

AIR IONIZER

FIELD OF INVENTION

The invention relates generally to devices for the generation of negative ions and ozone for indoor air applications. More specifically, the invention concerns an air ionizer to distribute negative ions and/or ozone to the surroundings.

BACKGROUND OF THE INVENTION

Over the last few decades air ionization devices are becoming more widely used to clean and improve indoor air in addition to other types of cleaning devices such as air filter purifiers. In general, all ionizers are designed to generate negative ions and the ion modules are built in the devices for specific applications only. These devices lack the capability and flexibility to perform different functions, such as the selective generation of ions, ozone, or a combination of ions and ozone.

Negative ions are generated by the application of a high AC voltage to an ionizer electrode assembly. An example of ionizer electrode assemblies, having novel electrode structures for enhancing ion generation, is disclosed in the applicant's international patent application WO 2010/074564 A1, the content of which is hereby incorporated by reference. The inner electrode, dielectric barrier(s) and at least one outer electrode are suitably encased within a modular casing with integrated contact elements to allow connection of a drive circuit for applying a control voltage to the electrodes. Using inner and outer electrodes of different materials for example, and/or adjusting their relative dimensions, provides the flexibility to vary and control the output of ions and ozone depending on application. The present invention, however, is not confined in its applicability to any particular form of electrode arrangement, provided there are at least two electrodes that are separated by a dielectric material.

US patent no. 6,137,670 discloses a system and method for cleaning and/or replacing emitter points of a pin-type electrical ionizer. The electrical ionizer has a replaceable electrical ionizer cartridge including a support platter having a central air passage opening therethrough and at least two emitter points or pins supported by the support platter so as to extend into the opening. At least one electrical connector is supported by the support platter and is electrically connected to at least one of the emitter points. The electrical contact members define the positive and negative contact members, which are driven by DC voltage. When the emitter points become dirty or contaminated, the cartridge which includes the dirty emitter points secured to a support platter is removed as a unit from the electrical ionizer housing. The cartridge is then moved to a desired location, the points cleaned and the cartridge reinserted into the housing. Installation of the cartridge (either the original cartridge with clean emitter points or new cartridge) requires time due to its complexity of the components.

There is an unfulfilled need for an ionizer to be able to cater to the needs of different users and environments, which is able to perform multiple functions, with greater standardization of hardware to simplify and reduce the cost of manufacture. The present invention was developed in consideration of this need.

SUMMARY OF THE INVENTION

In a first aspect, the invention provides an air ionizer to distribute negative ions and/or ozone to the surroundings, comprising:

a casing;

an electrode module comprising inner and outer planar electrodes that sandwich a dielectric barrier; and

a module holder adapted to receive and retain said electrode module within the casing in a replaceable/interchangeable manner;

wherein the electrode module is insertable into the holder so as to connect the module to a source of AC high voltage for the generation of negative ions and/or ozone.

The invention provides a solution for an ionizer to perform multiple functions by using different type of configuration of electrode modules to suit the needs of the user or environment in which the ionizer is used. The replaceability and interchangeability of the electrode module provides an advantage where one ionizer can cater to all different needs easily controlled by the user. The air ionizer provides a holder to receive the electrode module. The compartment inside the holder is configured with clearance to receive the electrode module. The electrode module is easily insertable, for example slidable into the holder and a module cover may be used to retain the electrode module in the holder. The holder allows the electrode module to be connected to a source of AC high voltage for the generation of negative ions and/or ozone.

In an embodiment, a control unit supplies DC voltage to a high voltage module. The high voltage module supplies AC voltage to the electrode module. The control unit controls the level of generation of negative ions and/or ozone by controlling the supply of power to the high voltage module.

In another embodiment, the ionizer has two module holders where each module receives a respective electrode module. Two electrode modules may be connected to a common high voltage module by inserting the electrode modules into respective module holders. The two module holders may be on either side of the high voltage module.

In another embodiment, the ionizer has four module holders where each module holder receives a respective electrode module. The ionizer has two high voltage modules. A set of two electrode modules may be connected to each common high voltage module by sliding the electrode modules into respective module holders. The two module holders may be on either side of the high voltage module.

