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SPECIFICATION



159159

HANDY TYPE IONIZER



G00002

5 [Technical Field]

The present invention relates to a handy type ionizer for locally ejecting any one of positive ions and negative ions or both, generated by corona discharge.

10 [Background Art]

Conventional handy type ionizers are either a pen-type or gun-type ionizer using a corona discharge method, and can be largely divided into a DC ionizer that uses a high DC voltage as a high voltage to be applied to a needle discharge electrode, and an AC ionizer that uses a high AC voltage.

15 The DC ionizer applies the high voltage to the needle discharge electrode to generate positive ions or negative ions from air, and ejects the positive ions or negative ions to a charged object to be discharged to discharge.

The AC ionizer applies the high AC voltage to the discharge electrode
20 to alternately generate positive ions and negative ions from the air (hereinafter, simply ions when the positive ions and negative ions are generically called), and ejects those ions to the charged object to be discharged to discharge.

For example, Japanese Patent Application Laid-Open No.
2000-311797 and Japanese Patent Application Laid-Open No. 2000-311797
25 disclose conventional techniques of such a handy type ionizer.

A gun-type ionizer is disclosed in all these patent documents.

In the handy type ionizer, there has been a demand to reliably eject the generated ions to the outside by allowing the air to flow around the needle electrode. However, both a structure for supporting the needle electrode and an air ejecting structure have a large mechanical configuration, and it is difficult to realize a configuration in which the air flows around the needle electrode.

For example, as shown in Fig. 8 of Japanese Patent Application Laid-Open No. 2000-311797, the structure for supporting the needle electrode and the air ejecting structure are installed at positions away from each other, so that the generated ions are sprayed upward from a lower side by the air and then ejected to a nozzle. Further, as shown in Fig. 1 of Japanese Patent Application Laid-Open No. 2003-24830, the generated ions are attracted downward by a venturi effect, and then ejected to the nozzle.

However, in the configuration of Japanese Patent Application Laid-Open No. 2000-311797, a nozzle hole is arranged at a point of the needle electrode in an axial direction, and the air is ejected to a wall above the nozzle in a direction approximately at a right angle to the axial direction of the needle electrode. It is predicted that most of the generated ions are sprayed to a counter electrode (opposed electrode) on the wall of the nozzle and absorbed, thereby deteriorating the performance.

In the configuration of Japanese Patent Application Laid-Open No. 2003-24830, because the axial direction of the needle electrode and the air ejecting direction are substantially parallel to each other, a configuration in which the air is attracted by the venturi effect is adopted. In this case, there is a possibility that a part of the ions is ejected to the axial direction of the needle

electrode and adhered to a side wall thereof, thereby making it difficult to reliably eject the whole ions.

Thus, in the handy type ionizer, because the ions cannot be ejected onto an air ejection passage, ions may be left in a body and cannot be
5 discharged efficiently.

Particularly, in the pen-type ionizer, miniaturization of a casing structure and a cover structure are demanded, and a structure that can eject the air efficiently while satisfying such a mechanical restriction is required.

The present invention has been achieved to solve the above problems,
10 and it is an object of the present invention to provide a handy type ionizer that efficiently ejects generated ions and realizes a compact structure.

[Disclosure of the Invention]

To solve the above problem, a handy type ionizer according to claim 1
15 comprises:

- a nozzle including a rotor provided with a hole at a point thereof;
- an ejector arranged in the nozzle for ejecting air into the nozzle;
- a needle discharge electrode arranged in the nozzle for generating
ions;

- 20 a power circuit connected to the discharge electrode;
- an air circuit connected to the ejector; and
- a body in which the power circuit and the air circuit are housed,

wherein

- the discharge electrode is arranged such that a central axis of the
25 discharge electrode and a central axis of the rotor in the nozzle are inclined

with an acute angle.

A handy type ionizer according to claim 2 provides the handy type ionizer according to claim 1, wherein the point of the discharge electrode is positioned near an ejection passage of the air ejected from the ejector.

5 A handy type ionizer according to claim 3 provides the handy type ionizer according to claim 2, wherein the nozzle is made of resin, a cylindrical counter electrode is provided outside of the nozzle, and the point of the discharge electrode is positioned near the counter electrode via the nozzle.

 A handy type ionizer according to claim 4 provides the handy type
10 ionizer according to any one of claims 1 to 3, wherein the power circuit comprises an inverter that inverts a DC voltage supplied from outside to an AC voltage, and a booster circuit that applies a high-voltage AC obtained by boosting the AC voltage to the discharge electrode.

 A handy type ionizer according to claim 5 provides the handy type
15 ionizer according to claim 4, comprising:

 an ion-generation-amount detecting circuit that outputs a detection signal proportional to a DC current flowing on an input side of the inverter; and

 a display unit that performs an output operation according to the detection signal.

20 According to the present invention, a handy type ionizer that can efficiently eject generated ions and realize a compact structure can be provided.

[Brief Description of the Drawings]

25 Fig. 1 is an outline view of a pen type ionizer.

Fig. 2 is an upper sectional view of a point of the pen type ionizer.

