UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

EDEN PARK ILLUMINATION, INC.,
LARSON ELECTRONICS LLC, FAR UV TECHNOLOGIES
and USHIO AMERICA, INC.,
Petitioners,

v.

S. EDWARD NEISTER,
Patent Owner.

IPR2022-00381
Patent No. 9,700,642

DECLARATION OF OLIVER R. LAWAL IN SUPPORT OF PETITIONERS' OPPOSITION TO PATENT OWNER'S CONTINGENT MOTION TO AMEND U.S. PATENT NO. 9,700,642

I, Oliver R. Lawal, declare as follows:

I. SUPPLEMENTAL '642 PATENT PRIORITY DATE ANALYSIS

1. I have reviewed the evidence set forth by Patent Owner and Patent Owner's expert, Dr. Mark Hernandez, regarding the disclosures in Provisional Application No. 60/593,626 that Patent Owner alleges discloses the claim limitation of "generating photons of at least two single line wavelengths[.]" (MTA, 8-9; EX2014, 9.) As an initial matter, I note that Patent Owner and Dr. Hernandez put forth identical evidence, with no accompanying argument supporting priority. Regardless, in my opinion, none of these disclosures direct or otherwise indicate to a POSITA that the inventor possessed the invention of generating photons of more than one single line wavelength, and specifically does not suggest the inventor possessed a combination of single line wavelengths at 222 nm and 254 nm. I address each disclosure in turn below.

2. "Apparatus that consists of *a NUV source*, ESP, ozone generator, *mercury lamps*, and humidifier with controls as defined in claims 3-8 and any combination therein." (EX1008, cl. 9 (emphasis added by Patent Owner).) In my opinion, this disclosure simply identifies various sources that can be used in accordance with the invention disclosed by the provisional application. Neither a "NUV source," "ESP," "ozone generator," "mercury lamps," or "humidifier" with

defined controls teaches or suggests using more than one single-line wavelength to destroy DNA or RNA.

3. "The commercial light source for UV irradiation near a principal absorption peak of DNA has been produced by using mercury as the source for generating protons. The mercury gas and its pressure in the lamp determine the wavelength of the emitting light. For low-pressure (LP) and low-pressure high output (LPHO) lamps, the emitting wavelength is 254 nm." (*Id*., ¶ 8.) In my opinion, this disclosure in the provisional application simply discloses the use of a low-pressure mercury lamp, which emits principally at 254 nm. A POSITA would not view this disclosure as a suggestion that the applicant intended to claim the well-known use of a low-pressure mercury lamp as a means of emitting more than one single line wavelength.

4. "An excimer lamp emitting at 222 nm is considered the most effective source because DNA chains and biochemical's[sic] have greater absorption at this wavelength." (*Id*., ¶ 12.) In my opinion, this disclosure in the provisional application also only discloses the use of one single line wavelength—here, a 222 nm wavelength emitted by an excimer lamp. The excimer lamp does not emit more than one single line wavelength. Moreover, this disclosure does not show that inventor possessed the idea that an excimer lamp would be a source of ***two*** single line emissions at both 222 nm ***and 254 nm***. An "excimer lamp emitting at 222 nm" is an

excimer lamp comprising KrCl gas. A KrCl excimer lamp does not have any peak emissions at 254 nm that would suggest to a POSITA that the applicant was describing a UV source emitting at both these single line wavelengths.

5. "The preferred embodiment is a NUV source at 222 nm, but other lines can also be used…The NUV source is chosen to supply the single line emission that matches the peak absorption of the targeted organism or chemical." (*Id*., ¶ 27.) Like the other disclosures, this disclosure from the provisional application simply teaches the use of one single line wavelength—222 nm—while acknowledging that other wavelengths ("lines") could be used in place of 222 nm. Indeed, the second sentence there specifically references a singular source, singular emission, and singular absorption peak: "***The NUV source*** is chosen to supply ***the single line emission*** that matches ***the peak absorption*** of the targeted organism or chemical." (*Id*. (emphasis added).) The only disclosed embodiment for the "NUV source" in the provisional application either emits photons "at 222 nm" or contains a reflector "transparent" to a single wavelength ("222 nm light"). (*Id*., ¶ 39.)

