ABSTRACT: Refillable sprayer apparatus employs a filling valve and an air-release valve which are directly or indirectly mechanically linked to provide sufficient filling of the sprayer while at the same time preventing overfilling and a resulting loss of excess liquid.
AEROSOL STORAGE CONTAINER AND REFILLABLE DOSING SPRAYER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to liquid sprayers operating by means of a power gas pressurized in the liquid, and more particularly to valving apparatus for filling gas pressurized liquid sprayers.

2. Description of the Prior Art

Generally speaking, sprayers of the type of instant concern comprise two main parts, namely a large storage container, which is sometimes also employed directly for the spraying operation, and the small sprayer having a maximum capacity of approximately 20 cc which is refillable from the storage container. Sprayers of the type mentioned above are particularly employed in hair treatment and are briefly referred to as aerosol sprayers. The small refillable sprayers are also called dosing sprayers. The filling of these small dosing sprayers facilitates the work of the hair dresser, because they contain precisely the amount of liquid necessary for a single treatment. Also, a woman can conveniently carry such a small sprayer in her handbag.

As a rule, the loading operation is accompanied by the drawback that there is a gas cushion in the dosing apparatus being loaded, which cushion hinders the filling of the apparatus. Thus, even after the dosing sprayer is empty, there still remains a residue of a power gas. Moreover, the liquid flowing in during the loading operations carry power gas, part of which passes out immediately, and together with the residue, takes possession of the filling chamber of the dosing sprayer. Hence, the loading operation is forcibly terminated by the counter pressure of the power gas in the sprayer so that only an insufficient small volume of liquid can be delivered to the dosing sprayer.

To obviate this drawback, it has long been proposed to provide such dosing sprayers with an air-release valve. An air release tube extends from this valve into the area of the sprayer container lying on top during the filling process and which, therefore, is filled with power gas. The user has heretofore had to actuate the air-release valve during the loading operation to enable the pressurized gas to escape. In many cases, there is not only power gas but also an inert gas, e.g. nitrogen, additionally provided to form a pressure cushion. During the loading operation the user of the apparatus has to pay particular attention when the liquid surface passes through the opening of the air-release tube, which is noticeable by the emergence of liquid through the air-release valve, and the user must close the air-release valve. The foregoing apparatus has not proved successful, so that it is known in the prior art as a proposal, but is not feasible in practice. This is apparently due to the fact that the women using these sprayers, since these articles are employed by women in hair treatment, are not inclined to perform complicated manipulations. Consequently, the dosing sprayers have remained without air-release valves and their deficiencies, being accepted out of necessity, have stood in the way of a broader acceptance of this type of sprayer apparatus which operate without air-release.

SUMMARY OF THE INVENTION

The present invention has taken the above points into consideration and employs techniques which enable a simple operation of an air-release valve. The present invention starts from the storage container for a liquid pressurized by a power gas, as well as a refillable dosing sprayer comprising an air-release valve in addition to the loading valve which, under certain circumstances, also serves as the outlet sprayer valve. The essential feature which distinguishes this combination of two cooperating aerosol containers from the prior apparatus referred to above resides in the provision of the air-release valve in an directly or indirectly mechanically linked relationship to the loading valve such that the air-release valve is forcibly opened at the beginning of the loading operation and closed when the loading operation is terminated.

There are various construction possibilities to carry this inventive concept into effect, for example, the air-release valve may be disposed in the dosing sprayer close to the loading valve, linking the air-release valve directly to the loading valve through intermediate members. A particularly attractive solution is to combine the loading valve and the air-release valve into a unit having a common valve body which is provided with separate through passages for the loading operation on the one hand and for the air-release operation on the other hand. The coupling of both valves to each other resides in the provision that they form a fixed structural unit and are thus forcibly opened and closed approximately at the same time. However, there is a third possibility, whereby both valves are disposed in the bottom surface of the dosing sprayer independently of each other, the bottom part of the dosing sprayer being so designed that the sprayer can only be mounted on the supply bottle or inserted into an opening in a very definite position, for example in relation to its contours, for the purpose of loading. However, the storage container carries on its upper front face underneath a release valve an upwardly projecting mandrel which is leveled accurately against the air-release valve so that in such an embodiment, when the dosing apparatus is pressed downwardly for the purpose of opening its loading valve, the air-release valve too is forcibly and simultaneously opened by the force of the mandrel of the storage container. When the dosing sprayer is removed, the two valves are likewise forcibly and simultaneously closed. Here, the two valves are directly coupled to each other, i.e. via the storage container. This solution is somewhat more complicated, but it assures that a dosing sprayer designed in this manner can only be filled from a storage container fitting therewith, thus giving a certain guarantee of quality.