Fig. 3 is a cross-sectional view of the point of the pen type ionizer.

Fig. 4 is a block diagram of an electric circuit of the pen type ionizer.

Fig. 5 is a block diagram of an air circuit of the pen type ionizer.

5 Fig. 6 is an explanatory diagram of a movement of the pen type ionizer in a nozzle.

[Best Modes for Carrying Out the Invention]

Embodiments of the present invention will be explained below with
10 reference to the drawings. An AC pen-type ionizer as a handy type ionizer is specifically explained as an embodiment. Fig. 1 is an outline view of the pen type ionizer. Fig. 2 is an upper sectional view of a point of the pen type ionizer. Fig. 3 is a cross-sectional view of the point of the pen type ionizer. Fig. 4 is a block diagram of an electric circuit of the pen type ionizer. Fig. 5 is a block
15 diagram of an air circuit of the pen type ionizer.

A pen type ionizer 100 includes, as shown in Fig. 1, a body 101, a nozzle 102, a switch 103, a display unit 104, an air introducing unit 105, a tube 106, an electric wire 107, and a counter electrode 108.

The body 101 is formed in a bar shape long sideways. An electric
20 circuit and an air circuit are housed in the body 101. The electric circuit and the air circuit are explained later.

The nozzle 102 includes, as shown in Fig. 2, a triangular pyramid rotor, and a hole 102a for ejecting the air is formed at the point of the rotor. The nozzle 102 is made of resin. Teflon (registered trademark) is specifically
25 employed as the resin. The reason thereof is explained later.

The switch 103 is an ON/OFF button pressed when positive ions or negative ions (hereinafter, ions) are ejected.

The display unit 104 performs output corresponding to an ejection amount of ions. In the embodiment, the display unit 104 is an LED, which
5 displays whether the ions are ejected according to presence of lighting.

The air introducing unit 105 is a connector for connecting inside and outside air tubes.

One end of the tube 106 is connected to the air introducing unit 105, and the other end thereof is connected to an air blasting unit (not shown) in an
10 actuator body (not shown).

One end of the electric wire 107 is drawn into the body 101, and the other end thereof is connected to a power source of the actuator body (not shown).

The counter electrode 108 is a cylindrical electrode arranged outside
15 of the nozzle 102.

The inner configuration of the pen type ionizer 100 is explained next.

In the pen type ionizer 100, as shown in Figs. 2 and 3, a discharge electrode 109 and an ejector 110 are arranged in the nozzle 102.

The discharge electrode 109 is arranged in the nozzle 102 with a point
20 thereof having a needle shape and ejects the ions into the nozzle 102.

The ejector 110 is arranged in the nozzle 102 to eject the air into the nozzle 102.

In the nozzle 102, as shown in Fig. 2, a direction of central axis of the nozzle 102, an ejection direction of the ejector 110, and a direction of central
25 axis of the discharge electrode 109 agree with each other, as seen from above.

However, as shown in Fig. 3, the discharge electrode 109 and the ejector 110 have characteristic structures, as seen from the side. That is, the central axis of the discharge electrode 109 is inclined with an acute crossed axes angle α relative to the central axis of the rotor of the nozzle 102. In this case, the point of the discharge electrode 109 needs only to be positioned on the ejection passage of the air ejected from the ejector 110, and the crossed axes angle α is determined to satisfy this condition. Further, the point of the discharge electrode 109 is positioned near the cylindrical counter electrode 108 (preferably an inner area, which is inside a cylinder of the counter electrode 108) provided outside of the nozzle 102. At this time, when the counter electrode 108 directly faces the point of the discharge electrode 109, the discharge amount of the ions becomes too much, and hence, the resin nozzle 102 is put between the counter electrode 108 and the discharge electrode 109. Teflon (registered trademark) is employed as the resin that hardly causes deterioration even if the ions reach the nozzle 102, as explained above, thereby improving serviceable life.

A power circuit provided in the body 109 is explained next. The power circuit includes, as shown in Fig. 4, a booster circuit 111, an inverter 112, and an ion-generation-amount detecting circuit 113.

The switch 103 is connected to the air blasting unit and the power source of the actuator body via an ON/OFF selection line 107a of the electric wire 107.

The counter electrode 108 is also connected to the power source of the actuator body via a GND line 107b of the electric wire 107.

The discharge electrode 109 is electrically connected to the booster

circuit 111, and the inverter 112 is also connected to the power source of the actuator body via a DC power supply line 107c.

The air circuit provided in the body 109 is explained next. As shown in Fig. 5, the air circuit includes an air tube 114. One end of the air tube 114 is
5 connected to the ejector 110, and the other end thereof is connected to the air introducing unit 105. The air in the specification has a concept including clean air in which dust and dirt are removed by a filter, and a rare gas such as argon that can be used for removing electricity and dust, in addition to the atmospheric air.

10 Subsequently, an operation of the pen type ionizer 100 is explained.

When the switch 103 is pressed, the air blasting unit and the power source of the actuator body receive an ON signal, and the air blasting unit and the power source start to be driven. The air blasting unit blasts the air, and the power source supplies a DC voltage as a power source.

