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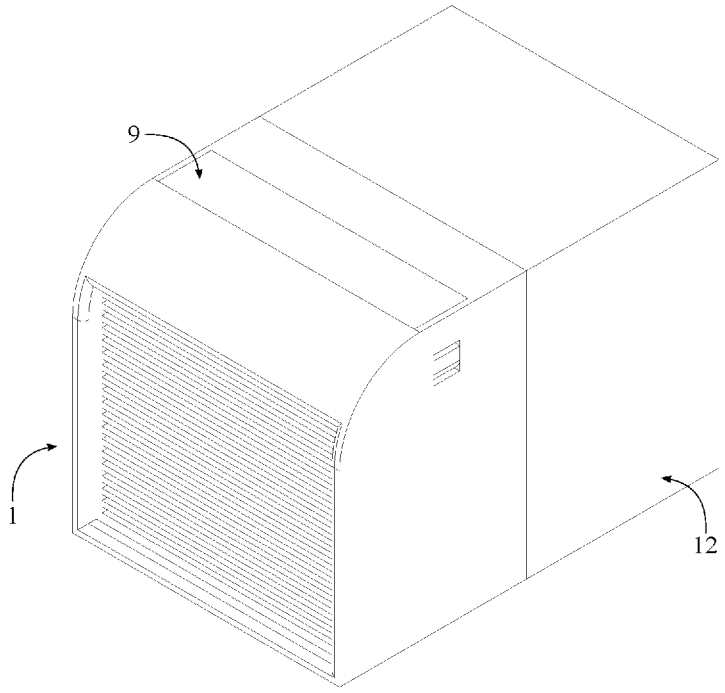
(54) Title: TWO-STAGE AIR FILTRATION SYSTEM

FIG. 1




(57) Abstract: A two-stage air filtration system includes a solid matter filtration unit, an active charcoal filter, a liquid matter filtration unit, and a quantity of distilled water infused with positively charged liquid nano silver particles. The active charcoal filter is removably attached to the solid matter filtration unit to initiate a first stage of air filtration for ambient air that is withdrawn through a plurality of inlets of the solid matter filtration unit. The quantity of distilled water infused with positively charged liquid nano silver particles is enclosed within the liquid matter filtration unit to initiate a second stage of air filtration after the first stage of air filtration is completed. Purified air is then discharged through an outlet channel of the liquid matter filtration unit for consumption.

[Continued on next page]

EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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# Two-Stage Air Filtration System

The current application claims priority to a U.S. provisional application serial number 62/409,972 filed on October 19, 2016.

## FIELD OF THE INVENTION

The present invention relates generally to an air filtration system. More specifically, the present invention is a two-stage air filtration system that efficiently removes air pollutants through an active charcoal filter and a quantity of distilled water infused with positively charged liquid nano silver particles.

## BACKGROUND OF THE INVENTION

The field of air purification, more particularly the removal of pollutants in the breathable air, is important for an individual's health as the air pollutants are substantially dangerous to human health and human respiratory system. Depending on one's geographic the amount of exposure to harmful air pollutants can rise to dangerous levels in short periods of time, which impact all ages of demographic. Especially elderly and young children, all of which result in loss of life as it pertains to quality of health, can have increase morbidity rate in that of consequential diseases and premature total loss of life. In these instances, wherein an individual must be exposed to these air pollutants due to normal functions of life and do not have the option efficiently clean breathable air.

it is therefore an object of the present invention to provides a system that can efficiently purify breathable air through an active charcoal filter and a quantity of distilled water infused with positively charged liquid nano silver particles. The present invention can be implemented into gas mask, air conditioning unit of automobiles, civil funded public transportation, private transportation, air conditioning units of building

structures, and any other similar entity that includes ambient air so that the breathable air can be filtered and purified to provide steady supply of clean breathable air.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the present invention.

FIG. **2** is an exploded view of the present invention.

FIG. **3** is a front view of the present invention, showing the plane upon which a cross sectional view is taken shown in FIG. **4**.

FIG. **4** is a cross section view the present invention taken along line A-A of FIG. **3**.

FIG. **5** is a perspective view for the active charcoal filter of the present invention.

FIG. **6** is a front perspective view for the solid matter filtration unit of the present invention.

FIG. **7** is a rear perspective view for the solid matter filtration unit of the present invention.

FIG. **8** is a side view for the solid matter filtration unit of the present invention showing the internal component of the first housing.

FIG. **9** is a side view for the liquid matter filtration unit of the present invention, showing the plane upon which a cross sectional view is taken shown in FIG. **10**.

FIG. **10** is a cross section view for the liquid matter filtration unit of the present invention taken along line A-A of FIG. **9**.

## DETAIL DESCRIPTIONS OF THE INVENTION

All illustrations of the drawings are for the purpose of describing selected versions of the present invention and are not intended to limit the scope of the present invention.

The present invention is a two-stage air filtration system that purifies pollutant air into clean breathable air. The present invention can be implemented to variety of entities

for functionality, wherein the entities can include, but is not limited to, gas mask, cars, trucks, sport utilities, air planes, trains, buses, taxi cabs, bus stations, train stations, air ports, residential buildings, hospitals, factories, manufacturing plants, government buildings, and schools, wherein the appropriate scale to adapt adequate amount of air filtration for specific area based upon the amount of anticipated consumption.

As shown in FIG. **1-4**, the present invention comprises a solid matter filtration unit **1**, an active charcoal filter **9**, a liquid matter filtration unit **12**, and a quantity of distilled water infused with positively charged liquid nano silver particles **21**. In reference to the general configuration, the active charcoal filter **9** is removably integrated into the solid matter filtration unit **1** completing a first stage of air filtration for the present invention. The quantity of distilled water influsedwith positively charged nano silver particles **21** is enclosed within the liquid matter filtration unit **12** completing a second stage of air filtration for the present invention. The solid matter filtration unit **1** and the liquid matter filtration unit **12** are adjacently attached to each other with a fastening mechanism that easily allows the solid matter filtration unit **1** and the liquid matter filtration unit **12** to be separated when necessary. The fastening mechanism can include, but is not limited to, a pair of compression fit tabs, a plurality of securing screws, and a plurality of securing tabs. A plurality of inlets **3** of the solid matter filtration unit **1** is in fluid communication with an outlet **8** of the solid matter filtration unit **1** through the active charcoal filter **9** thus completing the first stage of air filtration. The outlet **8** is in fluid communication with an inlet channel **14** of the liquid matter filtration unit **12** so that a partially purified air flow from the solid matter filtration unit **1** can discharge into the liquid matter filtration unit **12**. The inlet channel **14** is in fluid communication with an outlet channel **20** of the liquid matter filtration unit **12** through the quantity of distilled water infused with positively charged liquid nano silver particles **21** in order to complete the second stage of air filtration. The present invention then discharges a fully purified air flow from the outlet channel **20**.

The solid matter filtration unit **1** that withdraws ambient air from the surrounding for the first stage of air filtration further comprises a first housing **2**, a first collecting compartment **4**, an opening **5**, a second collecting compartment **6**, and a funnel **7** in addition to the plurality of inlets **3** and the outlet **8**. In reference to FIG. **6-8**, the first

collecting compartment **4** is positioned within the first housing **2** and delineates the opening **5** that provide access to the first collecting compartment **4**. More specifically, the opening **5** provides an empty area within the first housing **2** so that the active charcoal filter **9** can be inserted into the first collecting compartment **4**. The plurality of inlets **3** traverses from a front surface **22** of the first housing **2** into the first collecting compartment **4**. Resultantly, the plurality of inlets **3** is in fluid communication with the first collecting compartment **4** through the first housing **2**. The second collecting compartment **6** is positioned within the first housing **2**, adjacent to the first collecting compartment **4**. The first collecting compartment **4** is in fluid communication with the second collecting compartment **6** through the funnel **7**. More specifically, the funnel **7** is concentrically positioned with the first collecting compartment **4** and the second collecting compartment **6** so that the partially purified air flow of the present invention can be efficiently collected from the first collecting compartment **4** and discharged into the second collecting compartment **6**. The outlet **8** is connected to the first housing **2**, adjacent to the second collecting compartment **6**, and is in fluid communication with the second collecting compartment **6** through the first housing **2** in order to provide an unobstructed path for the partially purified air flow.

The active charcoal filter **9** that is inserted into the first collecting compartment **4** through the opening **5** comprises a cap section **10** and an active charcoal section **11**. In reference to FIG. **2** and FIG. **5**, the cap section **10** and the active charcoal section **11** are adjacently connected with each other to ensure proper placement within the first housing **2**. When the active charcoal filter **9** is inserted into the first collecting compartment **4** through the opening **5**, the cap section **10** is hermetically attached to the first collecting compartment **4** by a fastening mechanism that can include, but is not limited to, a pair of compression fit tabs, a plurality of securing screws, and a plurality of securing tabs. The active charcoal section **11** is then positioned within the first collecting compartment **4** and concentrically positioned in between the plurality of inlets **3** and funnel **7**. As a result, the plurality of inlets **3** is in fluid communication with the funnel **7** through the active charcoal section **11** initiating the first stage of air filtration. Since the solid state of the active charcoal section **11** maintains a fixed volume and shape, the active charcoal section **11** effectively functions as a single component of filtration by use of solid state

matter due to the characteristic of component particles when interacting with targeted particulate matter as pollutants. By maintaining a close proximity within the first collecting compartment **4**, the fixed volume of the active charcoal section **11** causes particulate matters and pollutants to become trapped within the active charcoal section **11**.

The liquid matter filtration unit **12** withdraws the partially purified air flow from the outlet **8** of the solid matter filtration unit **1** to the inlet channel **14** in order to initiate the second stage of air filtration. The liquid matter filtration unit **12** further comprises a second housing **13**, a first check valve **15**, an intermediate chamber **16**, at least one second check valve **17**, an outer chamber **18**, and a third check valve **19** in addition to the inlet channel **14** and the outlet channel **20**. In reference to FIG. **4** and FIG. **9-10**, the inlet channel **14** and the outlet channel **20** are traversed into the second housing **13** while the intermediate chamber **16** and the outer chamber **18** are positioned within the second housing **13**. Collectively, the inlet channel **14**, the outlet channel **20**, the intermediate chamber **16**, and the outer chamber **18** delineate the shape of the second housing **13**. The first check valve **15** traverses from the inlet channel **14** to the intermediate chamber **16**, wherein the inlet channel **14** is in fluid communication with the intermediate chamber **16** with the first check valve **15**. Resultantly, the partially purified air flow is able to discharge into the intermediate chamber **16** through the first check valve **15**.

In reference to FIG. **4** and FIG. **9-10**, the at least one second check valve **17** traverses from the intermediate chamber **16** to the outer chamber **18** as the quantity of distilled water infused with positively charged liquid nano silver particles **21** is enclosed within the intermediate chamber **16** to initiate the second stage of air filtration. More specifically, the first check valve **15** is in fluid communication with the at least one second check valve **17** through the quantity of distilled water infused with positively charged liquid nano silver particles **21**. A fixed quantity of distilled water infused with positively charged liquid nano silver particles **21** effectively functions as a single component of filtration by use of liquid state matter due to the characteristic of component particles when interacting with targeted particulate matter as pollutants. By maintaining the characteristic of variable shape and suspension of liquid state matter within the intermediate chamber **16** particulate matters and pollutants are trapped within

the quantity of distilled water infused with positively charged liquid nano silver particles **21**. As a result, the at least one second check valve **17** allows the fully purified air flow to be discharged from the intermediate chamber **16** to the outer chamber **18** while retaining the quantity of distilled water infused with positively charged liquid nano silver particles **21** within the intermediate chamber **16**.

In reference to FIG. **4** and FIG. **9-10**, the third check valve **19** traverses from the outer chamber **18** to the outlet channel **20**. Furthermore, the at least one second check valve **17** is in fluid communication with the third check valve **19** through the outer chamber **18**, and the third check valve **19** is in fluid communication with the outlet channel **20**. As a result, the third check valve **19** allows the fully purified air flow to be discharged from the outer chamber **18** to the outlet channel **20** so that the outlet channel **20** is able to discharge the fully purified air flow from the present invention.

Since the present invention utilizes both the active charcoal filter **9** and the quantity of distilled water infused with positively charged liquid nano silver particles **21** to produce the fully purified air flow from ambient air, the two independent processes function as one continuous process and provide a more effective filtration process. The first stage of air filtration and the second stage of air filtration that are used in combination effectively remove harmful particulate matter within a specific range of size to filtered breathable air, reducing the harmful health effects of particulate matter to the human body, which due to the size, penetrate the thoracic region of the respiratory system. Preferably, the present invention targets nonspecific particulate matter ranging in size from 10 microns to + or - 2.5 microns.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A two-stage air filtration system comprises:

a solid matter filtration unit;

an active charcoal filter;

a liquid matter filtration unit;

a quantity of distilled water infused with positively charged liquid nano silver particles;

the solid matter filtration unit comprises a plurality of inlets and an outlet;

the liquid matter filtration unit comprises an inlet channel and an outlet channel;

the active charcoal filter being removably integrated into the solid matter filtration unit;

the quantity of distilled water infused with positively charged liquid nano silver particles being enclosed within the liquid matter filtration unit;

the solid matter filtration unit and the liquid matter filtration unit being adjacently attached to each other;

the plurality of inlets being in fluid communication with the outlet through the active charcoal filter;

the outlet being in fluid communication with the inlet channel; and

the inlet channel being in fluid communication with the outlet channel through the quantity of distilled water infused with positively charged liquid nano silver particles.

2. The two-stage air filtration system as claimed in claim 1 comprises:

the solid matter filtration unit further comprises a first housing, a first collecting compartment, an opening, a second collecting compartment, and a funnel;

the first collecting compartment being positioned within the first housing;

the opening being delineated by the first collecting compartment;

the plurality of inlets traversing from a front surface of the first housing into the first collecting compartment;

the plurality of inlets being in fluid communication with the first collecting compartment through the first housing;

the second collecting compartment being positioned within the first housing, adjacent to the first collecting compartment;

the first collecting compartment being in fluid communication with the second collecting compartment through the funnel;

the outlet being connected to the first housing, adjacent to the second collecting compartment; and

the second collecting compartment being in fluid communication with the outlet through the first housing.

3. The two-stage air filtration system as claimed in claim 1 comprises:

the active charcoal filter comprises a cap section and an active charcoal section; and

the cap section and the active charcoal section being adjacently connected with each other.

4. The two-stage air filtration system as claimed in claim 1 comprises:

the solid matter filtration unit further comprises a first collecting compartment, an opening, and a funnel;

the active charcoal filter comprises a cap section and an active charcoal section;

the cap section being hermetically attached to the first collecting compartment through the opening;

the active charcoal section being positioned within the first collecting compartment; and

the active charcoal section being concentrically positioned in between the plurality of inlets and funnel.

5. The two-stage air filtration system as claimed in claim 1 comprises:

the solid matter filtration unit further comprises a funnel;

the active charcoal filter comprises an active charcoal section; and

the plurality of inlets being in fluid communication with the funnel through the active charcoal section.

6. The two-stage air filtration system as claimed in claim 1 comprises:

the liquid matter filtration unit further comprises a second housing, a first check valve, an intermediate chamber, at least one second check valve, an outer chamber, and a third check valve;

the inlet channel and the outlet channel traversing into the second housing;

the intermediate chamber and the outer chamber being positioned within the second housing;

the first check valve traversing from the inlet channel to the intermediate chamber;

the at least one second check valve traversing from the intermediate chamber to the outer chamber; and

the third check valve traversing from the outer chamber to the outlet channel.

7. The two-stage air filtration system as claimed in claim 1 comprises:

the liquid matter filtration unit further comprises an intermediate chamber; and

the quantity of distilled water infused with positively charged liquid nano silver particles being enclosed within the intermediate chamber.

8. The two-stage air filtration system as claimed in claim 1 comprises:

the liquid matter filtration unit further comprises a second housing, a first check valve, an intermediate chamber, at least one second check valve, an outer chamber, and a third check valve;

the inlet channel being in fluid communication with the intermediate chamber with the first check valve;

the first check valve being in fluid communication with the at least one second check valve through the quantity of distilled water infused with positively charged liquid nano silver particles;

the at least one second check valve being in fluid communication with the third check valve through the outer chamber; and

the third check valve being in fluid communication with the outlet channel.

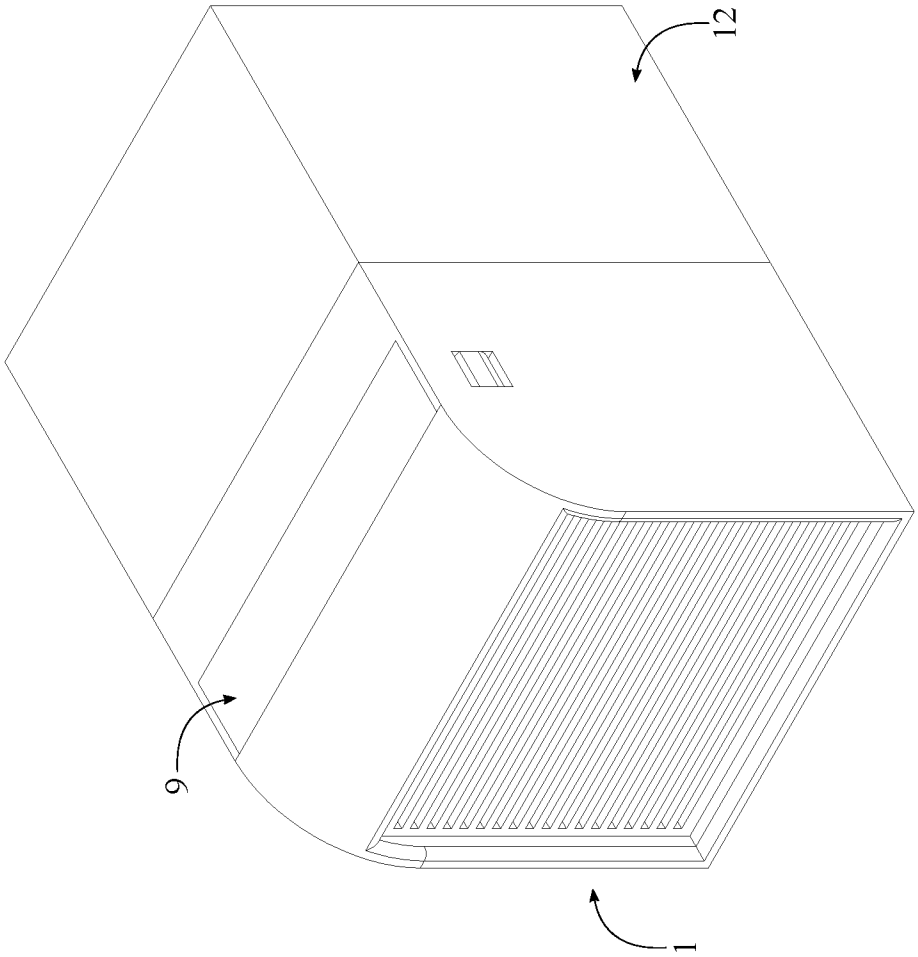


FIG. 1

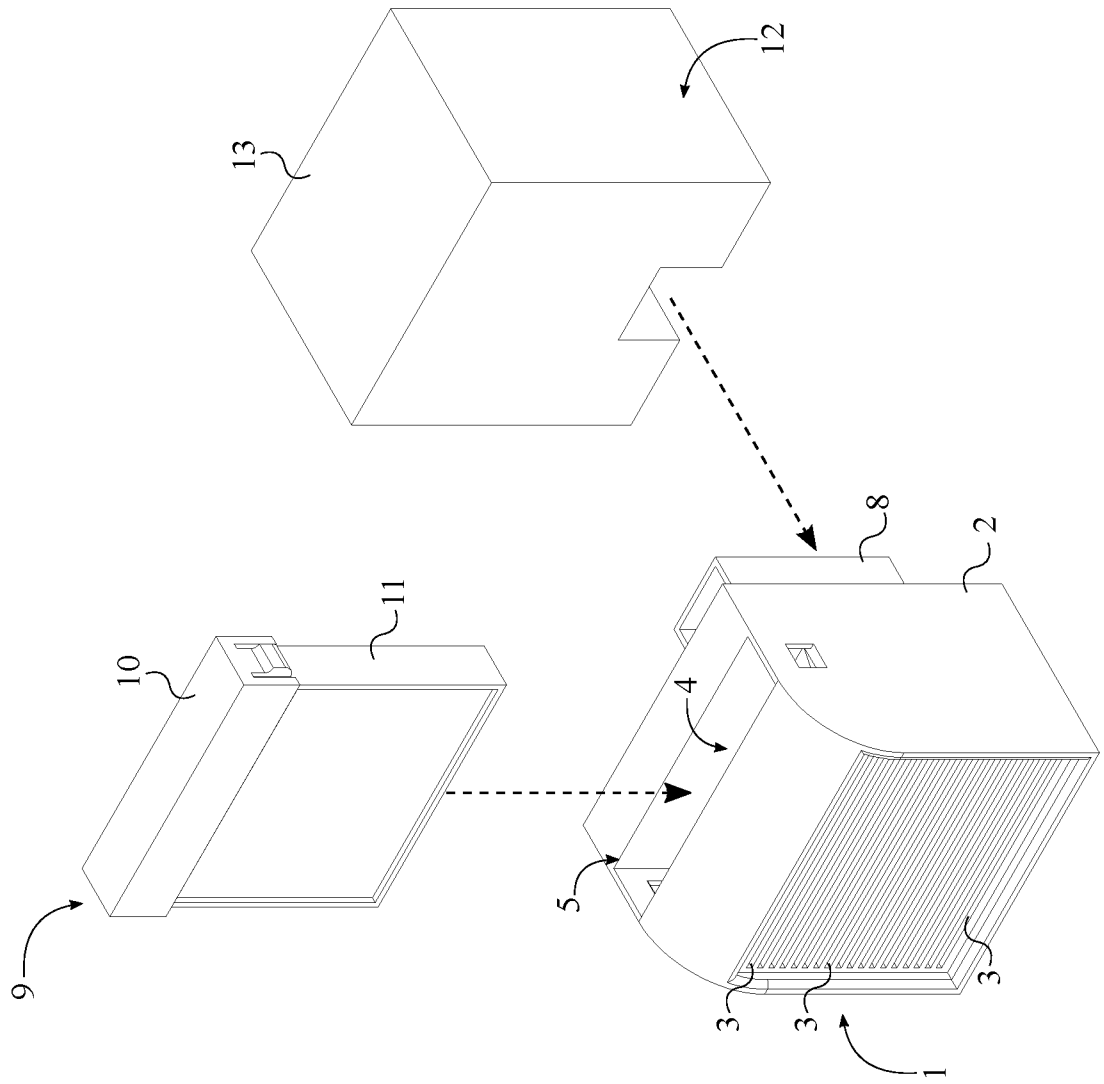


FIG. 2

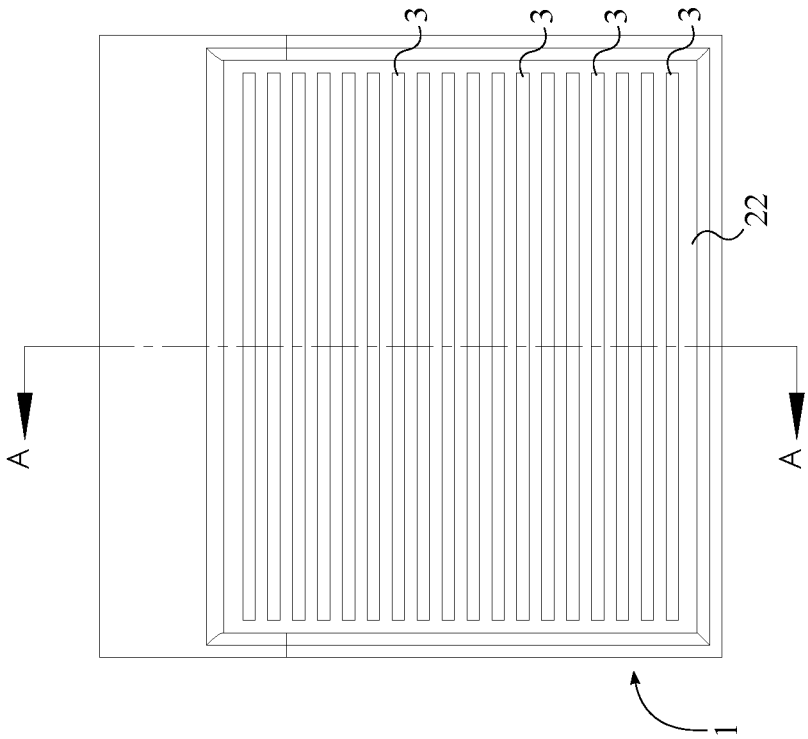


FIG. 3

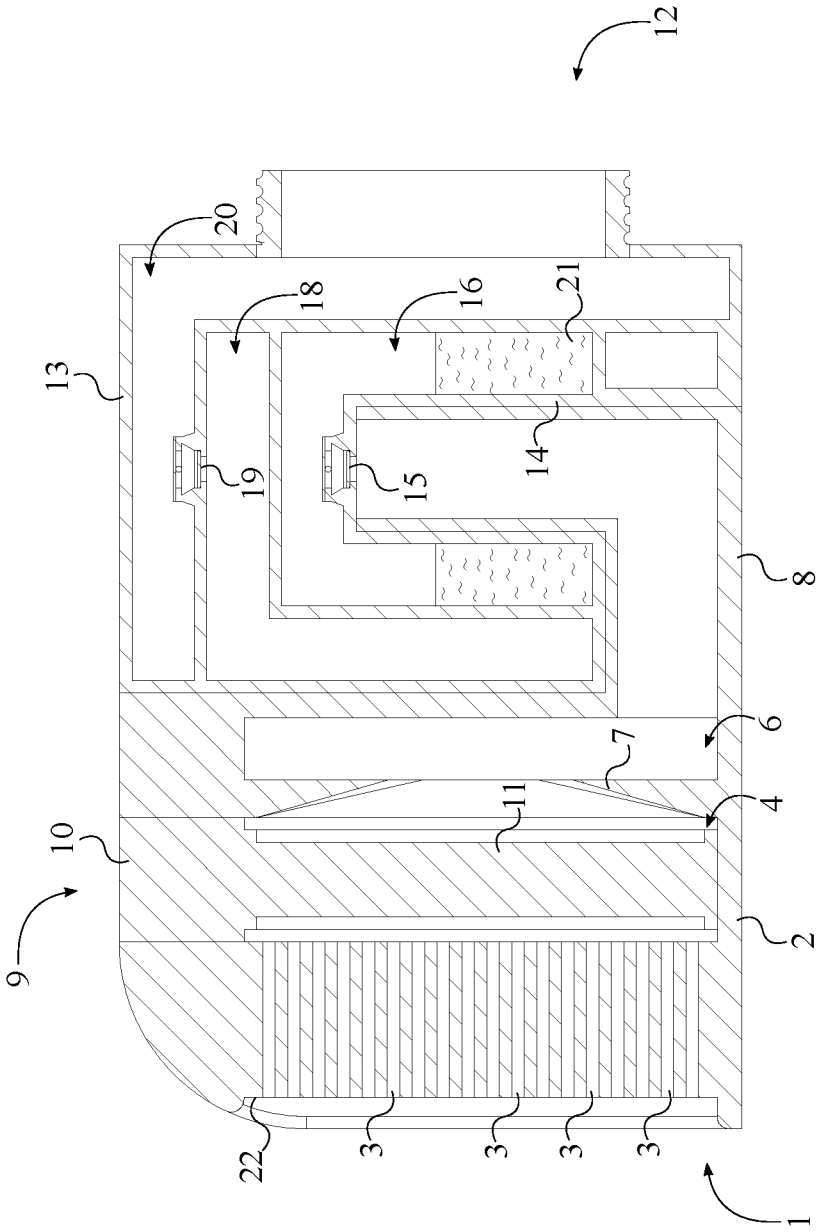


FIG. 4

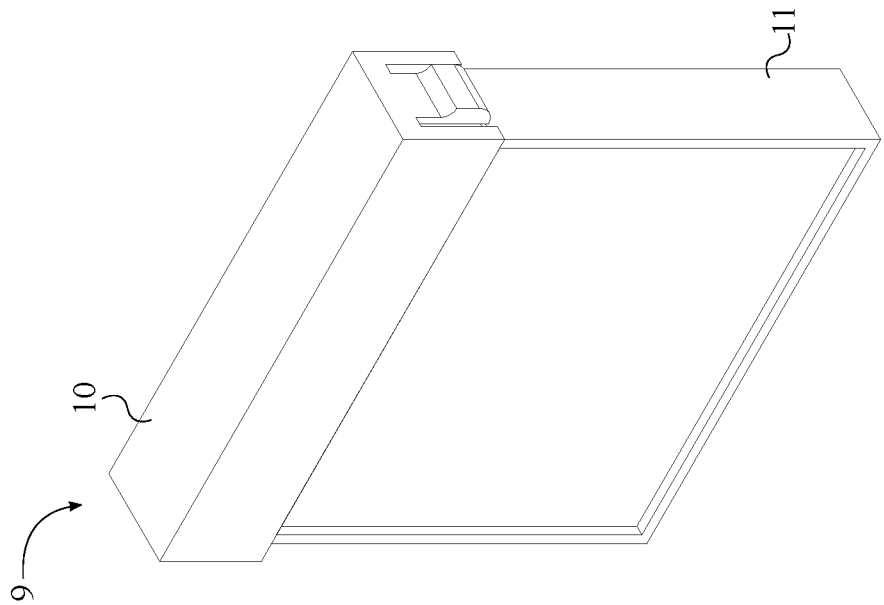


FIG. 5

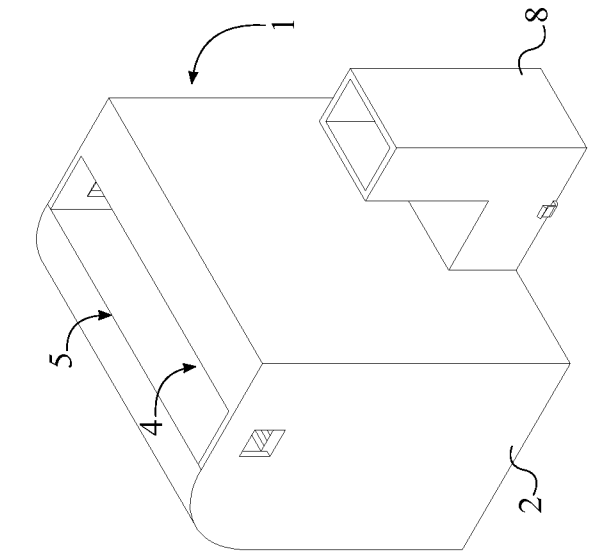