It may be feared, however, that the user of such a dosing sprayer does not terminate the loading operation at the proper time, so that as a result, the excess liquid, like the gas before, flows out through the air-release tube, this, of course, is not desirable though this danger is minimal, because no great attention is needed to determine the state of filling, and because an air-release valve with a small cross section, while making a slight outflow of the gases possible, still offers a comparatively great flow resistance to the somewhat viscous liquid. According to a further development of the invention it is, however, possible to practically rule out this excess flow of liquid.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, its organization, construction, and operation, will be best understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational cross-sectional view of a dosing sprayer wherein the air-release valve and the loading valve are disposed on the bottom of the housing and are mechanically and directly linked together;

FIG. 2 is an elevational view of an aerosol sprayer, shown partially in cross section, wherein the air-release valve and the loading valve are combined into a single fixed unit;

FIG. 3 is an enlarged cross-sectional side view of the valve body of the apparatus illustrated in FIG. 2, wherein the half located on the right-hand side of the central line is swung into the sectional plane by an angle of 90°, the cross section being taken along the line III-III of FIG. 4;

FIG. 4 is a horizontal cross-sectional view taken along the lines IV-IV of FIG. 3;

FIG. 5 is an elevational cross-sectional of another embodiment of the invention illustrating a dosing sprayer comprising a device to close the opening of an air-release tube by means of a floating member, the dosing sprayer being illustrated in cooperating engagement with a storage container; and

FIG. 6 is a cross-sectional elevational view of a dosing sprayer in accordance with the present invention which is also provided with a floating member in a different configuration.
DESCRIPTION OF THE PREFERRED EMBODIMENTS

The exemplary embodiment illustrated in FIG. 1 is provided in the usual manner with a cylindrical container body 1 which is closed at its upper end by an end cap 2 and at its lower end by another end cap 3. At the upper end is a spray valve 4 arranged in the usual manner and of which only the most important parts are shown since the details of the construction are known and are not important for clarifying the invention. The spray head 5 is disposed on this valve 4. The extraction tube 6 extends downwardly from the spray valve 4 to the bottom space of the container.

To seal the end cap 3, through which the cylindrical container 1 is closed at its lower end, there is provided a packing ring 7 which is squeezed tightly by the end cap 3 via an intermediate ring 8. The intermediate ring 8 extends upwardly into an axial hollow cylinder 9 which is opened at its upper end. Through this opening 10 the liquid is introduced into the interior of container 1 during the loading operation. At the lower end of the hollow cylinder 9 is disposed the valve body 11 of the loading valve having a diameter somewhat smaller than the inside diameter of the hollow cylinder 9 and which is supported with an annular ridge 12 on a flexible annular packing disc 13 likewise located in the cap 3 under the tension of a valve spring 14.

The loading connection 15 extends sealing through the central opening of the annular disc 13 and measures with its upper end in a recess of the valve body 11, that is, with play. Thus, the bore hole 16 of the loading connection 15 is in communication at its upper end above the packing disc 13 with the recess within the valve body 11 and, hence, within the small hollow space surrounded by the annular ridge 12.

Another essential element is the air-release tube 17 which extends with its opening on top into the gas-filled space. On this opening of the tube 17 is disposed tube 18, which is filled at its upper end with a porous filter, e.g., cotton wool, a porous stone or plastic lining or the like. Because of this material, which may also be designated as a filter and is disposed before the opening of tube 17, the conductance for air is practically not increased. However, for liquids, particularly for liquids having a somewhat higher viscosity, the numerous and extremely fine passages through the porous material nevertheless forms such a high flow resistance that there is practically no passage of liquid. The apparatus, after filling, would further have to be exposed to the loading pressure for an unusually long time before liquid could actually penetrate, but this condition has to be met out. At the upper end of the filter tube 18 determines the filling level 19 of the dosing sprayer.

