NON-SPITTING LIQUID DISPENSING DEVICE

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References Cited
UNITED STATES PATENTS

3,109,546 11/1963 Baruh ....................... 222/453 X
3,415,425 12/1968 Knight et al. .............. 222/387 X
3,666,150 5/1972 Lilgeholm .................. 222/453

ABSTRACT
A device for dispensing a spray of fine droplets of liquid in gas. The device has a dispenser body, with an aspirating nozzle opening out of the body and having a central through passage and lateral passages opening into the through passage. The dispenser body also has a supply chamber therein to which the lateral passages are connected. A source of liquid to be dispensed is operatively associated with the dispenser body and the dispenser body has a valved product flow path therethrough from the source of liquid to the supply chamber. A source of gas under pressure is also operatively associated with the body and the body has a branched compressed gas flow path therethrough from the source of gas under pressure to the central through passage of the nozzle and to the supply chamber.

5 Claims, 4 Drawing Figures
NON-SPIPING LIQUID DISPENSING DEVICE

BACKGROUND AND PRIOR ART

For many years, most of the aerosol dispensers have been the type in which a propellant is compressed in a valve container along with the product to be dispensed, so that when the valve is opened, the pressure of the propellant forces the product, mixed with the propellant, through the valve and out through a nozzle means, and because of the high pressure of the propellant, the mixed product and propellant emerge from the nozzle in spray form. Because of the high pressure, the start of flow of the mixed propellant and product is almost instantaneous and little or no trouble is experienced because of larger drops of liquid first being ejected followed by a fine spray. Such a difficulty will hereinafter be referred to as "spitting."

In the last few years, there has been developed a type of aerosol dispenser in which the propellant is stored in the dispensing apparatus separately from the product to be dispensed, the propellant and product being mixed only upon being actually dispensed. This has enabled the dispensing by means of aerosol dispensers, of products which are normally incompatible with the propellants being used when the two are stored together for any length of time. However, this type of dispenser still utilizes a propellant as the means for dispensing and atomizing the product. Occasionally this type of device is subject to spitting.

There has recently been much discussion about the possible damaging effects of the propellants commonly used in such aerosol dispensers, such as from freon gas. Where the products are not used on the human body, such as with paint or insecticide, precautions can be taken by the user so that he does not inhale the dispersed mixture of product and propellant. However, where the product is to be used on the human body or to be ingested into the human body, such as in the case of deodorant which is used directly on the body, or a breath freshener which is sprayed directly into the mouth, there is no way to avoid exposing the user to the damaging effects of the propellant.

This drawback in the aerosol dispensers has led to the recent development of dispensers which use a charge of compressed air to aspirate a product from a separate product container each time the dispenser is actuated. Examples of such dispensers are found in the U.S. Pat. Nos. 3,672,545 and 3,733,010. In these dispensers, since there is no propellant used, but only compressed air, there is no danger to the user from the propellant. These devices therefore have a great potential for use in dispensing such products as medicaments, cosmetic and personal hygiene products and the like where it is desirable that the user not be exposed to the dangers of conventional propellants. However, they are subject to the problem of spitting.

In addition, in U.S. application Ser. No. 496,282, filed Aug. 4, 1974, which is a continuation of Ser. No. 411,267, filed Oct. 31, 1973, now abandoned, there is disclosed a dispenser device in which at the same time as the compressed air is produced by a piston-cylinder means, pressure is also exerted on the liquid product to be dispensed, so that at the time the compressed air is released the liquid product is supplied under pressure.

A similar device is disclosed in U.S. application Ser. No. 411,265, filed Oct. 31, 1973, now U.S. Pat. No. 3,878,973. These devices have made it possible to provide a spray with a droplet size which makes it possible to use these devices for medicaments which are to be inhaled by the user. However, the devices, disclosed in both applications are also subject to the problem of spitting.

OBJECTS AND BRIEF DESCRIPTION OF THE INVENTION

It is an object of the present invention to provide a device for dispensing a spray of liquid in compressed gas in which the problem of spitting is avoided, and the device upon actuation immediately starts to dispense a spray of fine droplets without first ejecting larger droplets of the liquid to be dispensed.

It is a further object of the present invention to provide an arrangement in such a device which can be used with a variety of dispenser devices.

