Nov. 24, 1964 H. G. LEHMANN 3,158,179

AEROSOL METERING VALVE CONSTRUCTION

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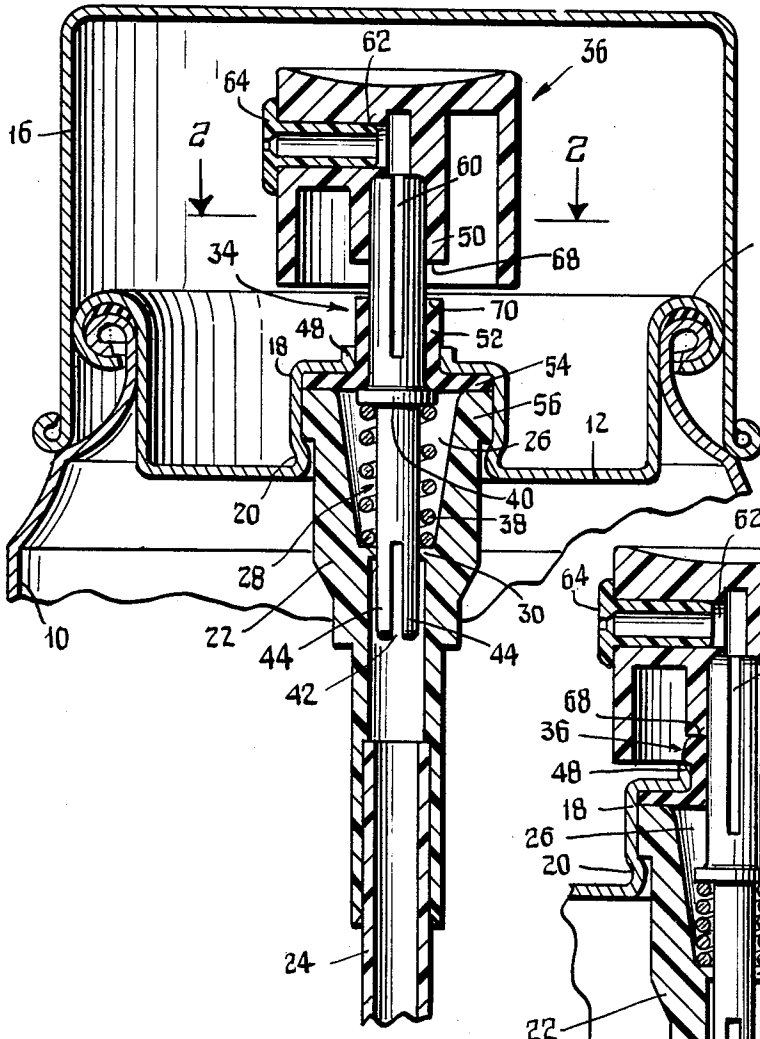


Fig. 1

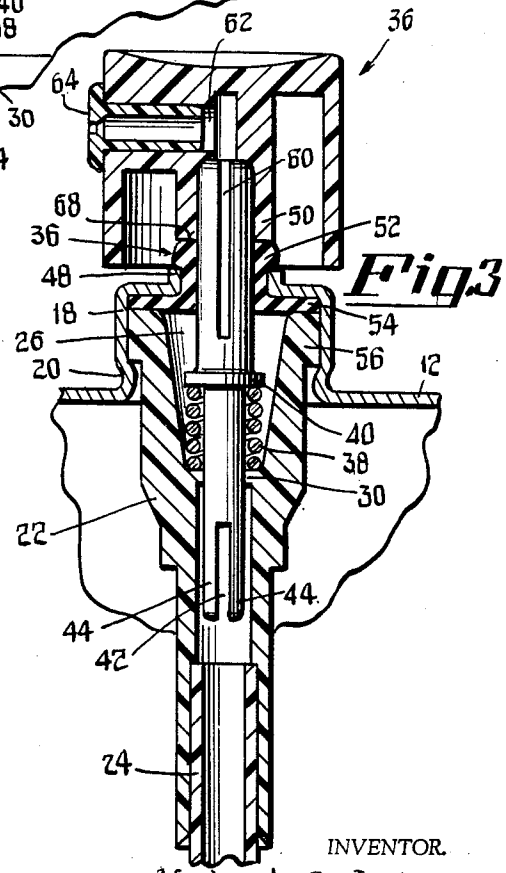
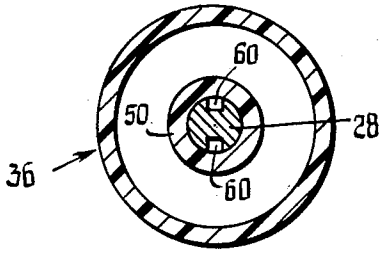


