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Williams et al.

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(54) **AIR DIRECTING SCOOP FOR HEAT SINK AND UV-C APPARATUS**

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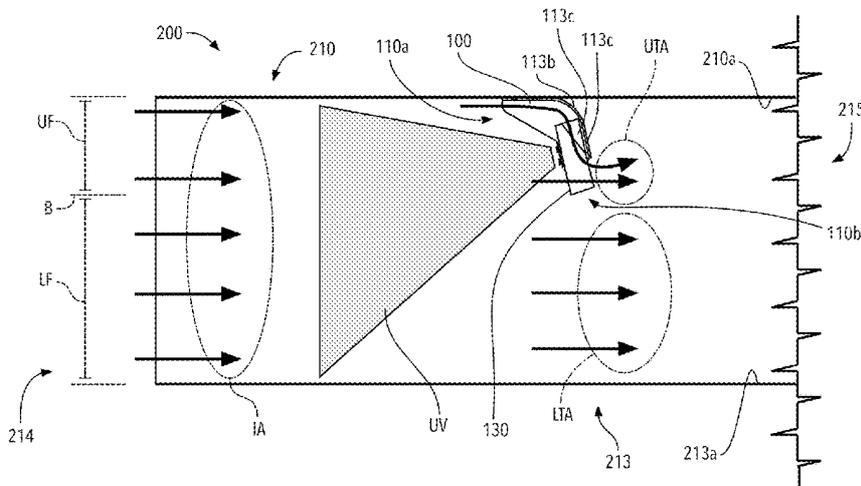
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(57) **ABSTRACT**

An air sanitizing apparatus arranged within an HVAC duct having an air scoop, the air scoop arranged on a surface of the HVAC duct, the air scoop having an inlet end and an outlet end, the air scoop having a bracket extending distally from the air scoop, a UV light module, the UV light module secured to the bracket, the UV light module having a temperature sensor, a heat sink, the heat sink secured to the UV light module and proximate to the outlet end and, a control board, the control board in communication with the UV light module, the control board having a microprocessor in communication with an ambient temperature sensor and a heat-source temperature sensor arranged proximate to an external heat source, the microprocessor in communication with the temperature sensor of the UV light module.

20 Claims, 11 Drawing Sheets



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H05K 1/02 (2006.01)
H05K 7/20 (2006.01)
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 (2013.01); *H05K 7/2039* (2013.01); *A61L*
2209/12 (2013.01); *A61L 2209/16* (2013.01);
H05K 2201/10106 (2013.01)
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A61L 9/20; *A61L 2209/12*; *A61L*
2209/16; *A61L 2209/111*; *G01K 7/22*
 See application file for complete search history.

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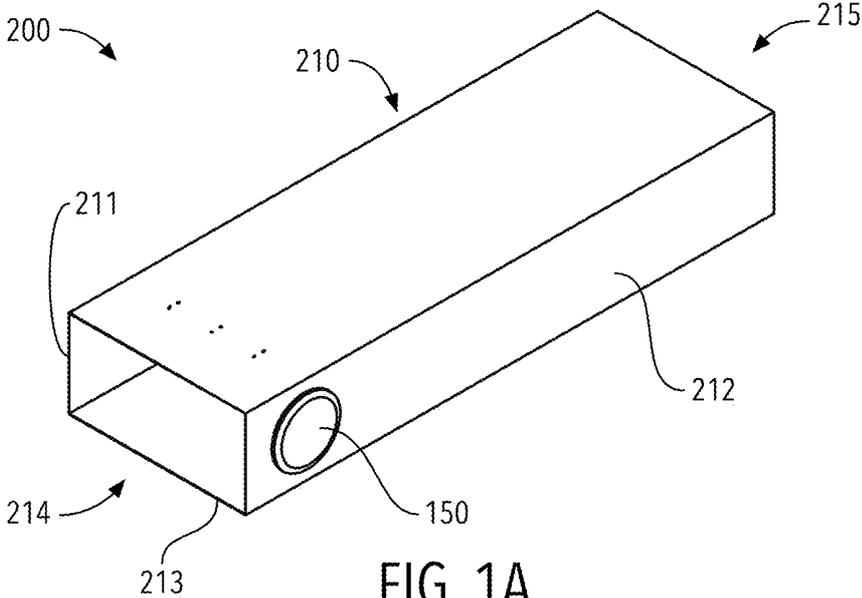