6. Figure 9, shown below:

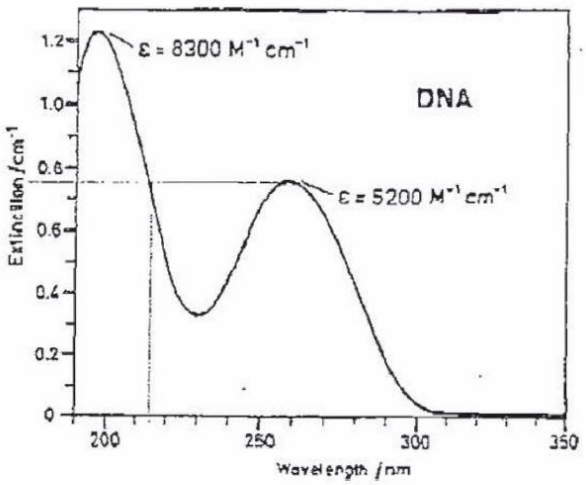

Figure 9: UV absorption of DNA

(*Id*., 30.) Figure 9 is a figure showing the UV absorption spectrum of DNA, with a plot adapted from the 1986 Von Sonntag publication, (EX1039, 16). (*See* EX1008, ¶ 7.) In my opinion Figure 9, on its own, does not teach or suggest using more than one single line wavelength for disinfection. And the next paragraph in the provisional application that addresses the DNA absorption spectrum specifies using only a single wavelength, at 254 nm, stating, "[t]he commercial light source for UV irradiation near a principal absorption peak of DNA has been produced by using mercury as the source for generating photons," going on to identify low-pressure mercury lamps emitting at 254 nm. (*Id*., ¶ 8.)

7. Therefore, in my opinion these disclosures, taken either alone or together, do not disclose to a POSITA the use of more than one single-line wavelength within the meaning of either the original or substitute claims.

II. ANALYSIS OF THE SUBSTITUTE CLAIMS OF THE '642 PATENT

8. I have reviewed Patent Owner's Contingent Motion to Amend U.S. Patent No. 9,700,642, (Paper No. 32), and Dr. Mark Hernandez's Declaration supporting Patent Owner's Motion, (EX2045). It is my opinion that the substitute claims 12-19 that Patent Owner proposes would have been obvious to a POSITA in view of the prior art.

A. Substitute Claims 12-18 are obvious in light of Brown-Skrobot in view of Clauss

9. It is my opinion that a POSITA presented with the teachings of Brown-Skrobot and Clauss would have found substitute claims 12-18 obvious.

10. I incorporate by reference my opinions regarding original claims 12-18 presented in the declaration I signed on February 4th, 2022, (EX1003). Here I will limit my analysis to addressing the two substantive amendments that Patent Owner has proposed to independent claim 12: (i) replacing destroying a DNA or RNA of "a microorganism" with destroying a DNA or RNA of "viral and bacterial agents"; and (ii) generating photons of at least two single line wavelengths "of 222 nm and 254 nm," instead of "of 222 nm, 254 nm and 282 nm." (MTA, 5, 8.)

1. *"destroying a DNA or RNA of viral and bacterial agents"*

11. I believe the combination of Brown-Skrobot and Clauss discloses "destroying a DNA or RNA of viral and bacterial agents."

12. As a preliminary matter, I note that the word "agents" does not appear in the specification of the '642 patent in relation to either viruses or bacteria. For the purposes of my analysis I will treat "viral and bacterial agents" to mean "viruses and bacteria." I reserve the right to supplement my opinion should Patent Owner clarify or alter this limitation.

13. Brown-Skrobot discloses using UV light to kill both viruses and bacteria. Brown-Skrobot defines the term "sterile" or "sterilization" at the outset of the "Description of the Invention" section to mean "the condition of an object, or an environment, which is free of all living cells, all viable spores (and other resistant and disseminative forms), and all viruses and subviral agents capable of replication." (EX1006, ¶ 0030.) In the discussion of one embodiment of the invention of Brown-Skrobot in which contact lenses are sterilized, Brown-Skrobot explains that "[v]iruses are susceptible to UV radiation, and vegetative bacteria are more susceptible to UV radiation." (*Id*., ¶ 0053.) Indeed, Brown-Skrobot discloses sterilizing specific strains of bacteria using 257 nm UV radiation. (*Id*., ¶¶ 0053, 0068-0069; *see also id*., ¶ 0033 (disclosing "most preferred" wavelength as having "the majority of radiation at 257 nm"); *id*., ¶¶ 0047-0048, 0056 (similar).)

