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(54) Device for entraining a substance in a water flow.

(57) A one-piece moulded plastics cap (1) fits on a container (6) of soluble plant food. A bore (8) directs a jet of water at a groove (21) in a rising bed (16). Water runs into the container (6) from the groove (21) through an orifice (24) and forms a concentrated solution which is sucked up through a tube (26) by the venturi effect of the water streaming over the bed (16) towards a spray-forming lip (18).

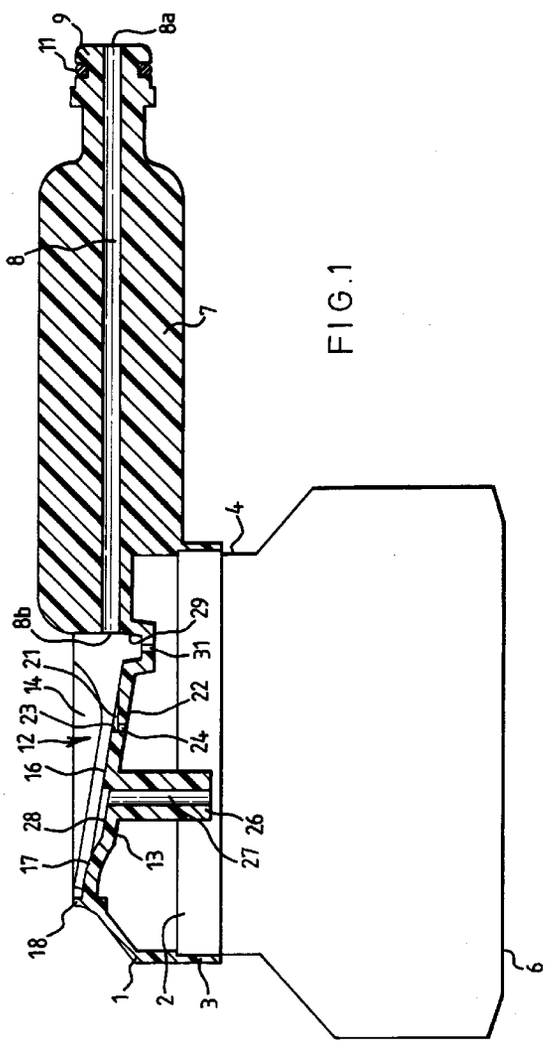

FIG.1

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This invention relates to a device for entraining a substance, e.g. plant food, in a flow of water.

GB-A-2 236 259 discloses a device comprising a cap adapted to be fitted to the open top of a container filled with soluble plant food. The cap comprises a duct which includes a venturi section for drawing concentrated solution from the container. Upstream of the venturi section, the duct has a lateral orifice through which water flows into the container under the pressure prevailing in the duct.

The construction of the device is expensive and includes an anti-siphon device or non-return valve to prevent contaminants from being sucked back into the water supply if there is a reduction or reversal of the main water pressure.

The present invention provides a device which directs a water jet onto an obliquely rising bed, the water flowing over the upper end of a duct and creating a venturi effect; upstream of the duct the bed has a recess or orifice through which part of the flow of water is diverted downwards.

In particular, the invention provides a device for entraining in a flow of water a substance contained in an open-topped container, the device comprising a cap adapted to be fitted to the open top of the container, the cap comprising a water inlet section having an inlet end which is connectable to a source of water under pressure and having a bore which communicates between the inlet end and an outlet end and which forms the water into a jet, and a base member and sidewalls delimiting an upwardly open cavity into which the bore discharges, the upper surface of the base member including a bed which slopes upwards in the downstream direction, the water jet impinging on the bed downstream of the outlet end of the bore and flowing as a stream over the bed towards an exit of the cavity, the base member including a hollow depending portion defining a suction duct having an upper end across which the water stream flows to cause a reduction in pressure in the suction duct, the bed including a recess which is aligned with the bore and open towards the bore, the recess being upstream of the suction duct and communicating with the underside of the base member to allow water to flow into the open-topped container, in use.

This structure can thus ensure an air break consisting of a space open to the air between the outlet end of the bore of the water inlet section and the location at which the water comes into contact with the substance, thereby preventing suck-back of contaminated water should there be a pressure drop or reversal in the bore.