FIG. 1A

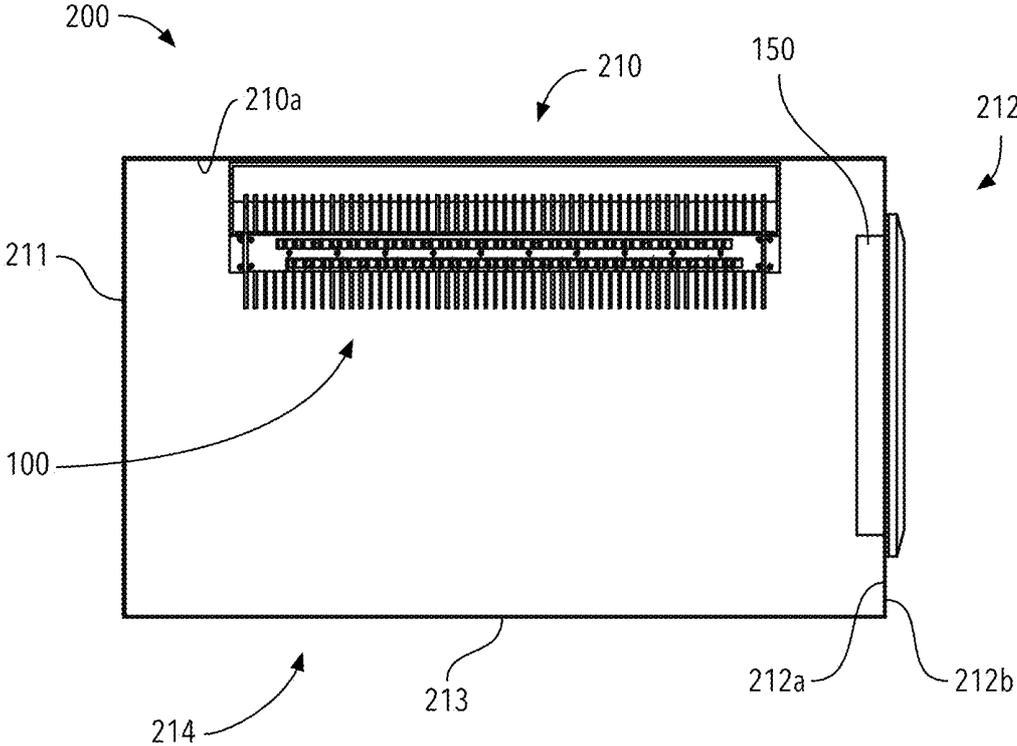


FIG. 1B

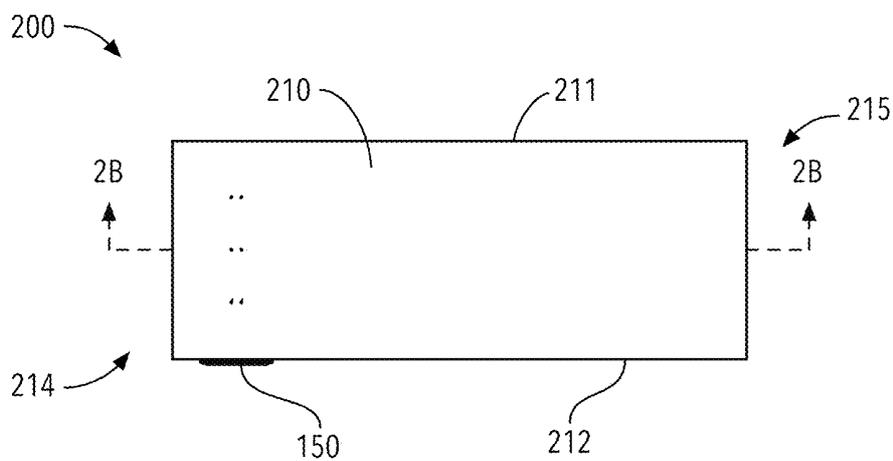


FIG. 2A

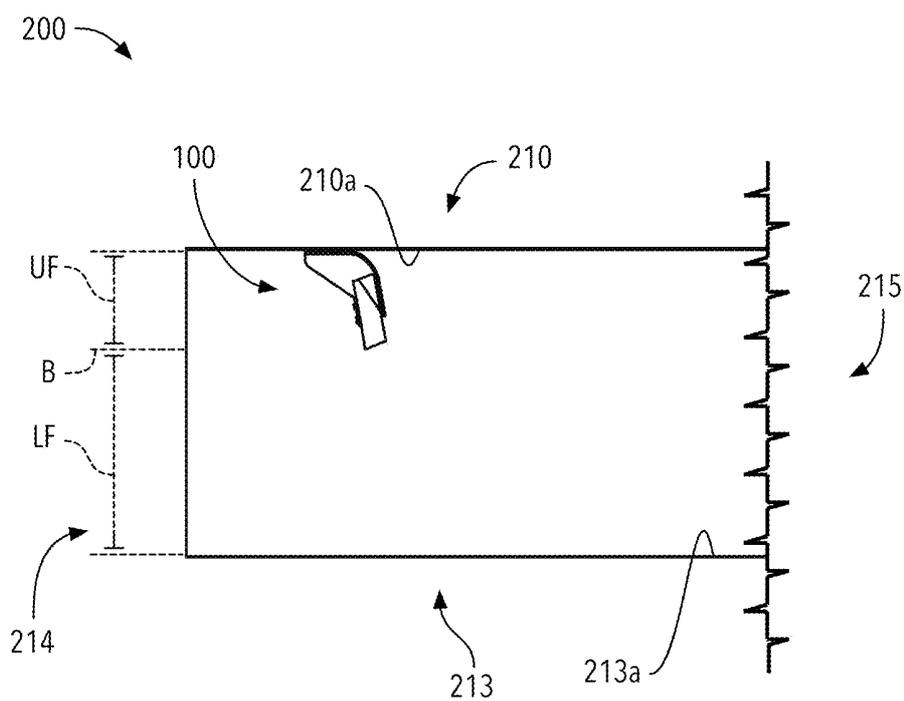


FIG. 2B

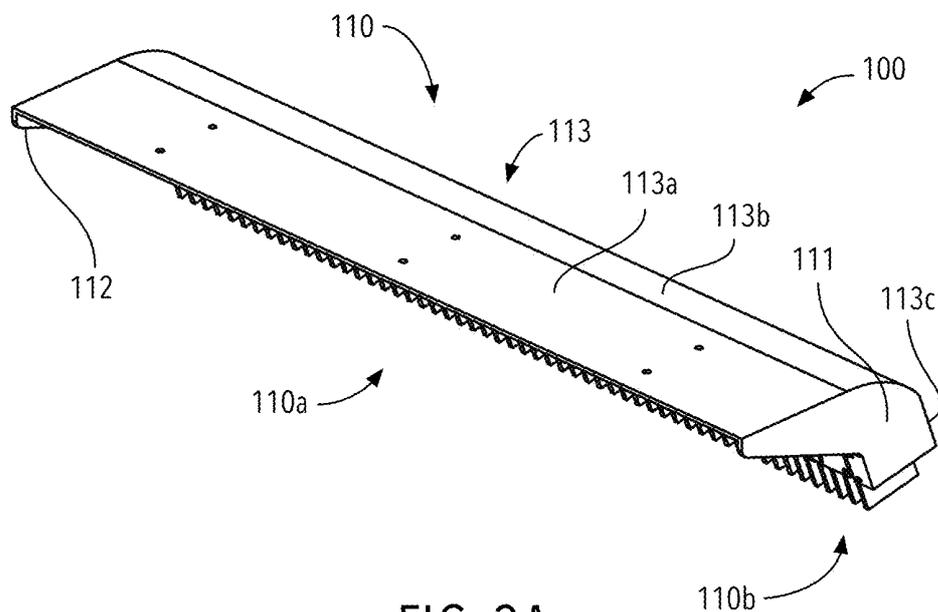


FIG. 3A

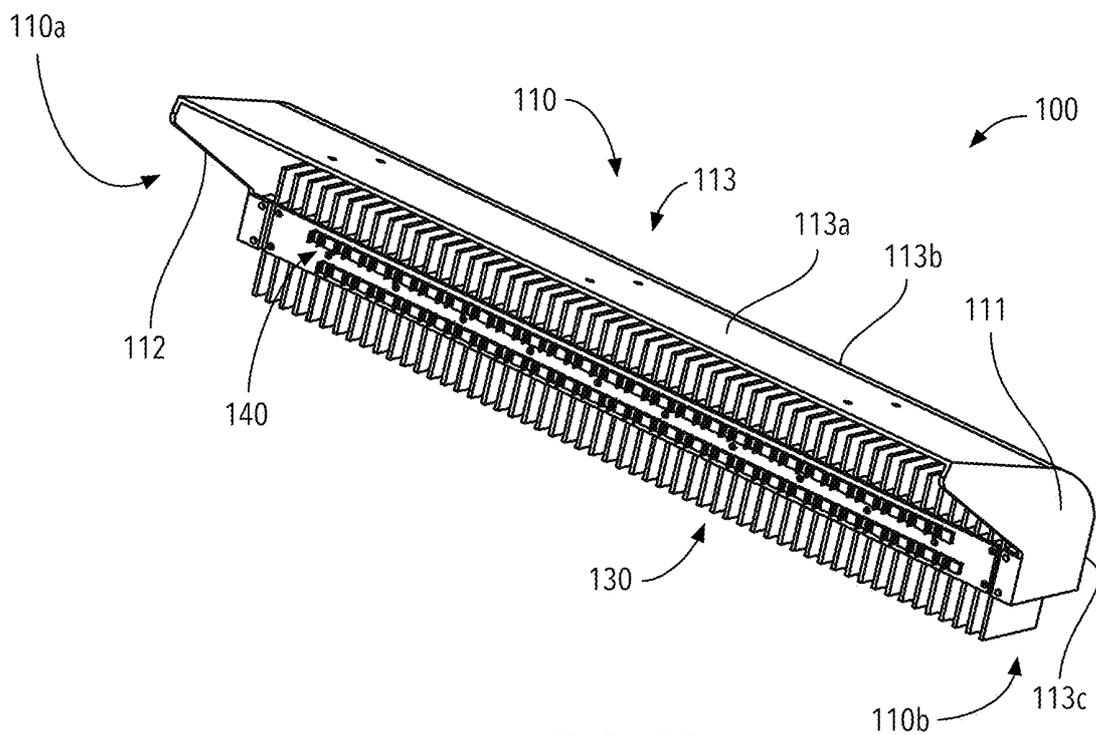


FIG. 3B

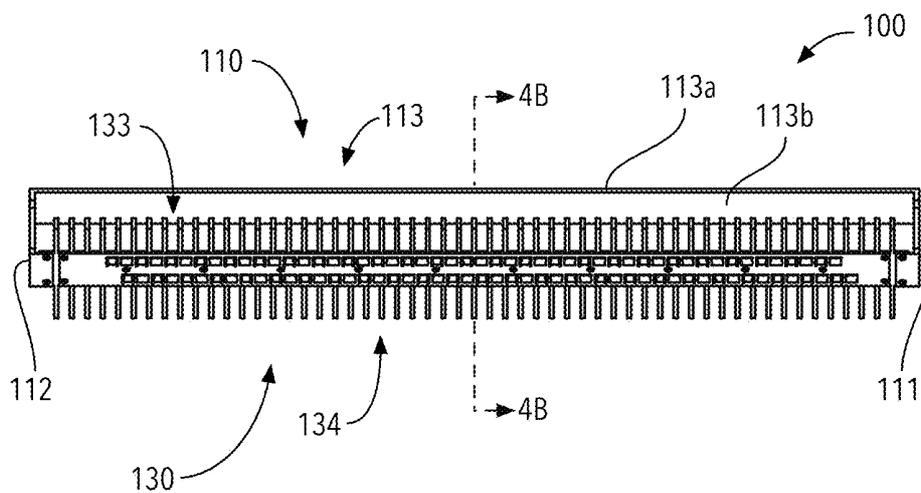


FIG. 4A

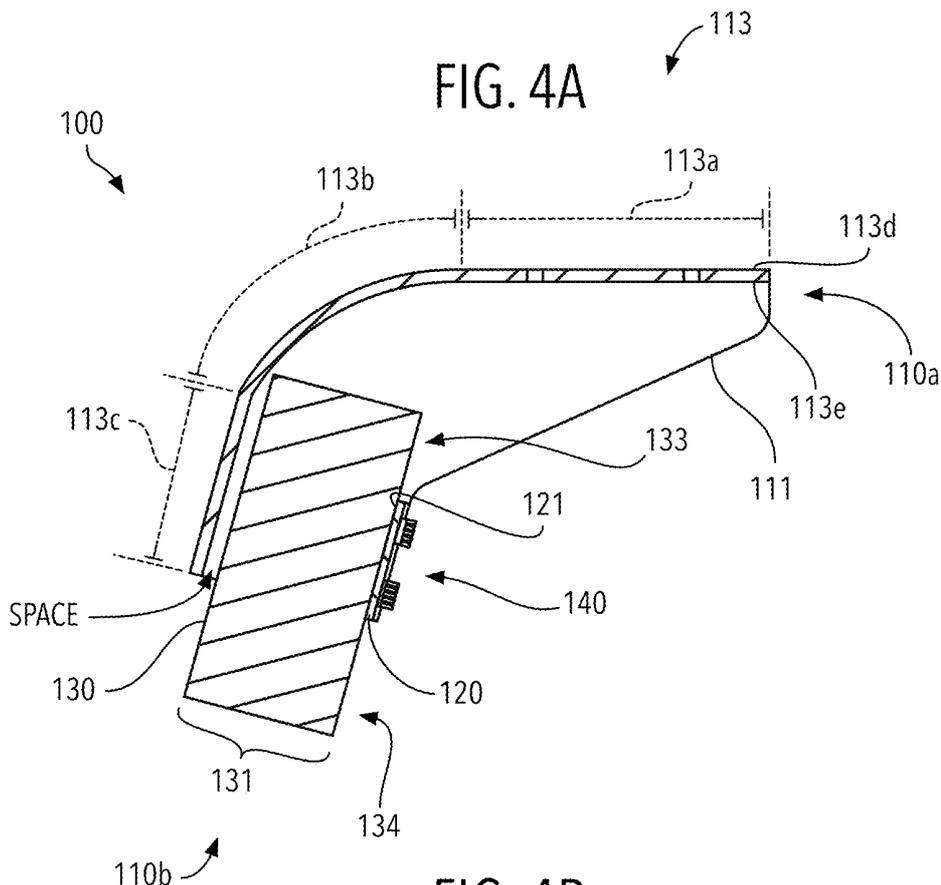


FIG. 4B

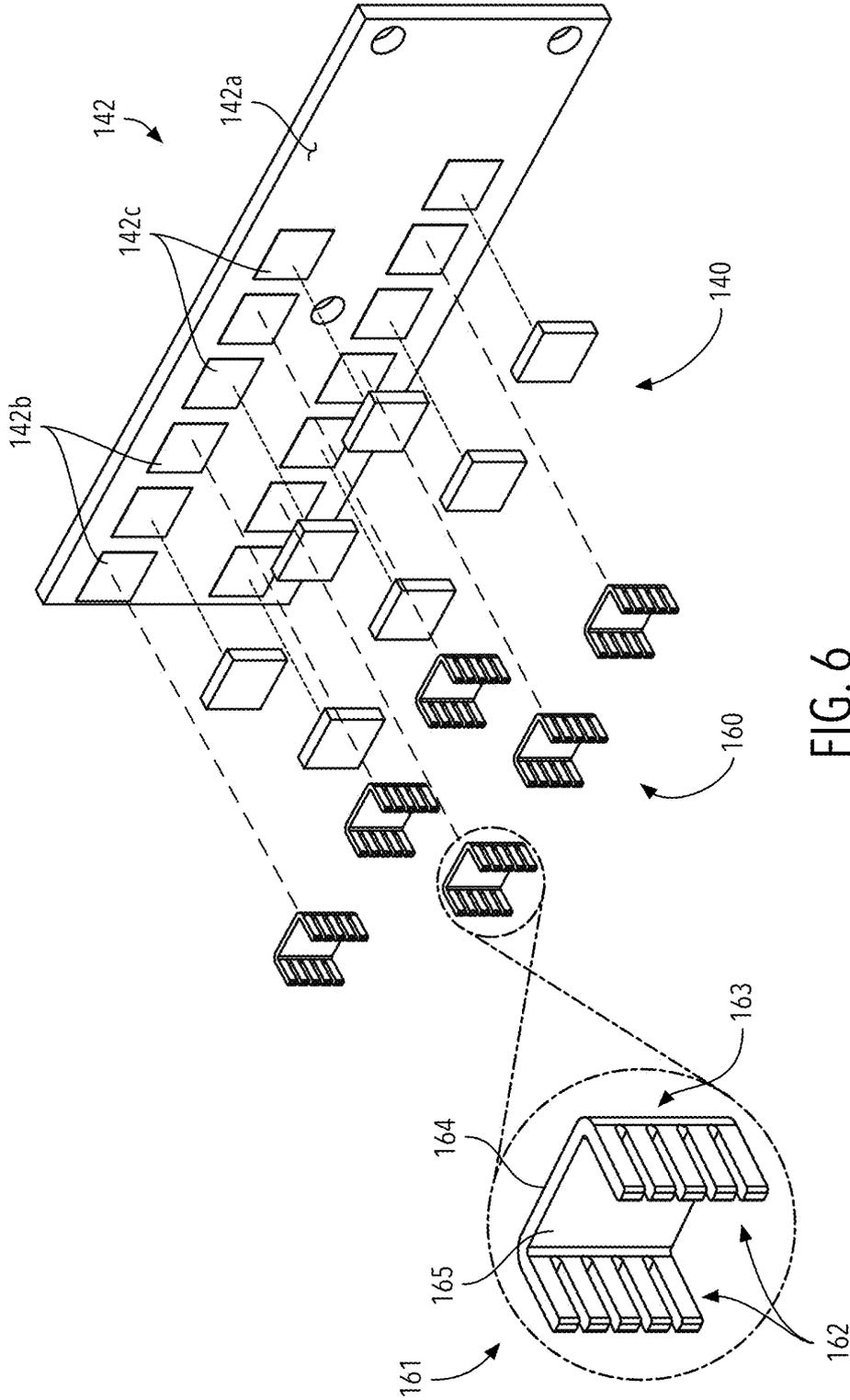


FIG. 6

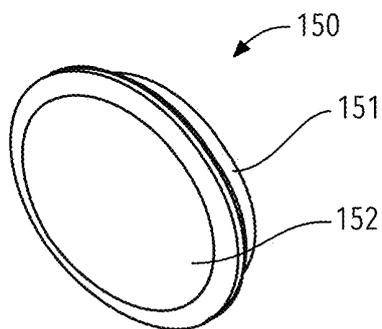


FIG. 7A

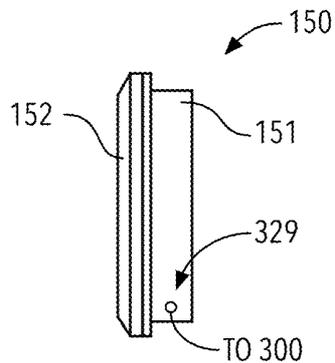


FIG. 7B

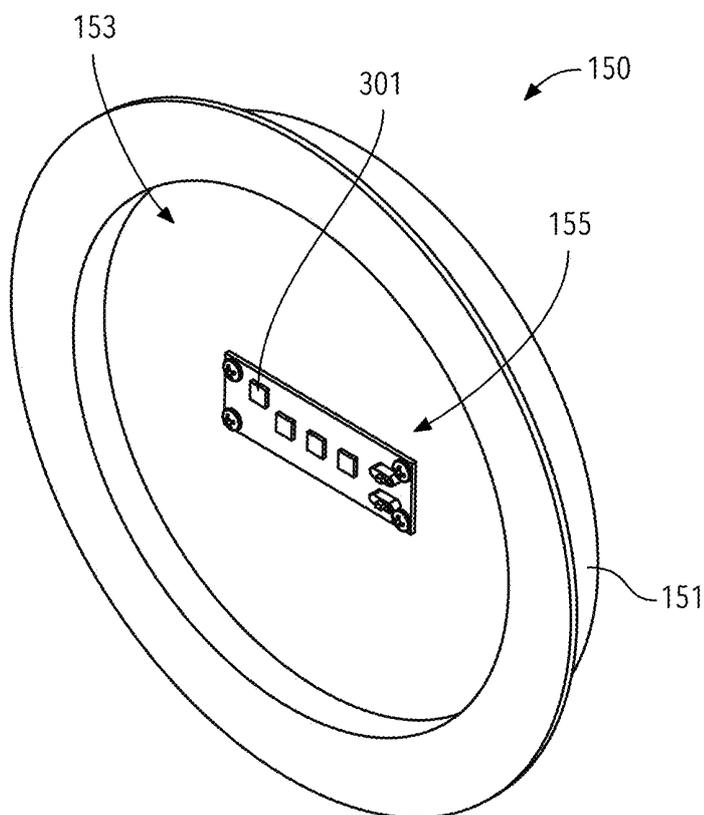


FIG. 7C

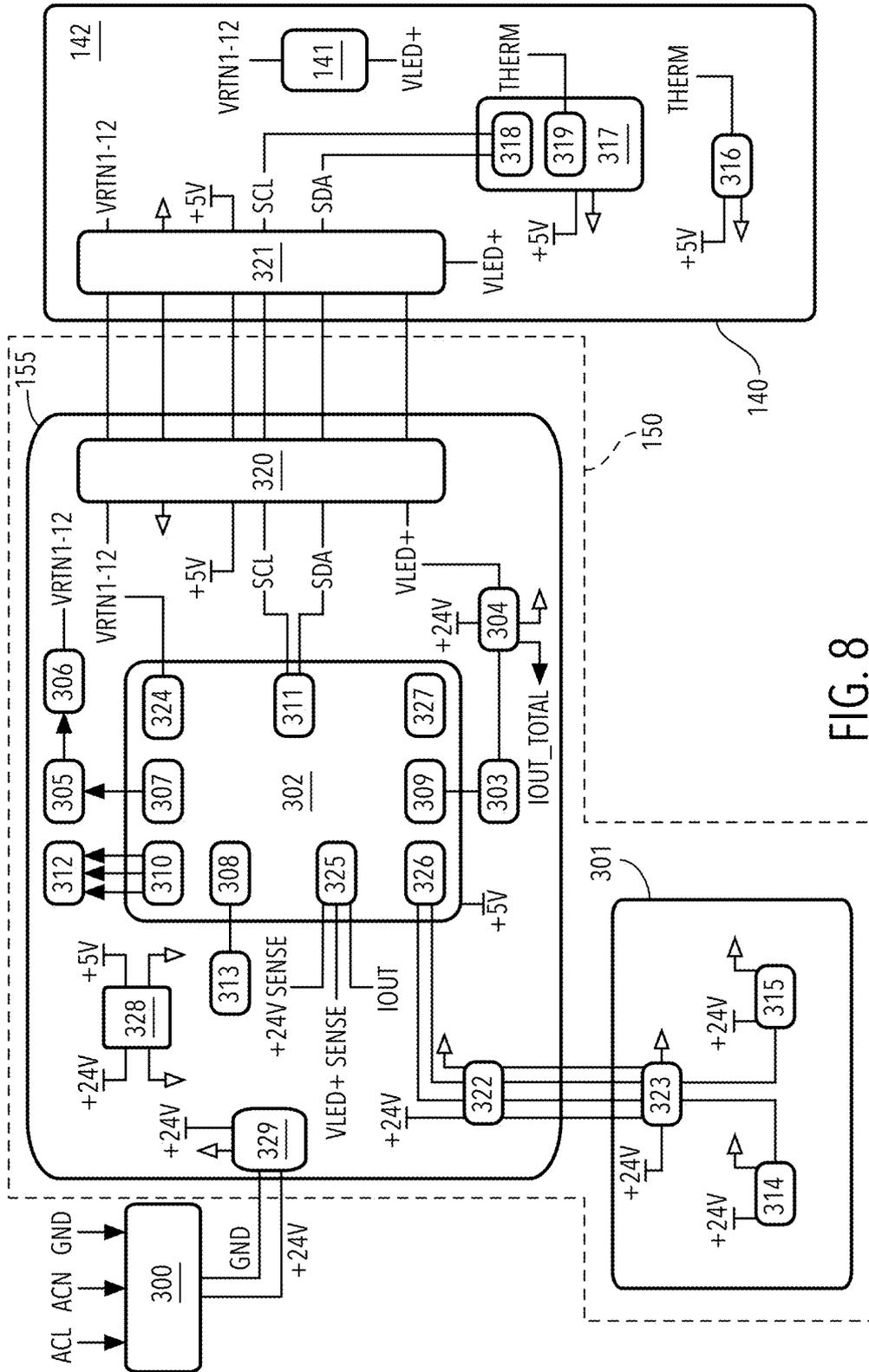


FIG. 8

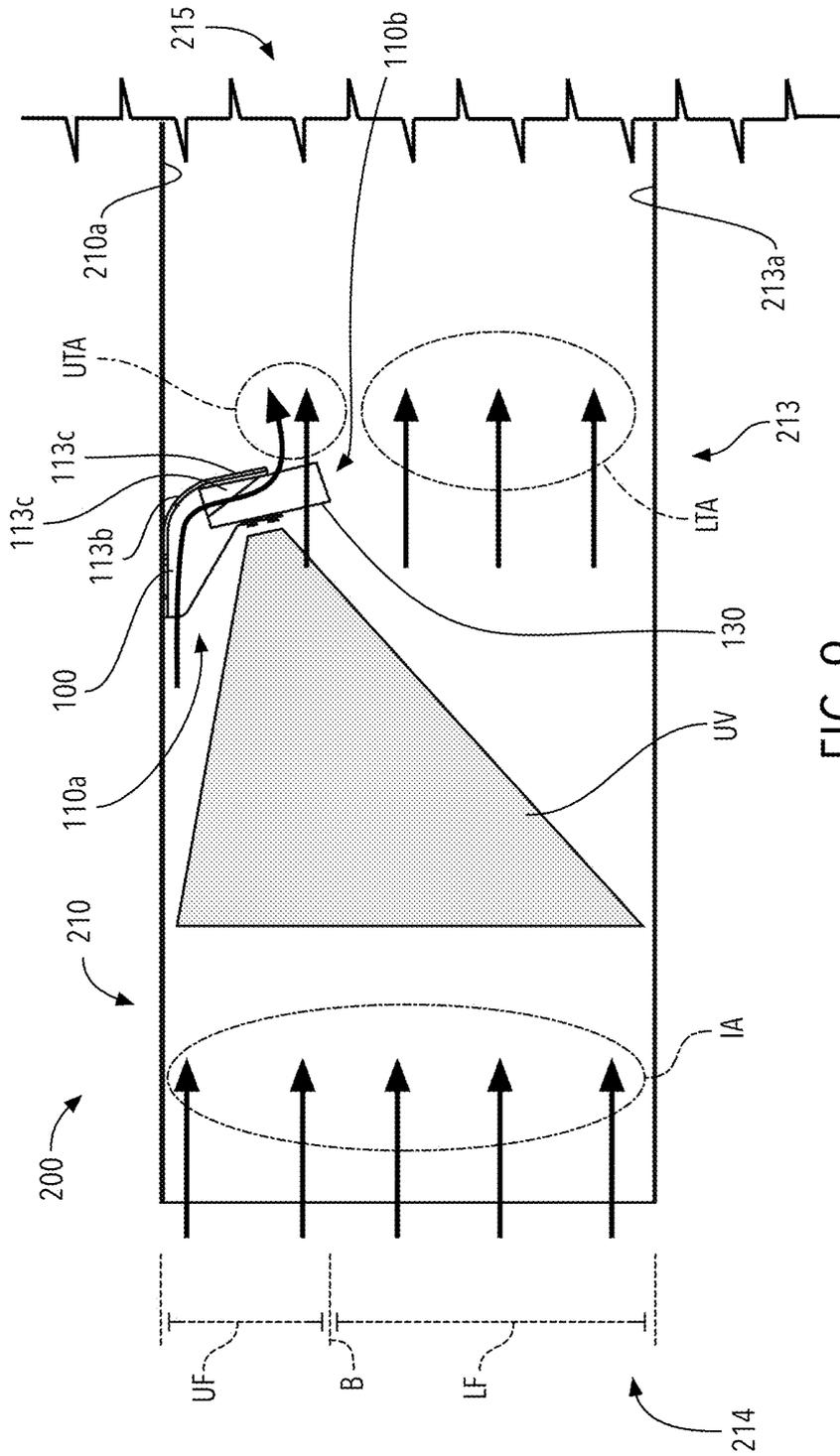


FIG. 9

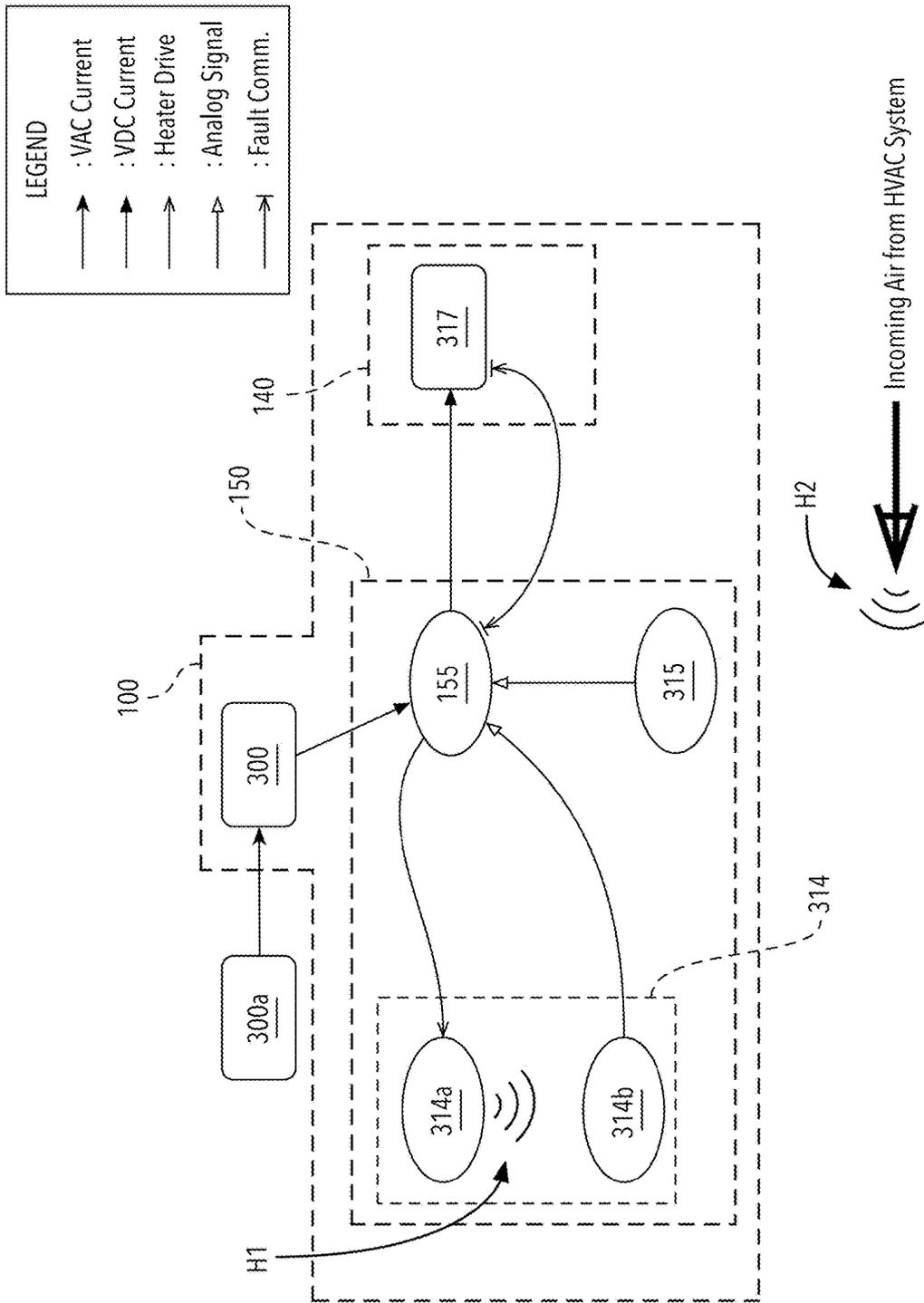


FIG. 10

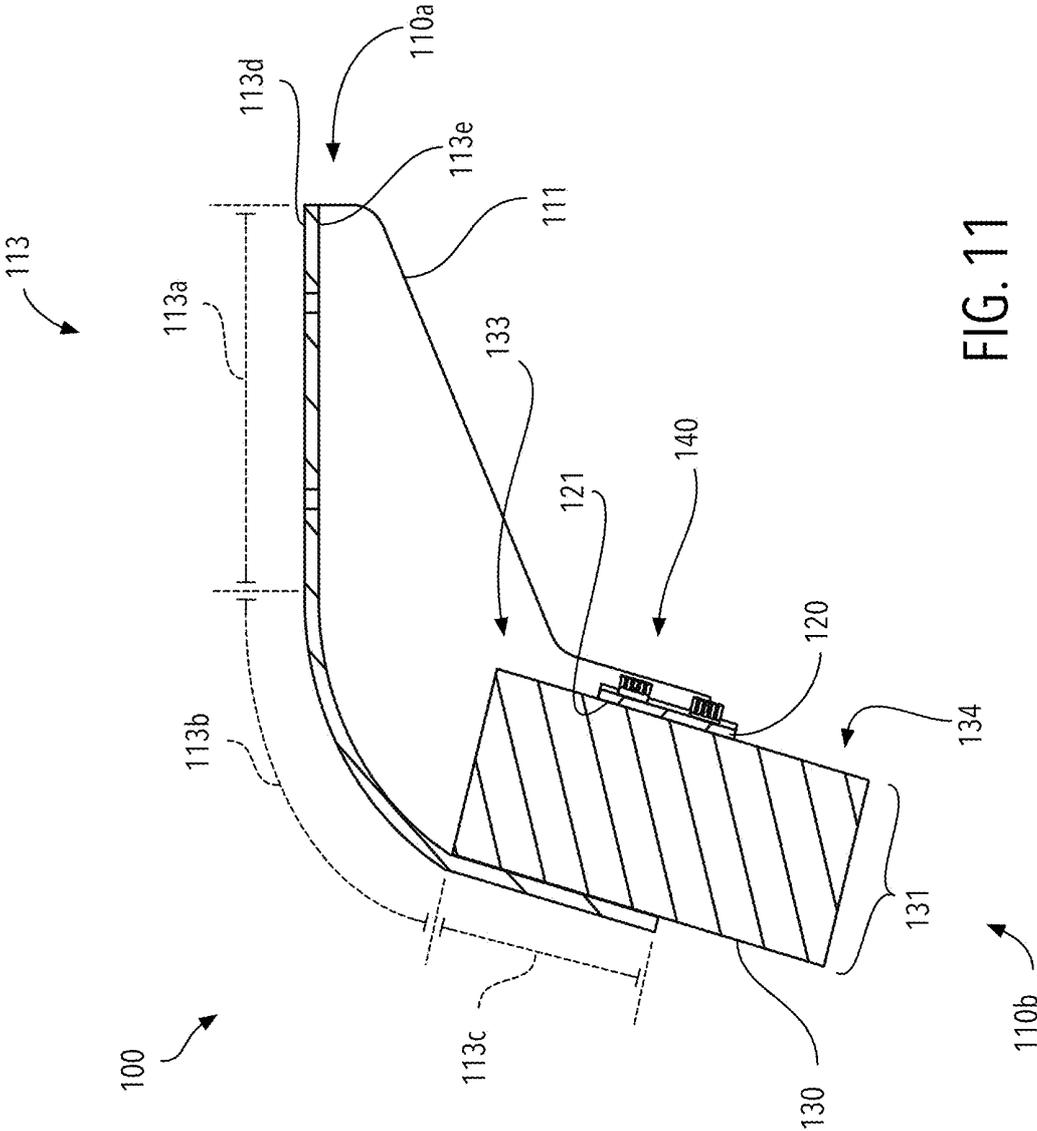


FIG. 11

AIR DIRECTING SCOOP FOR HEAT SINK AND UV-C APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority pursuant to 35 U.S.C. § 119 to U.S. Provisional Application No. 63/365,750, filed on Jun. 2, 2022, the entire contents of which are incorporated by reference in its entirety herein.

FIELD

The present invention generally relates to an apparatus arranged to secure a UV-C (ultraviolet) light module within an HVAC (heating ventilation air conditioning) duct where the apparatus is arranged to direct air flow within the duct over a heat sink apparatus arranged on the UV light module.

