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(71) Applicant: **SIG SIMONAZZI S.P.A.**
43040 Parma (IT)

(72) Inventors:
- **Abati, Stefano,**
  c/o Sig Simonazzi Veverage S.p.A.
  43040 Parma (IT)
- **Vescovi, Marco,**
  c/o Sig Simonazzi Veverage S.p.A.
  43040 Parma (IT)

(74) Representative: **Long, Giorgio et al**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

(54) Valve unit for filling machines

(57) The present invention relates to a valve unit for a container filling machine, particularly a bottle filling machine.

More specifically, the present invention relates to a valve unit (1), particularly for filling machines for filling containers (7), comprising a hollow body (2) housing a sliding plug (3), the unit being characterized in that the said plug (3) is provided with deflector means (27) for deflecting the flow of a filling fluid (6) onto the internal walls of the said container (7)

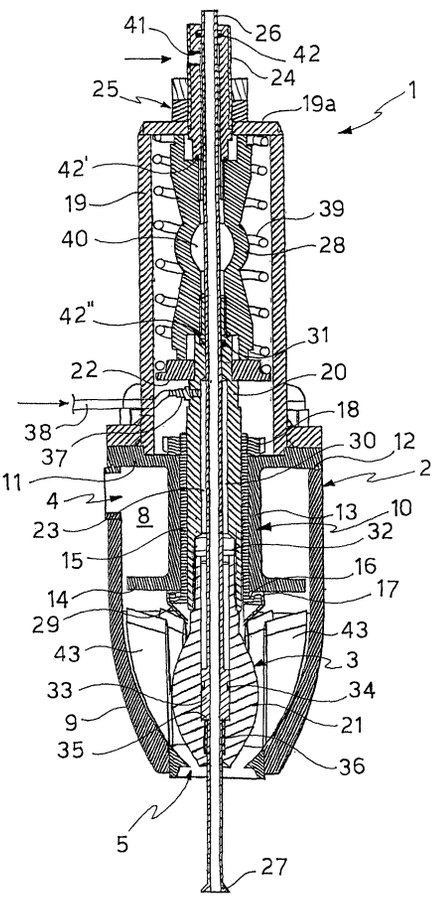

FIG.2

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Description

[0001] The present invention relates to a valve unit for a machine for filling containers, particularly a bottle filling machine.

[0002] In certain cases the process of filling containers encounters difficulties relating to the nature of fluids such as milk or tea, for example. This type of fluid, under filling conditions, tends to form large amounts of foam which may then spill over the sides of the container, with the immediate loss of some of the drink. With sugary or flavoured drinks there is also the problem that the outside of the container and the work surface are made dirty by the residues of the fluid, which means that the filled containers require external washing and the work surface has to be frequently cleaned.

[0003] In addition to these problems, foam formation impedes correct operation of the valve unit and tends to leave it contaminated with drink residues.

[0004] The problems delineated above are aggravated by the fact that foam formation is particularly evident in industrial-scale filling operations, because the high speed at which the liquid is filled into the container increases its turbulence and so makes the problem all the greater.

[0005] The problem addressed by the present invention is therefore that of providing a liquid dispensing system for a filling machine that will overcome the problems inherent in the filling operations carried out by the devices of the prior art.

[0006] This problem is solved with a valve unit as delineated in the appended claims.

[0007] Other features and advantages of the valve unit for a filling machine that forms the subject-matter of this invention will become clearer in the course of the description given below by way of non-limiting indication, of one preferred embodiment, with reference to the following figures, in which:

Figure 1 is a sectional side view of the valve unit of the invention, in the closed condition;
Figure 2 is the same view as Figure 1, but with the valve open; and
Figure 3 is a sectional side view of a detail of Figure 2 during filling.

[0008] Referring to the figures, the valve unit of the invention, indicated as a whole by the number 1, comprises a hollow body 2 housing a sliding plug 3.