These objects are achieved by providing a dispensing device having a source of gas under pressure and a source of liquid to be dispensed which can be under pressure or not, and a dispensing nozzle, of the Venturi type, which has a central through passage from an annular mixing chamber around the nozzle. The device has a product flow path from the source of liquid under pressure which opens into the mixing chamber, and has a compressed gas flow path from the source of compressed gas which has branches opening into the central through passage of the nozzle and into the mixing chamber. By this arrangement, the liquid to be dispensed is mixed with compressed gas to a certain extent prior to its being fed into the nozzle through the lateral passages, and the ejection of large droplets at the start of the flow of compressed gas and liquid under pressure is avoided.

BRIEF DESCRIPTIONS OF THE DRAWINGS

The invention will now be described in greater detail in the following specification taken in connection with the accompanying drawings, in which:

FIG. 1 is a sectional elevation view of a dispenser according to the present invention with the parts in the rest or non-dispensing positions;

FIG. 2 is a sectional elevation view similar to FIG. 1 with the parts in the dispensing positions;

FIG. 3 is an elevation view, on a reduced scale, of the device of FIGS. 1 and 2; and

FIG. 4 is a sectional elevation view of the alternative form of the source of liquid to be dispensed.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the figures, in a dispenser body 10 is an upwardly open recess 11 having a cross-sectional shape complementary to the cross-sectional shape of a lower body member 31 of a measured dose dispenser which is a source of liquid to be dispensed and which will be described below. The lower body member 31 fits into recess 11 in slidable relationship therewith. A further recess 12 is provided in the bottom of the recess 11 which has a cross-sectional shape complementary to the cross-sectional shape of the hollow stem portion 37 of the measured dose dispenser and which receives the hollow stem portion 37 in a substantially fluid tight fit with the end of the stem portion 37 in the bottom of the recess 12 and with the parts in the rest or non-dispensing positions as seen in FIG. 1, with the lower end of the lower body member 31 spaced above the bottom of the recess 11.
Nozzle means 13 in the form of a nozzle insert 14 opens out of the side of the dispensing body 10. The nozzle insert 14 is positioned in a laterally opening recess 16 in the dispenser body 10 which is shaped to leave an annular mixing chamber 17 around the nozzle insert. The nozzle insert has a Venturi passage 14a therethrough which has lateral passages 14b extending from the mixing chamber into the Venturi passage 14a.

In the specific form of the structure as shown, the recess 16 has a smaller diameter portion at the inner end and a larger diameter portion at the outer end and the nozzle insert 14 has a smaller diameter portion which fits into the smaller diameter portion of the recess but is longer than this portion is deep. The larger diameter portion of the nozzle insert is thus spaced outwardly of the bottom of the larger portion of recess 16 to leave the mixing chamber 17. The dispenser body has a liquid product flow path therethrough in the form of a passage 15 from the recess 12 to the mixing chamber 17 around the nozzle insert 14.

A source of gas under pressure in the form of an air compressing piston cylinder means is provided on the opposite end of the body 10 from the measured dose dispenser, and in the embodiment disclosed comprises a cylinder 18 which extends downwardly from the body 10 and within which a piston 19 is slidable positioned. Gasket 19a seals the piston in its movement into the cylinder 18. A return spring 20 within the cylinder 18 urges the piston 19 out of the cylinder 18. Opening out of the inner end of the cylinder 18 and into the body 10 is a recess 21, and from the recess 21 a compressed air path is provided which has a vertically extending portion 22 and one horizontal branch 23 extending to the central passage of the nozzle insert and a second horizontal branch 24 extending to the mixing chamber 17. The recess 21 and the air path portions comprise a compressed air flow path through the body 10. Within the recess 21 is a compressed air controlling poppet valve member 25 which seats on a seat 26 retained in the recess 21 by a retainer 27 which is positioned in the inner end of the cylinder 18. A valve return spring 28 in the recess 21 holds the poppet valve on the seat 26. An actuating pin 29 extends upwardly from the piston 19. At the inner end of the stroke of the piston 19, it is engaged with the poppet valve member 25 to lift the poppet valve member 25 from the seat 26 sufficiently far to pass compressed air into the recess 21.

The measured dose dispenser in this embodiment is in a form in which it is a source of pressurized liquid. It comprises a piston-cylinder means generally indicated at 30 in which the lower body member 31 is in the form of a piston over which a cylinder 32 is slidable. A gasket 32a in the end of the lower body member 31 seals against the inside surface of the cylinder 32 as the cylinder slides along the piston. The lower body member, 31 is made up of an outer shell 33 within which is positioned an inner body 34. The end of the shell 33 has an aperture 33a therein and on the inside of the shell between the bottom thereof and the end of the inner body 34 is a first annular sealing gasket 35. The inner body 34 has a larger diameter recess 34a in the end toward the bottom of the shell, and has a smaller diameter bore 34b extending from the inner end of the recess 34a to the end of the lower body member which is within the cylinder 32.

Movable mounted within the recess 34a and bore 34b is a metering valve stem generally indicated at 36 which has a solid stem portion within the recess 34a and has the hollow stem portion 37 extending from the solid stem portion out through the first annular sealing gasket 35 and the apertures 33a in the bottom of the shell 33, the outside surface of the hollow stem portion 37 being in sealing relationship with the first annular sealing gasket 35. At the joint between the hollow stem portion 37 and the solid stem portion is a flange 38 which in the rest position of the stem, as shown in FIG. 1, rests on the first annular gasket 35. The cross-sectional shape of the solid stem portion is such that it will move freely into the bore 34b. Around the end of the bore 34b where it opens into the larger diameter recess 34a is a second annular sealing gasket 40 through which the solid portions of the stem can move in sealing relationship therewith when the stem 36 is raised. A spring 39 is positioned between the second annular sealing gasket 40 and the flange 38, and urges the flange toward the first annular sealing gasket 35.

In the hollow stem portion 37 is an aperture 37b which in the rest position of the device as shown in FIG. 1 is below or outside the bottom of the lower body member 31. In the dispensing position this aperture is within the larger diameter recess 34a.

It will be seen that the valve stem 36 and the inner body 34 with its larger diameter recess 34a, the annular sealing gaskets 35 and 40, and the spring 39 form a simple metering stem which is known from the aerosol dispensing art and is shown in U.S. Pat. no. 2,721,010.

In operation, with the parts in the positions as shown in FIG. 1 and with the cylinder filled with the liquid L, pressure is exerted against the top of the cylinder 32 to urge the cylinder along the lower body member 31 to thereby exert pressure on the liquid L within the cylinder and within the smaller diameter bore 34b and larger diameter recess 34a. Since the stem 36 is fixed in position in recess 12, the pressure will move the lower body member 31 downwardly around the stem 36 against the action of the spring 39, first causing the second annular sealing gasket 40 to move around the upper end of the solid portion of the stem 36 and seal off the recess 34a from the smaller diameter bore 34b and the interior of the cylinder 32 thus trapping a metered quantity of liquid in the recess 34a. Thereafter, further movement of the lower body member 31 and cylinder 32 downwardly along the stem 36 causes the first annular sealing gasket 35 to move past the aperture 37b so that the recess 34a is in communication with the interior of the hollow stem portion 37.

It has been found that with this construction, when the aperture 37b is placed in communication with the recess 34a, the liquid which has been trapped in the recess 34a is ejected from the hollow stem portion 37 in a squirting force which has considerable force.

In the operation of the overall device when pressure is exerted by the fingers of the user on the cylinder 32 of the measured dose dispenser and the piston 19 of the air compressing piston cylinder means, the measured dose dispenser is caused to operate to dispense a squirt of liquid through the hollow stem portion 37 into the product flow path 15 and into the mixing chamber 17. At the same time, air is compressed in the cylinder 18, ahead of the piston 19. However, until the piston 19 reaches the end of its stroke, the poppet valve 25 remains closed. When the actuating pin 29 hits the poppet valve 25, the poppet valve is lifted from the seat 26, as shown in FIG. 2, and the air compressed in the cylinder 18 is suddenly released to flow through the compressed air path both to the mixing chamber 17 around
the nozzle insert 14 and through the central Venturi passage of the nozzle insert. The compressed air flowing into the mixing chamber 17 mixes with and exerts a shearing effect on the liquid under pressure from the metered dose dispenser so as to break up the liquid, and this mixture is drawn through the lateral passages 18 into the stream of gas under pressure which is flowing through the center of the nozzle insert. The liquid is subjected to further break up in the Venturi passage and is immediately dispensed from the nozzle insert as a fine spray of droplets of the liquid in compressed air without there first being ejected relatively large droplets of liquid.

