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Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *of inventorship (Rule 4.17(iv))*

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— *with international search report (Art. 21(3))*

(54) **Title**: STERILIZING AIR CONDITIONER

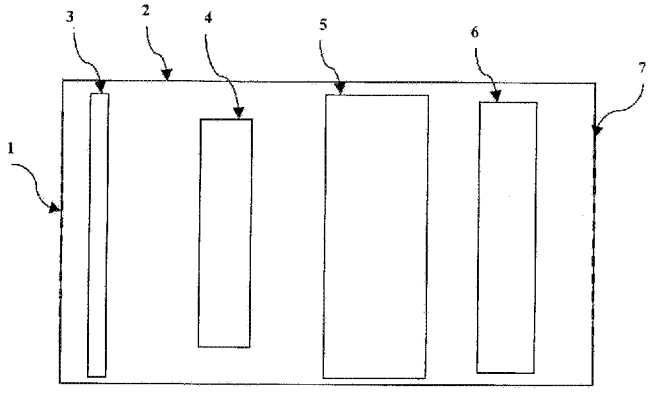

Figure 1

(57) **Abstract**: A sterilizing air conditioner that includes an air conditioner body, a dust filter, a heat exchange, a fan, and equipped with ozone stream wind generator with negative high-voltage corona wires and ground plates mounted next to dust filter. Ozone stream wind generator creates ozone stream blowing into the air conditioner while the air conditioner is off, causing ozone inside the air conditioner of sufficient concentration to destroy and inhibit the growth of germs, bacteria, viruses and fungi in the unit. Ozone is in the air conditioner at enough concentration and time to destroy germs such as bacteria, viruses and fungi. Then, the ozone stream generator is turned off, and time is allowed for ozone decomposition in order to be safe to people. After that, the fan blows air out through air inlet and ventilates new air into the unit. The cycle can be replicated at defined interval.

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Title of Invention

STERILIZING AIR CONDITIONER

Technical Field

The invention relates to sterilizing air conditioner engineering.

Background Art

The main function of air conditioners that are used nowadays is to control and adjust air temperature inside the room as set by users. Air conditioner generally consists of two parts, which are indoor unit and outdoor unit. Indoor unit ventilates air inside the room through heat exchanger filled with refrigerant, thus decreasing air temperature (in cool mode) or increasing air temperature (in heat mode). A fan or air blower is used to ventilate air into the air conditioning unit through air inlet and propel air forward through air outlet. Dust filter is also typically located at the air inlet to filter dust particles in the air before entering into the unit. Nevertheless, problems still occur as this system neither removes odor nor kill germs existing in the air.

As a consequence, some of the air conditioning models have included ozone purifiers in order to further purify air entering the air conditioning unit. Ozone is capable of eliminating odor and killing bacteria, virus, and fungi as long as sufficient ozone concentration is maintained. Ozone-generating device is located either at the air inlet between air filter and heat exchanger where air temperature is adjusted, or at the air outlet where air that exits the unit is purified after air temperature is adjusted.

However, ozone-generating device normally works only when the air conditioner is switched on. When it is switched off, area inside the air conditioner which is high in temperature and humidity will be very suitable for airborne pathogens such as bacteria, viruses, and fungi, to grow, resulting in progressive accumulation of these pathogens in many locations inside the air conditioner, namely dust filter, heat exchanger, fan, and interior surface of the air conditioner.

In regard to this problem, some air conditioners are invented to be capable of destroying and suppressing the growth of airborne pathogens (bacteria, virus, and fungi) by generating ozone when the air conditioner is switched off. Nonetheless, since there is no air circulation when the air conditioner is switched off, the problem is that ozone usually stays

within the area around its generator, without dispersing widely to every part of the area inside the air conditioner. Therefore, germs are destroyed only in the area nearby the ozone generating device. In case a fan of the air conditioner is turned on to facilitate air circulation, a concentration of ozone will decrease rapidly to the level that is no longer sufficient for killing pathogens.