[0009] The hollow body 2 comprises an inlet aperture 4 and an outlet aperture 5 for the fluid 6 with which the container 7 is to be filled. The said inlet aperture 4 is situated on the lateral surface of the hollow body 2, while the outlet aperture 5 is formed in its lower surface, in alignment with the plug 3. As a result, a passage 8 for the filling fluid 6 will be defined inside the said hollow body 2, which cavity, being coaxially occupied by the plug 3, will be essentially annular in shape.

[0010] The hollow body 2 of the valve unit 1 is essentially cylindrical in shape and its diameter, in cross section, is greater than the diameter of the outlet aperture 5. The connecting portion 9 between the larger-diameter cylindrical body and the outlet aperture 5 is ogival in section, truncated below at the said outlet aperture 5 for the filling fluid 6.

[0011] A plurality of fins 43 for stabilizing the flow of filling fluid 6 is arranged on the inside surface of the hollow body 2.

[0012] The valve unit 1 also includes guide means 10 for the plug 3. These guide means 10 comprise a perforated disc 11 fixed to the top edge 12 of the hollow body 2. Extending down from the perforated disc 11 around the central hole is a sleeve 13 through which the plug 3 will be able to slide. The sleeve 13 ends at the bottom, approximately half-way through the longitudinal length of the hollow body 2, in an outward flange 14.

[0013] Inside the sleeve 13 is a tubular part 15 whose axial length is slightly greater than that of the sleeve 13. The tubular part 15 ends at the bottom in an outwardly projecting flange 16. The upper surface of the flange 16 includes an annular relief 17.

[0014] A ring 18 is fixed removably, for example by means of a screw thread, to the outside of the tubular part 15, near its upper end, for axial retention of this cylindrical part.

[0015] An envelope 19 mounted on top of the perforated disc 11 encloses the upper portion of the plug 3 and its actuating means. The envelope 19 is closed at the top by a cap 19a with a central hole housing a cylinder 24 containing its own coaxial bore. The cylinder 24 is attached to the cap 19a by known fixing means 25.

[0016] The plug 3 comprises a tubular body 20, fixed to the bottom end of which is a closing member 21, which is basically bulb-shaped in the example: this serves to shut off the outlet aperture 5 of the valve unit when the latter is in the non-operating condition. The closing member 21 is preferably interchangeable to suit filling requirements.

[0017] The upper portion of the closing member 21 extends some way into the hole of the tubular body 20 and ends in an inwardly projecting abutment ring 32.

[0018] Both the tubular body 20 and the closing member 21 are hollow and open at their respective ends, thus defining a coaxial channel 23 running the entire length of the plug 3, being open at the top inside the envelope 19 and at the bottom on the outside of the valve unit 1, at the tip of the plug.

[0019] A sliding cannula 26 is housed in the channel 23, passing axially through the plug 3 and continuing above it through the envelope 19, the central hole in the cylinder 24 and emerging above on the outside of the valve unit.

[0020] At the bottom end of the cannula 26 are flow deflector means. In the example shown, these deflector means consist of the frustoconical portion 27 which projects outwards with a flared surface. The top end of

the cannula 26 meanwhile is open to let air out.

[0021] Observing the plug 3 in detail, the outer surface of the tubular body 20 ends at the top, inside the envelope 19, in a smaller-diameter portion, which is joined to the lower portion by a shoulder on which rests an annular disc 22. The upper surface of the annular disc 22 is stepped in cross section.

[0022] Held between the lower edge of the tubular body 20 and the closing member 21 is one edge of an annular diaphragm 29 isolating the passage 8 for the filling fluid 6. The upper edge of this diaphragm is gripped between the lower surface of the flange 14 of the sleeve 13 and the annular relief 17 of the flange 16 of the tubular part 15. The annular diaphragm 29 ensures the asepsis of the outgoing flow of fluid 6, preventing contamination by the unsterile air that could get in from the channel 23 of the closure member 3.

