower end; the conical tube body is provided at the upper end with an outlet pipe in the longitudinal direction, and at the lower end with an opening such that dust falls to bottom of the dust cup; an inlet pipe enters along the upper sidewall of the conical tube body in the tangential direction, making gas stream included with dust produce cyclone in the conical tube body; the dust grains fall to bottom of a dust-collecting box along the sidewall of the conical tube body under the centrifugal force, and the gas stream after dust removal is discharged upwards via the outlet pipe.

[0004] However, the cyclone dust remover also has the shortcoming of large volume, especially the cyclone dust remover that is used with a large vacuum cleaner requiring a higher air flow, which not only increases the cost but also makes usage troublesome.

SUMMARY OF THE INVENTION

[0005] A purpose of the present invention is to provide a dust collector, which includes an upstream cyclone separator and several parallel downstream separators positioned outside; the air outlet of the upstream separator is communicated with the air inlet of the several downstream separators, which can increase the air volume and keep a higher dust removal efficiency without increasing volume of the machine body.

[0006] A technical solution of the present invention is as below: A dust collector is provided, which includes a bare body composed of a vacuum chamber and a motor chamber accommodating a motor; a detachable dust-collecting unit mounted in the vacuum chamber includes an upstream cyclone separator and several downstream cyclone separators connected with the upstream cyclone separator; the downstream cyclone separators are positioned in parallel around the upstream cyclone separator, and interconnected to form a first dust cup.

[0007] The first dust cup is provided at the upper part with a closed communicating layer, where a primary air outlet of the upstream cyclone separator and a secondary air inlet of the downstream cyclone separator are communicated with each other; the communicating layer is provided at the upper part with an outlet layer, into which the secondary outlet pipe of the downstream cyclone separator is extended to communicate.

[0008] The upstream cyclone separator includes a tube body provided with a primary air inlet; the tube body is provided at the upper part with a reversed conical filtering tube, which is connected with the primary air outlet at the upper part; the primary air outlet is provided with a pillar strainer positioned in the communicating layer; the tube body is provided at the upper edge with a notch and communicated via the notch with the first dust cup.

[0009] The downstream cyclone separator includes a cylindrical tube body positioned at the upper part and extended into the communicating layer, a conical tube body at the center, and a secondary dust cup at the lower part; the secondary air inlet is positioned on the sidewall of the cylindrical tube body, and the secondary outlet pipe inside the cylindrical tube body; the secondary outlet pipe is communicated at the upper end with the outlet layer by passing through the communicating layer, and provided at the end with some parallel spaced ribs; the conical tube body is provided at the lower part with an umbrella reflective disk, which is provided at the center with a reflux hole; between the peripheral of the umbrella reflective disk and the sidewall of the conical tube body is positioned a dust-falling ring gap communicated with the secondary dust cup, whose bottom face is on the same plane with that of the first dust cup.

[0010] The dust remover is provided at the bottom with a bottom cover, between which and the dust remover is further positioned a dust cover; the dust cover is buckled on the dust-pouring opening of one kind of the cyclone separators, while the bottom cover at least on the dust-pouring opening of another kind of the cyclone separators; the dust cover is buckled on the dust-pouring opening of the downstream cyclone separator, while the bottom cover on the dust cover and the dust-pouring opening of the upstream cyclone separator; the dust-pouring opening of the downstream cyclone separator is positioned at the bottom, and the dust cover is composed of some small covers buckled on the dust-pouring opening; the upstream cyclone separator has at the center an upstream cyclone chamber, corresponding to which is a conical convex positioned on the bottom cover; the bottom cover and the dust cover are coaxially hinged to the bottom outer edge of the dust remover.

[0011] A dust collector is provided, which includes a bare body composed of a vacuum chamber and a motor chamber accommodating a motor; a detachable dust-collecting unit mounted in the vacuum chamber includes

an upstream cyclone separator and several downstream cyclone separators connected with the upstream cyclone separator; the downstream cyclone separators are positioned in parallel around the upstream cyclone separator, and interconnected to form a first dust cup; part of the external surface of each downstream cyclone separator forms the outer edge of the first dust cup, while other part of the external surface the outer edge of the dust remover.

[0012] A dust collector is provided, which includes a bare body composed of a vacuum chamber and a motor chamber accommodating a motor; a detachable dust-collecting unit mounted in the vacuum chamber includes an upstream cyclone separator and several downstream cyclone separators connected with the upstream cyclone separator; the downstream cyclone separators are positioned in parallel around the upstream cyclone separator, and interconnected to form a first dust cup; the upstream cyclone separator is communicated with the first dust cup via a notch, which is positioned at the upper edge of the upstream cyclone separator.

[0013] The present invention has the following advantages:

1. The present invention includes an upstream cyclone separator and several parallel downstream separators positioned outside; the air outlet of the upstream separator is communicated with the air inlet of the several downstream separators, which can increase the air volume and keep higher dust removal efficiency without increasing volume of the machine body.

2. The downstream cyclone separator of the present invention is of a diffusion structure; the conical tube body is small at the upper end and big at the lower end, and the cyclone inlet is positioned at the upper small end; gas stream is in a decelerated centrifugal state when revolving in the conical tube body, which decreases pressure loss of the gas stream and thus obtains a better dust removal result.

3. The gas stream at the lower part of the downstream cyclone separator of the present invention revolves slower than that at the upper part, which can thus prevent the dust at bottom of the dust cup from flying and avoid secondary pollution.

4. The present invention adds, between the bottom and the bottom cover of the dust remover, a dust cover buckled on the dust-pouring opening of the downstream cyclone separator, and the bottom cover and the dust cover are hinged to the outer lower edge of the downstream cyclone separator at the same time; to pour dust, one can first open the bottom cover and pour dust out of the upstream cyclone separator, and then open the dust cover and pour dust out of the downstream cyclone separator, which can prevent the dust from flying due to being poured violently.

5. The dust cover of the present invention is composed of some small covers connected with each other; each of the small covers is respectively buckled on the dust-pouring opening of the downstream cyclone separator, and the bottom cover on the dust cover and the dust-pouring opening of the upstream cyclone separator, which can ensure the airtight performance of the dust cover buckled on the downstream cyclone separator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The present invention will further be described below with reference to drawings and embodiments.

