



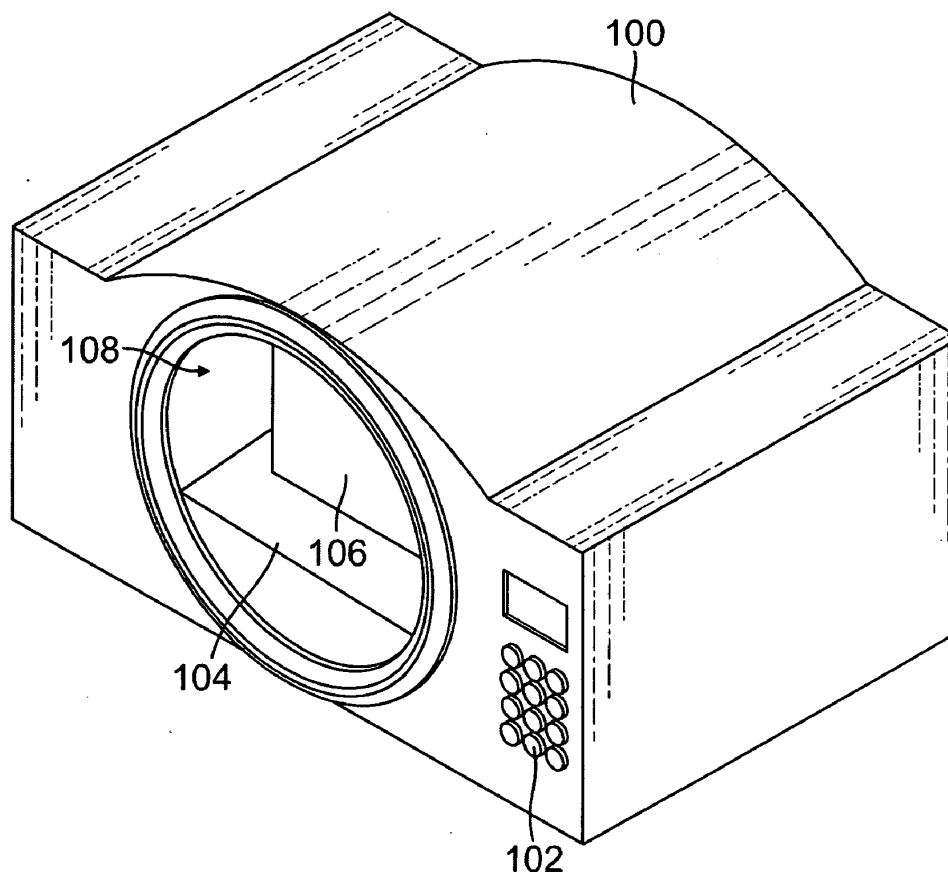
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(19) **United States**(12) **Patent Application Publication**
Stanley et al.(10) **Pub. No.: US 2010/0108917 A1**(43) **Pub. Date: May 6, 2010**(54) **ULTRAVIOLET LIGHT SANITIZING
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A61L 2/10 (2006.01)(52) **U.S. Cl. 250/504 R; 422/24**(57) **ABSTRACT**

A unit, system, and method for disinfecting or sterilizing the entire surface area of an item. The system includes at least one ultraviolet light source producing ultraviolet light for disinfecting an item. In addition, the system including a cavity housing the ultraviolet light source, the cavity having a reflective interior for redirecting light produced by the at least one ultraviolet light source. Furthermore, the system including a shelf positioned above a bottom portion of the cavity to support the item, the shelf capable of passing light produced by the at least one ultraviolet light source therethrough to disinfect an entire surface area of the item.



