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(72) Inventor(s):
Fariz Khellaf

(73) Proprietor(s):
Sensio Limited
Unit 7 Speedwell Road, Whitwood, CASTLEFORD, Yorkshire, WF10 5PY, United Kingdom

(74) Agent and/or Address for Service:
Appleyard Lees IP LLP
15 Clare Road, HALIFAX, West Yorkshire, HX1 2HY, United Kingdom

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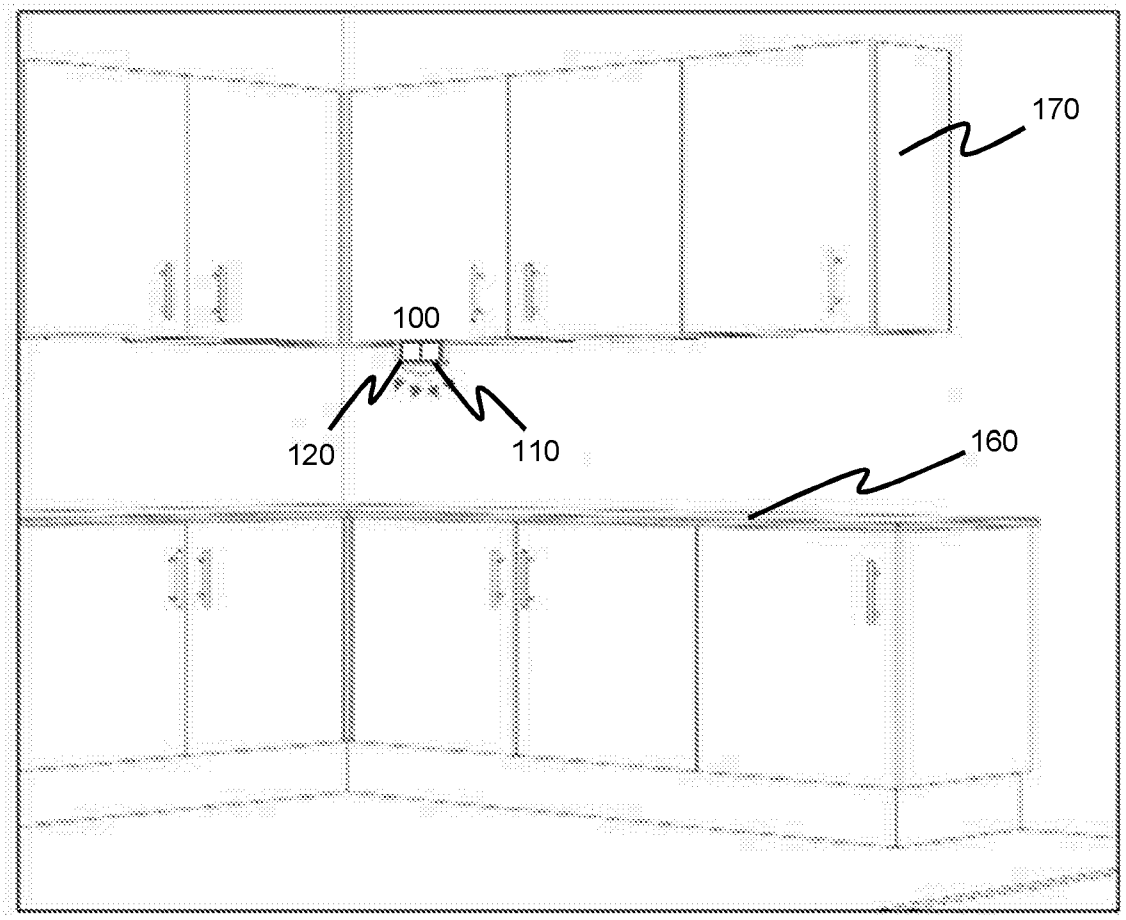