[0023] The two end sections of the channel 23 - the upper end section in the upper portion of the tubular body 20 and the lower end section in the lower portion of the closing member 21 - have approximately the same diameter as the cannula 26, while the remaining central tract of the channel 23 has a larger diameter so as to define a tubular chamber 30. A seal 31, such as an 0-ring, positioned in a seating on the surface of the channel 23 near its upper end, prevents leaks at the upper end of the tubular chamber 30.

[0024] The tubular chamber 30 is divided by the abutment ring 32 into an upper half-chamber and a lower half-chamber. The cannula 26 possesses a piston portion 33 where the diameter is approximately the same as the diameter of the tubular chamber 30. The said piston portion 33 is housed in the lower half-chamber of the tubular chamber 30 and, in the non-operating condition, is immediately underneath the abutment ring 32. A seal 34, such an O-ring, housed in a seating on the surface of the piston portion 33 of the cannula 26, prevents leaks at the lower end of the upper half-chamber.

[0025] The said lower half-chamber of the tubular chamber 30 is further subdivided into two portions with different diameters, connected by a shoulder 35. Another shoulder defines the connecting point between the end portion of the channel 23, which as described earlier has a diameter approximately equal to the diameter of the cannula 26, and the half-chamber above it. Means for returning the cannula 26, in this case a spring 36, press down on this latter shoulder. These return means 36 also act upwards against the piston portion 33 of the cannula 26. As will be realized from the above account, the lower half-chamber of the tubular chamber 30, which is that lying between the abutment ring 32 and the shoulder 35, defines the stroke of the piston portion 33 of the cannula.

[0026] A connector 37 to a tube 38, which is in fluid communication with a source of compressed air or other pressurizing fluid, feeds into the upper half-chamber of the tubular chamber 30, immediately underneath the annular disc 22.

[0027] Turning now to the detail of the actuating means of the plug 3, these comprise a deformable lung element 28 made of an elastic material such as a rubber tube. The lung element 28 is housed within the envelope 19 and sits around the cannula 26. The lung element 28 is attached at one end to the lower surface of the cap 19a of the envelope 19 and at the other end to the upper surface of the annular disc 22.

[0028] The lung element 28 is associated with return means, in this case a spring 39. The spring 39 is arranged concentrically around the outside of the lung element 28 and it too presses on the lower surface of the cap 19a of the envelope 19 and on the upper surface of the annular disc 22.

[0029] Between the inside surface of the lung element 28 and the cannula 26, a gap is created which constitutes a pressurization chamber 40. The cylinder 24 possesses, on the portion outside the envelope 19, an aperture 41 for the injection of compressed air, which can reach the pressurization chamber 40 because of a gap between the cannula 26 and the hole of the cylinder 24. Suitable seals 42, 42', 42'', such as 0-rings, keep the pressurization chamber 40 leaktight. The aperture 41 is in flow communication with a source of compressed air or other pressurizing fluid.

[0030] Remaining with the figures, the operation of the valve unit according to the invention will now be described.

[0031] In the closed condition, the valve unit 1 is as shown in Figure 1. In this condition the closing member 21 interacts with the edge of the outlet aperture 5 of the hollow body 2 to seal it.

[0032] The valve is actuated by injecting compressed air through the aperture 41 into the pressurization chamber 40. The compressed air causes the lung element 28 to expand, consequently reducing its axial length. The axial shortening of the lung element 28 lifts the annular disc 22, to which it is attached, and hence also the plug 3, in opposition to the spring 39. Simultaneously, or immediately before this, compressed air is also injected through the connector 37 into the tubular chamber 30 so as to act on the piston portion 33 of the cannula 26, causing it to slide down in opposition to the spring 36. The cannula 26 is therefore pushed out and protrudes from the closing member 21 by the amount permitted by the stroke of the piston portion 33 until it meets the lower shoulder 35 of the tubular chamber 30 (Figure 2). In this way, as shown in Figure 3, the cannula 26 passes into the neck of the container 7 and, by means of the deflector means 27 at its lower end, will direct the flow of filling fluid 6 onto the walls of the container, thereby reducing or eliminating foam formation.