14. Clauss also discloses using UV light to irradiate (inactivate) bacteria. Indeed, Clauss employs two wavelengths of UV light, 222 nm and 254 nm, to irradiate two strains of bacteria, *Escherichia coli* and *Yersinia enterolytica*. (*See*

EX1007, 579 ("Photoreactivation of *Escherichia coli* ATCC 11229 and *Yersinia enteroiytica* ATCC 4780 after irradiation with a 222 nm krypton-chloride excimer lamp compared to a 254 nm mercury tamp was investigated under laboratory conditions.").) Clauss discloses that 254 nm UV light is used specifically because it is "near DNA absorption max," in contrast to 222 nm UV light that is "near protein absorption max[.]" (*Id*., 580.) Thus, a POSITA reading Clauss and Brown-Skrobot would understand that UV light at around 254 nm wavelength destroys DNA.

15. In my opinion, even apart from Brown-Skrobot and Clauss, it would have been well known to a POSITA that UV lamps emitting principally at 254 nm were useful for treating both viruses and bacteria. For example, the "Background" section of the '642 Patent explains that "commercially available" UV lamps that were "mercury based and emit principally at 254 nm" were known to be used for sterilization and disinfection. (EX1001, 1:33-43.) Specifically, these lamps were known to be an "effective treatment" for "the destruction of 'virus, bacteria, spores and pathogens' (microorganisms or VSP)[.]" (EX1001, 1:33-43.) A POSITA would also have understood that different amounts of energy would be needed to kill different types of microorganisms. (*See, e.g.*, EX1015, Table 4 (disclosing energy needed at 253.7 nm to achieve 100% kill of several common viruses).)

16. A POSITA would also have known that it was beneficial to target the absorption spectrum of macromolecules, including nucleic acids and proteins.

Clauss explained that low-pressure mercury lamps were traditionally used for disinfection, and "[t]heir nearly monochromatic emission of 254 nm almost corresponds with the maximum of DNA absorption at approx. 260 nm." (EX1007, 580.) Using 254 nm UV light "causes damage to DNA by altering nucleotide base pairing," which, if unrepaired, "finally leads to cell death." (*Id*.) Indeed, it had been known for decades that the "inactivation spectrum of bacteria and viruses is very close to the absorption spectrum of DNA[.]" (EX1039, 16.)

17. Additionally, a POSITA would have understood that viruses are susceptible to UV light at about 222 nm as well. (*See, e.g.*, EX1024, ¶ 0011 (disclosing sterilization systems "effective in inactivating viral and bacterial microorganisms" using "discrete wavelengths" including 222 (+/-5 nm)).) Indeed, the '642 Patent itself specifically references an EPA report that discloses that the tobacco mosaic virus was "more sensitive to ultraviolet light emitted at 220 nm." (EX1046, 1-4; EX1001, 5:8-15 (referencing EX1046).)

18. Therefore, for these reasons, the amended claims that are directed to destroying the DNA or RNA of "viral and bacterial agents," as opposed to destroying the DNA or RNA of "microorganisms" are obvious over the combination of Brown-Skrobot and Clauss.

2. *"generating photons of at least two single line wavelengths…being two of 222 nm and 254 nm"*

19. I believe the combination of Brown-Skrobot and Clauss discloses "generating photons of at least two single line wavelengths…being two of 222 nm and 254 nm." As discussed above, a POSITA would have understood the effectiveness of generating photons of a single line wavelength at 254 nm for destroying the chemical bonds of bacteria or virus for disinfection. The combination teaches that a POSITA would have been motivated to add generating at least a second single line wavelength at 222 nm to enhance its effectiveness.