A particular advantage of such a source of pressurized liquid as described above is that it can be simply replaced by a filled measured dose dispensing device. In addition to dispensing only a measured dose, the valve means of the measured dose dispenser acts to control the flow of the liquid product from the liquid supply in a simple and effective manner and independently of the air valve controlling the flow of the compressed air from the air compressing piston cylinder means.

While the metered dose dispensing device has been shown as one specific source of pressurized liquid, other sources can also be provided, such as are disclosed in the above mentioned copending application Ser. No. 496,282. Moreover, while the piston-cylinder air pressurizing means have been described as a specific source of gas under pressure, other sources could be provided, for example a valve V carried on the air compressor high pressure side containing a conventional aerosol can containing a conventional propellant under pressure.

The source of liquid can be a source which does not supply liquid under pressure, i.e., can be a source which simply presents to the system the source of liquid so that the liquid is aspirated by the reduced pressure in the system caused by the compressed air flowing through the Venturi passage in the nozzle 14. One embodiment of such a source of liquid is shown in FIG. 4, which shows the structure thereof and only a part of the structure of the remainder of the device. As seen in FIG. 4 the source of liquid 41 has an outer casing 43 which fits into the recess 11 in the dispenser body 10 in the same manner as does the source 30. Over the upper end of the casing 43 is a cover 43c. Within the casing 43 is an inner body 44. The end of the casing 43 has an aperture 43a therein and on the inside of the casing between the bottom thereof and the end of the inner body 44 is a first annular sealing gasket 45. The inner body 44 has a larger diameter recess 44d in the end toward the bottom of the casing 43 and has a smaller diameter bore 44b extending from the inner end of the recess 44a to the end of the inner body 44 which is within the upper part of the casing 43. A nipple 44c projects upwardly from the end of the smaller diameter bore 44b.

Movably mounted within the recess 44a and bore 44b is a metering valve stem generally indicated at 46 which has a solid stem portion within the recess 44a and has a hollow stem portion 47 extending from the solid stem portion out through the first annular sealing gasket 45 and the aperture 43a in the bottom of the casing 43, the outside surface of the hollow stem portion 47 being in sealing relationship with the first annular sealing gasket 45. At the joint between the hollow stem portion 47 and the solid stem portion is a flange 48, which in the rest position of the stem, as shown in FIG. 4, rests on the first annular gasket 45. The cross-sectional shape of the solid stem portion is such that it will move freely into the bore 44b. Around the end of the bore 44b where it opens into the larger diameter recess 44b is a second annular sealing gasket 50 through which the solid portion of the stem can move in sealing relationship therewith when the stem 46 is raised. A spring 49 is positioned between the second annular sealing gasket 50 and the flange 48, and urges the flange toward the first annular sealing gasket 45.

In the hollow stem portion 47 is an aperture 47b which in the rest position of the device as shown in FIG. 4 is below or outside the bottom of the casing 43. In the dispensing position this aperture is within the larger diameter recess 44a.

It will be seen that the valve stem 46 and the inner body 44 with its larger diameter recess 44a, the annular sealing gaskets 45 and 50, and the spring 49 form a simple metering stem which is known from the aerosol dispensing art and is shown in U.S. Pat. No. 2,721,010.

A flexible bag 51 filled with liquid L is positioned within the upper end of casing 43 with the mouth in liquid tight engagement with the nipple 44c. An aperture or vent 43d is provided in casing 43 opening into the space containing the bag.

In operation, with the parts in the position as shown in FIG. 4 and with the bag 51 filled with liquid L pressure is exerted against the cover 43c. Since the stem 46 is fixed in position in recess 12, the pressure will move the casing 43 down around the stem 46 against the action of the spring 49, first causing the second annular sealing gasket 50 to move around the upper end of the solid portion of the stem 46 and seal off the recess 44a from the smaller diameter bore 44b and the interior of the bag 51 thus trapping a metered quantity of liquid in recess 44a. Thereafter, further movement of the casing 43 downwardly along the stem 46 causes the first annular sealing gasket 45 to move past the aperture 47b so that the recess 44c is in communication with the interior of the hollow stem portion 47. When the aperture 47b is placed in communication with the recess 44c, the liquid which has been trapped in the recess 44a is free to flow through the hollow stem portion 47.