Figure 1 is a schematic view for mounting the dust remover in the dust collector;

Figure 2 is an exploded schematic view of the dust remover;

Figure 3 is an assembly schematic view of the dust remover;

Figure 4 is a structural schematic view of the dust remover;

Figure 5 is a structural schematic view of the primary air outlet, the filtering tube and the strainer in the upstream cyclone separator;

Figure 6 is a structural schematic view of the secondary outlet pipe of the downstream cyclone separator;

Figure 7 is a structural schematic view of the dust remover with the bottom cover opened and the dust cover buckled;

Figure 8 is a structural schematic view of the dust remover with the bottom cover and the dust cover opened at the same time; and

Figure 9 is an exploded structural schematic view of the bottom cover and the dust cover of the dust remover.

[0015] In the drawings: 1. Upstream cyclone separator; 2. downstream cyclone separator; 3. first dust cup; 4. secondary dust cup; 5. primary air inlet; 6. secondary air inlet; 7. secondary outlet pipe; 8. rib; 9. communicating layer; 10. primary air outlet; 11. outlet layer; 12. tube body; 13. filtering tube; 14. strainer; 15. notch; 16. cylindrical tube body; 17. conical tube body; 18. umbrella reflective disk; 19. reflux hole; 20. dust-falling ring gap; 21. bottom cover; 22. dust cover; 23. dust-pouring opening;

24. dust-pouring opening; 25. small cover; 26. upstream cyclone chamber; and 27. conical convex.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0016] Embodiment: As shown in Figures 1 to 6, a dust collector is provided, which includes a bare body composed of a vacuum chamber and a motor chamber accommodating a motor; a detachable dust-collecting unit mounted in the vacuum chamber includes an upstream cyclone separator 1 and several downstream cyclone separators 2s connected with the upstream cyclone separator 1; the several downstream cyclone separators 2s are positioned in parallel around the upstream cyclone separator 1, and interconnected to form a first dust cup 3; part of the external surface of each downstream cyclone separator 2 forms the outer edge of the first dust cup 3, while other part of the external surface the outer edge of the dust remover; the first dust cup 3 is provided at the upper part with a closed communicating layer 9, where a primary air outlet 10 of the upstream cyclone separator 2 and a secondary air inlet 6 of the downstream cyclone separator 2 are communicated with each other; the communicating layer 9 is provided at the upper part with an outlet layer 11, into which the secondary outlet pipe 7 of the downstream cyclone separator 2 is inserted to communicate.

[0017] The upstream cyclone separator 1 includes a tube body 12 provided with a primary air inlet 5; the tube body 12 is provided at the upper part with a reversed conical filtering tube 13, which is connected with the primary air outlet 10 at the upper part; the primary air outlet 10 is provided with a strainer 14 positioned in the communicating layer 9; the tube body 12 is provided at the upper edge with a notch 15 and communicated via the notch 15 with the first dust cup 3.

[0018] The downstream cyclone separator 2 includes a cylindrical tube body 16 positioned at the upper part and extended into the communicating layer 9, a conical tube body 17 at the center, and a secondary dust cup 4 at the lower part; the secondary air inlet 6 is positioned on the sidewall of the cylindrical tube body 16, and the secondary outlet pipe 7 inside the cylindrical tube body 16; the secondary outlet pipe 7 is communicated at the upper end with the outlet layer 11 by passing through the communicating layer 9, and provided at the end with some parallel spaced ribs 8s; the conical tube body 17 is provided at the lower part with an umbrella reflective disk 18, which is provided at the center with a reflux hole 19; between the peripheral of the umbrella reflective disk 18 and the sidewall of the conical tube body 17 is positioned a dust-falling ring gap 20 communicated with the secondary dust cup 4.

[0019] As shown in Figure 4, while in use, the dirty air included with dust enters the tube body 12 in the first dust cup 3 from the primary air inlet 5; the rough dust falls in the tube body 12 when going through the conical filtering tube 13, part of the rough dust entering the first dust cup 3 via the notch 15 at the upper edge of the tube body 12; the fine dust and air keep on entering the filtering tube 13 and, after being further filtered by the strainer 14 upwards from the primary air outlet 10, enter the communicating layer 9, and then keep on entering each of the downstream cyclone separators 2s from each of the secondary air inlets 6s and forming cyclone in the cylindrical tube body 16 and the conical tube body 17; in the cyclone process, the fine dust falls along the inner wall of the cyclone tube 17, and enters the secondary dust cup 4 via the dust-falling ring gap 20; the air after dust removal then enters the outlet layer 11 upwards from the secondary outlet pipe 7, and is discharged in a concentrated way from an exhaust pipe on the outlet layer 11.

[0020] As shown in Figures 7 to 9, each of the downstream cyclone separators 2s is provided with the secondary dust cup 4, whose bottom face is on the same plane with that of the first dust cup 3; the dust remover is provided at the bottom with a bottom cover 21, between which and the dust remover is further positioned a dust cover 22; the dust cover 22 is buckled on the dust-pouring opening 23 of the downstream cyclone separator 2, while the bottom cover 21 on the dust cover 22 and the dust-pouring opening 24 of the upstream cyclone separator 1; the dust-pouring opening 23 of the downstream cyclone separator 2 is positioned at the bottom, and the dust cover 22 is composed of some small covers 25s buckled on the dust-pouring opening 23; the upstream cyclone separator 1 has at the center an upstream cyclone chamber 26, corresponding to which is a conical convex 27 positioned on the bottom cover 21; the bottom cover 21 and the dust cover 22 are coaxially hinged to the bottom outer edge of the dust remover.

[0021] The dust cover 22 can be made of such flexible materials as rubber (embodied as a cushion which is directly plugged into bottom of the secondary dust cup 4), or such plastic materials as PVC, PP and PE.

[0022] The present invention adds, between the bottom and the bottom cover 21 of the dust remover, a dust cover 22 buckled on the dust-pouring opening 23 of the downstream cyclone separator 2, and the bottom cover 21 and the dust cover 22 are hinged to the outer lower edge of the downstream cyclone separator 2 at the same time. To pour dust, one can first open the bottom cover 21, and pour dust out of the upstream cyclone separator 1, and then open the dust cover 22 and pour dust out of the downstream cyclone separator 2, which can prevent the dust from flying due to being poured violently. The dust cover 22 of the present invention is composed of some small covers 25s connected with each other; each of the small covers 25s is respectively buckled on the dust-pouring opening 23 of the downstream cyclone separator 2, while the bottom cover 21 on the dust cover 22 and the dust-pouring opening 24 of the upstream cyclone separator 1, which can ensure the airtight performance of the dust cover buckled on the downstream cyclone separator 2.

