

HEALTHCARE CUM OPTIMAL ILLUMINATION DEVICE

FIELD OF INVENTION

The present invention relates to a multifunction healthcare cum optimal illumination device that makes full use of the electromagnetic radiation (infra-red, visible light, ultra-violet) emitted from any non-incandescent light source(s) fitted inside a frame enclosed by treated filter covers to provide non-glaring illumination with air circulation (enhanced by air circulator) and efficient air detoxification / purification by integrating into its system in a flexi-add-on manner various air cleaning capabilities such as air filtration, neutralization, ionization, sorption, electrostatic, photo-catalysis and the use of essential oils with anti-microbial and aroma-therapeutic properties while the attachment of an audio system for entertainment and social activities becomes an add-on feature of this multi task healthcare device. By this one invention that appeals to the users' seeing, smelling, breathing and hearing is created thereby an indoor environment where we can breathe in clean fragrant air, see and read in visual comfort, and listen and enjoy audio recordings altogether contributing positively to our health in line with the World Health Organization's definition (quote) "Health is a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (unquote).

BACKGROUND

Electric lamps are mainly used for illumination and decorating purposes since Thomas Edison invented the first incandescent bulb in 1879. Until now, other potentials of the lamp are not fully utilized.

The incandescent lamp is energy inefficient converting only 4-6% of electricity into illumination. The energy saving fluorescent lamp is much more efficient in energy usage, yet the major part of the electric energy (more than 75 %) is converted to heat energy, raising the indoor temperature of buildings where these lamps are used.

For human comfort and energy conservation, air heating system and air cooling system are installed in highly insulated buildings to maintain the desired temperature range of 21-25°C and relative humidity range of 20-40% in winter and 40-60% in summer. The air heating systems and air cooling systems in modern buildings often create indoor air pollution conditions that adversely affect indoor air quality. Other sources of indoor air pollution include synthetic building materials and furnishings, household cleaning products and personal care products, home appliances and office equipment, indoor plants, fertilizers, pets and pests, pesticides, garbage and decayed food, waste substances, various human activities like smoking, cooking, coughing, spraying pesticide, etc. and even the human body is continuously producing biological and chemical pollutants.

In modern cities and farms, man and nature produce continuously outdoor air pollutants and indoor air pollutants consisting of dust particles, microbes, organic and inorganic substances, liquid droplets, odors and toxic gases from diverse sources. They affect adversely the health of the occupants especially the young, the old and the sick much to the detriment of the well-being and productivity of people living and working inside such places thereby increasing the burden of healthcare costs on individuals, families, employers as well as the state.

Many of the common diseases and sickness like allergies, asthma, cold, influenza, sinus, fever, sore throat, bronchitis, pneumonia, tuberculosis, measles, chickenpox, eye and skin diseases, cancers, cardiovascular diseases are caused partly by harmful airborne biological pollutants like virus, bacteria, fungus, protozoa, spore, pollen, algae, dust mites and by organic and inorganic chemical air pollutants. Current treatments like vaccination and the taking of drugs and antibiotics that are normally disease specific may not be very effective sometimes due to mutation by germs.

Hence, for healthy and productive indoor living, it is imperative to have clean air and proper lighting at appropriate, balance and non-toxic levels.

It is desirable for indoor living environment such as residences, private and public buildings, offices, shopping malls, hospitals, school, factories, livestock housing to have proper lighting and to reduce and control the concentration level of various kinds of harmful air pollutants to non-toxic levels by capturing and destroying them with various air cleaning technologies/capabilities that are already mentioned in the Field of Invention.

With the objective of lowering energy costs, reducing the carbon footprint of the light source further, improving the well-being of individuals and reducing healthcare costs for individuals, employers and the state, the inventor has come up with a novel, unique, useful and cost-effective way to make optimal use of the light (being visible light, infra-red and ultra-violet radiation) from energy efficient light sources such as fluorescent lighting, UV lighting and LED lighting while achieving all the stated purposes of killing air borne harmful microbes as well as removing fine and ultra fine particulates, aerosols, volatile organic chemicals with the innovative and effective use of a number of air cleaning technologies in the inventive device.

The inventor believes that it is desirable that the frames of the inventive device are modular and standardised so that standard modular units of various shapes, sizes, designs, colours, materials can be joined together to form various sizes of the inventive device with varying number of configurations. With such a modular approach, the inventive device is connectable, scalable, and flexible to accommodate varying room size ranging from a small bedroom to the lobby of a hotel, even the interior of a shopping mall and other large buildings. This approach enables the inventory requirements of standard modular units to be greatly reduced because of standard sizes and common parts.

It is also desirable that the treated fabric covers of the inventive device as a décor illuminator with air cleaning functions are easily changeable to match the décor of the place, the mood of the users and the theme of the occasions whereas for most ordinary lamps the lampshades are not changeable.

It is desirable that the inventive device caters for the physical health conditions of the users while at the same time improving their mental health and social well-being by the control of lighting of various colours and brightness, improvement of ambience through music and other audio-visual therapies plus essential oils which have anti-microbial and aroma-therapeutic properties to add fragrance to the surrounding atmosphere. The inventive device will not only provide clean air for healthy living but also creates sound, smell and sight conditions to help relaxation, rest and sleep. It can also stimulate and facilitate physical movements and social interactions such as dancing, singing, exercising, etc using various hardware and software for various health problems and healthcare solutions.

PRIOR ART

There exist already many air purifiers, fans and light bulbs with air purifying property in the market.

There are prior art patents that use fabric filter treated with photo-catalytic materials together with UV radiation and fan positioned within enclosed casing to purifying air. United States patents 6,666,912 and 5,330,722 disclose stand-alone air cleaning apparatus. But they are not fabric lamps for illumination functions as well.

