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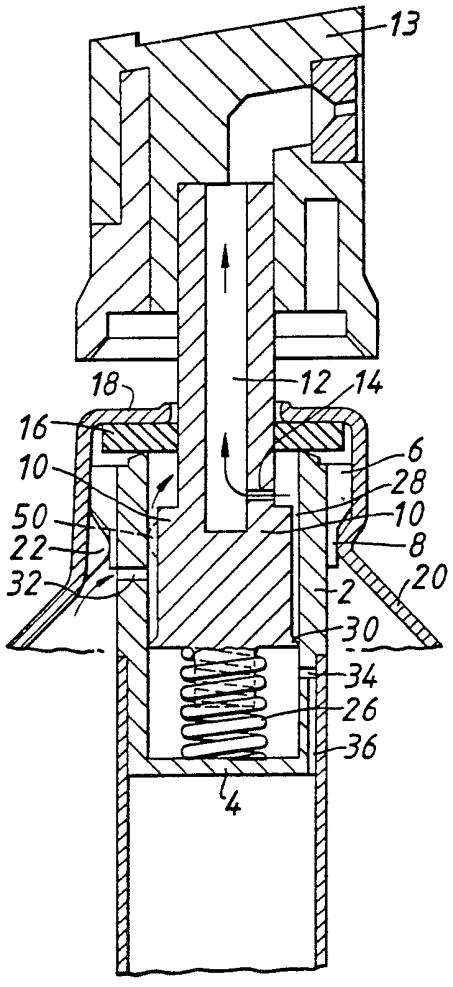
(54) Dispensing valve assembly

(57) A dispensing valve assembly for an aerosol container is provided in which, when the dispensing button is fully depressed a flow path for propellant is established through inlet 32, chamber 28, hole 14 and passage 12 in the valve stem and at the same time a flow path for product is established from dip tube 24 through recess 36, inlet 34, chamber 28, hole 14 and the passage 12 in the stem. However, when the button is only partly depressed, a sealing flange 30 at the bottom of the valve stem isolates the product inlet 34 and so only the propellant flow path is open. Consequently, for a brief period when the button is being released there is a flow of propellant only through the dispensing passageway which clears it of product. Thus products such as paint which may dry out in this passageway and clog it are not given the opportunity to do so.

FIG.2.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1.