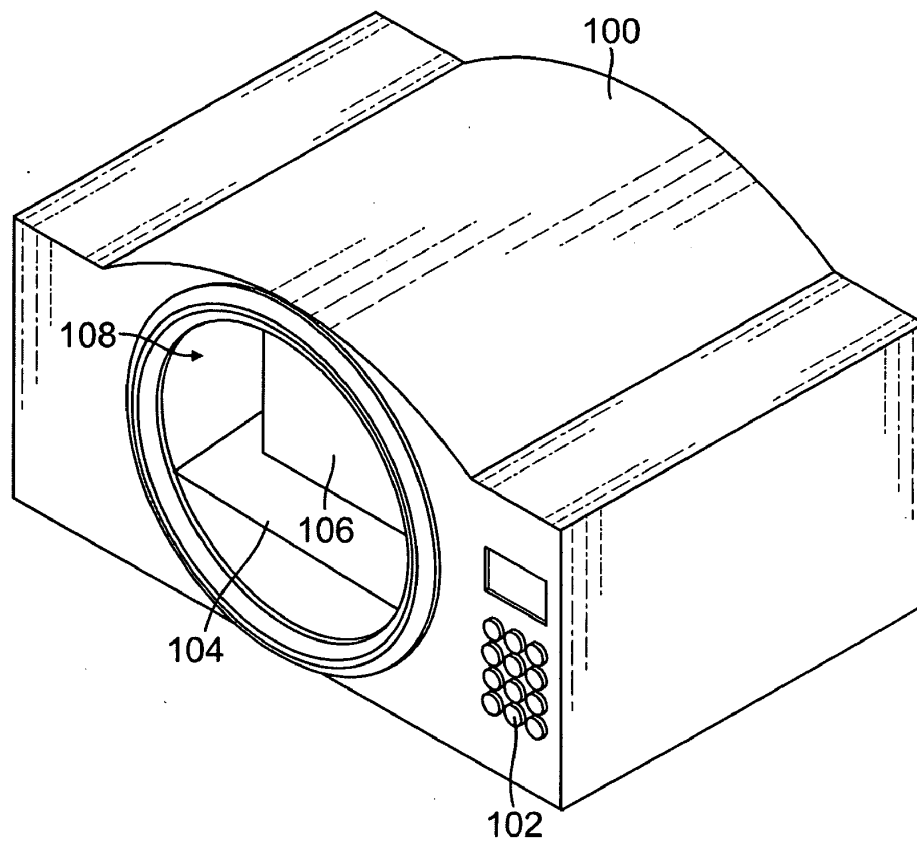


FIG. 1

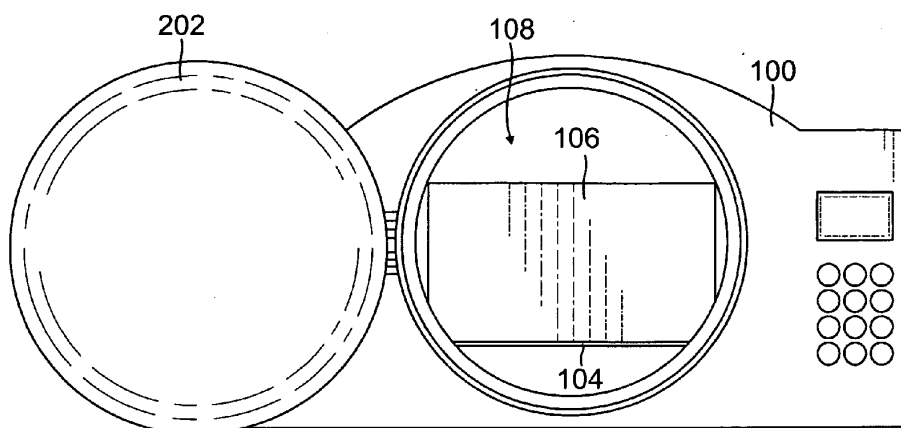


FIG. 2

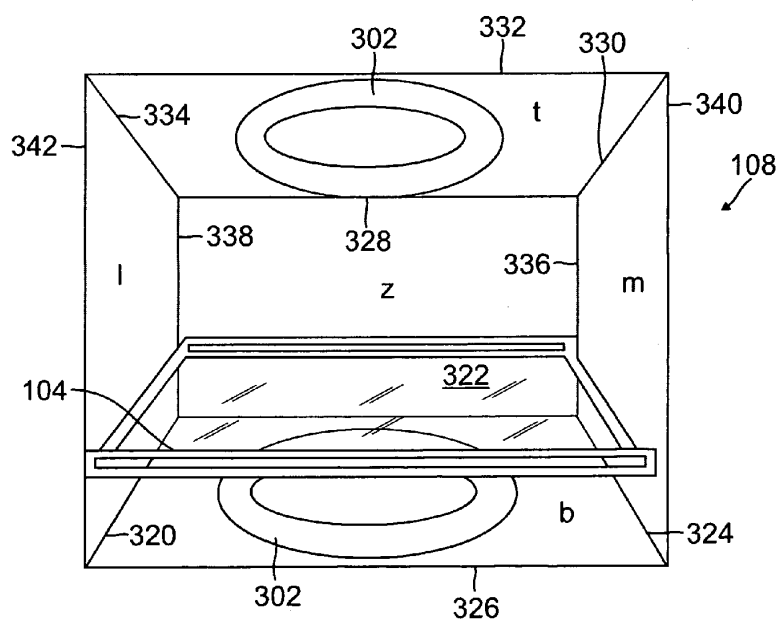


FIG. 3

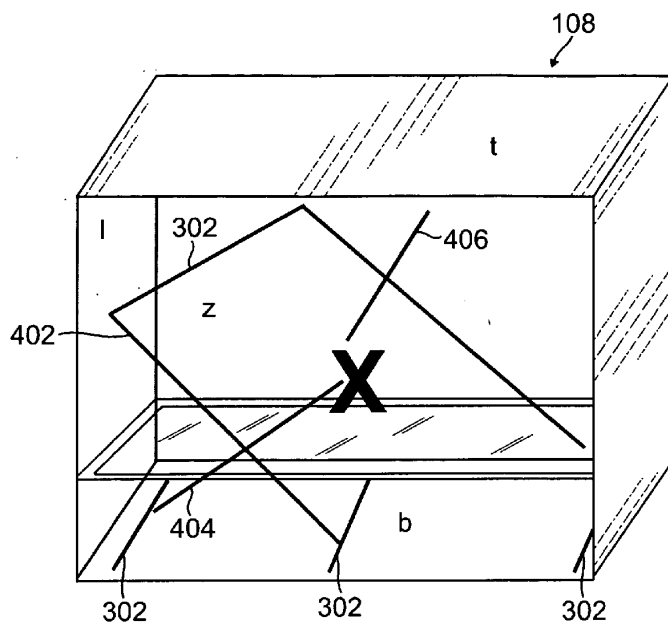


FIG. 4

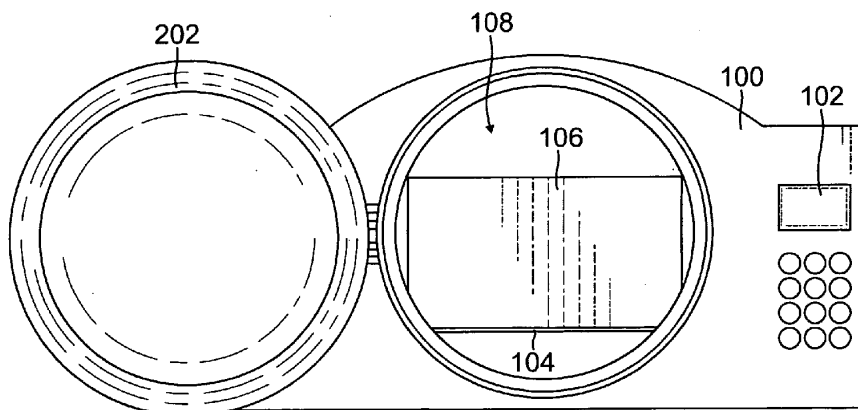


FIG. 5

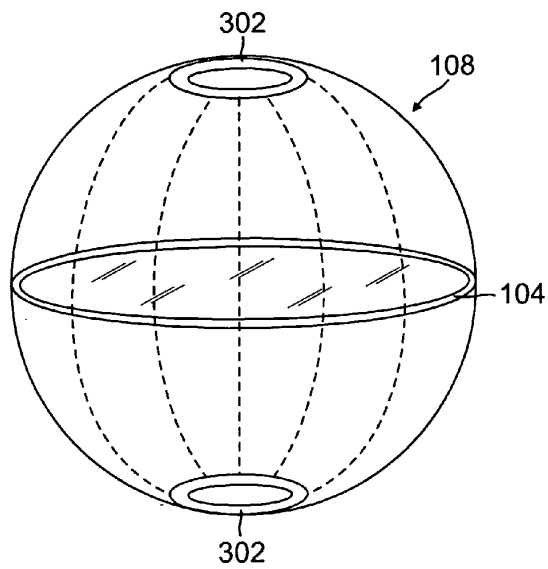


FIG. 6

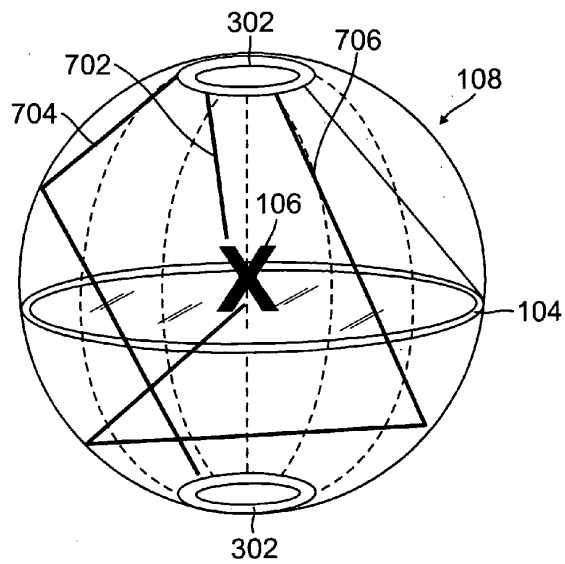


FIG. 7

ULTRAVIOLET LIGHT SANITIZING METHOD AND APPARATUS

TECHNICAL FIELD

[0001] The present application relates to microbes, and more particularly, to a system for disinfecting the entire surface area of an object using ultraviolet light and a surface capable of passing the ultraviolet light therethrough.

BACKGROUND ART

[0002] Each year, thousands of children and adults get sick as a result of contaminated food. Microbes gain access to food virtually at any stage of the food's manufacture, from harvest of the raw materials through post-harvest storage, processing, and distribution. Good practice through the food chain from raw material to finished product is intended to ensure that the food that reaches the consumer is wholesome and above all, safe to eat, yet outbreaks of illnesses attributable to food-borne pathogenic microbes still arise, implying microbial contamination at some link in the chain before the food reaches the consumer.

[0003] Cooking sterilizes food using heat to kill the microbes. In general applications of heat, water with the temperature of about 74° C. (165° F.) or higher sterilize the food. Nonetheless, food often becomes contaminated thereafter causing sickness and possibly, death to those who are more susceptible to food poisoning, such as the very young or old, or those whose immune system is already compromised.

