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SPACE INHALATION DEVICE

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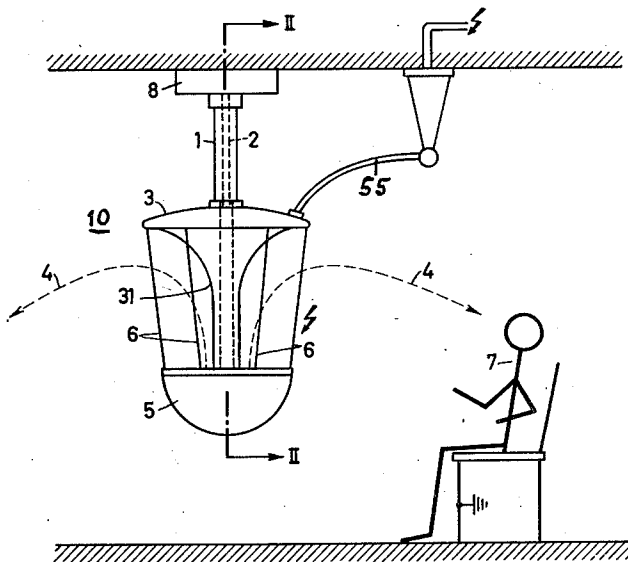


Fig. 1

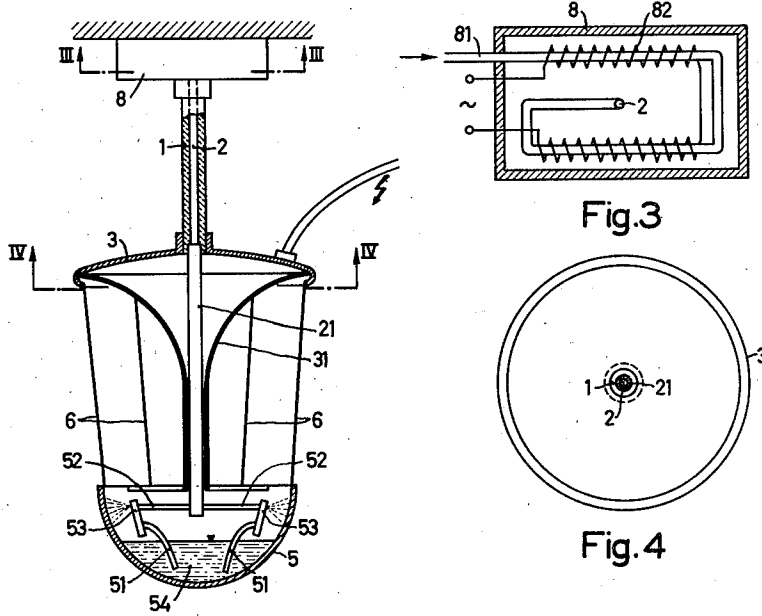


Fig. 2

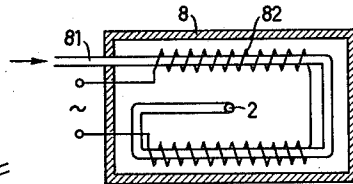


Fig. 3

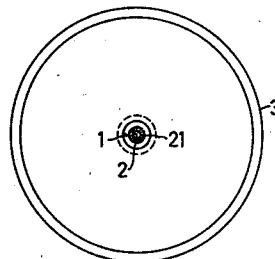


Fig. 4

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7 Claims. (Cl. 128—191)

My invention relates to inhalation devices for medical treatment, and is more particularly directed to an apparatus for atomizing and electrically charging the atomized particles of a medicament to be used as an inhalant.

For some kinds of medicinal inhalation treatment, it is known to be advantageous to electrically charge the atomized particles of the aerosol to be inhaled with a unipolar charge. Best results are usually obtained when the electric charge is made as high as possible. For this purpose, it is preferable to highly atomize the inhalant to obtain the smallest atomized particle sizes, for instance in the order of magnitude of 1 micron. The mist containing these small particles is then conducted through a high-voltage corona system in which the electric charge is imparted to the particles.

It is an object of my invention to secure, in apparatus of the character described, a more effective electric charge than has heretofore been possible. To this end, the formation of the aerosol, that is the atomization, is carried out within a high-voltage corona system.

According to one of the more specific features of my invention, particularly advantageous results are obtained by placing the atomizer nozzle system at the same electric potential as the system of corona electrodes.

According to a further feature of my invention, the corona system is so designed that it more or less surrounds the atomizer nozzle system concentrically. Such construction results in an electric field extending radially in space around the apparatus. Thus, the electric field lines from a central atomizer in a treatment room are directed equally to a number of patients seated in a circle about the device. The paths of the electric field lines and the air current are for the most part coincident, so that the aerosol particles will remain in highly charged condition during their flow toward the patients.

The novel features which I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, and other objects and advantages thereof will be understood from the following description of a preferred embodiment when read in conjunction with the accompanying drawing.

In the drawings—

Fig. 1 is an elevational view of the apparatus embodying the invention installed in an inhalation treatment room.

Fig. 2 is a vertical cross-sectional view, on an enlarged scale, of the apparatus shown in Fig. 1, taken along the line II—II thereof in the direction of the arrows.

Fig. 3 is a horizontal cross-sectional view of the atomizing air heating unit, taken along the line III—III of Fig. 2 in the direction of the arrows, and

Fig. 4 is a horizontal cross-sectional view of the device shown in Fig. 2, taken along the line IV—IV thereof in the direction of the arrows.

Referring now to the drawings, the numeral 10 illustrates one embodiment of the inhalation device comprising the invention, the same comprising a heater unit 8, fixed at a central location against the ceiling of the in-

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halation treatment room, and a tubular support member 2 fixed to and extending down from the heater unit 8. The lower end of the support member 2 has centrally fixed thereto a rounded metallic disc structure 3 forming the top of the atomizer assembly. The bottom of the atomizer assembly is comprised of a semispherical metallic shell 5 supported about its periphery by a plurality of electric corona wires 6 fixed to and extending down from the periphery of the disc structure 3, thus forming together a slightly conical arrangement. A curved, funnel-shaped member 31 is secured in axial alignment with the disc structure 3, preferably by having the outer edge of said disc bent about the periphery of said funnel-shaped member as illustrated in Fig. 2. The lower end of the funnel-shaped member 31 is interconnected with the shell 5.

The heater unit 8 is for the purpose of heating the atomizing air as it flows through the air conduit 81 before it flows through the central opening 2 of the tubular support member. As illustrated in Fig. 3, the air can be electrically heated by means of an electrical heater wire 82 wound around a loop of the air conduit 81 within the unit 8. The heating unit 8 serves to heat the inflowing air to such an extent that the exterior surface of the insulating tubular support member is kept at a temperature above the dew point of the inhalation room, thereby preventing condensation to preserve its insulating character while the device is in operation.

An axial air tube 21 interconnects the lower end of the tubular support member 1 with a plurality of radially extending tubes 52, the ends of which are fitted with atomizing units 53. Suction tubes 51 from the atomizing units 53 extend downwardly into the medicinal liquid 54 to be atomized contained within the lower portion of the shell 5.

The parts 3 and 5 are so shaped as to guide the aerosol mist into a flow that extends toward all sides in the radial direction and is turned slightly in the downward direction, this flow being schematically indicated by the dotted-line arrows 4 in Fig. 1. Thus directed, the flow of aerosol mist reaches the patients 7 seated approximately on a circle about the axis of the device so that they inhale the highly charged aerosol mist. The entire arrangement carried by the insulator support member 1 is at high-voltage potential with respect to ground by connection to the electric source through a high-voltage conductor 55. The lines of the electric field extend toward the patients, who are at ground potential.

The high voltage can be produced in any known manner, for instance by the use of a high-voltage dry-rectifier assembly (not shown). For protection of the patients from touching the high-voltage parts, any desired expedience conventional for such purposes may be used.

An essential advantage of the device according to the invention resides in the fact that a diversion and discharge to grounded parts, of the aerosols to be inhaled is prevented to a large extent, thus affording the possibility of directing aerosols of unipolar charge into the respiratory organs of the patients at an extremely high efficiency. The device also minimizes the danger that the aerosol droplets, on the way to the patient, may immediately consolidate to undesirably large droplets within the electric charging system. The extremely fine division of the atomized substance, essential for best therapeutic results, is thus fully maintained and utilized.

It will be understood by those skilled in the art that the invention permits of various embodiments, modifications, and uses other than those specifically described herein. For instance, depending upon the number and seating arrangement of the patients to be treated, the directing elements for the field and for the flow of aerosol can be so shaped and located that the flow of charged

aerosol will practically only reach the places where a patient is seated, so that waste of the inhalant is kept to a minimum.

I claim:

1. Apparatus for producing a vaporous and an electrically charged inhalant, comprising nozzle means issuing an atomized flow of particles, an electrically conductive cage structure surrounding said nozzle means for electrically charging the particles, and voltage supply means electrically connected with said nozzle means and said cage structure and having at both the same electric potential.

2. Apparatus for producing medical inhalants having electrically charged particles, comprising an electrically-conductive cage structure, said cage structure having a plurality of corona wires defining the openings of said cage structure, means for charging said cage structure to a high potential, said cage structure comprising container means adapted to hold a supply of liquid medicine to be atomized, and atomizer means within said cage structure for atomizing the liquid medicine, whereby atomized particles will be charged to the potential of said cage structure and whereby the charged particles can flow out of the openings of said cage structure following the lines of electric force emanating therefrom.

3. Apparatus for producing medical inhalants having electrically charged particles, comprising an electrically-conductive cage structure, said cage structure having a plurality of corona wires defining the openings of said cage structure, means for charging said cage structure to a high potential, said cage structure comprising container means adapted to hold a supply of liquid medicine to be atomized, atomizer means within said cage structure for atomizing the liquid medicine, and a baffle within said cage structure and operative to direct charged atomized particles out of the openings of said cage structure and along the lines of electric force emanating therefrom.

4. Apparatus for atomizing and electrically charging medicinal liquids for inhalation treatment of a plurality of patients in an inhalation room, comprising an electrically-conductive cage structure, an electrically insulating support member connected with said cage structure and adapted to suspend said cage structure from the ceiling of the inhalation room, said cage structure having a

plurality of corona wires defining openings in said cage structure, means for charging said cage structure to a high potential, said cage structure comprising container means adapted to hold a supply of liquid medicine to be atomized, atomizer means within said cage structure for atomizing the liquid medicine, and a baffle within said cage structure operative to direct-charged atomized particles out of said openings and along the lines of electric force emanating from said cage structure in the direction of ground potential.

5. The invention as defined in claim 4, wherein said electrically insulating support is hollow to provide air conduit means, said atomizer means comprising said air conduit means.

6. The invention as defined in claim 4 wherein said corona wires are arranged along generatrices of a downwardly tapering conical surface.

7. Apparatus for atomizing and electrically-charging medicinal liquids for inhalation treatment of a plurality of patients in an inhalation room, comprising an electrically-conductive cage structure, an electrically-insulating support connected with said cage structure and adapted to suspend said cage structure from the ceiling of the inhalation room, said electrically-insulating support being hollow to provide conduit means for supplying atomizing compressed air, an air pipe connected with the ceiling end of said insulating support, means for preheating the air in said air pipe before it flows through said insulating support conduit means, said cage structure having a plurality of corona wires defining the openings of said cage structure, means for charging said cage structure to a high potential, container means in said cage structure adapted to hold a supply of liquid medicine to be atomized, and atomizer means within said cage structure and connected with said insulating support conduit means, whereby atomized particles will be charged to the potential of said cage structure and whereby the charged particles can flow out of the openings of said cage structure following the lines of electric force emanating therefrom.

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