

United States Patent

Gauthier et al.

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[54] ATOMIZER

[72] Inventors: William D. Gauthier, Sylvania Township; Ernest G. Lierke, Toledo, both of Ohio

[73] Assignee: Champion Spark Plug Company, Toledo, Ohio

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239/346, 239/347, 239/349, 239/350

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[58] Field of Search..... 239/342, 350, 71, 74, 346,
239/347, 348, 349, 127, 433; 222/383, 384, 385;
128/186, 194, 196, 198, 201

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Primary Examiner—M. Henson Wood, Jr.

Assistant Examiner—Edwin D. Grant

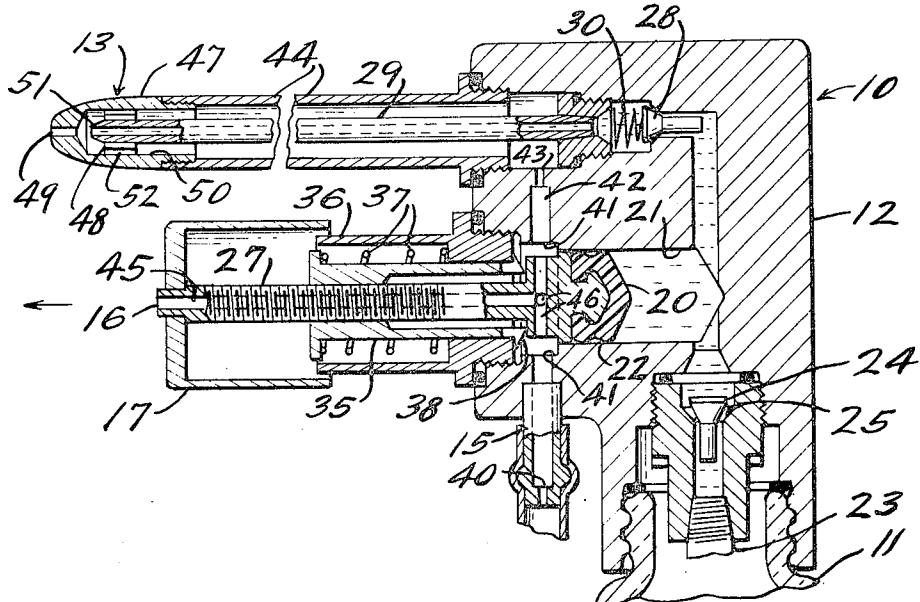
Attorney—Owen & Owen

[57]