[0004] Ordinary utensils, bottles, and everyday items coming in contact with those susceptible to illness may also retain microbes making them sick and possibly, even causing death. Heat and chemicals often provide the best option to sterilize these items. Nonetheless, using these results in releasing harmful environmental pollutants into the air.

DISCLOSURE OF THE APPLICATION

[0005] This summary is provided to introduce a selection of concepts in a simplified form that is further described below in the DETAILED DESCRIPTION OF THE APPLICATION. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0006] In accordance with one aspect of the present application, a disinfection unit is presented. The disinfection unit includes at least one ultraviolet light source producing ultraviolet light for disinfecting an item. In addition, the disinfection unit includes a cavity housing the ultraviolet light source, the cavity having a reflective interior for redirecting the ultraviolet light produced by the at least one ultraviolet light source. Furthermore, the disinfection unit includes a shelf positioned above a bottom portion of the cavity to support the item, the shelf capable of passing light produced by the at least one ultraviolet light source therethrough to disinfect an entire surface area of the item.

[0007] In accordance with another aspect of the present application, a system for sterilizing an item is presented. The system includes a chamber and a light source located within the chamber. In addition, the system includes a member positioned within the chamber to allow ultraviolet light produced from the light source to disinfect an entire surface area of the item by allowing the ultraviolet light to pass through.

