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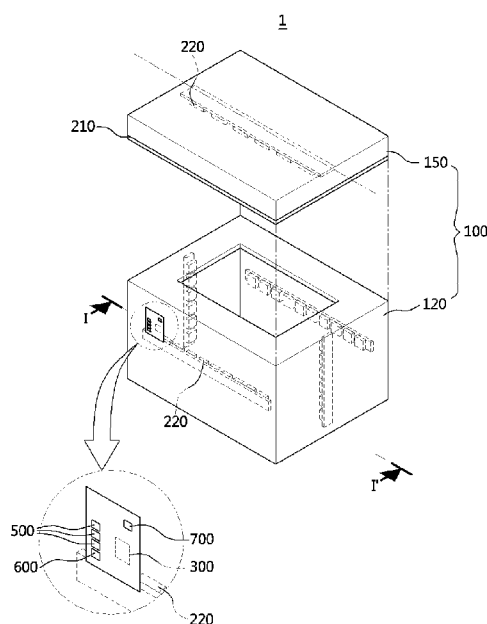
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(54) Title: MULTI-PURPOSE CONSERVATION APPARATUS



(57) Abstract: Provided is a multi-purpose conservation apparatus. The multi-purpose conservation apparatus includes a storage case, a light source module disposed in the storage case and configured to selectively remove a harmful gas in the storage case, and a control unit configured to control intensity of radiation of the light source module according to internal environmental data of the storage case. Accordingly, the intensity of radiation of the light source module can be adjusted according to the internal environmental data of the storage case, efficiently adjusting a level of photocatalysis.

Description

Title of Invention: MULTI-PURPOSE CONSERVATION APPARATUS

Technical Field

- [1] The present invention relates to a multi-purpose conservation apparatus, and more particularly, to a multi-purpose conservation apparatus for controlling intensity of radiation of a light source module according to internal environmental data.

Background Art

- [2] Ethylene gas is one of gases generated during ripening of vegetables and fruits, which reduces freshness. Apples, persimmons, mandarins, pears, and so on, among fruits, are known to generate a large amount of ethylene gas.
- [3] The ethylene gas is continuously generated during storage of the vegetables and fruits to excessively ripen and age the vegetables and fruits, degrading value of commodities of the vegetables and fruits.
- [4] For example, when fruits are stored in a sealed container, ethylene gas is continuously discharged. While there is no symptom on the exterior of the fruits for one to two weeks, the fruits are blackened after that.
- [5] In addition, when different kinds of fruits are stored together, the ethylene gas also wizens the different kinds of fruits. Accordingly, the fruits are recommended to be solely stored without sealing.
- [6] In order to solve the problem, the ethylene gas generated in the sealed space can be absorbed using an absorbent such as fibrous activated carbon or the like. However, since the method using the absorbent is restricted by an absorption capacity and the ethylene gas is discharged again when the capacity arrives at its limit, a periodic exchange of the absorbent is needed.
- [7] In addition, as the ethylene is decomposed and removed using an ultraviolet light mercury lamp and a structure coated with a photocatalyst, freshness of fruits and vegetables could be maintained. Korean Patent Application Laid-Open No. 10-2004-0064933, filed on July 21, 2004, discloses a freshness maintaining apparatus for fruits, vegetables, and flowers, in which a photocatalyst is installed. However, an ultraviolet light mercury lamp is driven regardless of a height or weight of the stored fruits and vegetables or flowers, and thus, energy consumption becomes inefficient.

Disclosure of Invention

Technical Problem

- [8] In order to solve the foregoing and/or other problems, a photocatalyst is used with a light emitting diode, and the intensity of radiation is adjusted according to internal en-

vironmental data, inducing effective photocatalysis.

Solution to Problem

[9] The foregoing and/or other aspects of the present invention may be achieved by providing a multi-purpose conservation apparatus including: a storage case; a light source module disposed in the storage case and configured to selectively remove a harmful gas in the storage case; and a control unit configured to control intensity of radiation of the light source module according to internal environmental data of the storage case.