Fig. 1

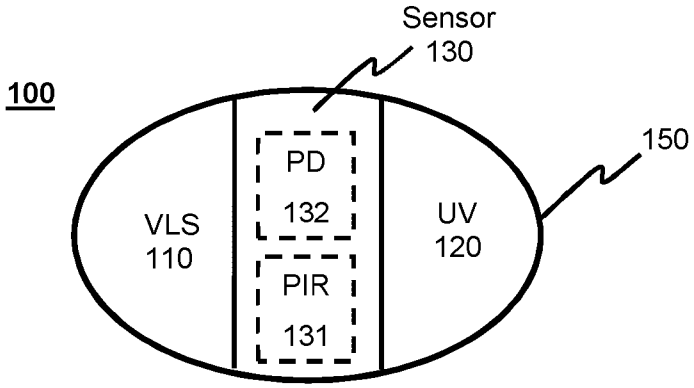

Fig. 2

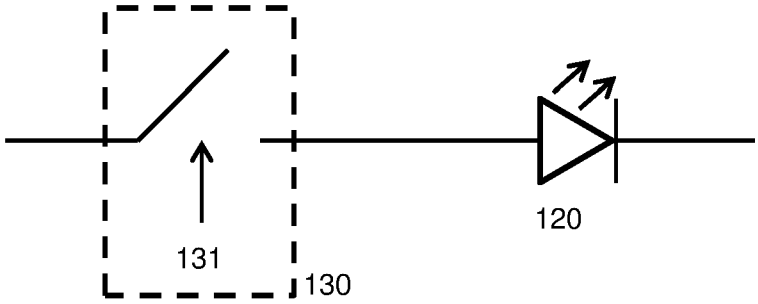

Fig. 3A

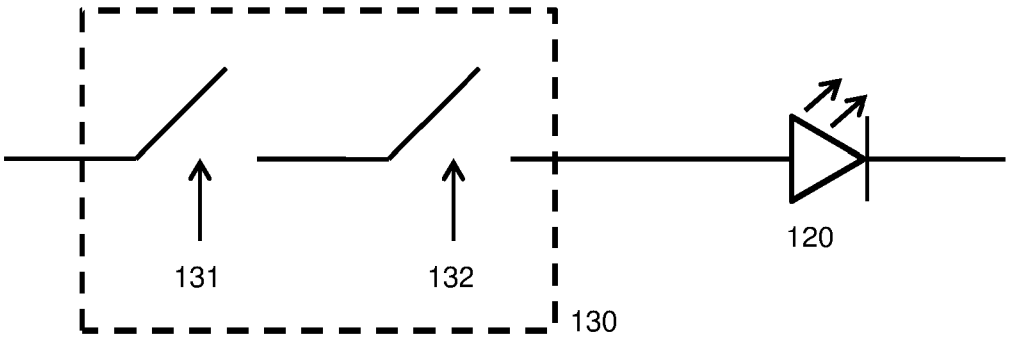

Fig. 3B

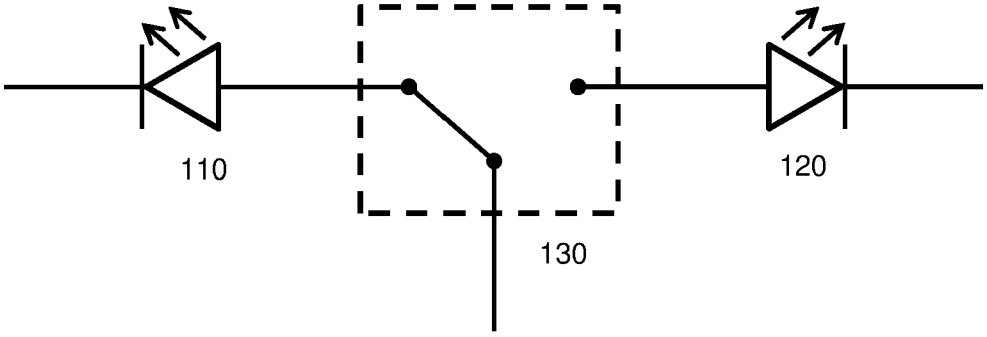

Fig. 3C

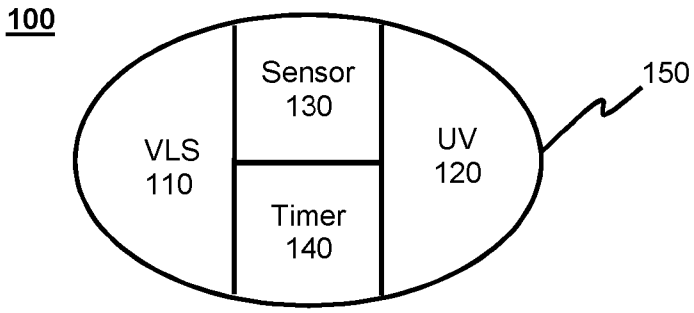