[0008] In accordance with yet another aspect of the present application, a method is presented. The method includes plac-

ing an item on a surface within a chamber having reflective walls. In addition, the method includes applying ultraviolet light from a single light source to the item, wherein the ultraviolet light directly strikes the item and further, indirectly strikes the item through the surface or redirected off the chamber walls allowing the ultraviolet light to strike the item at three hundred sixty degrees using the single light source.

BRIEF DESCRIPTION OF THE DRAWING(S)

[0009] For a better understanding of the present application, reference is made to the below-referenced accompanying Drawing(s). Reference numbers refer to the same or equivalent parts of the present application throughout the several figures of the Drawing(s).

[0010] FIG. 1 is a diagram showing a side elevated view of an exemplary disinfection unit having a rectangular box configuration in accordance with one aspect of the present application;

[0011] FIG. 2 is an illustration showing a front view of the exemplary disinfection unit having the rectangular box configuration in accordance with one aspect of the present application;

[0012] FIG. 3 depicts exemplary placements of illustrative ultraviolet light sources within the rectangular box configuration in accordance with one aspect of the present application;

[0013] FIG. 4 shows typical paths taken by ultraviolet light produced from the ultraviolet light sources within the rectangular box configuration in accordance with one aspect of the present application;

[0014] FIG. 5 is an illustration showing a front view of an exemplary disinfection unit having a spherical configuration in accordance with one aspect of the present application;

[0015] FIG. 6 depicts exemplary placement of an illustrative ultraviolet light source within the spherical configuration in accordance with one aspect of the present application; and

[0016] FIG. 7 shows typical paths taken by ultraviolet light produced from the ultraviolet light sources within the spherical configuration in accordance with one aspect of the present application.

DETAILED DESCRIPTION OF THE APPLICATION

[0017] The detailed description set forth below in connection with the appended drawings is intended as a description of presently-preferred embodiments of the application and is not intended to represent the only forms in which the present application may be constructed and/or utilized. The description sets forth the functions and the sequence of steps for constructing and operating the application in connection with the illustrated embodiments. It is to be understood, however, that the same or equivalent functions and sequences may be accomplished by different embodiments that are also intended to be encompassed within the spirit and scope of this application.

[0018] Generally described, the present application relates to an apparatus for microbial decontamination. More specifically, the present application relates to a disinfecting unit having a member allowing ultraviolet light to pass through, the ultraviolet light capable of striking an item placed on the member at three hundred sixty degrees around the item. As a result, the ultraviolet light disinfects or sterilizes the entire surface area of the item. In an illustrative embodiment, an

item is placed on a surface within a chamber having reflective walls. A single ultraviolet light source, placed within the chamber, generates ultraviolet light capable of striking the entire surface area of the item either directly or indirectly. Light not only strikes the item directly, but can pass through the transparent glass surface and strike the item. Furthermore, the reflective walls of the chamber redirect any ultraviolet light into the item, thus disinfecting or sterilizing the entire surface area of the item. The disinfecting unit provides an attractive alternative to radiation or pasteurization.

[0019] Central to the disinfecting unit is the shelf, member, or surface providing support for the item. While shelf, member, or surface are described throughout this application, one skilled in the relevant art will appreciate that such terms may be interchangeable together or with other terms representing the same concept.

[0020] While the term “item” is described generally throughout this application, item can refer to, but is not limited to, food, clothes, surgical tools, baby bottle tops, hair-brushes, etc. Depending on the size of the disinfecting unit itself, a variety of different types of items can be placed within the disinfecting unit. Furthermore, more than one item can typically be placed within the unit, the unit still capable of disinfecting or sterilizing the entire surface area of the item. Most items can be placed within the numerous embodiments and aspects described throughout this application.

[0021] In addition, the term cavity may be interchangeably used with the term chamber. Also, the terms disinfecting unit may also be referred to as system through the application. One skilled in the relevant art will appreciate that there are numerous terms that may be exchanged and as such, this application is not limited to those terms.

[0022] Ultraviolet light is useful for sterilizing and disinfecting surfaces. Ultraviolet light, having a wavelength sufficient to break down microbes, can be used in a variety of applications, such as food, air, and water purification. Effectively, the ultraviolet light destroys the nucleic acids in the microbes so that their DNA is disrupted by the ultraviolet light radiation, which is a form of ionizing radiation, removing their reproductive capabilities and killing them.

[0023] Dependent on the source of ultraviolet light, disinfecting or sterilizing times may vary. In one embodiment, items are exposed to ultraviolet radiation from about one to thirty seconds. In other embodiments, items are radiated with the ultraviolet light from about thirty seconds to the time needed to disinfect item(s). Exposing items to such conditions generates little or no increase in temperature of the item.

[0024] Ultraviolet light having wavelengths from about one hundred nanometers to about four hundred nanometers are typically used in this application. It has been found that these wavelengths effectively eliminate microbes on the entire surface area of the item. More preferably, however, ultraviolet light having wavelengths of about two hundred fifty three point seven nanometers have been used to eliminate microbes. One skilled in the relevant art can appreciate that many different types of light may be used to effectively eliminate microbes and the application, as presented, is not limited to the use of ultraviolet light.

[0025] To effectively eliminate microbes on an item, multiple configurations of using ultraviolet light are presented. The embodiments presented in this application allow for the ultraviolet light source to strike the item around three hundred sixty degrees thereby completely removing microbes or other infectious germs from the entire surface area of the item. FIG.

1 is a diagram showing a side elevated view of an exemplary disinfection unit **100** having a rectangular box configuration in accordance with one aspect of the present application. Disinfection unit **100** can have a bubble top for a more sleek style or any other shape thereof.