[0033] After the filling fluid 6 has been dispensed, the injection of compressed air is suspended both through the aperture 41 and through the connector 37. The respective springs 39, 36 will relax and move the plug 3 back so that it closes the outlet aperture 5 of the hollow body 2 and also return the cannula 26 to the retracted

position.

[0034] Compressed air can be injected into the valve unit 1 via solenoid valves (not shown) controlled by a command and control unit. The amount of fluid dispensed is monitored by known flow-measuring means.

[0035] The advantages of the valve unit according to the present invention will be immediately apparent from the above description.

[0036] In the first place, the use of the cannula 26, with its flow deflector means, minimizes foam formation and therefore facilitates the filling operation even with very problematic liquids such as tea or milk.

[0037] The diaphragm 29 helps to maintain optimal asepsis during filling by isolating the internal mechanisms of the plug from the passage 8 for the fluid 6.

[0038] The valve unit is simple in terms of construction and is easy to operate. The type of means for actuating the plug 3 and the cannula 26 minimizes maintenance requirements.

[0039] It will be obvious that only one particular embodiment of the valve unit of the present invention has been described, and that a person skilled in the art will be able to make all necessary modifications thereto for its adaptation to particular applications, without thereby departing from the scope of protection of the present invention.

Claims

1. Valve unit (1), particularly for a machine for filling containers (7), comprising a hollow body (2) housing a sliding plug (3), the unit being **characterized in that** the said plug (3) is provided with deflector means (27) for deflecting the flow of a filling fluid (6) onto the internal walls of the said container (7) .

2. Valve unit according to Claim 1, in which a channel (23) formed inside the said plug (3) houses a sliding cannula (26), the said cannula (26) being moveable between a retracted position inside the said plug (3) and an extended position, and in which the said deflector means (27) of the flow of fluid (6) are operatively connected to the said cannula (26).

3. Valve unit according to Claim 2, in which the said cannula (26) comprises a frustoconical end portion (27) projecting outwards with a flared surface which constitutes the said flow deflector means.

4. Valve unit according to any one of Claims 1 to 3, in which the said cannula (26) comprises a piston portion (33) that can be moved by the action of a pressurized fluid such as compressed air, in opposition to return means (36), between first and second positions inside a chamber (30) into which the said pressurized fluid is injected, the said first position corresponding to the retracted condition and the said second position corresponding to the extended condition of the said cannula (26).

5. Valve unit according to any one of Claims 1 to 4, in which the said plug (3) is operatively connected to actuating means comprising:

   - A lung element (28) that can be inflated by a pressurized fluid such as compressed air injected into a pressurization chamber (40) located inside the said lung element (28), the said lung element (28) being connected at the lower end to the said plug (3) and at the upper end to the cap (19a) of the envelope (19) in which the said actuating means are housed, and
   - return means (39) arranged concentrically around the outside of the said lung element (28) and acting on the said plug (3) and on the said cap (19a) of the said envelope (19),

     in such a way that inflating the said lung element (28) causes it to shorten in the axial direction and consequently lifts the said plug (3) from the non-operating valve-closed position to the valve-open position.

6. Valve unit according to Claim 4 or 5, in which the said return means (36, 39) are springs.

7. Valve unit according to any one of Claims 1 to 6, in which a plurality of fins (43) are arranged around the internal surface of the said hollow body (2) to stabilize the flow of outgoing fluid (6).

8. Valve unit according to any one of Claims 1 to 7, in which guide means (13, 15) for the said plug (3) are located on its outside.

9. Valve unit according to any one of Claims 1 to 8, in which the said plug (3) comprises an interchangeable closing member (21).