[10] The light source module may include a photocatalyst layer and at least one light emitting diode configured to radiate light to the photocatalyst layer.

Advantageous Effects of Invention

[11] According to the present invention, the intensity of radiation of the light source module can be adjusted according to internal environmental data in the conservation apparatus to efficiently adjust a level of photocatalysis.

[12] Aspects of the present invention should not be limited by the above description, and other unmentioned aspects will be clearly understood by one of ordinary skill in the art from exemplary embodiments described herein.

Brief Description of Drawings

[13] FIG. 1 is a perspective view showing a multi-purpose conservation apparatus according to an embodiment of the present invention.

[14] FIG. 2 is a cross-sectional view taken along line I-I' of FIG. 1.

[15] FIG. 3 is a cross-sectional view showing the multi-purpose conservation apparatus according to the embodiment of the present invention.

[16] FIG. 4 is a control block diagram of the multi-purpose conservation apparatus according to the embodiment of the present invention.

Mode for the Invention

[17] Hereinafter, reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings. However, it will be apparent to those skilled in the art that the following embodiments can be readily understood and modified into various types, and the scope of the present invention is not limited to the embodiments.

[18] When a layer is described as being formed on another layer or substrate, the layer may be formed directly on the other layer or substrate, or a third layer may be interposed between them. In addition, in the description, directional expressions such as an upper side, an upper portion, an upper surface, and so on, can be understood to include a lower side, a lower portion, a lower surface, and so on. That is, spatial direction expressions should be understood as relative directions, other than a limited

direction, which refers an absolute direction.

[19] In the embodiment, it will be understood that, although the terms "first", "second", "third", or the like, may be used herein to discriminate various elements, these elements should not be limited by these terms.

[20] In addition, in the description and drawings, the thickness of layers and regions are exaggerated for clarity. Like numerals refer to like elements throughout the description of the drawings.

[21] **First Embodiment**

[22] FIG. 1 is a perspective view showing a multi-purpose conservation apparatus 1 according to a first embodiment of the present invention. FIG. 2 is a cross-sectional view taken along line I-I' of FIG. 1.

[23] Referring to FIGS. 1 and 2, the multi-purpose conservation apparatus 1 includes a storage case 100, a light source module 200 and a control unit 300.

[24] The storage case 100 may include an inner case 110, an outer case 120, and a cover unit 150.

[25] The inner case 110 may have an accommodating unit 130 formed therein, at least one surface of which may be open. Accordingly, articles can be stored in the accommodating unit 130 of the inner case 110. The article may be a solid product or a fluid product. The solid article may be fruits and/or vegetables, and the fluid article may be water. The inner case 110 may be formed of a material through which light from the light source module 200 can pass.

[26] The outer case 120 is spaced apart from an outer circumferential surface of the inner case 110 and surrounds the outer circumferential surface. A space section 140 is formed between the inner case 110 and the outer case 120. However, portions of the outer case 120 and the inner case 110 can be connected to each other. The outer case 120 may be formed of various materials such as a plastic material or the like.

[27] The storage case 100 may have a box shape or a pipe shape.

[28] Meanwhile, the storage case 100 may further include a support frame (not shown) configured to help maintain a space between the inner case 110 and the outer case 120.

[29] The cover unit 150 may be connected to the accommodating unit 130 and may include a space section 160 formed therein. Accordingly, when the cover unit 150 is coupled to the accommodating unit 130, the inside of the storage case 100 can be hermetically sealed. The cover unit 150 may be formed of various materials such as a plastic material or the like. However, one surface of the cover unit 150 opposite to the accommodating unit 130 may be formed of a material through which light from the light source module 200 (to be described later) can pass.

[30] The light source module 200 may be disposed in the storage case 100 to selectively remove a harmful gas in the storage case 100.

