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(54) Improvements in valves for the atomized delivery of liquids.

(57) Improvements in valves for the atomized delivery of liquids contained under pressurized gas, such as nitrogen, in cans or other containers, comprising a body and a valving member and in which liquid is mixed with gas in a chamber (12, 12A) positioned upstream of the valving member (11, 11A) which controls the delivery of the atomized product and moves within said chamber, said improvements comprising premixing the liquid and gas in a premixing chamber (21, 21A) positioned prior to that (12, 12A) in which the valving member (11, 11A) moves and separated therefrom by a nozzle or narrow passage (20, 20A) having a cross-section substantially less than that of said chambers.

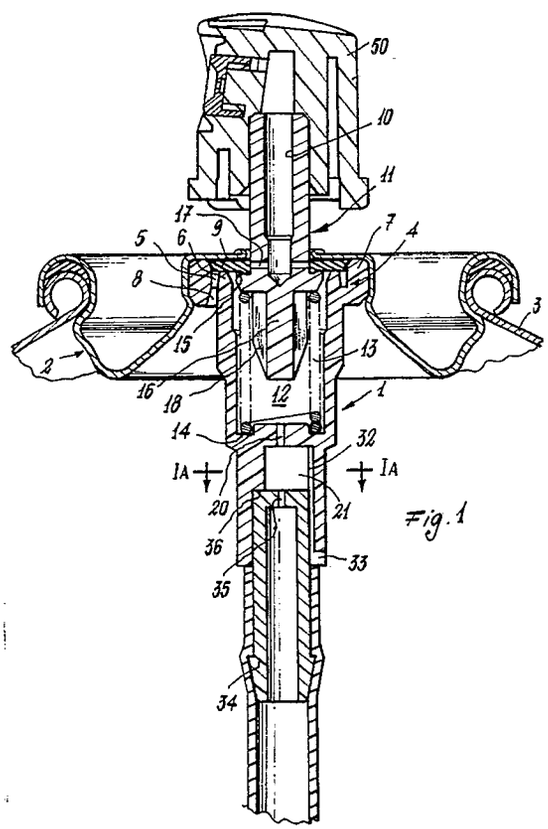

Fig. 1

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This invention relates to improvements in valves for the atomized delivery of liquids contained under pressurized gas, such as nitrogen, in cans or other containers.

More particularly, the valves of the invention are of the type in which liquid mixes with gas in a chamber located upstream of a valving member which controls the delivery of the atomized product and moves within said chamber. A valve of this type is described for example in Italian patent 1,096,119 or its corresponding U.S.A. patent 4,417,674.

In this known valve the valving member moves against a spring in a chamber in which the gas and liquid are mixed. This system is susceptible to improvement in the sense of reducing its gas consumption to thus maintain acceptable pressure levels even when the contained liquid is nearly exhausted and, more importantly, in the sense of providing a more complete atomization.

According to the invention, this improvement is obtained by providing for premixing between the liquid and gas to take place in a premixing chamber positioned prior to that in which the the valving member moves and separated from it by a nozzle or narrow hole having a cross-section substantially less than that of said chambers.

According to a preferred embodiment of the invention, separate nozzles or narrow passages for the gas and liquid open into the premixing chamber.

The invention will be more apparent from the description of two preferred embodiments thereof given hereinafter by way of non-limited example and illustrated on the accompanying drawing, in which:

Figure 1 is a cross-section through a first embodiment of the atomizing valve;

Figure 1A is a cross-section on the line A-A of Figure 1;

Figure 2 is an identical view of a second embodiment of the invention.

With reference to the figures, the valve for the delivery of liquids in atomized form comprises a hollow body 1, 1A clinched to a base or cap 2, 2A fixed in known manner to a can or other container 3 containing a pressurized gas such as nitrogen and a liquid such as perfume. In proximity to its upper end the hollow body 1 comprises a flange 4A in which an annular channel 5, 5A is provided, bounded on its inside by a wall 6, 6A having a height less than the outer wall 7, 7A.

