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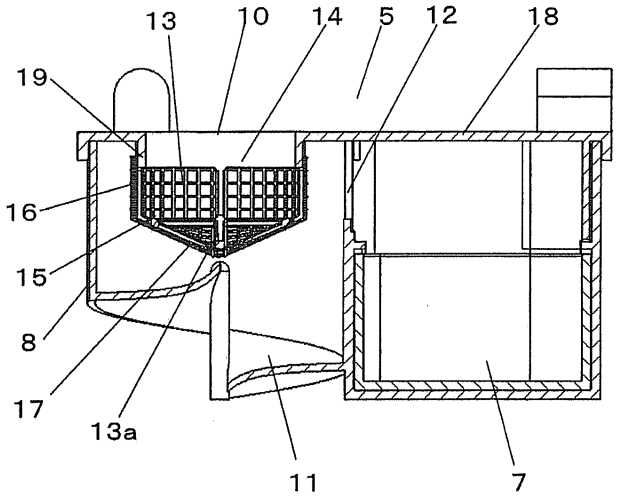
(54) DUST COLLECTING DEVICE

(57) A dust collecting device includes a mesh filter 13 provided between a swirling unit 11 and an airflow outlet 10 in a cylinder 8 which constitutes a cyclonic separating unit 5. Further, the mesh filter 13 includes a reticulated cylinder body 16 having an airflow-outlet-side opening 14 connected to the airflow outlet 10 and a swirling-unit-side opening 15 directed to the swirling unit 11 and a reticulated cover 17 configured to cover the swirling-unit-side opening 15 of the reticulated cylinder body 16. The reticulated cover 17 includes a protrusion portion axially protruding toward the swirling unit 11 at the center thereof and has such a shape that the reticulated cover 17 is gradually inclined from the protrusion portion toward the airflow outlet 10 up to an outer peripheral portion thereof.

FIG. 4



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Description

TECHNICAL FIELD

[0001] The present invention relates to a dust collecting device provided with a cyclonic separating unit.

BACKGROUND ART

[0002] A dust collecting device has been widely used in a vacuum cleaners. Conventionally, the dust collecting device includes a body case having an airflow suction portion and an airflow discharge portion, a fan installed in the body case and configured to discharge an airflow sucked into the body case through the airflow suction portion to the outside of the body case through the airflow discharge portion, and a cyclonic separating unit configured to swirl, by the fan, the airflow sucked into the body case through the airflow suction portion and to separate dust contained in the sucked airflow.

[0003] The cyclonic separating unit includes a cylinder having an airflow inlet disposed at one end thereof and an airflow outlet disposed at the other end thereof, a swirling unit provided between the airflow inlet and the airflow outlet in the cylinder, and a dust exhaust port provided in a circumferential wall extending between the swirling unit and the airflow outlet (As a related art document disclosing a similar technology, there exists, e.g., Japanese Unexamined Patent Application Publication No. 2000-157463).

[0004] In the conventional case mentioned above, when the fan is driven, an airflow is first sucked into the body case through the airflow suction portion. Then, the airflow is swirled by the cyclonic separating unit. Thus, the dust contained in the sucked airflow is separated and is discharged to an external trash box through the dust exhaust port of the cylinder of the cyclonic separating unit.

[0005] However, in case of a dust such as a long hair, even though a part of the dust is moving toward the dust exhaust port, it may be eventually discharged through the airflow outlet if the other part of the dust is directed toward the airflow outlet of the cylinder. This is because the volume of the airflow moving toward the airflow outlet is larger than the volume of the airflow moving toward the dust exhaust port.

[0006] That is to say, such dust, e.g., the long hair, cannot be separated by the cyclonic separating unit, and this reduces a dust collecting effect.

SUMMARY OF THE INVENTION

[0007] In view of the above, the present invention provides a dust collecting device capable of increasing a dust collecting effect.