Multiple electrode modules, i.e. not necessarily only two modules, may be connected to a common high voltage module, if desired. Alternatively, for multiple electrode modules, one module holder may be connected to one high voltage module, if desired.

The electrode module generally comprises an inner electrode, an outer electrode and a dielectric barrier sandwiched between the inner electrode and the outer electrode. The inner electrode has a continuous (i.e. non-apertured) overall surface and the outer electrode provides a plurality of ion generating points for generation of negative ions and/or ozone. With the application of high AC voltage to the module, it allows the generation of negative ions and controlling of the generation of ozone. Using different types of electrode modules controls the multiple functions of the ionizer. There may be several different types of electrode modules, which are able to generate negative ions, ozone or combination of both. Suitably, there can be three types of electrode for generating negative ions, ozone and combination of negative ions and ozone. The needs of the user can be met by installing or changing different interchangeable electrode modules into the ionizer to obtain the desired effect.

The type of electrode module may be identified by electrical or mechanical interaction with the ionizer.

In one embodiment, the control unit may function to detect the type of electrode module by detecting the level of power consumption of the electrode module. Different types of electrode modules have different power usage requirements. The control unit is arranged to supply a range of high voltage, determined by the user, to the electrode module.

Alternatively, the control unit may detect the type of electrode module by sensing and detecting an identification code on the electrode module. The identification code may be stored in a memory chip, mounted on the electrode module. This identification code specifies the specific function of the electrode module. Alternatively, the identification code is a bar code or other optically detectable code which specifies the specific type and function of the electrode module. This bar code is located on the electrode module which allows the control unit to detect type of the electrode module through an optical sensor or scanner.

The control unit may shut down voltage supply to an electrode module upon detecting that it requires a voltage higher than the range of supply of high voltage by the control unit.

Alternatively, the type of electrode is identified by the module holder being adapted to receive a specific type of electrode module as determined by the user. The compartments in the module holder are structurally adapted to selectively receive specific type of electrode module to prevent wrong type of electrode module from being fully inserted into the module holder. For this purpose, the electrode module and/or module holder may comprise structural elements that cooperate to determine whether or not a particular type of module may be fully inserted (and thereby connected) to a particular holder. An example of such elements are a pin and a receiving hole for the pin, each provided on one or other of the module and holder.

In another aspect, the present invention provides an electrode module for use in an air ionizer, the module comprising:

- an inner electrode with a connection terminal;
- an outer electrode with a connection terminal; and
- a dielectric barrier sandwiched between the inner electrode and the outer electrode;

wherein the electrode module comprises a stored identification code which contains information of the type of electrode module.

In an embodiment, the electrode module comprises a memory chip in which the identification code is stored.

In a further aspect, the present invention provides an air ionizer to distribute negative ions and/or ozone to the surroundings, comprising:

- a casing;

- a module holder adapted to receive and retain an electrode module within the casing in a replaceable/interchangeable manner;

- wherein the holder receives the electrode module so as to connect the module to a source of AC high voltage for the generation of negative ions and/or ozone;

- wherein the electrode module is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone; and

- wherein the type of module is identifiable by interaction between the module and the ionizer.

The components in the ionizer are encased within a casing. The casing may be enclosed by a top cover having apertures for the release of ions/ozone.

The air ionizer may also include a fan that is located so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. A timer controls the rate or duration for which air circulates through the casing.

The ionizer has the ability to perform multiple functions in accordance to the needs of the user. The electrode modules used in the ionizer can be readily removed and replaced with an electrode module which performs different functions or a new electrode module to replace the old module. The lifetime of the electrode module may be monitored, and the user alerted when replacement is needed.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more clearly understood from the following description of the embodiments thereof, when taken in conjunction with the accompanying drawings. However, the embodiments and the drawings are given only for the purpose of illustration and explanation, and are not to be taken as limiting the scope of the present invention, the scope of which is to be determined by the appended claims.

In the accompanying drawings, like reference numerals are used to denote like parts throughout the several views. The features of the described embodiments are generic to all embodiments unless specifically stated otherwise or required by the context.