[0026] Front panel **102** provided on the face of disinfection unit **100** allows the user to view, select, and enter in a variety of options. Such options can include a clock, time of ultraviolet light exposure, clear function, enter function, and numerical digits for entering in the time for ultraviolet exposure. Front panel **102** can use a computer system that takes the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment containing both hardware and software elements. In one embodiment, the computer system is implemented in software, which includes but is not limited to firmware, resident software, microcode, etc.

[0027] Continuing with FIG. 1, enclosed within disinfection unit **100** is cavity **108**. Cavity **108** houses item **106**. While a circular opening to cavity **108** is provided, the opening may come in a variety of different forms allowing item **106** to be inserted into the disinfection unit **100**. This may include, but is not limited to, a square, rectangle, or any other type of shape. Provided on the opening to cavity **108** may be a rubber seal for preventing ultraviolet light from escaping cavity **108**.

[0028] Disinfection unit **100** also contains shelf **104**. To provide three hundred sixty degrees of exposure to item **106** from the ultraviolet light, shelf **104** is can be made of glass, but can be made of a variety of other materials. Shelf **104** is generally made of materials capable of passing and not affecting ultraviolet light. Shelf **104** can generally be made of quartz, Teflon AF, or Teflon FEP. Furthermore, shelf **104** can be made of soft glass. Each of these materials allow ultraviolet to pass therethrough without interfering or altering the ultraviolet light. While preferred embodiments have been disclosed, shelf **104** may incorporate other materials that allow ultraviolet light to pass through.

[0029] Although a single shelf **104** is provided for in FIG. 1, multiple shelves may be incorporated within cavity **108**. These shelves **104** may be stacked on one another or some combination thereof. Alternatively, walls made of the same material as shelf **104** along with the shelves **104** can be used to separate items **106** by forming cubicles within cavity **108**. Separate items **106** can be stored in different cubicles as each item **106** may require different treatment times. As such, shelves **104** may be placed horizontally and walls may be placed vertically in any combination thereof.

[0030] To expose item **106** from every angle, item **106** is placed on top of shelf **104** allowing the underside of item **106** to be exposed to ultraviolet light. Shelf **104**, as shown in FIG. 1, is typically placed above a bottom portion of the cavity. Shelf **104** can support item **104** and be supported by bracings on the side of cavity **108**. Alternatively, shelf **104** can be supported through other means including support from the bottom of cavity **108** or on top of cavity **108**.

[0031] Shelf **104** can also be rotated within cavity **108**. Through rotation, item **106** can be displaced relative to cavity **108**, preferably substantially radially or substantially arcuately, so as to expose contact points on the item **106** to ultraviolet radiation. Rotation and displacement not only helps to eliminate untreated areas, but also help to make the treatment more uniform across the entire surface area of item **106**, helping to reduce the required treatment times.

[0032] A front view of exemplary disinfection unit **100** having the rectangular box configuration is depicted in FIG.

2. In preferred embodiments, door **202** coupled to disinfection unit **100** can be used to close and open disinfection unit **100** preventing ultraviolet light from escaping or exiting cavity **108**. In the rectangular box configuration, the interior surface of door **202** that is exposed to the cavity of disinfection unit **100** is typically flat.

[0033] Typically, items **106** are placed within cavity **108** and door **202** is shut to prevent ultraviolet light from escaping disinfection unit **100**. Alternatively, disinfection unit **100** does not include door **202**. In this embodiment, items **106** can be transported in and out of the disinfection unit **100** using an automated process. This automated process can include a conveyor belt made of the same glass as shelf **104**.

[0034] Preferred dimensions of disinfection unit **100** have a depth of fourteen inches, a height of eleven point ninety-nine inches, and a width of twenty-one point thirty-five inches. These dimensions are exemplary and do not limit the scope of the application. One skilled in the relevant art will appreciate that different types of dimensions may exist for disinfection unit **100**.

[0035] To create cavity **108**, bottom wall b, top wall t, left side wall l, right side wall r, back wall z, and a wall connected to door **202**, not shown, are used to form a rectangular box configuration. Each wall is planar and coupled to at least another wall with the exception of the wall connected to door **202**. Bottom wall b has edges **320**, **322**, **324**, and **326**. Edge **320** is coupled to left side wall l. Edge **322** is coupled to back wall z. Edge **324** is coupled to right side wall r. When sealed, edge **326** is coupled to the wall connected to door **202**.

[0036] Top wall t has edges **328**, **330**, **332**, and **334**. Edge **328** is coupled to back wall z. Edge **330** is coupled to right side wall r. When sealed, edge **332** is coupled to the wall connected to door **202**. Edge **334** is coupled to left side wall l. Back wall z has edges **322**, **328**, **336**, and **338**. Edge **322** is coupled to bottom wall b. Edge **328** is coupled to top wall t. Edge **336** is coupled to right side wall r. Edge **338** is coupled to left side wall l. Right side wall r has edges **324**, **330**, **336**, and **340**. Edge **324** is coupled to bottom wall b. Edge **330** is coupled to top wall t. Edge **336** is coupled to back wall z. When sealed, edge **340** is coupled to the wall connected to door **202**.

[0037] Left side wall l has edges **320**, **334**, **338**, and **342**. Edge **320** is coupled to bottom wall b. Edge **334** is coupled to top wall t. Edge **338** is coupled to back wall z. When sealed, edge **342** is coupled to the wall connected to door **202**. The wall connected to door **202**, when sealed, has edges **326**, **332**, **340**, and **342**. Edge **326** is coupled to bottom wall b. Edge **332** is coupled to top wall t. Edge **340** is coupled to right side wall r. Edge **342** is coupled to left side wall l.