Fig 3

Fig. 2



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Fig. 4

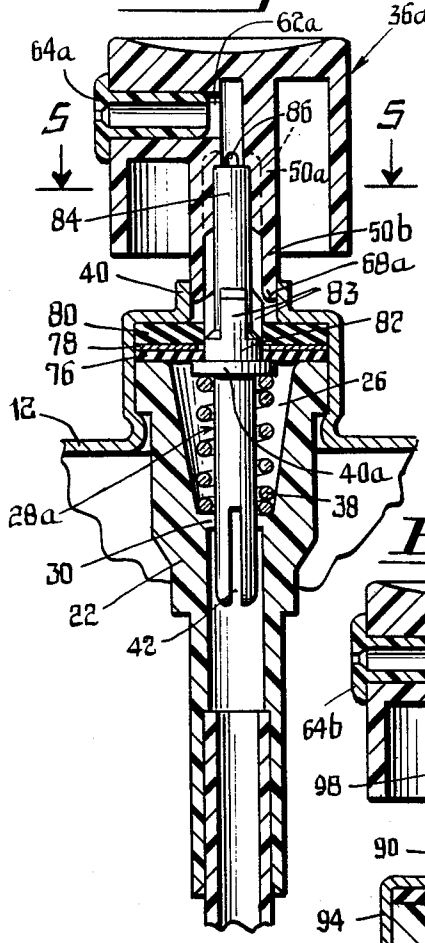


Fig. 6

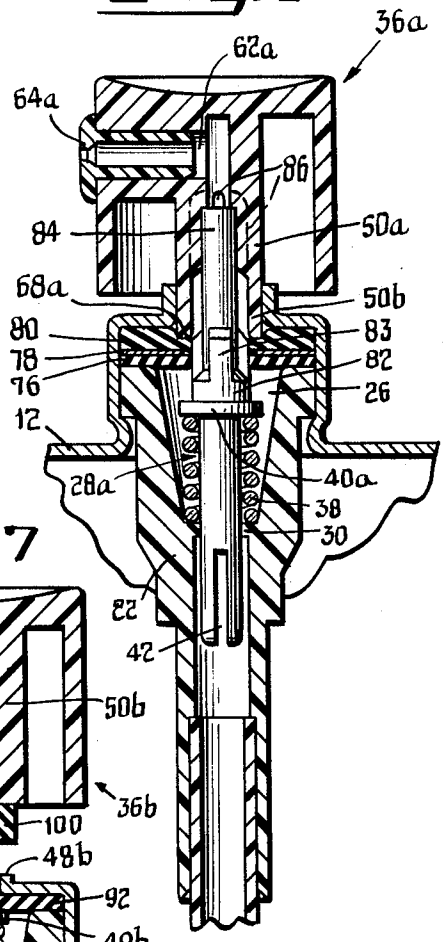


Fig. 7

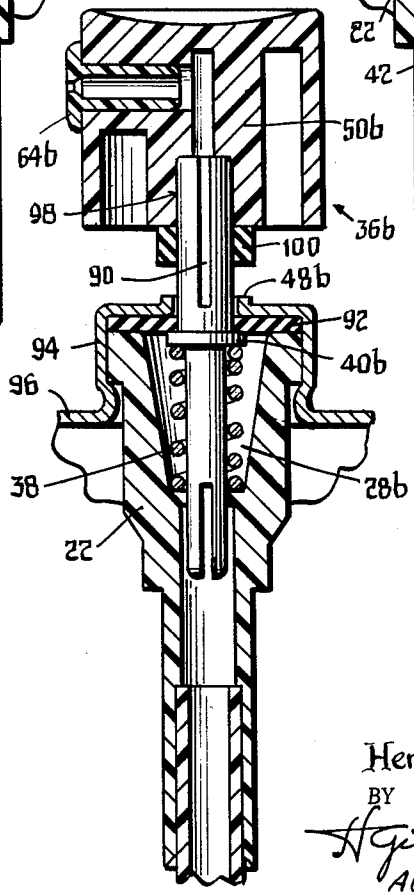
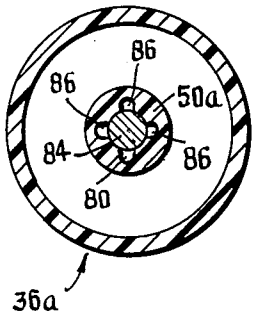


Fig. 5



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AEROSOL METERING VALVE CONSTRUCTION

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14 Claims. (Cl. 137—627.5)

This invention relates to small hand-held aerosol devices, and more particularly to metering valve constructions for the same.

An object of the invention is to provide a novel and improved metering valve construction of the type wherein there is a longitudinally movable valve stem in a metering or measuring chamber of a valve housing, which construction is characterized by a seal effected by the depress button normally removably carried by the valve stem, such seal completing a normally discontinuous discharge channel, and the valve construction further being so constituted that it may be especially devoid of expansion chambers or the equivalent to receive the discharge from the metering chamber, yet providing a satisfactory spray discharge of the pressurized aerosol substance, this latter being possible by virtue of the use of a relatively long discharge channel of substantially uniform cross sectional area.

A further object of the invention is to provide an improved metering valve construction as above set forth, wherein there is eliminated the prior known relatively costly-to-make hollow or tubular stem structures and instead the stem has simple outer formations such as a groove or ribs with the depress button carried thereby, to provide the discharge channel of uniform cross sectional area and which is devoid of any expansion chamber.

Yet another object of the invention is to provide a novel metering valve construction in accordance with the foregoing, wherein a simple and effective partially-continuing seal is provided by, and rendered operative upon actuation of, the depress button to make continuous the discharge channel which normally has separated, unconnected or open portions.