- [31] The harmful gas may be a gas generated from the article stored in the storage case 100. For example, the harmful gas may include a gas generated from fruits and vegetables. The harmful gas may include ethylene gas.
- [32] The light source module 200 may include a photocatalyst layer 210 and at least one light emitting diode 220 configured to radiate light to the photocatalyst layer 210.
- [33] The light emitting diode 220 may be disposed in at least one of a space between the inner case 110 and the outer case 120, and the space section 160 of the cover unit 150.
- [34] The light emitting diode 220 functions to convert an electrical signal of power or the like provided from the outside into light. One or a plurality of light emitting diodes 220 may be provided. The number of light emitting diodes 220 may be adjusted according to a size or use of the storage case 100. In addition, the light emitting diodes 220 may be arranged in a pattern to evenly irradiate a surface of the photocatalyst layer 210 (to be described below). Accordingly, as the surface of the photocatalyst layer 210 is uniformly irradiated, a surface area of the activated photocatalyst layer 210 is also increased, improving photocatalysis efficiency.
- [35] The light emitting diode 220 may include a light emitting diode configured to radiate light having a wavelength of 200 nm to 400 nm, which functions to provide a light source configured to activate the photocatalyst. If the wavelength of the light emitting diode 220 is larger than 400 nm, since light has energy smaller than bandgap energy of the photocatalyst itself is generated, the photocatalyst cannot be activated. In addition, when the wavelength of the light emitting diode 220 is smaller than 200 nm, energy efficiency for activation of the photocatalyst may be decreased. For example, the light emitting diode 220 may be a near ultraviolet light (NUV) light emitting diode or a deep ultraviolet light (DUV) light emitting diode.
- [36] The photocatalyst layer 210 may be coated on at least one of an inner circumferential surface of the inner case 110 and one surface of the cover unit 150 opposite to the accommodating unit 130. However, when the inner case 110 and the cover unit 150 are formed of a photocatalyst material, the photocatalyst layer 210 may be omitted.
- [37] The photocatalyst layer 210 may be formed of any material as long as the material can function as a photocatalyst. For example, the photocatalyst layer 210 may include any one selected from the group consisting of TiO_2 , SiO_2 , WO_3 , ZnO , and a mixture thereof. For example, the photocatalyst layer 210 may include TiO_2 .
- [38] When the photocatalyst layer 210 is activated, a harmful gas, for example, ethylene gas can be removed. This is performed by using a photolysis reaction of the photocatalyst. When light having energy larger than the bandgap energy of the photocatalyst itself is radiated to the photocatalyst layer 210, an electron is generated from the surface of the photocatalyst. The generated electron reacts with a hydrogen molecule contained in moisture to generate a hydroxyl radical (OH-radical). Here, the generated

hydroxyl radical reacts with another gas in a very instable state, and in particular, has a function of decomposing an organic material with excellent oxidizing power. Accordingly, the photocatalyst can be activated to decompose and remove the ethylene gas. For example, when the TiO₂ photocatalyst is activated, the ethylene gas can be removed through photo-oxidation decomposition under an atmosphere of moisture in the air according to the following [Chemical Formula 1].

[39] [Chemical Formula 1]

[40] $C_2H_4 + 4H_2O \rightarrow 2CO_2 + 6H_2$

[41] A thickness of the photocatalyst layer 210 may be 10 μm to 30 μm . If the thickness of the photocatalyst layer 210 is less than 10 μm , the ethylene gas cannot be sufficiently removed and durability of the photocatalyst layer 210 may be insufficient. In addition, when the thickness of the photocatalyst layer 210 is more than 30 μm , since the thickness of photocatalyst layer is increased while an area in contact with the ethylene gas is constant, economic feasibility may be reduced.

[42] Accordingly, when the entire inner surface of the inner case 110 is coated with the photocatalyst layer 210, since a reaction area with the ethylene gas is maximized, photocatalysis efficiency can be improved.

[43] An absorbent (not shown) may be further provided on the photocatalyst layer 210. The absorbent may include activated carbon, supported metal activated carbon, potassium permanganate (KMnO₄), Zeolite, or the like. Accordingly, a bad smell or the like generated from the stored articles can be removed through the absorbent.

[44] The control unit 300 may include a microcomputer. The control unit 300 can control the intensity of radiation of the light source module 200 according to the internal environmental data.