[0038] Continuing with FIG. 3, shelf **104** is placed above bottom wall b allowing ultraviolet light to strike items **106** that are placed on shelf **104**. While shelf **104** extends from left side wall l to right side wall r, this is not limiting. As such, shelf **104** may be supported by bottom wall b, back wall z, or even top wall t.

[0039] Cavity **108** also includes at least one ultraviolet light source **302**. Placement of ultraviolet light sources **302** within cavity **108** may vary and are not limited to the positions described herein. As depicted in FIG. 3, one ultraviolet light source **302** is coupled to top wall t, while another ultraviolet light source **302** is coupled to bottom wall b. One skilled in the relevant art will appreciate that the larger the number of ultraviolet light sources **302** used, the more energy required.

[0040] Each wall of cavity **108** can include reflective material to redirect ultraviolet light from ultraviolet light sources **302**. The reflective material can be made of a thin polished layer of metal, such as aluminum, which is deposited on glass substrates. Metals used determine the reflective characteristics. Aluminum is typically the cheapest and most common reflective material. Other reflective materials may include, but are not limited to, silver and gold. Silver, which has a reflectivity of about ninety-five percent to about ninety-nine percent can reflect ultraviolet spectral regions. Gold, which has a reflectivity of about ninety-eight percent to about ninety-nine percent, can reflect light which has wavelengths below five hundred and fifty nanometers. Increasing and decreasing the density and thickness of the metals used also determines the reflectivity of the walls. Preferably, the metals are grounded.

[0041] In other embodiments of the present application, non-reflective walls may be used within cavity **108**. Typically, this embodiment would require a plurality of light sources in order for the entire surface area of item **106** to be exposed to ultraviolet light. Still yet, some of the walls will allow light to pass through, while others do not.

[0042] Instead of using reflective metals as described above, reflective coatings can be placed on the walls. In exemplary embodiments, dielectric coatings having a different refractive index to the substrate may be used. Dielectric coatings can include magnesium fluoride, calcium fluoride, and various metal oxides, which are deposited onto a substrate. By carefully choosing the exact composition, thickness, and number of layers, reflectivity and transmittivity of the coating can produce any desired characteristic.

[0043] Through the dielectric coatings, reflectivity can be increased to greater than ninety-nine point ninety-nine percent producing a high-reflector coating. The level of reflectivity can also be tuned to any particular value, for instance to produce a mirror that reflects ninety percent and transmits ten percent of the light that falls on it, over some range of wavelengths.

[0044] Multiple implementations of producing reflective walls for disinfecting unit **100** can be used and as such, is not limited to the discussion presented above. Furthermore, ultraviolet sources **302** may be shaped and formed in many different ways. Still yet, ultraviolet light sources **302** may be embedded into the walls or rise above the walls. Thus, the ultraviolet light sources **302** may come in a variety of different shapes, sizes, and placed in a variety of locations with cavity **108**.

[0045] Typical paths taken by ultraviolet light produced from the ultraviolet light sources **302** within the rectangular box configuration of cavity **108** are shown in accordance with one aspect of the present application depicted in FIG. 4. While the ultraviolet light is depicted in beams, ultraviolet light is understood to contain properties of both waves and particles. The beams can directly strike item **106**. In addition, the beams can strike item **106** through the transparent glass surface **104** or be redirected off the cavity **108** walls allowing the ultraviolet light to eventually strike item **106**. Through the combination of glass surface **104** and the walls, item **106** can be hit with ultraviolet light at three hundred sixty degrees using a single ultraviolet light source **302**. For purposes of illustration, three separate beams **402**, **404**, and **406** will be followed within cavity **108** of disinfecting unit **100**.

[0046] In one illustrative beam, beam **402** begins at the middle ultraviolet light source **302** coupled to bottom wall b

of cavity 108. Beam 402 is projected towards glass 104. When beam 402 reaches glass 104, beam 402 goes through glass 104 as if glass 104 was transparent. Because of the chemical properties of glass 104, beam 402 is only slightly or not affected in any manner.

[0047] Thereafter, beam 402 hits or strikes left side wall l. Left side wall l redirects beam 402 based on the incoming angle and reflects beam 402 towards top wall t. Because item 106 has not been reached, beam 402 is again redirected off top wall t towards right side wall r. Beam 402 continues to be redirected off the walls and through glass 104 until beam 402 finally strikes the surface of item 106.

[0048] Exemplary beam 404 begins at the left ultraviolet light source 302 coupled to bottom wall b of cavity 108. Beam 404 is projected towards glass 104. When beam 402 reaches glass 104, beam 402 goes through glass 104 striking a bottom portion of item 106. Through similar directed beams, the bottom portion of the entire item 106 can receive ultraviolet light from ultraviolet light source 302.

[0049] Illustrative beam 406 begins from ultraviolet light source 302 coupled to top wall t of cavity 108. Beam 406 is projected towards item 106. Thereafter, beam 406 directly strikes item 106. Beams can also be redirected or reflected of back wall z and the wall on door 202. Through exemplary beam 402, beam 404, and beam 406 light can strike item 106 three hundred sixty degrees thereby disinfecting or sterilizing the entire surface area of item 106.

