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METHOD AND SOLUTION FOR PRODUCING INSECTICIDAL AEROSOLS

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Fig. 1.

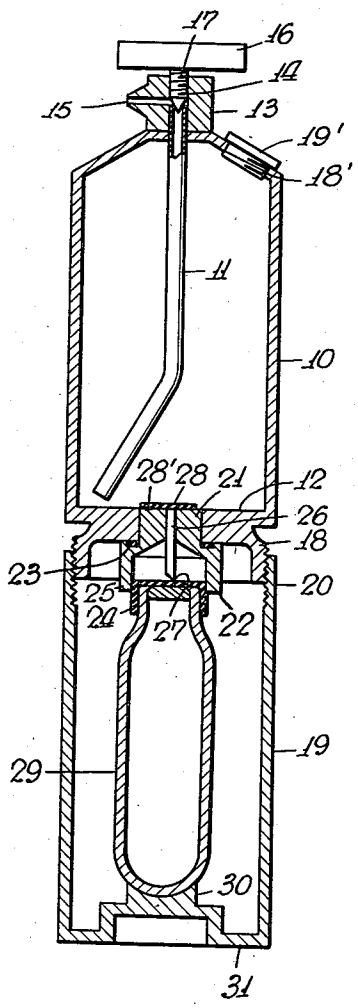
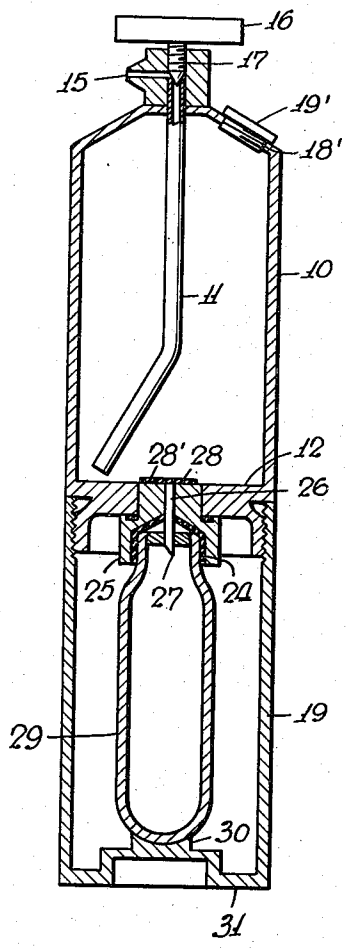


Fig. 2.



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METHOD AND SOLUTION FOR PRODUCING INSECTICIDAL AEROSOLS

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4 Claims. (Cl. 167—39)

1

The present invention relates to the production of aerosols or aerocolloids.

The use of liquefied gases such as "Freon-12" as the solvent or carrier for the material to be dispersed, which solvent or carrier evaporates rapidly when the solution or mixture is sprayed into the atmosphere is objectionable for domestic insect sprays, because of explosion hazards and other dangers involved, since storage and transportation under high pressure is necessary to maintain the liquefied gases in the liquid phase.

Solvents such as acetone or alcohol that are liquid at atmospheric temperature but have a boiling point sufficiently low to evaporate fairly readily and that are dispersed by a gas such as carbon dioxide dissolved therein are also objectionable for domestic insect sprays because they are characterized by one or more of the following objections: inflammability, toxicity, irritancy to the eyes, the nasal and the bronchial tracts, and injuriousness to drapes, wall paper and furniture.

It is among the objects of the present invention to provide a method for producing aerosols, employing a carrier or solvent, which though liquid at or near room temperature, has a boiling point materially lower than those of acetone and alcohol, which is non-inflammable, non-corrosive, non-toxic, non-irritant to the bronchial or nasal tracts, which is an excellent solvent or carrier for a wide variety of insecticides and disinfectants, which has a relatively high density so that a relatively small volume is required to form a dispersion consisting of a definite weight of the solvent or carrier, and which has a solubility for carbon dioxide gas, which solubility is not so great that an inordinately large amount must be dissolved to obtain the desired dispersion of the carrier or solvent and yet is adequate to produce a solution by dissolving a relatively small amount, say from 8 to 10 grams, in about 100 cc. of the solvent, from which solution, when sprayed, carbon dioxide gas escapes with explosive force to form particles so minute that their surface area is large compared to their volume and the solvent or carrier content of which particles promptly evaporates to produce the desired aerosol particles.