15 As shown in Fig. 5, the air reaches the ejector 110 via the tube 106, the air introducing unit 105, and the air tube 114. The ejector 110 ejects the air.

The DC voltage is applied to the ion-generation-amount detecting circuit 113. The ion-generation-amount detecting circuit 113 detects a part of
20 the DC voltage. Because a current flows at the time of discharging the ions, a detection signal proportional to the flowing DC current can be output. The detection signal output from the ion-generation-amount detecting circuit 113 is input to the display unit 104, and the display unit 104 displays that ions are generated. Because the LED is used for the display unit 104 in the
25 embodiment, the DC voltage can be directly supplied to the LED as the

detection signal. The LED lights up and it can be confirmed that the ions are generated.

The DC voltage is input to the inverter 112. The inverter 112 converts the DC voltage to an AC voltage and outputs the AC voltage to the
5 booster circuit 111.

The booster circuit 111 boosts the AC voltage to generate high-voltage AC, and applies the high-voltage AC to the discharge electrode 109. An electric field is formed by the high voltage between the counter electrode 108 having ground potential arranged via the nozzle 102 and the discharge
10 electrode 109, and positive ions and negative ions are alternately generated near one discharge electrode 109.

A movement in the nozzle 102 is described below.

As shown in Fig. 6, the positive ions and the negative ions are generated at the point of the discharge electrode 109. The point is located
15 near the ejection passage of the air from the ejector 110 (preferably, on the ejection passage). The air is ejected before the generated positive ions and negative ions are recombined and can be emitted far away from the hole 102a of the nozzle 102.

According to the embodiment, the positive ions and the negative ions
20 are alternately ejected from the hole 102a, and positive and negative static electricity charged on the surface of the object to be discharged is neutralized to effect discharge. Dust and dirt are easily removed by neutralizing positive and negative static electricity. Accordingly, the pen type ionizer can be also used for removing the dust.

25 According to the embodiment, because the positive ions and the

negative ions are present uniformly, inverse charging (the object to be discharged is charged to the polarity of the ions by intensively ejecting the ions of the same polarity to the same position) hardly occurs, even when the ions are generated near the object to be discharged.

5 Even when the positive and negative ions are reflected from the object to be discharged, because the discharge electrode 109 arranged outside of the nozzle 102 absorbs the ions, it can be prevented that the positive and negative ions adhere to the nozzle 102 to cause partial charging, which is desirable in view of safety.

10 Further, such a configuration is employed that a relatively low voltage (for example, DC 24V) is input from the power source of the actuator body via the DC power supply line 107c of the electric wire 107 and boosted to the high voltage by the power circuit in the body 101. Accordingly, such a risk is reduced that noise is generated, which affects the ON/OFF selection line 107a
15 and the GND line 107b near the DC power supply line 107c, or on the contrary, noise is superimposed on the DC power supply line 107c.

Because the DC power supply line 107c transmits a relatively low-voltage (for example, DC 24V) DC power signal, getting an electric shock can be avoided.

20 Further, because the discharge electrode 109 is inclined, the structure for supporting the needle electrode and the air ejecting structure can be juxtaposed, thereby contributing to miniaturization of the device.

In the embodiment explained above, the alternating current system has been explained. However, the system may be a positive DC system for
25 generating positive ions by applying the positive high voltage to the discharge

electrode 109 or a negative DC system for generating negative ions by applying the negative high voltage to the discharge electrode 109. In this case, the power circuit generates the positive high voltage.

While the pen type ionizer has been explained in the embodiment, the
5 handy type ionizer is not limited to the pen type, and the gun type ionizer can be applied to the handy type ionizer. The gun type ionizer can exert the effect of the present invention explained above.

CLAIMS

1. A handy type ionizer comprising:
 - a nozzle including a rotor provided with a hole at a point thereof;
 - an ejector arranged in the nozzle for ejecting air into the nozzle;
 - 5 a needle discharge electrode arranged in the nozzle for generating ions;
 - a power circuit connected to the discharge electrode;
 - an air circuit connected to the ejector; and
 - a body in which the power circuit and the air circuit are housed,
 - 10 wherein
 - the discharge electrode is arranged such that a central axis of the discharge electrode and a central axis of the rotor in the nozzle are inclined with an acute angle.
- 15 2. The handy type ionizer according to claim 1, wherein the point of the discharge electrode is positioned near an ejection passage of the air ejected from the ejector.
3. The handy type ionizer according to claim 2, wherein the nozzle is
20 made of resin, a cylindrical counter electrode is provided outside of the nozzle, and the point of the discharge electrode is positioned near the counter electrode via the nozzle.
4. The handy type ionizer according to any one of claims 1 to 3, wherein
25 the power circuit comprises an inverter that inverts a DC voltage supplied from

outside to an AC voltage, and a booster circuit that applies a high-voltage AC obtained by boosting the AC voltage to the discharge electrode.

5. The handy type ionizer according to claim 4, comprising:
- 5 an ion-generation-amount detecting circuit that outputs a detection signal proportional to a DC current flowing on an input side of the inverter; and
- a display unit that performs an output operation according to the detection signal.