Summary of the Invention

Firstly, the objective of this invention is to solve several problems that has been mentioned by providing a sterilizing air conditioner which includes an air conditioner body, a dust filter (to filter dust particles before air entering the unit), a heat exchange (to decrease, or increase, air temperature), a fan (to ventilate air from air inlet through dust filter to heat exchanger and also to blow air out toward air outlet), and an ozone stream wind generator with negative high-voltage corona wires together with ground plates located next to dust filter. Ozone stream wind generator creates ozone airflow that blows into the air conditioner when the air conditioner is switched off. This ozone stream wind generator develops an ozone concentration that is sufficient to destroy and inhibit the growth of pathogens, such as bacteria, virus, and fungi, which accumulate inside the air conditioning unit. A sterilizing air conditioner is fumigated with sufficient ozone concentration and defined time period in order to destroy airborne pathogens, such as bacteria, virus, and fungi. Then, after the ozone stream wind generator is turned off, sufficient amount of time is required for ozone decomposition to take place until it is not harmful to people, before a fan can be turned on to blow air out through air outlet and to ventilate new air into the unit. This cycle of sterilization can be repeated a number of times as set earlier. The ozone stream wind generator is controlled by a control system of the air conditioner.

The second objective of this invention is to provide ozone airflow in a wider distribution over many parts of the air conditioner. This can be done by equipping ozone stream wind generator with negative high-voltage wires with ground plates which are arranged in layer next to dust filter in the air conditioner. The negative high-voltage wires are applied with a voltage -3 kV to -8 kV in reference to the ground plates, and the current flowing from the negative high-voltage wires to the ground plates is 1 micro amp to 30 micro amps. As the negative high-voltage wires are located in front of the middle lines between the ground plates, electron current flows from the negative high-voltage wires to the ground

plates. Considering the voltage of the negative high-voltage wires which are up to -3 kV, this causes corona effect that energizes oxygen to generate ozone molecules which flow with electrons to the ground plates called as ozone airflow.

The benefit of this invention is to decontaminate an inner area of the air conditioner that is generally a place for pathogen growth and accumulation, as well as unpleasant odors as a result of high moisture and high temperature while the air conditioner is switched off. The sterilization can be accomplished by a high concentration of ozone inside the air conditioner with sufficient time period of ozone fumigation. Ozone stream wind generator contains the negative high-voltage wires together with the ground plates arranged in layer, which are expanded in width instead of small narrow needles; therefore, ozone airflow can diffuse widely to many inner parts of the air conditioner.

Brief Description of Drawings

Figure 1 shows a block diagram of the sterilizing air conditioner according to this invention.

Figure 2 shows a side view of ozone stream wind generator according to this invention.

Figure 3 shows an ozone stream wind generator according to this invention.

Figure 4 shows an ozone stream wind generator and a heat exchanger according to this invention.

Figure 5 shows a structure of the sterilizing air conditioner according to this invention.

Figure 6 shows a block diagram of the sterilizing air conditioner at a fan installed at air inlet before heat exchanger according to this invention.

Figure 7 shows a cross section of the sterilizing air conditioner at a fan installed at air inlet before heat exchanger according to this invention.

Disclosure of Invention

According to Figure 1 showing a block diagram of the sterilizing air conditioner comprises an air inlet (1), an air conditioner body (2), a filter (3), an ozone stream wind generator (4), a heat exchanger (5), a fan (6), and an air outlet (7). When an air conditioner is switched on, the fan (6) ventilates air in through air inlet (1) and filter (3), in order to filter dust particles, pathogens, and large objects from entering the air conditioner body (2). Then,

air bulk flows through ozone stream wind generator (4) to generate ozone for air purification, as ozone is used for removing odors, together with destroying and inhibiting the growth of pathogens such as bacteria, virus, fungi, that exist in the air but too small to be trapped at the filter (3). In addition, ozone stream wind generator (4) can generate negative ions that are capable to capture small particles and attract these particles to the ground plates (10) by electric field. When the air that was purified with ozone created from ozone stream wind generator (4) passes through a heat exchanger (5) filled with refrigerant, air will exchange heat with the refrigerant, resulting in a decrease (in cool mode) or an increase (in heat mode) in air temperature. A fan (6) is used to ventilate air in and blow the purified and temperature-adjusted air out through air outlet (7).

When an air conditioner is switched off, there will be high humidity due to water condensation in the air at heat exchanger (5) and temperature will normally increase inside the air conditioner. Pathogens such as bacteria, virus, and fungi, as well as dust particles in the air that couldn't be captured at dust filter will attach at inner parts of the air conditioner such as the surface inside the air conditioner (2), dust filter (3), heat exchanger (5), and fan (6). Then, these pathogens will multiple in the condition of high humidity and high temperature when the air conditioner is switched off, as it is an appropriate place for the growth of pathogens. This can lead to odor problem and reintroduction of these pathogens into the room when the air conditioner is switched on again.

