

Sept. 17, 1963

T. J. MAHON
NEBULIZING DISPENSER

3,104,062

Filed May 10, 1960

4 Sheets-Sheet 1

FIG. 1.

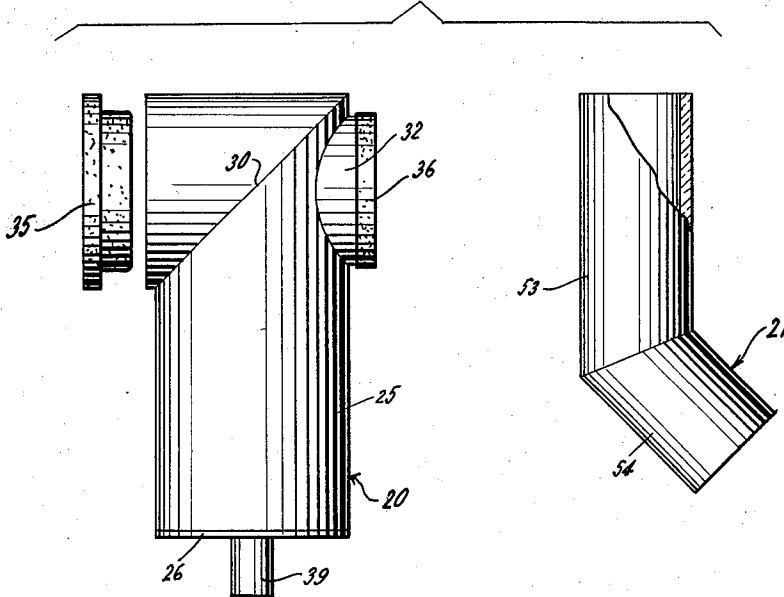


FIG. 2.

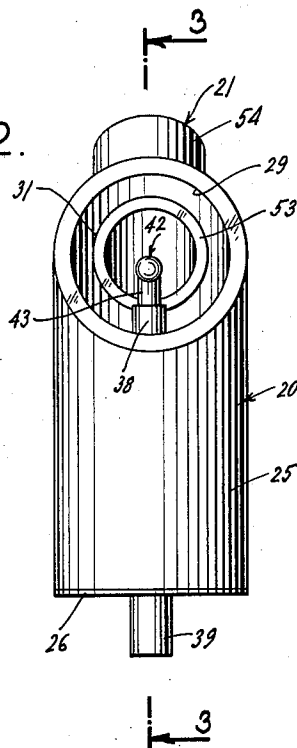
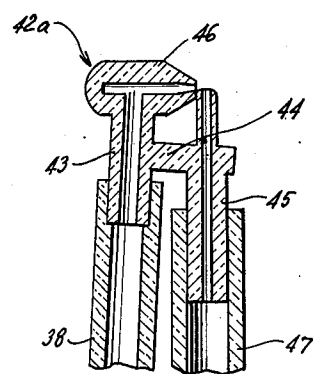


FIG. 4.



Thomas J. Mahon

INVENTOR.