ABSTRACT

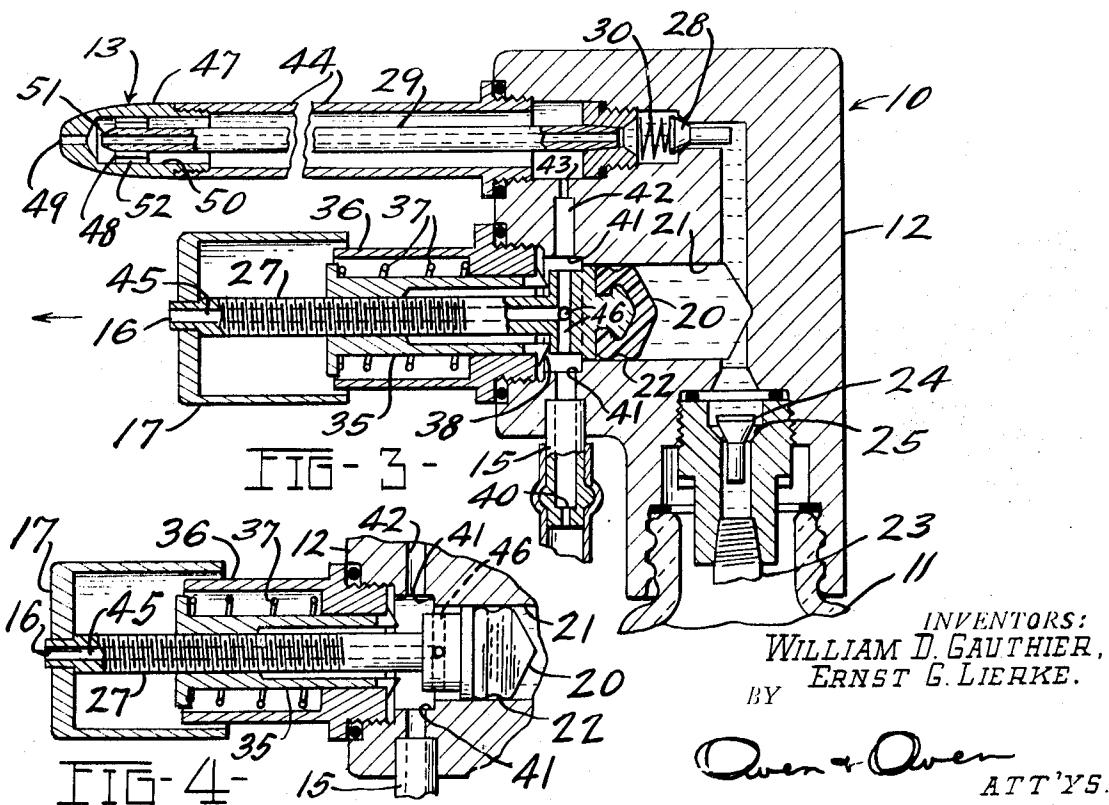
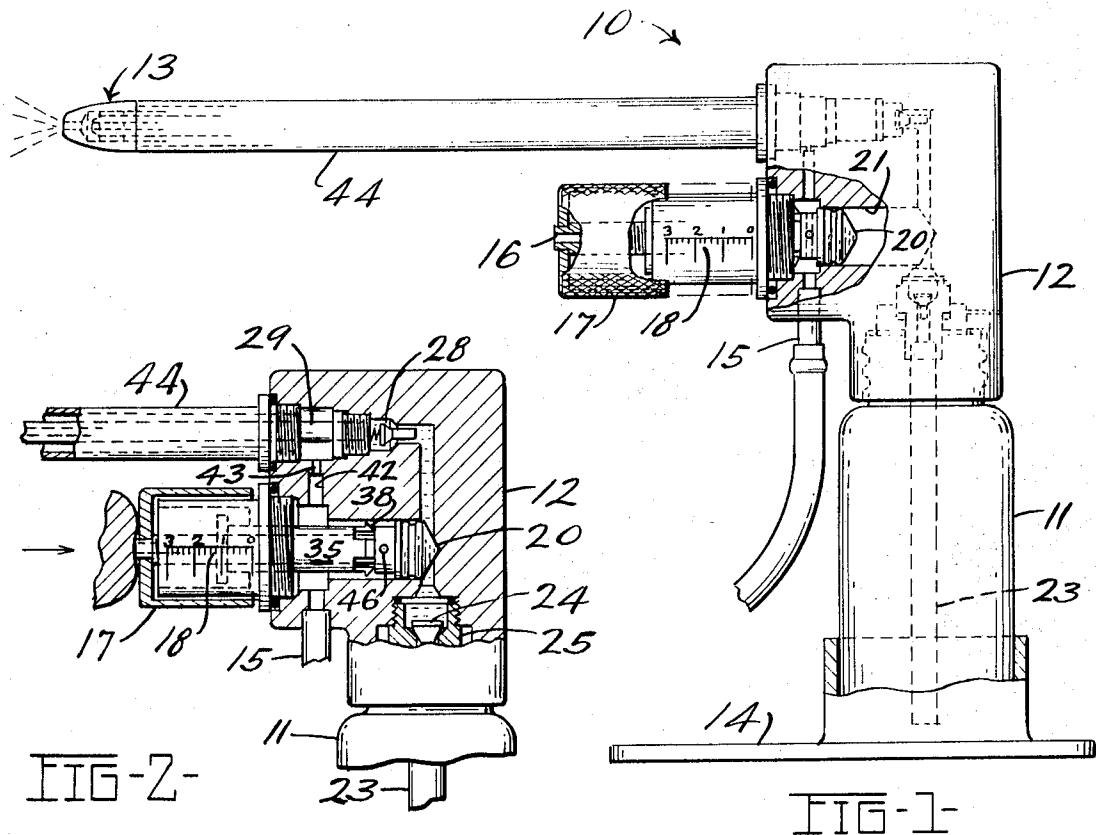
Apparatus for measuring and atomizing a predetermined quantity of liquid. Compressed atomizing gas is supplied through a passage to an atomizing nozzle. A finger actuated plunger moves a piston pump for measuring and delivering the predetermined quantity of liquid from a reservoir to the nozzle. The displacement of the piston is varied to change the predetermined quantity of liquid delivered to the nozzle. An optional gas pressure relief passage may extend from the gas passage through the plunger for reducing gas flow to the nozzle when the apparatus is not in use. When a finger is placed on the plunger to operate the pump, gas flow to the nozzle is reestablished.