20. The combination discloses at least two single line wavelengths, with Brown-Skrobot teaching that "[t]wo or more monochromatic [UV] radiation sources can be used together to provide the same or different amounts of energy at different wavelengths of monochromatic [UV] radiation[.]" (EX1006, ¶ 0042.) The combination discloses that "'monochromatic UV radiation' means radiation having a wavelength or wavelengths between from 160 to 400 nm, and the majority of the radiation is concentrated within a bandwidth of 3 nm." (*Id*., ¶ 0033.) "The preferred monochromatic UV radiation has the majority wavelength or wavelengths within about 220 to 320 nm . . . " and "preferably the majority of radiation is within a bandwidth of 2 nm, more preferably within 1 nm." (*Id*., ¶ 0033.) The radiation source may be "lasers or excimer lamps" but may also be other sources of monochromatic UV radiation. (*Id*., ¶¶ 0034, 0038, 0054.) A POSITA would recognize that 222 nm and 254 nm wavelengths fall within the expressly disclosed monochromatic UV

radiation range of "220 to 320 nm." Further, in my opinion a POSITA would also understand that a "monochromatic" light source such as an excimer lamp where "the majority of radiation within a bandwidth of 2 nm, more preferably within 1 nm" generates photons of a single line wavelength.

21. The combination also discloses generating photons of single line wavelengths of at least 222 nm and 254 nm. To begin, Brown-Skrobot teaches KrCl and XeI excimer lamps as exemplary monochromatic UV radiation sources that can be used with its disclosed invention, which a POSITA would understand would generate photons at about 222 nm and 253 nm, respectively. (*Id.* ¶¶ 0038-0034.) Additionally, Clauss further teaches using a low-pressure mercury lamp generating photons at 254 nm, in addition to a KrCl excimer lamp emitting 222 nm radiation. (EX1007, 580.)

22. Clauss teaches selecting lamps emitting photons of single line wavelengths 222 nm and 254 specifically because they each are a peak absorption wavelength of chemical bonds within the proteins or DNA/RNA of a microorganism. (*Id*., 580.) For example, Clauss teaches selecting 254 nm because it was known to be a maximum absorption wavelength that causes damage to DNA by altering nucleotide base pairing. (*Id*., 580 ("254 nm almost corresponds with the maximum of DNA absorption"); EX1001, 2:16-19, FIG. 9.) Clauss also teaches selecting 222 nm because it is near a "peak UV absorption . . . at 220 nm" for many

common amino acids, including those that the '642 Patent asserts can be found associated with DNA or RNA such as "phenylalanin[e], tyrosin[e], tryptophan, cystein[e], cystin[e] and histidin[e]." (EX1007, 580; EX1001, 6:33-46, FIGs. 9, 10; EX1018, 7:38-50; EX1019, 2:49-52, 3:1-7, 3:38-4:7.)

23. Additionally, I note also that the absorption maxima of DNA/RNA and amino acids were natural phenomena known long before the application for the '642 Patent was filed. (*See, e.g.,* EX1001, 4:4-11 (citing EX1039, a 1986 publication disclosing DNA absorption which states "inactivation spectrum of bacteria and viruses is very close to the absorption spectrum of DNA[.]") and 5:13-16 (citing EX1046, a 1996 publication which lists exemplary research indicating "tobacco mosaic virus [is] more sensitive to ultraviolet light emitted at 220 nm").)

24. Therefore, in my opinion the combination of Brown-Skrobot and Clauss discloses that "multiple monochromatic radiation sources" of UV light at 222 nm and 254 nm wavelengths can be used for destroying microorganisms such as viruses and bacteria. (EX1006, ¶¶ 0038, 0042; EX1007, 580.)

25. Thus, in my opinion the prior art discloses every limitation of Patent Owner's proposed substitute claims 12-18.

B. Substitute Claim 19 is obvious over Brown-Skrobot and Clauss in view of Liang

26. It is my opinion that a POSITA presented with the teachings of Brown-Skrobot, Clauss, and Liang would have found substitute claim 19 obvious.

27. I incorporate by reference my opinions regarding original claim 12 presented in the declaration I signed on February 4th, 2022, (EX1003), and my opinions above regarding substitute claim 12, (Section II(A), *supra*). Here I will limit my analysis to the limitation added in dependent claim 19, i.e. "wherein the substances[sic] is air." (MTA, 21.)

1. *Overview of Liang*

28. Liang is a published U.S. patent application titled "Method and Apparatus for Sterilizing Air in Large Volumes By Radiation of Ultraviolet Rays."

29. The invention disclosed in Liang is "an air sterilizing method and apparatus to destroy all live microorganisms in the air in large volumes to satisfy the increasing needs for the purposes of anti infectious disease and anti-terrorism." (EX1047, ¶ 0012.) In the background section, Liang explains that "[t]he air transmission of harmful bacteria, viruses and other microorganisms is one of the most common causes of infectious disease in the world today," and notes that "[t]he worldwide outbreak of SARS (caused by coronaviruses) has become a serious global concern since Jan. 2003," leading to concerns about both airborne diseases as well as "non-airborne harmful bacteria and viruses [that] can become airborne when they are in the form of aerosols or microdroplets." (*Id*., ¶¶ 0004-0005.)