Still another object of the invention is to provide an improved metering valve construction with longitudinally movable valve stem, wherein the lower, valve-carrying extremity of the stem has a novel resilient guide portion coacting with a resilient valve seat to provide a desirable soft or smooth yet effective valve action.

A feature of the invention resides in the provision of an improved metering valve construction having the above characteristics and which is nevertheless simple in structure, involving few components which may be readily economically fabricated and assembled, to the end that the device is of lower cost while retaining reliability of operation and a long useful life.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference are used to disignate like components throughout the several views, wherein:

FIGURE 1 is an axial, longitudinal sectional view of a valve construction and aerosol container, as provided by the invention.

FIG. 2 is a transverse sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is a view similar to that of FIG. 1, but showing the valve construction in the operative or discharge position.

FIG. 4 is an axial sectional view of a valve construction made in accordance with the invention, illustrating another embodiment thereof.

FIG. 5 is a transverse sectional view, taken on the line 5—5 of FIG. 4.

FIG. 6 is a sectional view similar to that of FIG. 4, but showing the valve construction in the operative or discharging position.

FIG. 7 is an axial sectional view of a metering valve construction constituting yet another embodiment of the invention.

Considering first FIG. 1, the valve construction illustrated therein is shown as mounted on a pressurized container 10 having a circular metal closure portion or mounting cup 12 attached to the container by the usual curled or beaded peripheral portions designated generally by the numeral 14. A removable cover 16 is customarily provided for such aerosol device.