BY Blum, Moscovitz, Friedman,
& Blum
ATTORNEYS

Sept. 17, 1963

T. J. MAHON

3,104,062

NEBULIZING DISPENSER

Filed May 10, 1960

4 Sheets-Sheet 2

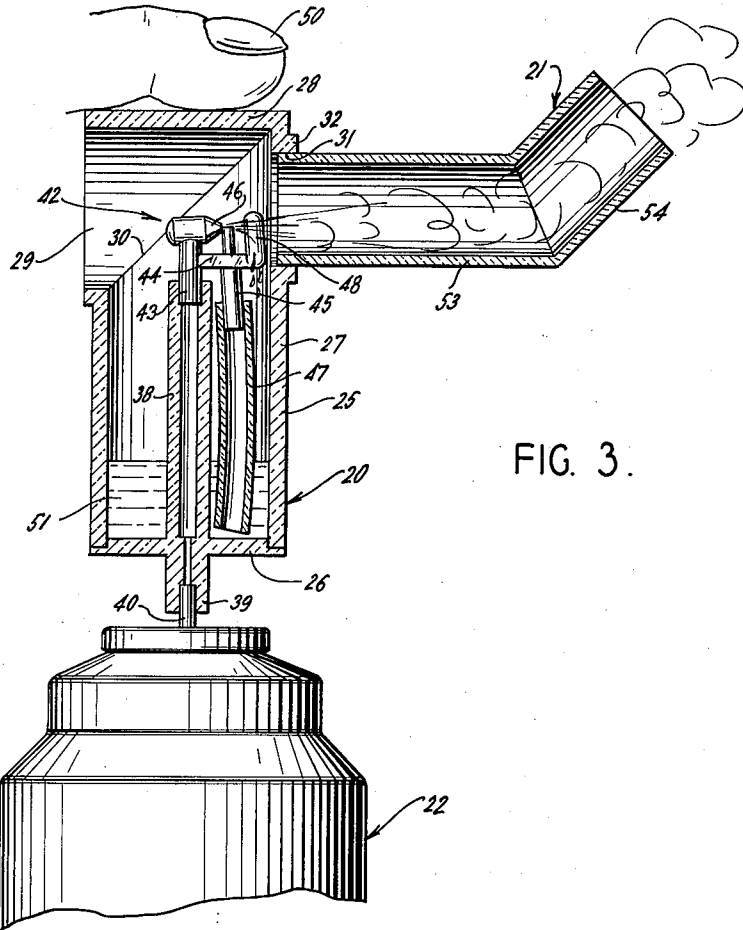


FIG. 3.

FIG. 7.

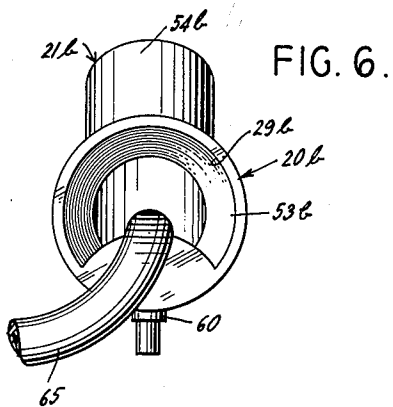
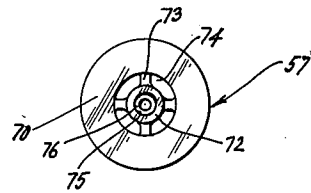


FIG. 6.



Thomas J. Mahon

INVENTOR.

BY Blum, Moscovitz,
Friedman, & Blum
ATTORNEYS

Sept. 17, 1963

T. J. MAHON
NEBULIZING DISPENSER

3,104,062

Filed May 10, 1960

4 Sheets-Sheet 3

FIG. 5.

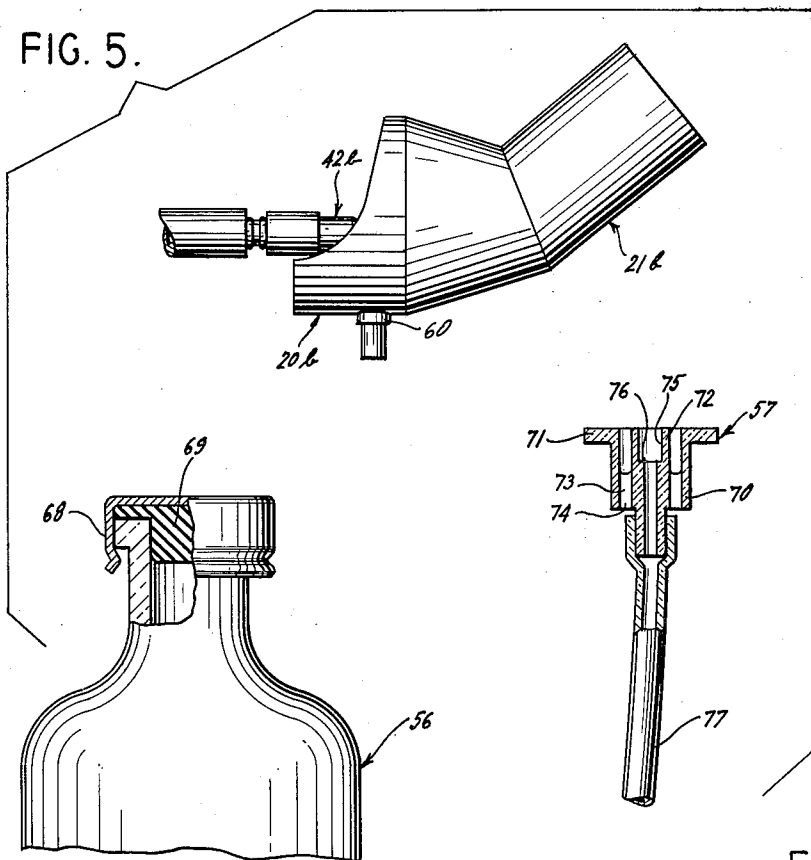


FIG. 10.