[0050] In a preferred embodiment, a single ultraviolet light source 302 is used taking advantage of the reflective walls and glass shelf 104. This greatly lowers the cost as it reduces the hardwiring needed to operate multiple ultraviolet light sources 302. Furthermore, the costs can be realized when only one ultraviolet light source 302 needs to be replaced.

[0051] Through this configuration, items 106 may also be scattered along glass shelf 104 and do not have to be directly placed within the middle. The combination of glass shelf 104 and the reflective side walls allow for items to be struck around three hundred sixty degrees even though items 106 are not placed within the middle.

[0052] In alternative embodiments, a front view of an exemplary disinfection unit 100 having a spherical configuration in accordance with one aspect of the present application is depicted in FIG. 5. Similar to the previous FIGURES, disinfection unit 100 includes cavity 108 for placing item 106 on top of shelf 104. In addition, disinfection unit 100 contains front panel 102 allowing the user to view, select, and enter in a variety of options. Unlike the previous FIGURES, however, disinfection unit 100 includes door 202 having a round interior portion. When closed, and as shown below, the door creates a spherical configuration for cavity 108.

[0053] FIG. 6 depicts exemplary placements of illustrative ultraviolet light sources 302 within the spherical configuration of cavity 108 in accordance with one aspect of the present application. Again, item 106 can be placed anywhere on top of glass shelf 104, the glass shelf 104 positioned above the bottom of cavity 108. Furthermore, while not shown, a single light source 302 can be used to disinfect or sterilize the entire surface area of item 106.

[0054] FIG. 7 shows typical paths taken by ultraviolet light produced from the ultraviolet light source 302 within the spherical configuration in accordance with one aspect of the present application. As shown, there are no walls and the interior of cavity 108 is rounded creating a spherical configuration. The spherical configuration, as will be shown below,

redirects each beam of light to the center making this embodiment more practical for items 106 to be placed on the center of shelf 104.

[0055] For purposes of illustration, three separate beams 702, 704, and 706 will be followed within the cavity 108 of disinfecting unit 100. Beam 702 begins at ultraviolet light source 302 coupled to the top of cavity 108. Thereafter, beam 702 directly strikes item 106.

[0056] Beams may also indirectly strike item 106. Exemplary beam 704 begins at ultraviolet light source 302 coupled to the top of cavity 108. Beam 704 is projected toward the left side of cavity 108. Cavity 108 redirects beam 704 towards shelf 104. Because shelf 104 is transparent to the ultraviolet light, beam 704 passes through shelf 104 and strikes the bottom of cavity 108. Beam 704 is redirected again through glass 104, shelf 104 passing beam 704 and allowing beam 704 to strike the bottom portion of item 106.

[0057] In another illustration, beam 706 is projected at shelf 104. Shelf 104 passes beam 706 allowing beam 706 to strike the bottom portion of cavity 108. Thereafter, beam 706 is redirected toward the other bottom portion of cavity 108. Beam 706 is then redirected upwards towards shelf 104. Beam 706, after passing through shelf 104 for the second time, strikes the side of item 106. As a result of the plurality of beams, it can be shown that items 106 placed in the center of cavity 108 are more likely to be struck by the beams in a spherical configuration.

[0058] While only a rectangular box configuration and spherical configuration are presented, one skilled in the relevant art will appreciate that cavity 108 of disinfecting unit 100 may include multiple shapes and is not limited to those presented above. For example, cavity 108 may come in a box, columnar, oblong, irregular, or any other shape to disinfect and sterilize items 106.

[0059] Furthermore, ultraviolet light sources 302 can be placed throughout the cavity 108 at many different locations. Because of the reflectivity of cavity 108 and the transparency of shelf 104, the ultraviolet light produced by the ultraviolet light sources 302 will eventually strike item 106 within cavity 108.

[0060] Ultraviolet light sources 302 can also be interchanged to provide additional types of radiation to item 106. Each source 302 can typically be snapped on and off from cavity 108. As recited above, ultraviolet light sources 302 can produce light having wavelengths from about one hundred nanometers to about four hundred nanometers. More preferably, however, ultraviolet light having wavelengths of about two hundred and fifty three point seven nanometers have been used to eliminate microbes. In alternative embodiments, pulsating ultraviolet light sources 302 may be used. Experiments have shown that pulsating ultraviolet light sources 302 more effectively kill bacteria and other microbes that affect items 106. In preferred embodiments, ultraviolet light sources 302 can be made from quartz and a material called soft glass.

[0061] Disinfecting unit 100 can either come by itself or include other elements which may sterilize or provide other features for a user. For example, disinfecting unit 100 can incorporate a microwave in the cavity 108 of disinfecting unit 100. The microwave would include a dielectric element for heating item 106. Through the dielectric element, microbes on item 106 would be killed. Important, however, is the fact that the reflective walls or coating cannot be made of any type of metal as the microwaves will bounce back to the dielectric element causing damage to disinfecting unit 100. Alterna-

tively, disinfecting unit 100 can incorporate a wash down chamber. The wash down chamber would include a cleansing element for removing dirt or other particles on item 106. One skilled in the relevant art will appreciate that multiple embodiments can be incorporated into disinfecting unit 100. [0062] Furthermore, the basic principles applied in disinfecting unit 100 can be incorporated to other types of devices. One device can include a home countertop disinfection system. This system would have an ultraviolet light source 302 attached to a top portion, the top portion surrounded by reflective walls. The system would thereby be placed over the countertop to disinfect the system. The reflective walls would bounce any ultraviolet light towards the countertop. Alternatively, the system provided above can be applied to any other dirty surface containing microbes or other germs and does not have to be a countertop.