In the operation of the overall device when pressure is exerted by the fingers of the user on the cover 43c of the measured dose dispenser and the piston 19 of the air compressing piston cylinder means, the measured dose dispenser exposes a measured amount of liquid through the hollow stem portion 47, the product flow path 15 and the mixing chamber 17. At the same time, air is compressed in the cylinder 18, ahead of the piston 19. However, until the piston 19 reaches the end of its stroke, the poppet valve 25 remains closed. When the actuating pin 29 hits the poppet valve 25, the poppet valve is lifted from the seat 26, as shown in FIG. 2, and the air compressed in the cylinder 18 is suddenly released to flow through the compressed air path both to the mixing chamber 17 around the nozzle insert 14 and through the central Venturi passage of the nozzle insert. Compressed air flowing through the Venturi passage 14a aspirates the measured amount of liquid from the source 41 and draws it into the mixing chamber 17. The compressed air flowing into the supply chamber 17 mixes with and exerts a shearing effect on the liquid from the metered dose dispenser so as to break up the liquid, and this mixture is drawn through the lateral openings 18 into the stream of gas under pressure which is flowing through the center of the nozzle insert. The liquid is subjected to further break up in the Ven-
turi passage and is immediately dispensed from the nozzle insert as a fine spray of droplets of the liquid in compressed air without there first being ejected relatively large droplets of liquid.

The source of liquid as described above can also be resupplied simply by replacing the throwaway measured dose dispensing device. In addition to dispensing only a measured dose, the valve means of the measured dose dispenser acts to control the flow of the liquid product from the liquid supply in a simple and effective manner and independently of the air valve controlling the flow of the compressed air from the air compressor piston cylinder means, and also blocks flow of compressed air back into the bag 51.

When pressure or the source of liquid is released the parts return to the positions of FIG. 4, and air pressure on the bag 51 from vent 43c forces liquid into the recesses 44a and 44b.

It will thus be seen that by a very simple change in the structure such that the gas under pressure and the liquid to be dispensed are supplied together to the supply chamber around the nozzle, and the gas under pressure is supplied to the central passage of the nozzle, the liquid is initially dispensed in the form of fine droplets, and the problem of spitting is overcome.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the form hereinbefore described and illustrated in the drawings being merely a preferred embodiment thereof.

What is claimed is:

1. A device for dispensing a spray of the fine droplets of liquid in gas, comprising a dispenser body, said dispenser body having a nozzle means opening out of said body and having a central Venturi passage therethrough and lateral passages opening into said Venturi passage, said dispenser body having an annular mixing chamber around said central passage to which said lateral passages are connected, a source of liquid to be dispensed having means for mechanically pressurizing said liquid and operatively associated with said dispenser body valve means controlling dispensing of liquid from said source; said dispenser body having a product flow conduit therethrough from said valve means for said source of liquid to said annular mixing chamber and a source of gas under pressure and opening axially into the central Venturi passage of said nozzle means, and a branch compressed gas flow conduit branching from said main compressed gas flow conduit and opening into said annular mixing chamber at a point spaced from the point at which said product flow conduit opens into said annular mixing chamber.

2. A device as claimed in claim 1 in which said source of liquid comprises a measured dose dispenser having a piston-cylinder means containing the liquid to be dispensed, and said valve means is a measured dose dispensing valve means for dispensing a measured dose of the liquid when the piston-cylinder means is actuated.

3. A device as claimed in claim 1 in which said source of compressed gas comprises an air compressing piston-cylinder means having a fixed member and a movable member moveable through a compressing stroke, relative to the fixed member and a compressed air controlling valve member in said compressed air flow path normally closing said path, actuating pin means operatively associated with said air compressing piston-cylinder means and said compressed air controlling valve member for actuating said compressed air valve member to open it near the end of the compression stroke.

4. A device as claimed in claim 3 in which said source of liquid comprises a dispenser having a liquid pressurizing piston-cylinder means containing the liquid to be dispensed, and said valve means is a measured dose dispensing valve means for dispensing an amount of the liquid when the liquid pressurizing piston-cylinder means is actuated, said air compressing piston-cylinder means being on one end of said dispenser body and the liquid pressurizing piston-cylinder means being on the other end of said dispenser body, whereby pressure on the opposite ends of said device actuates both piston-cylinder means.

5. A device as claimed in claim 1 in which said source of liquid is a source of unpressurized liquid and comprises a measured dose dispenser having a container for the liquid which is at atmospheric pressure, and said valve means is a measured dose dispensing valve means for permitting aspiration of a measured dose of the liquid when said valve means is actuated.

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