The mounting cup 12 has a central raised hollow part 18 having an inwardly spun ring-like portion 20 by which there is secured in place a molded valve housing 22. Depending from the lower portion of the valve housing 22 is the usual dip tube 24.

The valve housing 22 has a metering chamber 26 in which there is longitudinally or vertically movable a novel valve stem construction designated generally by the numeral 28. At the lower end of the metering chamber 26 there is an annular resilient valve seat 30 which coacts with the lower valve-carrying portion of the stem 28 to provide a shut-off between the metering chamber 26 and the interior of the container 10.

In accordance with the present invention, a novel organization is provided comprising the valve stem 28 and an annular valve or sealing element designated generally by the numeral 34 in conjunction with a depress button and orifice member 36 by which a desirable fine metered or measured spray discharge of the aerosol substance carried by the container 10 is had in response to downward movement of the depress button 36, said action being further characterized by a desirable soft or smooth action of the valve stem and button.

Normally the valve stem 28 is held in the raised position shown in FIG. 1 by the valve return spring 38 bearing against the shoulder formed by the valve seat 30, and against an annular valve shoulder 40 provided on the valve stem 28.

As provided by the invention, the lower extremity or tip portion of the valve stem 28 has a diametric slot 42 resulting in a pair of slender tines 44 which are normally disposed within the annular valve seat 30 and which provide a degree of resiliency to the said lower tip portion. Further, the slot 42 in conjunction with the valve seat 30 provides a smooth valving action. As seen in FIG. 1, aerosol substance may ascend in the dip tube 24 and pass through the upper portion of the slot 42 into the metering chamber 26. However, when the depress button 36 and the valve stem 34 are in the depressed or discharging position shown in FIG. 3, the solid portion of the stem 28 which is immediately above the slot 42 is disposed in the valve seat 30, thereby closing the same and shutting off the contents of the container 10 from the metering chamber 26.

By virtue of the slotted lower tip portion of the valve stem 28 a smooth or soft action or movement of the valve stem is had, since oppositely disposed rounded outer surfaces of the stem are always in contact with the valve seat 30 and provide an effective guide means for the stem.

Further, in accordance with the invention, the central raised portion 18 of the mounting cup 12 has an upwardly drifted or formed edge 48 surrounding the central aperture thereof, and the sealing element 34 is constructed in a novel manner whereby it provides a double sealing or valve action. That is, there is effected closure of the bore of the element 34 in conjunction with the shoulder enlargement 40 of the stem on the one hand, and effected a connection with a central hollow supporting portion 50 of the depress button 36 on the other hand. In accom-

plishing this, the sealing or valve element 34 is constituted to have a tubular or sleeve portion 52 and a lower outwardly radially extending flange portion 54. The flange portion 54 is clamped between the top wall of the central raised portion 18 of the mounting cup 12 and the upper rim portion 56 of the valve housing 22. The inner peripheral portion of the flange 54 (or the lower edge portion of the sleeve 52) is cooperable with the valve shoulder 40 of the stem 28 to effect a seal as indicated on FIG. 1 or else to open the passage through the sealing element 34 in response to downward movement of the valve stem 28, this latter opening being accomplished by a pair of longitudinally extending, oppositely disposed grooves 60 located in the upper portion of the valve stem 28.

As clearly seen in FIGS. 1 and 3, the depress button 36 has a discharge channel 62 and a discharge orifice member 64, communicating with the bore of the hollow mounting portion 50. The said mounting portion frictionally receives the upper end of the valve stem 28, such arrangement effecting a mounting of the button 36 on the valve stem.

By the invention, the combined cross sectional areas of the two groove 60 constituting part of the discharge channel, is substantially equal to the cross sectional area of the discharge channel 62 in the depress button 36, whereby there is eliminated any enlargements of the channel which might function as an expansion chamber. I have found that such expansion chamber is not essential to the producing of a satisfactory spray discharge of a pressurized aerosol substance, especially where the discharge channel has an overall effective length of appreciable magnitude, as in the present instance.