30. Liang explains that while "many air purification devices have been created and patented" in the prior art, "none of them was created for sterilizing air in large volumes and destroying more than 99.999% of the microorganisms in the air." (*Id*., ¶ 0009.) Specifically, Liang notes that the prior art devices "have a so short sterilizing path or a so small chamber that the sterilizing effect is quite questionable," with the "weakest point" being that "they do not offer enough dosage of UV radiation to kill microorganisms," and instead may cause "dangerous effects" by aerosolizing and spreading the microorganisms. (*Id*.)

31. Liang's invention is "designed for a killing rate higher than 99.999% by adjusting the number of UV lamps and extending the length of the circuitous sterilizing chamber(s)," which serve to "increas[e] exposure to UV radiation that is used to kill all live microorganisms that pass through the chamber." (*Id*., ¶ 0012.) Liang uses UV radiation at "about 253.7 nm" because it is "very effective in killing microorganisms" and "is the most sensitive UV radiation to all microorganisms." (*Id*., ¶¶ 0013, 0047.) Liang explains that the "fundamental difference of this invention from prior art methods and apparatus" is the "UV radiation exposure intensity." (*Id*., ¶ 0048.) Specifically, the "formula is that the product (UV radiation value) of UV power multiplying exposure time must be higher than the UV death value of any microorganisms." (*Id*.) In other words, "the sterilizing dosage of UV

radiation should be high enough that there will not be any microorganism survived." (*Id*.)

32. To accomplish such a high level of sterility, Liang uses a circuitous sterilizing chamber, "which can increase both the traveling time of the sterilized air and the number of UV lamps installed[.]" (*Id*., ¶ 0049; *see also id*. ("Increasing the number of UV lamps can increase the sterilizing power of the apparatus.").) I note that in the "preferred embodiment," Liang uses "98 UV lamp tubes[.]" (*Id*.) Further, Liang teaches using UV lamps that are specifically "germicidal lamps" which "have the characteristics of higher UV power output and lower cost." (*Id*., ¶ 0050.) These germicidal UV lamps are depicted as element 15 in Figure 3, reproduced from the patent below:

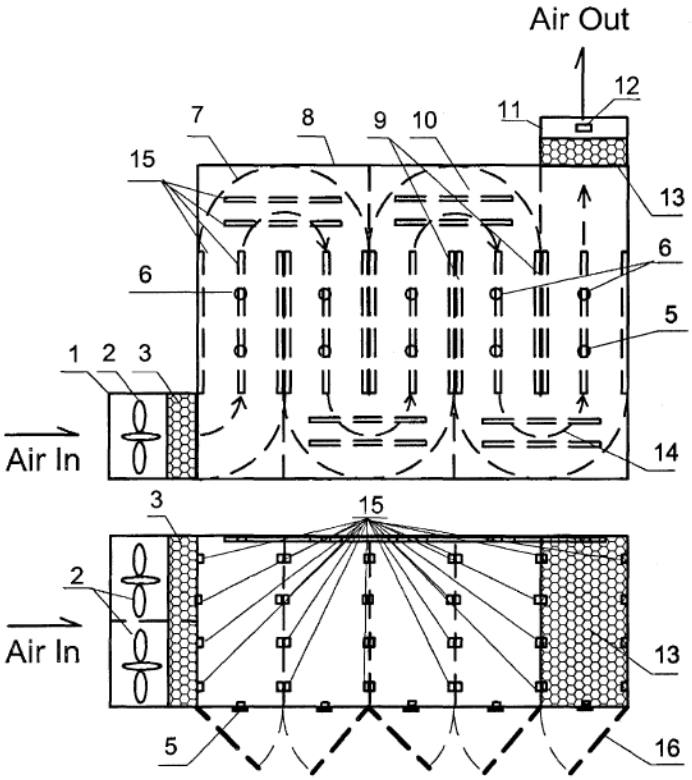

FIG. 3

(*Id*., FIG. 3; *see also id*., ¶ 0050.) I note that the apparatus also includes an "inspection window," labeled element 12, on outlet 11 in the image above, used "for taking air samples for live microorganisms inspection to supervise sterilizing effect and air quality." (*Id*., ¶ 0045.)