[0063] In accordance with one aspect of the present application, a disinfection unit 100 is presented. The disinfection unit 100 includes at least one ultraviolet light source 302 producing ultraviolet light for disinfecting an item 106. In addition, the disinfection unit 100 includes a cavity 108 housing the ultraviolet light source 302, the cavity 108 having a reflective interior for redirecting the ultraviolet light produced by the at least one ultraviolet light source 302. Furthermore, the disinfection unit 100 includes a shelf 104 positioned above a bottom portion of the cavity 108 to support the item 106, the shelf 104 capable of passing light produced by the at least one ultraviolet light source 302 therethrough to disinfect an entire surface area of the item 106.

[0064] In accordance with another aspect of the present application, a system 100 for sterilizing an item 106 is presented. The system 100 includes a chamber 108 and a light source located within the chamber 108. In addition, the system 100 also includes a member 104 positioned within the chamber 108 to allow ultraviolet light produced from the light source 302 to disinfect an entire surface area of the item 106 by allowing the ultraviolet light to pass through.

[0065] In accordance with yet another aspect of the present application, a method is presented. The method includes placing an item 106 on a surface 104 within a chamber 108 having reflective walls. In addition, the method includes applying ultraviolet light from a single light source 302 to the item 106, wherein the ultraviolet light directly strikes the item 106 and further, indirectly strikes the item 106 through the surface 104 or redirected off the chamber walls allowing the ultraviolet light to eventually strike the item 106 three hundred sixty degrees using the single light source 302.

[0066] The foregoing description is provided to enable any person skilled in the relevant art to practice the various embodiments described herein. Various modifications to these embodiments will be readily apparent to those skilled in the relevant art, and generic principles defined herein may be applied to other embodiments. Thus, the claims are not intended to be limited to the embodiments shown and described herein, but are to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically stated, but rather, "one or more." All structural and functional equivalents to the elements of the various embodiments described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedi-

cated to the public regardless of whether such disclosure is explicitly recited in the claims.

What is claimed is:

1. A disinfection unit comprising:
 - at least one ultraviolet light source for producing ultraviolet light for disinfecting an item;
 - a cavity housing the ultraviolet light source, the cavity having a reflective interior for redirecting the ultraviolet light produced by the at least one ultraviolet light source; and
 - a shelf positioned above a bottom portion of the cavity to support the item, the shelf capable of passing the ultraviolet light produced by the at least one ultraviolet light source therethrough to disinfect an entire surface area of the item.
2. The disinfection unit of claim 1, wherein the ultraviolet light produced from the at least one ultraviolet light source has a wavelength from about 100 nm to about 400 nm.
3. The disinfection unit of claim 1, wherein the ultraviolet light produced from the at least one ultraviolet light source has a wavelength of about 253.7 nm.
4. The disinfection unit of claim 1, wherein the reflective interior comprises rectangular walls maintained within a box configuration.
5. The disinfection unit of claim 1, wherein the reflective interior comprises curved walls maintained within a spherical configuration.
6. The disinfection unit of claim 1, wherein the reflective interior is a thin polished layer of metal.
7. The disinfection unit of claim 1, wherein the reflective interior is a dielectric coating.
8. The disinfection unit of claim 1, wherein the reflective interior is a combination of a thin polished layer of metal and a dielectric coating.
9. The disinfection unit of claim 1, further comprising a door having a reflective interior for sealing the cavity.
10. The disinfection unit of claim 1, wherein the glass shelf is made of quartz.
11. The disinfection unit of claim 1, wherein the glass shelf is made of Teflon.
12. A system for sterilizing an item, the system comprising:
 - a chamber;
 - a light source located within the chamber; and
 - a member positioned within the chamber to allow ultraviolet light produced from the light source to disinfect an entire surface area of the item by allowing the ultraviolet light to pass through.
13. The system for sterilizing an item of claim 12, the system comprising a dielectric element for heating the item.
14. The system for sterilizing an item of claim 12, the system comprising a cleansing element for removing dirt or other particles on the item.
15. The system for sterilizing an item of claim 12, the chamber further comprising reflective plates to redirect the ultraviolet light produced from the light source to the item.
16. The system for sterilizing an item of claim 12, the chamber further comprising a reflective coating to redirect the ultraviolet light produced from the light source to the item.
17. A method comprising:
 - placing an item on a surface within a chamber having reflective walls; and
 - applying ultraviolet light from a single light source to the item, wherein the ultraviolet light directly strikes the item and further, indirectly strikes the item through the

surface or redirected off the chamber walls allowing the ultraviolet light to strike the item 360 degrees using the single light source.

18. The method of claim 17, further comprising turning the item by rotating the surface.

19. The method of claim 17, wherein applying ultraviolet light from the single light source to the item includes pulsating the ultraviolet light from the single light source.

20. A disinfection unit comprising:

at least one ultraviolet light source for producing ultraviolet light for disinfecting an item, the ultraviolet light having wavelengths from about 100 nm to about 400 nm;

a cavity housing the ultraviolet light source and having rectangular walls maintained within a box configuration, the cavity having a reflective interior for redirecting the ultraviolet light produced by the at least one ultraviolet light source;

a door having a reflective interior for sealing the cavity; and
a shelf positioned above a bottom portion of the cavity to support the item, wherein the shelf is made of quartz, Teflon, or soft glass, the shelf capable of passing the ultraviolet light produced by the at least one ultraviolet light source therethrough to disinfect an entire surface area of the item.

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