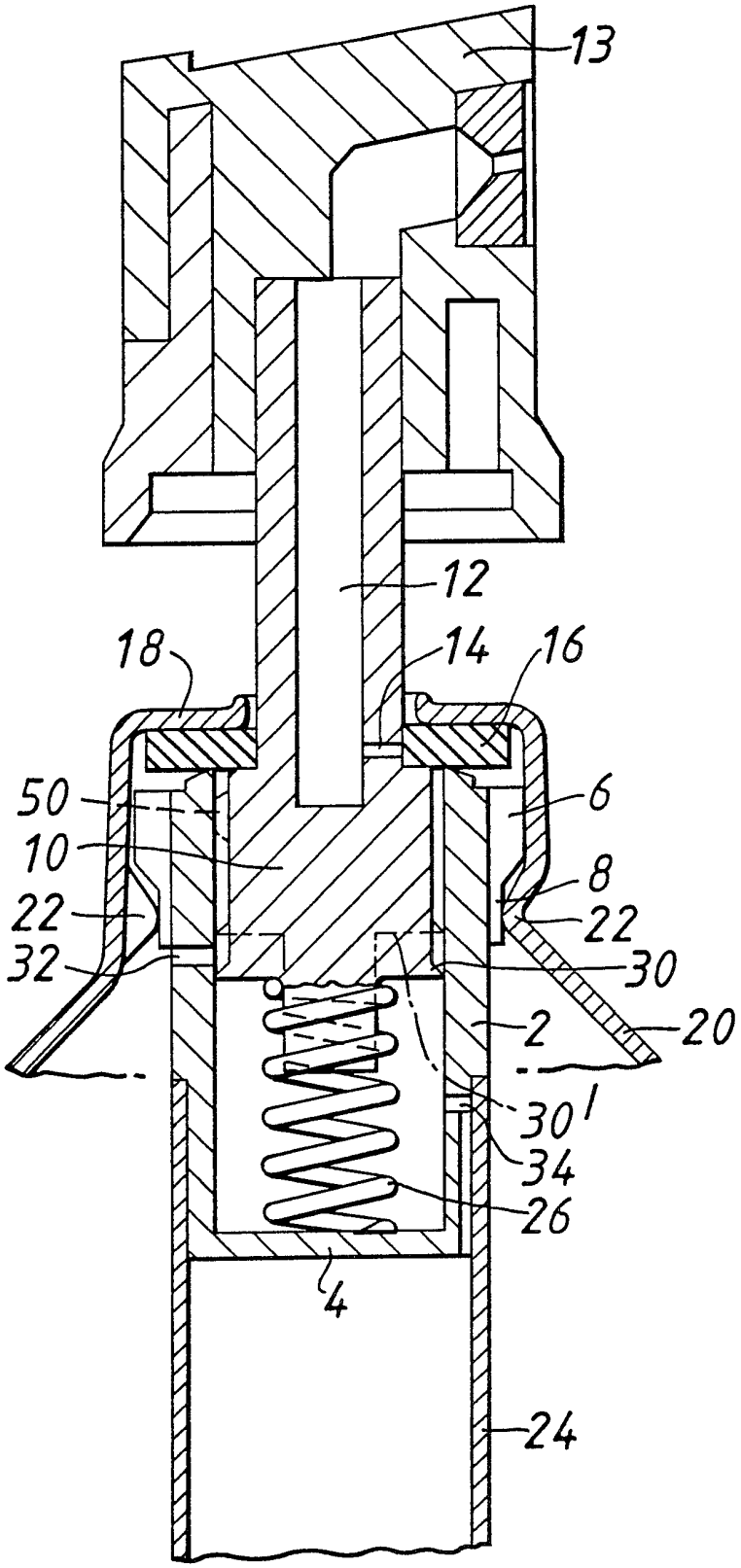

FIG.2.

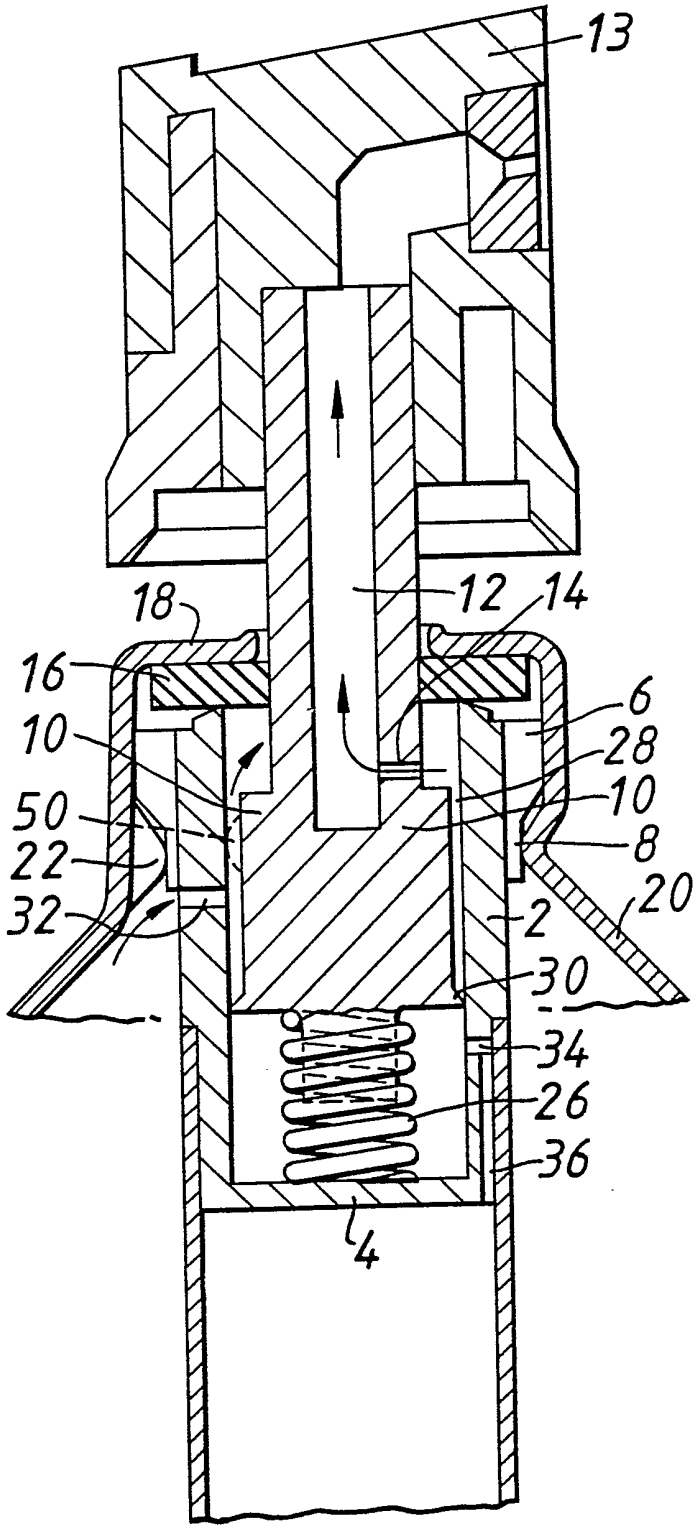

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FIG.3.