Prior art patents have also considered incorporation of air purifying properties into fluorescent bulbs. They coated the glass bulbs with photo-catalytic materials but without the use of partially enclosed fabric lampshade as filter to capture the air pollutants and without the air circulation functions.

Prior art patents such as CN 2864975 have disclosed the use of ultra-violet light from an illumination coating of rare earth phosphor whose wavelength is between 280-400 nm, which is capable of transforming 7-deoxidation ergot cholesterol in the skin into vitamin D[3] or D[2].

Other prior art patents such as J P 9294817 have disclosed the features of air purification through ionization and use of biochemical rays and ultra-violet rays to refresh and promote the health of the user.

PROBLEMS OF PRIOR ART

Electric lamps are mainly used for illumination and decorating purposes since Thomas Edison invented the first incandescent bulb in 1879. Until now, other potentials of the lamp are not fully utilized.

The incandescent electric lamp is also quite wasteful in energy usage. The energy saving fluorescent lamp is more efficient at energy usage yet the major part of the energy is still converted to heat energy raising the temperature of its surroundings but otherwise unutilised.

Prior art appliances directed towards killing of virus and bacteria also exist. Prior art appliances directed towards removal of V.O.C and odors also exist. Prior art appliances for improvement of air quality similarly exist.

It is desirable if an invention could creatively integrate these three kinds of products into a useful, stand-alone and innovative healthcare cum illumination device which is more energy efficient, cost effective, is safe, environment friendly, flexible and space saving, while it is able to remain relevant to user's health and decor requirements, and is user-friendly and affordable.

OBJECTS OF THE INVENTION

The innovative healthcare optimal device not only (a) makes optimal or full use of the electrical energy converted to radiation energy of different wavelengths (infra-red, visible light, ultra-violet) for non-glaring illumination but also (b) performs the following additional useful functions with flexibility to meet the individual needs of the users through flexi-add-on configuration / arrangement of various standardized components in the innovative system of the inventive device that:

1) Circulates indoor air drawn through one or more layer(s) of treated fabric filter cover of the inventive device by:

(a) Convectional means using only the heat (infra-red radiation) produced by one or more energy efficient light source(s), and / or

(b) Mechanical means by using one or more electric fan(s) to generate greater volume of air flow and also using the heat energy produced by the electric fan(s) for air circulation.

2) Improves indoor air quality (IAQ) by innovative and integrative applications of various proven air cleaning technologies in a flexible, efficient and cost-effective manner to agglomerate, precipitate, capture, hold, decompose and dispose various kinds of biological (living and dead organisms) and chemical (organic and inorganic substances) air pollutants such as particulates matters (PM) of various kinds and sizes (coarse > 2.5 μ m, fine 2.5-0.1 μ m and ultra fine < 0.1 μ m), volatile organic and inorganic substances, odors and toxic gases from diverse sources which can cause adverse health effects.

- 3) Improves health by increasing the negative ions concentration / level in indoor air and also to balance the ratio of excess positive ions which exist in many enclosed and insulated buildings with insufficient ventilation.
- 4) Enhances safety as access into the inventive device is restricted with the use of safety mesh (on top) and treated fabric filter cover (on the sides) to further enclose it preventing the breaking of any light bulb(s) fixed inside it. If an accident does occur the light bulb(s) is (are) broken inside the inventive device, the treated fabric filter cover will hold the harmful broken bulb(s) and provides protection against harm especially for young children.
- 5) Enhances the cleanliness and brightness of the light bulb(s) and the useful service life span of the electric fan(s) with the capture and removal of dusts and other air pollutants in the inventive device by the treated fabric filter cover.
- 6) Blends and matches well with other home fixtures (e.g. curtains, furniture, carpet, etc.). The inventive device is hence a versatile and aesthetic fixture with its wide varieties of designs, texture and colors. The treated fabric filter cover can be taken off easily, washed and is useable again. Moreover, the use of specific combination of treated fabric filter cover also improves the anti-viral, anti-bacteria, anti-odor and other air cleaning properties of the inventive device.
- 7) Enhances physical and mental health of the user including his mood with appropriate volatile anti-microbial and aroma-therapeutic essential oil / plant extract treatment by natural inhalation and absorption. Plant extracts put into containers are placed next to light source(s) in the chassis at the upper outlet of the inventive device and the warm convectional airflow evaporates and disperses the volatile essential oils throughout the room. As such this therapeutic capability extends the functionality of the inventive device that can thus be used as a therapeutic device, for instance, as a SAD or a circadian device with the additional benefits of its add-ons that provide a pleasant ambience of clean indoor air, appropriate colourful lighting, fragrance and sound that an ordinary SAD or circadian device cannot do.
- 8) Standardizes for the majority of users and customization for the minority with special needs.
- 9) Functions as unique healthcare light boxes with anti-microbial, aroma-therapeutic and audio-visual properties for display purposes while illuminating and cleaning the indoor air of the premises where these boxes are located.
- 10) Functions as a multitasked space saving and costs saving organiser with its in-built infrastructure that enables the installation of various add-ons like ionizers, essential oils, audio system with MP3/MP4 player, speakers and other audio aids so that all these are centralised into one device.

The innovative integration of these capabilities and technologies for healthy indoor living is the invention's flexi-add-on system and continuous flow process named SC Technologies (in short SC-Tec) by the inventor as it is a sustainable and caring device.

SUMMARY OF THE INVENTION

This invention is a holistic healthcare cum optimal illumination device for indoor use and comprises the following:

1. An electrical light source(s) connected by electric cable, an on-off switch and a plug to an electric power source.
2. A modular frame with a chassis for holding the electrical light source(s), ionizer(s), essential oil(s); and it is also used for holding one or more layer(s) of treated fabric filter cover(s) functioning as mechanical and electrostatic air filter(s), substrate, glare diffuser, noise absorber, microbe shield, UV radiation shield, safety shield, decorative finishes and display screen.