FIG. 7

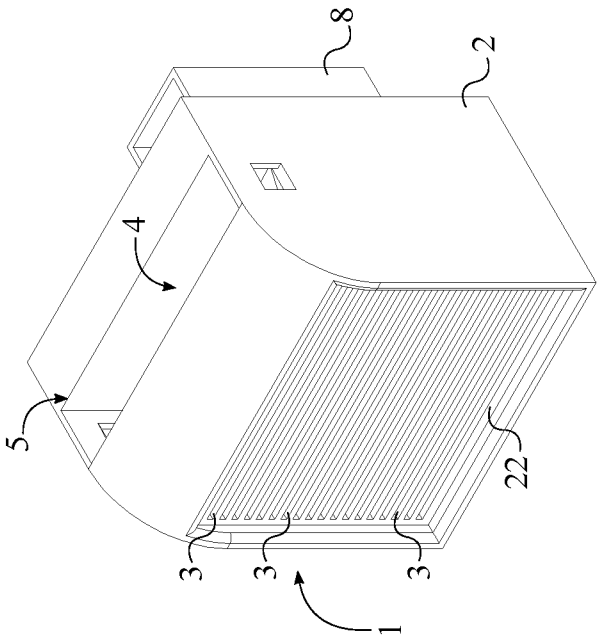


FIG. 6

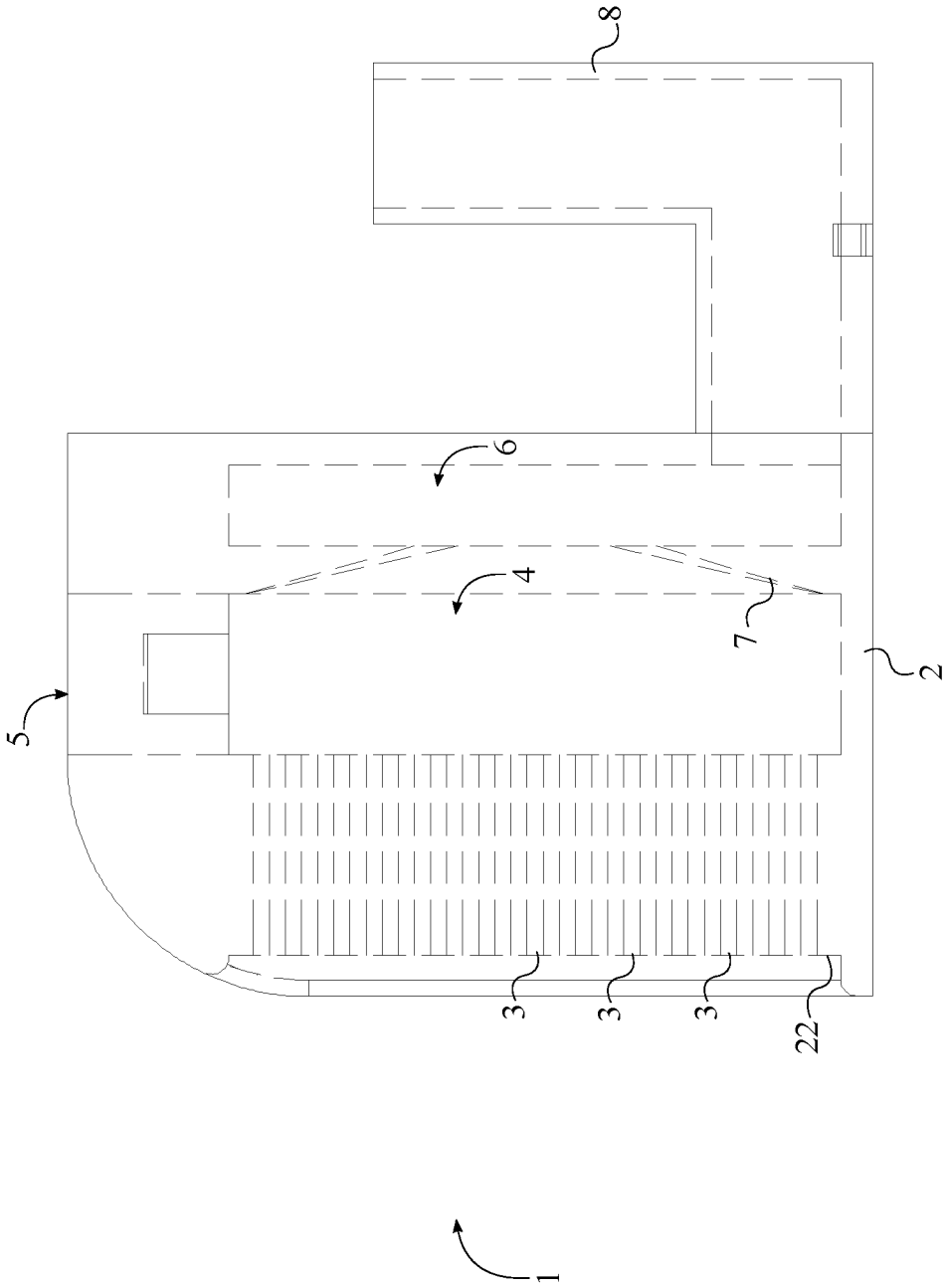


FIG. 8

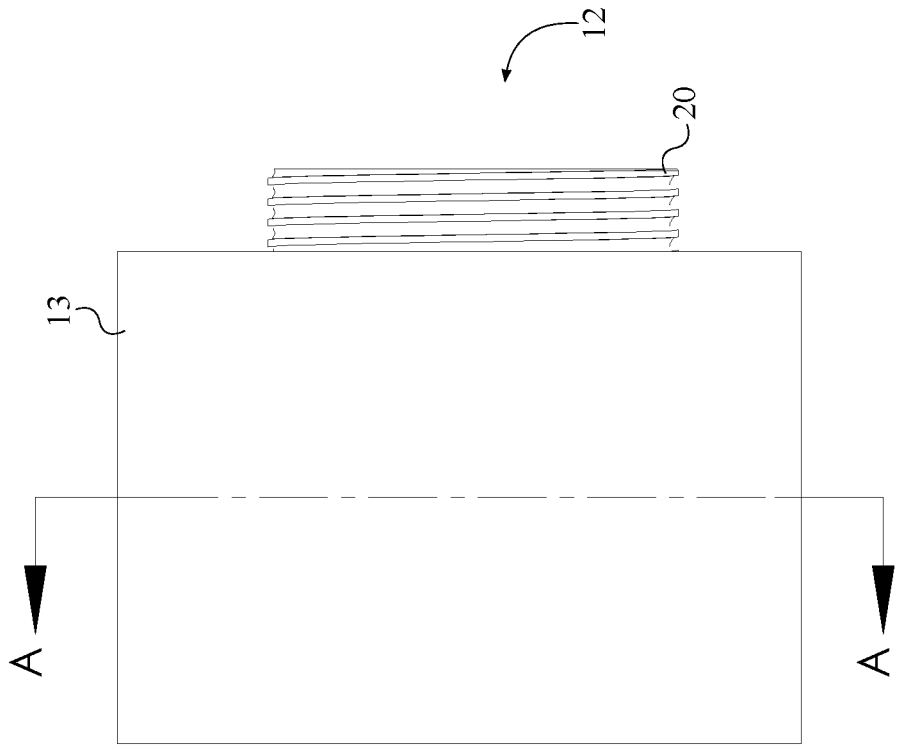


FIG. 9

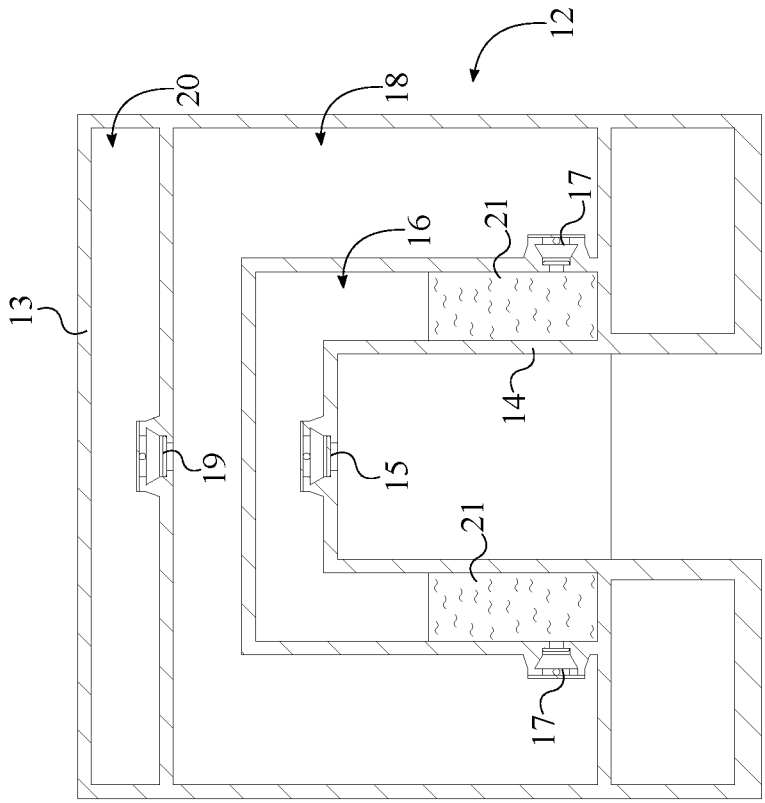


FIG. 10

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/IB 2016/057045

A. CLASSIFICATION OF SUBJECT MATTER ***B01D 50/00*** *(2006.01)*
***F24F 3/16*** *(2006.01)*

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)

A61L 9/00-9/22, A62B 9/00- 9/06, 11/00, 23/00- 23/06, B01D 45/00- 45/18, 46/00- 46/54, 47/00-47/18, 50/00, 53/00- 53/96, F24F 1/00, 3/00-3/16, 5/00, 6/00- 6/18

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)

RUPAT, PatSearch, Esp@cenet, PAJ, USPTO, DEPATISnet, PCT Online, EAPO, K-PION, KIPRIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y<br>A | KR 1020090081306 A (P&I CORPORATION INDUSTRY-ACADEMIA COOPERATION GROUP OF SEJONG UNIVERSITY) 28.07.2009, abstract, fig.1 | 1, 3, 7<br>2, 4-6, 8 |
| Y | JP 2016156536 A (PANASONIC IP MAN CORPORATION) 01.09.2016, paragraph [0018], fig.1 | 1, 3, 7 |
| A | CN 203494351 U (WANG SHAOKUN) 26.03.2014, abstract, fig.1 | 1-8 |
| A | US 2016/0138818 A1 (BONECO AG) 19.05.2016, claims, fig.1 | 1-8 |

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 26 June 2017 (26.06.2017) | 20 July 2017 (20.07.2017) |
| Name and mailing address of the ISA/RU:<br>Federal Institute of Industrial Property,<br>Berezhkovskaya nab., 30-1, Moscow, G-59,<br>GSP-3, Russia, 125993<br>Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37 | Authorized officer<br>E. Kuropatova<br>Telephone No. 495 531 65 15 |