[45] The internal environmental data may include at least one of an amount of stored articles, opening/closing of the storage case 100, and a generation amount of a harmful gas. For example, the amount of stored articles may be an amount of fruits and vegetables stored in the storage case 100.

[46] For example, the control unit 300 can control a lighting quantity and on/off switching time of the light source module 200 according to a predetermined reference lighting quantity and on/off switching time corresponding to the internal environmental data.

[47] The reference lighting quantity and on/off switching time may be previously set to be appropriate to predict a harmful gas amount generated from the stored articles and remove the harmful gas based on a height, a weight, a flow rate, or the like, of the stored articles. In addition, the harmful gas amount to be removed may be set to each unit section, and the number of light emitting diodes and lighting hours needed to remove the harmful gas corresponding to the unit section can be previously set.

[48] Information on the predetermined set of reference lighting quantity and on/off

switching time may be stored in a storage unit (not shown). The storage unit may include a memory.

[49] The multi-purpose conservation apparatus 1 may further include a sensor unit 400 configured to collect the internal environmental data.

[50] The sensor unit 400 may be disposed in the storage case 100 and collect the internal environmental data of the storage case 100.

[51] The sensor unit 400 may include any one selected from the group consisting of a height sensor 410, a pressure sensor 420, a gas sensor 430, and a flow rate sensor (not shown). The gas sensor 430 may be a gas sensor configured to measure a harmful gas amount. Accordingly, the internal environmental data collected by the sensor unit may be data related to a height, a weight, a harmful gas amount, or a flow rate of the stored articles.

[52] The height sensor 410, the gas sensor 430, or the flow rate sensor may be formed on an inner surface of the inner case 110, and the pressure sensor 420 may be formed between a lower surface of the inner case 110 and a lower surface of the outer case 120.

[53] The multi-purpose conservation apparatus 1 may further include a display unit 500 configured to display data received from the control unit 300.

[54] The display unit 500 may be a liquid crystal display (LCD), a plasma display panel (PDP), a light emitting diode (LED), a laser diode, or a touch screen. However, the display unit 500 may be omitted according to the embodiment.

[55] The display unit 500 may include an internal environment display unit or a radiation intensity display unit. The internal environment display unit may include a height display unit, a weight display unit, a flow rate display unit, or a gas amount display unit. The radiation intensity display unit may include a light source lighting display unit or an on/off switching time display unit. For example, when the sensor unit 400 includes the height sensor, the pressure sensor, and the gas sensor, the display unit 500 may include the height display unit, the weight display unit and the gas display unit. In addition, the display unit 500 may further include the light source lighting display unit or the on/off switching time display unit.

[56] The control unit 300 and the display unit 500 may be mounted on the storage case 100, or may be separately provided from the storage case 100. Accordingly, when the control unit 300 and the display unit 500 are separately provided from the storage case 100, they can be connected to each other through a wired or wireless communication network (not shown) in a wired or wireless manner. In this case, the internal environmental data in the storage case 100 can be remotely monitored, or the light source module mounted in the storage case can be remotely controlled.

[57] The multi-purpose conservation apparatus 1 may further include a timer 600. The

timer 600 is controlled by the control unit 300. Of course, the timer 600 can be manually adjusted to adjust an on/off switching time of the light source module 200.

[58] The multi-purpose conservation apparatus 1 may further include an ON/OFF switch 700. The ON/OFF switch 700 functions to supply and cut off the power to the multi-purpose conservation apparatus 1.

[59] Meanwhile, the multi-purpose conservation apparatus 1 may include a power supply unit (not shown). For example, when the multi-purpose conservation apparatus 1 has a small box shape, the power supply unit may include a mercury battery.

[60] Accordingly, the multi-purpose conservation apparatus 1 of the present invention can adjust the intensity of radiation of the light source module 200 according to the internal environmental data of the storage case 100, efficiently adjusting a level of the photocatalysis.

[61] **Second Embodiment**

[62] A multi-purpose conservation apparatus 1' according to an embodiment of the present invention is provided.