At the lower end, the air-release tube extends as far as the packing disc 13. In the rest position shown, the valve spring 14 urges the annular packing disc 13 tightly against the inner front face of the end cap 3, so that the air-release tube is sealed off at its lower end toward the geometrical axis of the apparatus. If the aerosol sprayer, in order to load, is mounted with its loading connection 15 on the opening of a storage container, the loading connection 15 presses the valve body 11 upwardly against the force of the valve spring 14. The annular packing ridge 12 is thereby lifted from the packing disc 13 and the passage from the storage container through the bore hole 16, then across the opening of the loading connection 15 through the lifted packing ridge 12 and sideways past the valve body 11 to the inlet tube 10 is opened. Since the pressure which squeezes the packing disc 13 against the end cap 3 is thereby neutralized, the power gas being under excess pressure can penetrate in an axial direction across the air-release tube 16 on all sides of between small packing disc 13 and the front face of the end cap 3 and can exit into the exterior of the apparatus adjacent the loading connection 15 which is not sealed airtight in the end cap 3. The lower opening of the air-release tube 17 and the packing disc 13 in communication with the end cap 3 represent, so to speak, the air-release valve in a very simple structural form.

When the apparatus is filled-up to the upper opening of the filter body 18, the passage for the gaseous medium is blocked, while the passage of liquid through the filter 18 is kept constant and a liquid break is made sufficiently resistive to liquid flow that such flow is practically stopped. The filling operation is now terminated, since the pressure of the residual gas stops further flow of liquid. The user of the apparatus will immediately notice this and will remove the aerosol sprayer. In this way, the sealing between the packings 13 and end cap 3 is closed again at the lower end of the air-release tube 17, that is, simultaneously with the closing of the loading valve. The foregoing discussion reveals that in this exemplary embodiment, in addition to the spray valve 4 and the loading valve containing the loading valve body 11, there is a special air-release valve which is mechanically linked to the loading valve and is thus forcibly and simultaneously opened and closed with such loading valve.

The aerosol sprayer illustrated in FIGS. 2-4 represents the best solution in that here the loading valve and the air-release valve form a single unit. The valve body 31 thus becomes slightly more complicated in that it must contain the passages for the liquid medium to be conducted during the loading operation, namely via the loading passages 32, as well as the passages 33 for air-release. However, since the two passage guides form a single member, this form of construction is less expensive than the construction of the sprayer employing two separate valves, and it is also more compact and less susceptible to trouble. To better illustrate the course of the channels, which is not possible on the drawing of FIG. 2, the valve body 31 is illustrated on a larger scale in FIGS. 3 and 4.

FIG. 3 is an axial view according to two diametral planes intersecting each other at an angle of 90°. These two planes intersect each other in the axis wherein the right hand portion of FIG. 3 is at right angles to the drawing plane and is thus swung into the drawing plane at an angle of 90° for purposes of illustration. The section shown in FIG. 4 thus runs through an angled part line marked III-III.

FIG. 4 illustrates a horizontal cross section through the valve body according to the plane marked IV-IV in FIG. 3.

The air-release tube 17 coming from above extends via a hollow connection piece 37 into two radial outlet channels 33 facing each other and exiting underneath the sealing valve disc 34 so that they exit directly into the open when the valve body 31 is pressed upwardly, namely through the central opening of the lower cap 33. Likewise, the inlet channel 36 for the fluid flowing from the storage container is divided into the two subchannels 32 previously mentioned. The plane of the two loading subchannels 32 and that of the two air-release subchannels 33 are thus moved 90° in relation to each other so that the pairs of channels do not adversely affect each other but can be disposed in staggered relation within the valve body 31. FIG. 4 illustrates how the axial loading channel 36 extends into the two loading subchannels 32. The transition from the air-release channel 37 to the two air-release subchannels 33 is likewise evident from the drawing. Moreover, this exemplary embodiment may correspond to that illustrated in FIG. 1 so that like numerals are employed for like parts.

In the exemplary embodiment illustrated in FIG. 5, only the sealing at the upper end of the air-release tube is of interest. It is thereby unimportant how the air-release valve located at the lower end of the air-release tube 47 is designed and how it is linked to the loading valve. Here, too, the same numerals are used for parts corresponding to the parts of the first-mentioned exemplary embodiments.

The air-release tube 47 extends in this exemplary embodiment with its upper end into a hollow cylinder 48 which is closed opening on all sides of between small packing disc 13 and the front face of the end cap 3 and can exit into the exterior of the apparatus adjacent the loading connection 15 which is not sealed airtight in the end cap 3. The lower opening of the air-release tube 17 and the packing disc 13 in communication with the end cap 3 represent, so to speak, the air-release valve in a very simple structural form.
floating member 50 made of a light material so that the upward thrust of the member when the liquid surface has reached the bottom of the cylinder 48 and completely washes the floating member 50 is sufficiently great to seal the through port 49. Needless to say that an absolute sealing can not occur; however, the subsequent flow of liquid is reduced considerably. A counter pressure is built up in the circular-cylinder-shaped gas-filled space outside the hollow cylinder 48. In the interior of container 48, the further rise of liquid is so slow that one can not fail to notice the instant filling level is reached. As a further precaution there is finally the blocking effect of the filter 18 previously described.