In the base of the groove 5, 5A there are provided apertures 8, 8A, and on the inner wall 6, 6A there rests an elastic seal ring 9, 9A which is compressed on one side by the wall 6, 6A and on the other side by the cap 2, 2A.

Through the central hole in the ring 9, 9A there extends the hollow stem 10, 10A of a valving member 11, 11A, the remaining part 16, 16A of which is housed in that part 12, 12A of greatest cross-section of the cavity provided axially in the body 1, 1A. Said part 12, 12A is known hereinafter as the delivery chamber for simplicity.

The valving member 11, 11A is mobile axially against a spring 13, 13A resting lowerly on an annular base recess 14, 14A which delimits the delivery chamber 12, 12A and surrounds a nozzle or narrow hole 20, 20A.

In the rest state shown in the figures and assuming that the cap 2, 2A has been fixed to the container 3, the seal for the delivery valve is provided by an upper annular edge 15, 15A of the part 16, 16A urged against the seal ring 9, 9A by the spring 13, 13A and by the ring 9, 9A itself at the level of a series of radial apertures 17, 17A in said stem, which it intercepts in a sealed manner. The part 16, 16A of the valving member 11, 11A comprises one or more preferably helical grooves 18, 18A in a number equal to the number of radial apertures 17, 17A.

The narrow hole 20, 20A connects the delivery chamber 12, 12A to a premixing chamber 21, 21A.

In the embodiment shown in Figure 1, the premixing chamber 21 has the shape shown in the cross-sectional view of Figure 1A, defined by a flat wall 30, a wall 31 in the shape of a circular arc extending through more than 180°, and a groove 32 which extends parallel to the axis of the body 1 to open (via a slot 33) into the gaseous environment of the container 3 when this latter is in its substantially erect position for use.

The premixing chamber 21 is bounded lowerly by the upper end of a tubular insert 34 rigid with the body 1 and provided in said end with a nozzle or narrow hole 35 coaxial with 20 and leading to the premixing chamber. The tubular insert defines with its outer wall and the groove 32 a channel through which the gas can reach the premixing chamber 21.

A usual dip tube 37 is mounted on the tubular insert 34, which abuts against a step 36 on the body 1.

The cross-sectional areas of the nozzles 20 and 35 and of the groove 32 are substantially less than those of the chamber 12 and 21.

It is interesting to note that in the described delivery valve of the invention the groove 32 can be obtained by frontal forming, which enables passage cross-sections (in the part in which the groove is bounded by the insert 34) of 0.2 mm^2 to be obtained, which would otherwise be obtainable only by laser, ie by additional operational means and processes. Grooves of different cross-section can be obtained merely by changing the forming pin. It is important to note that a relationship exists be-

tween principally the cross-sectional areas of the nozzles 20, 35 and the channel formed by the groove 35, such that by varying these a very low gas consumption through the groove 35 can be obtained. Specifically, the passage cross-sections of the nozzles and groove are chosen so that this latter is the smaller and the nozzle 20 has a greater cross-section than the nozzle 35. For example the cross-section of the nozzle 35 could be 0.3 mm^2, that of the nozzle 20 could be 0.35 mm^2 and that of the groove 32 could be 0.2 mm^2. It can be assumed that on delivery, a Venturi effect is created by the liquid under pressure, with the result that a small quantity of gas is drawn through the groove 32 and mixed with the liquid fraction in the premixing chamber 21, the gas and liquid then emerging into the further chamber 12 in which intimate gaseous state mixing takes place by the effect of expansion. In the chamber 12, pressure energy is transformed into kinetic energy with the result that the mixture gains velocity in passing to the delivery knob 50.