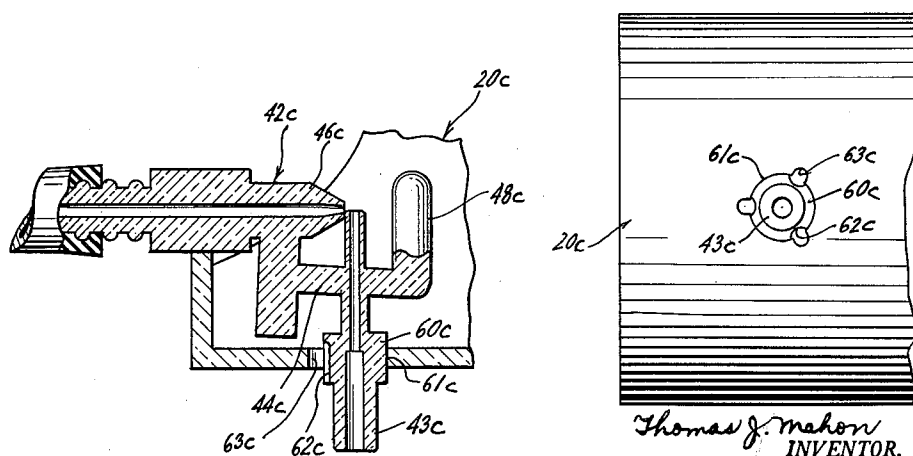


FIG. 9.

Thomas J. Mahon
INVENTOR.
BY Blum, Moscovitz,
Friedman, & Blum
ATTORNEYS

Sept. 17, 1963

T. J. MAHON
NEBULIZING DISPENSER

3,104,062

Filed May 10, 1960

4 Sheets-Sheet 4

FIG. 8.

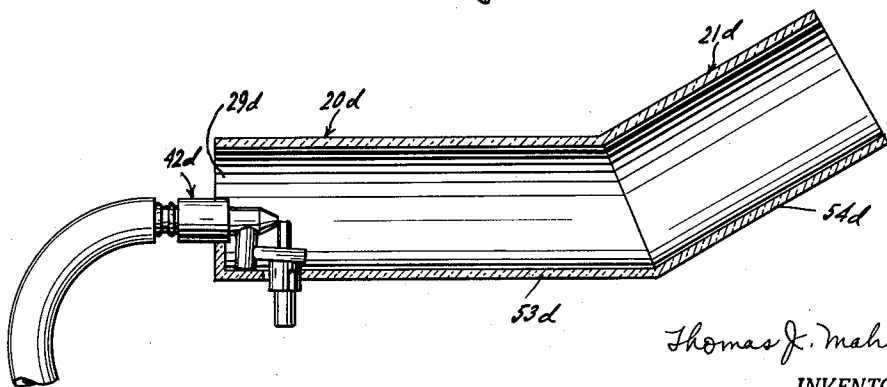
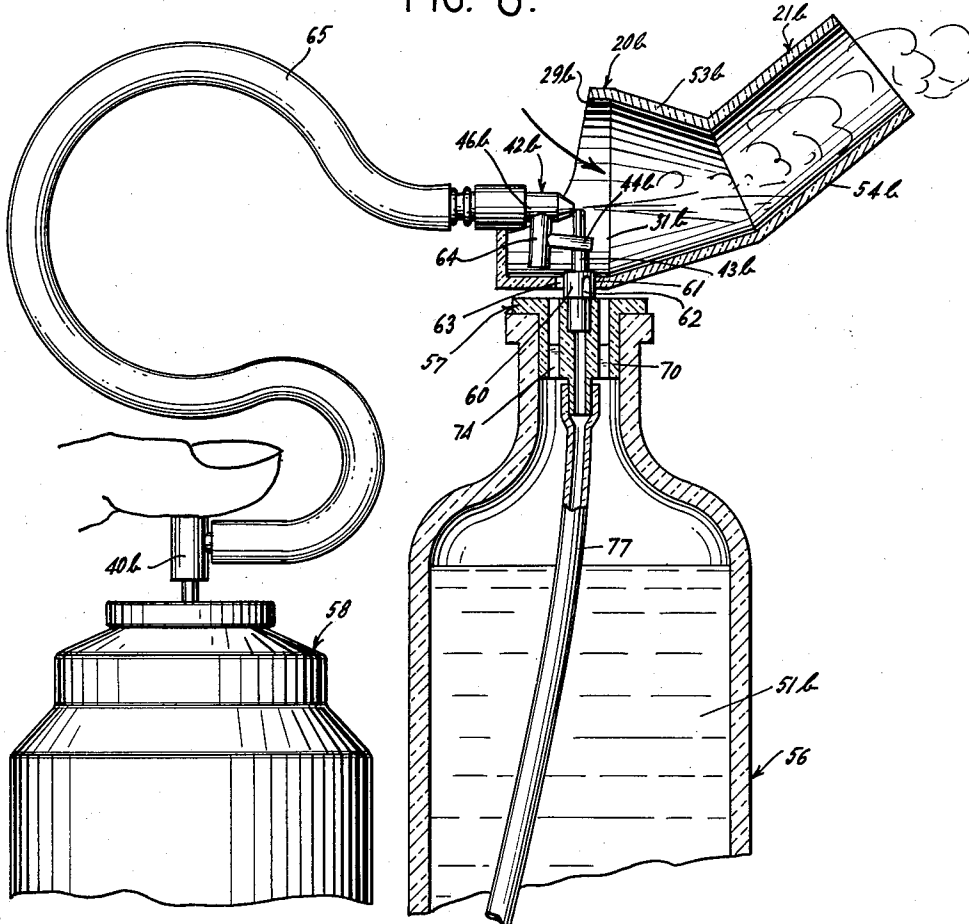