The light source(s) emitting visible light and invisible infra-red radiation and UV radiation is optimally used, with the visible light illuminating the surrounding, the infra-red radiation heating the air around the light source(s) and the said hot air within the inventive device rising to form a convection current, said convection current drawing cool ambient air from the surroundings into the lower part of the inventive device to replace the warm air that has risen through the upper end of the inventive device. Harmful air pollutants, including virus, bacteria, spores, molds, pollens, and various pathogens, allergens, and other organic matters are captured by the filter covers coated with various air cleaning chemicals including photo-catalyst. Upon exposure to UV radiation from the light source(s), the photo-catalyst will produce strong redox reactions which will break down organic hazardous matters into relatively innocuous molecules like carbon dioxide, water and inorganic salt.

Preferably, a modular frame with an opening at its top and having a safety mesh, coated with activated carbon and photo-catalyst for the outflow of warm clean air from the inventive device;

Preferably, a chassis connected to the upper part of the frame for housing one or more ionizers, lighting source(s) and essential oil container(s), and

Preferably, one or more layer(s) of treated fabric filter cover functioning as mechanical filter(s) and also as substrate for holding and bonding anti-microbial agent to capture and kill various microbes physically by stabbing and electrocution; and/or treat the outer layer of filter cover with biocides like ZnO, CuO and Ca(OH)₂ which can also remove acidic gases like NO_x, SO_x, HCl, CO₂, etc, chemically by neutralization.

Preferably, a layer of treated fabric filter cover treated with zeolite and activated carbon to remove odors by adsorption and ozone by reduction

Preferably, the inventive device has one or more electrical light sources e.g. fluorescent lighting or a Light Emitting Device (LED) or High Intensity Discharged (HID) lighting or UV lighting.

Preferably, the inventive device has one or more air circulation units to produce a stronger and larger air current drawn in from the surrounding through one or more layer(s) of fabric filter cover treated with anti-pollutant properties so that air borne pollutants in the air current are caught and held by the said treated fabric filter cover.

Preferably, a chassis for holding one or more electrical light sources, one or more ionizers and one or more containers for essential oils; the chassis is fitted below the safety mesh at the top of the inventive device;

Preferably, a Photo-catalytic Air Cleaner (PAC) consisting of a frame with a UV light source fitted within it; it also has a base plate fitted with a fan on top of it. The frame is also enclosed by one or more layers of filter covers treated with photo-catalyst and /or other chemicals.

Preferably, the electrical light source emits visible light, infra-red light and UV light, said visible light illuminating the surrounding, said infra-red light heating the air in the cavity of the inventive device, said hot air within the inventive device rising to form a convection current, said convection current evaporates and diffuses the essential oils, heated by the electrical light source, out of the inventive device to the surrounding;

Preferably, the treated fabric filter cover for the inventive device can be washed with soapy water to remove un-decomposed air pollutants and it can be used again.

Preferably, the base plate for a PAC has one or more slots to house an electric fan, various audio-visual gadgets, programmable controller and other devices.

Preferably, the treated fabric filter cover for the inventive device is printed with designs to match the decor of the interior of a building.

Preferably, the treated fabric filter cover for the inventive device is printed with words and pictures to be used as advertisements, notices and signs or motivational messages.

Preferably, the inventive device has one or more ionizing units.

Preferably, the ionizing unit for the inventive device will produce millions of very active negative ions and positive ions which will collide with air pollutants that will

be charged and attracted oppositely. They will agglomerate into larger and heavier clusters and gravity will precipitate them in the surrounding air which will be drawn into the inventive device by the air circulation. Air pollutants in clusters will be trapped and decomposed at the one or more layers of treated fabric filter cover by photo-catalysis.

Preferably, the ionizing unit is a plasma ionizer.

Preferably, the ionizing unit is negative ion ionizer which can also be incorporated into the light source as a fusion unit.

Preferably, the base plate for the inventive device has a plurality of slots and connection points spaced apart.

Preferably, the base plate has a slot for installation of control means (one or more switches) for operating the device, the MP3 or MP4 player and speakers slotted therein, microphones, earplugs and tuner.

Preferably, the control means is a programmable controller, a remote control or a display panel.

Preferably, the chassis for the inventive device is fitted with one or more light sources and each of the light sources emits light of the same colour or emits light of different colours and different brightness.

Preferably, the programmable controller for the inventive device is connected to the light sources and air circulation units to operate the light sources and air circulation units.

Preferably, the programmable controller for the inventive device is additionally connected to the MP3 or MP4 player and other audio devices.

Preferably, the programmable controller for the inventive device can be programmed to control the different colours of light emitted by the light sources and said colours can be synchronised with the MP3 or MP4 player and release of essential oils to introduce different ambience and atmosphere in the surroundings of the inventive device.

Preferably, the programmable controller for the inventive device controls the operation of the light sources, air circulation units, MP3 /MP4 player using a radio frequency or an infra- red remote control device.

Preferably, the programmable controller for the inventive device controls the operation of the light sources, air circulation units, MP3 /MP4 player using a Bluetooth device.

Preferably, the programmable controller has a display panel so that the user can select various modes of working of the inventive device.

Preferably, the modular frame for the inventive device is a circle, an oval, a square, a rectangle, a pentagon, a hexagon, an octagon, a star when viewed from cross sections.

Preferably, the modular frame for the inventive device is a cylinder, a cube, an oblong, a cone, a hemisphere, a sphere or other shapes when viewed from the side.