Furthermore, the inlet section, the base member, and the sidewalls can easily be made in one piece, e.g. by injection moulding.

Optional and preferred features of the invention are set forth in the subsidiary claims.

The invention will be described further, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a cross-section (taken on line I-I in Figure 2) through an entrainment device fitted on a container;

Figure 2 is a plan view of the device;

Figure 3 is a side view, partly in axial cross-section, of a preferred embodiment of the entrainment device;

Figure 4 is a front end view of the preferred embodiment;

Figure 5 is a rear end view of the preferred embodiment; and

Figure 6 is a plan view of the preferred embodiment.

Figure 7 shows a modified detail of Figure 6.

The device illustrated in Figures 1 and 2 comprises a one-piece moulded plastics cap 1 with a mixing chamber 2 having an internally screw-threaded circumferential wall 3 which is screwed onto the externally screw-threaded neck 4 of a transparent container 6 filled with powdered plant food (not shown) which dissolves in water to form a solution (which term includes colloidal solutions and dispersions).

The cap 1 includes a water inlet section 7 having a bore 8 of circular cross-section which progressively decreases in diameter from an inlet end 8a to an outlet end 8b. The inlet end of the inlet section 7 is constituted by a spigot 9, accommodating an O-ring 11 (Fig. 1), for connection to a conventional click-fitting connector (not shown) providing communication with the main water supply. The water, under mains pressure, accelerates along the gradually convergent bore 8 and leaves the outlet end 8b as a jet which enters an upwardly open divergent cavity 12 defined by a base member 13 and sidewalls 14. The upper surface of the base member 13 includes a bed 16 on which the water jet impinges and forms a divergent stream flowing towards a convex ramp 17 rising towards a lip or ridge 18 at a downstream exit of the cavity 12. The surface over which the water flows acts to direct the flow in such a way as to create an even fan-shaped spray with fine droplets, suitable for irrigation in a wide range of garden situations. The lip 18 enhances the formation of fine droplets. Two inward projections 19 at the exit ends of the sidewalls 14 act to produce a clearly defined ending to the spray pattern.

The bed 16 includes a recess comprising a groove 21 which is aligned with the bore 8. The base 22 of the groove 21 is horizontal and is substantially level with the lowest point of the outlet end 8b of the bore 8. The end of the groove 21 remote from the bore 8 is closed by a (preferably vertical) step 23 which is semi-circular in plan view. The groove 21 is of constant width and is narrower than the outlet end 8b. Adjacent the step 23, an orifice 24 communicates between the groove 21 and the mixing space 2. Part of the water flow becomes diverted through the orifice

24 into the container 6, causing a continuous turbulent flow in the powder, preventing the formation of an insoluble matrix, while the powder dissolves in the water to form a concentrated solution in the container 6.

The base member 13 includes a downwardly projecting tube 26 defining a duct 27 through which the concentrated solution is sucked from the container 6 owing to the venturi effect of the stream of water flowing over the upper end of the duct 27, which opens into the upstream end of a depression 28 in the bed 16. The tube 26 depends below the top of the container 6, thereby preventing overflow. When the cap 1 is screwed onto the neck 4 a slight air gap is left to allow pressure equalisation in the container 6.

The duct 27 is wider than the orifice 24 and the ratio of their diameters is selected empirically so as to achieve a desired dilution rate (weight of powder/volume of water) without overflow from the container 6.

Between the bed 16 and the inlet section 7 the base member 13 includes a trough 29 enhancing the air break between the duct 27 and the bore 8. The trough has an optional drainage hole 31 (or holes).

Various modifications may be made within the scope of the invention. For example, the groove 21 may be omitted and the orifice 24 extended upwards to intersect the bed 16 so that the upper end of the orifice is open towards the outlet end 8b of the bore 8 and intercepts the jet of water.