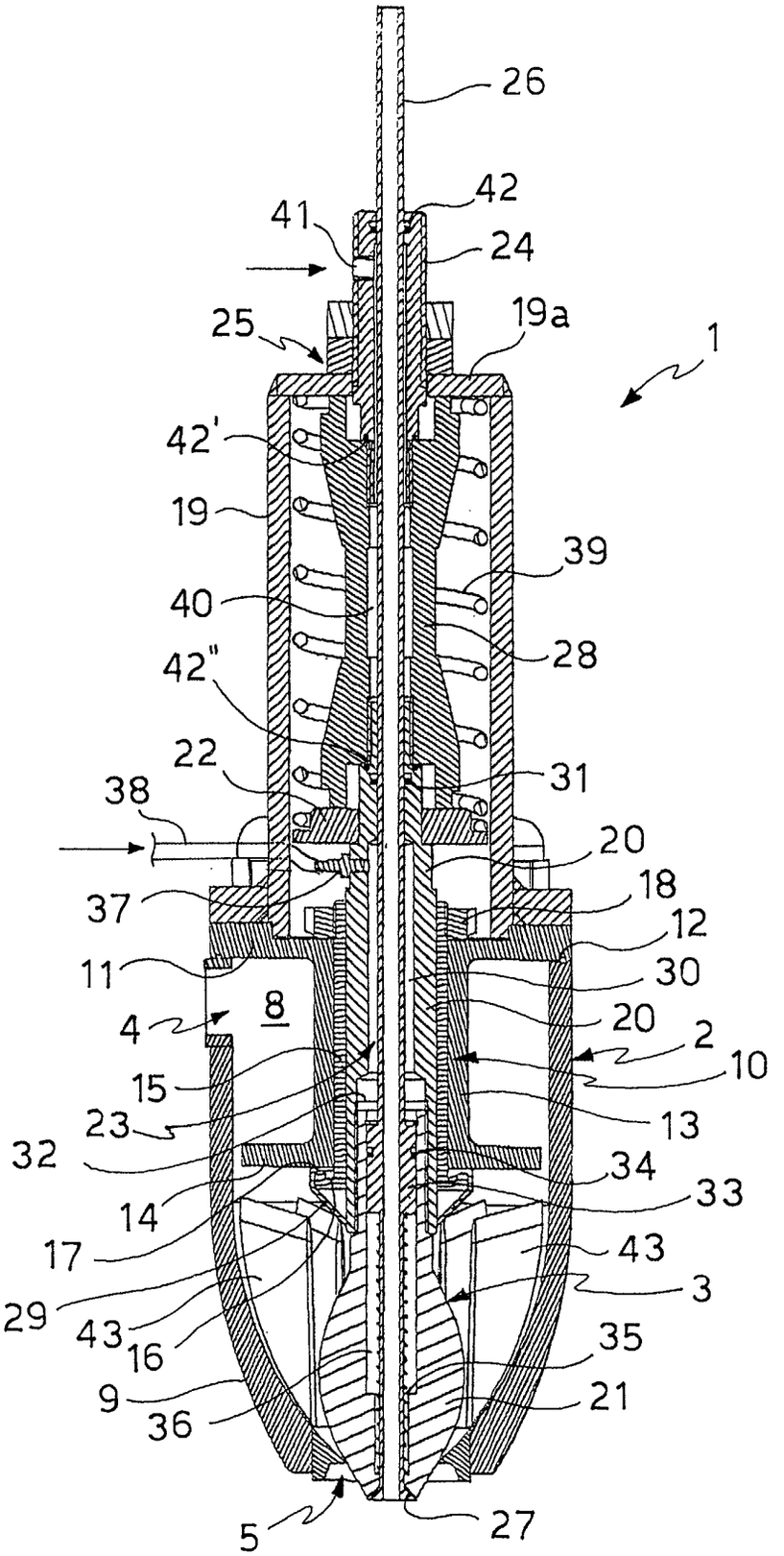
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FIG. 1