FIG. II.

Thomas J. Mahon
INVENTOR.

BY Blum, Moscovitz,
Friedman & Blum

1

2

3,104,062

NEBULIZING DISPENSER

Thomas J. Mahon, Englewood, N.J., assignor to Thomas J. Mahon, Inc., Englewood Cliffs, N.J., a corporation of New Jersey

Filed May 10, 1960, Ser. No. 28,155

5 Claims. (Cl. 239—338)

This invention relates generally to devices for dispensing fluent material, and is especially concerned with the dispensing of medicines in nebulized condition.

While the device of the instant invention has been primarily developed and employed for use in the medical field, and will be described and illustrated hereinafter with particular reference thereto, it is appreciated that many advantageous features of the instant invention have utility in many diverse fields, all of which are intended to be comprehended herein.

As is well known in the medical profession, certain afflictions and diseases are preferably treated by the introduction of medicine, which may originally be in liquid state, into the oral cavity and passages in a nebulized condition. 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. Such detergency not only contributes to the effective reduction of coughing, but also aids in liquefaction of bronchopulmonary secretions. Toward these ends, treatment by inhalation has proved quite effective. Unlike the average particles of two microns required in inhalation for broncho-dilation, as in asthma, it is preferable in nebulizing medicinal detergent aerosols that the particles be of a broader range in size for deposition, rather than absorption, in the upper bronchi, without too much of a wetness upon the tongue or in the throat.

It is one object of the present invention to provide a nebulizing device of the character aforesaid which is advantageously well adapted to limit the size of particles nebulized and received by the patient. For example, the device of the instant invention prevents the application of excessively large particles or droplets to the oral cavity, and specifically provides for the return of such droplets to the reservoir of liquid supply.

It is another object of the present invention to provide a dispensing device of the type described which is susceptible of easy operation by the patient, without professional or other outside help. Such a device may be used at home, during travel, or wherever and whenever desired, without the need for any special skill.

The invention further contemplates the provision of a device of the type described which is adapted for use with a conventional pressurized container, such as the well known and readily available aerosol bomb, but without the dip tube therein for removing the upper, gaseous phase in nebulizing medicinal inhalants.

It is another object of the present invention to provide a medicine dispensing device having the advantageous characteristics mentioned in the preceding paragraphs, which may be small in size and light in weight, as well as clean and safe for portability on the person of the user.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

In the drawings:

FIG. 1 is an elevational view showing a liquid or non-use condition, partly exploded and partly in section, for clarity of understanding;

FIG. 2 is a rear elevational view showing the dispensing device of FIG. 1 in condition for use;

FIG. 3 is a longitudinal sectional view showing the device of FIG. 2 in its operative condition, and partially illustrating association with the device of a propellant container or aerosol bomb;

FIG. 4 is a partial sectional view showing a slightly modified atomizing assembly constructed in accordance with the teachings of the present invention;

FIG. 5 is an elevational view, partly in section, with certain parts separated from each other, showing a modified liquid dispensing device constructed according to the present invention;

FIG. 6 is a rear end view of one of the parts of FIG. 5;

FIG. 7 is a top plan view of another of the parts of FIG. 5;

FIG. 8 is a longitudinal sectional view showing the dispensing device of FIGS. 5-7 in operative relation, and illustrating a propellant container associated therewith;

FIG. 9 is a partial, longitudinal sectional view showing a slightly modified atomizing assembly for use with the dispenser of FIGS. 5-8;

FIG. 10 is an enlarged, bottom plan view of the structure of FIG. 9; and

FIG. 11 is an additional slightly modified construction of liquid dispensing device according to the present invention.