Figures 3 to 6 of the drawings illustrate a preferred embodiment of the above-described device. Equivalent parts are denoted by the same reference numerals, and therefore no further description is necessary. Preferred dimensions of the parts of the cap 1 are as follows. Cap 1: overall length 191.5 mm; wall 3 : outer diameter 90 mm; bore 8 : length 100 mm, inlet diameter 8.8 mm, outlet diameter 3.5 mm; bed 16 : slope 8°; ramp 17 : radius 85.8 mm; lip 18 : height 0.57 mm, length 24.5 mm; groove 21 : width 2 mm; step 23 : height 1.5 mm; orifice 24 : upper end diameter 0.8 ± 0.1 mm, downward divergence 4°, length 1.5 mm; duct 27 : upper end diameter 1.8 ± 0.1 mm, downward divergence 6°, lower end 5 mm above lower edge of wall 3; depression 28 : depth 1.5 mm; trough 29 : length 5.5 mm, width 14.5 mm, depth 5 mm.

Figure 7 shows a modification of the inlet end of the inlet section 7 of the preferred embodiment, with a manually operable on/off valve 32 for selectably turning the water jet on and off. The valve 32 may be a sliding gate valve (as shown) or a rotary gate valve or any other conventional type of on/off valve. The valve 32 may be incorporated into the body of the inlet section 7, as shown, or may be provided as a fixed or removable attachment on the spigot 9.

Claims

1. A device for entraining in a flow of water a substance contained in an open-topped container, the device comprising a cap (1) adapted to be fitted to the open top of the container, the cap (1) comprising a water inlet section (7) having an inlet end (8a) which is connectable to a source of water under pressure and having a bore (8) which communicates between the inlet end (8a) and an outlet end (8b) and which forms the water into a jet, and a base member (13) and sidewalls (14) delimiting an upwardly open cavity (12) into which the bore (8) discharges, the upper surface of the base member (13) including a bed (16) which slopes upwards in the downstream direction, the water jet impinging on the bed (16) downstream of the outlet end (8b) of the bore (8) and flowing as a stream over the bed (16) towards an exit of the cavity (12), the base member (13) including a hollow depending portion (26) defining a suction duct (27) having an upper end across which the water stream flows to cause a reduction in pressure in the suction duct (27), the bed (16) including a recess (21) which is aligned with the bore (8) and open towards the bore (8), the recess (21) being upstream of the suction duct (27) and communicating with the underside of the base member (13) to allow water to flow into the open-topped container, in use.

2. A device as claimed in claim 1, in which the recess comprises an orifice which communicates with the underside of the base member.

3. A device as claimed in claim 1, in which the recess comprises a groove (21) which is aligned with the bore (8), the groove (21) being open at one end facing the bore (8) and being closed by a step (23) at the other end remote from the bore (8), the groove (21) being upstream of the suction duct (27), the base member (13) having an orifice (24) which communicates between the groove (21) and the underside of the base member (13).

4. A device as claimed in claim 3, in which the orifice (24) is nearer the said other end of the groove (21).

5. A device as claimed in claim 4, in which the orifice (24) is adjacent to the step (23).

6. A device as claimed in any of claims 3 to 5, in which the width of the groove (21) at the position of the orifice (24) is substantially equal to the corresponding transverse dimension of the orifice (24).

7. A device as claimed in any of claims 3 to 6, in which the groove (21) is narrower than the outlet end (8b) of the bore (8).

8. A device as claimed in any of claims 3 to 7, in which the width of the groove (21) is substantially constant along its length.

9. A device as claimed in any preceding claim, in which the base member (13) includes an upwardly open trough (29) between the water inlet section (7) and the bed (16).

10. A device as claimed in claim 9, in which at least one drainage hole (31) communicates between the trough (29) and the underside of the base member (13).

11. A device as claimed in any preceding claim, in which the bore (8) has a diameter which decreases in the downstream direction.

12. A device as claimed in any preceding claim, in which the upper end of the suction duct (27) opens into a depression (28) in the bed (16).

13. A device as claimed in any preceding claim, in which the downstream end portion of the upper surface of the base member (13), between the suction duct (27) and the cavity exit, includes a ramp (17) which is convex and which rises towards the cavity exit.

14. A device as claimed in any preceding claim, in which the sidewalls (14) have respective inward projections (19) adjacent the cavity exit.

15. A device as claimed in any preceding claim, in which the base member (13) has an upwardly projecting lip (18) adjacent the cavity exit.