Preferably, the modular frame of the same shape and size for the inventive device can be combined to form inventive devices of different configurations and of various shapes and sizes.

Preferably, each of the modular frames of the same shape or size can be stacked into each other for storage, packaging and transport purposes.

Preferably, the inventive device is formed from combining a PAC at the lower part with the upper modular frames covered by one or more layers of treated fabric filter cover, and having one or more ionizers, one or more essential oil containers and one or more electrical light sources all of which are housed or fitted onto the chassis connected below the safety mesh at the upper part of the modular frame.

Preferably, the inventive device can be placed on a table or the floor or suspended from a wall or from a ceiling of the interior of a building.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, its advantages, and the objects attained by its use, reference should now be made to the accompanying drawings. The accompanying drawings illustrate several embodiments of the invention and together with the descriptions herein, serve to explain the workings and principles of the invention.

FIG. 1 and FIG. 1a illustrate a basic embodiment of the invention consisting of a frame (12), a chassis (20), a light source (26) and a treated filter cover (24) enclosing the frame (12).

FIG. 2a and 2b show the Top View and Front View of the basic embodiment and FIG. 2c and FIG. 2d show two containers of essential oil (42) and two units of ionizer (46) added at the chassis (20) to the basic embodiment of the invention.

FIG. 3a-1 and FIG. 3a-2 are illustration of a working embodiment of the invention showing it as a table lamp with an upper frame and lower frame joined together by a base plate (22) with the lower frame containing a PAC.

FIG. 3b and FIG. 3c show the top view of the chassis (20) and base plate (22) respectively.

FIG. 3d is an illustration of a PAC fitted with a controller unit (50) and an audio unit (52).

FIG. 4 is an illustration of another working embodiment of the invention showing it as a pendant lamp with LED light source and treated deco-fabric added.

FIG. 5 is an illustration of another embodiment of the invention showing how the modular frames can be used to construct a taller and bigger floor lamp for use in a large indoor space with more illumination, air circulation, air cleaning and also with anti-microbial aroma-therapeutic and audio-visual effects.

FIG. 6 is an illustration of another embodiment of the invention showing how two standard modular frames can be used to make two different working embodiments of the invention.

FIG. 7 shows various combinations of standard modular frames are used to make the inventive device in different shapes.

FIG. 8 shows modular frames of various shapes are used to build various configurations of the inventive devices with standard common parts of the invention.

FIG. 9 shows various shape of modular frame components used to build various configurations of the inventive device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 is an illustration of a taper shape modular frame. FIG. 1a is an illustration of a basic embodiment of the inventive device consisting of these basic components:

a modular frame (12) enclosed by a layer of treated fabric filter cover (24); and

a chassis (20) attached to the frame (12) is fitted with a light source (26);

The modular frame (12) is shown in bold black lines and the dashed lines represent the layers of treated fabric filter cover (26) covering the modular frame (12). The arrows show the convectional air inflow through the treated fabric filter cover (26) and air outflow through the upper end of the inventive device.

FIG. 2a is a top view showing the safety mesh (28) connected to the modular frame (12) of a circular taper shape inventive device;

FIG. 2b is a side view of the modular frame (12) of a circular taper shape inventive device;

FIG. 2c is a top view of the chassis (20) having three sockets/holders one of which is for light source (26) and two are for containers of essential oil (42);

FIG. 2d is a side view of the modular frame (12), enclosed by treated fabric filter cover (24), having a chassis (20) fitted with one light source (26), two containers (42) and two ionizers (42);

The containers can be filled with essential oils (42) or a mixture of different types of essential oils. The heat from the light source will evaporate the essential oils allowing it to diffuse throughout the surrounding.

The chassis (20) also has two units of ionizers (46) which produce negative ions and positive ions. These charged particles or plasma will spread throughout the surrounding by air circulation and Brownian diffusion movement generated by the inventive device to clean the air outside the inventive device. Although the inventive device can consist of a single frame device as shown in FIG. 2d, a more effective embodiment of the inventive device is shown in FIG. 3a-1.

FIG. 3a-1 is an illustration of an embodiment of the inventive device having two frames (12) in the form of a table lamp. A base plate (22) is fitted between the upper and lower modular frames (12). The upper modular frame of this embodiment is similar to the basic embodiment as described in FIG. 2d except that it now has three light sources (26) instead of having only one light source. The chassis (20) is fitted at the top of the upper modular frame (12) so that the two units of essential oil (42) can be heated by the three units of light sources (26) and be evaporated and diffused easily into the surrounding. The lower modular frame houses the photo-catalytic air cleaner PAC. It consists of an UV light source (30) fitted below the electric fan (44) which is disposed at the top of the base plate (22) which is connected to the lower frame and enclosed by one more layers of treated filter cover. The base plate (22) has an opening for installation of an electric fan (44) to generate higher volume of airflow for more effective air cleaning.

The base plate (22) has a number of slots (40) which can be fitted with several devices such as MP3/MP4 player, speakers, ear plug, timer, dimmer, programmable controller, etc. as flexi-add-on components depending on the requirements of the users. The modular frame (12) can be fitted with one or more layers of treated fabric filter cover (24) which not only acts as a lamp shade for aesthetic purpose but as a filter for air pollutants and also as substrates for holding various air cleaning chemicals/substances. In FIG. 1a, a portion of the treated fabric filter cover (24) is cut away to show the interior structure of the inventive device. The layers of treated fabric filter cover (24) can be changed to suit the indoor air quality (i.e. extent of cleaning required) and the health requirements of users. The layers can include:-

- a. a layer treated with anti-microbial agents to trap and kill microbes and to capture coarse particulates;

- b. a layer treated with biocides like ZnO, CuO or Ca(OH)₂ to trap and kill microbes like virus, bacteria, fungi, etc. and also to neutralize acidic gases like CO₂, NO_x, SO_x, HCl, etc. ;
- c. a layer treated with activated carbon to remove odors and ozone;
- d. a layer having photo-catalytic material to capture and decompose air pollutants like V.O.C., odors, microbes, etc. by strong redox reactions upon radiation with UV light;
- e. a combination of the above.