Fig. 1 is a perspective view of the construction of an ionizer of a first embodiment;

Fig. 2 shows a perspective view of the ionizer of Fig. 1 in its assembled state;

Fig. 3 is a perspective view of the construction of an ionizer of a second embodiment; and

Fig. 4 is a perspective view of the construction of an ionizer of a third embodiment;

Fig. 5 is a perspective view of a construction of an electrode module;

Fig. 6 is a perspective view of a construction of a different embodiment of an electrode module;

Fig. 7 is a perspective view of an electrode module with an identification code;

Fig. 8 is a perspective view of a holder configured to receive two types of electrode modules;

Fig. 9 is a perspective of another embodiment with a different holder; and

Fig. 10 is a perspective of another embodiment with a different holder; and

Fig. 11 is a schematic block diagram of an air ionizer.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figures 1 and 2 illustrate, in perspective view, the first embodiment of an ionizer 10 with the components of an electrode module 11, a module holder 12, a high voltage module 13, a control unit 14, a power supply unit 15, and a connector 16 which are encased in a casing 17.

The rectangular casing 17 serves as a housing in which all the components are mounted or supported. The components on the casing 17 are enclosed by a rectangular cover 18 which has a vented opening 18a. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the casing 17. This connector 16 connects the ionizer 10 to an AC voltage power supply through a wall mounting bracket (as shown in Figure 3).

The AC voltage power supply is directed to the power supply unit 15. The power supply unit 15 converts the AC voltage to a DC voltage. The control unit 14 receives the DC voltage from the power supply unit 15 and supplies power to the high voltage module 13. The high voltage module 13 converts the DC voltage to AC voltage to supply power to the electrode module 11.

An electrode module 11 comprises an inner electrode, an outer electrode and a solid dielectric barrier sandwiched between the inner and outer electrode. The electrode module 11 is used to generate negative ions. The electrode module 11 has two terminals 11a at one side edge of the module 11. Each of the two ends of the electrode module 11 has one notch 11b. The module holder 12 is mounted to the casing 17. The module holder 12 has two terminals 12a which are connected to the high voltage module 13. The terminals 11a of the module 11 are connected to the high voltage module 13 automatically once the module 11 is installed in the holder 12. One end (as shown in Figure 5) of the inner electrode has an extended portion in the shape of a spring plate extension to be fitted to a modular casing of the module 11. Similarly, one end (as shown in Figure 5) of the outer electrode is made in the shape of a spring plate extension. The compartment inside the module holder 12 is configured with clearance to

receive the electrode module 11. The electrode module 11 is slidable into the module holder 12 for the terminals 11a of the module 11 to make electrical contact with the terminals 12a of the module holder 12. The module 11 is retained inside the holder 12 by a module cover 19 which is fastened to the holder 11 with a screw.

The high voltage module 13 supplies AC high voltage to the electrode module 11. Negative ions and/or ozone are released when the electrode module 11 receives high voltage. A fan 26 is located next to the electrode module 11 and module holder 12 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the vented opening 18a of the cover 18 to the atmosphere. The outlet 18a is located directly over the module holder 12 inside the casing 17.

The control unit 14 controls the level of generation of negative ions and/or ozone by controlling the high voltage module 13. The control unit 14 has a timer to control the ON/OFF setting of the high voltage module 13. The level of generation of negative ions and/or ozone can be controlled by the control unit 14 in the order of three settings of low, medium and high.

Alternatively, in another embodiment, in the module holder 12, there is a locking mechanism which fits the two notches 11b on the electrode module 11 to further secure the module 11 in the holder 12. The electrode module 11 may be released from the module holder 12 by pushing the module 11 to release the notches 11b on the module 11 from the locking mechanism.

Figure 2 shows a perspective view of the air ionizer 10 of Fig. 1 in its assembled state. An on-off switch for the ionizer 10 is located on the exterior of the cover 18.

Figure 3 illustrates, in a perspective view, a second embodiment of an ionizer 30 with the components of two electrode modules 31, two module holders 32, a high voltage module 33, a control unit 34, a power supply unit 35, and a connector 16 which are encased in a casing 37.