BACKGROUND

Indoor air filtration is well known within the art. In expensive filtration apparatuses, mechanical filtration is commonly utilized, such as the use of filters. It is well known that UV-wavelength light also provides radiation filtration of air.

Unlike other air filtration systems that depend on HEPA (high efficiency particulate air) filters or other like devices to trap dust and other particles, UV air filtration uses state-of-the-art ultraviolet light technology to keep viruses and other microorganisms from reproducing and infecting a home, office, or other indoor space. Ultraviolet light damages the genetic material that controls the reproduction of these organisms, making it impossible for them to reproduce. UV light stops these illness-inducing microbes and prevents the spread of various diseases and other problems.

UV purification is most effective when the microorganisms have prolonged contact with the UV lamp. The longer that a virus or other organism is bathed in UV light, the greater the damage to its DNA and its ability to replicate itself. There are three types of UV light: UV-A, UV-B, and UV-C—differentiated by the wavelength of the light. UV-A light has the largest wavelength, ranging from 315-400 nm. UV-C light has the shortest wavelength, from 100-280 nm. As UV-C light has the shortest wavelength, it also has the most energy of the UV light types. Meaning UV-C light has the most power to destroy genetic material within viruses and other microbes. UV-C light at a specific wavelength of approximately 254 nm has been found to be effective in killing coronavirus such as a severe acute respiratory virus (SARS-COV) and Middle Eastern Respiratory Syndrome (MERS-COV) as well as other viruses such as H1N1 influenza—approximately 267 nm is the preferable wavelength for best results. UV lights used for disinfection generate UV-C with wavelengths in the approximate range of 250-280 nm. Approximately 250-280 nm UV light is commonly acknowledged as the germicidal UV-C range.

In previous attempts to utilize UV treatment, an apparatus was used to treat air within a duct with a negative oxygen enhancer. The apparatus includes a baffle which is arranged to direct the incoming air flow in a direction proximate the negative oxygen enhancer. A temperature sensor within the apparatus is arranged to measure the temperature of the incoming air and, when the measured temperature is less than a predetermined temperature, the negative oxygen enhancer is programmed to turn off. The negative oxygen enhancer also includes a UV light apparatus which irradiates

water released from a water tank and into the air passing through the air duct to treat the air before exiting the apparatus.