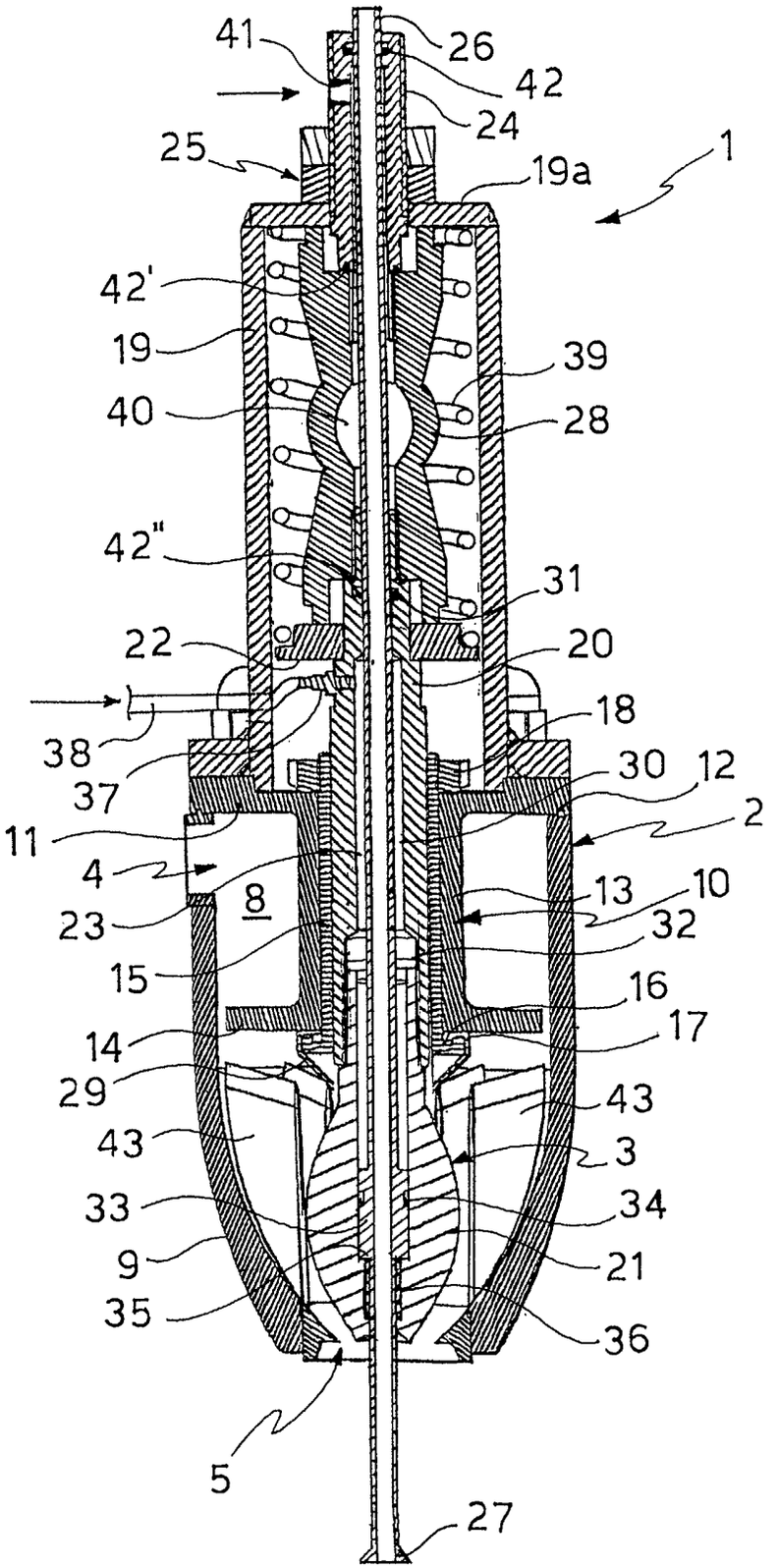
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FIG.2