It will be observed from an inspection of FIG. 3 that when the depress button 36 and the valve stem 28 are in the lowered or operative, discharge position, the bottom rim 68 of the hollow support portion 50 of the button 36 is in engagement with the upper rim 70 of the sealing element 34, squeezing and thickening the sleeve portion 52. In consequence, leakage of the aerosol substance out of the grooves 60 and past these edges is prevented, and instead a continuous discharge channel is provided, constituted of the channel portion 62 on the one hand and the two longitudinal grooves 60 on the other hand, these latter being closed by the hollow support portion 50 and by the sleeve portion 52 of the button and sealing elements respectively.

Considering FIG. 3, when the valve stem 28 and button 36 are in the depressed or lower position, a sequential valving action has occurred, and the charge of aerosol substance in the metering chamber 26 may be discharged through the grooves 60 and the discharge channel 62, while at the same time the metering chamber 26 is closed off or sealed from the contents of the container 10 by the solid lower portion of the valve stem 28 which is disposed in the valve seat 30. Such closing of the metering chamber 26 or sealing of the same from the contents or interior of the container 10 is effected prior to opening of the main or upper valve comprising the sealing element 34 and grooved stem portion inasmuch as the valve stem 28 must move downward an appreciable distance before the lower ends of the grooves 60 are shifted past the bottom of the sleeve portion 52 of the sealing element 34. Prior to this, no discharge can take place from the metering chamber. However, when discharge does take place, the lower valve comprising the seat 30 and the solid portion of the stem 28 will have closed.

The general metering action as above described is in many respects similar to that already understood in the art.

After the lower rim or edge 68 of the supporting portion 50 engages the upper rim 70 of the sealing element 34, a continued downward movement of the button 36 and valve stem 28 takes place, squeezing the sleeve 52 and compressing it, before the lower ends of the grooves 60

clear the bottom face of the flange 54. In consequence, there is a sequential valving relationship whereby the discharge channel is closed prior to opening of the valve constituted by the solid portion 29 of the stem and the flange portion 54 of the sealing element 34.

Another embodiment of the invention is illustrated in FIGS. 4, 5 and 6. In this embodiment, components which are similar to those already described have been given like characters.

The main differences between the embodiments of FIGS. 1–3 and that of FIGS. 4–6 resides in the construction of the upper portion of the valve stem, which stem has been labelled 28*a* in FIGS. 4 and 6. Also, the seal-effecting button construction is somewhat different, as well as the construction of the upper sealing element.

As shown, the said upper sealing element comprises a rubber or resilient valve washer 76 over which there is disposed a thin rigid or stiff washer 78 (made of metal, fiber, rigid plastic, etc.). Over the rigid washer 78 there is a thick second rubber or rubber-like resilient washer 80. The valve stem 28*a* has a shouldered valve portion 40*a* which is cooperable with the valve disk 78 to effect a seal or closure of the metering chamber 26. The portion of the valve stem 28*a* which is located above the valve shoulder 40*a* is ribbed and has two different diameters, a larger diameter portion 82 immediately above the shoulder 40*a*, and a smaller diameter portion 84 extending for the remainder of the valve stem. Guide or bearing ribs 83 are also provided.