In another attempt to use UV treatment, an air filtration/purification device generally includes a housing, where the housing is defined by an inlet end and an outlet end. A fan, arranged to move air through the device, is positioned proximate the inlet end. Disposed proximate the outlet end are a VOC (volatile organic compounds) filtration device, a final particulate filtration means and a humidifier. Within the device, at least one UV lamp is disposed therein, aiding in the filtration of air passing through.

UV wavelengths, specifically LED-emitted UV-C wavelengths, generate a considerable amount of heat from their respective light source or sources. Extended heat exposure degrades the light sources, e.g., LED light sources, such that excess heat alters the wavelengths of the light emitted therefrom and decreases the longevity of the light-emitting devices.

Thus, there is a long-felt need for an apparatus that utilizes UV-C to treat air flowing through an HVAC apparatus, where the apparatus is further arranged to direct the airflow onto a heat dissipation apparatus arranged on a UV-C light module, that is further arranged to measure the incoming airflow and selectively toggle the UV-C light module on and off based on measured variables, to manage heat of the UV-C apparatus.

Additionally, there is also a long-felt need for a UV-C light module including a plurality of individual heat sinks arranged to manage heat dissipation of individual UV LED lights.

Further, there is another long-felt need for a UV light air-treatment apparatus that can be installed into an existing HVAC structure with minimal components and minimal disruption of the existing structure.

SUMMARY

The present invention generally is arranged to be installed into commercial and residential air duct systems to purify the air moving through the air duct systems. The present invention aims to be a replacement, economical alternative, or supplemental, for typical air filtration systems within established HVAC structures, or other air-movement systems, by providing cleaner air via UV radiation with less required maintenance.

The present invention broadly comprises an air sanitizing apparatus arranged within an HVAC duct having an air scoop, the air scoop arranged on a surface of the HVAC duct, the air scoop having an inlet end and an outlet end, the air scoop having a bracket extending distally from the air scoop, a UV light module, the UV light module secured to the bracket, the UV light module having a temperature sensor, a heat sink, the heat sink secured to the UV light module and proximate the outlet end and, a control board, the control board in communication with the UV light module, the control board having a microprocessor in communication with an ambient temperature sensor and a heat-source temperature sensor arranged on an external heat source, the microprocessor in communication with the temperature sensor of the UV light module.

The present invention also broadly includes a PCB board to which the UV light module is secured, the UV light module including a plurality of LED light modules, each of the plurality of LED light modules arranged to emit UV-C.

The heat sink of the present invention further comprises a plurality of radiator fins arranged to extend beyond the UV

light module, the plurality of radiator fins having an upper portion and a lower portion, wherein the upper portion and the lower portion of the plurality of radiator fins are secured to the bracket and are further arranged perpendicularly to a pair of mounting faces of the bracket, wherein the upper portion of the plurality of radiator fins is disposed within the air scoop and the lower portion of the plurality of radiator fins extend past the outlet end of the air scoop.

The UV light module of the present invention further comprises a plurality of individual heat sinks secured to the PCB board, each of the plurality of individual heat sinks disposed adjacent to each of the plurality of LED light modules, where each of the plurality of individual heat sinks includes a plurality of fins.

As stated supra, a primary object of the present invention is to provide for an air sanitation apparatus utilizing UV radiation.

Another object of the present invention is to provide for an air sanitation apparatus that comprises minimal installation components within an existing HVAC system.

A further object of the present invention is to utilize a temperature comparison protocol to initiate a power on or a power off function of the UV light module, where the protocol improves the longevity of the individual LEDs of the UV light module and provides for efficient energy consumption of the apparatus, specifically the UV light module in response to air flow within the HVAC duct, or air passageway.

A still further object of the present invention is to provide for a heat mitigation apparatus that directs air flowing through an HVAC system into a heat sink apparatus.

An even further object of the present invention is to provide for individual heat mitigation apparatuses disposed adjacent to the individual LEDs of the UV light module.

Another further object of the present invention is to provide for an air sanitation apparatus having a fault-detection protocol that is communicated to an onboard microcontroller, i.e., a control module, that can be stored in the module, or, alternatively, communicated to an external device.

These and other objects, features, and advantages of the present invention will become readily apparent upon a review of the following detailed description of the invention, in view of the drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments are disclosed, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, in which:

FIG. 1A is a perspective view of an HVAC duct;

FIG. 1B is a front view of the present invention;

FIG. 2A is a top view of the HVAC duct shown in FIG. 1A;

FIG. 2B is a cross-sectional view of the HVAC duct taken generally along line 2B-2B in FIG. 2A, with the present invention installed therein;

FIG. 3A is a top perspective view of UV-C air scoop apparatus 100 of the present invention;

FIG. 3B is a bottom perspective view of UV-C air scoop apparatus 100 of the present invention;

FIG. 4A is a front view of UV-C air scoop apparatus 100 of the present invention;

FIG. 4B is a cross-sectional view of UV-C air scoop apparatus 100 taken generally along line 4B-4B in FIG. 4A;

FIG. 5 is an exploded view of UV-C air scoop apparatus 100;

FIG. 6 is a partial exploded view of PCB board 142 taken from FIG. 5, also illustrating an enlarged view of LED heat sink 161;

FIG. 7A is a perspective view of control module 150;

FIG. 7B is a side view of FIG. 7A;

FIG. 7C is a perspective view of control module 150 without cover 152;

FIG. 8 is a high-level circuit schematic of the present invention;

FIG. 9 is a cross-sectional view of the HVAC duct taken generally along line 2B-2B in FIG. 2A specifically showing air flow pathways through HVAC duct 200;

FIG. 10 is a high-level flow diagram of the operation of the present invention; and,

FIG. 11 is a cross-sectional view taken generally along line 4B-4B in FIG. 4A.

DETAILED DESCRIPTION

At the outset, it should be appreciated that like drawing numbers on different drawing views identify identical, or functionally similar, structural elements. It is to be understood that the claims are not limited to the disclosed aspects.

Furthermore, it is understood that this disclosure is not limited to the particular methodology, materials and modifications described and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to limit the scope of the claims. As such, those in the art will understand that in any suitable material, now known or hereafter developed, may be used in forming the present invention and/or components of the present invention, as described herein.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this disclosure pertains. It should be understood that any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the example embodiments.

It should be appreciated that the term “substantially” is synonymous with terms such as “nearly,” “very nearly,” “about,” “approximately,” “around,” “bordering on,” “close to,” “essentially,” “in the neighborhood of,” “in the vicinity of,” etc., and such terms may be used interchangeably as appearing in the specification and claims. It should be appreciated that the term “proximate” is synonymous with terms such as “nearby,” “close,” “adjacent,” “neighboring,” “immediate,” “adjoining,” etc., and such terms may be used interchangeably as appearing in the specification and claims.

It should be understood that use of “or” in the present application is with respect to a “non-exclusive” arrangement, unless stated otherwise. For example, when saying that “item x is A or B,” it is understood that this can mean one of the following: (1) item x is only one or the other of A and B; (2) item x is both A and B. Alternately stated, the word “or” is not used to define an “exclusive or” arrangement. For example, an “exclusive or” arrangement for the statement “item x is A or B” would require that x can be only one of A and B. Furthermore, as used herein, “and/or” is intended to mean a grammatical conjunction used to indicate that one or more of the elements or conditions recited may be included or occur. For example, a device comprising a first element, a second element and/or a third element, is intended to be construed as any one of the following

structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element.

Moreover, as used herein, the phrases “comprises at least one of” and “comprising at least one of” in combination with a system or element is intended to mean that the system or element includes one or more of the elements listed after the phrase. For example, a device comprising at least one of: a first element; a second element; and, a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element. A similar interpretation is intended when the phrase “used in at least one of:” or “one of:”, is used herein.

It should be appreciated that the embodiments as illustrated are only one of a variety of possible embodiments of the claimed invention. It should also be appreciated that directional adjectives, such as “upper”, “lower”, “right”, “left”, and similar variations, are to be interpreted in view of the corresponding drawings and are intended to be exemplary.

It should be noted that the terms “having”, “has”, “including”, “includes”, “containing”, and “contains”, are intended to be interpreted as substantially synonymous to the terms “comprising” and/or “comprises”.

It will be appreciated that various aspects of the disclosure above and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

Adverting now to the figures. The following description should be taken in view of FIGS. 1A and 2B. FIG. 1A illustrates a perspective view of HVAC duct 200. FIG. 1B illustrates a front view of the heat duct shown in FIG. 1A having UV-C air scoop apparatus 100 attached therein. FIG. 2A illustrates a top view of HVAC duct 200 having UV-C air scoop apparatus 100 attached therein and FIG. 2B is a cross-sectional view of the duct, taken generally along line 2B-2B in FIG. 2A.

Although FIGS. 1A-2B illustrate HVAC duct 200 having a generally rectangular configuration, it should be appreciated that HVAC duct 200 may comprise a circular, tubular configuration, where UV-C air scoop apparatus 100 may be adapted to include a curvature to accommodate the curved configuration of the HVAC duct. It should be noted that the illustrations of HVAC duct 200 arc portions of an entire HVAC duct system, and that other shapes of ducts are considered to be within the scope of the appended claims.

HVAC duct 200 is generally formed by top member 210, first side member 211, second side member 212, and bottom member 213. HVAC duct 200 has inlet end 214 and outlet end 215. Inlet end 214 is defined as the end of HVAC duct 200 that air flows into and outlet end 215 is defined as the end of HVAC duct 200 that air flows out of. In other words, inlet end 214 represents the inflow portion of HVAC duct

200, that is, the section of an HVAC duct system that is attached to, or begins, at an air source, e.g., heating, ventilation, and/or air conditioning, whereas outlet end 215 represents the outflow portion of HVAC duct 200, that is, the section of an HVAC duct system that terminates at an outflow vent or exhaust.

In a preferred embodiment, UV-C air scoop apparatus 100 is arranged to be removably secured to internal surface 210a of top member 210 of HVAC duct 200. In a preferred embodiment, UV-C air scoop apparatus 100 is secured to internal surface 210a via a plurality of screws. However, it should be appreciated that other removable securement means known in the art may be used to secure the apparatus to the duct wall/ceiling. Also arranged on HVAC duct 200 is control module 150 (shown in FIG. 1B) of UV-C air scoop apparatus 100. Control module 150 may be removably secured to internal surface 212a of second side member 212 or removably secured to external surface 212b of second side member 212 or may be disposed within second side member 212 via a cut-out through-bore arranged to accept control module 150 therein.

As shown in FIG. 2B, UV-C air scoop apparatus 100 is configured to bifurcate incoming air from inlet end 214 between internal surface 210a and internal surface 213a, such that its configuration separates the incoming air flow into upper flow UF and lower flow LF at a plane defined by B, and further, where a portion of upper flow UF is arranged to enter UV-C air scoop apparatus 100 to be directed over the heat sink of UV-C air scoop apparatus 100, discussed further infra.