Another object is to provide as a new article of commerce, a novel solution or mixture of a parasiticide, disinfectant, or other material to be dispersed in a solvent or carrier, which solution or mixture has properties which render it eminently satisfactory for producing an aerosol of such material.

Still another object is to provide an improved

2

apparatus for producing aerosols, which apparatus is designed to use a readily available carbon dioxide bulb or cartridge, such as the well-known Sparklet containing a relatively small amount of carbon dioxide, from 8 to 10 grams, and does not require a special charging device for introducing the carbon dioxide into the solution of material to be dispersed when it is desired to form the aerosol.

Other objects and advantages of this invention will be apparent from the following description thereof.

I have discovered that a specific compound more particularly trichlor monofluor methane, which is liquid at ordinary atmospheric temperatures, uniquely presents the desired properties of importance for insecticide or disinfectant sprays for domestic use. More especially, trichlor monofluor methane has a relatively low boiling point of about 25° C. (at 760 mm. of mercury pressure), has a high vapor pressure so that it evaporates readily, is non-inflammable, has a slight but agreeable odor, is non-toxic and non-irritant, is an excellent solvent or carrier for various parasiticides including insecticides and fungicides, and disinfectants that are commonly used, has a high density about 1.5, and has just the proper solubility characteristics for carbon dioxide, absorbing as it does about thirty times its volume of such gas at 100 pounds per square inch gauge pressure.

According to this discovery, the material to be dispersed in the form of an aerosol or aerocolloid is dissolved in or mixed with trichlor monofluor methane, and the resultant solution, when it is desired to produce the aerosol, placed under superatmospheric pressure, such that when the pressure is released the solution is dispersed in finely divided form into the atmosphere to form the desired aerosol. The pressure under which the solution is placed when it is desired to produce the aerosol may be created in any suitable manner. Preferably, carbon dioxide or other gas is dissolved in the solution, thereby placing the solution under a pressure, desirably of at least 40 pounds per square inch gauge, preferably within the range of 125 to 225 pounds per square inch gauge. The solution may be placed under such pressure by heating it as disclosed in copending application Serial No. 638,879 of Z. M. Roehr, now issued as Patent No. 2,440,915, dated May 4, 1948, to increase the vapor pressure of the solution when it is desired to produce the aerosol. This invention includes broadly the placing of a solution or mixture of trichlor monofluor methane

and material to be dispersed as solute under pressure in any desired manner, and includes specifically the charging of such solution or mixture with carbon dioxide to place the same under the desired pressure, followed by release of the pressure when it is desired to produce the aerosol, the carbon dioxide thereby flashing into the atmosphere, dispersing the solution in small droplets; upon evaporation of the solvent or carrier, which results in further subdivision of the particle size of the material to be dispersed, the desired aerosol results.

Among the materials which may be dispersed in the form of an aerosol employing as the solvent or carrier trichlor monofluor methane in accordance with this invention, are DDT (dichloro diphenyl trichlorethane), pyrethrins, rotenone, sesame oil and other insecticides, fungicides, disinfectants and fumigants soluble or dispersible in trichlor monofluor methane. This invention is particularly effective for producing aerosols of DDT and pyrethrin mixtures, which mixtures combine the desirable properties of pyrethrins, which has the effect of giving rapid but not lasting control when used, for example, to control flies or mosquitoes, and DDT which gives initially slow but lasting control when used to combat flies and mosquitoes. This invention accordingly includes solutions or mixtures of parasiticides and other materials to be dispersed in trichlor monofluor methane, specifically solutions of DDT, pyrethrin, and mixtures of DDT and pyrethrin in trichlor monofluor methane. Examples of disinfectants which may be employed are triethylene glycol and propylene glycol. These disinfectants, while not soluble in trichlor monofluor methane, are soluble for example in a mixture of trichlor monofluor methane and methylene chloride, or a mixture of trichlor monofluor methane and acetone; for example, the constituents may be mixed in the proportion of 10 parts by weight of triethylene glycol to 65 parts of the trichlor monofluor methane and 25 parts of methylene chloride.

The amount of material to be dispersed, dissolved in or admixed with trichlor monofluor methane, will depend on the intended use for the aerosols, the conditions under which it is used, e. g., the size of the room, chamber, cabin or other space to be treated for the purpose of killing insect pests, fumigating or disinfecting the room, chamber or other space, the temperature and pressure conditions prevailing therein, the degree of infestation in the case where the aerosol is used to control insect pests, etc. From approximately 5 to 25 parts by weight of material to be dispersed per 100 parts of solvent or carrier will usually be found satisfactory.