In order to make a sterilizing air conditioner, an ozone stream wind generator (4) is turned on when the air conditioner is switched off to create ozone airflow without a fan (6) being turned on. Ozone stream wind generator (4) produces ozone airflow from the negative high-voltage wires (9) with voltage from -3 kV to -8 kV (depending on the distance from the ground plates and the amount of ozone to generate), which forms corona effect that energizes oxygen to ozone molecules. Moreover, the negative high-voltage wires (9) also release negative ions from the negative high-voltage wires (9) to the ground plates (10), and these ions lead ozone molecules created at the negative high-voltage wires (9) to flow as ozone airflow from the negative high-voltage wires (9) to the ground plates (10). Therefore, the ozone airflow flows throughout the inner area of the air conditioner and diffuses over many parts such as dust filter (3), surface of inner air conditioner area (2), heat exchanger (5), and fan (6). Ozone stream wind generator (4) that creates sufficient ozone concentration to kill and inhibit pathogen growth operates by turning it on and off at the defined interval to control

the level of ozone concentration. After ozone stream wind generator (4) is turned on, ozone can diffuse throughout area inside the air conditioner and fumigate with sufficient concentration in defined time period to destroy and inhibit the growth of pathogens such as bacteria, virus, and fungi. Finally, ozone stream wind generator (4) is tuned off in order to reduce ozone concentration to the level that is safe for consumers. Then, a fan (6) can be turned on in order to blow air inside the air conditioner (2) out and to ventilate new air into the air conditioner. This cycle can be repeated at the given time period.

According to Figure 2 showing a side view of ozone stream wind generator (4) without showing the high-voltage generator equipment, the negative high-voltage wires (9) are small in diameter (0.3 mm), can be stretched, and made of conductive metals namely steel, tungsten, aluminum, copper, and other conductive metals. The negative high-voltage wires (9) are supplied with voltage -3 kV to -8 kV depending on the distance from the ground plates (10) and the amount of ozone to be created. The negative high-voltage wires (9) are located in front of the middle lines between the ground plates (10). The ground plates (10), which are composed of conductive metals such as steel, tungsten, aluminum, copper, and plastic sheet, is applied with zero voltage in reference to the negative high-voltage wires (9).

When turning on ozone stream wind generator (4) by applying voltage -3 kV to -8kV to the negative high-voltage wires (9), this results in corona effect around the negative high-voltage wires (9), which energize oxygen gas in the air to be converted to ozone molecules. At the same time, there are negative ions flowing from the negative high-voltage wires (9) to the ground plates (10) which have zero voltage. This leads to the fact that ozone molecules generated around the negative high-voltage wires (9) also flow as ozone airflow from the negative high-voltage wires (9) to the ground plates (10). The speed of ozone airflow and the amount of ozone generated depend on the voltage at the negative high-voltage wires (9) and the distance from the negative high-voltage wire (9) to the ground plate (10).

Figure 3 shows the ozone stream wind generator (4).

According to Figure 4 showing ozone stream wind generator (4) with heat exchanger (5) in three- dimension, ozone airflow moves from the negative high-voltage wires (9) to the ground plates (10) and finally to the heat exchanger (5).

Figure 5 shows the structure of the sterilizing wall-mounted air conditioner which consists of air inlet (1), air conditioner body (2), filter (3), ozone stream wind generator (4), heat exchanger (5), fan (6), and air outlet (7). Ozone fumigation inside the air conditioner,

aiming to destroy and inhibit the growth of pathogens such as bacteria, virus, and fungi, is accomplished by ozone stream wind generator (4) creating ozone airflow from air inlet (1) to inner part of the air conditioner (2). Therefore, sufficient concentration of ozone diffuses into every part of the air conditioner such as inner surface of air conditioner body (2), filter (3), heat exchanger (5), fan (6), and other devices located inside the air conditioner (2).

According to Figure 6 showing a block diagram of the sterilizing air conditioner and Figure 7 showing a cross section of the sterilizing air conditioner, a fan is installed at the air inlet (1) before the heat exchanger (5). Ozone stream wind generator (4) is installed next to the filter (3) in order to create ozone airflow blowing into inner part of the air conditioner (2).

Best Mode for Carrying Out the Invention

As disclosed in the disclosure of the invention completely.