The following description should be taken in view of FIGS. 3A and 3B. FIG. 3A is a top perspective view of UV-C air scoop apparatus 100, shown removed from HVAC duct 200 and FIG. 3B is a bottom perspective view of the same. UV-C air scoop apparatus 100 generally comprises air scoop 110, heat sink 130, and UV light module 140. Air scoop 110 includes first side panel 111 and second side panel 112. Air directing portion 113 of air scoop 110 is defined by three sections: mounting portion 113a; contoured portion 113b; and, outlet portion 113c. Air scoop 110 has two ends which respectively designate the preferred directional arrangement of UV-C air scoop apparatus 100 when positioned in HVAC duct 200, inlet end 110a and outlet end 110b. Inlet end 110a is the end of UV-C air scoop apparatus 100 that is arranged to accept, or receive, incoming air and outlet end 110b is the end of UV-C air scoop apparatus 100 that the incoming air leaves UV-C air scoop apparatus 100.

Air scoop 110 may be comprised of heat-resistant plastics, polymers, or molded plastics. Air scoop 110 could alternatively be comprised of different lightweight metals. In a preferred embodiment, heat sink 130 may be comprised of aluminum. Heat sink 130 may be alternatively comprised of a copper-nickel combination, stainless steel (e.g., 316, 304, or other suitable stainless steel types), copper, Heresite P413-coated aluminum, E-coated aluminum, or other suitable steel alloys.

The following description should be taken in view of FIGS. 4A and 4B. FIG. 4A is a front view of UV-C air scoop apparatus 100 removed from HVAC duct 200 and FIG. 4B is a cross-sectional view taken generally along line 4B-4B in FIG. 4A. Heat sink 130 is arranged on heat sink mounting surface 121 of mounting bracket 120, where mounting bracket 120 is secured to air scoop 110 (shown in FIG. 5). Heat sink 130 comprises plurality of fins 131, where plurality of fins 131 includes upper portion 133 and lower portion 134. Upper portion 133 of plurality of fins 131 is arranged to be disposed within air scoop 110 and lower

portion **134** of plurality of fins **131** is arranged to extend outwardly from outlet end **110b**, that is, lower portion **134** is outside of air scoop **110**. Plurality of fins **131** are preferably radiator fins which are surfaces that extend from heat sink **130** to increase the rate of heat transfer from UV-C air scoop apparatus **100** by increasing convection. It should be appreciated that, in alternative embodiments where increased heat transfer is needed, plurality of fins **131** could also include heat pipes, that is, fully scaled, passive two-phase heat transfer devices that take advantage of a fluid's high heat of vaporization, contained within the heat pipes, to achieve more efficient heat transfer. As shown in FIG. 4B, a space (SPACE) may be present between internal surface **113e** and plurality of fins **131**.

Air scoop **110** includes air directing portion **113**. Air directing portion **113** is arranged to direct incoming air into air scoop **110** at inlet end **110a**, over plurality of fins **131** of heat sink **130**, and out through outlet end **110b**. Air directing portion **113** includes three portions: mounting portion **113a**; contoured portion **113b**; and, outlet portion **113c**. Mounting portion **113a** is defined as the area of air scoop **110** that is removably secured to internal surface **210a** of top member **210** of HVAC duct **200**, as shown in FIGS. 1B and 2B. Mounting portion **113a** merges into contoured portion **113b** which curves mounting surface **113d** and internal surface **113e** in a substantially downward configuration, towards heat sink **130** and UV light module **140**. Contoured portion **113b** merges into outlet portion **113c** which terminates at outlet end **110b**. Heat sink **130** and UV light module **140** are preferably arranged proximate to outlet portion **113c**.

As shown in FIG. 11, which generally illustrates an alternative arrangement of the invention shown in FIG. 4B, specifically, no space (SPACE shown in FIG. 4B) is present between internal surface **113e** and plurality of fins **131**. This alternative arrangement is generally referred to as a "closed" arrangement. The closed arrangement results in increased air pressure proximate the front of the heat sink, i.e., the surface having the LEDs, thusly creating greater air flow through the heat sink, or the plurality of fins of the heat sink, therefore increasing the temperature mitigation properties of the heat sink. Specifically, the closed arrangement, prevents incoming air from bypassing the plurality of fins, via the space (SPACE) between the fins and the internal surface of the air scoop (shown in FIG. 4B), causing the differential pressure to rise in front of the heatsink (i.e., the surface proximate the LEDs) and rise behind the heatsink, which increases net airflow through the heatsink, thereby generating an appreciable drop in temperature at the LED junction, i.e., UV light module **140**.

FIG. 5 is an exploded view of UV-C air scoop apparatus **100**. Air scoop **110** includes mounting bracket **111a** of first side panel **111** and mounting bracket **112** of second side panel **112**, both of which extend from the respective side panels. Mounting brackets **111** and **112** are arranged to engage first mounting end **123** and second mounting end **124** of mounting plate **120**, preferably via screws, however other acceptable mounting means may be contemplated. Heat sink **130** is arranged on heat sink mounting surface **121** (shown in FIG. 4B) of mounting bracket **120**. UV light module **140** is arranged to secure to UV light module mounting surface **122**, specifically PCB board **142**, preferably via screws, however other acceptable mounting means may be contemplated. Arranged on PCB board **142** are plurality of LED heat sinks **160** and plurality of UV LEDs **141**, having individual LED lights **141a**, **141b**, **141c**, etc.

In a preferred embodiment, plurality of LED heat sinks **160** are comprised of copper. Alternatively, plurality of LED

heat sinks **160** may be comprised of a copper-nickel combination, stainless steel (e.g., **316**, **304**, or other suitable stainless steel types), Heresite P413-coated aluminum, E-coated aluminum, aluminum, or other suitable steel alloys.

Plurality of UV LEDs **141** may comprise any suitable LED rated at approximately 270 to 280 nm wavelength. Possible LEDs may include single LEDs, chip-on-board LEDs, LED strip(s), to a complete LED light source. Examples of suitable LEDs are provided by International-Light Technologies, part Nos.: E275-3, E275-3-S, ILT-PWRTYLED.3 W, E275-10, E275-10-S, E275-60-Strip, or ILT-PWR-12600P5. It should be appreciated that the above-identified examples of LEDs are intended to be non-limiting in view of the appending claims.

FIG. 6 illustrates a partial view of PCB board **142** taken from FIG. 5. FIG. 6 also illustrates an enlarged view of LED heat sink **161**. Plurality of UV LEDs **141** and plurality of LED heat sinks **160** are arranged on mounting surface **142a** of PCB board **142**. Mounting surface **142** includes a plurality of inputs, inputs for LED lights **142b** and inputs for heat sinks **142c**. It should be appreciated that inputs **142b** and **142c** are in electronic and powered communication with PCB board **142**, where PCB board **142** is in electronic and powered communication with control module **150** (shown in FIGS. 7A-7C). Inputs **142b** and **142c** are arranged to accept an LED light and an LED light heat sink. It should also be appreciated that inputs **142c** may be arranged as mounting positions for plurality of LED heat sinks **160** and may not be in electronic and powered communication with PCB board **142**.

Individual LED light heat sink **161** of plurality of LED heat sinks **160** are arranged to collectively provide additional heat dissipation of the heat generated by plurality of UV LEDs **141** and heat from incoming air traveling towards and through HVAC duct **200**, in conjunction with heat sink **130** (shown in FIG. 5). Individual LED light heat sink **161** generally comprises base **163** and plurality of fins **162**. Plurality of fins **162** are arranged to extend from base **163**. Plurality of fins **162** are preferably radiator fins which are surfaces that extend from Individual LED light heat sink **161** to increase the rate of heat transfer by increasing convection. Mounting surface **164** of base **163** is arranged to engage one of inputs for heat sinks **142c** on PCB board **142** and external surface **165** of base **163** is arranged opposite from mounting surface **164**.

The following description should be taken in view of FIGS. 7A through 7C. FIG. 7A illustrates a perspective view of control module **150**, FIG. 7B illustrates a side view of control module **150**, and FIG. 7C illustrates a perspective view of control module **150** without cover **152**. Control module **150** is arranged such that it will receive power from an external power source and communicate the power to UV light module **140**. UV-C air scoop apparatus **100** is arranged to be connected to a power source, preferably an alternating voltage supply (VAC) and is also arranged to provide a conversion to a direct voltage supply (VAC to VDC) conversion internally in addition to a VAC bypass to allow VAC current to power components of the present invention in addition to the VDC current. Control module **150** includes internal cavity **153** within main body **151** which is sealed by cover **152**. Disposed within internal cavity **153** is control board **155** which is arranged to execute and control UV-C air scoop apparatus **100** and the external components, discussed infra. Control module **150** receives power from power source **300** at 2-pin connector **329**, which power will be VAC which is converted by power source **300** to VDC. Also

shown in FIG. 7C is sensor board **301**, shown in greater detail in FIG. 8 and discussed further, infra.

FIG. 8 is a high-level circuit schematic of the components of UV-C air scoop apparatus **100**. Specifically, FIG. 8 illustrates control module **150**, control board **155**, UV light module **140**, sensor board **301**, and power source **300**. Power source **300** is preferably arranged to accept VAC and convert the VAC current to VDC current. In a preferred embodiment, power source **300** accepts an approximate minimum of 120 VAC 60 Hz with approximately 10% variation. In alternative embodiments, power source **300** would be capable of a universal input range to cover installation of UV-C air scoop apparatus **100** in all regions, e.g., 90 VAC to 277 VAC at both 60 Hz and 50 Hz. Power source **300** preferably provides an output voltage of 24 VDC+/-5% under all load conditions. Depending on the wattage of plurality of UV LEDs **141**, the output power rating of power source **300** may vary from 100 W-300 W for plurality of UV LEDs **141** having an approximate wattage of 75 W-225 W. Control board **155** also includes buck regulator **328**, which is arranged to step down the 24 VDC to approximately 5 VDC to provide 5 VDC power to selected components within control board **155** and/or UV light module **140**.

Microcontroller **302** in a preferred embodiment includes three (3) PWMs (pulse width modulated signal generator) **307**, **308**, and **309**. PWMs **307**, **308**, and **309** are connected to low pass filter **305**, alarm **313**, and low pass filter **303**, respectively.

Microcontroller **302** in a preferred embodiment may be an AVR® AVR32DA48, which includes the AVR® processor with hardware multiplier, running capability up to 24 MHz with 32 KB Flash, 4 KB SRAM and 512 bytes of EEPROM in 48-pin packages having TQFP and VQFN package options. It should also be appreciated that microcontroller **302** may comprise any alternative microcontroller that can provide the functionality described herein.