[0008] In accordance with one aspect of the present invention, there is provided a dust collecting device including: a body case having an airflow suction portion and an airflow discharge portion; a fan installed in the body case and configured to discharge an airflow sucked into the body case through the airflow suction portion to the outside of the body case through the airflow discharge portion; and a cyclonic separating unit configured to swirl, by the fan, the airflow sucked into the body case through the airflow suction portion and to separate dust contained in the sucked airflow. Further, the cyclonic separating unit includes a cylinder having an airflow inlet disposed at one end thereof and an airflow outlet disposed at the other end thereof; a swirling unit provided between the airflow inlet and the airflow outlet in the cylinder; a dust exhaust port provided in a circumferential wall of the cylinder extending between the swirling unit and the airflow outlet; and a mesh filter provided between the swirling unit and the airflow outlet in the cylinder. In addition, the mesh filter includes a reticulated cylinder body having an airflow-outlet-side opening connected to the airflow outlet and a swirling-unit-side opening directed to the swirling unit, and a reticulated cover configured to cover the swirling-unit-side opening of the reticulated cylinder body, and the reticulated cover includes a protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to an outer peripheral portion thereof.

[0009] As mentioned above, according to the aspect of the present invention, the mesh filter is provided between the swirling unit and the airflow outlet in the cylinder of the cyclonic separating unit. The mesh filter includes the reticulated cylinder body having the airflow-outlet-side opening connected to the airflow outlet and the swirling-unit-side opening directed to the swirling unit, and the reticulated cover configured to cover the swirling-unit-side opening of the reticulated cylinder body. Further, the reticulated cover includes the protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to an outer peripheral portion thereof. Therefore, it becomes possible to increase the dust collecting effect.

[0010] That is to say, with such configuration, even if a dust such as a long hair is sucked, it is possible to exhaust such dust to an outer dust exhaust port by discharging it along a slant surface of the mesh filter. As a result, it becomes possible to increase the dust collecting effect.

[0011] Furthermore, in this configuration, the mesh filter has a large air passage area. As a result, it becomes possible to suppress an increase of an air passage resistance and, consequently, to increase the dust collecting effect.

[0012] Moreover, the reticulated cover includes the protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to an outer peripheral

portion thereof. It is therefore possible to restrain a resistance when the airflow is swirled by the swirling unit. As a result, it becomes possible to increase the dust collecting effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The figures depict one or more implementations in accordance with the present teaching, by way of example only, not by way of limitations. In the figures, like reference numerals refer to the same or similar elements.

Fig. 1 is a perspective view of a dust collecting device according to an embodiment of the present invention.

Fig. 2 is a vertical sectional view of the dust collecting device.

Fig. 3 is a perspective view showing a cyclonic separating unit of the dust collecting device.

Fig. 4 is a sectional view of the cyclonic separating unit of the dust collecting device.

Fig. 5 is a perspective view showing a main part of the cyclonic separating unit of the dust collecting device in an inverted state.

Fig. 6A is a front view showing a filter of the cyclonic separating unit of the dust collecting device, and Fig. 6B is a perspective view of the filter.

DETAILED DESCRIPTION

[0014] An embodiment of the present invention will now be described with reference to the drawings.

[0015] In Figs. 1 and 2, reference symbol 1 designates a box-shaped body case having an airflow suction portion 2 at the lower side thereof and an airflow discharge portion 3 at the upper side thereof.

[0016] A fan 4 is installed in the body case 1. If the fan 4 is driven, an air existing outside the body case 1 is sucked into the body case 1 through the airflow suction portion 2. Subsequently, the air passes through a cyclonic separating unit 5 and then a filter 5a.

[0017] A part of the airflow passing through the filter 5a flows through a humidifying body 6 while the remaining part of the airflow flows around the humidifying body 6 without flowing through the humidifying body 6. Then, the airflow passes through the fan 4 and is discharged to the outside of the body case 1 through the airflow discharge portion 3.

[0018] Specifically, large particles in the dust contained in the airflow sucked into the body case 1 through the airflow suction portion 2 are swirled and separated by the cyclonic separating unit 5 and are then collected in a dust collection box 7.

[0019] Small particles in the dust contained in the airflow sucked into the body case 1 through the airflow suction portion 2 pass through the cyclonic separating unit 5 and are then collected in the filter 5a.

[0020] A part of the airflow from which the dust is removed is humidified as it passes through the humidifying body 6. The humidified airflow and the airflow passing by the humidifying body 6 without being humidified pass through the fan 4. Thereafter, the airflow passing through the fan 4 is discharged to the outside of the body case 1 through the airflow discharge portion 3.

[0021] As shown in Figs. 3 and 4, the cyclonic separating unit 5 of the present embodiment includes a plurality of cylinders 8 arranged side by side in a horizontal direction.

