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(54) Title: AIR POLLUTION CONTROL SYSTEM

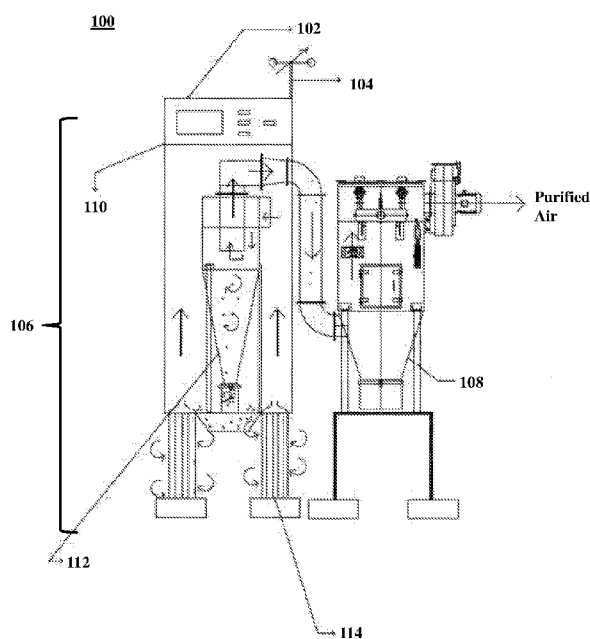


FIG.1

(57) Abstract: Accordingly, embodiments herein disclose an air pollution control system (100) comprises an air quality monitoring device (102) configured to measure a quality of air in an area, a wind direction monitoring device (104) configured to determine a direction of wind, an air purification device (106) configured to purify the air by removing dust particles from the air, wherein the air purification device is automatically activated based on the measured quality of the air; and a pulse jet bag house (108) to collect the dust particles from the air purification device (106) and release the purified air in the determined direction of the wind.

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AIR POLLUTION CONTROL SYSTEM

FIELD OF INVENTION

5 [0001] The present disclosure relates to an air pollution control system, and more specifically related to a method and system for ambient air purifier fitted with baffled cyclone separator followed by reverse pulse jet type bag house. This application is based on Indian provisional application number **201841036288** filed on **26th September 2018**, the disclosure of which is incorporated herein.

10

BACKGROUND OF INVENTION

15 [0002] In general, rapid urbanization and increase in population have led to higher concentrations of air pollutants in the cities. Complex land use and infrastructure development resulted in poor dispersion condition and increase in vehicular emissions are responsible for creating air pollution hotspots in urban areas. The past studies carried out indicated that the air pollutants concentration is several times higher in urban hotspots. In order to address the air pollution problems, the government has initiated several control measures at source, such as the implementation of
20 euro norms, standards for fuel, encouraging electric vehicles etc.

25 [0003] At present, limited efforts have been made to treat the air pollutants in the ambient environment. The present application addresses the air pollution issues in the urban environment through a combination of wireless sensor networks which detects the pollution levels and triggers the operation of air pollution control system. Air pollution control systems work on the principle of centrifugal force, gravitational settling, and different types of impaction and adsorption to remove particulate pollution. The collected dust particles can also be used as resources for various construction activities.

[0004] Further, there are procedures in the existing methods to measure the air quality inside the room and accordingly adjusts the flow rate of an exhaust fan with respect to indoor air quality. There is no such system to decide the direction of pure air discharge based on ambient wind direction for outdoor environment.

[0005] Furthermore, there are procedures in the existing methods that uses a normal cyclone separator which has limitations with removing particles of smaller size.

10

OBJECT OF INVENTION

[0006] The principal object of the embodiments herein is to provide air pollution control system with baffled cyclone separator followed by reverse pulse jet type baghouse.

15

SUMMARY OF INVENTION

[0007] Embodiments herein provides an air pollution control system comprising an air quality monitoring device configured to measure a quality of air in an area, a wind direction monitoring device configured to determine a direction of wind, an air purification device, communicably connected to the air quality monitoring device, configured to purify the air by removing dust particles from the air, and a pulse jet bag house, connected to the air purification device, to collect the dust particles from the air purification device and release the purified air in the determined direction of the wind. The air purification device is automatically activated based on the measured quality of the air.