The depress button 36*a* has a hollow central supporting portion 50*a* having a lower edge or rim 68*a* which is cooperable with the thick upper resilient washer 80 when the button 36*a* is depressed as illustrated in FIG. 6. Normally, as seen in FIG. 4, the valve shoulder 40*a* engages the lower resilient washer 76 to close the discharge opening from the measuring chamber 26. The supporting portion 50*a* of the button 36*a* has a skirt portion 50*b* which is spaced from the small diameter stem portion 84 and which slidably fits into the upwardly drifted edge 48 of the mounting cup 12. The small diameter stem portion 84 is gripped by a close fitting bore in the portion 50*a*, said bore having a plurality of grooves 86 as seen in FIGS. 4, 5 and 6. The button 36*a* also has a discharge channel portion 62*a*. The space between the skirt 50*b* of the button and the small diameter portion 84 of the stem 28*a* is arranged to have a total cross sectional area which is roughly the equivalent of the discharge channel 62*a* in the button, and this same is true of the four grooves 86 provided in the portion 50*a*. Thus, the entire discharge channel means is generally of uniform cross sectional area and is devoid of any enlargements which might function as an expansion chamber. As with the construction of FIGS. 1–3, I have found that no expansion chamber is necessary in order to provide a satisfactory spray discharge when the button 36*a* is depressed, and I attribute this to the appreciable length of the discharge channel provided by the channel portions 62*a*, 86 and the space between the skirt 50*b* and the small diameter portion 54 of the valve stem.

It will be observed from an inspection of FIG. 6, that when the button 36 is pushed downward, the communication which normally existed between the metering chamber 26 and the interior of the aerosol container 10 will be discontinued and instead of the metering chamber 26 will be open to the discharge channel by virtue of the large diameter portion 82 being disposed below the sealing or valve washer 76. Thus, the metering action is generally similar to that already described in connection with FIGS. 1–3, and which is in general well understood in the art.

As with the construction of FIGS. 1–3, a sequential valving action is effected when the button 36*a* and the valve stem 28*a* are depressed. The bottom rim surface 68*a* of the skirt or mounting portion 50*a* engages the thick upper washer 80 and compresses the same prior to

the ribbed portion of the stem passing the lower washer **76** to open the passage at the top of the metering chamber **26**.

The sequential valve operation in FIGS. 4 and 6 is essentially effected by virtue of the thickness of the upper washer **80**, which may be appreciably compressed by the skirt portion **50***b* of the depress button, to effect the opening of the valve at the lower washer **76**.

Preferably, the valve stem **28***a* has a plurality of ribs **83** to constitute guides which facilitate the upward or return movement of the stem under the action of the return spring **38**.

Another embodiment of the invention is illustrated in FIG. 7. In this figure the valve stem **28***b* has in one side of its upper portion a longitudinal groove **90**, and a single resilient sealing and valve washer **92** is located in the raised central portion **94** of the mounting cup **96**.

The depress button **36***b* has a hollow central supporting portion **50***b* with an enlarged bore **98** to frictionally receive and grip the upper extremity portion of the valve stem **28***b*. On the upper slotted portion of the valve stem there is provided a relatively thick resilient washer **100** made of rubber or rubber-like substance, said washer being engageable with the lower surface of the mounting portion **50***b* and also with the upwardly drifted flange or edge **48***b* of the mounting cup **96**. Engagement between the flange **48***b* and the washer **100***b* occurs prior to the bottom end of the groove **90** arriving at the lower face of the valve washer **92**. Continued downward movement of the button **36***b* and stem **28***b* will now effect a compression or squashing of the resilient washer **100**, and will dispose the bottom end of the groove **90** below the underface of the valve washer **92**, whereby the upper valve will be opened and the discharge channel completely closed, to effect discharge of the aerosol substance from the orifice member **64***b*. The metering action of the valve construction of FIG. 7 is similar to that already described in connection with the preceding figures, such metering action involving a sequential operation of the lower valve of the valve stem and the valve comprising the shoulder **40***b* (corresponding to the shoulders **40** and **40***a* respectively in FIGS. 1 and 4).