In a preferred embodiment, microcontroller **302** will include a dedicated communication interface to printed circuit board (PCB) MCU **317** of UV light module **140**, via I2C **311** (I2C **311** to 14-pin connector **320** to 14-pin connector **321** to I2C **318** of PCB MCU **317**). It should also be appreciated that UART (universal asynchronous receiver-transmitter) **327** may be arranged to allow for external communication from microcontroller **302**, e.g., to an external computing device such as a cell phone. PCB MCU **317** is primarily arranged to log faults related to plurality of UV LEDs **141**, discussed further infra, which are communicated to microcontroller **302**. Depending on the particular fault encountered, either alarm **313** or indicator **312**, or both, will be activated. Indicator **312** is arranged to provide a visual alarm, e.g., indicator light, and is connected to PWM x3 **310** of microcontroller **302**. Indicator **312** in a preferred embodiment is arranged to be able to display a plurality of colors associated with a plurality of different faults. Alarm **313** is arranged to provide an audio alarm and is connected to PWM **308**.

In a preferred embodiment, PCB MCU **317** may be an AVR® ATtiny404 microcontroller, which includes 8-bit AVR® processor with a hardware multiplier, with a running capability up to 20 MHz and 4 KB Flash, 256B SRAM, and 128B of EEPROM in a 14-pin package. It should also be appreciated that PCB MCU **317** may comprise any alternative microcontroller that can provide the functionality described herein.

Adjustable boost converter **304** is connected to low pass filter **303** and PWM **309** of microcontroller **302**. Adjustable boost converter **304** is arranged to supply any voltage

necessary to begin driving current through plurality of UV LEDs **141**, until a maximum voltage is reached. Adjustable boost converter **304** is preferably arranged to have an approximate maximum output voltage of 60V+/-5%, however it should be appreciated that the approximate maximum output voltage is merely exemplary and one having ordinary skill in the art would appreciate possible alternatives in the practice of the present invention. Microcontroller **302** is arranged to control the output of adjustable boost converter **304** to preferably maintain an approximate minimum of 250 mV as the lowest return voltage of plurality of UV LEDs **141**—ensuring maximum efficiency and the lowest heat generation from linear current control **306**, however it should be appreciated that the approximate lowest return voltage is merely exemplary and one having ordinary skill in the art would appreciate possible alternatives in the practice of the present invention.

Linear current control **306** is connected to low pass filter **305** and PWM **307** of microcontroller **302**. Linear current control **306** is arranged to regulate the current in each LED of plurality of UV LEDs **141** to maintain a high degree of current accuracy in each of the individual LEDs and to protect the individual LEDs. PWM **307** of microcontroller **302** is arranged as a single filtered PWM output to each linear current control circuit of the linear current control **306**, driving each of individual current control circuits with the same reference. Linear current control **306** is arranged to maintain an approximate LED current within 10 mA of the reference input, where the reference input is programmably adjustable via microcontroller **302**.

Control board **155** within control module **150** is arranged to control the current through UV light module **140** and is further arranged to provide the on/off protocol of plurality of UV LEDs **141** of UV light module **140** based whether approximately 200 fpm, or greater, of air is flowing through an HVAC duct. The on/off protocol is primarily conducted via microcontroller **302** which is determined by calculating approximate airflow from communicated temperature readings from NTC thermistor and resistor **314** (heat-source temperature sensor and external heat source) and NTC thermistor **315** (ambient temperature sensor). In a preferred embodiment the on/off protocol of microcontroller **302** is arranged to turn on plurality of UV LEDs **141** of UV light module **140** when approximately 200 fpm, or greater, airflow is detected and is arranged to off plurality of UV LEDs **141** of UV light module **140** when approximately 175 fpm, or less, airflow is detected.

Negative temperature coefficient (NTC) thermistor and resistor **314** and NTC thermistor **315** are both arranged on sensor board **301**. Sensor board **301** is connected to control board **155** via 4-pin connectors **323** and **322**, specifically 4-pin connector is connected to ADC x2 **326** of microcontroller **302**. 4-pin connectors **323** and **322** also connect NTC thermistor and resistor **314** and NTC thermistor **315** to control board **155**. NTC thermistor and resistor **314** are arranged such that the resistor will be used as the heat source in which NTC thermistor will measure the heat emitted therefrom. NTC thermistor **315** is arranged to measure the ambient temperature which measurements are thereby communicated to microcontroller **302** for comparison. By comparing the ambient temperature reading of NTC thermistor **315** and the temperature reading of NTC thermistor and resistor **314**, microcontroller **302** can decide as to whether airflow is present and thereby initiate the on/off protocol, e.g., when the temperature readings of **314** and **315** are closer, airflow is present and when the temperature readings of **314** and **315** are farther apart, airflow is not present.

UV light module **140** includes PCB board **142**, having plurality of UV LEDs **141** arranged thereon and connected thereto. Control board **155** is connected to PCB board **142** via 18-pin connectors **320** and **321**, respectively. This arrangement allows PCB board **142** to be easily replaced in the event it is damaged. 18-pin connector **320** is arranged to be connected to adjustable boost converter **304**, input ADC x12 **324** (analog-to-digital converter) of microcontroller **302**, and I2C **311** (inter-integrated circuit) of microcontroller **302**, thereby connecting the aforementioned components to UV light module **140**. PCB board **142** includes PCB MCU **317** which includes ADC **319** and I2C **318**. Specifically, I2C **318** is connected to 18-pin connector **321**, 18-pin connector **321** is connected to 18-pin connector **320**, and 18-pin connector **320** is connected to microcontroller **302** at I2C **311**—connecting microcontroller **302** to PCB MCU **317** for communication relay. PCB board **142** also includes NTC thermistor **316** that is arranged to provide microcontroller **302** with temperature readings of PCB board **142** and/or plurality of LEDs **141** for safety shutoff purposes.

ADC x3 **325** (analog-to-digital converter with three inputs) of microcontroller **302** has three inputs that arranged to monitor values for the fault-logging protocol of microcontroller **302**. The three inputs from ADC x3 **325** are +24V SENSE, VLED+SENSE, and IOUT. The first input, +24V SENSE is arranged to monitor power supply **300**, specifically the main power coming from power supply **300** into control board **155**. In a preferred embodiment, a target range of power is programmed into microcontroller **302** and if the +24V SENSE input of ADC x3 **325** detects incoming power that is not within the target range, microcontroller **302** will log the detection and determine based on the detected range whether to shut off plurality of LEDs **141**. The second input, VLED+SENSE is arranged to monitor the output provided by adjustable boost converter **304**. Boost converter **304** is arranged to have a preselected output, such that if VLED+SENSE detects an output different than the preselected output, microcontroller **302** may be programmed to turn off plurality of LEDs **141** and/or trigger an alarm through indicator **312** and/or alarm **313**. The third input, IOUT is arranged to monitor the total current through plurality of LEDs **141**. In a preferred embodiment, a target range of current is programmed into microcontroller **302** and if IOUT input of ADC x3 **325** detects current through plurality of LEDs **141** that is not within the target range, microcontroller **302** will log the detection and determine which of the VRTN1-12 signals is out of the range and shut that individual LED string off.

FIG. 9 is a cross-sectional view of the present invention taken generally along line 2B-2B in FIG. 2A specifically showing air flow pathways through HVAC duct **200** with UV-C air scoop apparatus **100** installed therein. Incoming airflow IA comes from inlet end **214** of HVAC duct **200**. Incoming airflow IA is treated by ultraviolet light UV emitted from UV-C air scoop apparatus **100**. Ultraviolet light UV emitted from UV-C air scoop apparatus **100** treats incoming airflow IA prior to reaching UV-C air scoop apparatus **100**. Once incoming airflow IA reaches inlet end **110a** of UV-C air scoop apparatus **100**, it is bifurcated B into upper flow UF and lower flow LF. As discussed supra, UV-C air scoop apparatus **100** includes mounting portion **113a**, contoured portion **113b**, and outlet portion **113c** of air directing portion **113**. Upper flow UF of incoming airflow IA, that has been treated by ultraviolet light UV, does two things, a portion of incoming airflow IA enters mounting portion **113a**, contoured portion **113b**, and outlet portion **113c** of air directing portion **113**, which directs the treated

incoming airflow IA over heat sink **130** to assist in the heat mitigation of UV-C air scoop apparatus **100**, while the other portion of incoming air IA passes directly through the lower fins of heat sink **130**—also assisting in the heat mitigation of UV-C air scoop apparatus **100**. Upper treated airflow UTA and lower treated airflow LTA will both continue to flow through duct **200** towards outlet end **215**.

FIG. 10 is high-level flow diagram of the on/off protocol of UV-C air scoop apparatus **100**. External VAC power source **300a** sends VAC current to power source **300**. Power source **300** converts/rectifies the VAC current to VDC current which powers UV-C air scoop apparatus **100** and provides power to all of control module **150** (shown providing power to control board **155**). FIG. 10 illustrates UV light module **140** and PCB MCU **317** receiving VDC from control board **155**. The heater drive is sent from control board **155** to NTC thermistor and resistor **314**, specifically to resistor **314a**. Resistor **314a** generates heat H1 which is detected by NTC thermistor **314b** to be communicated from NTC thermistor and resistor **314** to control board **155**. NTC thermistor **315** detects heat/airflow temperature H2 from incoming air from the HVAC system. NTC thermistor **315** communicates the temperature reading of H2 to control board **155**. Control board **155** measures the differential between NTC thermistor **315** and NTC thermistor and resistor **314** to determine if airflow is present in the HVAC duct, i.e., smaller differential equates to airflow and larger differential equates to no airflow. PCB MCU **317** also cross-communicates with control board **155** any fault condition that is either from UV light module **140** or control module **150**, which fault is stored in the memory of the microcontroller of control module **150**.

Fault Monitoring

The following description should be taken in view of FIG. 8 and relates to the fault monitoring recorded by microcontroller **302** or PCB MCU **317**, or both.

An open UV-C LED fault would occur if a single LED of plurality of LEDs **141** was to open. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

A shorted UV-C LED fault would occur if a single LED of plurality of LEDs **141** was to short out. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

An LED current fault would occur if a single LED of plurality of LEDs **141** has a current of more than a 10% deviation from the driven value for longer than approximately 100 ms. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

A Boost Converter fault would occur if the output of boost converter **304** is greater than approximately 24V +5%. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

A High Voltage Input fault would occur if the input voltage to control board **155** is greater than approximately 24V +5%. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

A Low Voltage Input fault would occur if the input voltage to control board **155** is less than approximately 24V-5%. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

An Airflow Detection fault would occur if NTC thermistor **315** (the ambient air thermometer) detects greater than approximately 85° C., or less than approximately -20° C. If this fault is detected, a signal will be sent to microcontroller **302** and the fault will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**. Airflow detection fault is also if the thermistor of NTC thermistor and resistor **314** has a temperature greater than approximately 10° C. less than the temperature detected by thermistor **315**, microcontroller **302** will be communicated the fault which will be logged into the memory of microcontroller **302** and will also indicate the failure via alarm **313** and indicator **312**.

An External MCU Communication fault would occur if communication between microcontroller **302** and PCB board MCU is lost. If this fault is detected, microcontroller **302** and/or PCB MCU **317** will log the fault into their respective memories while also indicating the failure via alarm **313** and indicator **312**.