6 Claims, 4 Drawing Figures



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3,647,143



ATOMIZER

BACKGROUND OF THE INVENTION

This invention relates to atomizers and more particularly to atomizers which measure and atomize a predetermined quantity of a liquid such as a medicament.

Jet-type atomizers are commonly used by the medical profession for treating certain afflictions and diseases by the introduction of material in an atomized condition into the patient's upper airways. For example, it has been found that coughs may be effectively reduced by increasing the moisture and pliability of the mucous membranes in the respiratory tract. Similarly, bronchial asthma and other bronchial diseases are commonly treated by introducing an atomized medicament as far as possible into the throat.

At times, it is desirable to meter the dose of atomized material. This is particularly true where the material is extremely expensive, highly concentrated, or has harmful side affects, such as narcotics, anesthetics or vaccines. To date, the only suitable devices for atomizing measured doses have been aerosol spray cans including metering valves, such as are shown in U.S. Pat. Nos. 3,187,748 and 3,464,596. Aerosol spray cans, however, have several disadvantages. Once empty, the aerosol can must be disposed of, since it is not refillable. This results in an unnecessary expense since metering valves for aerosol spray cans are relatively complicated. Furthermore, it is not possible to change the material composition or concentration in aerosol cans. The quantity of atomization from an aerosol can cannot be adjusted for a specific treatment and the propellant used may have an adverse affect on the treatment. Aerosol devices, as well as conventional jet atomizers, also have the limitation in that they are inoperative with viscous solutions and suspensions.

SUMMARY OF THE INVENTION

According to the instant invention, apparatus is provided for measuring and atomizing a predetermined quantity of a medicament, or other liquid. The atomizing apparatus is provided with a conventional jet-type atomizing nozzle. A suitable external source of compressed air or other gas is connected to provide atomizing gas to the nozzle. The liquid to be atomized is supplied to the nozzle from a suitable reservoir by means of a piston-type pump. Liquid from the reservoir is atomized when a person using the apparatus operates a finger actuated plunger to pump liquid to the nozzle. The plunger threadably engages a collar which limits movement of the piston. By rotating the plunger, the position of the collar on the plunger is changed and, hence, the displacement of the piston is changed to change the quantity of liquid atomized. An air relief passage is formed in the plunger. When the atomizing apparatus is not in use, the compressed airflows through the air relief passage, reducing airflow to the atomizing nozzle thereby reducing patient discomfort. When the apparatus is in use and the user places a finger on the plunger, the air relief passage is sealed to reestablish airflow to the nozzle. The air relief passage may be eliminated when control over airflow to the nozzle is not required. Or, as an alternative, a cutoff valve can be provided in the gas source.

Accordingly, it is a primary object of the invention to provide an improved atomizer.

It is another object of the invention to provide apparatus for atomizing viscous liquids.

Still another object of the invention is to provide apparatus for measuring and atomizing predetermined quantities of medicaments and other liquids.

Another object of the invention is to provide apparatus for measuring and atomizing controllable quantities of medicaments and other liquids.

Other objects and advantages of the invention will become apparent from the following detailed description, with reference being made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of an improved atomizer constructed in accordance to the instant invention;

5 FIG. 2 is a side elevational view, in fragmentary, showing the atomizer metering pump in an actuated position;

FIG. 3 is an enlarged side elevational view, in section, of the atomizer metering pump; and