[0008] In an embodiment, the air purification device comprises an air suction tower and a baffled cyclone separator. The air suction tower provides a flow of the air into the air purification device. The baffled cyclone separator receives the flow of the air from the air suction tower,

removes the dust particles from the air, and passes the air to the pulse jet bag house.

[0009] In an embodiment, the suction tower sucks the air using rotating inlets placed at a bottom of the air suction tower.

5 [0010] In an embodiment, a diameter of the rotating inlets is 30 centimeter and a height of the rotating inlets is 1 meter.

[0011] In an embodiment, the rotating inlets provides guided flow of the air from all directions into the air suction tower and subsequently to the baffled cyclone separator.

10 [0012] In an embodiment, coarse particles in the air are filtered at the air suction tower and is collected at a bottom of the air suction tower, and wherein the air free from the coarse particles is passed to the baffled cyclone separator.

[0013] In an embodiment, the baffled cyclone separator removes
15 the dust particles of a size of greater than 5 microns from the air.

[0014] In an embodiment, the baffled cyclone separator passes the air to the pulse jet bag house using at least one blower fan connected at an outlet of the baffled cyclone separator.

[0015] In an embodiment, the pulse jet bag house removes finer
20 particles from the air and releases the purified air in the determined direction of the wind using at least one blower fan connected at an outlet of the pulse jet bag house.

[0016] In an embodiment, the air pollution control system comprises at least one solar panel to provide power to the air pollution
25 control system.

[0017] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating

preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such
5 modifications.

BRIEF DESCRIPTION OF FIGURES

[0018] This method is illustrated in the accompanying drawings, throughout which like reference letters indicate corresponding parts in the
10 various figures. The embodiments herein will be better understood from the following description with reference to the drawings, in which:

[0019] FIG. 1 illustrates an air pollution control system, according to an embodiment as disclosed herein.

DETAILED DESCRIPTION OF INVENTION

[0020] The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying drawings and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. Also, the various embodiments described herein are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments. The term “or” as used herein, refers to a non-exclusive or, unless otherwise indicated. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein can be practiced and to further enable those skilled in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[0021] As is traditional in the field, embodiments may be described and illustrated in terms of blocks which carry out a described function or functions. These blocks, which may be referred to herein as units or modules or the like, are physically implemented by analog or digital circuits such as logic gates, integrated circuits, microprocessors, microcontrollers, memory circuits, passive electronic components, active electronic components, optical components, hardwired circuits, or the like, and may optionally be driven by firmware and software. The circuits may, for example, be embodied in one or more semiconductor chips, or on substrate supports such as printed circuit boards and the like. The circuits constituting a block may be implemented by dedicated hardware, or by a processor (e.g., one or more programmed microprocessors and associated circuitry), or by a combination of dedicated hardware to perform some functions of the block and a processor to perform other functions of the

block. Each block of the embodiments may be physically separated into two or more interacting and discrete blocks without departing from the scope of the invention. Likewise, the blocks of the embodiments may be physically combined into more complex blocks without departing from the scope of the invention.

[0022] The accompanying drawings are used to help easily understand various technical features and it should be understood that the embodiments presented herein are not limited by the accompanying drawings. As such, the present disclosure should be construed to extend to any alterations, equivalents and substitutes in addition to those which are particularly set out in the accompanying drawings. Although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are generally only used to distinguish one element from another.

[0023] Referring now to the drawings, and more particularly to FIG. 1, there are shown preferred embodiments.

[0024] FIG. 1 illustrates an air pollution control system (100), according to an embodiment as disclosed herein. The air pollution control system (100) comprising an air quality monitoring device (102), a wind direction monitoring device (104), an air purification device (106) and a pulse jet bag house (108). The air quality monitoring device (102) configured to measure a quality of air in an area. The wind direction monitoring device (104) configured to determine a direction of wind. The air purification device (106), communicably connected to the air quality monitoring device (102), configured to purify the air by removing dust particles from the air. The air purification device (102) is automatically activated based on the measured quality of the air. The pulse jet bag house (108), connected to the air purification device (102), to collect the dust

particles from the air purification device and release the purified air in the determined direction of the wind.