Fig. 4

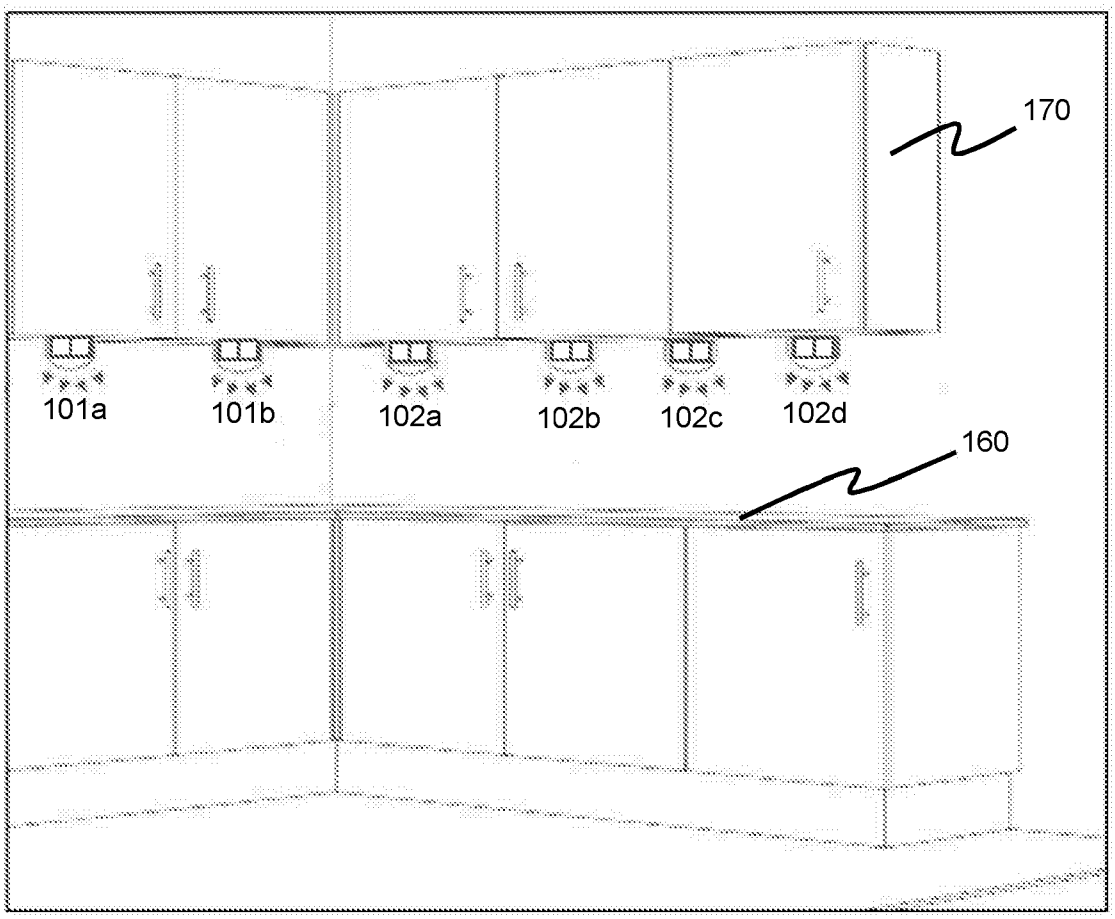

Fig. 5

LIGHT FIXTURE

[01] The present disclosure relates to lighting fixtures. In particular the disclosure is concerned with under-cabinet light fixtures suitable for use in a kitchen environment.

BACKGROUND

[02] Presently it is well known to use antibacterial chemicals to clean and sterilise a worktop, in particular a worktop in a kitchen environment where surfaces are easily contaminated. Such chemicals are often harsh to the worktop surface, i.e. by causing deterioration of a finish on the worktop. Also they can be harsh to human skin thus requiring protective gear to be worn whilst cleaning these worktops. Typical antibacterial chemicals are also harmful to the environment due to excesses being washed away into drainage systems and the plastic containers they are transported in often ending up in landfill sites.

[03] Hence it is highly desirable to implement cleaning and sterilisation methods that do not require the use of harsh antibacterial chemicals.

[04] The example embodiments have been provided with a view to addressing at least some of the difficulties that are encountered with current methods of sterilising work surfaces, whether those difficulties have been specifically mentioned above or will otherwise be appreciated from the discussion herein.

SUMMARY

[05] The present disclosure is concerned with an alternative technique for sterilising work surfaces that does not rely on harsh cleaning agents.

[06] In particular the present disclosure relates to light fixtures with integrated ultra-violet (UV) emitters suitable for sterilising a work surface in a kitchen environment. More particularly the light fixtures are suitable for use as under-cabinet lighting.

[07] According to the present disclosure there is provided a light fixture as in claim 1, a lighting strip as in claim 14, and a cabinet according to claim 19. Additional features will be apparent from the dependent claims and the discussion herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[08] For a better understanding of the present disclosure reference will now be made to the accompanying drawings, in which:

[09] Fig. 1 shows an example light fixture mounted in a kitchen environment;

[10] Fig. 2 shows an example light fixture suitable for sterilising surfaces;

[11] Fig. 3A illustrates a sensor unit configured to act as a switch for a UV light source;

[12] Fig. 3B illustrates another example switch for a UV light source;

[13] Fig. 3C shows an example of activating and deactivating a visible light source and UV light source;

[14] Fig. 4 shows another example light fixture;

[15] Fig. 5 shows an example of a plurality of light fixtures in a kitchen environment.

DETAILED DESCRIPTION

[16] The present disclosure provides for work surface sterilisation that desirably does not involve the use of antibacterial chemicals, and is particularly suited to domestic environments.

[17] Figure 1 shows one example of sterilising a work surface in a kitchen environment. A light fixture 100 is mounted in the vicinity of a work surface 160 which is to be sterilised: the work surface 160 may be, for example, a surface suitable for the preparation of food. The light fixture 100 may be mounted on a wall adjacent to the work surface 160 or may be mounted on the underside of a cabinet 170 positioned above the work surface 160, as shown.

[18] In a preferred arrangement, the mounted light fixture 100 is oriented to provide maximum illumination to the work surface 160. In the example of Figure 1 the light fixture 100 is fitted to a surface parallel to the work surface 160 and directly above it.

[19] In operation, the light fixture 100 operates in one of two modes: a visible light mode; and a UV light mode. It is possible that both operating modes may be activated at the same time, however it is generally preferable that only one mode is activated at any one time for reasons that will be evident from the discussion herein. Suitably the light fixture may also exist in an 'off' or 'standby' mode, whereby neither the visible light mode or UV light mode are active.

[20] When in visible light mode, a visible light source 110 of the light fixture 100 will be active while a UV light source 120 of the light fixture 100 will be inactive. This will generally be the case when, for example, the work surface 160 is in use for the preparation of food. UV radiation can be harmful to skin and therefore it is preferable that the UV mode cannot be activated whilst the visible light mode is in operation.

[21] Preferably, the ultra-violet light source 120 is configured to generate radiation in the UV-C spectrum, i.e. approximately 180–280 nanometres. UV-C has been shown to provide sufficient energy to destroy microorganisms, and is therefore appropriate for sterilisation purposes. The visible light source is configured to generate light in the visible spectrum, i.e. in the range of approximately 380–740 nm.

[22] It will be appreciated that the visible light source 110 and UV light source 120 may be activated or deactivated using conventional means such as a manual switch. Optionally the UV light source 120 may be activated in response to the visible light source 110 being deactivated, either immediately or after a small time delay. The UV light source is deactivated by a sensor, as will now be discussed.

[23] Figure 2 shows the example light fixture 100 in greater detail. Here the light fixture 100 is demonstrated as an ovoid shape, and might be termed a 'spotlight' in the domestic lighting industry. Preferably the light fixture 100 incorporates the visible light source 'VLS' 110 and the ultra-violet light source 120 in a single housing 150. Other arrangements are however possible whereby the visible and UV light sources are provided separate to each other. The light fixture 100 may additionally comprise mounting means (not shown) for affixing the light fixture to a surface, such as under the cabinet unit 170 of Figure 1.

[24] In this example the light fixture 100 also comprises a sensor unit 130. Suitably the sensor unit 130 is configured to activate and deactivate the UV light source 120.

[25] It is generally desirable that the UV light source 120 is inoperable while the kitchen is in use, or more generally is likely to be in use. Accordingly, the sensor unit 130 is primarily provided to deactivate the UV light source 120 in response to the sensor unit 130 being triggered. That is, the sensor unit 130 is configured to sense an ambient environment of the light fixture 100 and deactivate the UV light source 120 if the ambient environment fulfils a certain trigger condition. Put another way, the sensor unit 130 is configured to deactivate the UV light source 120 in response to an external stimulus.

[26] One example sensor trigger is the detection of movement in the vicinity of a light fixture 100, e.g. a human approaching the work surface 160, and accordingly the UV light source 120 is deactivated to prevent UV irradiation of said person. If no movement is detected after a predetermined time, then the sensor unit 130 may accordingly reactivate the UV light source 120 and sterilisation of the work surface 160 may continue.

[27] The sensor unit 130 may be configured to detect movement by being provided with a passive infrared 'PIR' sensor 131. That is, the sensor unit 130 may optionally comprise a PIR sensor 131 as shown. A PIR sensor 131 is an electronic sensor that measures infrared light radiating from objects in the field of view of the sensor. Suitably the trigger condition for deactivating the UV light source 120 may be the detection of movement by an infrared emitting source observed by the PIR sensor 131; e.g. a person walking into a field of view of the PIR sensor 131. Suitably the trigger condition for activating the UV light source 120 may be the detection of no movement by the PIR sensor 131 and/or the lack of a detected infrared emission by the PIR sensor 131 over a certain period of time. In other words the sensor unit 130 is configured to activate the UV light source 120 in response to a null result from the PIR sensor 131.

[28] Another example trigger is the detection of a pre-determined luminosity of the ambient environment; e.g. it is bright in the vicinity of the light fixture 100 due to either daylight or artificial light, and accordingly the UV light source is deactivated because it is likely someone will use the work surface. Suitably the UV light source may be reactivated if it becomes dark again; e.g. because it is night, and therefore it is unlikely someone will be using the work surface 160.

[29] The sensor unit 130 may be configured to sense luminosity by being provided with a photodetector 'PD' 132. Preferably the photodetector 132 is realised as a light dependent resistor 'LDR', sometimes known as a photocell. In other words, the sensor unit 130 may optionally comprise a photodetector 132 as shown. An LDR is particularly suited because it is a device which has a resistance that changes dependent on the intensity of light incident on it, and as such acts as a light dependent switch. Here, the photodetector 132 is preferably configured to detect light in the visible electromagnetic band (approximately 380–740 nanometres). Preferably the photodetector is configured to not detect the ultra-violet electromagnetic band, so that emissions from the visible light source 120 do not trigger the photodetector 132. This may be achieved by, for example, a filter on the photodetector 132.

[30] Suitably, the sensor unit 130 may be configured with trigger conditions by a manufacturer of the sensor unit 130, i.e. prior to installation of the light fixture 100. Additionally the sensor unit may be provided with means to set the trigger conditions by a user before or after the light fixture is installed. In either case the condition is set before the light fixture is put into operation.

[31] Figures 3A–C demonstrate examples of the sensor unit 130 trigger conditions being put into effect to control the UV light source 120.

[32] Figure 3A illustrates a circuit diagram for the general principle of the sensor unit 130 configured to act as an on/off switch for the UV light source 120. Suitably the switch is opened, and therefore the circuit broken, when the sensor unit 130 is triggered. In this way the UV light source 120 can be deactivated automatically if the work surface 160 starts to be used and as such safe UV sterilisation of a kitchen environment is provided. In this example the sensor unit 130 is provided with a single type of environment sensor, such as a movement sensor 131, which when triggered opens the switch.

[33] Figure 3B illustrates another example circuit diagram whereby the sensor unit 130 is configured to sense multiple trigger types. In this example two different sensors 131, 132 act as a series switch, as shown, such that the circuit is broken if either sensor triggers. That is, in this example, the sensor unit 130 is provided with a movement sensor 131 and luminosity sensor 132, and the UV light source 120 deactivates in response to either sensed movement or a certain threshold of luminosity. Conversely, both switches must be closed in order for the UV light source 120 to be on; for example no movement must have been detected recently and ambient light is below a predetermined threshold. Desirably, dependence on a plurality of sensor inputs provides safer operation than relying on a single sensor type.

[34] Figure 3C illustrates an example circuit diagram example whereby, advantageously, the sensor unit 130 is configured to coordinate activation of the visible light source 110 as well as deactivation of the UV light source 120. In other words the sensor unit 130 may simultaneously open (deactivate) the UV light source 120 circuit whilst simultaneously closing (activating) the visible light source 110 circuit. In this way the sensor unit 130 may enforce operation in only one

mode at a time. An additional advantage is that a user of the work surface 160 can be confident that the UV light source 120 is not active if the visible light source 110 is on.

[35] Suitably, all the example circuits discussed herein may be configured to also operate in conjunction with a manual switch, e.g. wall switch. For example, a manual switch may be wired in series with the sensor unit 130 such that both the manual switch and sensor must be 'on' in order for the UV light source to activate. In this way a user may control manually when UV sterilisation may occur but be certain that the UV lights source 120 deactivates if the work surface is in use.

[36] Figure 4 shows a further example light fixture 100 which also provides greater control over when UV sterilisation may occur. In this example, the light fixture 100 includes a timer 140 which provides time slots during which the UV light source 120 may be activate. As above, an active UV light source 120 may be deactivated when the sensor unit 130 is triggered. The sensor unit 130 may also reactivate the UV light source based on the sensing of the ambient environment, provided that the timer 140 also indicates that it is a time period for activation of the UV light source 120. In other words, the timer 140 may be configured to operate in a series arrangement with the sensor unit 130. In this way a user may set periods of time, such as overnight, when UV sterilisation may occur. Further suitably, the timer 140, sensor unit 130, and a manual control switch, may all be provided in a series arrangement to provide greater control to a user.

[37] Figure 5 demonstrates an example of using a plurality of light fixtures 101, 102. A plurality of light fixtures 101, 102 may be provided in order to increase light coverage of the work surface 160.

[38] In one example system the light fixtures are configured to operate in a parallel arrangement, such that each may activate and deactivate individually. In another example system, the light fixtures 101, 102 are configured in a series arrangement, such that deactivating one light fixture deactivates all the light fixtures. The light fixtures 101, 102 may also be arranged into two groups 101 a & b and 102 a–d, as shown, such that the first group of fixtures 101 may be activated or deactivated separately from the second group 102.

[39] In another example, a light fixture 100 may be coupled to a plurality of additional visible light sources and UV light sources. These additional light sources may be regarded as being slaved to the light fixture 100 and activated or deactivated in synchronicity with the light fixture 100. In other words, if the light fixture 100 activates the visible light source 110, the additional visible light sources also activate. If the light fixture 100 activates the UV light source 120, the additional UV light sources also activate. Thus the lighting fixture may be regarded as a master controller for additional slave lights. For example, in the system shown by Figure 5, light fixture 101a may be a master controller for slave light source 101b, and light fixture 102a may be a master controller for slave light sources 102b–d.

[40] It will also be appreciated that other forms of lighting fixture beyond the spotlight discussed thus far may also be provided.