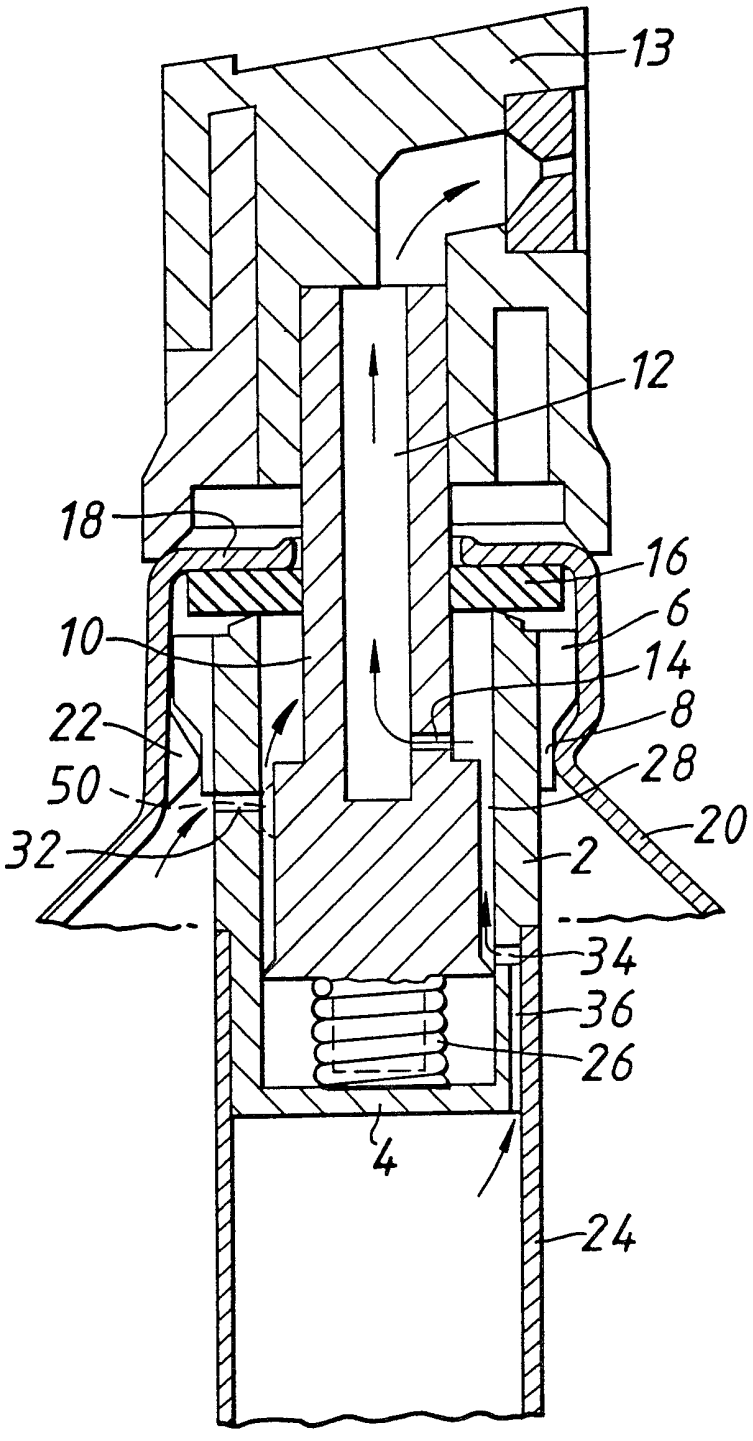


FIG. 4.