Referring to FIG. 3a-1 and 3a-2, two units of modular frames (12) are combined to form a new embodiment of the inventive device as a taller structure. An electric fan (44) is fitted onto the base plate (22), positioned between the two frames, to produce a stronger stream of air currents flowing from the surrounding, through filter covers (24) of the lower frame of the inventive device, and with an upward centrifugal vortex airflow in the cavity of the upper frame powered mainly by the rotating blade of the fan and then out through the side (covered) and the top (open) of the inventive device. Air cleaning takes place at the surfaces of the treated filter covers (24) which captured the harmful air pollutants in the airflow.

FIG. 3b shows a top view of the chassis (20) with sockets/holders for three light sources (26) and two containers for essential oils (42). Preferably, the chassis (20) be situated at the top of the inventive device. Heat radiated from the light source (26) will evaporate the essential oils which will then be lifted upwards from the inventive device and diffused into the surrounding due to the strong uprising convection current assisted by the electric fan (44) which is located at the middle part of the inventive device.

It is possible for the modular frame of the inventive device to be enclosed with different layers of treated fabric filter cover (24) for various functions and that strong glare will be diffused to provide soft lighting for visual comfort.

Due to the modular and flexi-add-on nature of the inventive device, it is possible for the base plate (22) not to be fitted with any devices and merely be an opening to allow air to flow through. Likewise, it is possible for the chassis (20) not to be fitted with any ionizer or any container for essential oil. Therefore the modular and flexi-add-on approach of this inventive device makes it possible for the user to select:-

the type and number of add-ons to be fitted onto the base plate (22);

the type and the number of light sources (26);

the type and number of fabric filter covers (24) to be used as shade covers;

the type and number of essential oils (42) to be used;

the type of chemicals to be coated on the treated fabric filter covers (24);

the air filtration efficiency of the filter covers (26) to be used;

the type and the number of ionizers (46) to be used;

all of which can be pre-selected or changed according to the health requirements of the users and according to the conditions and toxicities of the surrounding.

Operation of the healthcare cum illumination device

When the fluorescent light source is switched on, it gives out visible light, infra-red radiation and ultra-violet radiation. The air around the light source (26) in the modular frame (12) is heated up and hot air in the cavity of the modular frame (12) expands and rises up through an opening at the top of the inventive device. As the hot air rises, it draws cooler ambient air from the surroundings into the modular frame (12), going through the treated fabric filter cover (24) of the lower modular frame (12). A convection current is thus formed, with air within the modular frame (12) continuously heated, said hot air rising to the top of the modular frame (12) and drawing cooler ambient air through the treated fabric filter cover (24) of the lower end of the modular frame (12). A stronger air current is produced with the use of an electric fan (44). Air pollutants in the air current will be captured by the treated filter covers (24). The types of air cleaning chemicals used on the various layers of treated fabric filter cover (24) depend largely on the health conditions of the users and, to a great extent, the kinds of air pollutants usually present in the surrounding. They normally consist of various kinds of biological (living and dead organisms) and chemical (organic and inorganic substances) air pollutants such as particulates (PM) of various sizes (coarse $> 2.5\mu\text{m}$, fine $2.5\text{-}0.1\ \mu\text{m}$ and ultra fine $< 0.1\ \mu\text{m}$), volatile organic chemicals, inorganic substances, odors and toxic gases from diverse sources which can cause adverse health effects.

Air cleaning takes place at the treated fabric filter cover (24) as well as outside the inventive device by attaching negative ion and plasma ionizers at the outlet of the device with each emitter producing several millions of charged particle(s) per c.c. per second and emit them like shower or spray into the surrounding indoor air filled with air pollutants. Air circulation and random Brownian diffusion generated by the inventive device will spread and mix the highly reactive negative and positive ions with the air pollutants, especially the ultra fine and volatile substances which are difficult to filter even with HEPA filter causing them to be charged, attract oppositely, interact and form larger and heavier particulates and clusters. The agglomerated air pollutants cluster will become too large and heavy to remain suspended. Eventually, it will precipitate and remove from the air by gravitational force. Some falling

particulates will be drawn by the gentle circulating airflow and captured by the treated fabric filter cover (24) of the inventive device.

In operation, the inventive device will draw air through one or more layer(s) of treated fabric filter cover (24) (as filter) by:

- (a) convection means using only the heat (infra-red radiation) produced by the light source(s), and / or
- (b) mechanical means by using one or more air circulation units such as electric fan(s) (44) to generate greater volume of air flow.

Indoor air quality (IAQ) is therefore improved through this innovative and integrative applications of various air cleaning technologies in the inventive device.

The inventive device installed indoors such as offices, apartments and other buildings, is able to reduce the amounts of virus, bacteria, odors, V.O.C. and other pollutants to a minimum non-toxic level, after which it is no longer necessary and not cost-effective to remove the remaining insignificant amount of virus, bacteria, odors and other pollutants. Thus, the pre-set controller switches off the ionizing unit and air circulation unit once the setting for each of their time period has been reached.

It can be seen that the entire spectrum of radiation produced by a fluorescent light source is thus utilised to produce illumination as well as assisting, together with the use of one or more layers of treated fabric filter cover (24), ionizer (46) and the PAC, in cleaning the surrounding air by getting rid of air borne virus, bacteria, pollutants and odors. It can be seen that the inventive device which makes use of the entire electromagnetic radiation given out by the electrical light source (26) with flexi-add-on of essential oils is a fully functional healthcare cum optimal illumination device that promotes healthy living in an energy efficient environment.

A simple prototype PAC was made to test the working of the inventive device for air cleaning without using ionizer and essential oil. The test device consists of a frame enclosed by a single layer of filter cover treated with nano-TiO₂ photo-catalyst and a fan with airflow 95 c.f.m. fitted on a base plate located at the top of the frame with a 25 watt fluorescent light source fitted in the cavity of the frame. Test was carried out by an independent accredited testing company at an enclosed office room of floor area approximately 9m² and room volume of approximately 25m³.

The following results recorded for the first test:

Cumulative time (mins)	RSP (mg/m ³)	MOM(PELTS) (mg/m ³)	SIAQG (mg/m ³)
0	14.4	10 (Nuisance Particulates)	0.15 (for reference purpose only)
30	10.1		
60	5.4		
120	1.9		
180	0.73		
240	0.62		
300	0.43		
360	0.22		
420	0.08		

Remarks: Respirable Suspended Particulates (RSP) was introduced into the indoor environment with six Marlboro type cigarettes burning for the first 5 minutes of test duration.

MOM : Ministry of Manpower, Singapore

PELTS : Permissible Exposure Levels of Toxic Substances

SIAQG : Singapore Indoor Air Quality Guidelines

Cumulative time (mins)	VOC (ppm)	MOM (PELTS) (ppm)	SIAQG (ppm)
0	987	Acetone=750ppm Trichloroethylene =50ppm Isopropyl Alcohol=400ppm	3(for reference purpose only)
30	521		
60	312		
120	198		
180	108		
240	76		
300	52		
360	23		
420	0		

Remarks: Volatile Organic Compounds (VOC) was introduced into the indoor environment with evaporation of mixed solution comprised of acetone, trichloroethylene and isopropyl alcohol for the first 5 minutes of test duration.

The following results recorded for the second test:-

Cumulative time (hrs)	TBC (CFU/m ³)	TFC(CFU/m ³)	SIAQG (CFU/m ³)
0	1110	420	TBC:500
1	440	210	
6	45	30	TFC:500

Remarks: Both Bacteria and Fungi were introduced into the indoor environment with common airborne bacteria and fungi cultures media for the first 5 minutes of test duration.

TBC : Total Bacteria Count TFC: Total Fungi Count

OSHA : Occupational Safety and Health Administration, US

NIOSH : National Institute for Occupational Health & Safety, US

ACGIA : American Conference Of Governmental Industrial Hygienists, US

The test results showed that after two to four hours, the prototype inventive device working in a confined space could substantially reduce the amount of bacteria, fungi, V.O.C and respirable suspended particulates (RSP) to reach international air quality standards/guidelines for industrial buildings and office buildings. A larger inventive device with more capabilities added will perform these tasks better in a shorter time.

Combinations of Modular Units

Due to the modular nature of the frames (12), they therefore can be standardized, connectable and scalable. Thus two or more frames (12) can be connected with each other to form scalable inventive devices of various configurations, shapes and sizes for more functions and higher efficiency as illustrated in FIG.4 to FIG. 9.

FIG. 4 is an illustration of another working embodiment of the invention. This embodiment is a pendant lamp consisting of an upper modular frame (12) and a lower modular frame (12) with three electrical light sources (26) and the treated filter covers enclosing the lower and upper modular frames (12) with an opening at the top. A semi-hemispherical frame is connected to the top of the upper modular frame for holding the suspending deco-fabric cover. In this variation, the light sources (26) are two fluorescent light bulbs disposed at the cavities of the two modular frames. A plate of LED lighting (48) is disposed at the bottom of the lower frame.

FIG. 5 is an illustration of how several standard modular frames are connected vertically to form a tall standing floor lamp which is another embodiment of the inventive device that is very cost-effective and efficient for use in a large indoor space.

It has larger cross-section and greater height, more fans and stronger airflow, further dispersion and collection of air, larger and more filter surfaces, more in-out cycles of continuous multi-stages air filtrations which will result in better capture and more thorough decomposition of air pollutants by photo-catalysis.

FIG. 6 shows two standard taper shape modular frames (12) are used to make two different working embodiments of the invention by having two different configuration / combination.

FIG. 7 shows the use of three kinds of standard modular frames are used to make seven different two-frames combination inventive devices of various shapes and sizes.

FIG. 8 shows various shapes of modular frames (12) in cross section to be used to build inventive devices of various configurations using standard common parts.

FIG. 9 shows the various shape of modular frames (12) are used to build various configurations of the inventive device of the invention.

Selection of combinations of technologies for health and personal requirements of users

The inventive device can use various kinds of material to make fabric filter covers (24), and treated with different air cleaning substances, for enclosing the modular frames of the inventive device according to the requirements and choice of the users.

- a. a layer treated with anti-microbial agents to trap and kill microbes and to filter coarse particulates.
- b. a layer treated with biocides like ZnO, CuO or $\text{Ca}(\text{OH})_2$ to trap and kill virus, bacteria and other microbes and also to neutralize acidic gases like CO_2 , NO_x , SO_x , HCl etc.
- c. a layer treated with activated carbon to remove odors and ozone
- d. a layer having nano photo-catalytic material to trap, hold and decompose microbes and organic pollutants by strong redox reaction with UV radiation.
- e. a layer treated with combination of two or more of above.