The rectangular casing 37 serves as a housing in which all the components are mounted. The components are enclosed by a rectangular top cover 38 which has two vented openings 38a. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the casing 37. The plug 16 connects the ionizer 30 to an AC voltage power supply through a wall mounting bracket 20.

In this embodiment, two electrode modules 31 are used. One electrode module 31 is used to generate either only negative ions or combination of both negative ions and ozone. Another electrode module 31 is used to generate only ozone. Each electrode module 31 has two terminals 31a at one side edge of the module 31. Each of the two ends of the electrode module 31 has one notch 31b. Two module holders 32 are mounted to the casing 37. Each module holder 32 has two terminals 32a which are connected to a common high voltage module 33.

Each electrode module 31 is slidable into a respective module holder 32 for the terminals 31a of the module 31 to make electrical contact with the terminals 32a of the module holders 32. Each module 31 is retained inside the respective holders 32 by a respective module cover 39 which is fastened to the respective holder 32 with a screw.

A common high voltage module 33 supplies AC voltage to both electrode modules 31. The control unit 34 controls the supply of power to the high voltage module 33 to supply AC voltages to the electrode modules 31. The supply of AC voltages is dependent on the type of electrode module 31. The voltages supplied to the modules 31 through the respective module holders 32 may be the same for each module holder 32 or different, according to the types of module 31 that are intended to be installed.

Each electrode module 31 and module holder 32 are located to either side of the high voltage module 33. Negative ions and/or ozone are released when the electrode modules 31 receive high voltage. Two sets of fan 36 are located next to each two sets of electrode module 31 and module holder 32 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the vented openings 38a of the top cover 38 to the atmosphere. Two

sets of vented openings 38a are each located directly over the respective module holders 32 inside the casing 37.

Alternatively, a separate high voltage module 33 may be used to supply AC high voltage to each of the two electrode modules 31.

The control unit 34 has a timer to control the ON/OFF setting of the high voltage module 33. The level of generation of negative ions and/or ozone can be controlled by the control unit 34 in the order of three settings of low, medium and high.

The module cover 39 is removed to enable the old electrode module 31 to be slid out of the module holder 32 to be replaced with a new electrode module 31 or different type of electrode module 31.

Alternatively, in another embodiment, in each module holder 32, there is a locking mechanism which fits the two notches 31b on the electrode module 31 to further secure the module 31 in the holder 32. The electrode module 31 may be released from the module holder 32 by pushing the module 31 to release the notches 31b on the module 31 from the locking mechanism.

Figure 4 illustrates, in a perspective view, a third embodiment of an ionizer 40 with the components of two sets of two electrode modules 41, two module holders 42, and high voltage module 43 are controlled by a control unit 44, a power supply unit 45, and a connector 16 which are encased in a casing 47.

The rectangular casing 47 serves as a housing in which all the components are mounted. The components are enclosed by a rectangular top cover 48 which has four vented openings 48a. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the casing 47. The plug 16 connects the ionizer 40 to an AC voltage power supply through a wall mounting bracket 20.

In this embodiment, a set of two electrode modules 41 and two module holders 42 are connected to either side of a common high voltage module 43. Each electrode module 41 has two terminals 41a at one side edge of the module 41. Each of the two sides of the module 41 has one notch 41b. Each module holder 42 has two terminals 42a which are connected to a common high voltage module 43. Negative ions and/or ozone are released when the electrode modules 41 receive high voltages. Four sets of fan 46 are located next to each four sets of electrode module 41 and module holder 42 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the four vented openings 48a of the top cover 48 to the atmosphere. The four outlets 48a are each located directly over the respective module holders 42 inside the casing 47.

Alternatively, a separate high voltage module 43 may be used to supply AC high voltage to each of the four electrode modules 41.

The control unit 44 has a timer to control the ON/OFF setting of the two high voltage module 43. The level of generation of negative ions and/or ozone can be controlled by the control unit 44 in the order of three settings of low, medium and high. A high level of generation of negative ions and/or ozone requires the control unit 44 to control the two high voltage modules 43 to supply different AC voltages to the two sets of two electrode modules 41. The voltages supplied to the modules 41 through the respective module holders 42 may be the same for each module holder 42 or different, according to the types of module 41 that are intended to be installed.