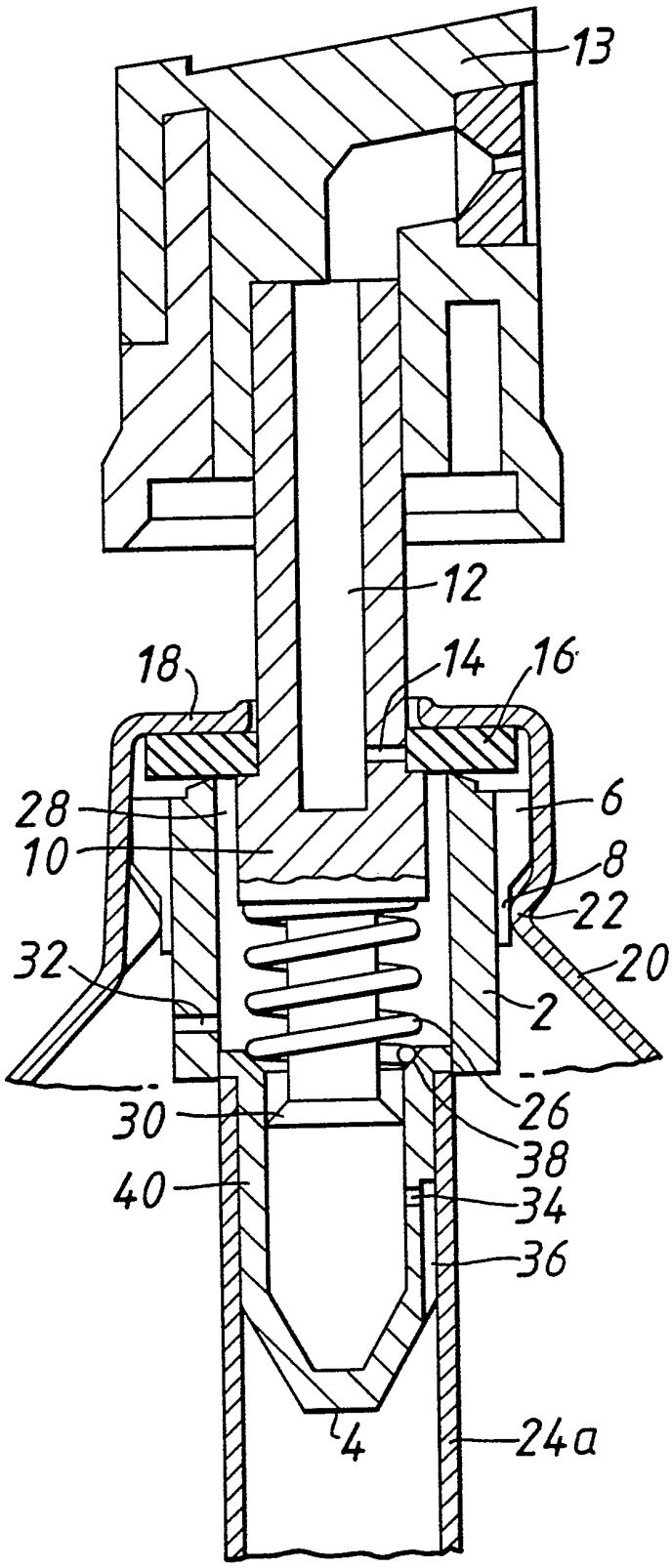


FIG.5.

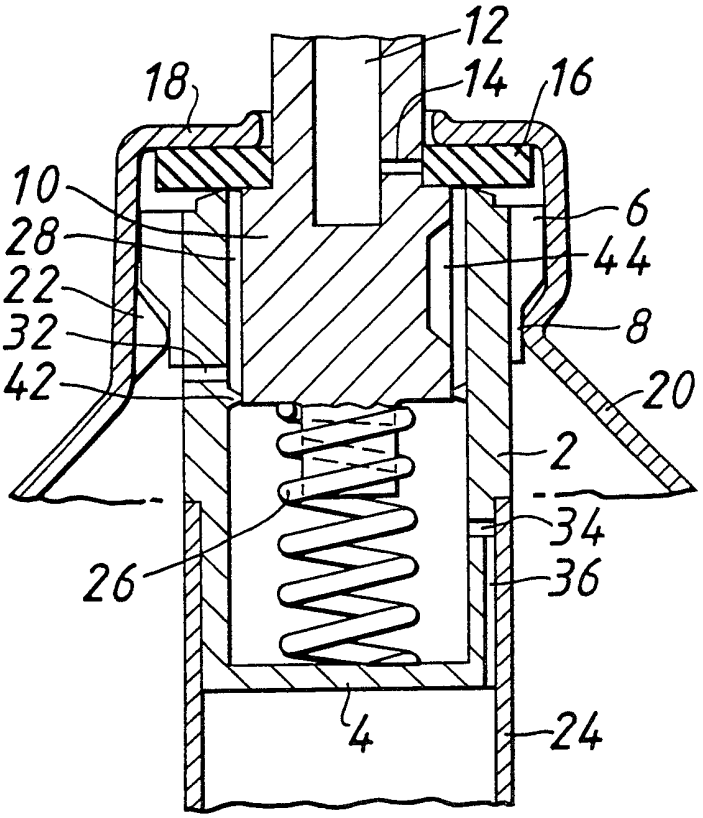


FIG.6.

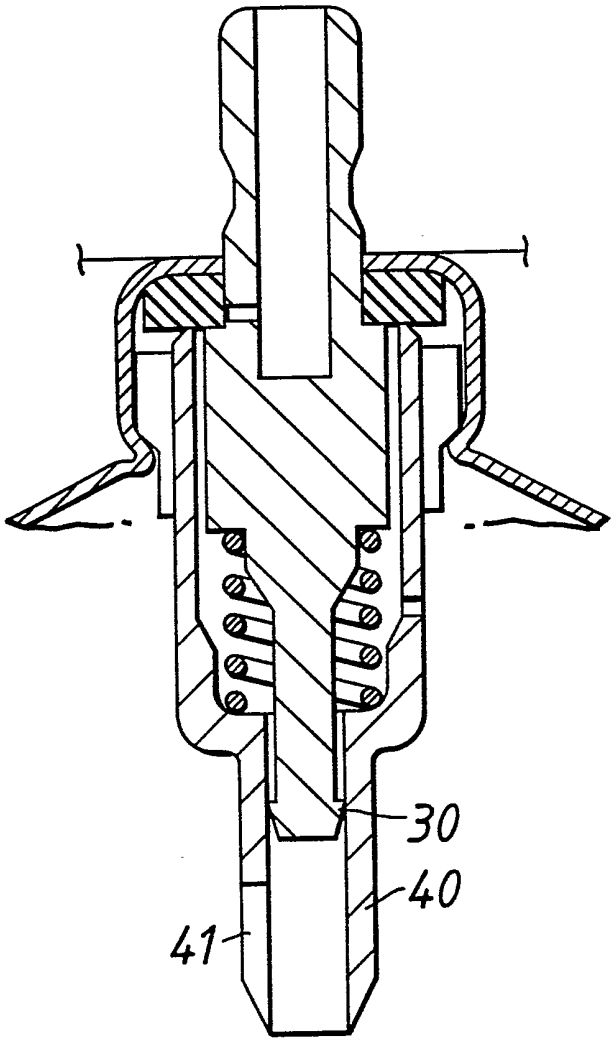
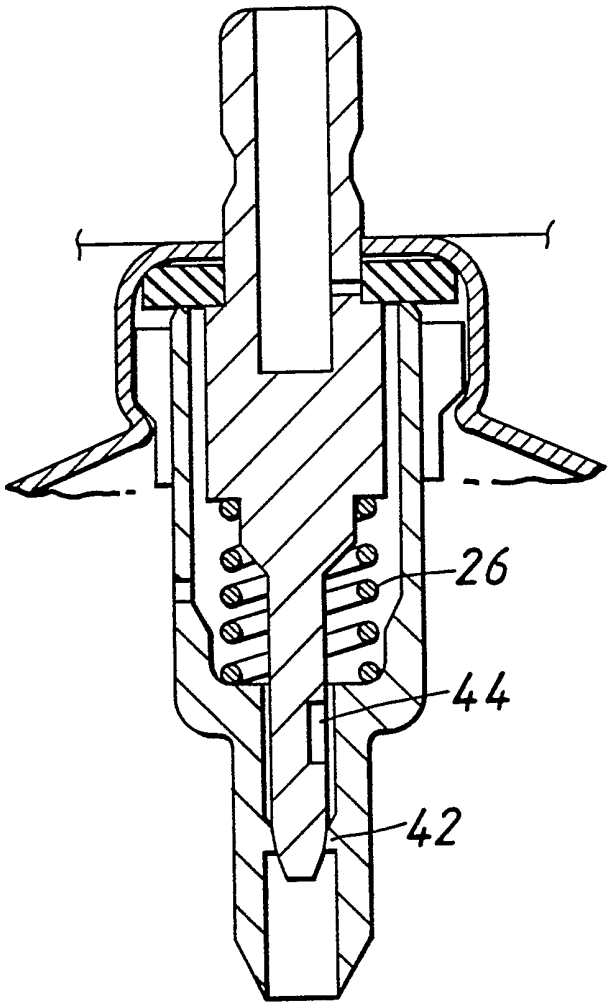


FIG.7.



VALVE ASSEMBLY FOR PRESSURISED CONTAINERS

This invention relates to dispensing valve assemblies for containers of the type containing a product kept under pressure by a fluid propellant, these being usually referred to as aerosol containers.

It is known that when certain products such as paints are dispensed from aerosol containers, the residue of product left in that part of the dispensing passageway which is accessible to air will dry out and clog that passageway making subsequent dispensing operations unreliable or impossible. The most common commercial approach to this problem is to provide instructions on the aerosol containers of such products, to the effect that when a dispensing operation has been completed the container should be inverted and the dispensing button should then be depressed briefly. With the container inverted, the dip tube through which product is normally dispensed terminates in the uppermost part of the container, to which the propellant rises, and consequently by operation of the dispensing button in this position, propellant only is discharged along the dispensing path and this flow of propellant dis-

perses residual product from the dispensing passageways. However, users frequently fail to follow these instructions and so the aforementioned problem still occurs in practice.

It has been proposed in U.S. Patents Nos. 3,583,606 and 3,733,009 to provide specially designed dispensing valve assemblies for aerosol containers which are arranged so that, as the dispensing button is being released from its fully depressed to its undepressed position at the end of a dispensing operation, a limited quantity of propellant only is automatically delivered through the dispensing passageways, so as to automatically disperse residual product from them. The constructions shown in both those patents are similar in certain basic respects and, in particular, in that the valve assemblies include two chambers one situated above the other, with the valve stem through which product is dispensed passing through both the chambers. Provision is made for pressurised propellant to be present in the upper chamber and pressurised product in the lower chamber. When the valve stem is depressed by use of the dispensing button, a lateral hole in it moves from a position where it is

sealed by a surrounding gasket, and during the initial movement the hole passes through the upper chamber so that a flow of pure propellant from that chamber goes through the hole and out through the valve stem. During further movement, the hole passes into the lower chamber from which pressurised product flows through the hole and is dispensed through the valve stem. This dispensing of product continues so long as the valve stem is held down but, when it is released, the opposite sequence occurs so that before the valve stem has returned completely to its released position a brief burst of propellant from the upper chamber is fed through the dispensing passageway so as to blow out any product which remains there.

However, the constructions shown in these patents involve relatively complicated and possibly unreliable arrangements for providing a partition between the upper and lower chambers, which partition has to be slidably sealed around the outside of the valve stem.

The invention aims to provide a dispensing valve assembly for a container of the type containing a product kept under pressure by a fluid propellant, which automatically delivers propellant only through the dispensing passageway of the valve during a brief

interval at the end of a dispensing operation, and which may be simple in construction and reliable in use.

A dispensing valve assembly in accordance with the present invention involves a different approach from that used in the prior art just referred to, in that propellant and product are not dispensed through two separate and respective chambers within the assembly, but are dispensed through a common chamber. However, the parts of the valve assembly are adapted so that the medium which is supplied to this common chamber from the interior of the container, when the valve assembly is in use, is dependent upon the extent to which the valve stem is depressed.