The solution or mixture of material to be dispersed in the trichlor monofluor methane may be stored and shipped as an article of commerce, or alternatively the individual constituents may be stored and shipped separately and combined when it is desired to produce the aerosol. Since the parasiticidal materials, disinfectants or other materials to be dispersed in general have little or no appreciable vapor pressure, the resultant solution thereof in or mixture thereof with trichlor monofluor methane has a vapor pressure which is equal to or slightly below that of the trichlor monofluor methane, and hence the solutions or mixtures can be stored and transported in a similar manner to aqueous solutions. When it is desired to form the aerosols, the solution or mixture may be placed in a container capable of withstanding high pressures of the order of 125 to 225 pounds per square inch gauge, which container is equipped, for example, with a carbon dioxide charging device such as the well-known and readily available bulbs or cartridges containing from 8 to 10 grams of liquid carbon dioxide under a pressure of from 800 to 1000 pounds per square inch.

In the accompanying drawing forming a part of this specification and showing, for purposes of exemplification, a preferred form of apparatus for practicing the process of this invention, without limiting the claimed invention to such illustrative instance,

Figure 1 is a vertical section through one form of apparatus embodying this invention, showing the parts of the apparatus in position such that the solution of material to be dispersed and the carbon dioxide are stored separately, no flow of carbon dioxide taking place into the solution; and

Figure 2 is a vertical section through the apparatus, showing the parts in position such that flow of carbon dioxide takes place from the carbon dioxide cartridge into the solution of the material to be dispersed.

In the drawing, container 10, desirably of steel or other metal capable of withstanding relatively high pressures of the order of 100 to 225 pounds per square inch, has a discharge tube 11 therein extending from a point just above base 12 into head 13. A needle valve 14 is provided in the head 13 for controlling flow through orifice 15, valve 14 being operated by handle 16 connected to valve stem 17 in threaded engagement with a threaded cylindrical opening in head 13. Orifice 15 and the needle valve 14 are dimensioned and designed to produce atomization of solution discharged through the orifice 15. Container 10 is provided with an opening 18' which is normally maintained closed by plug 19', which opening permits the introduction of the solution into the container 10.

Base 12 of container 10 has depending therefrom a threaded cylindrical flange 18. A housing 19 has its top 20 in threaded engagement with the threaded portion of flange 18. A central opening in base 12 is closed by a plug 21, having a depending collar 22, the upper portion of which is in gas-tight engagement with the underside of the base 12; packing 23 is inserted in the annular space between the underside of base 12 and the upper portion of collar 22 to produce this gas-tight seal. Collar 22 is provided with a rubber gasket 24 which may be in the form of a disc as shown in the drawing or may be of annular shape.

Extending through plug 21 is a hollow pin 26 having a pointed end 27. A check valve 28 desirably in the form of a rubber or other flexible material diaphragm having one end 28' cemented or otherwise secured to base 12 and the other end free to permit upward movement of the free end is disposed at the top of plug 21 to close the upper portion of the hollow pin 26, preventing flow of liquid in container 10 through this hollow pin. Check valve 28 permits flow of gas through the hollow pin into the container 10, as will be hereinafter more fully described.

A carbon dioxide cartridge or bulb 29, such as the well-known Sparklet, is disposed in housing 19 resting on concave support 30 on base 31 of housing 19. The upper neck portion of the bulb engages rubber gasket 24, collar 22 being so dimensioned that a gas-tight seal is produced between the neck portion of the bulb and the collar

22, preventing escape of gas from the bulb, when a wall thereof has been penetrated, into the housing 19, and causing substantially the entire gas content of the cartridge to flow into container 10. Instead of having the support and connection for the carbon dioxide cartridge with the base of container 10, these parts may be associated with the top portion of container 10 so that when the carbon dioxide cartridge is pierced, the carbon dioxide flows into the top of container 10. In the latter design, it is unnecessary to use a check valve for preventing flow of solution into the carbon dioxide cartridge.