It will now be seen from the foregoing that I have provided a novel and improved, simplified metering valve construction wherein the depress button has an operable sealing function, wherein a soft or smooth action of the valve stem is obtained by virtue of the bifurcated lower extremity portion of the stem, and wherein the discharge passage provided for the metering chamber contents is devoid of enlargements which might constitute expansion chambers, instead being of substantially uniform cross sectional area throughout its length. The valve construction involves relatively few components which may be economically fabricated and assembled. This construction is simple and reliable in its operation, and capable of an extended useful life.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. In an aerosol valve construction, in combination:
(*a*) a valve housing having an upper annular valve seat,
(*b*) a valve stem movable in the valve seat and having an enlargement cooperable with the seat to close the passage therethrough,
(*c*) said stem having a portion of reduced cross section above the enlargement to permit passage of aerosol substance through the seat when the stem is shifted downward,
(*d*) a depress button comprising a head enlargement carried by the stem to effect downward movement thereof,
(*e*) said head enlargement having a discharge passage through it, and
(*f*) a pair of cooperable mutually engageable normally separated conduit means connected respectively with the depress button and annular valve seat, providing a continuous passage surrounding portions of the stem located above the said enlargement and also located between the seat and the discharge passage of the button when the button and the valve stem are in downwardly shifted position, thereby to conduct the contents of the valve housing out through the passage in the button, both of said conduit means extending completely around and encompassing at least part of the portion of reduced cross section of the valve stem, one of said conduit means being resilient and yielding when engaged under pressure by the other.

2. A valve construction as in claim 1, wherein the said cooperable, normally separated conduit means comprises:
(*a*) a resilient sleeve surrounding the valve stem, joined to the valve seat and extending upward therefrom,
(*b*) an annular edge on the depress button engageable with one end of the resilient sleeve and compressing the latter longitudinally when the depress button and valve stem are shifted downward.

3. A valve construction as in claim 2, wherein:
(*a*) the resilient sleeve and the valve seat are integral with each other and constituted as a one-piece molding.

4. A valve construction as in claim 2, wherein:
(*a*) there are confining means surrounding a portion of the resilient sleeve, to limit outward bulging of the same when it is compressed longitudinally.

5. A valve construction as in claim 1, wherein the said cooperable, normally separated conduit means comprises:
(*a*) a resilient sleeve surrounding the valve stem,
(*b*) an annular edge on the depress button, engageable with one side of the resilient washer, and
(*c*) an annular edge fixed with respect to the valve seat and engageable with the opposite side of the resilient washer.

6. A valve construction as in claim 5, wherein:
(*a*) there is a mounting cup which clamps the valve seat to the valve housing,
(*b*) the said fixed annular edge is carried by the mounting cup.

7. A valve construction as in claim 1, wherein:
(*a*) the valve stem portion of reduced diameter has a longitudinal groove in it, reducing the cross sectional area.

8. A valve construction as in claim 1, wherein:
(*a*) the normally separated means comprise tubular elements which become engaged prior to the portion of reduced diameter of the stem passing entirely through the valve seat and opening the passage thereof upon the downward shifting of the valve stem.

9. A valve construction as in claim 1, wherein the said cooperable, normally separated conduit means comprises:
(*a*) a resilient washer surrounding the valve stem and disposed above the valve seat,
(*b*) an annular edge on the depress button, engageable with the top surface of the resilient washer when the depress button and valve stem are shifted downward.

10. A valve construction as in claim 9, wherein:
(*a*) the resilient washer is disposed adjacent and above the valve seat,
(*b*) there is a rigid washer interposed between the valve seat and resilient washer.

11. A valve construction as in claim 10, wherein:
(*a*) there are means clamping the resilient washer, rigid washer, and the valve seat in superposed relation.

12. A valve construction as in claim 11, wherein:
(*a*) the clamping means comprises a mounting cup which also mounts the valve housing.

13. In an aerosol valve construction, in combination:
(*a*) a valve housing having a lower annular valve seat,
(*b*) a valve stem movable in the housing and into the valve seat,
(*c*) said stem having a bifurcated lower end portion receivable in and closely fitting the valve seat,
(*d*) said bifurcated end portion comprising slender tines which have resilience and enable the end portion to yield slightly in a diametric direction to minimize binding of the stem in the seat and provide instead a smooth action despite the said close seat.

14. An aerosol valve construction as in claim 13, wherein:
(*a*) the annular valve seat comprises an integral part of the valve housing and has a thin section to enable it to have resilience, said seat and housing being molded of plastic substance.

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