The fabric filter cover functions/acts like "clothing /dress" for the inventive device and it is wrapped around the modular frame (12). For additional layers of cover to be added, the user would have to wrap the additional layer of cover over the inner covers, which are already wrapped around the frame. The fabric filter covers are usually selected by the users to meet their health and deco-matching concerns.

For clean air and to remove air borne pollutants, the user may choose to use a combination of treated fabric filter cover (24) and an ionizer (46).

For bacteria free and germ free air, the user may choose to use a combination of treated fabric filter cover (24) treated with antimicrobial agents to trap and kill microbes and a second layer treated with biocide to trap and kill bacteria and neutralize acidic gases like CO₂, NO_x, SO_x, HCl etc. together with an ionizer (46).

For relaxation and to reduce stress, the user may choose an aroma-therapeutic essential oil combined with different lights of soft colours and music (from the MP3 player installed at the base plate) to dance and / or sing along with the music.

The above are just a few combinations of the health promoting inventive device.

Scalability

Standardization and flexi-add-on approach in product design and assembly enables the scale up of the inventive device by expansion in size and improvement in performance. The use of several units of standard modular frames (12) joined together to form a bigger and taller structure which enables the installation of more units of light sources (26), and more units of electric fans (44), and more units of ionizers (46) and other components. In this way, the user can get a customized inventive device that suits his requirements for efficient lighting and effective removal of air pollutants such as virus, bacteria, mould, smoke, odors, V.O.C.s and other harmful airborne substances from the large volume of space he is in. Such an inventive device is shown in FIG. 5 which is an illustration of a tall standing floor lamp. The same can be hung from the ceiling of the lobby of a large building.

The various shapes and sizes also enable the user to use the inventive device of varying dimensions ranging from very large to smaller sizes for use in a lobby of an apartment building or hotel or in a small room. If the inventive device is used in a large space, it would be fitted with more units of bigger frames, larger filter covers, more fluorescent light sources, more electric fans and more ionizers (46) to enable it to work effectively in the larger space.

Safety

The use of fabric filter covers and modular frame (12) enhances the safety of the inventive device by restricting access into the enclosed treated fabric filter cover (2). In the event of accident, the inventive device will help to prevent the breaking of the light bulb(s). If the light bulb(s) is (are) broken inside the inventive device, the treated fabric filter cover (24) will hold the harmful broken bulb(s) providing, especially important for young children, protection against harm from live electric current and

toxic materials like mercury. Additional protection is through the use of a safety mesh (28) on top of the inventive device when necessary. The treated fabric filter cover (24) wrapped around the PAC too also acts to prevent the hands of children from accidentally being placed inside the inventive device.

Adaptation for other uses

Although the fabric filter cover (24) is treated, the outer layer fabric filter cover (24) of the inventive device can also be overprinted or painted with pictures, words, drawings, signs, photographs, and other graphic materials for the inventive device to be used as a light box for display, advertisement, signage, notices, learning / presentation visual aid . In this way, the users of this light box enjoy all the benefits of the inventive device conducive to working and learning in a clean air and fragrant fresh environment. This light box housed in the inventive device is thus unique.

Programmable to synchronize operations of various devices

The programmable controller (50) would ensure the inventive device operates at an efficient and optimal level at all times.

Since the inventive device can be suspended from a ceiling or the wall, a remote control is used to control the programmable controller (50). The remote control can be by infra- red or radio signals or Bluetooth.

Controls

A display panel may also be added for table size inventive devices so that the user can select various modes of working of the inventive device, such as:-

- a. Normal Lighting in early evening; without the air circulation unit on.
- b. Subdued lighting in the later part of the evening with different coloured lights and music and with air circulation unit and the ionizer (46) on.

The display panel would also allow the user to set the inventive device to operate certain features or lights during certain times of the day to reflect the outside environment or to simulate daylight conditions in winter.

With a programmable controller (50) and use of wired transmission or wireless transmission of signals, such as Wi Fi, a plurality of inventive devices could be installed in a building and connected through a computer communications network. In this manner, efficient use of the inventive devices not only in terms of lighting consumption but also usage of the other features of the inventive devices could be managed. For example all the features of the inventive devices in the lobby could be turned on to the maximum if the lobby is packed during peak hours and some features

of the inventive device could be turned off during non-peak hours, all these by managing each inventive device through issue of instructions to various components of the inventive device, through keying of instructions through a display console in a Personal Computer in a control room.

The above examples show how the modular frame and flexi-add-on nature of the inventive device can be operated that may also ensure the invention remains relevant and useful for a long time.

CLAIMS

What is claimed is:

- 1 A healthcare cum optimal illumination device comprising:
at least one frame (12);
at least one non-incandescent light source (26) disposed in a cavity of the frame (12), the light source (26) emitting infra-red radiation, visible light radiation, and ultra-violet radiation, said visible light radiation is used for illumination, while the said invisible infra-red radiation and the ultra-violet radiation are harnessed to improve indoor air quality; and
at least one layer of fabric filter cover (24), treated with substances of air cleaning properties and enclosing the frame (12), the treated filter cover (24) with an opening at the top where air in the frame (12) heated by the infra-red radiation flows out from the device and cooler ambient air surrounding the device is drawn through the enclosed filter cover (24) into the cavity of the frame (12) replacing the heated air that has flown out of the inventive device to form air circulation by convection means and to perform air filtration.
- 2 The healthcare cum optimal illumination device according to claim 1, wherein the filter cover (24) has one layer coated with anti-microbial agents, one layer treated with zinc oxide, copper oxide, or calcium hydroxide, one layer coated with activated carbon or zeolite, one layer coated with nano photo-catalyst, or the combination thereof to capture and remove air pollutants at surfaces of the filter cover (24).
- 3 The healthcare cum optimal illumination device according to claim 1 and claim 2 wherein different filter materials are used to make fibres of different thickness, length, and other chemical and physical properties and further make into fabric filters with different textures and finishing treatments according to customers' requirements.
- 4 The healthcare cum optimal illumination device according to claim 1 and claim 2 wherein the outer layer of filter cover (24) can be further printed with pictures, words, drawings, designs and can be used as healthcare light boxes for advertisements, displays, signage, notices, messages, learning and teaching visual aids and others.
- 5 The healthcare cum optimal illumination device according to claim 1, further comprising a chassis (20) disposed at the upper portion of the frame (12) with sockets / holders for disposing light sources (26), ionizers (46) and containers (42) for containing essential oils to improve indoor air quality outside the inventive device.
- 6 The healthcare cum optimal illumination device according to claim 5 wherein the ionizer (46) can be a plasma ionizer or an anion ionizer and the anion ionizer can be incorporated into the light source (26) as a fusion unit.