Alternatively, in another embodiment, in each module holder 42, there is a locking mechanism which fits the two notches 41b on the electrode module 41 to further secure the module 41 in the holder 42. The electrode module 41 may be released from the module holder 42 by pushing the module 41 to release the notches 41b on the module 41 from the locking mechanism.

Figure 5 illustrates, in an exploded perspective view, an embodiment of the electrode module which may be used for all embodiments described herein. The electrode module comprises a planar configuration with the components of an inner electrode 51, an outer electrode 52 and a dielectric barrier 53 arranged in parallel which are encased in a modular frame-like casing 54, 55.

The inner electrode 51 has a continuous overall surface and the outer electrode 52 provides a plurality of ion generating points for generation of negative ions and/or ozone. One end of the inner electrode 51 has an extended portion in the shape of a spring plate extension to be fitted to the modular casing 54, 55. Similarly, one end of the outer electrode 52 is made in the shape of a spring plate extension.

The modular casing 54, 55 of a rectangular shape that includes two covers 54, 55 is used to encase the components of the electrode module. Two opposing ends of the modular casing 54, 55 have notches 54a. The notches on the casing 54, 55 of the electrode module allow the electrode module to be locked and released in and from the holder of the air ionizer. The compartments inside the covers 54, 55 are configured with clearance to receive the electrode module components that are dielectric barrier 53, outer electrode 52 and inner electrode 51. The dielectric barrier 53 in this example is made of two dielectric plates is designed to be a relatively snug fit within frames defined by the inner structure of the covers 54, 55. On the other hand, the electrodes 51, 52 are undersized relative to the two dielectric plates 53. The electrodes 51, 52 are located centrally of the two dielectric plates 53.

The outer electrode 52 may have a plurality of apertures configured for example in the stars configuration, honeycomb configuration, sun-shaped configuration either in planar or in the form of 3-dimensional structures.

The cover 54 has a window-like opening 56 to expose the ion generating holes of the outer electrode 52. Screws 58 are used to secure the two covers 54, 55 of the casing to form an enclosure. Obviously, other means such as a snap-lock fit may be used to secure the casing covers 54, 55 together. In the case of the 3-dimensional star structure

for the outer electrode 52 as represented in Figure 5, slits are first formed as a set of radial cuts of a circle. The 3-dimensional star structures are then formed by punching through the slits whereby the pointed edges of the star formed by sectors of the circle are protruded from the surface at an inclined angle. The pointed edges protrude outside of the surface area of the outer electrode 52 that faces the window 56 of the modular casing 54, 55.

The electrode module for all the embodiments described herein is inserted into the module holder in the direction where the window-like opening 56 which exposes the outer electrode 52 facing upward or outward of the modular casing 54, 55 for the release of negative ions and/or ozone through the outlets of the casing of the ionizer.

There may be several different types of electrode modules, which are able to generate negative ions, ozone or combination of both. Suitably, there can be three types of electrode for generating primarily negative ions, primarily ozone and combination of negative ions and ozone.

Figure 6 illustrates, in an exploded perspective view, an electrode module using a different outer electrode which has a 3-dimensional claw structure. This outer electrode arrangement is used to form an electrode module that generates a combination of negative ions and ozone.

The ionizer may identify the type of electrode module through electrical interaction. In all the embodiments described herein, the control unit may also be used to detect the type of electrode module by detecting the level of power consumption of the electrode module once it is installed in the module holder. Different types of electrode module have different power usage requirements. The control unit may control the supply of power to the high voltage module to supply different AC voltages to one or more types of electrode module as determined by the user. For ionizer which has more than one module holder, the control unit supplies different power to different outputs of module holders which receives the different types of electrode modules. For example, the electrode module that generates only negative ions may require power of 1.5 W. The

electrode module that generates a combination of negative ions and ozone may require power of 2.0 W. The electrode module that generates ozone may require power of 5.0 W.