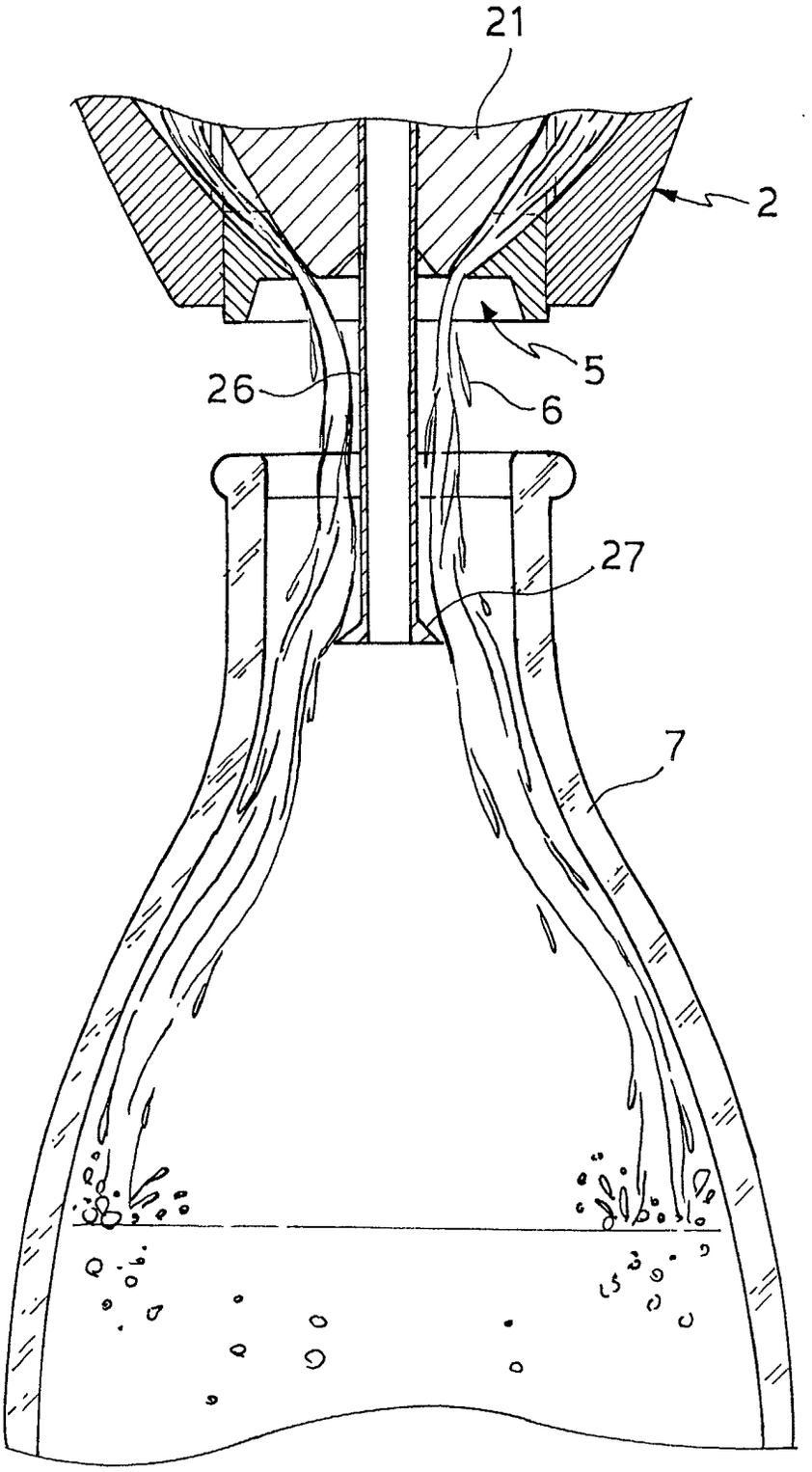

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5074

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B67C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 July 2002	Wartenhorst, F

CATEGORY OF CITED DOCUMENTS

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