10 FIG. 4 is an enlarged fragmentary cross-sectional view of a portion of the atomizer metering pump with the displacement of the pump piston reduced.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, atomizing apparatus 10 is shown according to the instant invention. The apparatus 10 generally includes a bottle or reservoir 11 for holding a liquid to be atomized, a pump body 12 and an atomizing nozzle 13. A suitable base 14 is attached to the bottle 11 for holding the apparatus 10 upright, when not in use. A source of compressed gas (not shown) is connected to a tube 15 on the pump body 12 for supplying atomizing air to the nozzle 13. When the atomizer is not in use, the compressed air escapes through an air bleed opening 16 in the center of a knurled cap 17. The atomizing apparatus 10 is used by filling the bottle 11 with a liquid or medicament to be atomized, aiming the nozzle 13 at an area in which the atomized liquid is to be applied, placing a finger over the air relief opening 16 to establish airflow to the nozzle 13, and squeezing the cap 17 to pump a predetermined quantity of liquid to the nozzle 13. The quantity of liquid atomized is controlled by turning the knurled cap 17, as is discussed in greater detail below. Calibration markings 18 are provided for indicating the amount of liquid atomized during each stroke of the pump.

35 Referring now to FIGS. 2-4, the atomizer pump is shown in detail. The pump generally comprises a piston 20 which is mounted to slide in a cylinder 21. The piston 20 is provided with a disposable elastomeric cap 22 for providing a suitable seal between the sliding piston 20 and the walls of the cylinder 21. When the piston 20 is moved to its unactuated or open position, as shown in FIG. 3, liquid is drawn from the bottle 11 up a dip tube 23, past a check valve 24, and into the cylinder 21. When movement of the piston 20 is stopped, the check valve 24 is urged into a closed position in engagement with a valve seat member 25 by gravity or a suitable spring (not shown). The valve seat member 25 threadably engages the body 12 and is removable for cleaning the valve seat member 25, the valve 24, and the body 12.

50 When the knurled cap 17 is moved towards the body 12, a plunger 27 moves the piston 20 in the cylinder 21 to force liquid from the cylinder 21 past a check valve 28, and down a semirigid tube 29 to the nozzle 13, as shown in FIG. 2. When movement of the piston 20 is terminated, a spring 30 urges the valve 28 into seating engagement with the pump body 12.

55 The plunger 27 which connects the knurled cap 17 to the piston 20 is threadably mounted in a collar 35. The collar 35 is mounted to slide coaxially in a sleeve 36 which is threaded into the body 12. Thus, the various pump parts are readily removed from the body 12 for cleaning. A spiral spring 37 is positioned coaxially with and between the collar 35 and the sleeve 36 for urging the sleeve 36 to a first or unactuated position, as shown in FIGS. 3 and 4. Radially extending flanges 38 on an end of the collar 35 limits the maximum axial movement of the collar 35. The flanges 38 are deflected when the collar 35 is initially inserted in the sleeve 36. When a user squeezes the knurled cap 17 towards the body 12 to operate the pump, the collar 35 moves, along with the plunger 27 and the piston 20, against the force exerted by the spring 37. When the user 60 releases his finger from the cap 17, the spring 37 returns the piston 20, the plunger 27, the collar 35, and the cap 17 back to the unactuated position wherein the flange 38 engages an end of the sleeve 36. It can be seen that the total travel of the piston 20 can be changed by turning the knurled cap 17 to change the relationship between the plunger 27 and the collar 65

35. When the cap 17 is rotated such that the piston 20 moves into the cylinder 21, as shown in FIG. 4, the displacement of the piston 20 is reduced to reduce the amount of liquid delivered to the nozzle 13. The position of the knurled cap 17 with respect to the calibration markings 18 indicates the actual displacement of the piston 20.

When the apparatus 10 is in use, airflows from the tube 15 through an orifice 40, an annular passage 41 extending around the piston 20 and the plunger 27, a passage 42 in the body 12, a second orifice 43, and down an elongated tube 44 to the nozzle 13. The liquid tube 29 is mounted coaxially within the air tube 44. A passage 45 in the plunger 27 and passages 46 in the piston 20 connect the air relief opening 16 to the annular air passage 41 in the body 12. When the apparatus 10 is not in use, airflows from the annular passage 41 through the passages 46 and 45 to the air relief opening 16, where the air escapes to the atmosphere. The only time a full flow of air is maintained to the nozzle 13 is when the air relief opening 16 is closed during use of the apparatus 10. The size of the orifices 40 and 43 and the passages 45 and 46 are selected to give a desired air flow with the air relief opening 16 both opened and closed. It has, for example, been found that a nozzle airflow of 5 to 8 liters per minute will provide sufficient atomizing gas, while a nozzle airflow of 0.2 liters per minute will prevent patient discomfort.