In a module holder which is configured to receive an electrode module that generates primarily negative ions, the control unit is configured to supply power of up to 1.5 W. For this module holder, the control unit is unable to supply sufficient power to different types of electrode module which require power of more than 1.5 W. The control unit shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder.

In another module holder which is configured to receive either an electrode module that generates either negative ions or a combination of negative ions and ozone, the control unit is configured to supply power of up to 2.0 W. For this module holder, the control unit may supply power of up to 2.0 W to either one type of the electrode module, once it is inserted into the module holder. The control unit is unable to supply sufficient power to different types of electrode module which require power of more than 2.0 W. The control unit shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder.

In another module holder which is configured to receive an electrode module that generates primarily ozone, the control unit is configured to supply power of up to 5.0 W. For this module holder, the control unit may supply power of up to 5.0 W to the electrode module that generates ozone. However, the control unit may also provide sufficient power to different types of electrode module that requires power less than 5.0 W.

Alternatively to the electrode module in relation to Figures 5 and 6, Figure 7 illustrates an electrode module having a memory chip 59 on the surface of the modular casing, where a terminal of the memory chip 59 is in parallel to the terminals of the electrodes 51', 52'. A stored identification code in the memory chip 59 specifies the type of module. As an alternative to the power detection option, the control unit may instead detect the type of electrode module by sensing and detecting the memory chip 59 once

the module is installed into the module holder, memory chip 59 is then connected to the control unit through the terminals of the memory chip 59. The control unit may detect the type of module through reading the memory chip 59.

As an alternative to the electrical detection of the type of electrode module, the ionizer may identify the type of electrode module through mechanical interaction. For this purpose, the module holder in all the embodiments described herein may be adapted to receive a specific type of electrode module as determined by the user. The module holder has one or more matching holes to receive a module pin of an electrode module. The position of the matching hole on the holder allows a specific electrode module as determined by the user, to be installed into the holder. A wrong type of electrode module is structurally prevented from being fully inserted into the module holder and so cannot become electrically connected to the control unit in the ionizer. Alternatively, the holder may instead be provided with a module pin to be inserted into the matching hole on the surface of the electrode module.

Figure 8 illustrates, in a perspective view of a module holder 82 configured to only receive two types of electrode module 81 that generates either negative ions or a combination of negative ions and ozone. The holder 82 is adapted with a module hole 82a at the bottom edge of the holder 82. The electrode module 81 has a module pin 81a on the modular casing, where module pin 81a is in parallel to the terminals of the electrodes 81', 82'. The relative position of the module pin 81a corresponds to the position of the module hole 82a formed in the holder 82.

Figure 9 illustrates, in a perspective view of another embodiment of a holder 92 configured to receive only an ozone electrode module 91 which generates only ozone. The holder 92 is adapted with a module hole 92a at the top edge of the holder 92. The electrode module 91 has a module pin 91a on the right surface of the modular casing, where module pin 91a is in parallel to the terminals of the electrodes 91', 92'. The relative position of the module pin 91a corresponds to the position of the module hole 92a formed in the holder 92.

Figure 10 illustrates, in a perspective view of another embodiment of a holder 102 configured to receive all three types of electrode module 101. The holder 102 is adapted with two module holes 102a at the top and bottom edges of the holder 102 to receive the three different types of electrode modules 101 which has a different location of its module pin 101a.

Figure 11 illustrates a schematic block diagram of an air ionizer using power detection to detect the type of electrode module. The high AC voltage power supply is directed to the power supply unit 15. The power supply unit 15 converts the AC voltage to a DC voltage. The control unit 14 receives the DC voltage from the power supply unit 15. The control unit 14 is connected to the high voltage module 13. The high voltage module 13 converts the DC voltage to AC high voltage to supply power to the electrode module 11. In the control unit 14, a main control panel 14a controls the ON/STANDBY setting. The main control panel 14a is connected to a power detection unit 14b, an ion/ozone control unit 14c and fan control unit 14d. The level of generation of negative ions and/or ozone may be controlled by the ion/ozone control unit in the order of three settings of low, medium and high. The power detection unit 14b detects the level of power consumption to determine the type of electrode module. The control unit shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder. The main control panel 14a is also connected to a fan control unit 14d which controls the ON/OFF setting of the fan 26.