7 The inventive device according to claim 5 and claim 6 wherein the ionizers can increase the ions concentration in the enclosed indoor surrounding to appropriate level depending on requirements and it can also modify or rebalance the ratio of negative ions to positive ions in indoor air similar to that as existing in nature or any desirable ratio.

8 The inventive device according to claim 6 and claim 7 wherein each plasma ionizer can produce several millions of highly reactive positive ions and negative ions per c.c. per second like shower of electric charges that will collide and interact with the fine and ultrafine suspended particulates, including microbes. The opposite charges imparted by the positive ions and negative ions to the particulates will cause them to attract and agglomerate to form clusters. The larger and heavier cluster will precipitate from the air by gravity. When hit intensively and repeatedly by the highly reactive positive ions and negative ions, virus and bacteria in the air and on surfaces in the surrounding can be injured and even be killed. This electronic sterilisation/disinfection is helpful and good for our immune system and our health.

9 The healthcare cum optimal illumination device according to claim 5 further comprising at least one container (42) containing anti-microbial and fragrant essential oil disposed at the chassis 20. It will evaporate and diffuse by heat from the light source to disinfect and refresh indoor air outside the inventive device by bio-chemical means.

10 The healthcare cum optimal illumination device according to claim 1 further comprising a base plate (22) disposing between two frames (12) so that the base plate enables the inventive device to be connectable, scalable and facilitating flexi-add-on and multifunction capabilities. Base plate (22) has a cavity/opening in the centre and a plurality of connection points (23) and slots (40) spaced apart around the plate.

11 The healthcare cum optional illumination device according to claim 1 and claim 10 wherein two or more modular frame (12) can be joined together by the base plate (22) to form the inventive device in larger sizes and of different shapes and configurations.

12 The healthcare cum optimal illumination device according to claim 1 and claim 10 wherein the frames (12) is in taper / slant shape or cut-in-half sections so that they can be stacked on each other for the reduction of storage space, packaging, transport and other costs reduction and they can be connected for various configurations.

13 The healthcare cum optimal illumination device according to claim 10 further comprising an electric fan (44) disposed at the opening / cavity of the base plate (22) to enhance air circulation and air filtration by mechanical means. It creates a centrifugal vortex air flow in the cavity of the inventive device for effective air cleaning.

14 The healthcare cum optimal illumination device according to claim 10 further comprising an audio system (52) with MP3/MP4 player, speakers, microphone, earplug, etc., are disposed at one or more slot (40) of the base plate (22) enabling the installation of software for music, singing, dancing, exercise, meditation, yoga, inspiration messages, narration, poetry, lullaby and other recordings to induce relaxation, stress release, rest, sleep and other activities that contribute to the health and well-being of the users.

15 The healthcare cum optimal illumination device according to claim 10 further comprising a programmable controller (50) disposed at one of the slot (40) at the base plate (22) wherein the programmable controller (50) is connected and programmed to control the operation of the various multi-functions of the inventive device including the on-off device, light sources, ionizers, fans, audio system, timer, dimmer and other devices.

16 The healthcare cum optimal illumination device according to claim 1, further comprising a safety mesh (28) disposed at the top of the inventive device.

17 The healthcare cum optimal illumination device according to claim 1 further comprising one or more layers of fabric filter cover (24) enclosing the frame (12), except the top for air outflow, thereby enhancing the safety of the inventive device by restricting access into it. The filter covers also help to reduce the likelihood of breaking of the light bulbs in the inventive device in the event of accident.

18 The healthcare cum optimal illumination device according to claim 10 and claim 13, further comprising a photo-catalytic air cleaner (PAC) which includes an ultra-violet light source (30) disposed in the cavity of the frame (12) which is joined to the base plate (22) fitted with a fan (44) and is located at the top of the frame (22) which is enclosed by two or more layers of filter covers treated with nano photo-catalysts. When the inventive device is switched on, the electric fan (22) and the heat from the light source (30) will draw the ambient air into the cavity of the PAC through the enclosed filter covers and flow out the PAC through the fan (22). Air pollutants will be captured by the filter covers treated with photo-catalyst and will be decomposed by strong redox reactions when radiated by the UV light source (30). Those air pollutants that cannot be decomposed by photo-catalysis will be removed by taking off the dirty filter covers for washing with soapy water. After drying, the clean filter covers can be re-used.

19 The healthcare cum optimal illumination device according to claim 1, wherein the light source (26) includes several different kinds non-incandescent light sources capable of emitting light of different colours and brightness such as fluorescent lighting, LED lighting, HID lighting, UV lighting and others.

20 The healthcare cum optimal illumination device according to claim 1 and

claim 19 thus makes optimal / full utilization of all radiation emitted by the light source(s) by harnessing the unused invisible IR and UV radiation for air cleaning / detoxification to improve air quality for healthy living.