[63] FIG. 3 is a cross-sectional view showing the multi-purpose conservation apparatus 1' according to the embodiment of the present invention. Referring to FIG. 3, the multi-purpose conservation apparatus 1' may include a storage case 100, a light source module 200, and a control unit (not shown).

[64] The storage case 100 includes an inner case 110 and an outer case 120. The inner case 110 has an accommodating unit 130 formed therein, at least one surface of which is open. The outer case 120 is spaced apart from an outer circumferential surface of the inner case 110 to surround the outer circumferential surface. Accordingly, a space section 140 is formed between the inner case 110 and the outer case 120. Portions of the outer case 120 and the inner case 110 may be connected to each other. In addition, a support frame (not shown) configured to support the outer case 120 and the inner case 110 may be further provided.

[65] Accordingly, the accommodating unit 130, at least one surface of which is open, is formed in the storage case 100. For example, the storage case 100 may have a pipe shape, both surfaces of which are open.

[66] Here, in some cases, the storage case 100 may further include a cover unit (not shown).

[67] The light source module 200 may be disposed in the storage case 100 to selectively remove a harmful gas in the storage case 100.

[68] The light source module 200 may include a photocatalyst layer 210 and at least one light emitting diode 220 configured to radiate light to the photocatalyst layer 210.

[69] The light emitting diode 220 may be disposed between the inner case 110 and the outer case 120 to radiate light to the photocatalyst layer 210. One or a plurality of light

emitting diodes 220 may be provided. The number of light emitting diodes 220 may be adjusted according to the size of the storage case 100. In addition, the light emitting diodes 220 may be arranged in a pattern.

[70] The photocatalyst layer 210 may be formed of any material as long as the material can function as the photocatalyst. For example, the photocatalyst layer 210 may include any one selected from the group consisting of TiO_2 , SiO_2 , WO_3 , ZnO , and a mixture thereof. For example, the photocatalyst layer 210 may include TiO_2 .

[71] An absorbent (not shown) may be further provided on the photocatalyst layer 210. The absorbent may include activated carbon, supported metal activated carbon, potassium permanganate (KMnO_4), Zeolite, or the like. Accordingly, a bad smell or the like generated from the articles can be removed through the absorbent.

[72] The control unit may further include a microcomputer. The control unit can control the intensity of radiation of the light source module according to the internal environmental data.

[73] For example, the control unit 300 can control a lighting quantity and on/off switching time of the light source module 200 according to a predetermined reference lighting quantity and on/off switching time corresponding to the internal environmental data.

[74] The multi-purpose conservation apparatus 1 may further include a sensor unit 400 configured to collect the internal environmental data. The sensor unit 400 is disposed in the storage case 100 and can collect the internal environmental data of the storage case 100. The sensor unit 400 may include a gas sensor 430 or a flow rate sensor 440. The gas sensor 430 may be a gas sensor configured to measure a harmful gas amount. Accordingly, the internal environmental data collected by the sensor unit may be a gas amount or a flow rate data of the stored articles. The gas sensor 430 or the flow rate sensor 440 may be formed on an inner surface of the inner case 110.

[75] The multi-purpose conservation apparatus 1 may further include a display unit (not shown).

[76] The control unit or the display unit may be mounted on the storage case 100 or may be separately provided from the storage case 100. Accordingly, when the control unit or display unit is separately provided from the storage case, they can be connected through a wired or wireless communication network (not shown) in a wired or wireless manner. In this case, information on the articles stored in the storage case 100 can be remotely monitored, or the light source module mounted in the storage case 100 can be remotely controlled.

[77] Accordingly, when the multi-purpose conservation apparatus 1' of the present invention is used as a portion of a water treatment circulation system, water quality can be improved through the photocatalyst layer or the absorbent. In addition, the intensity of radiation, for example, the lighting quantity and on/off switching time, of the light

source module may be adjusted according to the flow rate or harmful gas amount of the stored fluid to efficiently adjust a level of the photocatalysis.

[78] **Third Embodiment**

[79] A harmful gas control method according to an embodiment of the present invention will be described.