Claims

1. A sterilizing air conditioner consists of general air conditioning devices such as air inlet (1), air conditioner body (2), filter (3), heat exchanger (5), fan (6), and air outlet (7), characterize in ozone stream wind generator (4) equipped at the air inlet (1) behind the filter (3). Ozone stream wind generator (4) comprises the negative high-voltage wires (9) installed in front of the middle lines between the ground plates (10) which are arranged in layer creating ozone airflow from corona effect at the negative high-voltage wires (9) together with electron current flowing toward the ground plates. This ozone-generating system results in concentrated ozone flowing into inner area of the air conditioner (2) when it is switched off, while ozone fumigating inside the air conditioner (2) in the defined time interval which depends on the size of the air conditioner in order to create sufficient ozone concentration to destroy pathogens inside the air conditioner (2) such as bacteria, virus, fungi, as well as to inhibit their growth. After sufficient ozone fumigation, ozone stream wind generator (4) is turned off in order to reduce the concentration of ozone and then a fan (6) is turned on to blow air out and ventilate new air into the air conditioner body (2). This cycle can be repeated at the given time interval.
2. A sterilizing air conditioner as claimed in Claim 1, further comprising of ozone generating devices such as the negative high-voltage wires (9) with 0.3 mm diameter each that are made of conductive metals such as tungsten, stainless steel, copper, iron, chromium, aluminum, and other conductive metals. The diameter can be larger or smaller than 0.3 mm, since the wires can be stretched. The negative high-voltage wires (9) are located in front of the middle lines between the ground plates (10) which are arranged in layer. Ground plates (10) are made of conductive metals such as tungsten, tungsten wire, stainless steel, copper, iron, chromium, aluminum, plastic sheet, and other chemicals that can be plated with metal to conduct electricity. The negative high-voltage wires (9) are applied with voltage -3 kV to -8 kV, depending on the distance between the negative high-voltage wires (9) and the ground plates (10), and the magnitude of current flowing from the high-voltage wire (9) to the ground plates (10) which are from 1 micro amp to 30 micro amps. The negative high-voltage wires (9) with negative voltage results in corona effect which is able to energize oxygen to generate ozone molecules, resulting in

ozone airflow together with electron current flowing from the negative high-voltage wires (9) to the ground plates (10).

