INJECTION PUMP ASSEMBLY FOR AEROSOL CONTAINERS

9 Claims, 6 Drawing Figs.

ABSTRACT: Apparatus for injecting a liquid substance into a previously filled and pressurized aerosol canister. The apparatus comprises a pump including means for positively locking and sealing the pump in position on the canister in surrounding relation to the valve assembly such that said pump may be operated to withdraw liquid from a source and inject said liquid under pressure into said canister. The novel pump apparatus employs a check valve which precludes back flow during the injection procedure.
INJECTION PUMP ASSEMBLY FOR AEROSOL CONTAINERS

This invention relates to a pump assembly which can be used to inject a small quantity of a liquid or liquidlike substance into a pressurized aerosol container.

The aerosol can or similar container is a very popular packaging means for supplying a relatively small quantity of a sprayable material in a convenient form for use by the ultimate consumer. Aerosol cans are widely used for a wide variety of products, such as paints and other protective coatings, hair sprays, personal products, and the like. The typical aerosol container is a light-weight sheet metal can provided with a valve at its upper end surrounded by an upstanding circular rim. The valve is biased by an internal spring which presses the valve components into sealing engagement.

To operate the valve, a short length of a hollow tube is forced into the valve, opposing the action of the biasing spring, thereby opening the valve and permitting the enclosed propellant to discharge the contents of the can in the form of a fine spray.

For some applications, it would be desirable to be able to add conveniently a small quantity of additional ingredients to the contents of the can after the latter has been pressurized. Examples of such use include the addition of pigment to a neutral paint base, hair-tinting color to hair sprays, active pharmaceutical ingredients to pharmaceutical products, and the like, either by the ultimate consumer or by the retailer, as a means for reducing the total inventory which he must carry.

Such addition, however, is complicated by the fact that the contents of the can are under pressure which must be over come conveniently and safely without permitting blow-back or escape of the contents.

The pump assembly of the invention permits such additions to be made to pressurized aerosol cans in a simple, economical, and safe manner. The pump assembly has built-in safeguards which prevent its operation unless it is properly locked to the can, so that the proper seal is always maintained. If for any reason the adjustment of the pump assembly to the can is improper, the can valve remains closed under its own pressure and no loss of its contents can occur.

The invention will be better understood from the following detailed description thereof, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view in partial section of the pump assembly in locked position onto an aerosol can shown in fragmentary view;

FIG. 2 is an exploded view of the parts of the assembly, showing the locknut in position on an aerosol can and the pump body before it is inserted into the locknut to complete the assembly;

FIG. 3 is a sectional view along the line 3--3 of FIG. 1;

FIG. 4 is a sectional view along the line 4--4 of FIG. 1;

FIG. 5 is a bottom view of the plunger piston shown in partial section in FIG. 1;

FIG. 6 is a bottom view of the locknut assembly shown in position on an aerosol can in FIG. 2.

Referring to the figures, it will be seen that the pump assembly comprises three major components, housing 11, plunger 31 and locknut 51. Plunger 31 and a portion of housing 11 cooperate to form the pump proper, while locknut 51 serves to lock the pump assembly onto the neck of an aerosol can 61.

Referring to FIG. 2, housing 11 comprises a base plate 12 to one end of which is attached a screw cap 13 into which is screwed vial 14 containing the respective material to be added to the aerosol can. The other end of base plate 12 is connected to pump body 16, which as shown in FIG. 1 is a cylindrical body closed at its lower end by plate 17 and provided with a circular sleeve 18 which extends downwardly around the perimeter of the body. Cylindrical pumping chamber 19 is concentrically located within body 16, the respective walls of the pumping chamber and the body forming an annular space 21. The top of chamber 19 is open, while the bottom is drawn to an elongated nozzle 25.

Fitted within housing 11 is plunger 31, the upper end of which is a flattened head 32 which is connected to circular plate 33 by means of vertical plates 34 and 35. The lower portion of plunger 31 contains a cylindrical portion 36 containing a bore 37 into which is fitted plug 38 and check valve ball 39. The upper end of the bore 37 is formed as a valve seat 41 with which check valve ball 39 cooperates to seal the bore against the flow of liquid in an upward direction.

Plug 38 contains a cylindrical body portion 38a to which are attached a plurality of elongated ribs 38b which are deformed when the plug 38 is inserted into bore 37 to make a permanent pressed fit. Ribs 38b also define longitudinal annular channels for the flow of liquid within bore 37. The lower portion of plug 38 is a flattened 51 serves to lock the pump assembly onto the neck of an aerosol can 61.

Referring to FIG. 2, housing 11 comprises a base plate 12 to one end of which is attached a screw cap 13 into which is screwed vial 14 containing the material 15 to be added to the aerosol can. The other end of base plate 12 is connected to pump body 16, which as shown in FIG. 1 is a cylindrical body closed at its lower end by plate 17 and provided with a circular sleeve 18 which extends downwardly around the perimeter of the body. Cylindrical pumping chamber 19 is concentrically located within body 16, the respective walls of the pumping chamber and the body forming an annular space 21. The top of chamber 19 is open, while the bottom is drawn to an elongated nozzle 25.

Fitted within housing 11 is plunger 31, the upper end of which is a flattened head 32 which is connected to circular plate 33 by means of vertical plates 34 and 35. The lower portion of plunger 31 contains a cylindrical portion 36 containing a bore 37 into which is fitted plug 38 and check valve ball 39. The upper end of the bore 37 is formed as a valve seat 41 with which check valve ball 39 cooperates to seal the bore against the flow of liquid in an upward direction.

Plug 38 contains a cylindrical body portion 38a to which are attached a plurality of elongated ribs 38b which are deformed when the plug 38 is inserted into bore 37 to make a permanent pressed fit. Ribs 38b also define longitudinal annular channels for the flow of liquid within bore 37. The lower portion of plug 38 is a flattened 51 serves to lock the pump assembly onto the neck of an aerosol can 61.

Located within the annular space 21 defined by the walls of chamber 19 and body 16 is helical return spring 42 which biases plunger 31 in an upward direction. The upward travel of plunger 31 is limited by radial legs 33c which protrude into vertical slots 22 and 23 (see FIG. 4) diametrically located opposite each other in the wall of body 16.

The connection between pump body 16 and base plate 12 is strengthened by vertical, approximately triangular plates 26 and 27.

Attached to the upper surface of plate 33 in plunger 31 is a horizontal tubular receiver 43 which accepts one end of flexible tubing 44, the other end of which passes through screwcap 33 and acts as a dip tube 24 in vial 14 containing the liquid or liquidlike substance 15 to be added to the aerosol container. A passage for liquid flow from the end of tubing 44 in receiver 43 is provided by channels 46 and 47 to check valve seat 41 and thence to the bore 37 of plunger 31. Plug 38 is screwed into housing 11 between plates 26 and 27 and above base plate 12 is cut away, as shown, to provide clearance for receiver 43 on vertical movement of plunger 31.

In order to lock the pump assembly securely onto the aerosol can 71 with which it is to be used, locknut 51 is employed. Locknut 51 is of the generally cylindrical in shape, and is provided in its upper portion with internal threads 52 adapted to receive the partial threads 28 on diametrically opposite sides of the exterior of body 16. Vertical ribs 53 provide a
gripping surface for rotation of the nut. In its lower portion, locknut 61 is provided with a pair of opposed locking wings 54 defined in part by slots 56. The locking wings 54 are deformable to clear the upstanding rim 72 of the can 71 and to engage the undercut portion of the can's rim when the locknut is put in position on the valve of an aerosol can.

After locknut 51 is properly positioned, attachment of the remaining portions of the pump assembly to the aerosol can is made by screwing housing 11 into locknut 51 until sleeve 18 is fully extended behind locking wings 54 of locknut 51, as shown in FIG. 1. When this position is reached, injection nozzle 25 has entered the discharge opening of the can's valve into contact with resilient sealing pad 76, which forms an atmosphere seal around the perimeter of nozzle 25. As shown in FIG. 2, injection nozzle 25 has a length which is insufficient to open the valve 73 of the aerosol.

The operation of the device is as follows: With the parts in the relative position shown in FIG. 1, i.e., with housing 11 fully inserted into locknut 51 and with a vial 14 of the material to be added to the aerosol can in position as shown, the user presses down on head 32 of plunger 31 causing the plunger to move downwardly within pumping chamber 19. Check valve ball 39 rests on the top of plug 38, so that the check valve at the top of bore 37 is open, thus permitting the air within pumping chamber 19 to pass through tube 44 and to escape through the contents of vial 14. At the end of the downward stroke the force is removed from plunger 31, return spring 42 then causes plunger 31 to move upwardly. The upward movement of plunger 31 creates a partial vacuum in pumping chamber 19 which produces a syphon effect, drawing liquid from vial 14 through tube 44 and channels 46 and 47 and check valve 41 and into the bore 37 of plunger 31. The liquid passes through the channels defined by cylinder 38a and ribs 38b, through the openings in the plate 38c, and into the pumping chamber 19. On renewed application of downward force on the head 32 of the plunger 31, the initial downward movement of plunger causes check valve ball 39 to rise because of the hydraulic impact of the liquid into sealing engagement with seat 41, thus preventing the escape of the liquid from the pumping chamber. Continued application of force to head 32 increases the pressure of the liquid until the pressure reaches the point where it is sufficient to displace can valve member 73 and to permit the liquid to flow through ejection nozzle 25 and valve member 73 into aerosol can 71. Continued up and down movement of plunger 31 will quickly transfer all of the liquid in vial 14 into the can.

