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APPARATUS FOR GENERATING IONS IN THE ATMOSPHERE

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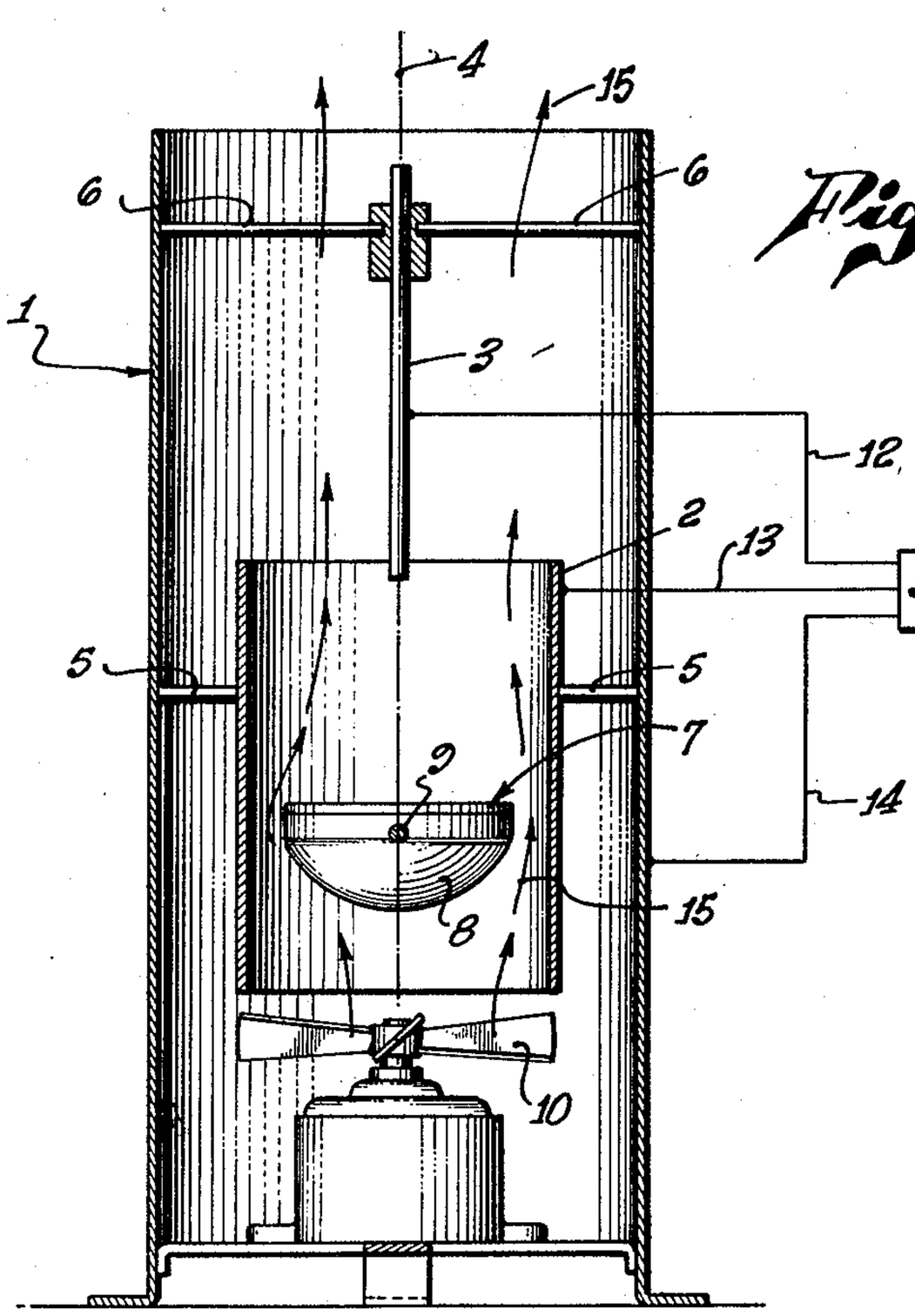

Fig. 1.