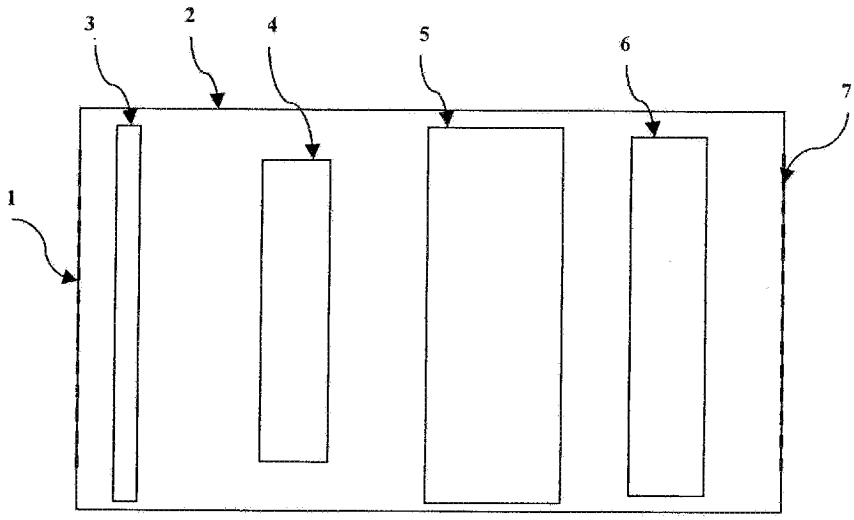

Figure 1

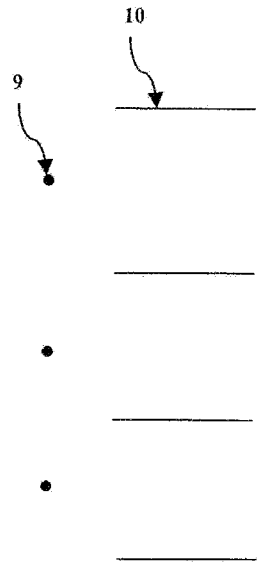

Figure 2

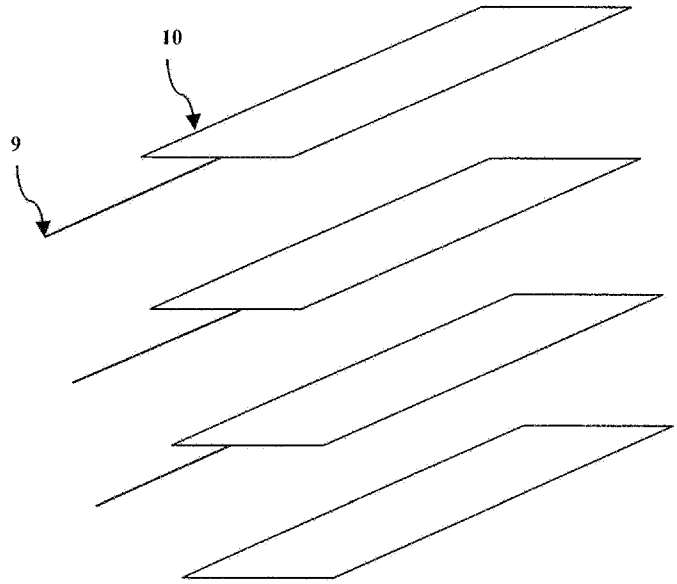

Figure 3

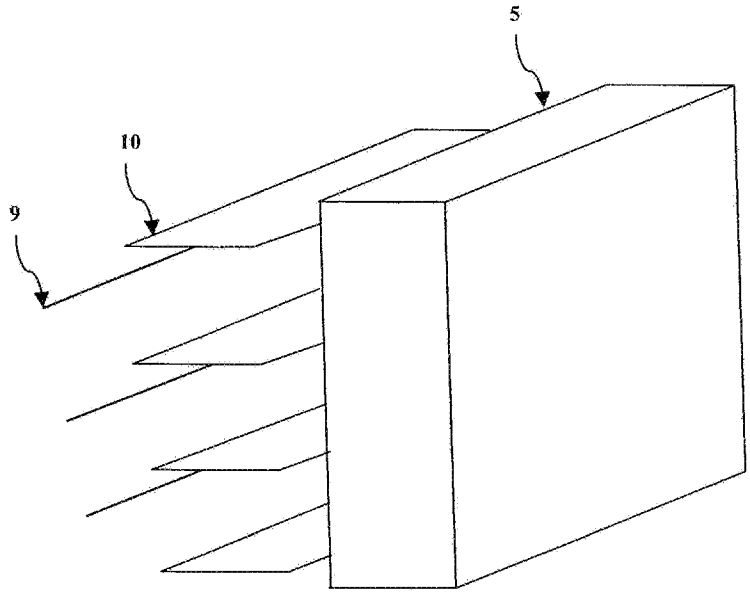

Figure 4

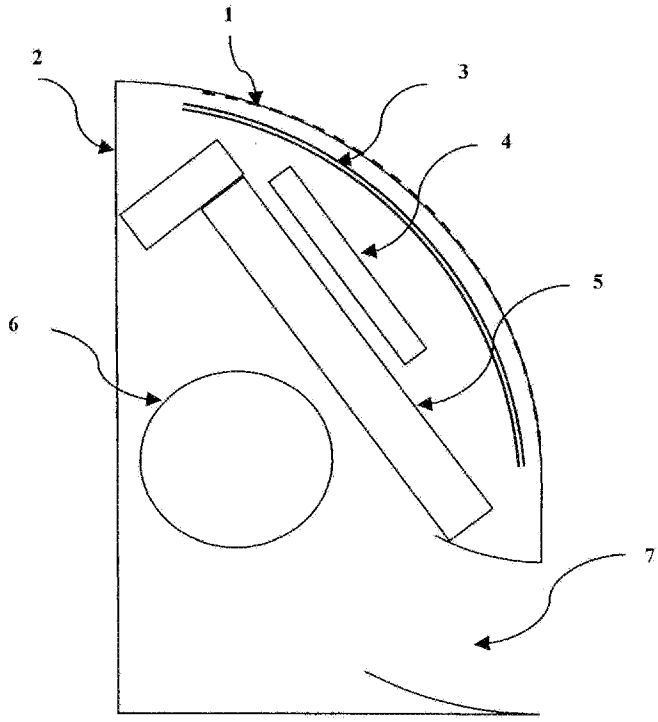

Figure 5

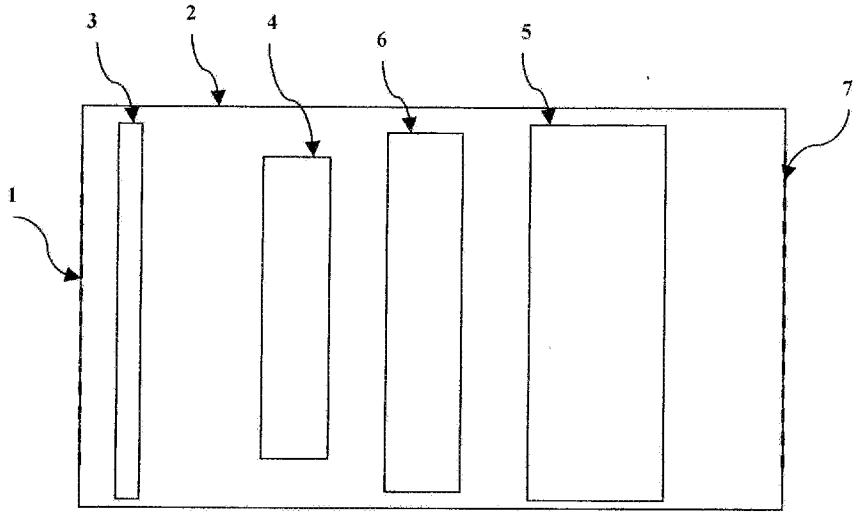

Figure 6

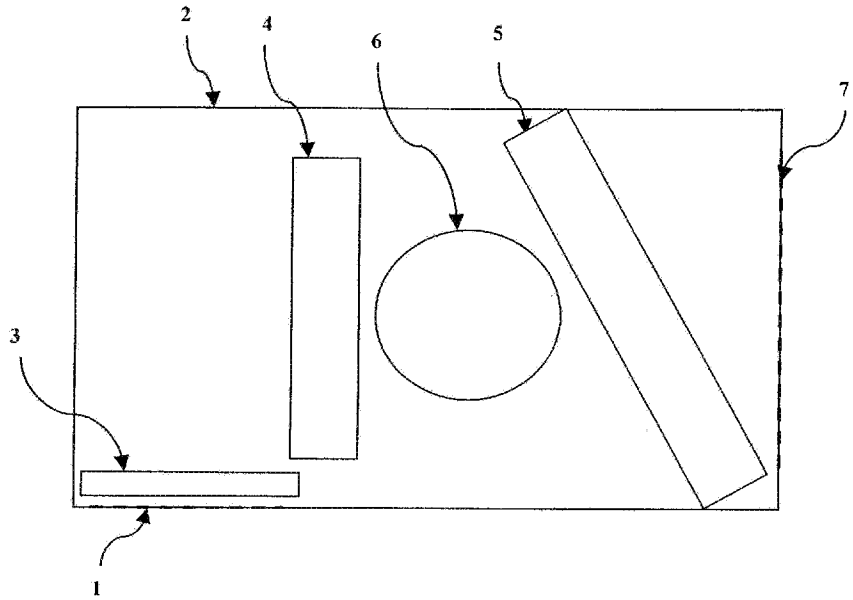

Figure 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TH 14/00021

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61L 2/00 (2015.01)
CPC - A61L 2/18, A61L 2/208 and A61L 2202/24
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A61L 2/00 (2015.01)
CPC - A61L 2/18, A61L 2/208 and A61L 2202/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A61L2/20, B01D2255/106, B01D46/0028, B01D2255/20769, B03C3/09, C01B13/11, C01B2201/40, B01J19/088, C01B2201/12, F24F2003/1682, F24F2221/22 and H01T23/00 (Search terms - See below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase and google. Search terms: air, condition, heat, exchange, cool, chill, filter, filtration, fan, blower, pump, compressor, inlet, input, entrance, outlet, output, exhaust, ozone, generate, produce, ground, negative, high, volt, wire, electrode, germ, pathogen, bacteria, fungus, mold, virus, anti-microbe, microbe, tungsten, stainless, copper,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,286,447 A (Fannin et al.) 15 February 1994 (15.02.1994) Entire document, especially col 2, ln 45-46; col 3, ln 11-12; col 4, ln 34-65; col 5, ln 21-56; col 6, ln 36-60; col 6, ln 67 to col 7 ln 24	1 and 2
Y	US 6,953,556 B2 (Taylor et al.) 11 October 2005 (11.10.2005) Entire document, especially Fig 4A, it 232, 240 and 242 and col 1, ln 31-33; col 6, ln 4-12; col 7, ln 6-8; col 8, ln 48; col 9, ln 18-40; col 10, ln 46.	1 and 2
A	WO 2012/035757 A1 (Hashida et al.) 22 March 2012 (22.03.2012) Entire document.	1 and 2

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

* Special categories of cited documents:
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"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
06 April 2015 (06.04.2015)	16 APR 2015

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774