Referring now more particularly to the drawings, and specifically to FIGS. 1-3 thereof, the liquid dispensing device illustrated herein includes an atomizing chamber or container, generally designated 20, and an inhaling conduit, generally designated 21. In FIG. 3, there is also shown a pressurized container 22 for propellant gas, a so-called aerosol bomb.

The atomizing chamber 20 is defined by a vertically elongate container 25, which may be of a generally cylindrical configuration, having a generally circular bottom wall 26 and a generally cylindrical, peripheral side wall 27 extending about and upward from the bottom wall. The bottom wall 26 is formed separate from the side wall 27 and cemented to the latter, for purposes appearing presently. The upper end of container 25 is closed by a top wall 28. In the upper region of the peripheral wall 27, on the rear side thereof, is provided an opening 29 which forms an inlet opening for carrier air, as will appear presently. The rear opening 29 may be of generally circular configuration; and if desired, the upper wall 28 of the container may be of a generally cylindrical configuration bounding the rear side opening 29 and intersecting with the cylindrical wall 27 along a forwardly and upwardly extending plane 30.

On the forward side of the cylindrical wall 27, in the upper region thereof and in substantial alignment with the rear opening 29, there is formed a front outlet opening 31, see FIG. 3. The outlet opening 31 may also be generally circular, of a size smaller than the inlet opening 29, and defined within a generally cylindrical forward extension 32 on the front side of the container 25 and opening rearward into the container.

As shown in FIG. 1, the rear inlet opening 29 and the front outlet opening 31 may be closed by the respective insertion therein of closure elements or plugs 35 and 36. In FIG. 3 the plugs 35 and 36 have been removed.

Interiorly of and preferably concentric within the container 25 is a generally vertical tube 38. The tube or tubular standard 38 extends integral with and upward

from the bottom wall 26 and terminates in the upper region of the container 25 adjacent to the lower regions of the inlet and outlet openings 29 and 31. In addition, an external nipple or tube 39 depends integrally from the underside of the bottom wall 26 and opens upward through the latter into the lower interior region of the tubular member or standard 38. The depending tube or nipple 39 is adapted to receive the discharge valve stem 40 of the aerosol bomb 22.

Mounted on the upper end of the tubular standard 38, within the upper region of the container 25, between the inlet and outlet openings 29 and 31, is an atomizing assembly, generally designated 42. The atomizing assembly includes a generally vertical propellant receiving tube 43 having its lower end inserted into the upper end of the tubular standard 38 to be mounted thereon and in fluid communication therewith. Fixed on the upper end of and in communication with the tube 43 is a discharge head or nozzle 46. A connection piece or cross member 44 is provided on the propellant tube 43, extending forwardly therefrom at a location spaced below the upper end of the propellant tube. At a location intermediate the forward and rearward ends of the connection piece 44 is carried a generally vertically extending open ended tube or nipple 45. Depending from the lower end of the nipple or tube 45 is a dip tube or conduit 47. The dip tube 47 terminates at its lower end proximate to the bottom wall 26 of the container 25. An upstanding bulbous member or baffle 48 is carried on the front end of the connection piece 44 and extends upward spaced in front of the propellant tube 43 and discharge head 46.

In operation, it will be appreciated that opening of the aerosol bomb valve 40, as may be effected by depression of an operator's finger 50, causes the escape of propellant gas under pressure through the nipple 39, tubular member 38, upward through the upper end of the propellant tube 43, and forward from the discharge head or nozzle 46. As the upper or discharge end of the nipple or tube 45 is located proximate to and at an angle with respect to the generally horizontally forwardly opening end of the discharge head or nozzle 46, suction will be created in the nipple. This suction or reduced pressure is communicated downward through the tube 45, and through the dip tube 47 to the lower end thereof. As the dip tube depends into a quantity of liquid 51 contained in the lower region of the container 25, the liquid is aspirated or sucked up for discharge from the upper end of tube 45 and atomization by propellant from the nozzle 46 in the upper region of the container 25.

The inhalation tube 21 includes a generally forwardly and rearwardly extending, tubular receiving portion 53, which may be substantially cylindrical and has its rear end adapted for snug insertion into the outlet opening 31. Extending forwardly and upwardly from the front end of and at an angle with respect to the receiving portion 53 is a tubular discharge portion 54.