[41] In one example, a lighting strip may be provided instead of the plurality of separate light fixtures 101, 102 shown in Figure 5. That is, a plurality of light fixtures may be provided on a single mounting means, e.g. a strip, for attaching the plurality of light fixtures to a surface. Similar to as discussed in relation to Figure 5, the plurality of light fixtures may operate independently of each other, i.e. in a parallel arrangement, or may operate in tandem, i.e. in a series arrangement. Also, certain light fixtures may be regarded as master controllers for controlling respective groups of group of slaved visible and UV light sources.

[42] In summary, under cabinet lighting is provided with an integrated UV light in order to sterilise a surface illuminated by said UV light. Exemplary light fixtures are provided with at least a visible light source, a UV light source for sterilising a surface illuminated by the UV light, and a sensor unit which deactivates the UV light source in response to detecting particular external stimuli. Advantageously the UV lighting for sterilising a surface is deactivated remotely such that a user of a work surface being sterilised is not erroneously exposed to harmful UV radiation. Thus the described exemplary embodiments provide for improved sterilisation of a food preparation environment.

[43] Historically UV sterilisation has been unsuitable for use in human environments due to harmful UV radiation, with existing methods of UV sterilisation typically involving the use of an ultra-violet oven in which a particular utensil is sterilised. Such methods are often used where a very high standard of sterilisation is required, for example in hospitals which need to sterilise surgery equipment. In other words, existing methods of UV sterilisation focus on cleansing individual items and ensure that human operators are safely shielded from any harmful UV radiation.

[44] Thus the presently described invention provides significant advantages over not only antibacterial chemicals but also the cumbersome UV sterilisation methods that are otherwise unsuitable for everyday domestic use.

[45] The described exemplary embodiments are convenient to manufacture and straightforward to use. The light fixtures may be manufactured industrially. An industrial application of the example embodiments will be clear from the discussion herein.

[46] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[47] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar

purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

CLAIMS:

1. A light fixture for sterilising a surface in a kitchen environment, comprising:

a visible light source, an ultra-violet 'UV' light source which generates ultra-violet emissions to sterilise a surface, a sensor unit configured to sense an ambient environment of the light fixture, and a timer defining a time period during which the UV light source may be active,

wherein the sensor unit is configured to sense movement in the ambient environment and a luminosity of the ambient environment, and to deactivate the UV light source in response to at least one of sensing movement in the ambient environment and sensing the luminosity being greater than a pre-determined threshold, and

wherein the UV light source is reactivated if no movement is sensed within a pre-determined period of time and the luminosity is below the pre-determined threshold and the timer indicates that it is the time period in which the UV light source may be active.

2. The light fixture according to claims 1, wherein activating the ultra-violet light source by the sensor unit requires that the visible light source is inactive.

3. The light fixture according to claim 2, wherein the sensor unit is configured to activate the visible light source when deactivating the UV light source, and to deactivate the visible light source when activating the UV light source.

4. The light fixture according to any preceding claim, wherein the sensor unit is configured to detect movement via a passive infra-red sensor.

5. The light fixture according to any preceding claim, wherein the sensor unit is configured to detect luminosity via a photocell.

6. A lighting strip comprising a light fixture according to any preceding claim.

7. The lighting strip according to claim 6, comprising a plurality of additional visible light sources and a plurality of additional ultra-violet light sources, and wherein the additional visible light sources and additional ultra-violet light sources activate and deactivate simultaneously with the visible light source and ultra-violet light source of the light fixture.

8. The lighting strip according to claim 7, comprising a plurality of lighting fixtures according to claims 1 to 5, and wherein each lighting fixture controls a subgroup of the additional visible light sources and additional ultra-violet light sources.

9. The lighting strip according to claim 8, wherein the plurality of lighting fixtures are arranged in series so as to activate and deactivate in tandem.

10. A cabinet comprising a light fixture according to any one of claims 1 to 5 or a lighting strip according to any one of claims 6 to 9.

11. The cabinet according to claim 10, wherein the cabinet is positioned above a surface for sterilisation, and the light fixture or lighting strip is positioned on an underside of the cabinet so as to be positioned above the surface.