The storage container 60 is also illustrated in FIG. 5 to show at least in part of one exemplary embodiment the cooperation between the whole system consisting of a storage container and a dosing sprayer. The dosing sprayers illustrated in FIGS. 1—5 are disposed in a previously known manner on the outlet valve 61 of the storage container whereby the outlet valve is opened by pressing the dosing sprayer downwardly.

FIG. 6 illustrates a further development of the invention which utilizes a floating member. In this dosing sprayer, the air-release tube 77, which is provided at its upper end with a filter 78, is extended upwardly slightly past the desired filling level. The filling level is likewise limited by a floating member 70 which, however, unlike the floating member illustrated in FIG. 5, can be slid on the loading tube 71 with no limit which is closed at its upper end. The flow of the liquid supplied during the loading process into the filling space of the sprayer occurs through two small openings 72 made at the side of the loading tube 71 in the area of the desired filling level, such that they are covered by the floating member 70 when the latter reaches the filling level. It is advantageous to flare the loading tube 71 upwardly in the form of a cone as illustrated in the drawing, or to extend it with a substantially horizontal bottom which would result in the most effective sealing so that the upward thrust of the floating body can be utilized as a sealing force to close the openings 72. Inasmuch as the floating member must embrace the loading tube 71 with a free play, so as to follow the liquid level with ease when such level goes up and down, the possibility of sealing is improved by such positioning of the outlet openings 72. Perfect sealing is not attained, but such is not required either. At any rate, when the outlet openings 72 is closed, the liquid is prevented to a large degree from flowing in. If the user does not notice this, so that the liquid level continues to rise slowly, the final limitation in the region of the filter opening 78 as previously described will occur. As a result of this double safeguard, it is sufficiently assured that the undesirable flow of liquid through the air-release tube 77 is avoided.

The exemplary embodiment illustrated in FIG. 1 and that illustrated in FIGS. 2—4 can be modified by placing a floating member in such a manner that the air-release tube 17 or 48 as the case may be is closed at its upper end and is provided with a side opening for the passage of air at such a point that it is covered by a floating member guided on the tube, as shown in FIG. 6, when the desired filling level is reached. Since, however, as explained above, the free play of the swimming member on the guiding tube must be sufficiently large to fully assure the free up and down movement of the floating member, the air passage opening is in this manner not completely sealed either. It may still be sufficient, however, particularly when, due to the conical extension of the tube at its end, the upward thrust of the floating member produces a slightly greater sealing pressure.

The construction in accordance with the invention of a system consisting of a supply bottle and a dosing sprayer makes it possible to utilize in an impeccable manner the concept of air-release during the loading of the dosing sprayer so that it is now possible to fill the dosing sprayer exactly up to the desired mark. It is known that this possibility has not existed heretofore and any of the dosing sprayers available and that the insufficient refilling possibility has been deplored. This deficiency has heretofore hindered the wide acceptance of dosing sprayers, of which so much was expected at the beginning. The present invention obviates these deficiencies, thus offering the possibility of marketing refillable dosing sprayers. Particularly important is the advantage that such apparatus may now forego the use of an inert gas.

We claim:

1. In a dosing sprayer for receiving a dose of spraying liquid within a closed container from a source of gas-pressurized liquid and having an inlet valve adapted for connection to the source and a spray valve for discharging the liquid, the improvement therein comprising a closed hollow chamber disposed within the upper end of the container including an inlet port and an outlet port which define the direction of gas travel from the container, a means forming a passageway interconnecting the inlet valve and the hollow chamber including flow resistant means having a greater resistance characteristic to liquid flow than to gas flow, a slidably mounted floating member within the container for floating into sealing engagement against said inlet port of said hollow chamber during filling, whereby the closure of said inlet port and the resistance characteristic of the flow resistant means preventing a backflow of liquid upon attaining the proper filling dosage.

2. The improvement in a dosing sprayer according to claim 1, wherein said means forming a passageway includes a tube connected to said outlet port, said outlet port is disposed adjacent said inlet port and said floating member includes an aperture therein loosely embracing said tube for sliding therealong.

3. The improvement in a dosing sprayer according to claim 1, wherein said means forming a passageway includes a tube extending from the inlet valve to the interior of said hollow chamber and having a mouth within said chamber, and said flow resistant means is mounted within said mouth of said tube.