In use, carrier air enters the upper region of container 25 through the rear, inlet opening 29, and carries forwardly with it the atomized liquid 51 and propellant into the tubular receiving portion 53 and through the angularly disposed tubular discharge portion 54. The finely atomized particles of liquid will be readily carried by the carrier air for administration to the patient, while heavier particles or droplets of liquid are effectively retained and their application to the patient is prevented. This is accomplished initially by the baffle or bulb 48 and finally by the upward inclination of the tubular discharge portion 54. That is, droplets impinging upon the baffle 48 will be halted thereby and returned by dripping to the quantity of liquid 51 in the lower region of the container 25. Further, due to the angularly upward change in direction of carrier air movement through the inhalation tube 21, as in the discharge portion 44,

the heavier particles or droplets will impinge upon the lower wall of the discharge portion and gravitationally return to the receiving portion 53, rather than be discharged from the inhalation tube.

When use is no longer required, the container 25 may be removed from the aerosol bomb 22, the inhalation tube 21 is removed from the container, and the plugs 35 and 36 replaced in the openings 29 and 31. In this condition, the container and its liquid contents may be safely carried on the person without danger of spilling.

The fabrication of the bottom wall 26 separately from the side wall 25 permits production filling before securement of the bottom wall in position. Thus, with the plugs 35 and 36 in their closing relation, the liquid 51 may be introduced into the container 20, and the bottom wall 26, together with the parts carried thereby, may be cemented in the position shown.

In FIG. 4 is shown an atomizing assembly, generally designated 42a, which is substantially identical to the atomizing assembly 42, except that the upstanding bulb or baffle 48 has been eliminated. This form of atomizing assembly may be employed under certain conditions, as when less droplets are formed, or when the complete elimination of droplets is not essential.

In both of the atomizing assemblies 42 and 42a, it is appreciated that there is fluid communication with both the liquid 51 to be dispensed, and an aspirating and atomizing propellant. While the illustrated arrangements show a tube 43 communicable with gaseous propellant, and the tube 45 communicable with the liquid, it is, of course, appreciated that the tube 43 may be communicable with the liquid and the tube 45 communicable with the propellant, if desired.

In the embodiment of FIGS. 5-8, an atomizing chamber is shown at 20b, and an atomizing assembly 42b is arranged within the chamber. Extending from the atomizing chamber is an inhalation tube 21b. Also shown in FIGS. 5 and 8 are a container 56 for liquid to be dispensed, and a fitting 57 for connecting the atomizing assembly 42b to the container 56. A pressurized container or aerosol bomb 58 is shown in FIG. 8 in operative association with the atomizing assembly 42b, fitting 57 and container 56.

The atomizing chamber 20b may be generally cylindrical and disposed horizontally, having its upper rearward region cut away to define a carrier air inlet opening 29b. The entire forward end of the chamber 20b is open, as at 31b, to provide an outlet opening. The inhalation tube 21b includes a rearward or receiving tube portion 53b which is defined by an integral forward extension of the chamber 20b, and converges forwardly from the open forward end 31b of the atomizing chamber. From the smaller, forward end of the convergent tubular receiving portion 53b, extends a forwardly and upwardly inclined, generally cylindrical tubular discharge portion 54b. Thus, the lower wall region of the receiving tubular portion 53b extends at an angle forwardly and upwardly, and the lower wall region of the discharging tube 54b extends forwardly and upwardly at a greater angle to the horizontal.

The atomizing assembly 42b is mounted in the lower wall region of the atomizing chamber 20b, and includes a generally vertically disposed open ended mounting tube 43b extending through and mounted in the lower wall region of the atomizing chamber. More specifically, the tubular mounting member 43b includes an external enlargement or shoulder 60 intermediate its ends and snugly received in a wall opening 61 in the lower region of the atomizing chamber. The external enlargement or shoulder 60 may be generally cylindrical, and preferably provided with a plurality of circumferentially spaced, generally vertically extending external grooves 62. The lower wall opening 61 of the chamber 20b may be generally circular for snug reception of the shoulder 60, and is preferably provided with a plurality of circumferen-

5

tially spaced, generally semi-circular cut-outs 63. The grooves 62 and cut-outs 63 are arranged in respective facing relation, so that each facing pair of grooves and cut-outs combines to define an opening through the lower region of the atomizing chamber 20b for a purpose appearing presently.

