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APPARATUS FOR OBTAINING AEROSOLS OF SUPERIOR QUALITY

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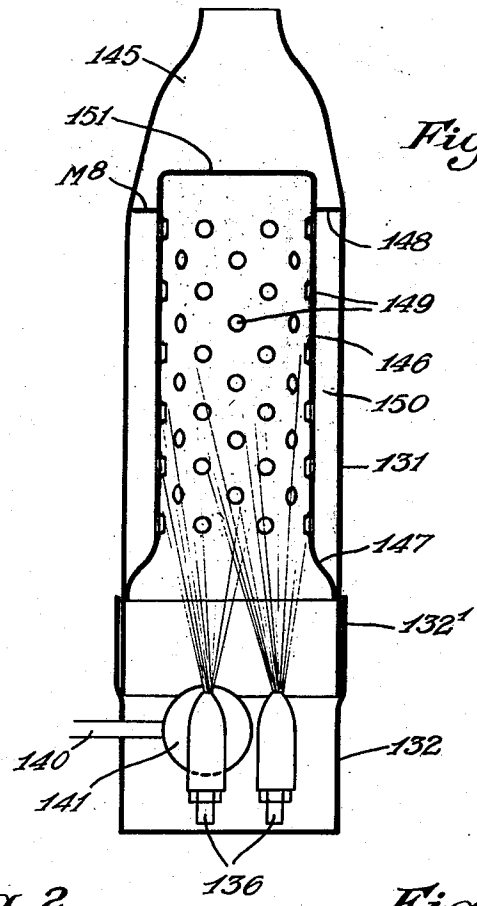


Fig. 1.

Fig. 2.

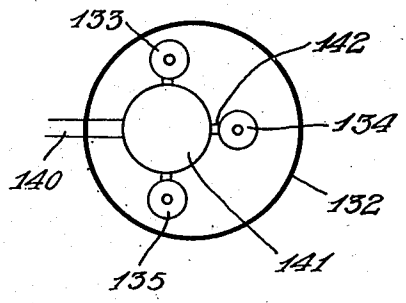
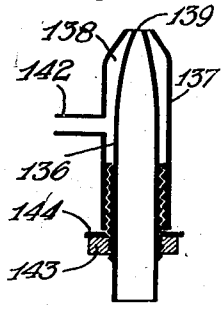


Fig. 3.



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APPARATUS FOR OBTAINING AEROSOLS OF SUPERIOR QUALITY

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3 Claims. (Cl. 183—22)

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The present invention relates to an apparatus for obtaining aerosols of superior quality in which a liquid is vaporized or atomized by means of a gas under increased or reduced pressure, and more particularly to an apparatus for atomizing a liquid in which a cloud or jet of colloidal liquid particles is passed through a liquid layer, whereby aerosols of great uniformity of size and stability are obtained, and especially to apparatus for producing aerosols wherein the average particle size or diameter of the dispersed liquid particles is below one micron.

The aerosols which are produced, using the apparatus of the present invention, are of a special type and can be considered as clouds of a dispersed liquid phase in a continuous gaseous phase, which have the following characteristics:

1. Independently of the nature of the substances dispersed, a given volume of aerosols contains a given number of particles for an aqueous saline solution of the same concentration.

2. This number of particles increases as the saline solution is diluted and can exceed 60,000 per cubic millimeter.

3. The quantity of solution present per cubic millimeter of aerosols is always the same for a particular apparatus regardless of the nature of the dissolved substances and the concentrations thereof in the mother liquor.

Two important factors are the quantity of particles emerging per unit time from the liquid, and more especially their quality, i. e., their characteristic of uniformity and stability.

The present invention relates to the "quality" factor and has as its object the production of aerosols of great uniformity of size and stability, the stability being conditioned by the small dimensions of the particles (below one micron) and by the uniformity of their size.

The majority of known apparatuses, and particularly those based on mechanical filtration, do not permit any limiting of the intensity of the mist emitted and do not guarantee that all the particles will have an adequate stability. Also in known apparatuses, using mechanical filtration, no selection is possible between light emission and increased emission.

In accordance with the present invention, the foregoing disadvantages are overcome by passing the cloud containing the liquid particles across a continuous liquid layer in such a manner that the condensable particles of liquid are either retained by the liquid layer or are returned to the mother solution and only particles having great stability penetrate into the final atmosphere.

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This selection by means of a liquid layer can be made in a static manner by washing the cloud in a continuous liquid layer in a suitable vessel of the Drechsel type, for example. This selection can also be performed in a dynamic manner by providing means by which the formation of a thin liquid film is made possible; this film may be reformed in a continuous manner from the liquid and provides a filtering agent for physical selection, not permitting the passage of particles which have not attained the desired stability.

The aerosols obtained by using the apparatus of the invention have numerous practical applications, among which are the introduction of medicaments with a local pulmonary action or a general action after penetrating the lungs, hygienic precautions, atmospheric conditioning, dust removel, moisteners for threads, fabrics, stationery, and the like, and progressive moistening of vegetable and animal fibres. The apparatus is also suitable for producing fine emulsions of all kinds and of all liquids, such as oil emulsions, medicaments, and the like.

In the apparatus of the invention the gas used may be a compressed gas, but the apparatus may also be used when the system is under reduced pressure, i. e., the interior of the apparatus is at a lower pressure than the inlet gas.

An additional advantage in the apparatus of the invention is that the liquid filtering elements have a continuous character, which ensures complete filtration because the dispersed and condensed particles must contact a non-dispersed phase.

The invention will be further illustrated by reference to the accompanying drawings in which:

Figure 1 is a diagrammatic longitudinal sectional view in elevation of an apparatus for producing aerosols in accordance with the invention;

Figure 2 is a diagrammatic transverse sectional view of the apparatus of Figure 1, and

Figure 3 is a sectional view in elevation of an atomizing jet used in the apparatus of the invention.

Figures 1, 2 and 3 relate to a particularly simple construction providing for three separate stages of selection. It is formed of a body, such as a cylindrical vessel, in which there is arranged co-axially a casing, the top of which constitutes a breaking surface for the air liquid mixture emitted from one or more atomizers and is spaced from the atomizers by a distance sufficient to permit the formation of a spray of liquid (which

acts as a first discontinuous turbulent liquid selection layer) and a continuous liquid film due to the particles striking this surface. The vertical wall of the surface of the casing is apertured and gives rise along its interior surface to the formation of a continuous liquid film, the uniformity of which is maintained on the one hand due to the liquid particles ascending from the vaporizers, and on the other hand from the particles which have not acquired the necessary degree of stability and which go back towards the mother liquid after having struck the breaking surface.

This apparatus comprises an envelope formed of a tubular member 131 which engages in the upper part of a base 132 having a collar 132' of slightly larger diameter in which the bottom of the member 131 can be located by projections or a screw thread (not shown) arranged horizontally around the base 132.

Within the member 132 are arranged a series of atomizers which in the example shown are three in number and each of which is formed (Fig. 3) of a tube 136 dipping into the liquid and surrounded by a sheath 137 through which air is conducted, which sheath is screwed to the lower part of the tube 136. The whole is secured by a collar 143 having a jointing member 144. The top of sheath 137 forms a passage 138 for the compressed air and the tops of the two elements 136 and 137 form a nozzle 139.

The compressed air is fed to the atomizer by means of a tube 140 (Figs. 1 and 2) leading to a sphere 141 which in turn is connected by tubes 142 with the vaporizers 133, 134, and 135.

The top of the member 131 forms an exit chimney 145 for the aerosols. A perforated cylindrical casing 146 is fitted tightly at its base in the member 131 by means of a collar or flanged portion 147 and is supported in position at the top by means of horizontal stays 148 which extend to the member 131.

In the example shown the position of the top 151 and consequently the distance which separates it from the jets can be regulated easily as the lateral stays 148 are in sliding contact with the member 131. Any other regulating means such as springs, hooks, etc. can be provided for this purpose.

The openings 149 in the casing 146 permit the passage of aerosols to the space 150 between the members 146 and 131, from which they pass to the exit chimney. The end of casing 146 is closed by member 151, which constitutes a breaking surface as will be described below.

In using such an apparatus, the discharge from each atomizer 133, 134, 135 and the distance between the nozzles 139 and the surface 151 are adjusted so as to produce within the sheath 146 a dispersion of the liquid particles in the form of a spray, which constitutes a liquid turbulent discontinuous layer which the particles must necessarily traverse as soon as they are emitted.

Simultaneously, there is formed along the interior cylindrical wall of the casing 146, a liquid continuous film by the ascending particles, which covers the openings 149 as soon as the atomization commences. Furthermore, the vertical jets strike the horizontal member 151 and result in the formation on this surface of a thick continuous liquid film. This liquid film functions as a liquid filter in such a way that the particles which have not acquired the requisite degree of stability to traverse it go back towards the mother liquid and give rise, along the interior surface of the casing, to a descending continuous film. The cooperation of the continuous ascending film and descending film results in the lateral liquid film remaining substantially of the same thickness.

There are thus four liquid filtering zones; one discontinuous and three continuous forming four successive stages of selection: (1) The column or vertical spray formed in the space within the casing 146 by the jets issuing vertically from the vaporizers 133, 134, and 135. The height and the dispersion of this spout are regulated by the position of the casing 146. (2) The continuous turbulent film formed by the spray striking the surface 151. (3) and (4) The continuous uniform ascending and descending films, as explained, along the interior wall of the casing 146.

As soon as they have been emitted the particles must thus traverse a liquid discontinuous layer formed by the spray emitted from the vaporizer, then the continuous layer on the horizontal top 151, and they cannot pass into the space 150 unless the two preliminary selections have given them the necessary stability to permit them to pass through the continuous film covering the interior surface of the casing 146.

In order to improve filtration by the ascending and descending films it is advantageous to arrange that the lateral apertures 149 have a rounded edge, which may be regular or irregular, towards the interior of the sheath.

The thickness of the upper liquid layers and the ascending and descending liquid layers can be regulated either by varying the amount of atomization or number of nozzles or by varying the height of the sheath 146 or by moving the top 151 towards or away from the nozzles. In this way it is possible to modify not only the quantity but also the quality of the particles emitted.

I claim:

1. An apparatus for producing aerosols of superior quality comprising a closed vessel containing an atomizing means including a gas inlet tube and a liquid feed tube terminating near the bottom of the vessel, an aerosol outlet tube having a discharge opening therein and an apertured cylindrical enclosure coaxially disposed within said vessel and said outlet tube and positioned between the atomizing means and said discharge opening and arranged across the path of the cloud formed by said atomizing means, said enclosure being enlarged near its lower end so as to fit snugly against the outer wall of the cylindrical vessel at a point near the outlet tube, the end of said enclosure being closed and the cylindrical walls of said enclosure being apertured.

2. An apparatus in accordance with claim 1 wherein the apertures in the cylindrical enclosure have their edges depressed toward the interior of said enclosure.

3. An apparatus for producing aerosols of superior quality comprising a vessel containing an atomizing means near one end of the vessel including a gas inlet tube and a liquid feed tube, an aerosol outlet tube extending outwardly from said vessel and having a discharge opening remote from said atomizing means, a hollow enclosure within and spaced radially from said outlet tube and positioned between said atomizing means and said discharge opening and separating said vessel from said outlet tube, said enclosure having an inner open end communicating with said vessel and an outer closed end extending

across the path of the aerosol cloud formed by said atomizing means and perforations in its side walls for passage of the aerosol cloud to said outlet tube and flow of condensed liquid back from said tube into said vessel.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
321,338	Burk	June 30, 1885
464,779	Reichhelm et al.	Dec. 8, 1891
740,714	Titus	Oct. 6, 1903
1,363,859	Fetters	Dec. 28, 1920
1,377,594	Lissauer	May 10, 1921
1,964,794	Gilbert	July 3, 1934
2,166,574	Adolphsen	July 18, 1939
2,251,986	Connell	Aug. 12, 1941
2,262,772	Larsen	Nov. 18, 1941
2,437,526	Heidbrink et al.	Mar. 9, 1948
2,438,868	Trier	Mar. 30, 1948

FOREIGN PATENTS

Number	Country	Date
813,994	France	Mar. 8, 1937
371,129	Great Britain	Apr. 21, 1932