Sept. 8, 1970 R. C. COOPRIDER 3,527,388

ASPIRATION-TYPE LIQUID DISPENSER

Filed May 20, 1968

FIG. 1

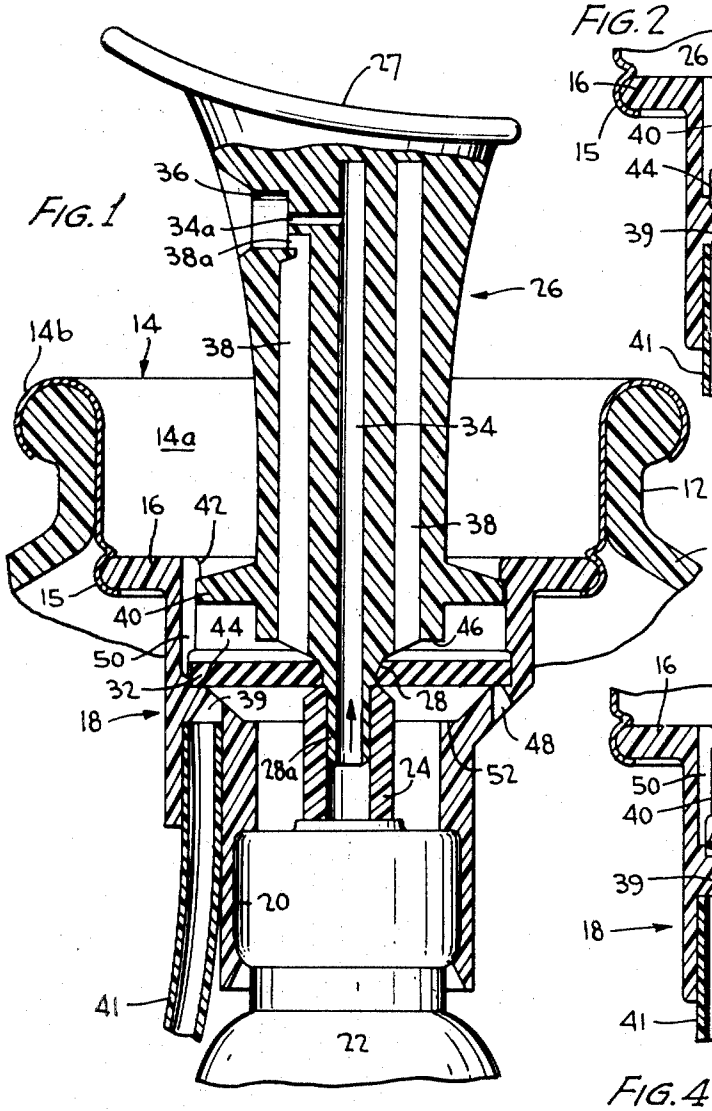


FIG. 2

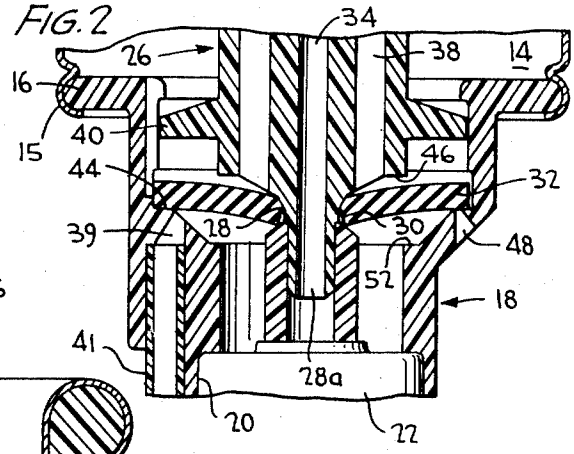


FIG. 3

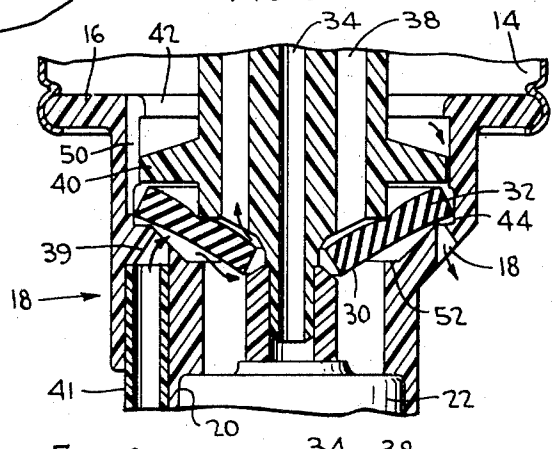


FIG. 4

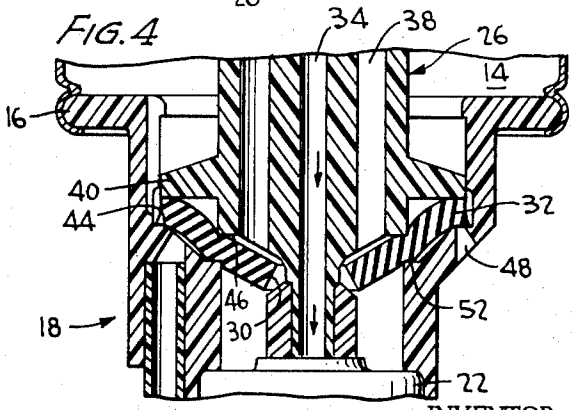
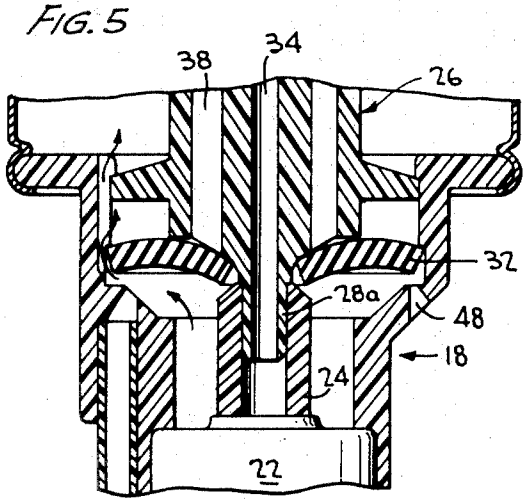


FIG. 5



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ASPIRATION-TYPE LIQUID DISPENSER

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U.S. Cl. 222—193 7 Claims

ABSTRACT OF THE DISCLOSURE

An aerosol dispenser of the type in which propellant discharged from a cartridge within the product container exerts an aspirating effect for discharging the product, there being a product control valve in the form of a resiliently deformable annulus having its inner and outer peripheral portions respectively cooperating with separate valve seats to control the discharge of the product and the venting of air from the atmosphere into the product container. The same valve is adapted to be raised off of its seat by excess pressures occurring within the product container to release the same. Also, the valve is arranged so that when deformed beyond its normal discharge position, it will engage concentric annular sealing ribs or edges on opposite radial sides of the product and vent openings to seal same, while at the same time the propellant discharge passage and propellant valve are opened to permit charging of the propellant cartridge with compressed propellant through the discharge head.

This invention relates to improvements in an aerosol dispensing device of the type in which the product is dispensed from the product container by the aspirating action of a propellant discharged through a passage which is so associated with the product discharge passage as to create an aspirating action for withdrawing the product and discharging it in the stream of propellant gas.

In particular, the invention relates to improvements in such a device including an improved product discharge valve, the action of which is coordinated with that of the propellant valve in a manner to achieve a purging of the product discharge passage by the aspirating action of the propellant.

Further, the same valve cooperates with a plurality of different valve seats to uncover an air inlet vent through one seat incident to permitting the discharge of products from the container between the valve and another seat.

In accordance with the invention, depression of the discharge head to commence the discharge of the propellant causes a sealing abutment on the head to engage and deform the product valve to permit the discharge of the product through the central opening of the valve, while at the same time establishing a fluid-tight coupling between said central valve opening and the product discharge passage of the head.

In its normal closed position, such a product valve seals the interior of the container from the atmosphere. But the valve is deformable in response to an abnormal pressure within the product container to permit release of pressures substantially greater than atmospheric, following which the valve returns automatically to its sealed position.

A further feature of the invention is the ability of the valve means thereof to permit charging of propellant into the propellant container housed within the product container, while excluding the propellant from the product container.

The preferred embodiment of the invention is shown in the accompanying drawing, in which:

FIG. 1 is a fragmentary axial cross section through

an aerosol dispensing device in accordance with the invention, the dispensing valve means being in closed position.

FIG. 2 is a sectional view of the valve means, taken in the same plane as FIG. 1, showing the valve positioned to purge the product discharge passage.

FIG. 3 is a view similar to FIG. 2 with the valve in product dispensing position.

FIG. 4 is a view similar to FIG. 2, with the valve positioned to permit charging of the propellant cartridge.

FIG. 5 is a view similar to FIG. 2, with the valve in overpressure release position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the accompanying drawings, the preferred embodiment of the invention therein illustrated comprises a product container **10** for the product to be dispensed. This container **10** will not be normally subjected to any substantial super-atmospheric pressure and, therefore, may be conveniently formed of any desired material, such as glass, plastics, or the like and may have any desired external configuration.

The mouth or filling opening of the container is defined by a generally conventional externally beaded circular neck **12** for sealing reception of a metal closure member or adapter **14** which includes a generally cylindrical sleeve portion **14***a* snugly received within the neck opening and preferably defining a socket for fluid tight reception of a propellant charging nozzle, as described hereinafter. The adapter includes an outwardly and downwardly curled flange **14***b* extending snugly around and beneath the beading of the neck. At its lower end within the container, the closure or adapter **14** is crimped at **15** around and in sealing engagement with the outwardly directed flange **16** of an annular valve housing **18** of generally tubular or sleeve-like form coaxial with the neck **12**. The lower portion of the housing **18** is formed to define a socket **20** for fluid tight gripping reception of the upper end of a propellant cartridge **22** containing a charge of a suitable propellant such as Freon. The cartridge **22** is equipped with a conventional discharge valve, of which only the tubular valve actuating stem and discharge conduit **24** is here illustrated, it being understood that this valve stem is normally projected upwardly by spring pressure to maintain the valve closed and may be depressed in the direction of its length to open the valve and permit discharge of the propellant. Such a valve may, for instance, be of the type disclosed in the U.S. patent to Abplanalp 2,631,814, granted March 17, 1953.

Coupled to and movable with the tubular valve stem **24** is a discharge head **26** of the aspirating type which extends upwardly through the annular valve housing **18** and is movable axially therethrough together with the valve stem **24** to actuate the latter. To facilitate its use, the discharge head **26** is preferably formed with a suitable finger piece **27** at its upper end to receive digital pressure which is transmitted through it to the valve stem **24** for control purposes. Thus, the valve stem **24** and discharge head **26** may jointly be regarded as constituting a plunger movable axially through the annular opening defined by the valve housing **18** for controlling the functions of the valve member hereinafter more fully described.

The discharge head **26** is provided with a preferably integral depending valve plug **28** for sealing reception in a product outlet port **30** defined by the inner periphery of the annular product discharge valve **32**. The propellant discharge duct or passage **34** extends through this plug and through a reduced diameter extension **28***a* thereof which in the present embodiment is snugly received in

the open upper end of the tubular valve stem **24**. In this manner, the discharge head **26** is coupled to the valve stem **24** with its propellant passage **34** communicating with the tubular valve stem. It will be seen that the propellant duct **34** extends upwardly through the discharge head and communicates with the atmosphere through a restricted discharge orifice **34***a* and mixing chamber **36**.

The product discharge passage **38** of the discharge head in the present embodiment is of annular configuration arranged with its discharge orifice **38***a* opening into the mixing chamber **36** closely adjacent the propellant discharge orifice **34***a*. In other words, the propellant discharge orifice **34***a* is in aspirating relation to the discharge orifice **38***a* of the product, so that when the product discharge passage **38** communicates with the container interior, the product may be drawn up through said passage by aspirating action to be broken up into a fine spray and entrained by the propellant. Communication between the product discharge passage **38** and container **10** is established under the control of valve member **32** by a product delivery port **39** in the valve housing **18** beneath the resilient flexible valve **32**, together with a dip tube **41** extending from said product delivery port to a location near the container bottom.

In the preferred embodiment of the invention, the discharge head **26** is formed near its base with a radially projecting flange **40** which is in freely sliding relation with the adjacent inner periphery of the valve housing **18** to cooperate with the product valve member as hereinafter described, and also to serve as a guide for the discharge head in its axial movement. Further, to assist in retaining the spray head in its operative position coupled to the tubular propellant valve stem **24**, the inner periphery of the valve housing **18** is formed above the said guide flange **40** with a radially inwardly projecting bead **42** to resist withdrawal of the flange, but arranged so that the flange may be snapped downwardly through it for assembly purposes.

It will be noted that at least a portion of this reduced diameter plug is of downwardly diverging conical configuration so that it will continue to abut against and maintain sealing relation with the inner periphery of the valve member, until after the propellant valve has opened and will return to such sealing relation just prior to closing of the propellant valve. With this arrangement, when the discharge head **26** is depressed substantially to the position shown in FIG. 2, the seal is still operative to prevent escape of the product from the outer container, but the propellant discharge valve stem is depressed sufficiently to permit a discharge of propellant alone and without the product so as to be capable of purging any product from the discharge orifice or mixing chamber at the termination of a dispensing operation.

In its normal closed flat condition as shown in FIG. 1, the annular valve member **32** cooperates with the annular upper valve seat **44** and the reduced diameter plug **28** of the discharge head to completely bar the escape of the product from the container.

However, the valve member **32** is adapted and arranged in accordance with the invention to have its central portion axially depressed by downward movement of the discharge head **26** and valve stem **24** beyond the position shown in FIG. 2, so as to stretch the inner periphery of the valve member slightly away from the reduced diameter plug **28** to provide an annular space, as indicated in FIG. 3, through which the product can escape from the container into the product discharge passage **38** of the discharge head.

The discharge head is formed to define a downwardly axially directed annular abutment and seal **46** for downward movement with the discharge head **26** concentric to and radially outwardly of the plug **28** to press downwardly against the valve member in a radial location inwardly of the annular upper valve seat **44**. It will thus depress the central portion of the valve member **32** and stretch its inner periphery slightly away from the reduced diameter plug **28** in the manner indicated in FIG. 3, to permit the passage of product through the product port **30** between the plug and the valve.

At this time with the central portion of the valve thus depressed, the outer margin thereof will be rocked about the inner edge of the annular valve seat **44**. Although the radially outer extremities of the valve member **32** at this time will be slightly raised above the valve seat **44**, the valve member will nevertheless remain in fluid tight sealing engagement with the inner edge of the valve seat to maintain a fluid tight seal for preventing out flow of product between the valve member and seat. At the same time the downward pressure of the annular abutment or rib **46** with the valve will provide a firm fluid tight seal around the product outlet port **30** of the valve between the upper surface of the valve and the discharge head **26**, thus to establish a fluid tight coupling between such port **30** and the product discharge passage **38** of the discharge head. In this position of the valve member **32**, the product port **30** communicates with the product containing portion of the container **10** through the product delivery port **39** and the dip tube **41**.

In order to admit air from the atmosphere into the container **10** to replace the product as the latter is discharged, the valve housing **18** is formed with an air inlet vent **48** opening upwardly from the interior of the outer container **10** and through the annular valve seat **44**. The arrangement is such that when the outer marginal area of the valve is raised above its seat, in the manner indicated in FIG. 3, by depression of the central area of the valve, the vent opening **48** communicates with the atmosphere around the outer periphery of the valve **32** and upwardly through the clearance space between the flange **40** and inner surface of the housing **18**, all in the manner indicated by the arrows in FIG. 3.

It will be appreciated that normally only the propellant within the cartridge **22** is maintained under any substantial pressure, whereas the product within the outer container **10** normally will be at substantial atmospheric pressure. Thus, the outer container need not be of a type which is adapted to withstand substantial internal pressures. It is however desirable to provide an overpressure release means for the outer container to prevent the building up of dangerous internal pressures, such as might occur either from expansion of the container contents or from leakage of the propellant into the product container through a defective propellant valve or propellant cartridge. The preferred embodiment of the invention is readily capable of achieving this function since, as shown in FIG. 5 of the drawing, excessive internal pressures within the container will act upon the under surface of the valve member **32** to raise the outer periphery of the valve member above its seat to release excess pressures around and past the outer periphery of the valve between the valve and the seat. In order to facilitate such release, it is desirable to form the inner periphery of the valve housing with a groove **50** extending downwardly to a location just above, but somewhat spaced from the valve seat **44**.

In accordance with a further feature of the invention, provision has been made for charging the propellant cartridge **22** with a suitable pressurized propellant such as Freon while it is assembled with its associated parts in the manner shown in the accompanying drawings, the propellant being directed solely into the cartridge and being barred by the valve member **32** from entry into the product container **10**. For this purpose it will be readily apparent that the adapter wall **14***a* is of cylindrical configuration and defines an upwardly opening cylindrical socket adapted for snug fluid tight reception of the conformingly shaped nozzle (not shown) of a pressurized propellant supply means which will, of course, encompass the entire discharge head while fully depressing same to the position of FIG. 4.

It will be noted that in this position, the guide flange **40** of the head is so located as to press the outer marginal area of the valve member **32** securely downward into sealing relation against the valve seat of ledge **44** at the outer periphery of the member, to close the air inlet vent **48**, while the annular abutment **46** of the valve head presses the valve member **32** into firm sealing engagement with an annular lower valve seat or sealing shoulder **52** of the valve housing to close and seal the product delivery part **39**. The valve member **32** thus is in sealing engagement with the valve housing **18** in annular zones which are located radially inwardly and outwardly, respectively, of the product delivery port **39**. Thus pressurized propellant is incapable of entering the product container **10** from the exterior of the discharge head. Although such propellant will be free to enter the product discharge passage **38** and to move past the product discharge valve **32** to a location therebeneath, its passage through the housing **18** into the product container **10** will be barred by the closed relation of the valve relative to the port **39** and vent **48**, as well as by the propellant cartridge, it being remembered that the cartridge is in fluid tight relation within the socket defined at the lower end of the annular valve housing.

OPERATION

Thus, in the overall operation of the preferred embodiment of the invention, the container **10** may be filled to the desired level with a suitable product to be dispensed as, for instance, a suitable liquid. The filling operation may, if desired, be completed before the adapter **14** and the dispensing device carried by it are inserted in the mouth of the container and secured in place by spinning over the rounded flange **14***b* of the adapter around the neck head of the container. Charging of the propellant cartridge with a suitable propellant under pressure may then be achieved by inserting a propellant nozzle in fluid tight relation into the coupling socket defined by the cylindrical portion **14***a* of the adapter, with part of the nozzle in axial engagement with the discharge head, preferably by way of its guide flange **40** (as shown in broken lines in FIG. 4) to depress the head to the position illustrated in FIG. 4. With the head thus positioned, the propellant gas is free to flow only into the propellant cartridge **22** and is barred from the outer product container **10** by action of the valve member as above described.

After the charging of the propellant container or cartridge **22** and release of the head towards normal position as in FIG. 1, the valve member **32** is closed, thus sealing off the product from the atmosphere, while the propellant discharge valve controlled by the stem **24**, similarly is spring projected to it closed position with the discharge head positioned as shown in FIG. 1.

As the head approaches the position of FIG. 1, it will again assume a position substantially as in FIG. 2 in which the valve seals the container from the product passage, while the propellant is still being discharged, the propellant valve steam, at this time, still being partially depressed.

It is to be noted that in the position of FIG. 2, the valve actuating abutment or shoulder **46** at the lower end of the discharge head will have been raised free of the valve member **32** to leave a space through which air from the atmosphere may enter the product discharge passage and be drawn upwardly therethrough by the aspirating action of the propellant, thus to positively purge the discharge passage of product. This highly important purging function is important in the case of products which might tend to solidify and clog the product discharge passage or such as might deteriorate upon exposure to the atmosphere.

It is to be particularly noted that throughout the operation of the invention, the propellant and the product come into contact with each other only at the time they are discharged into the atmosphere. Thus the invention is capable of advantageous use with products and propellants of types which react with each other.

Having thus described my invention, I claim:

1. An aerosol dispenser comprising an outer container for a product to be dispensed, an annular valve housing supported in fluid-tight relation within said container and defining a circular opening, extending from the interior of the container to the atmosphere, a cartridge for pressurized propellant supported in and closing the lower end of said opening, said cartridge including a dispensing valve having a tubular valve stem spring-projected upwardly toward closed position, a discharge head coupled to said stem for movement therewith through such circular opening, said head normally projecting upwardly through said opening for actuation by downward digital pressure, an upwardly directed upper annular valve seat within said valve housing around said opening, a vent separate from said opening extending through said valve seat at one side of said opening, said discharge head including a reduced diameter plug at its lower end connected to said tubular valve stem, a resiliently flexible annular product discharge valve of normally flat configuration, normally seated on said upper annular valve seat over said vent and normally having its inner periphery defining a product discharge port snugly encircling and in sealing relation with said plug, said discharge head being formed with a propellant discharge passage communicating through said plug with the tubular propellant valve stem and being formed with a product discharge passage having an intake end opening downwardly therethrough at a location above said product discharge valve, and an annular downwardly directed valve actuating and sealing abutment on said discharge head concentric to said annular product discharge valve and normally spaced slightly thereabove, said abutment encircling said intake end of the product discharge passage and being located radially between the inner and outer peripheries of the said valve, said abutment being movable axially downwardly with the discharge head to axially depress the central portion of said valve, so as to stretch the inner periphery thereof away from said plug, while rocking the outer periphery of said valve upwardly about the inner periphery of said upper valve seat to open said vent, and sealingly engaging the upper surface of said valve to provide a fluid-tight coupling between the said product container and the product discharge passage, said product discharge passage and the said propellant discharge passage being in aspirating relation.

2. A dispensing device as defined in claim **1**, in which said valve housing is formed around its annular opening with an upwardly presented lower annular valve seat concentric to said upper annular valve seat at a level to be normally disengaged from said annular product discharge valve, but to be sealingly engaged by said discharge valve when the discharge head is depressed below its normal discharge position, said housing being formed with a product delivery port located between said upper and lower valve seats and communicating with the container interior, said discharge head including a flange overlying said annular product discharge valve and positioned to depress said valve against said upper valve seat when said upper annular valve seat is seated against said annular product discharge valve incident to depressing said discharge head below its normal discharge position.

3. A cartridge-type aerosol valve as defined in claim **2**, in which said flange in the closed and raised position of said head is normally spaced slightly above the product discharge valve to permit upward flexing an unseating of radially outer edge portions of said product discharge valve from the said upper valve seat, whereby to permit release to the atmosphere of superatmospheric pressures occurring within the product container.

4. In a cartridge-type aerosol dispenser as defined in claim **3**, the further feature wherein said product discharge valve is of resilient material normally retained

against the outer valve seat via its engagement with the said plug.

5. In a cartridge-type aerosol dispenser as defined in claim 4 the further feature wherein said product discharge valve is resiliently flexible and capable of returning to seated relation with the said outer valve seat following release of excess pressures from the product container.

6. In a dispensing valve, the combination which comprises a housing adapted for sealing disposition in the outlet of a product container and formed with a circular opening therethrough, upper and lower valve seats defined by said housing concentrically to said opening, means beneath said lower valve seat closing the lower end of said opening, a resiliently flexible annular product discharge valve supported at its outer peripheral portion on said upper seat, said housing being formed with a vent separate from said opening, extending through said upper seat at one side of the opening for communication with the interior of the product container, a discharge head movable axially within said opening, said discharge head including a downwardly presented annular abutment located radially inwardly of said upper valve seat for depressing the central portion of said valve downwardly about the inner periphery of said upper seat to

uncover said vent incident to depression of said discharge head.

7. The combination defined in claim 6, in which said housing is provided with the product delivery port communicating with said opening at a location between said upper and lower valve seats, and an annular downwardly directed flange carried by said discharge head in a position normally above said upper valve seat and said valve member, said abutment and said flange being positioned to press said valve member simultaneously into sealing engagement with said respective valve seats in a predetermined fully depressed position of the discharge head.

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