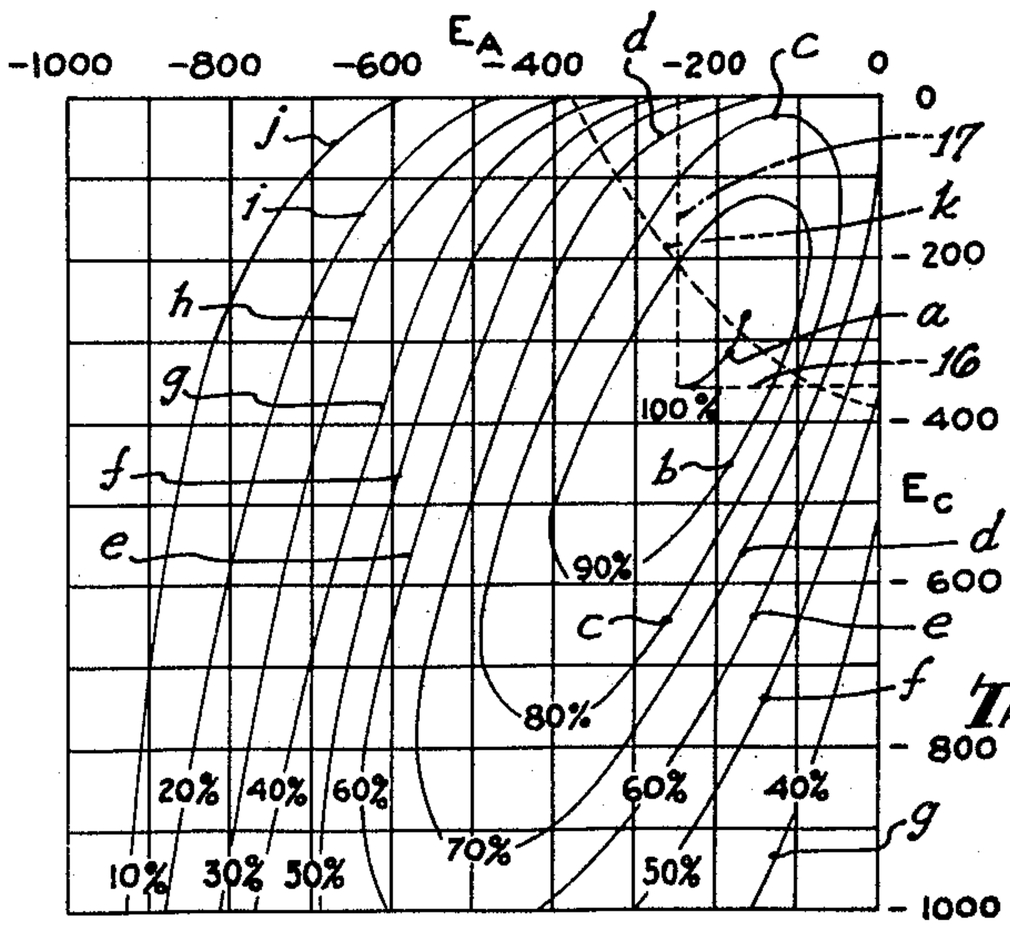

Fig. 2.

INVENTOR.
THOMAS L. MARTIN, JR.
BY

ATTORNEY.

United States Patent Office

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APPARATUS FOR GENERATING IONS IN THE ATMOSPHERE

Thomas L. Martin, Jr., Albuquerque, N. Mex., assignor to Ionaire, Inc., a corporation of California

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6 Claims. (Cl. 250—44)

This invention relates to a device for the efficient production of ions in atmosphere, such as in a room. The invention is concerned more particularly with copious production of "light" ions, consisting of a cluster of a few molecules, carrying either a positive or negative charge.

While it is possible, with the aid of this invention, to produce equally well, ions of either polarity, the ion generator is especially useful for the production of negative ions. The beneficial biologic effect of a preponderance in the atmosphere of negative ions over positive ions is now well understood. It is referred to for example in several prior patents, including three issued to W. W. Hicks, having No. 2,576,399 issued November 27, 1951; No. 2,589,613, issued March 18, 1952; and No. 2,594,777, issued April 29, 1952.

One form of ion generators utilizing a radioactive material, such as polonium, is described in Patent No. 2,594,777. This form utilizes an enclosing tubular electrode, having a potential such as to attract the ions of undesired polarity. When such generators are used, it is found that a substantial number of negative ions recombine with positive ions before they escape into the atmosphere. It is an object of this invention to increase the efficiency of such generators, by retarding the recombination of ions of opposite sign.

In order to accomplish this result, use is made of a supplemental electrode that serves as a collimator for facilitating the passage of the ions of the desired sign, outwardly of the device. In fact, by proper choice of relative potential differences between the electrodes, the passage of the ions of undesired polarity into the atmosphere is substantially entirely eliminated. Accordingly, it is another object of this invention to provide a device utilizing an additional electrode functioning in the manner hereinabove set forth.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming part of the present specification. The form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Figure 1 is a sectional view, mainly diagrammatic, of an embodiment of the invention; and

Fig. 2 is a graph explanatory of the performance of an embodiment of the invention, and consisting of a family of curves showing ion production, and based upon the potential differences between pairs of electrodes utilized in the device.

The device generally consists of an outer tubular electrode 1, an inner tubular electrode 2, and a center electrode 3. This center electrode 3 is in the form of a rod lying on the axis 4 of the device.

The three electrodes may be appropriately supported so that they form a concentric arrangement. For example, this may be accomplished by the aid of the radial plastic struts 5 supporting the inner tubular electrode 2 with respect to the outer tubular electrode 1; and a similar strut structure 6 for supporting the center electrode 3, with respect to the outer electrode 1.

Supported near and somewhat above the lower open end of the inner tubular electrode 3 is a source of ionizing radiation. This, for example, may include polonium which emits alpha particles, as an ingredient, although other sources for producing ionization in air may be utilized.

One way in which the source may be prepared may now be described. Polonium hydroxide in powder form is first intimately mixed with a powdered conducting metal, such as silver. The mixture is then flattened to form a foil. A thin sheet of silver, coated with a thin inactive material, such as gold, is then utilized as a base. The silver may be about one-eighth inch thick. The radioactive foil material is disposed over the gold; and another sheet of gold is then placed over this material. The entire unit may then be compressed by heat and pressure into a solid fused block. The block is then rolled to ribbon form of a thickness of .005 to .006 inch.

Since most of the thickness of this material is due to the silver backing, alpha particles can be emitted only from the side without the silver backing. A protective hard layer of palladium or rhodium of about four-tenths micron thickness is preferably provided.

Such a source of alpha radiations 7 is indicated in Fig. 1.

It is supported on a hemispherical base 8 in turn mounted upon the radial plastic struts 9 to the interior surface of the inner electrode tube. This base is also made of insulation material such as plastic. The lower convex surface reduces resistance to air flow (shown by arrows 15) outwardly of electrode 2.

Air flow at any suitable velocity may be produced by the aid of a fan 10. This fan may be mounted adjacent the intake end of the tubular electrode structures.

The outer electrode structure 1 extends axially considerably beyond the upper edge of the inner tubular electrode 2. The center electrode 3 extends upwardly from a region adjacent the upper end of the inner electrode 2.

In one form of the apparatus the fan 10, which is disposed adjacent the lower end of the annular passage between the two electrodes 1 and 2 was designed to produce a movement of air at about 450 feet per minute.

Furthermore, when it is desired to produce negative ions the electrode 1 has impressed thereon a potential that is positive with respect to the center electrode 3. The inner tubular electrode 2 has a negative potential with respect to the outer electrode 1. For this purpose a source 11, providing direct current potentials, is indicated with appropriate connections 12, 13 and 14 leading to the electrodes 3, 2 and 1 respectively.

The alpha particles emitted from the source 7 are effective to produce both positive and negative ions in air. Upon appropriate choice of electrode potentials, all or nearly all of the positive ions may be captured upon the center electrode 3. The desired negative ions are urged by the air flow outwardly into the circumambient atmosphere. The length of the inner electrode 2 beyond the polonium cell 7 is preferably greater than the mean range of alpha particles in air.

In the suppression or capture of positive ions and the passage of the negative ions into the air, the inner electrode 2 serves as a collimator. Thus this tubular electrode 2 prevents material fanning out of the ions that are produced. The negative ions are attracted towards the outer electrode 1, since it is maintained at a positive potential with respect to the center electrode 3. The

path of the ions through the inner electrode **2** is confined by this inner electrode, until the desired ions flow outwardly at the upper end of the electrode **2**. In this upper region the desired ions are drawn towards the outer electrode **1**. The undesired ions are drawn to the center electrode **3**.

If it be desired to produce positive ions in the atmosphere and to delete the negative ions, the anode or electrode structure **1** is made negative with respect to the center electrode **3**; and the collimator electrode is made positive with respect to anode **1**. Since it is contemplated that the apparatus will be used for beneficial biological effects of an increase of negative ions in the atmosphere, the apparatus in most instances will be utilized for the production of negative ions.

Fig. 2 illustrates how the production of the negative ions may be effected by appropriate choice of electrode potentials. The abscissae, having a scale at the top of the figure, represent the negative potentials of the center electrode **3** with respect to the outer electrode **1**. The ordinates, having a downwardly reading scale at the right-hand portion of the figure, correspond to the negative potential of the inner electrode or collimator **2** with respect to the outer electrode or anode **1**.

For any given rate of air flow through the device, a maximum production of negative ions is possible for different combinations of these relative potentials. If we can take this maximum production as 100%, then the graph *a* of Fig. 2 corresponds to those values of these potentials where maximum negative ions are produced. For example, when the center electrode or cathode **3** has a negative potential of 250 volts with respect to outer electrode or anode **1**, as shown by the abscissa **16**, and the inner electrode or collimator **2** has a negative potential of 350 volts with respect to anode **1**, as shown by ordinate **17**, then there is a maximum production of negative ions.

Similarly the curves *b*, *c*, *d*, *e*, *f*, *g*, etc., correspond respectively to diminishing production of negative ions with the percentages marked on graph.

The dotted curve *k*, extending diagonally from the upper reference line to the right-hand reference line, shows the limits of values in which the positive ions may be entirely deleted. Those portions of the graphs *a*, *b*, *c*, *d*, etc., which fall outside of the triangle represent potential values of the electrodes for which the positive ions are entirely suppressed.

Accordingly, the most desirable choice of electrode potentials is represented by that portion of the graph *a* which falls below the line *k*.

These graphs or curves of Fig. 2 represent the results of numerous experiments and are typical as well for positive ion generation.

The air velocity produced by the fan **10** has a material effect upon the efficiency of the device. An air velocity of 450 feet per minute is quite efficient.

Similarly, the relative lengths of the tubular electrodes **1** and **2** are chosen so as to provide quite an effective collimation of the ions. The negative potentials of the electrodes **2** and **3** repel the negative ions and if the current of air is strong enough these negative ions are blown clear of the electrode or anode **1**, before they can be absorbed.

The inventor claims:

1. In a device for supplying ions of a desired polarity in air: means for ionizing air; a center electrode extending along the path of discharge of ions from the device; a pair of tubular electrodes surrounding the center electrode; means for separately impressing a potential upon the tubular electrodes with respect to the center electrode; and means for creating air velocity through the space between the tubular electrodes.

2. In a device for supplying ions of a desired polarity in air: a center electrode; a pair of concentric tubular electrodes of different diameters; the center electrode being substantially at the axis of the tubular electrodes; the outer electrode at one end having a portion extending axially beyond the inner electrode; means for ionizing air and extending across the axis and at the other end of the tubular electrodes; said inner tubular electrode extending substantially beyond said source toward the central electrode; said center electrode extending beyond the inner tubular electrode; means for impressing a potential upon the tubular electrodes with respect to the center electrode; and means creating air velocity in an axial direction through the outer electrode.

3. In a device for supplying ions of a desired polarity in air: a pair of tubular concentric electrodes; a central rod-like electrode extending substantially along the axis of said electrodes and substantially beyond the inner tubular electrode; one of said tubular electrodes extending around the outside of the other tubular electrode to define an annular path for air; said outer electrode extending in an axial direction beyond one end of the inner tubular electrode; a source of alpha rays across the axis and adjacent the other end of the inner electrode; means impressing a potential difference between the central electrode, and the outer tubular electrodes and between the tubular electrodes; and means for passing air through the outer tubular electrode from said other end.

4. In a device for supplying ions of a desired polarity in air: means for producing ions of both polarities in air; a first electrode; a second electrode of hollow form for directing the ionized air past said first electrode; a third electrode of hollow form surrounding the first and second electrodes; means for impressing a potential upon the first electrode of such polarity as to attract only those of the resulting ions that have the undesired polarity; means for impressing upon the second electrode a potential to repel the ions of desired polarity; means for impressing upon the third electrode a potential opposite that of the first electrode; and means for producing a movement of air through the third electrode.

5. In a device for supplying ions of a desired polarity in air: means for producing ions of both polarities in air; a pair of tubular electrodes; a central rod-like electrode extending substantially centrally of said electrodes; one of said tubular electrodes extending around the outside of the other tubular electrode to define an air path; said outer electrode extending in an axial direction beyond one end of the inner electrode and around rod-like electrode; means for impressing a potential upon the rod-like electrode of such polarity as to attract only those of the resulting ions that have the undesired polarity; means for impressing upon the inner electrode a potential to repel the ions of desired polarity; means for impressing upon the outer electrode a potential opposite that of the first electrode; and means for producing a movement of air through the third electrode.

6. In a device for supplying ions of a desired polarity in air: a pair of tubular electrodes; a central rod-like electrode extending substantially centrally of said electrodes; one of said tubular electrodes extending around the outside of the other tubular electrode to define an air path; said outer electrode extending in an axial direction beyond one end of the inner electrode and around rod-like electrode; said rod-like electrode being located substantially entirely beyond said inner electrode; means for producing ions of both polarities adjacent to and within the other end of the inner electrode; means for impressing a potential upon the rod-like electrode of such polarity as to attract only those of the resulting ions that have the undesired polarity; means for impressing upon the inner electrode a potential to repel the ions of desired polarity; means for impressing upon the outer electrode a potential opposite that of the first electrode; and means for producing a movement of air through the third electrode.

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