It will be seen that the construction of the pump assembly of the invention has a number of built-in safety features. In order to establish a sealing relationship between injection nozzle 25 and the valve member 73 of the can, housing 11 must be fully inserted into locknut 51, thereby locking wings 54 into engagement with the rim of the can. Accordingly, until the assembly has been locked into position, the device is inoperative since a seal must be established at the end of injection nozzle 25 before a vacuum can be established in pumping chamber 19 in order to draw over any of the liquid to be added to the can. If at any point the downward stroke of plunger 31 is stopped, the reduced pressure in pumping chamber 19 permits the valve 73 of the can to close immediately, thus preventing the loss of the contents of the can. Any possible blow-back hazard or accidental loss of the can contents is thus eliminated. As an additional safety feature, the pump assembly of the invention cannot pressurize the aerosol can by pumping air after the contents of vial 14 are exhausted. The presence of liquid in pumping chamber 19 is necessary in order to actuate check valve ball 39. Thus the pump assembly cannot be used to pump a dangerous amount of air into the can.

The pump assembly of the invention may be constructed of any material which is adequately strong and rigid to withstand the imposed stresses while being impervious to the liquid materials with which it comes into contact. A suitable material is nylon or a similar plastic, which is strong yet somewhat resilient, permitting slight deformation which facilitates the assembly of the individual parts.

The many uses of the pump assembly of the invention will be obvious to those skilled in the art. The ability to add a small quantity of a desired ingredient to a pressurized aerosol can permits great flexibility in the use of the product. Thus, for example, a paint retailer need only stock a supply of pressurized cans containing paint of a neutral color, to which he or she can add the desired pigments or colors before use, thus greatly reducing his inventory space requirements. As another example, the device of the invention permits the convenience of aerosol packaging to be applied to certain synthetic polymeric materials, such as polyesters, polyamides, polyurethanes, epoxies, and the like which cure to form a hard or tough material on the addition of a catalyst material which initiates a chemical reaction. Because the pot life of such compositions is extremely limited after the catalyst material is added, an aerosol formulation of this type cannot be made at the manufacturer's plant, since the material would have cured long before the ultimate user could make use of the product. By means of the device of the invention, however, the ultimate user can add the catalyst material to the aerosol can immediately prior to use and before the reaction of the ingredients makes the contents of the can unspratable. Other similar applications will be apparent to those skilled in the art.

The foregoing detailed description has been given for clearness of understanding only, and any unnecessary limitations should be understood therefrom as modifications will be obvious to those skilled in the art.

1. A pump assembly for removing a liquidlike substance from an external container and injecting said liquidlike substance into a conventional aerosol container, the improvement comprising:
a housing means;
first means for connecting said housing means to said external container;
second means, spaced apart from said first connecting means for connecting said housing means to said aerosol container;
a pumping means located within said housing means, said pumping means including an inlet means and an outlet means;
first liquid flow path means located within said housing wherein said first liquid flow path provides a means for transferring said liquid from said liquid container to said inlet means;
second liquid flow path means located within said housing between said outlet means and said aerosol container, said second liquid flow path means being adapted to cooperate with the valve of said aerosol container to effect a vacuum seal and to allow a vacuum to be drawn in said pumping means;
a check valve means located within said first liquid flow path means for controlling the flow of liquid therethrough; and
locking means for locking said housing means to said aerosol container while said assembly is in operation.

2. The assembly of claim 1, wherein said pumping means comprises a pumping chamber located within said housing means, said pumping chamber having its top end open and its bottom end reduced to an elongated nozzle; and a plunger piston slidably positioned within and in sealing engagement with the wall of said pumping chamber.

3. The assembly of claim 2 which includes spring biasing means for biasing said plunger piston in one direction.

4. The assembly of claim 2, wherein said check valve means is adapted to be actuated by the presence of said liquidlike substance within said pumping chamber in order to close said inlet.

5. The assembly of claim 2, in which said nozzle is adapted to enter the valve of said aerosol can and to cooperate with said valve to create an atmospheric seal, permitting a vacuum
to be drawn in said pumping chamber, the length of said nozzle being insufficient to open said valve.

6. The assembly of claim 2, in which said locking means comprises a cylindrical sleeve attached to the lower end of said housing means and a locknut threadedly engaging said housing means and encircling said sleeve, said nut being provided with a plurality of flexible undercut wings which are outwardly biased into locking engagement with said aerosol container by axial relative movement of said sleeve on rotation of said nut.

7. The assembly of claim 2, in which said plunger is provided with a plurality of radially extending lock lugs and said body is provided with a plurality of longitudinal slots in which said lugs ride, said lugs and slots cooperating to limit the upward travel of said plunger.

8. The assembly of claim 2, in which said plunger has a longitudinal bore, the upper end of which serves as the inlet to said pumping means, a moveable sealing ball within said bore which cooperates with the upper end of said bore to seal said inlet, and a plug inserted into the lower end of said bore to limit the free movement of said ball, said plug being provided with openings permitting the flow of liquid from said bore into said pumping chamber.

9. A pump assembly for removing a liquidlike substance from an external container and injecting said liquidlike substance into a conventional aerosol container, the improvement comprising:

   a housing means;
   first means for connecting said housing means to said external container;
   second means spaced apart from said first connecting means for connecting said housing to said aerosol container;
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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Inventor(s) Francis E. Ryder

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

Column 2, line 14, after "flattened" cancel "51 serves to lock ........ aerosol can 61".

Signed and sealed this 6th day of June 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patents