Claims

1. A dust collector comprising:

   a bare body, including a vacuum chamber and a motor chamber accommodating a motor; and a detachable dust-collecting unit, mounted in the vacuum chamber, including an upstream cyclone separator (1) and several downstream cyclone separators (2s) connected with the upstream cyclone separator (1);
   wherein the downstream cyclone separators (2s) are positioned in parallel around the upstream cyclone separator (1), and interconnected to form a first dust cup (3).

2. The dust collector according to claim 1, wherein the first dust cup (3) is provided at the upper part with a closed communicating layer (9), where a primary air outlet (10) of the upstream cyclone separator (1) and a secondary air inlet (6) of the downstream cyclone separator (2) are communicated with each other.

3. The dust collector according to claim 2, wherein the communicating layer (9) is provided at the upper part with an outlet layer (11), into which the secondary outlet pipe (7) of the downstream cyclone separator (2) is inserted to communicate.

4. The dust collector according to claim 2, wherein the upstream cyclone separator (1) includes a tube body (12) provided with a primary air inlet (5); the tube body (12) is provided at the upper part with a reversed conical filtering tube (13), which is connected with the primary air outlet (10) at the upper part; the primary air outlet (10) is provided with a pillar strainer (14) positioned in the communicating layer (9); the tube body (10) is provided at the upper edge with a notch (15) and communicated via the notch (15) with the first dust cup (3).

5. The dust collector according to claim 3, wherein the downstream cyclone separator (2) includes a cylindrical tube body (16) positioned at the upper part and extended into the communicating layer (9), a conical tube body (17) at the center, and a secondary dust cup (4) at the lower part; the secondary air inlet (6) is positioned on the sidewall of the cylindrical tube body (16), and the secondary outlet pipe (7) inside the cylindrical tube body (16); the secondary outlet pipe (7) is communicated at the upper end with the outlet layer (11) by passing through the communicating layer (9), and provided at the end with some parallel spaced ribs (8s); the conical tube body (17) is provided at the lower part with an umbrella reflective disk (18), which is provided at the center with a reflux hole (19); between the peripheral of the umbrella reflective disk (18) and the sidewall of the conical tube body (17) is positioned a dust-falling ring gap (20) communicated with the secondary dust cup (4), whose bottom face is on the same plane with that of the first dust cup (3).

6. The dust collector according to claim 1, wherein the dust remover is provided at the bottom with a bottom cover (21), between which and the dust remover is further positioned a dust cover (22); the dust cover (22) is buckled on the dust-pouring opening of one kind of the cyclone separators, while the bottom cover (21) at least on the dust-pouring opening of another kind of the cyclone separators.

7. The dust collector according to claim 6, wherein the dust cover (22) is buckled on the dust-pouring opening (23) of the downstream cyclone separator (2), while the bottom cover (21) on the dust cover (22) and the dust-pouring opening (24) of the upstream cyclone separator (1).

8. The dust collector according to claim 7, wherein the dust-pouring opening (23) of the downstream cyclone separator (2) is positioned at the bottom, and the dust cover (22) is composed of some small covers (25s) buckled on the dust-pouring opening (23).

9. The dust collector according to claim 8, wherein the upstream cyclone separator (1) has at the center an upstream cyclone chamber (26), corresponding to which is a conical convex (27) positioned on the bottom cover (21).

10. The dust collector according to claim 6, 7, 8 or 9, wherein the bottom cover (21) and the dust cover (22) are coaxially hinged to the bottom outer edge of the dust remover.

11. A dust collector comprising:

    a bare body, including a vacuum chamber and a motor chamber accommodating a motor; and a detachable dust-collecting unit, mounted in the vacuum chamber, including an upstream cyclone separator (1) and several downstream cyclone separators (2s) connected with the upstream cyclone separator (1);
    wherein the downstream cyclone separators (2s) are positioned in parallel around the upstream cyclone separator (1), and interconnected to form a first dust cup (3); part of the external surface of each downstream cyclone separator (2) forms the outer edge of the first dust cup (3), while other part of the external surface of each downstream cyclone separator (2) forms the outer edge of the dust remover.

12. A dust collector comprising:

a bare body, including a vacuum chamber and a motor chamber accommodating a motor; and a detachable dust-collecting unit, mounted in the vacuum chamber, including an upstream cyclone separator (1) and several downstream cyclone separators (2s) connected with the upstream cyclone separator (1);
wherein the downstream cyclone separators (2s) are positioned in parallel around the upstream cyclone separator (1), and interconnected to form a first dust cup (3); the upstream cyclone separator (1) is communicated with the first dust cup (3) via a notch (15).

13. The dust collector according to claim 12, wherein the notch (15) is positioned at the upper edge of the upstream cyclone separator (1).