Referring now to FIG. 3, the nozzle 13 is shown in detail. The nozzle 13 includes a cap 47 and a fluid tip 48. The cap 47 is attached to an end of the tube 44 which projects from the body 12. A discharge opening 49 is provided in an end of the cap 47 for emitting the atomized liquid. The fluid tip 48 is threaded into an opening 50 in the cap 47 such that a fluid discharge opening 51 is spaced from and directed towards the cap discharge opening 49. A number of air passages 52 are spaced about the periphery of the fluid tip 48 to permit airflow from the tube 44 to the discharge opening 49. Thus, an atomized spray is emitted from the discharge opening 49 when air and liquid are supplied to the tubes 44 and 29, respectively. The tubes 29 and 44 are preferably semirigid so that they can be bent into shapes which facilitate in applying the atomized material.

Although the present invention has been described in some detail, by way of illustration and example for purposes of clarity and understanding, it will be appreciated that certain changes and modifications may be made within the spirit and the scope of the claimed invention.

We claim:

1. Apparatus for measuring and atomizing a predetermined quantity of liquid comprising, in combination, an atomizer nozzle having a gas inlet, a liquid inlet and an outlet for discharging atomized liquid, means for supplying a flow of compressed gas to said gas inlet in said nozzle for atomizing the liquid, a reservoir for holding a supply of liquid, and pump means for measuring and delivering the predetermined quantity of liquid from said reservoir to said liquid inlet in said nozzle, said pump means including a piston, a cylinder, said piston engaging said cylinder for sliding between first and second

positions, liquid passages connecting said cylinder to said reservoir and to said liquid inlet in said nozzle, check valve means in said liquid passages for preventing liquid flow from said nozzle to said cylinder and from said cylinder to said reservoir, and spring means for urging said piston to said first position for causing the predetermined quantity of liquid to flow from said reservoir to said cylinder whereby, when said piston is moved from said first position to said second position, the predetermined quantity of liquid is forced from said cylinder to said nozzle for atomizing.

5 2. Apparatus for measuring and atomizing a predetermined quantity of liquid, as defined in claim 1, and including adjustment means for changing the displacement of said piston to control the predetermined quantity of liquid delivered by said pump means.

15 3. Apparatus for measuring and atomizing a predetermined quantity of liquid, as defined in claim 1, and including gas pressure relief means for reducing gas flow to said gas inlet in said nozzle when the apparatus is not in use.

20 4. Apparatus for measuring and atomizing a predetermined quantity of liquid comprising, in combination, an atomizer nozzle, means for supplying a flow of compressed gas to said nozzle for atomizing the liquid, a reservoir for holding the liquid, pump means for measuring and delivering the predetermined quantity of liquid from said reservoir to said nozzle, said pump means including a piston and a cylinder, said piston engaging said cylinder for sliding between first and second positions, liquid passages connecting said cylinder to said reservoir and to said nozzle, check valve means in said liquid passages for preventing liquid flow from said nozzle to said cylinder and from said cylinder to said reservoir, spring means for urging said piston to said first position for causing the predetermined quantity of liquid to flow from said reservoir to said cylinder whereby, when said piston is moved from said first position to said second position, the predetermined quantity of liquid is forced from said cylinder to said nozzle for atomizing, a finger operated plunger for moving said piston, and gas pressure relief means for reducing gas flow to said nozzle when the apparatus is not in use, said gas pressure relief means including a gas passage extending between said plunger and said gas supply means such that said gas passage is normally vented to the atmosphere and is closed when a finger is placed on said plunger to move said piston.

25 5. Apparatus for measuring and atomizing a predetermined quantity of liquid, as defined in claim 4, and including adjustment means for changing the displacement of said piston to change the predetermined quantity of liquid delivered by said pump means.

30 6. Apparatus for measuring and atomizing a predetermined quantity of liquid, as defined in claim 5, wherein said adjustment means includes a collar, said collar threadably engaging said plunger, said collar having a stop for determining said first position, and wherein the displacement of said piston is changed by turning said plunger to change the position of said collar on said plunger.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,647,143 Dated March 7, 1972

Inventor(s) William D. Gauthier and Ernst G. Lierke

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The spelling of the co-inventor's name should be corrected to read: Ernst G. Lierke.

Signed and sealed this 13th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents