

- [54] **METERING VALVE FOR AEROSOL DISPENSER**
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[21] Appl. No.: **296,514**

Related U.S. Application Data

[63] Continuation of Ser. No. 69,249, Sept. 3, 1970.

- [52] **U.S. Cl.** **222/402.22**
[51] **Int. Cl.** **B65d 83/14**
[58] **Field of Search**..... 222/402.2, 402.21, 402.22,
222/402.23, 402.24, 506, 509, 450;
137/614.11, 614.13, 614.14;
239/579, 583, 577

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[57] **ABSTRACT**

A metering valve for aerosol dispensers having a pair of valves within a valve housing, one controlling access from the valve housing to the bore of an exterior valve stem, and the other controlling access of the contents of the container from the interior of the latter to the valve housing; a spring urging the first valve to closed position and the second valve to open position; and means responsive to manipulation of the valve stem successively to move the second valve to closed position and the first valve to open position, the spring returning the valves to their original condition in reverse order when said manipulation of the valve stem is discontinued.

12 Claims, 7 Drawing Figures

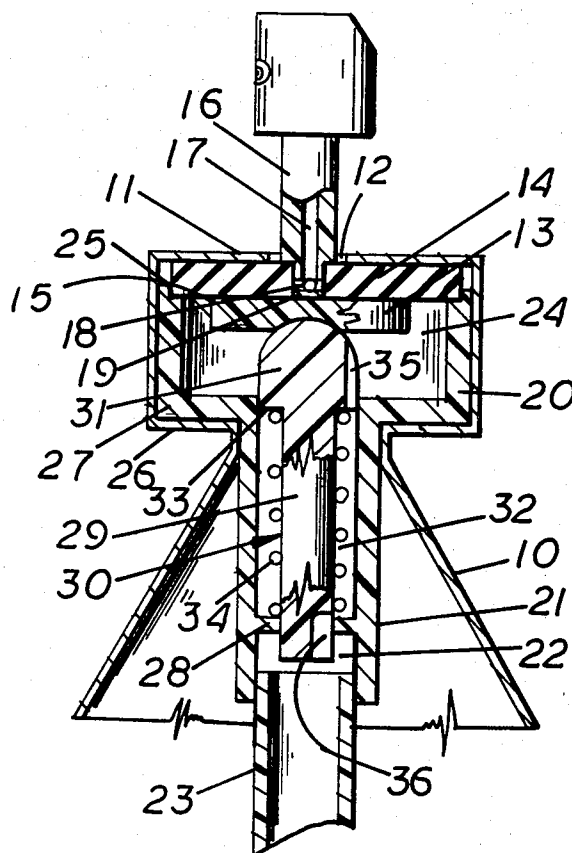


FIG. 1

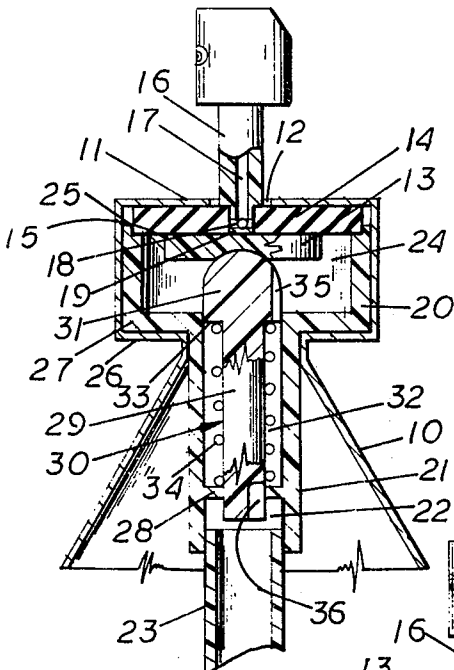


FIG. 1A

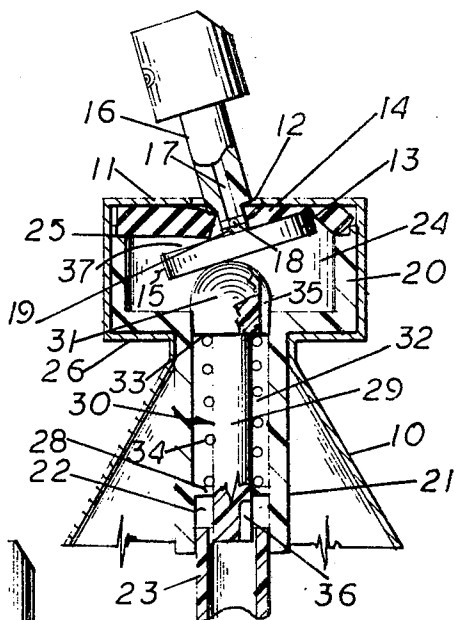


FIG. 2

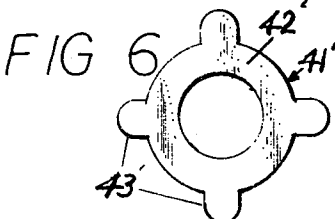
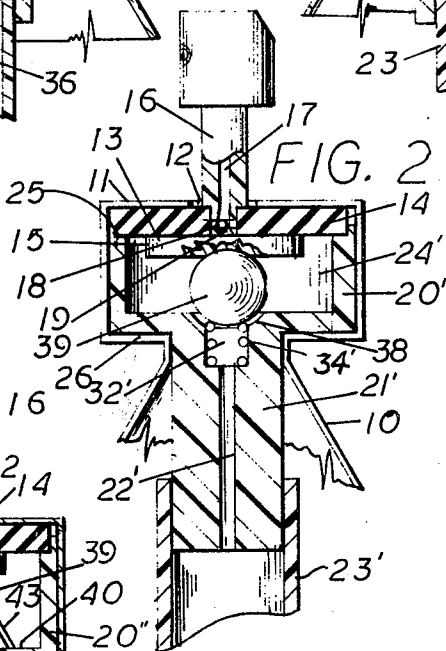


FIG. 5

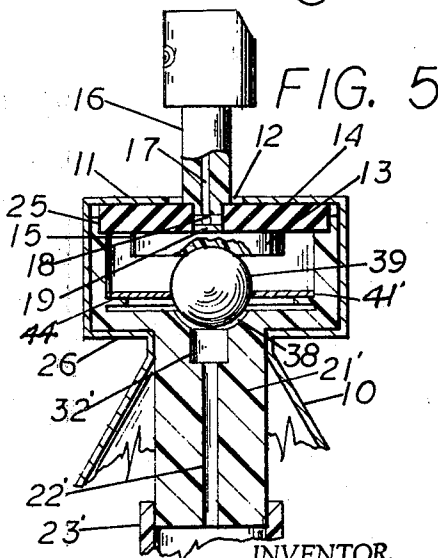


FIG. 3

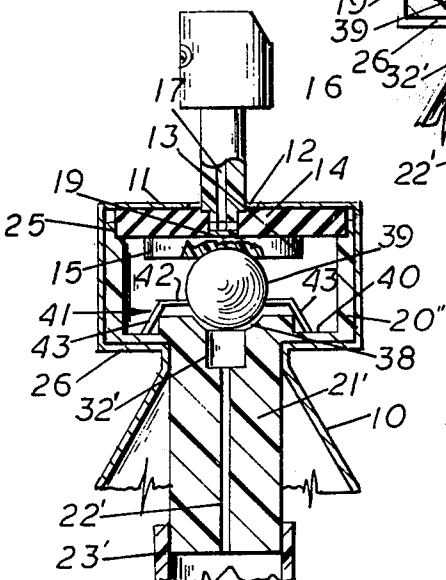
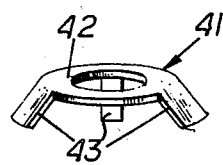


FIG. 4



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METERING VALVE FOR AEROSOL DISPENSER

This is a continuation of application Ser. No. 69,249, filed Sept. 3, 1970.

This invention relates to a metering valve for pressurized aerosol dispensers, of which the contents normally include a liquid or finely divided solid to be dispensed in the form of a spray, and as a propellant therefor, a liquified normally gaseous organic compound — usually a low boiling fluorinated or chlorofluorinated low molecular weight hydrocarbon. This mixture (solution, emulsion or suspension) is retained in a pressure resistant container — of sheet metal or the like — under the vapor pressure generated by the propellant at room temperature. When released through a nozzle to the atmosphere, the propellant vaporizes and the material to be dispensed is ejected from the nozzle in the form of a fine spray.

In order to provide metering action, it is necessary to admit a limited quantity of the liquid pressurized contents of the container into a separate chamber within the chamber, communicating with the exterior through an exteriorly operable valve controlling access to the spray nozzle — access of the liquid contents of the container to said separate chamber being closed off during release of the pressurized liquid contained therein through the nozzle. Following closure of the valve controlling access to the nozzle, the liquid contents of the aforesaid separate chamber is replenished from the interior of the container. Thus, emission from the dispenser for a single operation of the spray nozzle-controlling valve is limited to the quantity of pressurized liquid contained in the aforesaid separate chamber.

It is an object of this invention to provide a metering valve assembly for an aerosol container having few parts which are of simple design and economical to manufacture, which reliably operate to release a metered quantity of the pressurized contents of the aerosol dispenser and which reliably replenish the quantity to be released for the next operation when the current operation is discontinued.

These objects are attained in accordance with this invention by providing a metering valve assembly adapted to be mounted and enclosed — by crimping or the like — in a valve socket at the upper end of a pressurized aerosol container of sheet metal or the like, having a pair of valves, one of which controls access from a chamber formed within the valve housing to the bore of a valve stem extending through an aperture in the top of the container, and terminating in a spray nozzle. The second valve controls access from a dip tube, of which the lower end is immersed in the liquid contents of the aerosol dispenser, to the aforesaid chamber. Resilient means — especially a spring — normally urges the first valve to closed position and the second valve to open position. When the valve stem is manipulated e.g., by tilting or depressing, the spring yields to permit the second valve to close and then to open the first valve, releasing the liquid contents of the aforesaid chamber through the valve stem and nozzle to the atmosphere. When said manipulation of the valve stem is released, the pressure of the spring closes the first valve and then opens the second valve, permitting liquid from the interior of the container to enter the aforesaid chamber through the dip tube, ready to be released upon the next manipulation of the valve stem.

My invention will be more fully understood from the following description of a number of specific embodiments thereof, which are illustrated in the accompanying drawing wherein

FIG. 1 is a view — mainly in axial cross section — of a metering valve assembly in accordance with this invention, mounted in the valve socket of an aerosol dispenser — the assembly being in normal inoperative condition.

FIG. 1A is a view similar to FIG. 1 of the same valve assembly but in position to release a metered quantity of the contents of the aerosol container.

FIG. 2 is a view — mainly in axial cross section — of an alternative form of metering valve assembly in accordance with the invention.

FIG. 3 is also a view — mainly in axial cross section — of a second alternative form of metering valve assembly in accordance with the invention.

FIG. 4 is a detail in perspective of the spring included in the assembly shown in FIG. 3.

FIG. 5 is a view — mainly in axial cross section — of still a third alternative form of metering valve assembly in accordance with the invention.

FIG. 6 is a plan view of the spring included in the valve assembly of FIG. 5.

As illustrated in FIG. 1, a metering valve assembly in accordance with this invention is mounted in the valve socket of a pressure-resistant aerosol container 10 of sheet metal or the like, the socket having a generally flat circular top 11 with a central aperture 12, and including a valve seat 13 of resiliently yielding material such as rubber mounted against the inner wall of the top 11, and provided with a central aperture 14 of a diameter smaller than that of aperture 12 and in registry therewith. A valve disc 15 of substantially rigid material having a tubular valve stem 16 integral therewith is normally positioned against the inner surface of valve seat 13 with the valve stem 16 extending outward through apertures 12 and 14 of the valve socket and valve seat, and provided with a conventional spray nozzle at its outer end as shown. The central bore 17 of the valve stem 16 terminates adjacent the valve disc 15, and is connected at this point with a number of radial ports 18 extending to the outer surface of the valve stem at a portion 19 thereof of reduced diameter adjacent the valve disc, and of such length and diameter that the inner wall and edges of the aperture 14 in the valve seat fit therein — the inner wall of said aperture normally covering radial ports 18.

The valve seat 13 is peripherally clamped against the top 11 of the valve socket by a valve housing 20 of substantially rigid material, having a lower tubular portion 21 with a bore 22 adapted to be connected at its lower end to a conventional dip tube 23 which extends downward within the container 10 such that its lower end is immersed in the pressurized liquid within the container. The upper end of the valve housing 20 is of larger diameter, conforming with that of the interior of the valve socket, and is provided with a counterbore 24 of larger diameter than that of valve disc 15 but smaller than that of valve seat 13, such that its upper edge 25 is adapted to clamp the peripheral portion of valve seat 13 in sealing contact with the top 11 of the valve socket. Such clamping action is provided by an annular shoulder 26 formed in the side wall of the container 10 by crimping or the like, supporting an annular shoulder 27 at the base of the upper portion of the valve housing.

An annular ridge 28 is formed on the inner wall of bore 22 adjacent the lower end thereof, with a central aperture having a sliding fit with the stem 29 of a mushroom valve member 30. The upper end 31 of said mushroom valve member has a diameter corresponding to that of bore 22 so as to have a sliding fit therewith, and a height such that the upper (preferably rounded) surface thereof engages the base of valve disc 15 when the latter is positioned in sealing contact with the valve seat 13, while at the same time, the base of said upper end 31 extends a short distance into the upper end of bore 22 and the lower end of stem 29 extends through the aperture of annular ridge 28. Within the annular space 32 between said annular ridge 28 and the annular shoulder 33 at the base of the upper end 31 of the mushroom valve member, there is provided a helical spring 34 normally urging the mushroom valve member 30 and the contiguous valve disc 15 upward, such that the latter is held in sealing contact with valve seat 13.

The upper end 31 of mushroom valve member 30 has one or more vertical grooves 35 in its peripheral surface, providing permanently open passages from space 32 to the interior of counterbore 24 of valve housing 20. At its lower end the outer surface of stem 29 of the mushroom valve member is provided with one or more vertical grooves 36 extending upward to a point slightly above annular ridge 28 so as to provide a passage from the dip tube 23 to annular space 32 — and thus, through grooves 35 to the interior of counterbore 24 — when the valve disc 15 is seated in sealing contact with valve seat 13.

When the valve stem 16 is tilted by manual pressure applied to its upper end bearing the spray nozzle, valve disc 15 integral therewith tilts downward as shown in FIG. 1A, forcing mushroom valve member 30 downward against the resistance of spring 34, and closing the passage through grooves 36 by movement of the upper ends of these grooves downward beyond the upper surface of annular ridge 28. Such closure occurs in accordance with the invention, while valve disc 15 still engages valve seat 13 to seal off ports 18 of the valve stem 16 from the space within the valve housing 20. As further tilting of the valve stem proceeds, one side of valve disc 15 moves out of sealing contact with valve seat 13, while the inner wall of aperture 14 in the valve seat moves out of contact of one or more of radial ports 18, and thus, a passage 37 is opened from the interior of the counterbore 24 annular space 32 communicating therewith through grooves 35, to the bore 17 of valve stem 16. The pressurized liquid contents of the dispenser within spaces 24 and 32 within valve housing 20 is thereby released through said passage to the nozzle in an amount metered by the volume of the interior space of the valve housing.

When the valve stem 16 is released, the spring 34, bearing against shoulder 33 at the upper end of the mushroom valve member 30 urges the latter together with contiguous valve disc 15 upward until the latter resumes sealing contact with the valve seat 13 in the position shown in FIG. 1. After such sealing contact is re-established, final upward movement of mushroom valve member 30 under the influence of spring 34 against the cushion effect of valve seat 14 brings the upper ends of grooves 36 above the upper surface of annular ridge 28 — thus re-opening a passage from dip tube 23 to bore 22, annular space 32, and — through grooves 35 — to the counterbore 24. The pressurized

liquid within the container 10 rises through the dip tube and the aforesaid passages into spaces 24 and 32 in metered amount determined by their volume. When the valve assembly is again operated by tilting valve stem 16, the metered amount of aerosol contents are released through valve stem 16 and the nozzle at its outer end.

FIG. 2 illustrates a valve assembly in accordance with the invention, involving a variation in the construction of the valve mechanism constituted in FIG. 1 by mushroom valve member 30, its cooperating bore 22, annular ridge 28 and spring 34. In this construction, the valve housing 20' has a counterbore 24' generally similar to counterbore 24 of FIG. 1, having however a central bore 32' extending downward a short distance from the base of counterbore 24' and communicating with a smaller axial passage 22' in a depending tubular portion 21' of the valve housing 20', to which a dip tube 23' is connected. In this construction, the shoulder 38 at the junction of the bore 32' and the base of the counterbore 24' is formed as a concave spherical surface adapted to serve as a valve seat for a spherical valve member 39. The latter is adapted, when seated against the spherical surface 38 to close off the bore 32' from counterbore 24', and is moved to such sealing position by downward tilting of valve disc 15 to the position shown in FIG. 1A. When the valve disc returns to the position shown in FIG. 2, sufficient clearance exists between the valve member 39 and its spherical valve seat to permit the pressurized aerosol contents of the container to pass upward through dip tube 23', passage 22' and bore 32' into the counterbore 24' of the valve housing. If desired, a helical spring 34' may be provided in the bore 32' urging the spherical valve member 39 upward into contact with valve disc 15. The latter may be provided advantageously with a shallow central spherical depression conforming with the shape of said valve member.

FIGS. 3 and 5 illustrate alternative forms of springs cooperating with spherical valve member 39 to maintain it in contact with the valve disc 15 — the springs employed in these constructions being shown respectively in FIGS. 4 and 6.

In FIG. 3, the valve housing 20'' has in its base, a peripheral annular groove 40 serving as a supporting surface for a spring 41, shown in detail in FIG. 4. This spring has a centrally apertured circular disc or annulus 42 with a plurality of downwardly inclined outwardly extending resilient legs 43 the outer ends of which are supported spider-like upon the bottom of groove 40, the spherical valve member 39 being supported by the edges of the aperture in disc 42 in contact with valve disc 15 when the latter is in sealing contact with valve seat 14. When the valve stem 16 is tilted, the valve member 39 and its support are depressed while legs 43 yield resiliently, until a seal is formed with spherical valve seat 38 — followed, upon further tilting of the valve disc 15 by opening of the passage 37 to the valve stem bore 17 and the nozzle.

In FIG. 5, the valve spring differs from that of FIG. 3 in that its legs 43' are radial rather than downwardly inclined, and are supported on an annular shoulder 44 at the base of the valve housing. Otherwise, operation is similar to that of the construction shown in FIG. 3.

Variations and modifications which will be obvious to those skilled in the art can be made in the specific

embodiments hereinabove described without departing from the scope or spirit of the invention.

I claim

1. A metering valve assembly for pressurized aerosol dispensers having, within a valve housing, a pair of valves, one controlling access from the valve housing to the bore of an exteriorly extending valve stem and the other controlling access of the pressurized contents of the dispenser from the interior of the latter to the valve housing; means resiliently urging the first valve to closed position and the second valve to open position; and means responsive to lateral pressure upon the exteriorly extending portion of said valve stem to tilt the latter relative to its axis, first to move the second of said valves to closed position and thereafter to move the first of said valves to open position; said resiliently urging means returning the valves to their original condition in the reverse order when said lateral pressure ceases.

2. A metering valve assembly as defined in claim 1, having an annular valve seat surrounding an aperture in the valve housing of a pressurized aerosol dispenser; a valve member adapted to form a seal with said valve seat and said aperture in the valve housing, compressing an annular shoulder on said stem engaging the outer surface of the valve seat to form a seal therewith, and a lateral port in said stem connecting with the bore thereof spaced from said annular shoulder and from the inner surface of said valve seat so that said valve member, when engaging said valve seat, closes the passage from the interior of the dispenser through said lateral port and stem bore, and when the valve member is tilted, a passage is opened between the valve member and valve seat to said lateral port and stem bore; a second valve member within said housing and valve means cooperating therewith to close off a passage from said container to said valve housing; a valve spring normally urging said second valve member out of valveclosing relation with said valve means and said first valve member into sealing relation with its valve seat, said second valve member moving, against the force of said valve spring upon tilting of said first valve member together with its stem, to valve closing contact with said valve means before said passage opens from the valve housing to said lateral port and stem bore, and disengaging said valve means to open a passage to said valve housing from the interior of said dispenser after re-engagement of the first valve member with its valve seat, responsive to said valve spring, when tilting of the stem and its associated valve member ceases.

3. The metering valve assembly defined in claim 2, wherein said second valve member has a cylindrical stem with a port at its inner end cooperating with an annular ridge at the base of the valve housing to close said port when said valve member is depressed to move the port beyond the upper surface of said ridge, an upper end of larger diameter engaging the wall of the valve housing to guide movement of said valve member in axial direction, and an annular shoulder at the base of said upper end, said valve spring bearing upon said annular ridge and annular shoulder to urge said second valve member against the first valve member to hold the latter in sealing relation with its valve seat and to open said port between the interior of said dispenser and the valve housing, and to close said port in advance of the opening of the passage from the valve housing to said lateral port of said stem,

4. A valve assembly for a pressurized container, comprising, in combination:

- a. an annular valve seat of resiliently yielding material,
- b. a first valve means comprising a disc having an upper surface engageable and adapted to form a seal with said valve seat,
- c. a tubular valve stem on said valve disc, extending through an aperture in said valve seat, the bore of said stem terminating at the valve disc and communicating at said terminal with at least one lateral port, each of said ports being normally in sealing contact with the peripherally surrounding surface of said aperture in the valve seat.
- d. a valve housing secured at its upper end in sealing contact with said valve seat and connected at its lower end with a dip tube, said housing having biasing means engageable with the under side of said valve disc at a peripheral portion of the disc and constituting a support therefor to position said valve disc yieldably against said valve seat,
- e. tilting of said valve disc downward against said biasing means opening a passage for the contents of said pressurized container, successively, first from the interior of said valve housing between said valve disc and the valve seat, and second, between the peripheral surface of said aperture in the valve seat and the valve stem, to at least one of said lateral ports at the base of said valve stem, and thus to the central bore of the latter, and
- f. a second valve means in the housing including a second valve seat at a lower portion of the housing and a valve member adapted to form a seal therewith, for controlling flow into the housing through the dip tube, said second valve being closed upon tilting of said valve disc prior to opening of said passage from the interior of said valve housing to the bore of said valve stem, and being re-opened after re-closure of said passage when the valve disc is returned to non-tilted position.

5. A metering valve assembly for pressurized aerosol dispensers having, within a valve housing, a pair of valves, one controlling access from the valve housing to the bore of an exteriorly extending valve stem, and the other controlling access of the pressurized contents of the dispenser from the interior of the latter to the valve housing, said first-named valve having an annular valve seat surrounding an aperture in the valve housing of the dispenser and a valve member having an annular shoulder adapted to form a seal with said valve seat and said aperture in the valve housing, and further comprising a lateral port in said stem communicating with the bore thereof, spaced from said annular shoulder and from the inner surface of said valve seat, so that said valve member when engaging said valve seat closes the passage from the interior of the valve housing through said lateral port and stem bore and when the valve member is tilted, a passage is opened between the valve housing and said lateral port and stem bore; said second valve member comprising a ball and valve means cooperating therewith to close off a passage from said container to said valve housing; a valve spring normally urging said ball out of sealing contact with said valve means and against the first-named valve member to hold the latter in sealing contact with its valve seat, said ball moving, against the force of said valve spring upon tilting of said first-named valve member together with the valve stem

to valve-closing contact with said valve means before said passage opens from the valve housing to said lateral port and stem bore, and disengaging said valve means to open a passage to said valve housing from the interior of said pressurized dispenser after re-engagement of the first-named valve member with its valve seat when tilting of the valve stem and its associated valve member ceases.

6. The invention as defined in claim 5 wherein said valve spring is an annulus having a central aperture supporting said ball, and resilient peripheral projections supported on an annular shoulder within the interior of the valve housing.

7. The invention as defined in claim 6 wherein the peripheral projections on said annulus extend therefrom toward said annular shoulder at an acute angle outwardly relative to the axis of said annulus.

8. The invention as defined in claim 5 wherein said valve spring is a resilient helix resting upon an annular shoulder below the valve seat, within the passage from the interior of said dispenser to said valve housing.

9. A valve assembly for a pressurized container, comprising, in combination:

- a. an annular valve seat of resiliently yielding material,
- b. a first valve means comprising a disc having an upper surface engageable and adapted to form a seal with said valve seat,
- c. a tubular valve stem on said valve disc, extending through an aperture in said valve seat, the bore of said stem terminating at the valve disc and communicating at said terminal with at least one lateral port, each of said ports being normally in sealing contact with the peripherally surrounding surface of said aperture in the valve seat,
- d. a valve housing secured at its upper end in sealing contact with said valve seat and connected at its lower end with a dip tube, said housing having biasing means engageable with the under side of said valve disc at a peripheral portion of the disc and

constituting a support therefor to position said valve disc yieldably against said valve seat,

- e. tilting of said valve disc downward against said biasing means opening a passage for the contents of said pressurized container, successively, first from the interior of said valve housing between said valve disc and the valve seat, and second, between the peripheral surface of said aperture in the valve seat and the valve stem, to at least one of said lateral ports at the base of said valve stem, and thus to the central bore of the latter, and
- f. a second valve means in the housing including a second valve seat at a lower portion of the housing and a ball adapted to form a seal therewith for controlling the flow into the housing through the dip tube, said ball being urged by said biasing means out of sealing contact with said second valve seat and against said valve disc to hold the latter in contact with its valve seat, said second valve means being closed upon tilting of said valve disc prior to opening of said passage from the interior of said valve housing to the bore of said valve stem, and being re-opened after re-closure of said passage when the valve disc is returned to non-tilted position.

10. The invention as defined in claim 9 wherein said biasing means comprises an annulus having a central aperture supporting said ball, and resilient peripheral projections supported on an annular shoulder within the interior of the valve housing.

11. The invention as defined in claim 10 wherein the peripheral projections on said annulus extend at an acute angle outwardly relative to the axis of the valve disc.

12. The invention as defined in claim 9 wherein said biasing means comprises a resilient helix resting upon an annular shoulder located below said ball and within the passage leading from the interior of said dispenser into said valve housing.

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