33. Thus, in my opinion a POSITA would understand that Liang teaches using 253.7 nm wavelength UV light to effectively kill microorganisms and thus sterilize an air stream. (*See id*., ¶¶ 0013, 0048, 0050.) Further, Liang discloses that his invention "can be added onto existing air conditioning systems, or stand alone,

for hospitals, biomedical, pharmaceutical, biotechnology, genetic research, universities, laboratories, food processing, [etc.]" purposes. (*Id*., ¶ 0013.)

2. *Reasons a POSITA would Combine Brown-Skrobot and Clauss with Liang*

34. It is my opinion that a POSITA would have been motivated to combine Liang's "air sterilizing method and apparatus to destroy all live microorganisms in the air in large volumes" using the combination of the 222 nm KrCl excimer lamp and 254 nm low-pressure mercury lamp of Clauss, as taught by Brown-Skrobot's disclosure of using "[t]wo or more monochromatic uv radiation sources[.]" (EX1047, ¶ 0012; EX1006, ¶¶ 0033, 0042; EX1007, 580.)

35. There are multiple reasons (taken together or independently) that support my conclusion concerning the reasons a POSITA would have been motivated to integrate the disclosures of Liang with the combination of Brown-Skrobot and Clauss.

36. First, in my opinion a POSITA reading Liang would have been motivated to optimize Liang even further to maximize the killing of the microorganisms in the air. As I discuss above, Liang explained the importance of achieving maximum sterility and criticized prior art devices that were unable to destroy more than 99.999% of the microorganisms in the air or across large volumes. (*See* EX1047, ¶ 0009.) Specifically, Liang explained how airborne transmission of

"harmful bacteria, viruses and other microorganisms is one of the most common causes of infectious disease in the world today," leading to deaths worldwide, including "more than forty thousand people every year" from influenza alone. (*Id*., ¶ 0004.) A POSITA would have understood that, with the rise of coronaviruses like SARS and anthrax (i.e. Bacillus Anthracis), referenced in Liang, (*id*., ¶¶ 005, 0007), the need to produce devices and methods that could reliably kill the maximum amount of these kinds of microorganisms was of the utmost importance.

37. Second, a POSITA would have sought to produce such devices and methods using known techniques. A POSITA at the time of the invention would have known that photons around 254 nm, like the 253.7 nm photons employed by Liang, could inactivate microorganisms by damaging the nucleic acid of the DNA/RNA structure, thus preventing the microorganisms from replicating. But a POSITA would have known that when these treated microorganisms were subsequently exposed to certain kinds of light, they could begin repairing their DNA in a process known as photoreactivation, and in this manner survive. (*See, e.g.*, EX1007, 580; *see also* EX1003, APPXB, 97.) Given the importance of killing greater than 99.999% of microorganisms over a large volume emphasized by Liang, a POSITA would have sought to avoid or mitigate this photoreactivation response. In doing so, a POSITA would have known from Clauss that using an excimer lamp or laser with a wavelength of 222 nm could prevent photoreactivation. (EX1007,

583.) Specifically, he would have understood that 222 nm photons kill microorganisms by damaging the peptide bonds found in proteins, rather than the DNA or RNA, and render the microorganisms inactive in this manner. A POSITA would have understood that microorganisms would be unable to repair damage to their proteins and would subsequently die. Thus, Liang's overarching purpose and goal of air sterilization would be achieved.

38. Third, a POSITA would have understood and appreciated that using a UV light source comprising multiple wavelengths (and, specifically, the 222 nm and 254 nm wavelengths taught by Clauss, Brown-Skrobot, and Liang) would yield certain predictable advantages. As I explain above, the synergies of combining the two wavelengths were already appreciated; applying them to air sterilization was an obvious next step.