[0022] Each cylinder 8 includes an airflow inlet 9 disposed at one end side (lower end side) thereof and an airflow outlet 10 disposed at the other end side (upper end side) thereof.

[0023] A swirling unit 11 having a spiral-shaped surface is disposed in the cylinder 8 between the airflow inlet 9 and the airflow outlet 10.

[0024] A dust exhaust port 12 is formed in a circumferential wall of the cylinder 8 between the swirling unit 11 and the airflow outlet 10.

[0025] A mesh filter 13 shown in Figs. 4 to 6 is disposed between the swirling unit 11 and the airflow outlet 10 in the cylinder 8.

[0026] As shown in FIG. 4, the mesh filter 13 includes a reticulated cylinder body 16 and a reticulated cover 17. The reticulated cylinder body 16 has an airflow-outlet-side opening 14 connected to the airflow outlet 10 and a swirling-unit-side opening 15 directed to the swirling unit 11. The reticulated cover 17 is configured to cover the swirling-unit-side opening 15 of the reticulated cylinder body 16.

[0027] The reticulated cover 17 includes a protrusion portion axially protruding toward the swirling unit 11 at the center of the reticulated cover 17 and has such a shape that the reticulated cover body 17 is gradually inclined from the protrusion portion toward the airflow outlet 10 up to the outer peripheral portion thereof.

[0028] Specifically, as shown in Figs. 6A and 6B, the reticulated cover 17 has a cone shape having a protrusion portion axially protruding toward the swirling unit 11 at the center thereof and is gradually inclined from the protrusion portion toward the airflow outlet 10 up to the outer peripheral portion thereof.

[0029] The swirling-unit-side opening 15 of the reticulated cylinder body 16 is flush with a swirling-unit-side end portion of the dust exhaust port 12 as shown in Fig. 4, or may be disposed at the side of the airflow outlet 10 with respect to the swirling-unit-side end portion of the dust exhaust port 12.

[0030] In the present embodiment, the cylinders 8 each having a cylindrical shape are arranged side by side in the horizontal direction. Thus, a plate-shaped cover 18 is provided at the side of the airflow outlet 10 of the cyclonic separating unit 5 and the airflow outlet 10 of each of the cylinders is formed in the plate-shaped cover 18, as shown in Fig. 3.

[0031] With this configuration, the airflow outlet 10 is smaller in diameter than the cylinder 8 as shown in Fig.

4. The airflow-outlet-side opening 14 of the reticulated cylinder body 16 disposed in the cylinder 8 is mounted to a flange 19 which protrudes from the airflow outlet 10 into the cylinder 8, whereby the position of the mesh filter 13 can be set in the cylinder 8.

[0032] In the present embodiment, as shown in Fig. 5, the shape of the mesh filter 13 is maintained by a support member 13a. The support member 13a may be omitted as long as the mesh filter 13 has the strength large enough to maintain the shape thereof.

[0033] In the configuration described above, when the fan 4 is driven, an air existing outside the body case 1 is sucked into the body case 1 through the airflow suction portion 2. Subsequently, the sucked air passes through the cyclonic separating unit 5 and then the filter 5a.

[0034] A part of the airflow passing through the filter 5a flows through the humidifying body 6 while the remaining part of the airflow flows around the humidifying body 6. Then, the airflow passes through the fan 4 and is discharged to the outside of the body case 1 through the airflow discharge portion 3.

[0035] Specifically, large particles in the dust contained in the airflow sucked into the body case 1 through the airflow suction portion 2 are swirled and separated by the cyclonic separating unit 5 and are then collected in the dust collection box 7.

[0036] Small particles in the dust contained in the airflow sucked into the body case 1 through the airflow suction portion 2 pass through the cyclonic separating unit 5 and are then collected in the filter 5a.

[0037] A part of the airflow from which the dust is removed is humidified as it passes through the humidifying body 6. The humidified airflow and the airflow passing by the humidifying body 6 without being humidified pass through the fan 4. Thereafter, the airflow passing through the fan 4 is discharged to the outside of the body case 1 through the airflow discharge portion 3.

[0038] One of the features of the present embodiment resides in that the mesh filter 13 is installed between the swirling unit 11 and the airflow outlet 10 in the cylinder 8 of the cyclonic separating unit 5.

[0039] Furthermore, the mesh filter 13 includes the reticulated cylinder body 16 having an airflow-outlet-side opening 14 connected to the airflow outlet 10 and the swirling-unit-side opening 15 directed to the swirling unit 11, and the reticulated cover 17 configured to cover the swirling-unit-side opening 15 of the reticulated cylinder body 16.

[0040] Moreover, the reticulated cover 17 includes the protrusion portion axially protruding toward the swirling unit 11 at the center thereof and has such a shape that the reticulated cover 17 is gradually inclined from the protrusion portion toward the airflow outlet 10 up to the outer peripheral portion thereof.

[0041] For that reason, even if a dust such as a long hair is sucked, it is possible to exhaust such dust to the dust exhaust port 12 by moving it along the slant surface of the mesh filter 13. As a result, it is possible to increase the dust collecting effect.

[0042] In addition, in the configuration of the mesh filter 13 described above, the mesh filter 13 according to the present embodiment has a large air passage area, so that it is possible to suppress an increase of an air passage resistance and, consequently, to increase the dust collecting effect.

[0043] Moreover, since the reticulated cover 17 includes the protrusion portion axially protruding toward the swirling unit 11 at the center thereof and has such a shape that the reticulated cover 17 is gradually inclined from the protrusion portion toward the airflow outlet 10 up to the outer peripheral portion thereof, the space between the spiral swirling unit 11 and the reticulated cover 17 grows larger toward the circumferential wall of the cylinder 8. Thus, a swirling airflow is allowed to easily flow toward the outer circumference of the cylinder 8 where the space is large. It is therefore possible to restrain a resistance when the swirling airflow is swirled by the swirling unit 11. As a result, it is possible to increase the dust collecting effect.

[0044] In the embodiment described above, there is described the reticulated cover 17 having the cone shape. However, the reticulated cover 17 may have a hemispherical shape that has the protrusion portion axially protruding toward the swirling unit 11 at the center thereof and is gradually inclined from the protrusion portion toward the airflow outlet 10 over the outer peripheral portion thereof.

[0045] Further, in the embodiment described above, the reticulated cylinder body 16 and the reticulated cover 17 of the mesh filter 13 are one-piece formed by a synthetic resin. However, if there is a problem of dust adherence due to the static electricity, at least the reticulated cover 17 may be imparted with conductivity.

[0046] For example, at least the reticulated cover 17 may be made of an electrically conductive resin or a metal.

Industrial Applicability

[0047] As described above, in the present invention, the mesh filter is installed between the swirling unit and the airflow outlet in the cylinder of the cyclonic separating unit. The mesh filter includes the reticulated cylinder body having the airflow-outlet-side opening connected to the airflow outlet and the swirling-unit-side opening directed to the swirling unit, and the reticulated cover configured to cover the swirling-unit-side opening of the reticulated cylinder body. Further, the reticulated cover includes the protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to an outer peripheral portion thereof. It is therefore possible to increase the dust collecting effect.

[0048] That is to say, with such configuration, even if a dust such as a long hair is sucked, it is possible to

exhaust such dust to the outer dust exhaust port by moving it along a slant surface of the mesh filter. As a result, it becomes possible to increase the dust collecting effect.

[0049] Furthermore, in this configuration, the mesh filter has a large air passage area. As a result, it becomes possible to suppress an increase of an air passage resistance and, consequently, to increase the dust collecting effect.

[0050] Moreover, the reticulated cover includes the protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to the outer peripheral portion thereof. It is therefore possible to restrain a resistance when the airflow is swirled by the swirling unit. As a result, it becomes possible to increase the dust collecting effect.

[0051] Accordingly, it is expected that the dust collecting device according to the embodiment can be utilized as a dust collector in households or offices.

[0052] While the foregoing has described what are considered to be the best mode and/or other examples, it is understood that various modifications may be made therein and that the subject matter disclosed herein may be implemented in various forms and examples, and that they may be applied in numerous applications, only some of which have been described herein. It is intended by the following claims to claim any and all modifications and variations that fall within the true scope of the present teachings.

Claims

1. A dust collecting device, comprising:

a body case having an airflow suction portion and an airflow discharge portion;
a fan installed in the body case and configured to discharge an airflow sucked into the body case through the airflow suction portion to the outside of the body case through the airflow discharge portion; and
a cyclonic separating unit configured to swirl, by the fan, the airflow sucked into the body case through the airflow suction portion and to separate dust contained in the sucked airflow,
wherein the cyclonic separating unit includes a cylinder having an airflow inlet disposed at one end thereof and an airflow outlet disposed at the other end thereof; a swirling unit provided between the airflow inlet and the airflow outlet in the cylinder; a dust exhaust port provided in a circumferential wall of the cylinder extending between the swirling unit and the airflow outlet; and a mesh filter provided between the swirling unit and the airflow outlet in the cylinder,
the mesh filter includes a reticulated cylinder body having an airflow-outlet-side opening connected to the airflow outlet and a swirling-unit-side opening directed to the swirling unit, and a reticulated cover configured to cover the swirling-unit-side opening of the reticulated cylinder body, and
the reticulated cover includes a protrusion portion axially protruding toward the swirling unit at the center thereof and has such a shape that the reticulated cover is gradually inclined from the protrusion portion toward the airflow outlet up to an outer peripheral portion thereof.

2. The dust collecting device of claim 1, wherein the reticulated cover has a cone shape.

3. The dust collecting device of claim 1, wherein the reticulated cover has a hemispherical shape.

4. The dust collecting device of any one of claims 1 to 3, wherein the swirling-unit-side opening of the reticulated cylinder body is flush with a swirling-unit-side end portion of the dust exhaust port.

5. The dust collecting device of any one of claims 1 to 3, wherein the swirling-unit-side opening of the reticulated cylinder body is disposed at the side of the airflow outlet with respect to the swirling-unit-side end portion of the dust exhaust port.

6. The dust collecting device of any one of claims 1 to 5, wherein at least the reticulated cover is imparted with conductivity.

7. The dust collecting device of any one of claims 1 to 6, further comprising a plate-shaped cover, wherein the airflow outlet of the cyclonic separating unit is formed in the plate-shaped cover body.

8. The dust collecting device of claim 7, wherein the airflow outlet is smaller in diameter than the cylinder, and the airflow-outlet-side opening of the reticulated cylinder body in the cylinder is mounted to a flange protruding from the airflow outlet into the cylinder.