[80] FIG. 4 is a control block diagram of a multi-purpose conservation apparatus according to the embodiment of the present invention. Referring to FIG. 4, articles can be stored in the multi-purpose conservation apparatuses 1 and 1 described with reference to FIGS. 1, 2, and 3. The articles may be solid articles or fluids. The solid articles may be fruits and/or vegetables, and the fluids may be water.

[81] For example, fruits can be inserted into the accommodating unit 130 (see FIGS. 1 and 2) of the storage case 100 (see FIGS. 1 and 2), and the cover unit 150 (see FIGS. 1 and 2) is coupled thereto so that the fruits can be hermitically stored. For another example, the fluid can be inserted into the storage case 100 (see FIG. 3), fixed or circulated, and stored in the apparatus.

[82] A power supply unit 800 can supply power to the multi-purpose conservation apparatus.

[83] The internal environmental data can be collected by the sensor unit 400. For example, height and weight data of the filled solid articles can be collected by the height sensor and the pressure sensor, respectively. For another example, the harmful gas amount and the flow rate data generated from the fluid can be collected by the gas sensor and the flow rate sensor.

[84] The control unit 300 can control the intensity of radiation of the light source module 200 according to the internal environmental data. For example, the control unit 200 controls the intensity of radiation of the light source module 200 according to a predetermined reference lighting quantity and on/off switching time corresponding to the internal environmental data collected by the sensor unit 400.

[85] The collected information is displayed by the display unit 500 from the control unit 300.

[86] The light emitting diode 220 is driven based on the control. For example, the plurality of light emitting diodes 220 can be driven based on the control.

[87] The photocatalyst layer 210 can be activated by the light emitted from the light emitting diode 220 to decompose and remove the harmful gas generated from the stored articles.

[88] Accordingly, when the foods such as fruits, vegetables, or the like, are stored, the foods can be stored while maintaining the freshness of the foods through removal of the harmful gas.

[89] In addition, when the fluid such as water or the like is stored, the fluid can be stored

while improving quality of the fluid through removal of the harmful gas. Further, when the fluid is circulated in the conservation apparatus, since the amount of harmful gas in contact with the photocatalyst layer 210 activated by the light emitting diode 220 is increased, efficiency of photocatalysis can be improved.

[90] The foregoing description concerns an exemplary embodiment of the invention, is intended to be illustrative, and should not be construed as limiting the invention. The present teachings can be readily applied to other types of devices and apparatuses. Many alternatives, modifications, and variations within the scope and spirit of the present invention will be apparent to those skilled in the art.

[91]