[0025] As illustrated in the FIG. 1, the proposed air pollution control system (100) comprises three major components. The first component of the proposed air pollution control system (100) is the air quality monitoring device (102) for monitoring the air quality using the wireless network of sensors. This component provides real-time air quality information at hotspots as well as automatically triggers/activates operation of the air purification device (106). Further, the wind direction monitoring device (104) such meteorological station attached to the quality monitoring device (102) to measure a direction of wind in which the purified/treated air has to be released.

[0026] The second component of the proposed air pollution control system (100) is the air purification device (106). The air purification device (106) an air suction tower (110) connected to a baffled cyclone separator (112). The air suction tower (110) provides a flow of the air into the air purification device (106). The air suction tower (110) sucks the air using rotating inlets (114) placed at a bottom of the air suction tower (110). In an embodiment, a diameter of the rotating inlets (114) is 30 centimeter and a height of the rotating inlets (114) is 1 meter. This particular arrangement of inlets results into suction of high volume of air than any other conventional rotating inlets design and it also capture air from 360° with economic power consumption. In an embodiment, the rotating inlets (114) provides guided flow of the air from all directions into the air suction tower (110) and subsequently to the baffled cyclone separator (114).

[0027] The baffled cyclone separator (112) receives the flow of the air from the air suction tower (110), removes the dust particles from the air, and passes the air to the pulse jet bag house (108). In an embodiment, the proposed baffled cyclone separator (112) removes the dust particles of a

size of greater than 5 microns from the air. Conventional cyclone separators cannot remove particles less than 10 microns efficiently. Thus, a spiral baffle has been used inside the body of the cyclone separator (112). The baffle helps to remove the small particles having a smaller radius of rotation inside the cyclone. The baffled cyclone separator (112) helps to remove particles greater than size of 5 microns. The dust particles removed from the baffled cyclone separator (112) will be collected at a bottom of the baffled cyclone separator (112). The baffled cyclone separator (112) removes the dust particles from the air and passes the air to the pulse jet bag house (108). In an embodiment, the baffled cyclone separator (112) passes the air to the pulse jet bag house (108) using at least one blower fan connected at an outlet of the baffled cyclone separator (112). The blower fan at the outlet of the baffled cyclone separator (112) creates enough suction to make air pass through the control system.

[0028] The third component of the proposed air pollution control system (100) is pulse jet bag house (108) to collect the dust particles from the air purification device and release the purified air in the determined direction of the wind. The pulse jet bag house (108) house contains four number of dust bags which are capable of removing finer particulates. The purified air is passed using at least one blower fan connected at an outlet of the pulse jet bag house (108).

[0029] Therefore unlike the conventional systems, in the proposed air pollution control system (100), the air undergoes three stage filtration as follows:

1. First is due to sedimentation in the air suction tower (110). The coarser materials get screened at air suction tower (110) and gets collected in the bottom of the air suction tower (110).
2. Second due to centrifugal action in the baffled cyclone separator (112). The air moves up through the air suction tower (110) and

enters the baffled cyclone separator (112) where particles greater than 5 microns will be removed.

3. Third due to impaction in the pulse jet bag house (108). Finally, the air with finer particles is passed through the pulse jet bag house (108). The pulse jet bag house (108) contains four number of dust bags which are capable of removing finer particulates. Two number of blower fans are used, one at the outlet of the baffled cyclone separator (112) and one at the end of the pulse jet bag house (108), which creates enough suction to make air pass through the setup. The clean air is passed through outlet.

[0030] The detailed plans which include a top view and side views are shown in the FIG. 1. Further, Pressure gauges are installed in the system to monitor a cleaning period. The container placed at the bottom of the baffled cyclone separator (112) and the pulse jet bag house (108) can be cleaned periodically.

[0031] In an embodiment, air quality monitoring sensors are fitted to monitor the air pollutant concentration and a data transmission module will be used for data transfer. In an embodiment, the whole assembly of the components described above can be mounted on a truck and can be used as a mobile ambient air purifier or controller. In another embodiment, the whole assembly of the components described above can be built as a stationary air purification or control device. The use of baffled cyclone separator (112) and the pulse jet bag house (108) consumes less power when compared to other technologies available for air purification. Thus, solar panels can be used for power requirements. If the system has to be installed in industrial areas and waste management sites, an additional component of reactant system for gaseous pollutants including Volatile Organic Compounds (VOCs), hydrocarbons and pathogens are to be provided as an attachment to the system.

