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(54) **Title:** DRY FOG DENSITY DETECTION SYSTEMS AND APPLICATION SYSTEMS AND METHODS THEREOF

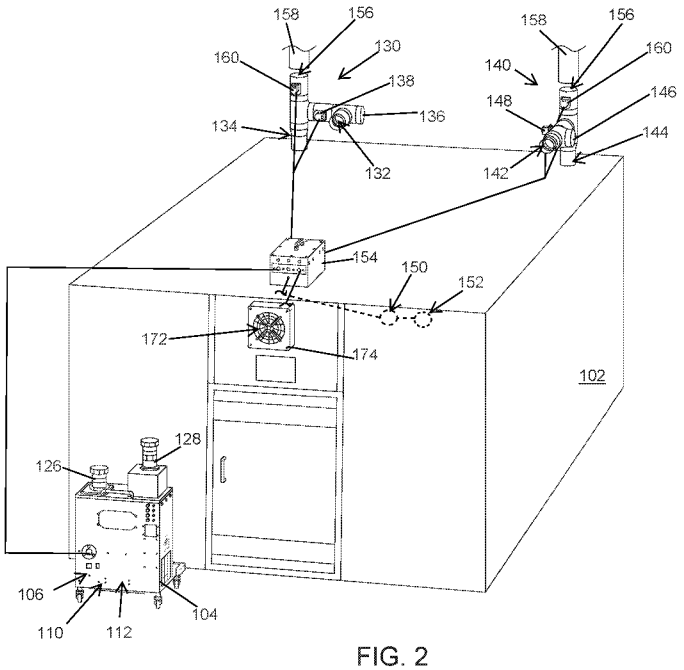

FIG. 2

(57) **Abstract:** A dry fog delivery system for use with an incubator includes a dry fog delivery unit having a dry fog flow generator to produce a flow of dry fog containing a treatment substance, a control unit, and a dry fog density detector that generates a dry fog density signal. The system further includes a supply manifold and return manifold along with selectively blocking dampers. The dampers actuate open conduits for flow to an incubator from the dry fog flow generator through the supply manifold and from the incubator to the dry fog flow generator through the return manifold. The system further includes sensors, in communication with the control unit, for at least temperature and humidity in the incubator or portions of the dry fog flow generator and the control unit operates the dampers and dry fog flow generator based on signals from the sensors and the dry fog density detector.

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[Continued on next page]

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US23/80195

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. A61L 2/28; A61L 2/22; A61L 9/015; B05B 12/08; G01N 15/02; G01N 21/53 (2023.01)
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CPC - INV. A61L 2/28; A61L 2/22; A61L 9/015; B05B 12/084; G01N 15/0211; G01N 21/532
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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)
See Search History document

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- A	US 2015/0020804 A1 (KONINKLIJKE PHILIPS N.V.) 22 January 2015; Abstract; Figure 1; Claims 1, 6; Paragraphs [0024, 0027-0028, 0042, 0044-0048, 0141]	30 --- 1-19, 31-32
A	US 2021/0252237 A1 (FRAUNHOFER-GESELLSCHAFT ZUR FöRDERUNG DER ANGEWANDTEN FORSCHUNG E.V.) 19 August 2021; Abstract; Figures 1A-1B; Paragraphs [0084, 0086]	1-19, 30-32
A	US 2019/0094056 A1 (DEKA PRODUCTS LIMITED PARTNERSHIP) 28 March 2019; Figure 1; Paragraphs [0015-0017]	1-19, 30-32

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US23/80195

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-***-Please See Supplemental Page-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-19 and 30-32

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US23/80195

-***-Continued From Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-19 and 30-32 are directed towards a bandpass filter for filtering light in a fog density detector.
Group II: Claims 20-26 are directed towards an off status indicator for control.
Group III: Claims 27-29 are directed towards a time setpoint control.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include at least a bandpass optical filter disposed between the optical sensor and the light source along the path, which are not present in Groups II and III.

The special technical features of Group II include at least signaling an off status with the control unit based on one of the at least one threshold circumstance or an operating time of the dry fog flow generator reaching the maximum time limit; stopping the flow generated by the dry fog flow generator with the control unit when the off status is signaled; blocking the dry fog supply conduit and dry fog return conduit with the control unit when the off status is signaled; and opening the air intake opening and air exhaust opening with the control unit when the off status is signaled, which are not present in Groups I and III.

The special technical features of Group III include at least wherein the control unit is configured to accept a contact time setpoint; receiving a contact time setpoint at the control unit, wherein the contact time setpoint is a minimum period of time required for the flow of dry fog to contact surfaces within the space to decontaminate the space of a specific target pathogen; confirming successful treatment when the density of the dry fog within the space exceeds a threshold for a cumulative time period exceeding the contact time setpoint, which are not present in Groups I and II.

The common technical features shared by Groups I, II, and III are a dry fog density detector comprising: a light source configured to produce an illumination beam comprising light within a specified wavelength band and direct the illumination beam along a path; an optical sensor disposed in the path at a set distance from the light source; wherein the optical sensor is configured to provide dry fog density signals based on fog disposed within the path, providing a dry fog flow delivery unit, and the dry fog flow generator generates a flow of dry fog.

However, these common features are previously disclosed by US 2015/0020804 A1 to KONINKLIJKE PHILIPS N.V. (hereinafter "KONINKLINJKE"). KONINKLINJKE discloses a dry fog density detector comprising: a light source configured to produce an illumination beam comprising light within a specified wavelength band and direct the illumination beam along a path (a system to detect density of an aerosol includes a light source which will produce an illumination beam at a specified wavelength along a path; abstract); an optical sensor disposed in the path at a set distance from the light source; wherein the optical sensor is configured to provide dry fog density signals based on fog disposed within the path (an optical detecting component detects light signals, the detector at a set distance from the light source and will provide density of aerosols based on the aerosols disposed in the path of the light; abstract; para [0021]), providing a dry fog flow delivery unit, and the dry fog flow generator generates a flow of dry fog (a flow device generates an aerosol which may be dry fog; claim 1).

Since the common technical features are previously disclosed by the KONINKLINJKE reference, these common features are not special and so Groups I, II, and III lack unity.