[92] <Description of Reference Numerals>

[93] 1, 1: multi-purpose conservation apparatus 100: storage case

[94] 110: inner case 120: outer case

[95] 130: accommodating unit 140: space section

[96] 150: cover unit 160: space section

[97] 200: light source module 210: photocatalyst layer

[98] 220: light emitting diode 300: control unit

[99] 400: sensor unit 410: height sensor

[100] 420: pressure sensor 430: gas sensor

[101] 440: flow rate sensor 500: display unit

[102] 600: timer 700: ON/OFF switch

[103] 800: power supply unit

Claims

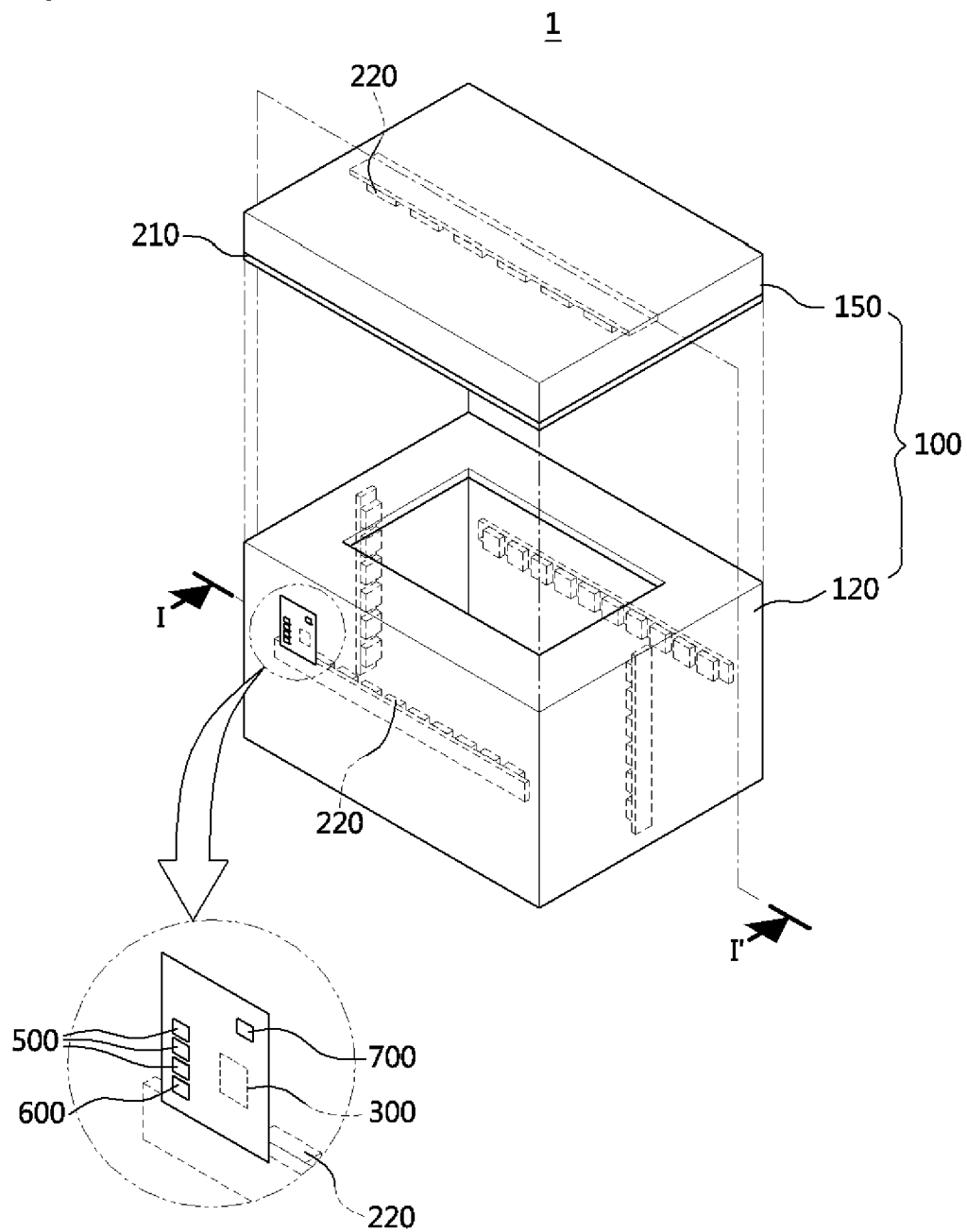
- [Claim 1] A multi-purpose conservation apparatus comprising:
a storage case;
a light source module disposed in the storage case and configured to selectively remove a harmful gas in the storage case; and
a control unit configured to control intensity of radiation of the light source module according to internal environmental data of the storage case.
- [Claim 2] The multi-purpose conservation apparatus according to claim 1, wherein the light source module comprises:
a photocatalyst layer; and
at least one light emitting diode configured to radiate light to the photocatalyst layer.
- [Claim 3] The multi-purpose conservation apparatus according to claim 2, wherein the storage case comprises:
an inner case having an accommodating unit formed therein and at least one surface of which is open;
an outer case spaced apart from an outer circumferential surface of the inner case and surrounding the outer circumferential surface; and
a cover unit coupled to the accommodating unit and having a space section formed therein.
- [Claim 4] The multi-purpose conservation apparatus according to claim 3, wherein the light emitting diode is disposed at least one of between the inner case and the outer case, and the space section of the cover unit, and
the photocatalyst layer is coated on at least one of an inner circumferential surface of the inner case and one surface of the cover unit opposite to the accommodating unit.
- [Claim 5] The multi-purpose conservation apparatus according to claim 2, wherein the light emitting diode radiates light having a wavelength of 200 nm to 400 nm.
- [Claim 6] The multi-purpose conservation apparatus according to claim 1, wherein the harmful gas comprises a gas generated from fruits and vegetables.
- [Claim 7] The multi-purpose conservation apparatus according to claim 6, wherein the harmful gas comprises ethylene gas.
- [Claim 8] The multi-purpose conservation apparatus according to claim 1,

wherein the internal environmental data comprises at least one of an amount of fruits and vegetables, opening/closing of the storage case, and a generation amount of the harmful gas.

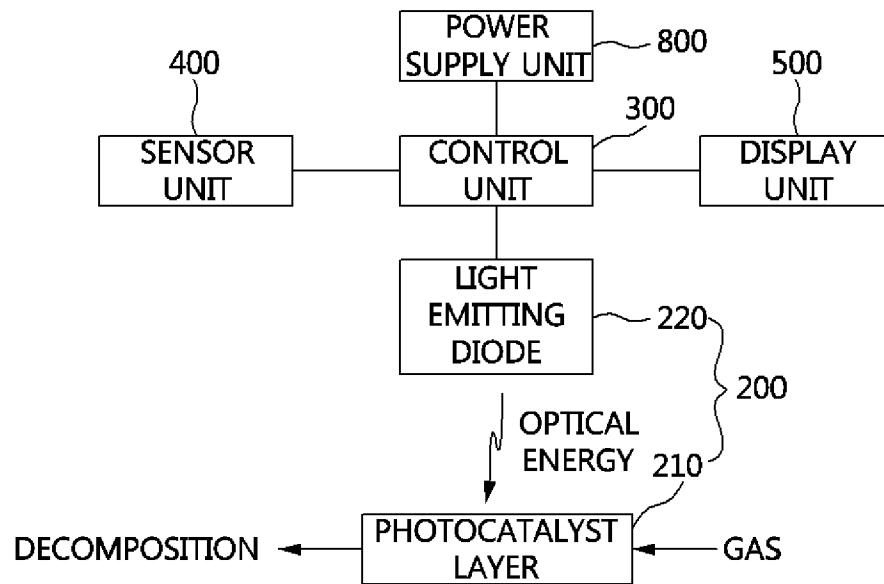
[Claim 9]

The multi-purpose conservation apparatus according to claim 1, further comprising a display unit configured to display data received from the control unit.

[Fig. 1]



[Fig. 4]



A. CLASSIFICATION OF SUBJECT MATTER**A23B 7/015(2006.01)i, B01J 21/06(2006.01)i, B65D 85/34(2006.01)i**

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)

A23B 7/015; A23B 7/01; A01G 5/06; A23B 7/00; F25D 11/00; F25D 23/00; A23B 7/152; F25D 27/00; B01J 21/06; B65D 85/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: conservation, ethylene, photocatalyst, light emitting diode, control

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009-027970 A (PANASONIC ELECTRIC WORKS CO., LTD.) 12 February 2009 See abstract; paragraphs [0013]-[0015], [0017], [0019]-[0021]; and figures 1-2.	1-8
Y		9
Y	JP 2003-247773 A (MATSUSHITA REFRIG. CO., LTD.) 5 September 2003 See abstract; paragraphs [0201], [0202], [0204], [0210]; claims 1, 16, 40-41, 43-44; and figures 1, 94-95.	9
A	JP 2002-204653 A (TOSHIBA LIGHTING & TECHNOLOGY CORP.) 23 July 2002 See abstract; paragraphs [0022]-[0024]; claims 1, 3-4; and figures 1-2.	1-9
A	JP 2009-085521 A (TOSHIBA CORP. et al.) 23 April 2009 See abstract; claims 1-8; and figure 1.	1-9
A	KR 10-2004-0064933 A (BANG, YOUNG JUNG) 21 July 2004 See page 3 - page 4; and figure 3.	1-9
A	KR 10-2005-0040259 A (JUNG, JIN WOO) 3 May 2005 See page 3; and figures 1-5.	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2013/003016

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