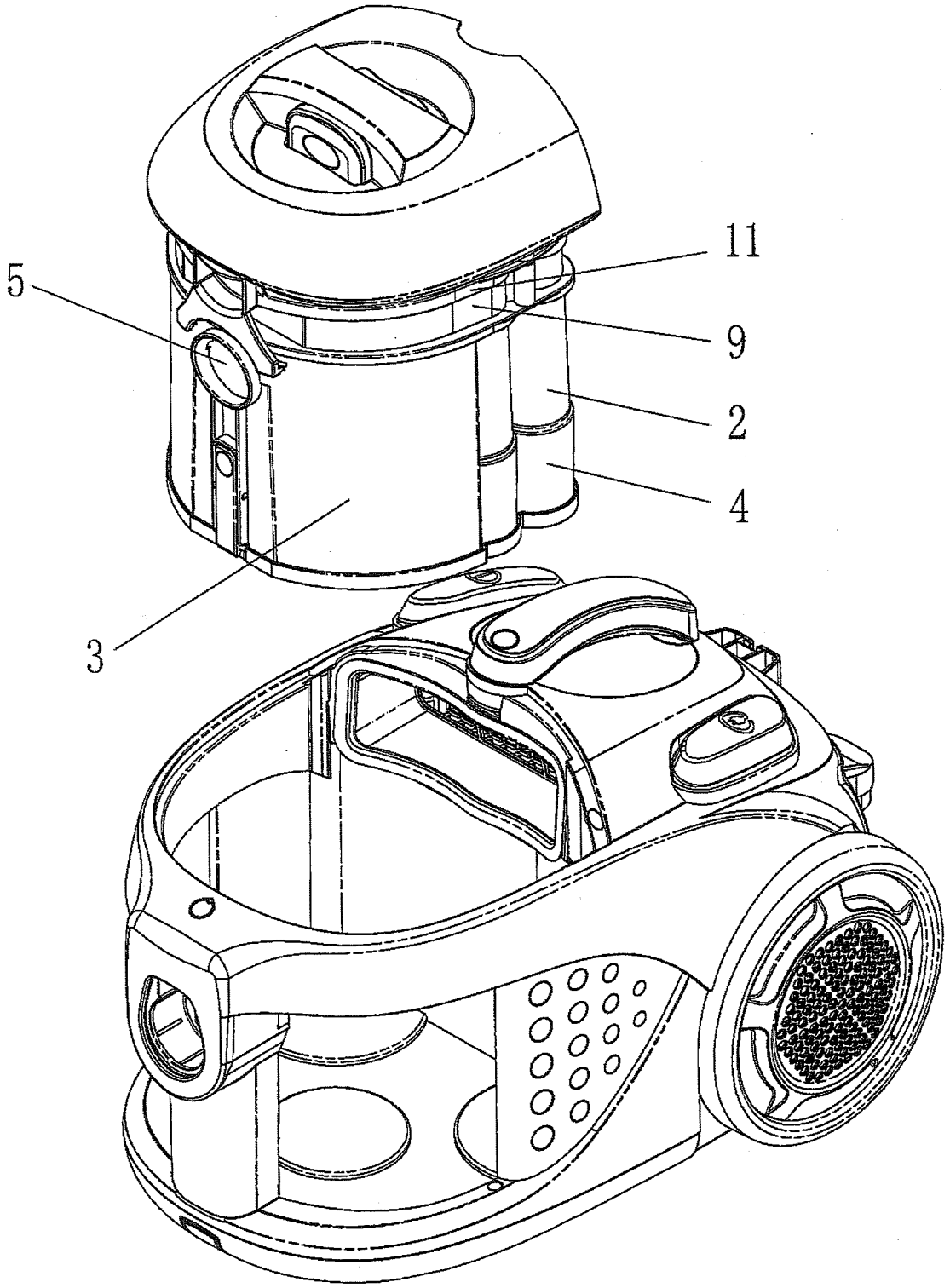

Fig. 1

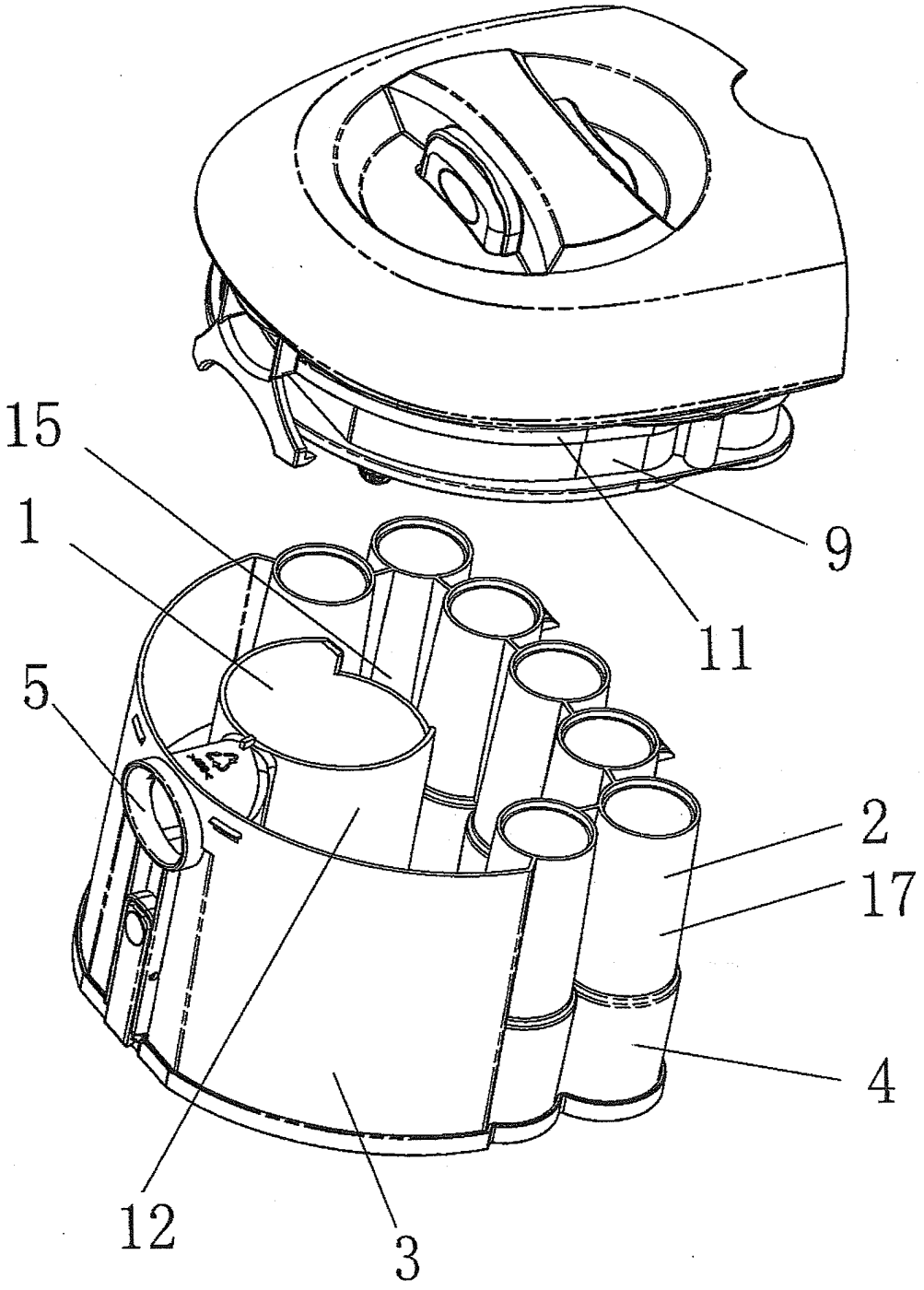

Fig. 2

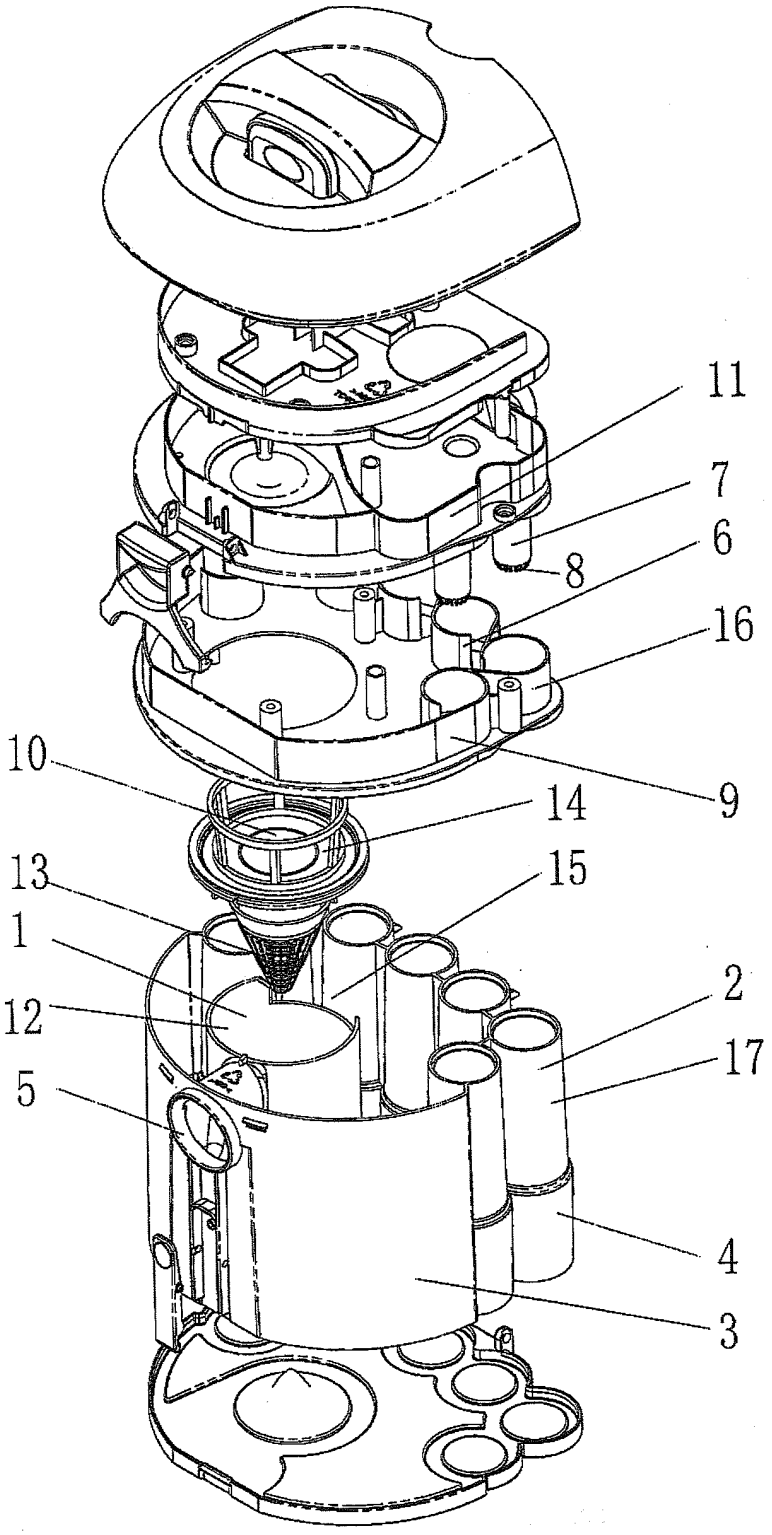

Fig. 3

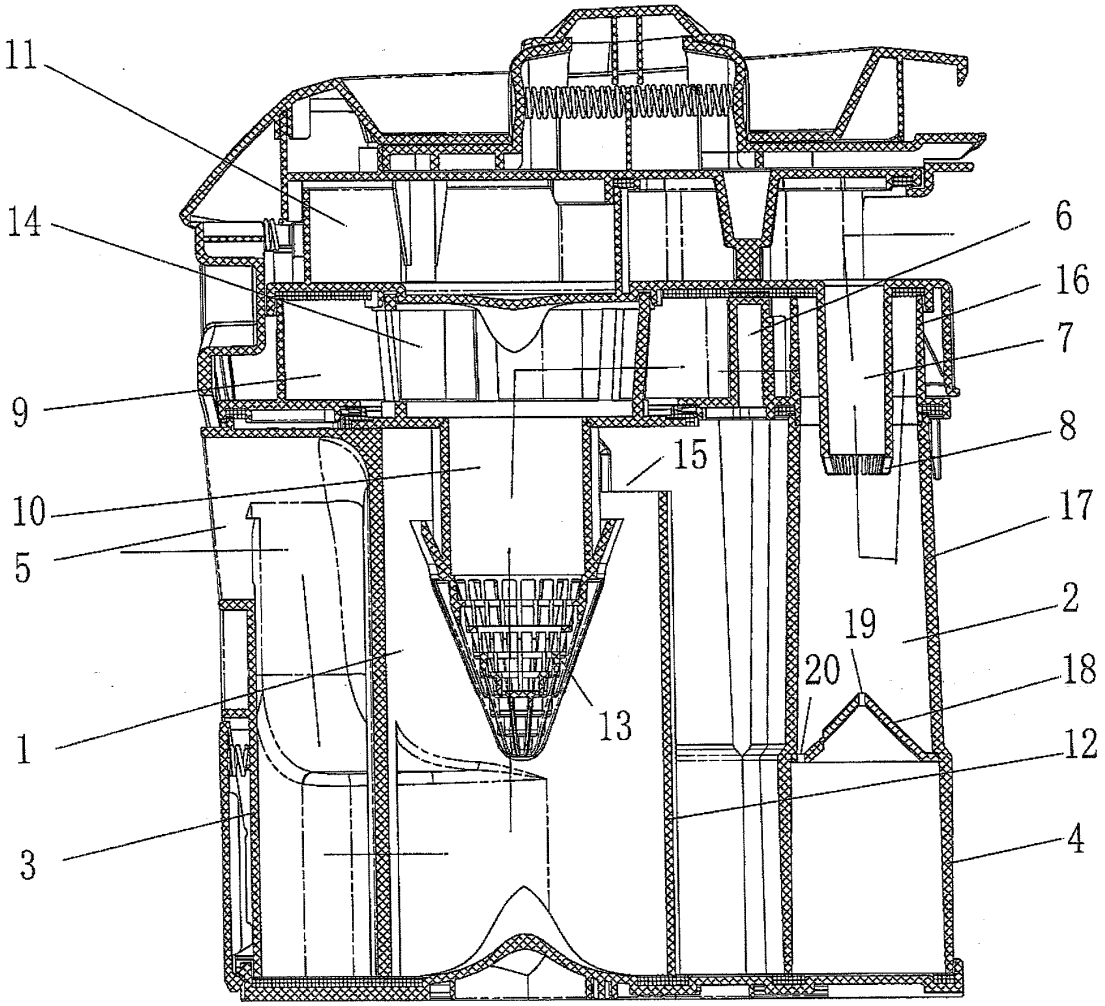

Fig. 4

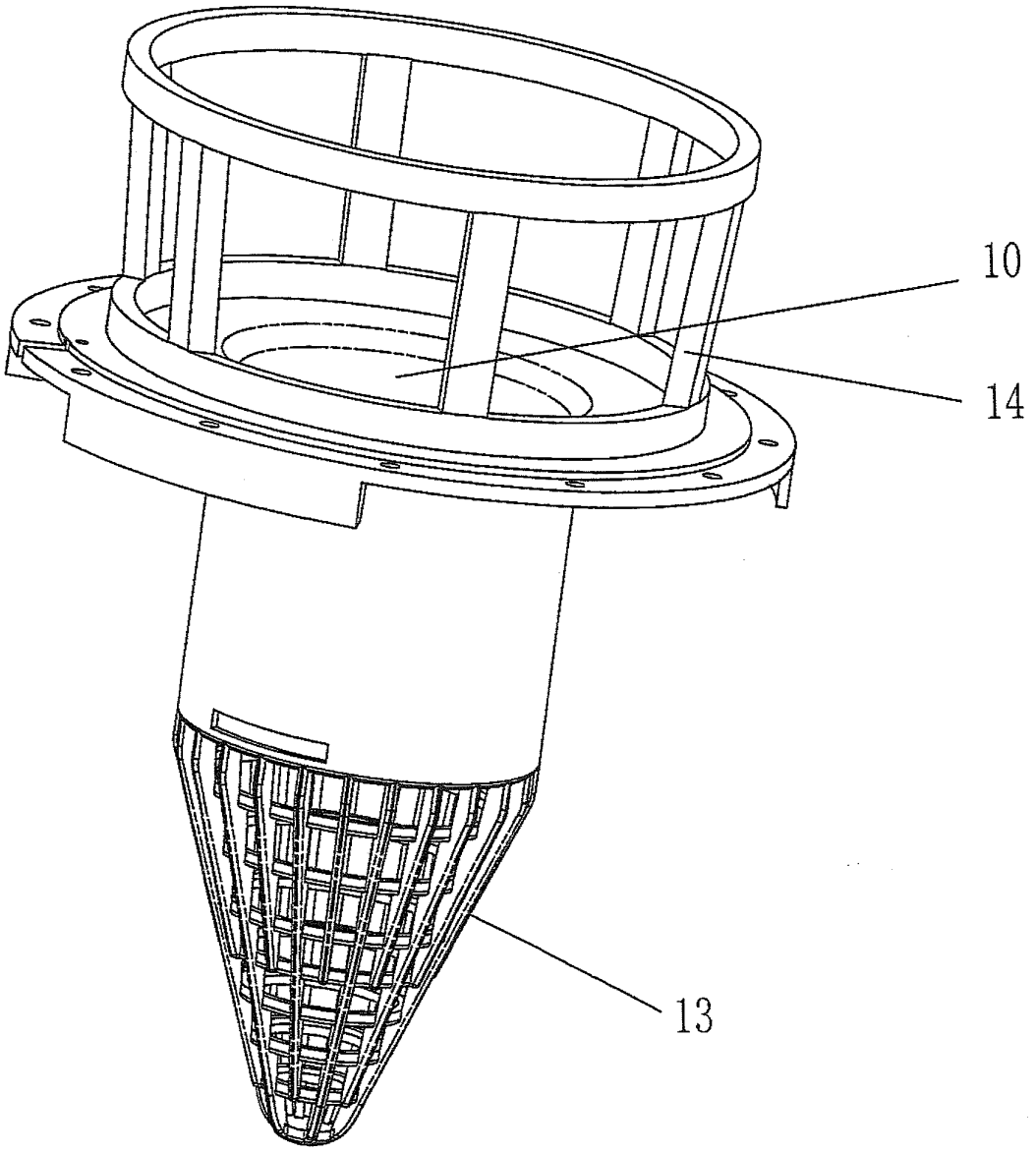

Fig. 5

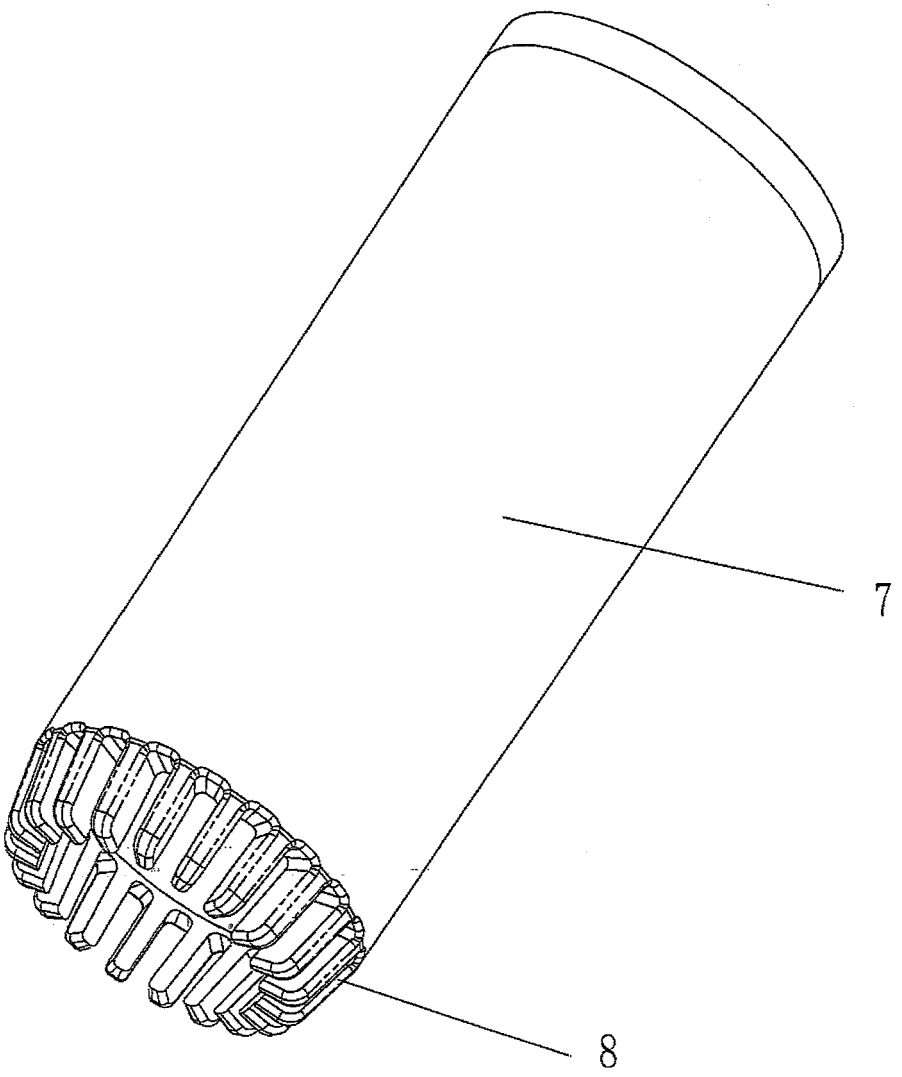

Fig. 6

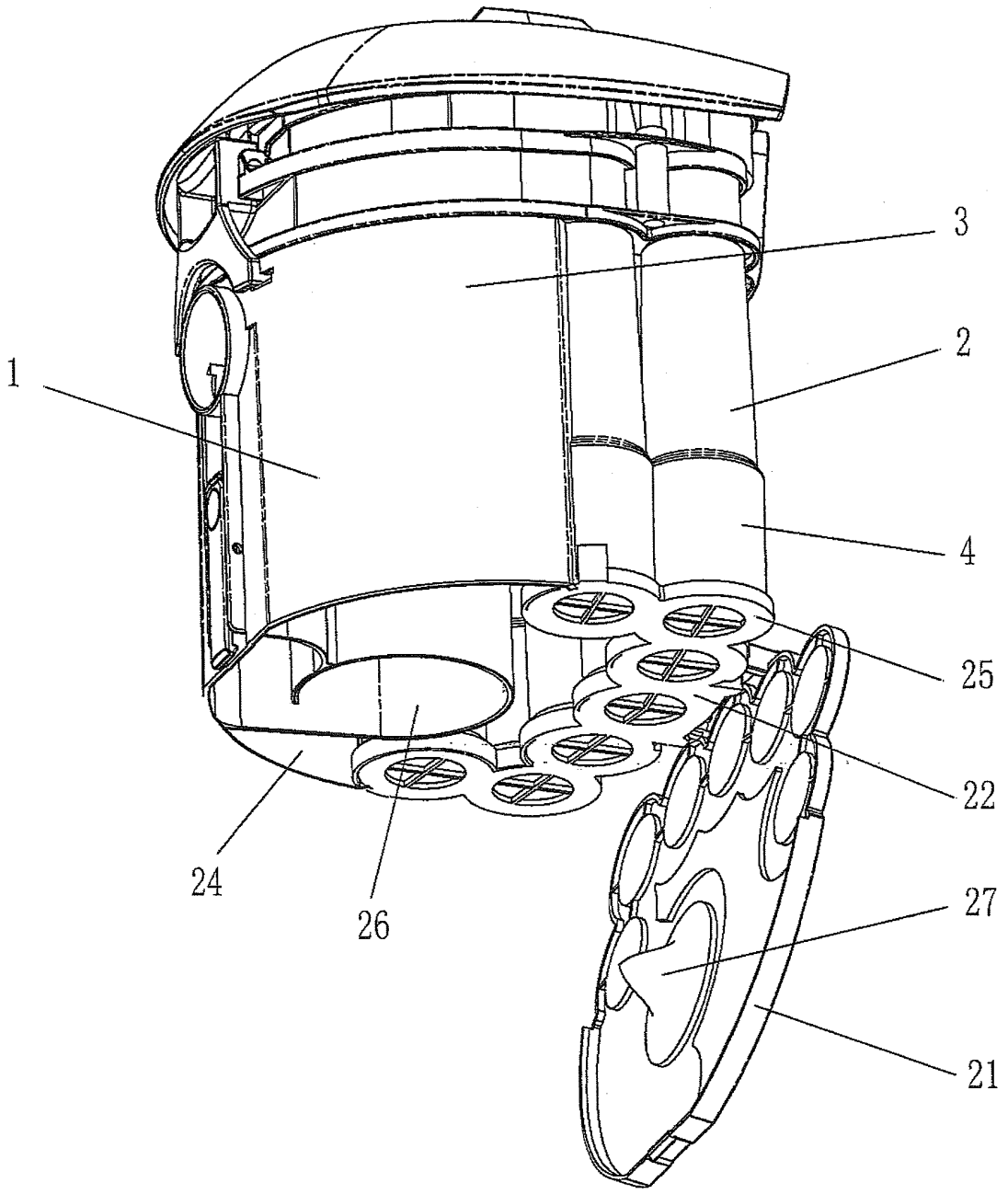

Fig. 7

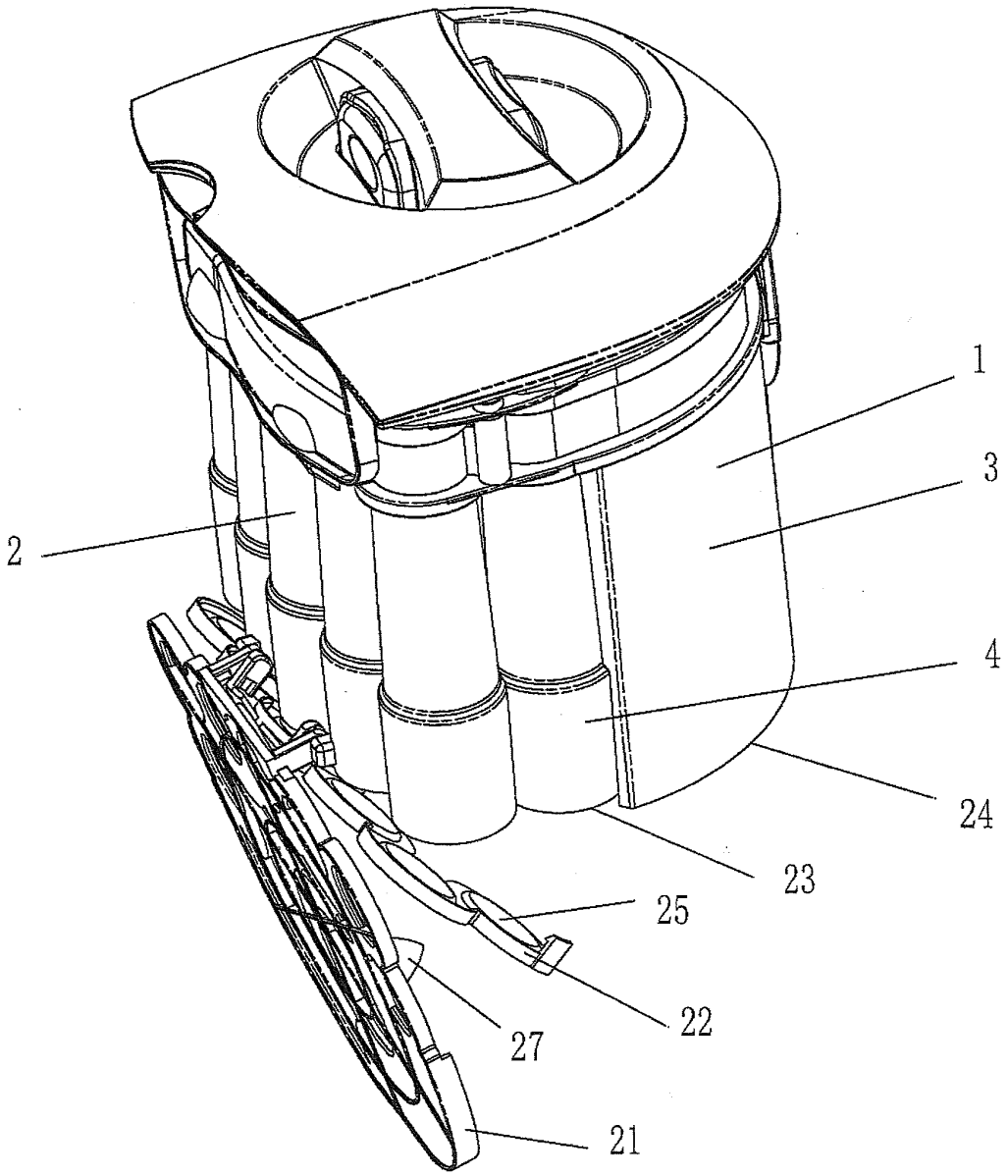

Fig. 8