The embodiment shown in Figure 2 also comprises a premixing chamber 21A to which however the gas flows via a narrow radial passage 60, the cross-section of which is less than that of the nozzle 20A. The premixing chamber has a lower larger-diameter portion with the frusto-conical connecting part 61 acting as a total or partial sealing seat for a ball 62 which is retained in the chamber 12 by an inserted cup 63 provided with axial grooves 64 for liquid passage. The cup is retained in situ by the dip tube 65 and an inner shoulder 66 on the body 1A.

The purpose of the ball 62 is to prevent or reduce gas consumption when the container 3 is used inverted instead of upright, which is its correct position.

On pressing the delivery knob 50A with the container upright, the depressed knob 50A allows the liquid to pass from the dip tube 65 through the axial grooves 64 and into the premixing chamber 21A to reach its upper narrow region in which mixing takes place with the gas which enters through the narrow passage 60. The gas/liquid mixture is throttled by the nozzle 20A and passes into the chamber 12A in which further intimate mixing takes place.

Under these conditions, which are those under which the container is normally used, the ball 62 is in the cup 63, but on inverting the container the ball becomes positioned against the conical seat 61 by gravity. In this case, access to the chamber 12A can occur only via the passage 60, where the liquid is present. Thus only liquid can reach the chamber 12A, via said passage. However by providing narrow passages on the frusto-conical surface 61 it is possible for a certain small quantity of gas to enter the chamber 21A through the dip tube 65, the mouth of which is now within the gaseous region of the container.

The invention also evidently covers an embodiment in which the delivery valve of Figure 1 is provided with a ball with the same purpose of reducing or excluding gas consumption if the container is incorrectly used inverted. For this purpose it is sufficient to use the ball arrangement shown in Figure 2.

Claims

1. Improvements in valves for the atomized delivery of liquids contained under pressurized gas, such as nitrogen in cans or other containers, comprising a body and a valving member and in which liquid is mixed with gas in a chamber (12, 12A) positioned upstream of the valving member (11, 11A) which controls the delivery of the atomized product and moves within said chamber, characterised in that premixing between the liquid and gas takes place in a premixing chamber (21, 21A) positioned prior to that (12, 12A) in which the valving member (11, 11A) moves and separated therefrom by a nozzle or narrow passage (20, 20A) having a cross-section substantially less than that of said chambers.

2. Improvements as claimed in claim 1, characterised by comprising a ball (62) for totally or partially interrupting the connection between the premixing chamber (21, 21A) and a dip tube (65) when the container (3) is used inverted.

3. Improvements as claimed in claim 1 or in claims 1 and 2, characterised in that separate nozzles or narrow passages (32, 35) for the gas and liquid open into the premixing chamber (21).

4. Improvements as claimed in claims 1 and 2, characterised in that the premixing chamber (21A) comprises a region of lesser diameter which is connected to the narrow passage (20A) opening into the chamber (12A) in which the valving member (11A) moves, the connection between said region and the dip tube (65) being partially or totally interruptable by the ball (62).

5. Improvements as claimed in claim 3, characterised in that the narrow passage (32) for the flow of gas to the premixing chamber (21) is a groove which extends within the body (1) parallel to its axis and is partly delimited by an

insert (34) containing the narrow passage (35) for the liquid.

6. Improvements as claimed in claim 5, characterised in that one side of the insert (34) delimits the premixing chamber (21), which has a smaller cross-section than the insert (34).

7. Improvements as claimed in claims 1 and 3, or claims 1, 3 and 5, or claims 1, 3, 5 and 6, characterised in that the narrow passage (32) for the gas has a smaller cross-section than the narrow passage (35) for the liquid, this latter having a smaller cross-section than the narrow passage (20) leading from the premixing chamber (21) to the chamber (12) in which the valving member (11) moves.

8. Improvements as claimed in claim 4, characterised in that a narrow radial passage (60) for the gas opens into the narrow region of the premixing chamber (21A).

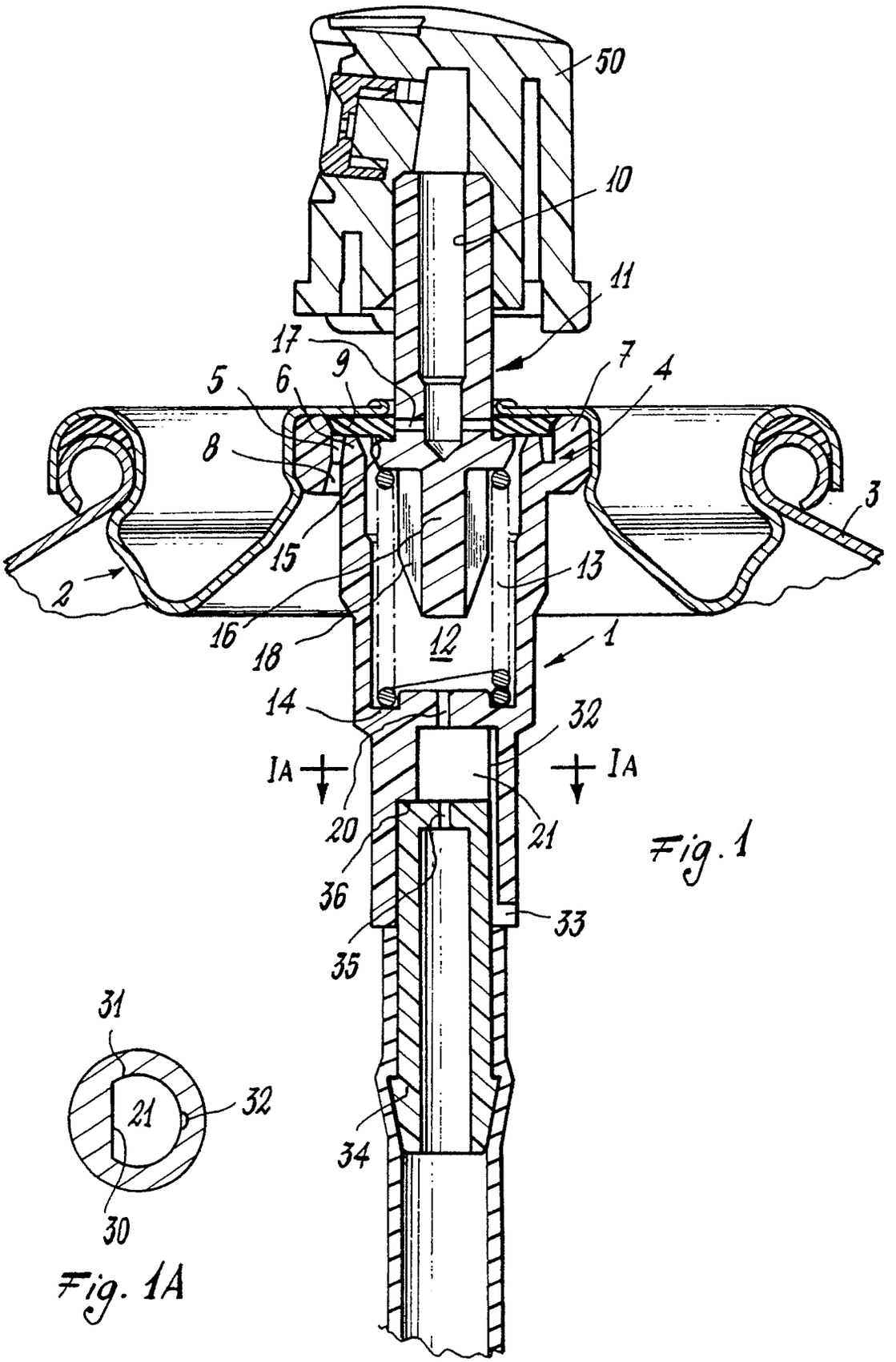
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Fig. 1

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Fig. 1A

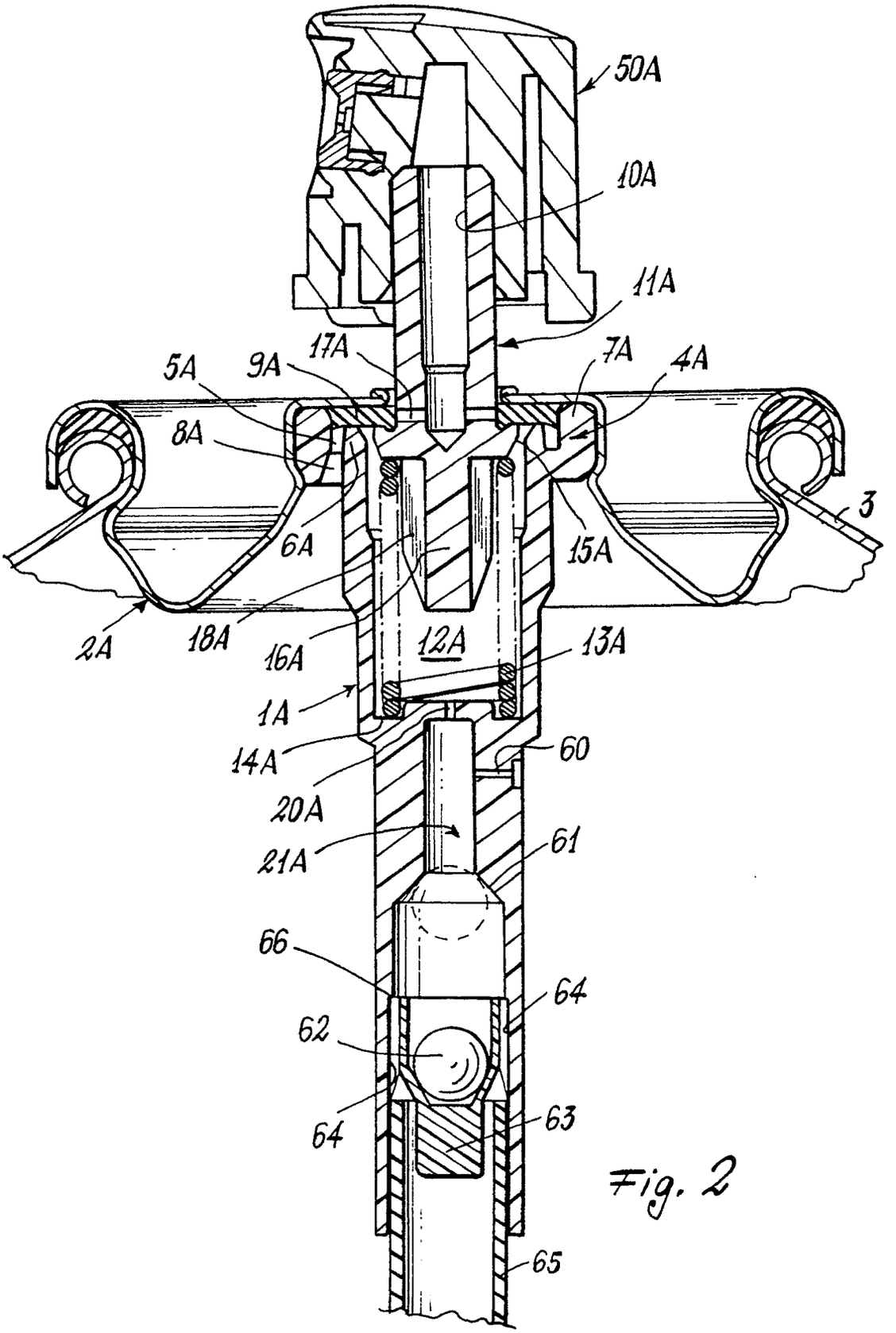
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Fig. 2