A cross member 44b extends generally rearward from the mounting tube 43b interiorly of the atomizing chamber 20b, and is provided on its rear end with a generally vertical supporting piece 64. The supporting piece 64 carries on its upper end a discharge head or nozzle 46b which extends generally horizontally and opens forwardly at a location just rearward of and proximate to the upper discharge end of the mounting tube 43b. The discharge or nozzle 42b extends rearward through the carrier air inlet 29b and out of the chamber 20b, for connection to a propellant conducting tube or hose 65. The hose 65 is connected between the rearward ends of the nozzle 42b and the outlet valve 40b of the aerosol bomb 58.

The liquid container or bottle 56 preferably is provided with a cap 68 of any suitable reusable construction, and having suitable sealing means 69, such as a rubber stopper or the like. The container or bottle 56 may thus be repeatedly opened and closed, as required for use, and be effectively sealed in its closed condition to prevent contamination, evaporation, and the like.

The fitting 57 may include an externally cylindrical plug or insert 70 for snug insertion into the neck of bottle 56. Also, an external annular flange 71 may be provided on the upper end of the insert or plug 70 to seat on the upper end or mouth of the bottle neck for limiting insertion of the plug and affording ease of removability from the bottle neck. As may be observed in FIGS. 5 and 7, the insertable plug 70 of the fitting 57 is internally hollow or tubular, and may be considered as provided with an internal spider construction, including an internal tube 72 and a plurality of circumferentially spaced, radially extending arms or legs 73. That is, the tube 72 is arranged in spaced relation concentrically within the central opening of the insert 70, and the radial legs 73 extend from the tube to the internal surface of the insert to fix the tube in the insert. The spaces 74 between each adjacent pair of radial legs 73, the tube 72 and the internal surface of the insert 70 combine to define passageways or openings extending longitudinally through the insert. As best seen in FIG. 5, the upper end of the tube 72 is substantially flush or co-terminous with the upper end of the insert 70 and the upper surface of the flange 71, while the lower end of the tube 72 depends beneath the lower end of the insert. Also, the upper interior region of the tube 72 is enlarged, as at 75, to define an annular, upwardly facing internal shoulder 76 in the tube 72.

To complete the fitting 57, a dip tube or hose 77 is provided depending from the lower end of the internal tube 72. That is, the upper end of the hose 77 snugly embraces the lower depending end of the tube 72. In the assembled condition of FIG. 8, it is seen that the hose 77 depends interiorly of the container 56 into the contained liquid 51b.

Operation of the embodiment of FIGS. 5-8 may now be easily understood. It is only necessary to open the aerosol bomb valve 40b, to pass propellant from the discharge nozzle 42b over the upper discharge end of the tube 43b. This serves to aspirate or suck liquid 51b up the hose 77, through the internal fitting tube 72, and through and out of the upper end of the mounting tube 43b. The liquid so aspirated is atomized by the propellant, and in this condition, along with carrier air entering through the inlet opening 29b, passes through and out of the discharge end of the inhalation tube 21b. By reason of the forward and upward inclination of the discharge tube portion 54b, serving to change direction of carrier air flow and presenting its lower wall region to

6

the stream of carrier air, heavier particles or droplets of liquid engage the lower internal wall surface of the discharge tube 54b and prevent discharge from the inhalation tube of the heavier particles and droplets. The droplets retained by the discharge tube portion 54b flow gravitationally rearward to the atomizing chamber; and, the openings 62, 63 there combine to permit dripping of the returned liquid through the lower wall region of the atomizing chamber to the fitting 57. The drippings further pass gravitationally downward through the openings 74 of the fitting 57 and return to the interior of the vessel or container 56.

The embodiment of FIGS. 9 and 10 shows an atomizing assembly 42c which may be substantially identical to the atomizing assembly 42b, except for the provision of an upstanding baffle or bulb 48c mounted on a forward extension of the cross member 44c. The baffle or bulb 48c is arranged to extend upward, in spaced relation in front of the upper end of the mounting tube 43c, and the forward end of the discharge head 46c. The mounting arrangement and drip hole construction provided for the atomizing assembly 42b in the chamber 20b is substantially identical to that shown in FIGS. 9 and 10. Thus, the lower wall region of the atomizing chamber 20c is provided with a generally circular through opening 61c having, at circumferentially spaced locations, a plurality of generally semi-circular cut-outs 63. The enlarged shoulder or collar 60c of the mounting tube 43c fits snugly in the opening 61c, and is provided with a plurality of external grooves 62c respectively facing toward the cutouts 63c and combining therewith to define a plurality of through drip openings.

A further embodiment of the instant invention is shown in FIG. 11, wherein an atomizing chamber 20d carries internally thereof an atomizing assembly 42d, and an inhalation tube 21d extends from the atomizing chamber. More specifically, the atomizing chamber may be of a generally horizontally disposed cylindrical tube having its rear end open at 29d to define a carrier air inlet. Further, the inhalation tube 21d may be considered as including a generally horizontally disposed, cylindrical receiving tube portion 53d, which is an integral forward extension of the atomizing chamber 20d. The inhalation tube also includes a forwardly inclined discharge portion 54d extending forward from the forward end of the receiving portion 53d. The structure of FIG. 11 may be substituted for the corresponding structure of FIGS. 5-8, and operation is substantially the same as that described hereinbefore. That is, carrier air enters through the rear end opening 29d and carries forwardly the atomized liquid and propellant. By reason of the upward inclination of the discharge portion 54d, heavier particles or droplets of liquid are prevented from passing forward or outward from the inhalation tube, and return to the atomization chamber for drip return to a liquid container or vessel.

From the foregoing, it is seen that the present invention provides a liquid dispenser which fully accomplishes its intended objects and is well adapted to meet practical conditions of manufacture and use.

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

What is claimed is:

1. In a nebulizing dispenser, an atomizing chamber having an air-inlet opening, an atomizing assembly located within said chamber and adapted for communication with a liquid to be dispensed and a propellant to atomize the liquid, said atomizing assembly being arranged to discharge in general alignment with and away from said air-inlet opening, and an angulate inhaling conduit extending from said chamber for inhaling atom-

ized liquid and air from said chamber, said inhaling conduit extending from said chamber in alignment with said air-inlet opening and atomizing assembly for receiving discharge from the latter and having its distal region remote from said chamber extending angulately upward, said inhaling conduit having a minimum diameter substantially less than that of said air-inlet opening, said atomizing assembly comprising a liquid suction tube depending through the bottom wall of said atomizing chamber, said chamber being provided in its lower region with a downwardly opening drip hole, a fitting engaged on the lower end of said suction tube beneath said chamber and engageable with the neck of a bottle, and a dip tube connected to said fitting in fluid communication with said suction tube and having its lower end depending for fluid communication with the contents of a bottle, said fitting being provided with a through drip opening below said drip hole for receiving drippings from the latter and returning drippings to said bottle.

2. In a nebulizing dispenser, an atomizing chamber 20 having an air-inlet opening on one side for carrier air, an atomizer mounted in said chamber and adapted for communication with a liquid to be dispensed and a propellant to aspirate and atomize the liquid in said chamber, said atomizer being arranged to discharge in general alignment with and away from said air-inlet opening, and an inhaling conduit extending outward from and opening through the opposite side of said atomizing chamber for conducting from said chamber the atomized liquid, propellant and carrier air, said inhaling conduit extending 30 from said chamber in alignment with said air-inlet opening and atomizer for receiving discharge from the latter and including an upwardly angulate outer end portion to prevent the flow therethrough of liquid droplets, said inhaling conduit having a minimum diameter substantially less than that of said air-inlet opening, said atomizer com-

prising a liquid suction tube depending through the bottom wall of said atomizing chamber, said chamber being provided in its lower region with a drip hole, a fitting on the lower end of said suction tube and engageable with the neck of a bottle, and a dip tube connected to said fitting in fluid communication with said suction tube and having its lower end depending for communication with the contents of the bottle, said fitting being provided with a through drop opening below said drip hole for receiving drippings from the latter and returning the drippings to said bottle.

3. A nebulizing dispenser according to claim 2, said fitting comprising a plug engageable in a bottle neck and having a through central opening adapted to receive the lower end of said suction tube.

4. A nebulizing dispenser according to claim 2, said inhaling conduit being outwardly convergent from said chamber to said outer end portion to provide Venturi action.

5. A nebulizing dispenser according to claim 2, said drip hole being defined by facing complementary cut-outs in said suction tube and the bottom wall of said chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

2,181,421	Fahr et al.	Nov. 28, 1939
2,202,701	Lehmann	May 28, 1940
2,245,872	Pitts	June 17, 1941
2,421,359	Sutherland	May 27, 1947
2,586,845	McKinnon	Feb. 26, 1952
2,785,923	Hickman	Mar. 19, 1957
2,869,188	Cameto	Jan. 20, 1959
2,906,463	Curry	Sept. 29, 1959
2,951,644	Mahon et al.	Sept. 6, 1960