The apparatus may be shipped in commerce with or without the container 10 filled with the solution of material to be dispersed and desirably without the carbon dioxide cartridge or bulb in housing 19. Just before it is desired to produce the aerosol, a carbon dioxide cartridge or bulb is placed in housing 19 as shown in Fig. 1, with the sharp end of the pin 26 in contact with the upper wall of the cartridge, or if a disc type gasket 24 is used, as shown in the drawing, in contact with the upper wall of this gasket. The housing 19 is threaded on to the flange 18, so that the cartridge is held firmly in position between collar 22 and support 30, without the sharp end of pin 26 penetrating the wall of the cartridge. If the solution of material to be dispersed in trichlor monofluor methane has not previously been introduced in container 10, it is introduced thereinto and the needle valve 14 is closed.

When it is desired to produce the aerosol, the housing 19 is moved into the position shown in Fig. 2, to move the cartridge vertically upwardly, so that the pin 26 penetrates the upper wall thereof, as shown in Fig. 2, causing the carbon dioxide to flow from the cartridge 29 into the solution in container 10. Flow of solution from container 10 is prevented by the check valve 28 and needle valve 14; check valve 28 permitting flow of the carbon dioxide into the solution but preventing flow of solution in a downward direction, into the housing 19 or cartridge 29. For household use, container 10 preferably is dimensioned so that, with the container half to three-quarters filled, a standard carbon dioxide bulb used for producing carbonated water will result in the production of a pressure of from 125 to 225 pounds per square inch in the solution. For industrial uses, container 10 may be made larger and two or more carbon dioxide bulbs used to place the solution under the desired pressure.

After the solution has been charged with the carbon dioxide resulting in the production of a pressure in container 10 of at least 40 pounds per square inch gauge, preferably within the range of 125 to 225 pounds per square inch gauge, the handle 16 of the needle valve may be moved to effect partial opening of the needle valve. The pressure within the container causes the solution to flow through the discharge tube 11 into and through the discharge orifice 15. The solution flashes into the atmosphere due to the release of the carbon dioxide and is thereby subdivided into small droplets of the material to be dispersed in the solvent trichlor monofluor methane. Upon evaporation of the solvent content of the droplets which takes place rapidly due to the relatively high vapor pressure of this solvent, the solute is further subdivided, producing a stable aerosol.

Container 10 may be refilled whenever desired, the solvent being supplied from a bottle or can containing it at a normal pressure.

The process and apparatus herein described are particularly applicable to the production of aerosols of DDT and pyrethrins to combat flies, mosquitoes and other insect pests.

It will be noted the use of trichlor monofluor methane as the solvent or carrier for the material to be dispersed eliminates the dangers and hazards attendant upon the storage and transportation of liquefied gases heretofore employed in the production of aerosols, since trichlor monofluor methane can be stored and transported without danger at a normal pressure. Furthermore, trichlor monofluor methane combines, to an exceptional extent, the desirable properties required for the production of aerosols; namely, it is not inflammable, has a slight but agreeable odor, is of high density, is a good solvent for commonly used parasiticides, disinfectants and fumigants, has just the proper solubility characteristic for carbon dioxide permitting use of this gas for effecting dispersion of the solvent or carrier and the contained material to be dispersed, is remarkably non-toxic to human beings, is non-irritating and is of relatively high volatility at room temperatures. Moreover, the apparatus of this invention employs readily available carbon dioxide bulbs or cartridges such as the well known Sparklets for placing the solution under superatmospheric pressure when it is desired to produce the aerosol, and hence eliminates the need for special charging devices for this purpose.

The term "solution" is used in the specification and claims in a broad sense and is intended to include not only true solutions, but also colloidal solutions, dispersions and mixtures in which the material to be dispersed in the form of an aerosol is distributed in trichlor monofluor methane alone or with added materials such as methylene chloride.

As many changes could be made in the above process and apparatus and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of producing an aerosol which comprises storing a solution of the material to be dispersed in trichlor monofluor methane under a pressure not greatly differing from the vapor pressure of trichlor monofluor methane, storing said solution in an air tight container at approximately atmospheric pressure, dissolving liquefied carbon dioxide in said solution to produce a solution under a pressure of from 125 to 225 pounds per square inch gauge, and releasing the pressure to disperse the solution into the atmosphere in finely divided form, whereby the solute is dispersed into the atmosphere to form the aerosol.

2. A liquid solution of a parasiticide in trichlor monofluor methane and carbon dioxide under pressure.

3. A liquid solution of dichloro diphenyl trichlorethane in trichlor monofluor methane and carbon dioxide under pressure.

4. A liquid solution of dichloro diphenyl tri-

chlorethane and pyrethrin in trichlor monofluor methane and carbon dioxide under pressure.

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