[0032] In an embodiment, the proposed air pollution control system (100) works on an automated air delivery system which changes the direction of outlet based on the monitored air quality and meteorological data. The air quality monitoring station measures the major air pollutants
5 such as PM₁₀, PM_{2.5}, SO₂, NO_x, O₃, CO, Humidity and temperature in an outdoor environment and transmits the data to the database. The invention also serves as a combination of low-cost air quality monitoring station as well as an outdoor air purifier.

[0033] Further, the proposed air pollution control system (100) uses
10 monitoring data to adjust the flow rate of an exhaust fan and also decides a direction of pure air discharge.

[0034] Further, the proposed air pollution control system (100) uses a set of spiral baffles within a cyclone body to enhance the collection efficiency and collect smaller size particles.

15 [0035] Further, the proposed air pollution control system (100) having a rotating inlet captures air in a more efficient way by reducing the pressure on the suction fan. The air is sucked through all the fans and passed into the air suction tower for subsequent pollutant removal.

[0036] Furthermore, the proposed air pollution control system (100)
20 having an outlet tower fitted with a rotating outlet and the house to remove particulate pollutant. The outlet changes its direction opposite to the upwind direction to discharge pure air on the downwind.

[0037] The proposed air pollution control system (100) can be used
25 in municipal corporations, industrial clusters, mining companies, and gated communities etc.

[0038] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic

concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of
5 limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein.

10

STATEMENT OF CLAIMS

We Claim:

1. An air pollution control system (100), comprises:
 - an air quality monitoring device (102) configured to measure a
5 quality of air in an area;
 - a wind direction monitoring device (104) configured to determine a
direction of wind;
 - an air purification device (106), communicably connected to the air
quality monitoring device (102), configured to purify the air by
10 removing dust particles from the air, wherein the air purification device
is automatically activated based on the measured quality of the air; and
 - a pulse jet bag house (108), connected to the air purification device
(106), to collect the dust particles from the air purification device (106)
and release the purified air in the determined direction of the wind.
15
2. The air pollution control system (100) as claimed in the claim 1,
wherein the air purification device (106) comprises:
 - an air suction tower (110) to provide a flow of the air into the air
purification device; and
 - 20 a baffled cyclone separator (112) receives the flow of the air from
the air suction tower (110), removes the dust particles from the air, and
passes the air to the pulse jet bag house (108).
3. The air pollution control system (100) as claimed in the claim 2,
25 wherein the air suction tower (110) sucks the air using rotating inlets
(114) placed at a bottom of the air suction tower (110).

4. The air pollution control system (100) as claimed in the claim 3, wherein a diameter of the rotating inlets (114) is 30 centimeter and a height of the rotating inlets (114) is 1 meter.
- 5 5. The air pollution control system (100) as claimed in the claim 3, wherein the rotating inlets (114) provides guided flow of the air from all directions into the air suction tower (110) and subsequently to the baffled cyclone separator (112).
- 10 6. The air pollution control system (100) as claimed in the claim 2, wherein coarse particles in the air are filtered at the air suction tower (110) and is collected at a bottom of the air suction tower (110), and wherein the air free from the coarse particles is passed to the baffled cyclone separator (112).
- 15 7. The air pollution control system (100) as claimed in the claim 2, wherein the baffled cyclone separator (112) removes the dust particles of a size of greater than 5 microns from the air.
- 20 8. The air pollution control system (100) as claimed in the claim 2, wherein the baffled cyclone separator (112) passes the air to the pulse jet bag house (108) using at least one blower fan connected at an outlet of the baffled cyclone separator (112).
- 25 9. The air pollution control system (100) as claimed in the claim 1, wherein the pulse jet bag house (108) removes finer particles from the air and releases the purified air in the determined direction of the wind using at least one blower fan connected at an outlet of the pulse jet bag house (108).

10. The air pollution control system (100) as claimed in the claim 1, comprise at least one solar panel to provide power to the air pollution control system (100).

