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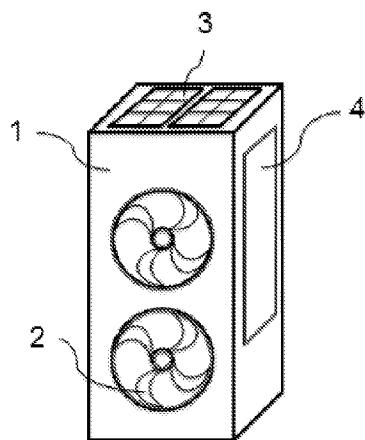


FIG. 1

(57) Abstract: The invention refers to a device for collecting particulate matter (MP2.5-10.0) in gaseous fluids by using a filtering system with nanopores. This device is made up of only one compact unit and with the possibility of removing the filtering system when replacement is required. The device is energetically self-sufficient, using solar cells for driving the ventilation system that pushes the fluid to be treated into the device. Both the use of clean energy and the use of a nano-particle filtering system are novel concepts in the device for removing solids from gaseous fluids.



**DEVICE FOR SEPARATING SOLID PARTICLES FROM GASEOUS
FLUIDS**

OBJECT OF THE INVENTION

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The present invention refers to the technical field of the devices for gaseous fluids purification by means of filtration systems.

More particularly, the object of the present invention refers to a device for
10 filtration of MP2.5 and MP10.0 solid particles from air polluted by emissions from vehicle motors.

BACKGROUND OF THE INVENTION

15 It is known worldwide that solid particle deposition resulting from the emissions of vehicle motors running on petrol derivatives, is asymmetrically concentrated in the environment; thus finding higher deposition in traffic congestion areas or at crossroads provided with traffic lights. Therefore, these places are an important niche for implementing devices intended for
20 treating the environmental pollution problems produced by vehicle emissions. Other sceneries that may have high levels of pollution with nano-particles are, for example, tunnels, hospitals and factories.

The content of these polluting emissions may be in the form of gases or
25 solids; in case of the latter, the micro-particles with a size from 2.5 to 10 microns have already been related as being important in the development of respiratory disease in humans.

Among the devices that are known for removing solid particles from gases
30 there is, for example, that disclosed in the document US 3,731,459, referring to an apparatus for treating polluted air at roads with vehicle traffic; however,

said apparatus is not provided with systems for nano-filtration of solid particles.

Document US 2004/0031248 A1 refers to a casing for air purification within
5 motor vehicle cabins.

On the other side, the process and apparatus for nanocellulose production, and composition and products thereof was patented in 2015 (US 9,187,865 B2), and the impact of using such material in different areas has been
10 reviewed by Durán et al. *Recent Pat Nanotechnol.* 2012; 6(1), 16-28: Review of Cellulose Nanocrystals Patents: Preparation, Composites and General Applications and in Charreau et al. *Recent Pat Nanotechnol.* 2013; 7(1):56-80: Nanocellulose Patents Trends: A Comprehensive Review on Patents on Cellulose Nanocrystals, Microfibrillated and Bacterial Cellulose.

15

The present invention discloses a device for separating particles from the air or other gaseous fluid based on a nanopore filtration system. Said device is effective in particle filtration, energetically self-sufficient and environmentally friendly, since it uses solar energy for operation thereof.

20

DESCRIPTION OF THE INVENTION

The present invention refers to a device to be used for capturing particles being mainly produced (although not limited thereto) by emissions from
25 vehicle motors running on hydrocarbons, derivatives and mixtures thereof and any other type of fuel. These devices are intended to be placed on posts or bases at certain height from the ground, at traffic congestion areas or adjacent to crossroads provided with traffic lights or signals to stop. These devices could also be used in other places such as tunnels or factories.

30

Then, a first aspect of the present invention refers to a device for separating particles from gaseous fluids comprising:

- a structure or casing comprising:
 - openings for the gaseous fluids to be treated to get in and out.
 - a ventilation system configured for driving the gaseous fluid to be treated into the casing.
- 5 • an access window configured for accessing the inner area of the casing.
- solar cells arranged on the casing and configured for producing energy.
- nanocellulose membranes, located inside the casing, configured for
10 filtering MP2.5 and MP10.0 particulate matter from the gaseous fluid.

MP2.5 and MP10.0 particulate matter refers to small solid or liquid particles, dispersed in the atmosphere, the aerodynamic diameter of which is less than 2.5 μm and 10 μm respectively.

15

Preferably, the nanocellulose membranes are arranged on a detachable panel which can be replaced periodically according to the saturation level thereof.

20 The air inside the device will circulate and be in contact with nanocellulose membranes, which shall capture MP2.5 and MP10.0 particulate matter present in the gaseous fluid, preferably air, and then this gaseous fluid, having a lower amount of particles, will go out through openings located at the sides of the device casing.

25

The use of nanocellulose in this type of devices is innovative, since the conventional air filtering devices are not provided with this technology, being developed for capturing particles of the indicated size.