More specifically, the invention provides a dispensing valve assembly for a container of the type containing a product kept under pressure by a fluid propellant, and comprising a valve housing, a valve stem extending outwardly from the housing and having a passage therein, and valve means which is opened by displacing the valve stem relative to the housing, wherein the housing includes a chamber which communicates with the passage in the stem when the valve means is opened, and means is provided for selectively communicating two inlets, provided in the housing, with said chamber in dependence upon the amount of displacement of the valve stem relative to the housing.

It will be understood that the selective communication between the two inlets and the chamber is not restricted simply to the option of either the one inlet being in communication with the chamber, and the other not, or vice versa. In fact, in the described embodiments the first selectable form of communication (which normally will exist only temporarily when the valve stem is partially displaced) is that a propellant inlet only is in communication with the chamber. The second form of communication, when the valve stem is fully displaced, is communication of both of the propellant inlet and a product inlet with the chamber, so that a mixture of propellant and product is dispensed. A modification will be described whereby in the latter position product alone, without mixture with propellant, could be dispensed.

In the specific structure of the embodiments to be described, the valve stem is slidably displaceable in a bore in the housing, sealing means is provided between the stem and the bore, the valve stem is biassed outwardly relatively to the bore and to a position in which said valve means is closed, one inlet leads into the bore below said sealing means when the stem is not inwardly displaced, the chamber is a part of the bore above the sealing means, and

sufficient inward displacement of the stem uncovers a port which communicates that inlet with the chamber.

In one embodiment, the sealing means is on the valve stem and the port is on an internal wall of the housing. In another embodiment, the sealing means is on the wall of the bore in the housing and the port is in the valve stem.

From a further aspect the invention provides a dispensing valve assembly for a container of the type containing a product kept under pressure by a fluid propellant, and comprising a valve housing formed with a chamber, and a valve stem extending outwardly from the chamber and having a passage therein, the assembly including valve means which is opened by displacing the valve stem in an inward direction relative to the housing so as to communicate the passage in the stem with the chamber in the housing, the housing being formed with first and second inputs for the said chamber, spaced along the housing in relation to the stem movement and arranged to communicate the chamber with the interior of the product container, wherein sealing means between the stem and the housing is provided for varying the extent of the chamber in the said inward direction so as to communicate the two said inlets with the chamber selectively in dependence upon the amount of displacement of the valve stem relative to the housing.

Advantageously, and as in the embodiments shown in the drawings, the assembly includes sealing means integrally provided by the stem and the housing in combination, at least during an initial part of movement of the stem in the said inward direction the sealing means being effective to define the distal end of the chamber at a position which is short of the second input, further movement of the stem in the said inward direction causing the chamber to be extended in the said inward direction so as to include the second input.

In order that the invention may be more clearly understood, five embodiments thereof will now be described, by way of example, with reference to the accompanying diagrammatic drawings in which:

Figure 1 shows a vertical cross section through one embodiment of a dispensing valve assembly according to the invention in its normal closed or non-dispensing position,

Figure 2 shows the same valve assembly when its dispensing button has been partly depressed and propellant, only, is being delivered,

Figure 3 shows the same assembly again with the dispensing button fully depressed so as to dispense a mixture of product and propellant,

Figure 4 shows a second embodiment having much in

common with the first but in which the valve housing has a reduced diameter lower portion to accept a smaller dip tube,

Figure 5 shows a third embodiment in which a different arrangement is employed for controlling the communication of propellant and product inlets of the valve with its outlet, and

Figures 6 and 7 respectively show fourth and fifth embodiments.

Many of the features of the valve assembly shown in Figures 1 and 3 are already known from British Patent No. 2104597 and those features will be referred to only relatively briefly herein. Also, that previous patent fully describes how an aerosol container can be filled through the dispensing valve and although the same filling technique is applicable to the present valve, it is not relevant to the present invention and so will not be described herein.

Briefly, the valve assembly includes a generally tubular valve housing 2 which is closed at its lower end 4 and around its upper end has a head 6 with a reduced diameter portion 8 just below it, the portions 6 and 8 both being provided with a plurality of narrow vertical slots in them. A valve stem 10 having a dispensing passage 12 therein extends outwardly from the interior of the housing 2 and has a dispensing

button 13 on its upper end in conventional fashion. A lateral hole 14 in the valve stem is normally closed by a resilient gasket 16, as illustrated, and in known manner this gasket is held in compression between the top 18 of a cup or pedestal 20, and the periphery of the upper end of the housing

2, by virtue of the fact that a plurality of crimps 22 are formed around the cup or pedestal which engage under the head 6 of the valve housing and also engage onto the reduced diameter part 8 of the head so as to secure the entire valve assembly in the cup or pedestal. The latter in turn is secured around the top of an aerosol container in known manner. A dip tube 24 is push-fitted onto the lower end of the valve housing and extends down to the bottom of the aerosol container. When the container is filled with a fluid (i.e. liquid and/or gaseous) propellant and a product, the propellant (in its gaseous form) is in the upper part of the container and within the cup or pedestal 20, and the product is in the lower part of the container and the dip tube thus extends deeply down into the product.

