A valve and spray head to be used with a pressurized container for dispensing metered amounts of fluids, comprising a valve seat mounted at the opening of the container. Adjacent the valve seat, a tubular support member is positioned in which a plug member is spring biased to abut and seal the valve seat. Spray head means having a tubular stem is positioned about the plug member for spraying fluid. The stem of the spray head has a nozzle opening for metering the passage of fluid through the head.
SPRAY HEAD AND VALVE FOR PRESSURIZED CONTAINER

This invention relates to a spray head and valve for a pressurized container and more particularly to a new improved spray head and valve arrangement for dispensing metered amounts of fluids.

A great number of valves and spray heads have been developed for metering the dispensing of fluids from pressurized containers, such as aerosol containers and the like. In most if not all of such devices the fluid is metered by means of slots or grooves in the external surface of the spray head stem, which slots pass into the interior of the stem. Such devices suffer from the fact that it is exceptionally difficult to meter fluids with such slots. The metering is accomplished only when the flow of fluid is such that it completely fills the cross-sectional area of the slot. Thus, these devices are suitable only for metering large flow rates of fluids. If the slot is made sufficiently small so that a low flow rate of fluid is metered therethrough, the slot is liable to close through the drying of the fluid in the slot or the accumulations of particles and impurities therein. As a result, a number of valves have been developed which include means for the periodic cleaning of such slots. Further, such slots are liable to close due to lateral pressure being applied on the stem.

Other valve structures provided a valve-sealing member having a base surface on which was located a protruding portion with ribs or grooves thereof, such that the spray head stem fitted over the protruding portion. The stem further rested on ribs located on the base surface, so that the fluid could pass under the stem and through the passage formed between the stem and the protruding portion of the valve-sealing member. As with the other devices, this type of structure could not meter a small flow of fluid. Further, as a result of the ribs on the flat base area, the stem of the spray head could not be firmly supported on the valve-sealing member.

A number of investigators in this area described the use of an orifice or orifices in the spray head stem for metering the flow of fluid. However, all of these structures devised suffered from the fact that the fluid would dry, or particles would collect and close the orifice. Another disadvantage of such valve and spray head constructions, is that they are formed from parts which are relatively expensive to form as well as to assemble. As a result, such valve constructions are not widely used.

Other difficulties encountered with metering valves, are in the construction and operation of the tubular member which supports the valve-sealing member. Longitudinal ribs are provided on the inner surface of such members for guiding the travel of the valve-sealing members. Ribs are also provided on a flat inner surface in said tubular member, wherein the biasing spring is seated, so as to permit the fluid to flow past the spring. However, it is very difficult to keep the spring seated in one position on such ribs and, as a result, the spring tends to move thus tilting or moving the valve-sealing member, such that it improperly abuts the valve seat and forms a poor seal therewith.

Further, the valve-sealing member and tubular member are so constructed that they cooperate to prevent the valve sealing member from bottoming out so as to impede the flow of fluid. This involves providing additional surfaces, which adds to the expense of forming such parts.

In view of the foregoing, it is an object of this invention to provide a new and improved spray head which accurately meters fluid even at low fluid flow rates.

Another object of the invention is to provide a new, improved and economical spray head and valve device for pressurized containers which can be constructed from simple parts and easily assembled.

A further object of the invention is to provide a new and improved spray head for accurate metering of fluid from a pressurized container by means of a nozzle opening.

Yet another object of the invention is to provide a new and improved valve in which the travel of the valve-sealing member is limited and in which the flow of fluid through the valve is unimpeded.

A still further object of this invention is to provide a new and improved valve having a valve-sealing member of superior dynamic stability to provide exceptional support for the spray head.

Still other objects and advantages of the invention will in part appear hereinafter.

The present invention comprises resilient valve seat means having an opening therein and located at the opening of a pressurized container. Adjacent the valve seat, a tubular member is mounted. The tubular member has a first section with an inner surface of uniform diameter having longitudinal ribs thereon for guiding a plug member. A second section in said tubular member adjacent said first section is formed such that the diameter of the inner surface decreases in a direction away from the valve seat to form a seat for a spring biasing the plug member, such that the plug member abuts the valve seat to form a seal. At least one groove is formed in the inner surface of the second section of said tubular member to permit fluid to flow past said spring without the flow being impeded by the spring. The upper section of said plug member has a raised portion which passes through the opening in the valve seat so that the tubular stem of the spray head can be mounted thereon. An annular shoulder is formed about said raised portion for supporting the end of the tubular stem. An annular skirt is formed about said annular shoulder, such that the end of the annular skirt abuts the valve seat to form a seal therewith. At the lower end of the spray head stem there is preferably formed a nozzle opening wherein the cross-sectional area of the opening on the inner surface of the stem is substantially smaller than the area of the opening in the external surface of the stem, so as to create nozzle flow conditions in the opening. Alternatively, if the nozzle opening is too small, it can be formed with a uniform cross-sectional area along the axis of the opening. In addition, longitudinal ribs are formed on the inner surface of the stem above said nozzle opening to provide passages between said raised portion of said plug member and said stem for the passage of fluids.

The invention accordingly comprises an article of manufacture possessing the features, properties and the relation of elements which will be exemplified in the article hereinafter described and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a sectional view of the preferred embodiment;
FIG. 2 is a sectional view of an alternate embodiment; and
FIG. 3 is a view taken along line 3-3 of FIG. 1.

Referring to FIG. 1, the valve of this invention is preferably applied to a pressurized container (not shown) by means of a gripping cap 12 having a resilient sealing layer 14 for forming a tight seal with the walls of the container. The cap 12 has an opening about which is positioned a resilient valve seat 16. The valve seat 16 can be constructed from any resilient or elastomeric material, such as rubber or the like. Further, the valve seat 16 has an opening 18 which engages and provides a tight fit with a stem 20 of spray head 22. Adjacent the valve seat 16, is positioned a tubular support member 24 which is mounted by gripping the cap 12 about a shoulder 26.

The tubular support member 24 is composed of an upper section 28, a middle section 30 and a lower section 32. The upper section 28 has an inner surface of uniform diameter about which are formed longitudinal ribs 34 for guiding the travel of a plug member 36. The middle section 30 is formed with the inner surface of the tubular member decreasing in diameter in a direction away from the valve seat 18, so as to form a spring seat 38. A spring 40 rests on the seat 38 to bias the plug member 36. There is also formed in the inner surface of section 30, grooves 42 for permitting fluid to pass therethrough. The lower section 32 of the member 24 comprises a small uniform diameter cylindrical extension 45 about
which is stretch-fitted a dip tube 44 whose lower end (not shown) is immersed in the fluid in the pressurized container.

The plug member 36 is composed of upper and lower sections formed symmetrically about a plane passing through the stem 20. The fluid then passes over the upper section 36 and flows centrally raised upper portion 46 of a smaller diameter than the inner diameter of stem 20. The central raised upper portion 46 increases in diameter to form a section 48 which fits tightly into the stem 20. The section 48 then increases in diameter to form an annular shoulder 50 for supporting the stem 20. As shown, it is evident that upper portion 46, section 48 and shoulder 50 firmly support stem 20, as well as providing a seal at the point at which stem 20 engages shoulder 50. Further, the plug member 36 is provided with an annular skirt portion 52, whose ends abut resilient valve seat 16 to form a seal therewith under the influence of biasing spring 40. As has been noted previously, the upper part of the plug member 36 is symmetrical to the lower part such that the parts just described are the same upside down or vice versa. The advantage of this construction is that it does not matter which end of plug member 36 is first inserted into tubular member 24. As a result, the possibility of error by assembly workers, in assembling the valve, is substantially decreased. Further, central raised lower portion 54, which is equivalent to portion 46, is used as a spring guide for spring 40. It can be seen that, with the use of portion 54 and spring seat 38, the spring is kept in position such that it acts upon the plug member 36 to cause the skirt portion 52 to abut and form a tight seal with the valve seat 16. At the lower end of the stem 20 there is formed a nozzle 56 having an opening 58. The opening 58 in the external surface of the stem is substantially larger than the opening 60 in the internal surface of the stem, so as to produce a nozzle effect. The diameter of opening 60 may be generally 0.1 to 0.7 mm. and, preferably, 0.1 to 0.3 mm., to obtain desirable sprays from the spray head 22. The ratio of the surface area of the opening 60 to opening 58 should generally be 1 to 3, to obtain the necessary nozzle effect. This effect is an important aspect of the present invention, since it prevents nozzle 56 from being closed by the accumulation of fluid, impurities, particles and the like. The comparatively large surface area of opening 58 creates an exceedingly large pressure in opening 60 to force an opening therein should it become closed. Alternatively, if its diameter is sufficiently large, nozzle 56 may have a uniform cross-sectional area along its axis. Thus, if its diameter is about 0.8 mm., the nozzle 56 may have a uniform cross-sectional area. Longitudinal ribs 62 are formed in the internal surface of stem 20 above opening 60, such that they abut raised portion 46 to support the stem on the raised portion and to form passages for the travel of the fluid. An annular area 64 is located adjacent opening 60 to permit fluid to pass between ribs 62. Shoulders 66 are formed at the upper end of the stem 20 so that the movement of plug member 36 and stem 20 into the valve is terminated at the point at which shoulders 66 abut the edge 68 of cap 12. This prevents the lower section of the plug 36 from bottoming out to the point where it impedes or terminates the flow of fluid. It must be emphasized that this is an extremely simple and inexpensive method for preventing the bottoming out of the valve-sealing member, compared to the means and the valves of the prior art.