30 The ventilation system will be powered by energy produced by solar cells, located at any of the outer surfaces of the device casing, ideally at the upper

part thereof. The use of this technology, incorporating the use of clean energy, is convenient for keeping the autonomy of the device.

5 In a preferred embodiment, the device comprises a rechargeable battery so as to store the energy produced by the solar cells, which will allow operation thereof at periods of low or no sun lightning. The battery shall have a cable so as to transmit energy to the ventilation system.

10 Preferably, the openings for the gaseous fluid to be treated to go out, will not be at the sides of the casing comprising the ventilation system.

The access window or gate, which allows replacement of the nanocellulose panel, may be closed, thus keeping integrity and an appropriate operation of the device therein.

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DESCRIPTION OF THE DRAWINGS

The figures represent, in an illustrative and non-limiting manner, the following:

20 FIG. 1.- It shows an outer isometric view of the disclosed device.

FIG. 2.- It shows a side isometric view with inner details of the device.

25 FIG. 3.- It shows a view of the detachable panel with the nanocellulose membranes.

PREFERRED EMBODIMENT OF THE INVENTION

30 The following is a more detailed description supported on the above figures. The figures are not drawn to scale; thus, the dimensions and shapes of the components of this device may vary. The diagrams presented show how this device can be constructed in a general manner.

FIG. 1 shows an external isometric view of the disclosed device; in said figure the device cover or casing (1) can be observed, as well as the potential arrangement of the ventilation system (2), which will push the air to be treated inside the device.

5

There are solar cells (3) arranged at the top of the device, which will generate the energy required for driving the fans of the ventilation system (2).

One of the surfaces of the device casing will be provided with an opening such as a gate or access window (4), which shall be used for accessing the panel with the nanocellulose membranes located inside the casing (1).

The casing is provided with openings for allowing the air that has already circulated inside thereof to go out. Preferably, these shall not be in the sides comprising the ventilation system.

FIG. 2 shows inner details of the device, such as the battery (5) and a potential representation about the location of the panel holding the nanocellulose membranes (6), the battery must have a cable for transmitting the energy up to the ventilation system.

FIG. 3 shows the potential arrangement of the nanocellulose membranes (6), which will be arranged in a detachable panel, in such a way that these can be easily removed and replaced.

25

CLAIMS

1. Device for separating particles from gaseous fluids comprising:
- a casing comprising:
 - 5 • openings for the gaseous fluids to be treated to get in and out.
 - a ventilation system configured for driving the gaseous fluid to be treated into the casing.
 - an access window configured for accessing the inner area of the casing.
 - 10 - solar cells arranged on the casing and configured for producing energy.
 - nanocellulose membranes, located inside the casing, configured for filtering MP2.5 and MP10.0 particulate matter from the gaseous fluid.
- 15 2. Device according to claim 1, wherein the nanocellulose membranes are arranged in a detachable panel which can be replaced periodically according to the saturation level thereof.
3. Device according to claim 1, comprising a rechargeable battery for storing
20 the energy produced by the solar cells.
4. Device according to claim 1, wherein the openings for the gaseous fluid to be treated to get in and out, are not in the sides of the casing comprising the ventilation system.
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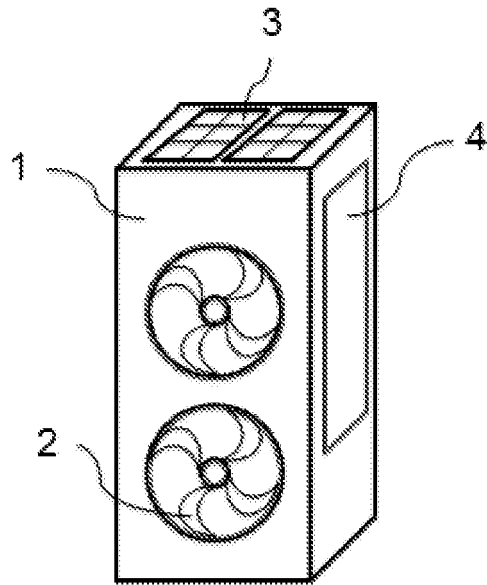


FIG. 1

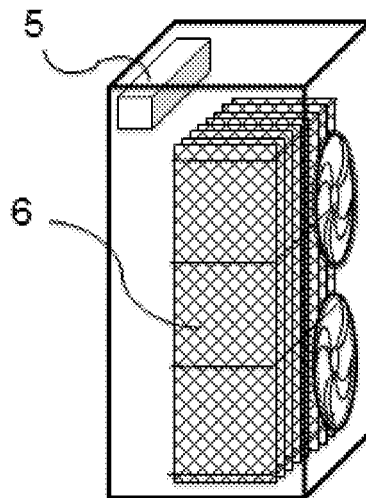


FIG. 2

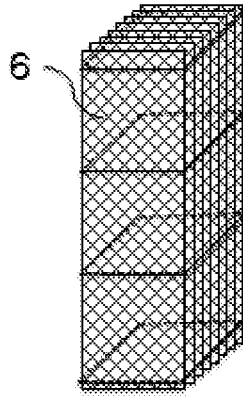


FIG. 3