39. A POSITA would have understood from Brown-Skrobot that "different wavelengths may provide increased levels of sterility, because different microorganisms that have to be sterilized on a medical device may have greater or lesser sensitivities to uv radiation at different wavelengths" and "therefore, multiple monochromatic uv radiation sources can be used which…when used together will successfully sterilize all the microorganisms, that might not otherwise be sterilized[.]" (EX1006, ¶ 0042; *see also* EX1015, 3:43-5:25 (tables showing different microorganisms requiring different radiant doses to achieve different levels

of disinfection).) For the reasons I explain above, a POSITA would have been motivated to combine Brown-Skrobot and Clauss to produce a device that achieved these increased levels of sterility. A POSITA reading Liang would therefore have sought to apply such a device to Liang's air sterilization device to maximize sterilization and achieve Liang's explicit purpose of achieving a "killing rate higher than 99.999%" in the air in large volumes. (EX1047, ¶ 0012.)

40. Finally, a POSITA would have been motivated to apply the combination of Brown-Skrobot and Clauss to Liang because Brown-Skrobot taught sterilization of a medical device, (EX1006, ¶ 0042), and Liang's expressly taught that his invention could be used in "hospitals, biomedical, pharmaceutical, [and] biotechnology" environments, (EX1047, ¶ 0013).

3. *Analysis of Substitute Claim 19: "The process of claim 12 wherein the substances is air."*

41. It is my opinion that a POSITA presented with the teachings of Brown-Skrobot, Clauss, and Liang would have found substitute claim 19 obvious.

42. I believe the combination of Brown-Skrobot, Clauss, and Liang discloses substitute claim 19.

43. This combination of prior art expressly discloses directing (and exposing) an air stream to UV photons. Specifically, Liang teaches "an air sterilizing method and apparatus to destroy all live microorganisms in the air in large

volumes[.]" (EX1047, ¶ 0012.) An exemplary apparatus is depicted in Figure 3 of Liang, which I have reproduced above. (*Id*., FIG. 3.) I note that Liang's "circuitous sterilizing chamber" "increase[s] both the traveling time of the sterilized air and the number of UV lamps installed[.]" (*Id*., ¶ 0049.) Additionally, I note that Liang's "preferred embodiment" uses "98 UV lamp tubes" in two rows along the circuitous sterilizing chamber, "fixed on both front and rear side of the chamber[.]" (*Id*.) As the source of UV radiation, Liang teaches using "non-ozone germicidal lamps" which "have the characteristics of higher UV power output and lower cost." (*Id*., ¶ 0050.) Specifically, Liang uses 253.7 nm wavelength UV radiation. (*See id*., ¶¶ 0013, 0047.) In my opinion, a POSITA familiar with commercially-available UV light sources would immediately recognize that Liang's description of "253.7 nm" light is simply a more precise description of the light generated by a germicidal mercury lamp, which the '642 Patent describes as emitting light "principally at 254 nm." (EX1001, 1:36-37.)

44. Next, Brown-Skrobot teaches using at least two wavelengths: "Two or more monochromatic [UV] radiation sources can be used together to provide…the same or different amounts of energy at different wavelengths of monochromatic [UV] radiation." (EX1006, ¶ 0042.) A POSITA would have known that Brown-Skrobot specifically taught that using multiple wavelengths was desirable to

maximize sterilization of different kinds of microorganisms. (*See id.*) Thus, I note that Brown-Skrobot and Liang share the same goal of achieving maximum sterility.

45. More specifically, a POSITA would understand that the combination discloses generating photons of single line wavelengths of 222 nm and 254 nm. Besides Liang's disclosure of using 254 nm radiation generally, Brown-Skrobot specifically teaches that KrCl and XeI excimer lamps are exemplary monochromatic UV radiation sources that can be used to deactivate microorganisms. (*See* EX1006, ¶ 0038; EX1020, 30.) A POSITA would have been well aware that these specific excimer lamps generate photons at about 222 nm and 253 nm, respectively. (*Id*.)

46. Therefore, in my opinion it would have been obvious to a POSITA reading Liang, which emphasizes the importance of maximizing the killing of microorganisms to achieve greater than 99.999% sterility, to incorporate the multiple wavelengths of radiation taught by Brown-Skrobot and Clauss, where these wavelengths specifically deactivate the DNA/RNA and proteins of microorganisms. Thus, the combination of Brown-Skrobot, Clauss, and Liang teaches directing an air stream to the generated photons of at least two wavelengths selected from the group consisting of 222 nm and 254 nm, and exposing the air stream to the generated photons, thus disinfecting it.

III. CONCLUSION

47. I currently hold the opinions set expressed in this Declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

48. I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Respectfully submitted,

Date: 30th January 2023

Oliver R. Lawal