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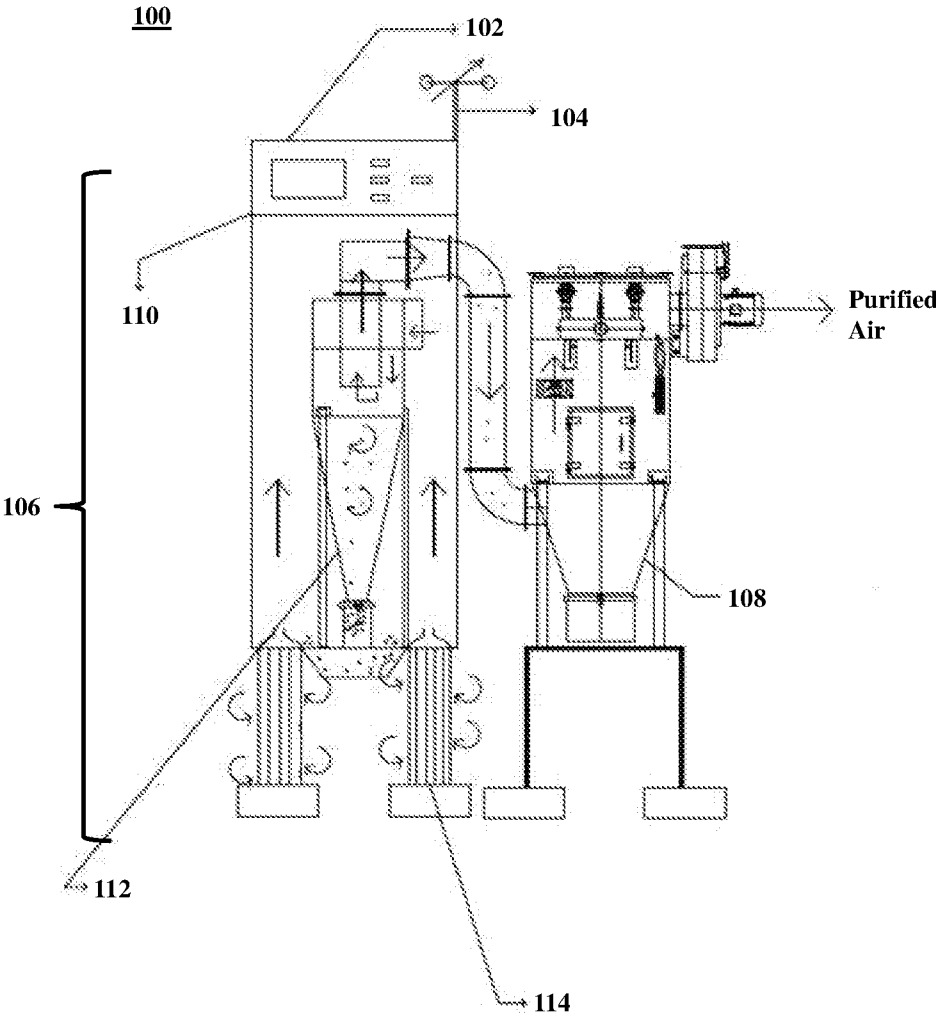


FIG.1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2019/050701

A. CLASSIFICATION OF SUBJECT MATTER
B01D45/12 Version=2019.01

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)

B01D

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)

TotalPatent One, IPO Internal Database

Keywords: Air purification, Air pollution, Cyclone separator, Solar panel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5147429 A (BARTHOLOMEW JAMES Et al.) 15 September 1992 (15.09.1992) abstract, col. 6, lines 20-21, col. 10, lines 59-65, col. 11, lines (1-5, 33-38), col. 13, lines 28-31, col. 14, lines 29-39	1-10
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Y	JP 2017185427 A (AFLAIR INC (JP)) 12 October 2017 (12.10.2017) (abstract from US2019111370A1, a family document)	3-5
Y	WO 2017018784 A1 (LG CHEMICAL LTD (KR)) 02 February 2017 (02.02.2017) abstract	1-10

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

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/IN2019/050701

Citation	Pub.Date	Family	Pub.Date
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