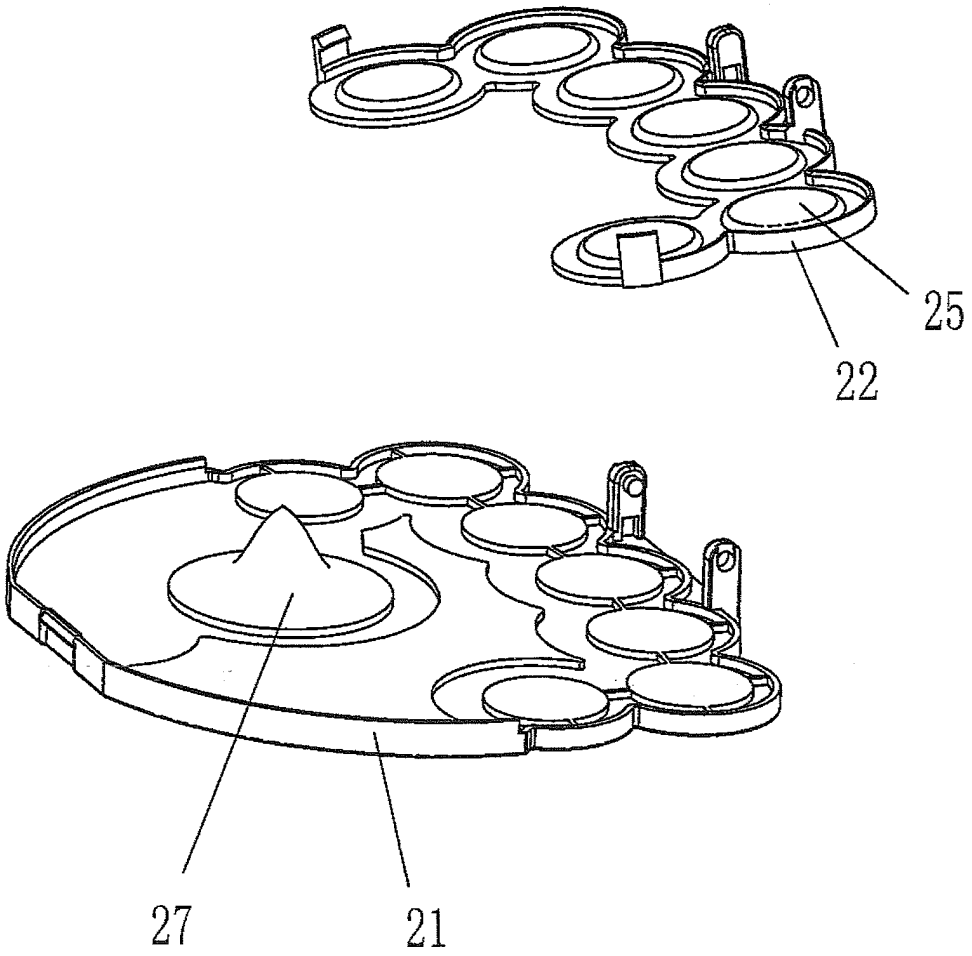

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/002234

A. CLASSIFICATION OF SUBJECT MATTER

A47L9/16(2006.01)i

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 A47L

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)

WPI, EPODOC, PAJ: cyclone, cyclonic, first, second, cup, chamber, inlet, outlet, gap, cover, around, upstream, downstream

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN1729924A (SUZHOU KINGCLEAN FLOORCARE CO) 08.Feb.2006(08.02.2006) pages 5-6, figures 1-4	1-13
Y	CN1729923A (TEK ELECTRICAL SUZHOU CO LTD) 08. Feb.2006(08.02.2006) page 4, lines 1-15, figures 2, 3	1-13
Y	CN2675032Y (FAN Jianwen) 02. Feb.2005(02.02.2005) pages 4-5, figure 1	4, 12, 13
A	US2006123590A(BISSELL HOMECARE INC) 15.Jun.2006(15.06.2006) the whole document	1-13
A	GB2399780A(DYSON LTD) 29.Sep.2004 (29.09.2004) the whole document	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16.Oct.2007 (16.10.2007)	**01 Nov. 2007 (01.11.2007)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer Yin Haixia Telephone No. (86-10)62085793

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/002234

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The subject matter of claims 1, 11, 12 is a dust collector. Since claims 1, 11, 12 are known lack of inventiveness, the above 3 claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept. The application hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2007)

INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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