A dispensing operation will now be described with reference to Figures 2 and 3. In Figure 2, the dispensing button 13 has been partially depressed so as to displace the valve stem 10 partially into the valve housing 2 against the force of the biassing spring 26 which normally holds it in the Figure 1 position. The hole 14 is thus uncovered by the gasket 16. A chamber 28 which surrounds the lower end of the valve stem and which is bounded at its upper end by the gasket 16 and at its lower end by a flange 30 on the outside of the valve stem and in sliding

sealing contact with the interior wall of the housing 2, is permanently exposed, through a propellant inlet 32 in the housing wall, to the gaseous propellant in the upper part of the container. Consequently, in the position shown in Figure 2, propellant, and propellant only, flows through inlet 32, chamber 28, hole 14 and passageway 12 to be eventually dispensed through the dispensing button 13 as indicated by arrows in Figure 2.

When the dispensing button becomes fully depressed as shown in Figure 3 the flange or sealing means 30 moves to a position below a product inlet 34 which leads through a wall portion of the housing 2 into a recess 36 which extends axially down the outside of that wall portion to the interior of the dip tube 24. Thus, product can now be driven by the pressure of the propellant up the dip tube 24, along recess 36, through inlet 34 into the extended (elongated) chamber 28 where it mixes with propellant which is continuing to flow along the path already described, so that a mixture of propellant and product will now be dispensed from the dispensing button for as long as it remains in its fully depressed position, as indicated by arrows in Figure 3.

When a dispensing operation is completed, the dispensing button will be released from the Figure 3 position to the Figure 1 position and in the course of

this movement it must pass through the Figure 2 position so that, for a brief period of time, only propellant will once more flow through the chamber 28, hole 14 and dispensing passageway 12. It is this flow of propellant that automatically clears product such as paint from these regions and it will be appreciated that a careful operator may if he wishes hold the dispensing button temporarily in the intermediate position so as to ensure even more thorough cleaning than might automatically occur.

Referring to Figure 4, it can be seen that the modified embodiment shown there is very similar to that shown in Figures 1 to 3. However, the biassing spring 26 rests at its lower end on an internal shoulder which occurs where the housing 2 changes from larger to smaller diameter. The smaller diameter lower section 40 has fitted over it a dip tube 24a of smaller diameter than that shown in the previous figures. The product inlet 34 and recess 36 are here provided in the reduced-diameter portion of the valve housing and the flange 30 is provided at the end of a portion of the valve stem 12 which is of correspondingly reduced diameter so as to be able to work within the portion 40 of the valve housing. With this construction, the biassing spring 26 lies

inside, rather than outside, the chamber 28. In operation, the embodiment of Figure 4 is similar to that of Figures 1 to 3.

Figure 5 shows a further embodiment which in most respects is similar to that of Figures 1 to 3, and in particular has a chamber 28 with which the hole 14 in the stem is permanently in communication while the stem is depressed. However, the embodiment of Figure 5 differs from the previous embodiments in that instead of the lower end of the valve stem being provided with flange 30, the inner wall of the valve housing 2 is provided with an inwardly projecting annular flange 42 which slides sealingly against the outside of the lower part of the valve stem 10 to define the bottom end of the chamber 28. The outer surface of that part of the stem 10 is provided with a vertically extending slot or recess 44. This has no effect when the dispensing button 13 is partially depressed and, in that condition, the valve operates to dispense only propellant as in Figure 2. However, when the dispensing button becomes fully depressed recess 44 extends partially past annular flange 42 in the downward direction so as to extend the chamber 28 to include the whole of the base of the housing 2; therefore product can again flow from the dip tube 24 and be dispensed through the dispensing button along a similar path to that illustrated in Figure 3 except that it gets past the flange 42 by travelling through the groove or recess 44.

The embodiment shown in Figure 6 is the same as that in Figure 4 except that recess 36 and inlet 34 are replaced by an inlet in the form of a slot 41 through the housing wall extending from its lower end up to the position of the top of the illustrated inlet 34. The lower extremity of the housing is open, not closed as shown in Figure 4. Instead of slot 41, a plurality of internal grooves of similar length may be provided in the housing inside wall, which may reduce the possibility of stem movement being hindered by friction after the dip tube (not shown) has been fitted over the reduced diameter bottom part 40 of the housing.

The embodiment of Figure 7 resembles that of Figure 5 except that the lower ends of the stem and the housing are of reduced diameter, the seal 42 and slot 44 are located below the spring 26, and the lower end of the housing is open instead of the product inlet being provided by the side recess and inlet 36, 34. As with Figure 6, the dip tube is again omitted for clarity.

It will be appreciated that in all the embodiments there is a port, which in the first two embodiments is constituted by the opening at the inward end of aperture 34, in the fourth embodiment is constituted by the inward edges of slot 41, and in the

third and fifth embodiments is constituted by the recess 44, which becomes partially or wholly uncovered by the respective flange 30 or 42, as the dispensing button becomes fully depressed, and this uncovering of the port communicates the product inlet 34 with the chamber 28.