When the spray head 22 is moved downwardly, fluid passes up the dip tube 44, through the grooves 42 and into the passages between the longitudinal ribs 34. If grooves 42 were not formed, the flow of fluid would be impeded by spring 40 especially since the spring is being compressed during this time. The fluid then passes through the central raised upper portion 46 into annular area 70. From there it flows through nozzle 56 into annular area 64 and into the passages between longitudinal ribs 62. The fluid can then travel through channel 72 and out of the spray head 22.

It can be appreciated that the valve and spray head of this invention can provide an extremely accurate metered flow of fluid. In order to accomplish this, it is necessary that a tight seal be formed between the lower end of the stem 20 and the plug member 36 at shoulder 50. Further, in order for the valve to operate properly, it must seal properly when the skirt portion 52 abuts the valve seat 18. However, since the stem 20 passes through a resilient valve seat 18, it can be moved and dislodged from shoulder 50, thus breaking the seal. Also, as a result of such lateral movement, plug member 26 can be tilted so that, when the valve is released, the skirt portion 52 does not form a good seal with the valve seat 18. The main advantage of plug member 36, is that it eliminates the possibility of an assembly worker incorrectly inserting the member 36 into tubular member 24.
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jacent said first section such that the inner surface of said second section decreases in diameter in a direction away from said valve seat means to form a seat for said spring means, and wherein at least one groove is formed in the inner surface of said second section to permit fluid to pass through said tubular member without being impeded by said spring means.

4. A valve and spray head in accordance with claim 1, wherein said valve seating means comprises a plug member having a central raised portion which is capable of passing into said stem, having an annular shoulder about said central raised portion for supporting said stem of said spray head, and having an annular skirt portion surrounding said annular shoulder such that the end of said skirt portion abuts said valve seat means to close said valve.

5. A valve and spray head in accordance with claim 4, wherein said plug member is symmetric about planes passing through the longitudinal axis and transverse axis of said plug member.

6. A valve and spray head in accordance with claim 3, wherein said valve seating means comprises a plug member having an upper section with a central raised portion, an annular groove about said raised portion such that the stem of said spray head may be firmly locked in position on said central raised portion and in said annular groove, and an annular rib about said annular groove such that said rib abuts and seals said valve seat means.

7. A valve and spray head in accordance with claim 6, wherein said plug member further includes a lower section having a central guiding portion and an annular skirt positioned about said central guiding portion.

8. A valve and spray head in accordance with claim 7, wherein said plug member is formed with a hollow area extending along the longitudinal axis from the end of said central guiding portion to an upper level in said central raised portion.

9. A valve and spray head in accordance with claim 1, wherein said nozzle has an opening on the inner surface of said stem which has a substantially smaller diameter than the corresponding opening on the external surface of said stem.

10. A valve and spray head in accordance with claim 9, wherein the ratio of the area of the inner surface opening to the area of the external surface opening of said nozzle opening is about 1 to 3.

11. A spray head for spraying metered amounts of fluid from a pressurized container, comprising
   a. a head member, and
   b. a stem member extending from said head member and having a nozzle in said stem wherein the ratio of the area of the inner surface opening of said nozzle to the area of the external surface opening of said nozzle is about 1 to 3, and wherein longitudinally extending ribs are formed on the inner surface of said stem above said nozzle.

12. A valve for a pressurized container having an opening therein, comprising
   a. a resilient valve seat having an opening therein adapted for positioning at the opening of the container,
   b. a tubular support member mounted adjacent said valve seat, and
   c. plug member means spring biased in said tubular member and including an upper section having a central raised portion, an annular groove formed about said central raised portion, an annular rib formed about said groove which abuts and seals the valve seat, a lower section having a central guiding portion and an annular skirt formed about said central guiding portion, wherein a hollow area is formed in said plug member means along the longitudinal axis thereof from the end of said guiding portion to the upper section in said central raised portion.

13. A valve in accordance with claim 12, wherein said tubular member has a first section adjacent said valve seat means whose inner surface is of uniform diameter and contains longitudinal ribs therein and a second section whose inner surface decreases in diameter to form a seat for said spring biasing said plug member means.

14. A valve in accordance with claim 13, wherein at least one groove is formed in the inner surface of said second section to permit fluid to pass alongside said spring without being impeded by said spring.

15. A valve and spray head in accordance with claim 1, wherein said nozzle opening has a uniform cross-sectional area along its axis.
CERTIFICATE OF CORRECTION

Patent No. 3,608,830 Dated September 28, 1971
Inventor(s) Mario A. Ramella

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 8, after "part" insert --be apparent and will in part--.
Column 3, line 30, after "opening" change "56" to --58--.
Column 4, line 7, change "26" to --36--.

Signed and sealed this 4th day of April 1972.

(SEAL)
Attest:

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