The embodiments in accordance with the invention can use different types of electrode modules to suit the application of the user. Using inner and outer electrodes of, for example, different configurations, materials, and/or adjusting their relative dimensions, provides the flexibility to vary and control the output of ions and ozone depending on the application. The ionizer provides a flexibility to use different electrode modules interchangeably in accordance with different needs.

The invention may also be embodied in many ways other than those specifically described herein, without departing from the scope thereof.

AMENDED CLAIMS

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1. An air ionizer (10) to distribute negative ions and/or ozone to the surroundings, comprising:

a casing (17);

an electrode module (11); and

a module holder (12) adapted to receive and retain said electrode module within the casing in a replaceable/interchangeable manner;

wherein the electrode module is insertable into the module holder so as to connect the electrode module to a source of AC high voltage for the generation of negative ions and/or ozone;

wherein the electrode module (11) is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone, and

wherein the type of electrode module is identifiable by interaction between the electrode module and the ionizer.

2. An air ionizer (10) according to Claim 1, further comprising a control unit (14);

wherein the control unit is adapted to detect the type of electrode module (11) by detecting the power consumption of the electrode module.

3. An air ionizer (10) according to Claim 1, further comprising a control unit (14);

wherein the control unit is adapted to detect the type of electrode module (11) by detecting an identification code of the electrode module.

4. An air ionizer (10) according to Claim 3, wherein the identification code is stored in a memory chip mounted on the electrode module.

5. An air ionizer according to any of Claims 2 to 4, wherein the control unit (14) is adapted to shut down the supply of voltage to the electrode module (11) upon detecting that the type of electrode module is not suitable for use with the ionizer.

6. An air ionizer (10) according to any of the preceding claims, wherein the type of module is identifiable by physical interaction between the electrode module (11) and the ionizer.

7. An air ionizer (10) according to Claim 6, wherein the module holder (12) is adapted to selectively receive at least one type of electrode module (11).

8. An air ionizer (10) according to Claim 6 or 7, wherein the module holder (12) is adapted to block at least one type of electrode module (11) which is not suitable for use with the ionizer from being fully inserted into the holder.

9. An air ionizer (10) according to any of Claims 6 to 8, wherein the electrode module (11) comprises a modular casing;

wherein the structure of the modular casing defines the type of electrode module.

10. An air ionizer (30; 40) according to any of the preceding claims, wherein the ionizer comprises a plurality of said module holders (32; 42) each for receiving a respective said electrode module (31; 41).

11. An air ionizer (10; 30; 40) according to any of the preceding claims, wherein the electrode module (11; 31; 41) comprises terminals for making electrical contact with corresponding terminals (11a; 31a; 41a) in the holder (12; 32; 42) when the module is mounted in the holder.

12. An air ionizer (10; 30; 40) according to any of the preceding claims, wherein the ionizer comprises a module cover (19; 39; 49) fastenable to the casing (17; 37; 47) to secure and retain the electrode module (11; 31; 41) in the module holder (12; 32; 42).

13. An electrode module (11; 31; 41) for use in an air ionizer (10; 30; 40) according to Claim 3 or any claim dependent on Claim 3, the module comprising:

an inner electrode (51) with a connection terminal (51'); and

an outer electrode (52) with a connection terminal (52'); and

a dielectric barrier (53) sandwiched between the inner electrode and the outer electrode;

wherein the electrode module comprises a stored identification code which contains information of the type of electrode module.

14. An electrode module (11; 31; 41) according to Claim 13, comprising a memory chip (59) in which said identification code is stored.

15. An air ionizer (10; 30; 40) to distribute negative ions and/or ozone to the surroundings, comprising:

a casing (17; 37; 47);

a module holder (12; 32; 42) adapted to receive and retain an electrode module (11; 31; 41) within the casing in a replaceable/interchangeable manner;

wherein the module holder receives the electrode module so as to connect the electrode module to a source of AC high voltage for the generation of negative ions and/or ozone;

wherein the electrode module is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone; and

wherein the type of electrode module is identifiable by interaction between the electrode module and the ionizer.