In a modification of each of the described embodiments, which for clarity is only illustrated in relation to the first embodiment, a small and protruding blocking element 50 is formed on the outside of the valve stem 10 at such a position that it covers and seals the propellant inlet 32 when the stem is fully depressed as shown in Figure 3; thus, only product is dispensed from the container during this time. Such an arrangement would require the valve stem to be correctly orientated relative to the valve housing 2, and this might be achieved by moulding a peg onto the outside of the valve stem, which would ride in an axially directed groove moulded on the inner wall of the valve housing.

In a further possible modification of the first embodiment, the flange 30 is located above, rather than below, the propellant inlet 32 when the valve is in its closed position, as is indicated by the broken line 30' in Figure 1. Thus the chamber 28 is not subject to the propellant pressure when the

container is not being used for dispensing, so helping to minimise propellant weight loss during prolonged periods of storage etc.

CLAIMS:

1. A dispensing valve assembly for a container of the type containing a product kept under pressure by a fluid propellant, and comprising a valve housing, a valve stem extending outwardly from the housing and having a passage therein, and valve means which is opened by displacing the valve stem relative to the housing, wherein the housing includes a chamber which communicates with the passage in the stem when the valve means is opened, and means is provided for selectively communicating two inlets, provided in the housing, with said chamber in dependence upon the amount of displacement of the valve stem relative to the housing.

2. A valve assembly as claimed in claim 1, wherein one inlet is a product inlet and the other is a propellant inlet.

3. A valve assembly as claimed in claim 2, wherein the lower end of the valve housing is fitted with a dip tube and the product inlet leads from the dip tube into the housing.

4. A valve assembly as claimed in claim 3, wherein the propellant inlet is located above the dip tube.

5. A valve assembly as claimed in any one of claims 2 to 4, wherein the means for selectively communicating the two inlets with the chamber is adapted to communicate the product inlet with the chamber when the valve stem is fully displaced, and to communicate only the propellant inlet with said chamber when the valve stem is partly displaced.

6. A valve assembly as claimed in claim 5, wherein said means is adapted to communicate the product and propellant inlets with the chamber when the valve stem is fully displaced.

7. A valve assembly as claimed in any preceding claim, wherein the valve stem is slidably displaceable in a bore in the housing, sealing means is provided between the stem and the bore, the valve stem is biassed outwardly relative to the bore and to a position in which said valve means is closed, one inlet

leads into the bore below said sealing means when the stem is not inwardly displaced, the chamber is a part of the bore above the sealing means, and sufficient inward displacement of the stem uncovers a port which communicates that inlet with the chamber.

8. A valve assembly as claimed in claim 7, wherein the other inlet communicates permanently with the chamber.

9. A valve assembly as claimed in claim 7 or claim 8, wherein said sealing means is on the valve stem and said one inlet opens into said bore at said port, which is in the wall of said bore.

10. A valve assembly as claimed in claim 7 or claim 8, wherein said sealing means is on the wall of said bore, and said port is in said valve stem.

11. A valve assembly as claimed in any one of claims 7 to 10, wherein said sealing means and said one inlet are in a portion of the housing which is of reduced diameter.

12. A valve assembly as claimed in any one of claims 7 to 11, wherein said one inlet leads through a wall portion of the housing, and a dip tube is fitted over the outside of said wall portion, the inlet being in communication with the interior of the dip tube.

13. A valve assembly as claimed in any one of the preceding claims, wherein the valve means comprises a resilient annular gasket surrounding the valve stem and in contact with one end of the valve body, and an aperture leading from the passage in the valve stem to the outside thereof where, in the valve closed position, the aperture is sealed by the gasket.

14. A dispensing valve assembly for a container of the type containing a product kept under pressure by a fluid propellant, and comprising a valve housing formed with a chamber, and a valve stem extending outwardly from the chamber and having a passage therein, the assembly including valve means which is opened by displacing the valve stem in an inward direction relative to the housing so as to communicate the passage in the stem with the chamber in the housing, the housing being formed with first and second inputs for the said chamber, spaced along the housing in

relation to the stem movement and arranged to communicate the chamber with the interior of the product container, wherein sealing means between the stem and the housing is provided for varying the extent of the chamber in the said inward direction so as to communicate the two said inlets with the chamber selectively in dependence upon the amount of displacement of the valve stem relative to the housing.

15. A dispensing valve assembly as claimed in claim 14 which includes sealing means integrally provided by the stem and the housing in combination, at least during an initial part of movement of the stem in the said inward direction the sealing means being effective to define the distal end of the chamber at a position which is short of the second input, further movement of the stem in the said inward direction causing the chamber to be extended in the said inward direction so as to include the second input.

16. A container of the type containing a product kept under pressure by a fluid propellant, and equipped with a dispensing valve assembly as claimed in any preceding claim.

17. A container of the type containing a product kept under pressure by a fluid propellant,

and equipped with a dispensing valve assembly as claimed in claim 1, wherein when the container is upright with the valve assembly at the top, one said inlet has access to pressurised propellant and the other said inlet has access to pressurised product, only said one inlet communicates with the chamber when the valve stem is partially displaced relative to the housing, and at least the said other inlet communicates with the chamber when the valve stem is further displaced relative to the housing.

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