An LED Stick Overtemperature fault would occur if NTC thermistor **316** detects a temperature greater than approximately 60° C., in which case microcontroller **302** will turn off plurality of LEDs **141** and microcontroller **302** and/or PCB MCU **317** will log the fault into their respective memories while also indicating the failure via alarm **313** and indicator **312**.

Thus, it is seen that the objects of the present invention are efficiently obtained, although modifications and changes to the invention should be readily apparent to those having ordinary skill in the art, which modifications are intended to be within the spirit and scope of the invention as claimed. It also is understood that the foregoing description is illustrative of the present invention and should not be considered as limiting. Therefore, other embodiments of the present invention are possible without departing from the spirit and scope of the present invention.

REFERENCES NUMERALS

100 UV-C air scoop apparatus
110 Air scoop
110a Inlet end of air scoop **110**
110b Outlet end of air scoop **110**
111 First side panel of air scoop **110**
111a Mounting bracket of first side panel **111**
112 Second side panel of air scoop **110**
112a Mounting bracket of second side panel **112**
113 Air directing portion of air scoop **110**
113a Mounting portion of air directing portion **113**
113b Contoured portion of air directing portion **113**
113c Outlet portion of air directing portion **113**
113d Mounting surface of mounting portion **113a**
113e Internal surface of air directing portion **113**
120 Mounting plate
121 Heat sink mounting surface of mounting plate **120**
122 UV light module mounting surface of mounting plate **120**
123 First mounting end of mounting plate **120**
124 Second mounting end of mounting plate **120**
130 Heat sink of air scoop **110**
131 Plurality of fins of heat sink **130**

132 Mounting surface of heat sink **130**
133 Upper portion of plurality of fins **131**
134 Lower portion of plurality of fins **131**
140 UV light module of air scoop **110**
141 Plurality of UV LEDs
141a, 141b, . . . Individual UV LEDs
142 PCB board of UV light module **140**
142a Mounting surface of PCB board **142**
142b Inputs for LED light
142c Inputs for LED heat sinks
150 Control module
151 Main body of control module **150**
152 Cover of main body **151**
153 Internal cavity of main body **151**
155 Control board
160 Plurality of LED heat sinks
161 LED heat sink of plurality of LED heat sinks **160**
162 Plurality of fins of LED heat sink **161**
163 Base of LED heat sink **161**
164 Mounting surface of base **163**
165 External surface of base **163**
200 HVAC duct
210 Top member of duct **200**
210a Internal surface of top member **210**
211 First side member of duct **200**
212 Second side member of duct **200**
212a Internal surface of second side member **212**
212b External surface of second side member **212**
213 Bottom member of duct **200**
213a Internal surface of bottom member **213**
214 Inlet end of duct **200**
215 Outlet end of duct **200**
300 Power source
300a External VAC power source
301 Sensor board
302 Microcontroller
303 Low pass filter
304 Adjustable boost converter
305 Low pass filter
306 Linear current control
307 Pulse width modulated signal generator (PWM)
308 PWM
309 PWM
310 PWM x3
311 Inter-integrated circuit (I2C)
312 Indicator
313 Alarm
314 NTC thermistor and resistor
314a Resistor
314b NTC thermistor
315 NTC thermistor
316 NTC thermistor
317 PCB (printed circuit board) MCU
318 I2C
319 Analog-to-digital converter (ADC)
320 18-pin connector
321 18-pin connector
322 4-pin connector
323 4-pin connector
324 ADC x12
325 ADC x3
326 ADC x2
327 Universal asynchronous receiver transmitter (UART)
328 5V buck regulator
329 2-pin connector
B Bifurcation plane of UV-C air scoop apparatus **100**
H1 Heat

H2 Heat/Airflow temperature
 IA Incoming air
 LF Lower flow of incoming air from bifurcation B
 LTA Lower treated air
 UF Upper flow of incoming air from bifurcation B
 UTA Upper treated air
 UV Ultraviolet light
 What is claimed is:

1. An air sanitizing apparatus arranged within an HVAC duct, comprising:
 - an air scoop, said air scoop arranged on a surface of said HVAC duct, said air scoop having an inlet end and an outlet end, said air scoop having a bracket extending distally from said air scoop;
 - a UV light module, said UV light module secured to said bracket, said UV light module having a temperature sensor;
 - a heat sink, said heat sink secured to said UV light module and proximate said outlet end; and,
 - a control board, said control board in communication with said UV light module, said control board having a microprocessor in communication with an ambient temperature sensor and a heat-source temperature sensor proximate an external heat source, said microprocessor in communication with said temperature sensor of said UV light module.
2. The air sanitizing apparatus arranged within said HVAC duct recited in claim 1, wherein said UV light module is secured to a PCB (printed circuit board), said UV light module includes a plurality of UV LEDs, each of said plurality of UV LEDs are configured to emit UV-C.
3. The air sanitizing apparatus arranged within said HVAC duct recited in claim 1, wherein said heat sink further comprises:
 - a plurality of radiator fins arranged to extend beyond UV light module, said plurality of radiator fins have an upper portion and a lower portion,
 - wherein said upper portion and said lower portion of said plurality of radiator fins are secured to said bracket and are further arranged perpendicularly to a pair of mounting faces of said bracket, wherein said upper portion of said plurality of radiator fins is disposed within said air scoop and said lower portion of said plurality of radiator fins extend past said outlet end of said air scoop.
4. The air sanitizing apparatus arranged within said HVAC duct recited in claim 2, wherein said UV light module further comprises a plurality of individual heat sinks secured to said PCB, each of said plurality of individual heat sinks is disposed adjacent to each of said plurality of UV LEDs.
5. The air sanitizing apparatus arranged within said HVAC duct recited in claim 1, wherein said air scoop is arranged to partially obstruct air passing through said duct and direct the obstructed air over said heat sink.
6. The air sanitizing apparatus arranged within said HVAC duct recited in claim 1, wherein when said ambient temperature sensor and said heat-source temperature sensor collect temperatures that are closer in degrees said microcontroller communicates to said UV light module to turn on.
7. The air sanitizing apparatus arranged within said HVAC duct recited in claim 6, wherein when said ambient temperature sensor and said heat-source temperature sensor collect temperatures that are farther in degrees said microcontroller communicates to said UV light module to turn off.
8. The air sanitizing apparatus arranged within said HVAC duct recited in claim 1, wherein said control board is housed in a control module, said control module arranged on

said HVAC duct, said control module in electrical communication with an external power source, said control module in electrical communication with said UV light module.

9. A method of sanitizing air flow within an HVAC duct, comprising the steps of:

- exposing incoming air within the HVAC duct to UV light with the apparatus recited in claim 1;
- bifurcating said incoming air with the air scoop of the apparatus; and,
- directing said bifurcated air with the air scoop to the heat sink of the apparatus.

10. An air sanitizing apparatus arranged within an HVAC duct, comprising:

- an air scoop, said air scoop arranged on a surface of said HVAC duct, said air scoop having an inlet end and an outlet end, said air scoop having a bracket extending distally from said air scoop;
- a UV light module, said UV light module secured to said bracket, said UV light module having a temperature sensor;
- a heat sink, said heat sink secured to said UV light module and proximate to said outlet end; and,
- a control board, said control board in communication with said UV light module, said control board having a microprocessor in communication with an ambient temperature sensor and a heat-source temperature sensor arranged proximate to an external heat source, said microprocessor in communication with said temperature sensor of said UV light module,

wherein said air scoop is arranged to partially obstruct air passing through said duct and direct the obstructed air over said heat sink,

wherein when said ambient temperature sensor and said heat-source temperature sensor collect temperatures that are closer in degrees said microcontroller communicates to said UV light module to turn on.

11. The air sanitizing apparatus arranged within said HVAC duct recited in claim 10,

wherein said UV light module is secured to a PCB (printed circuit board), said UV light module includes a plurality of UV LEDs, each of said plurality of UV LEDs are configured to emit UV-C,

wherein said air scoop is arranged to partially obstruct air passing through said duct and direct the obstructed air over said heat sink.

12. The air sanitizing apparatus arranged within said HVAC duct recited in claim 11, wherein said UV light module further comprises a plurality of individual heat sinks secured to said PCB, each of said plurality of individual heat sinks is disposed adjacent to each of said plurality of UV LEDs.

13. The air sanitizing apparatus arranged within said HVAC duct recited in claim 10, wherein said heat sink further comprises:

a plurality of radiator fins arranged to extend beyond UV light module, said plurality of radiator fins have an upper portion and a lower portion,

wherein said upper portion and said lower portion of said plurality of radiator fins are secured to said bracket and are further arranged perpendicularly to a pair of mounting faces of said bracket, wherein said upper portion of said plurality of radiator fins is disposed within said air scoop and said lower portion of said plurality of radiator fins extend past said outlet end of said air scoop.

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14. An air sanitizing apparatus arranged within an HVAC duct, comprising:

an air scoop having an inlet end and an outlet end, said air scoop having a bracket extending distally from said air scoop;

a UV light module mounted on a PCB (printed circuit board), said PCB secured to said bracket, said UV light module having a temperature sensor, said UV light module having a plurality of individual heat sinks arranged thereon;

an air scoop heat sink, said air scoop heat sink secured to said UV light module and proximate to said outlet end; and,

a control board, said control board in communication with said UV light module, said control board having a microprocessor in communication with an ambient temperature sensor and a heat-source temperature sensor arranged proximate to an external heat source, said microprocessor in communication with said temperature sensor of said UV light module.

15. The air sanitizing apparatus arranged within said HVAC duct recited in claim 14, wherein said air scoop arranged on a surface of said HVAC duct.

16. The air sanitizing apparatus arranged within said HVAC duct recited in claim 14, wherein said air scoop heat sink comprises a plurality of fins, a portion of said plurality of fins are disposed within said air scoop and an opposite portion of said plurality of fins are disposed externally to said outlet end.

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17. The air sanitizing apparatus arranged within said HVAC duct recited in claim 16, wherein said UV light module further comprises a plurality of UV LEDs secured to said PCB, each of said plurality of individual heat sinks is disposed adjacent to each of said plurality of UV LEDs.

18. The air sanitizing apparatus arranged within said HVAC duct recited in claim 14, wherein each of said plurality of individual heat sinks comprises a plurality of fins.

19. The air sanitizing apparatus arranged within said HVAC duct recited in claim 14,

wherein when said ambient temperature sensor and said heat-source temperature sensor collect temperatures that are closer in degrees said microcontroller communicates to said UV light module to turn on,

wherein when said ambient temperature sensor and said heat-source temperature sensor collect temperatures that are farther in degrees said microcontroller communicates to said UV light module to turn off.

20. The air sanitizing apparatus arranged within said HVAC duct recited in claim 14, wherein said control board is housed in a control module, said control module arranged on said HVAC duct, said control module in electrical communication with an external power source, said control module in electrical communication with said UV light module.

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