FIG. 1

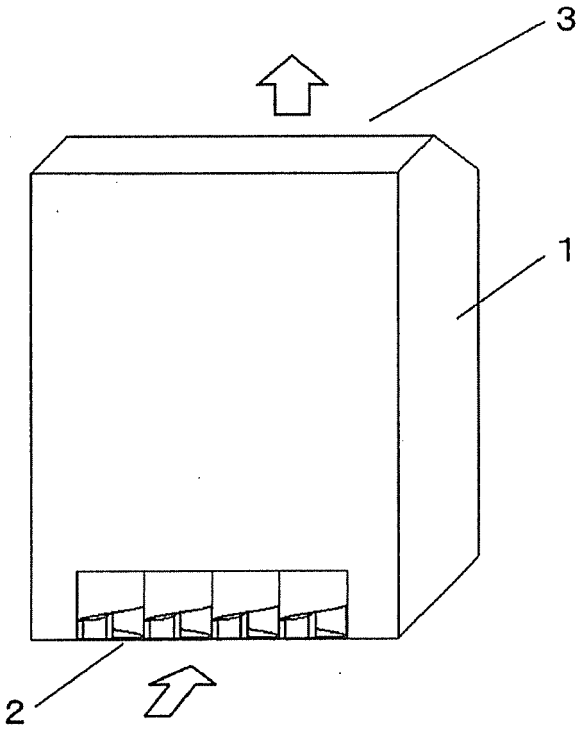


FIG. 2

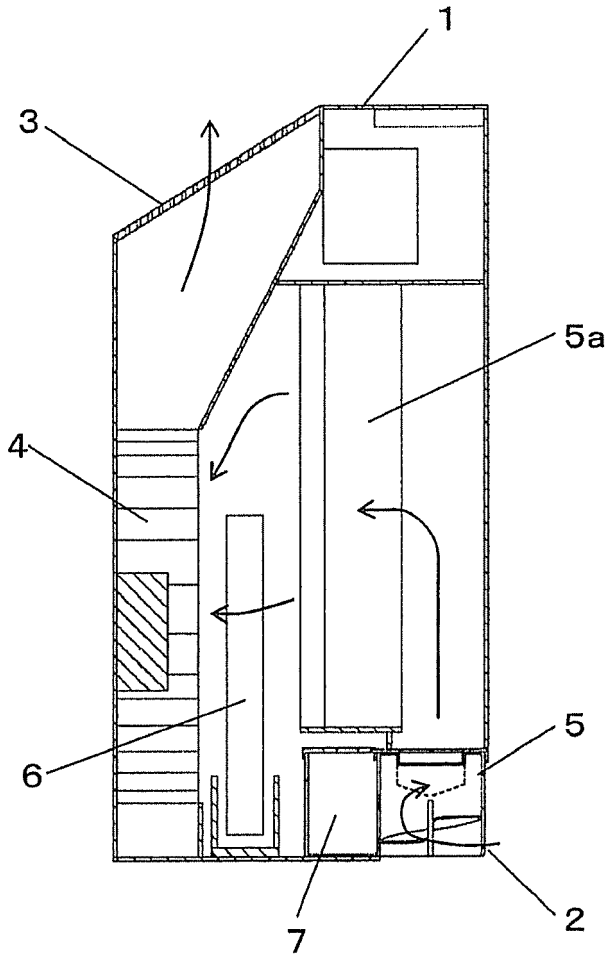


FIG. 3

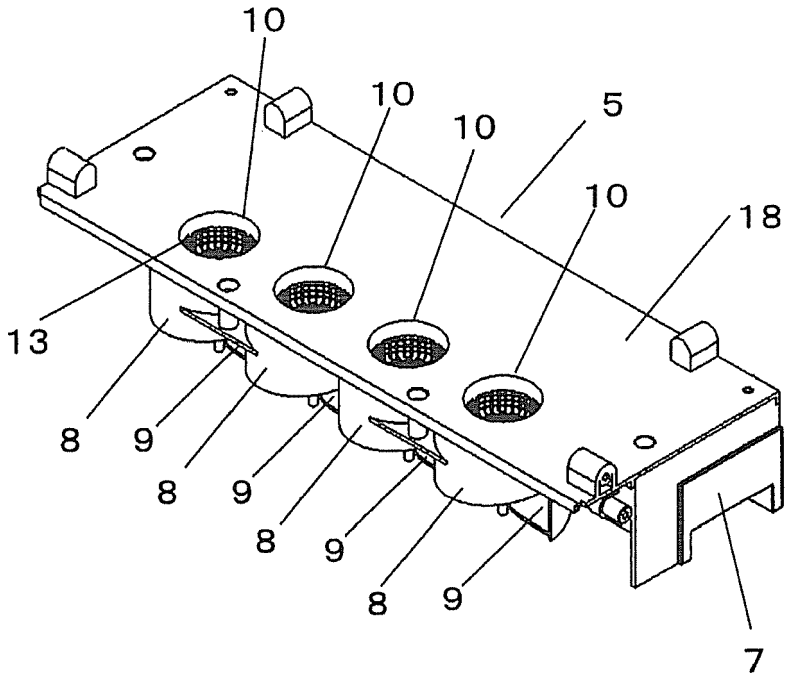


FIG. 4

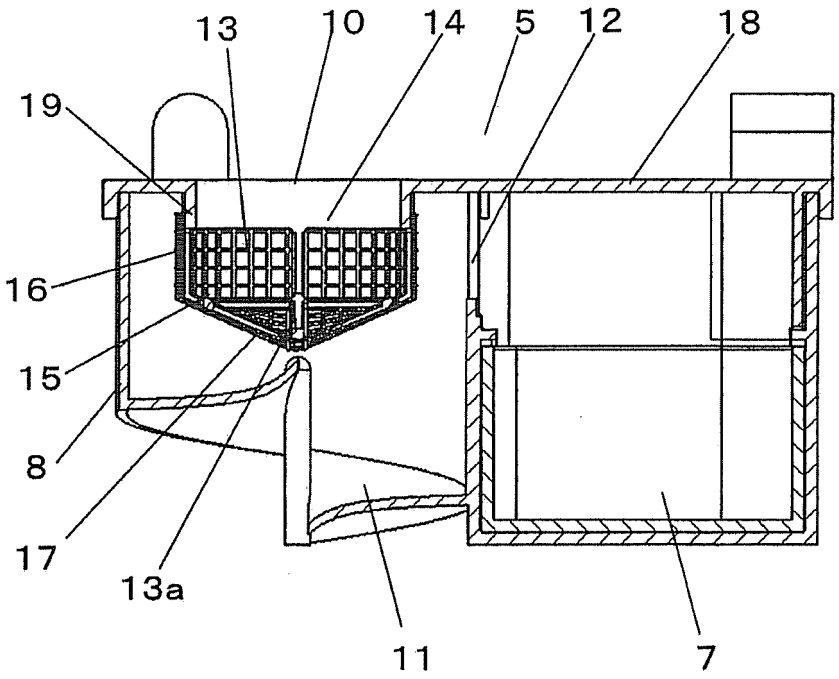


FIG.5

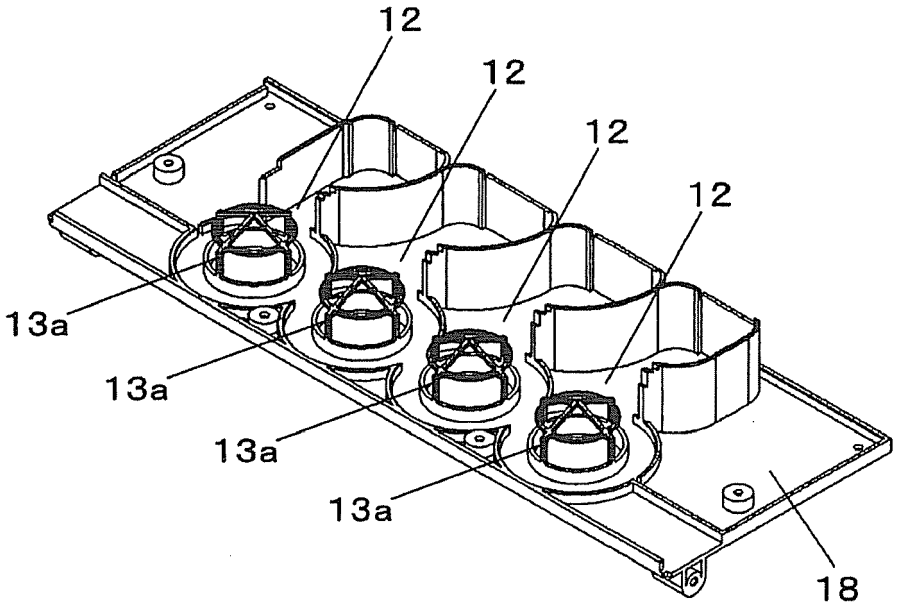


FIG. 6A

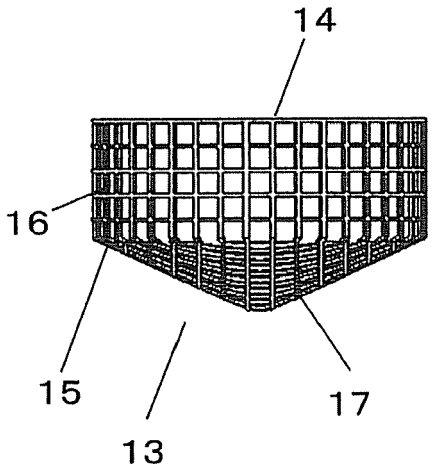
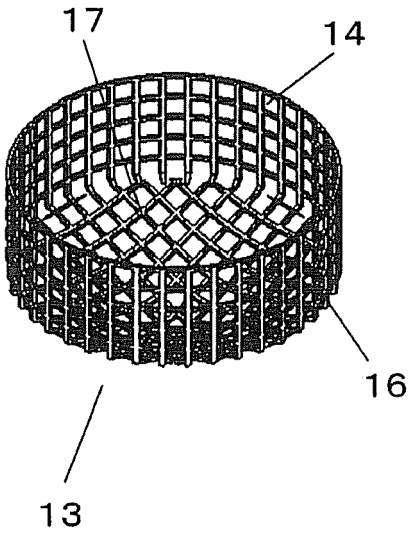


FIG. 6B



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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 7491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

A47L
B04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 July 2015	Lopez Vega, Javier

CATEGORY OF CITED DOCUMENTS

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01-07-2015

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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