16. A device as claimed in any preceding claim, in which the inlet section (7), the base member (13), and the sidewalls (14) are constituted by a single integral moulded body of plastics material.

17. A device as claimed in any preceding claim, in which the inlet section (7) is provided with a valve (32) for selectably turning the water jet on and off.

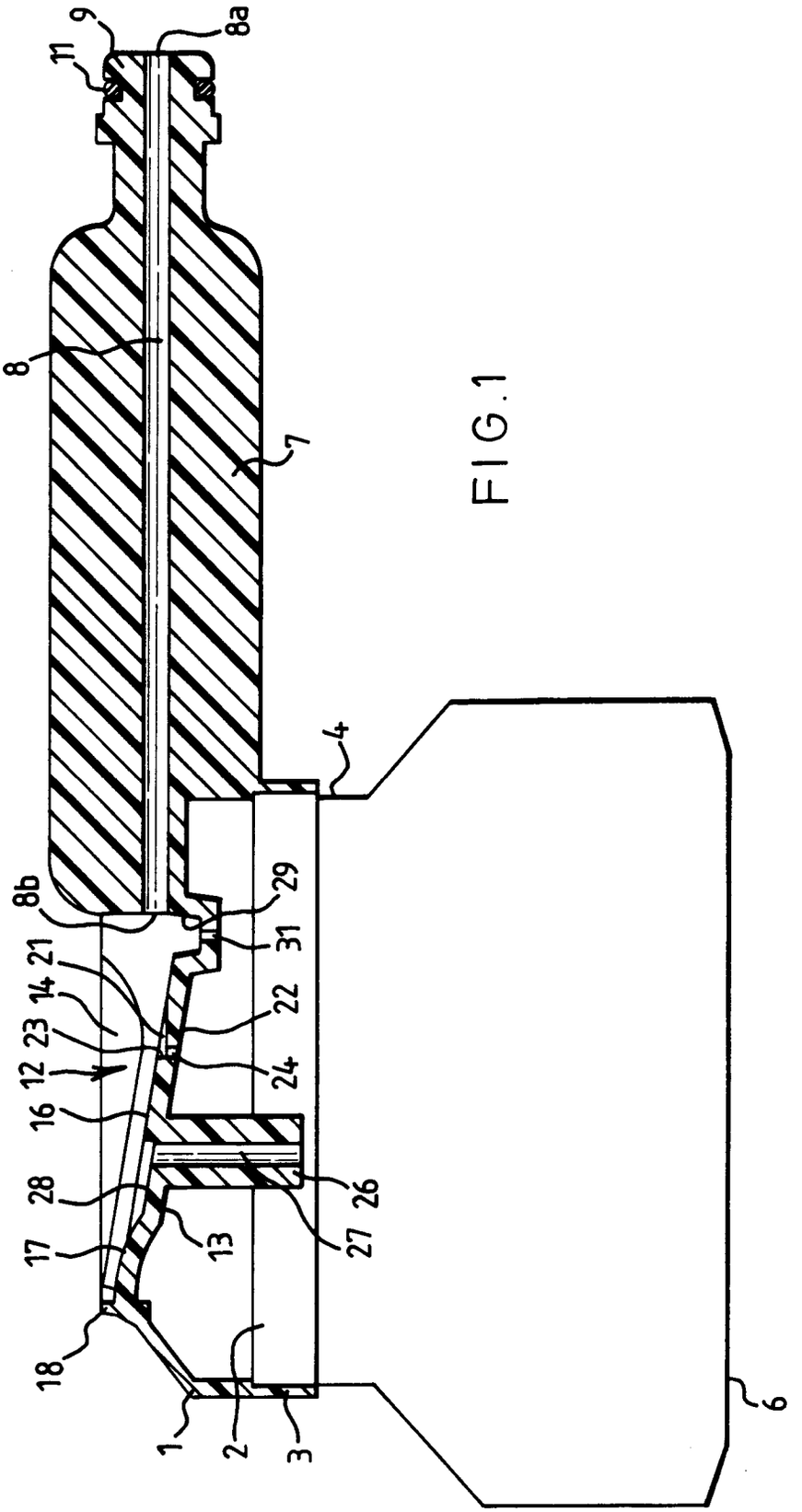

FIG.1

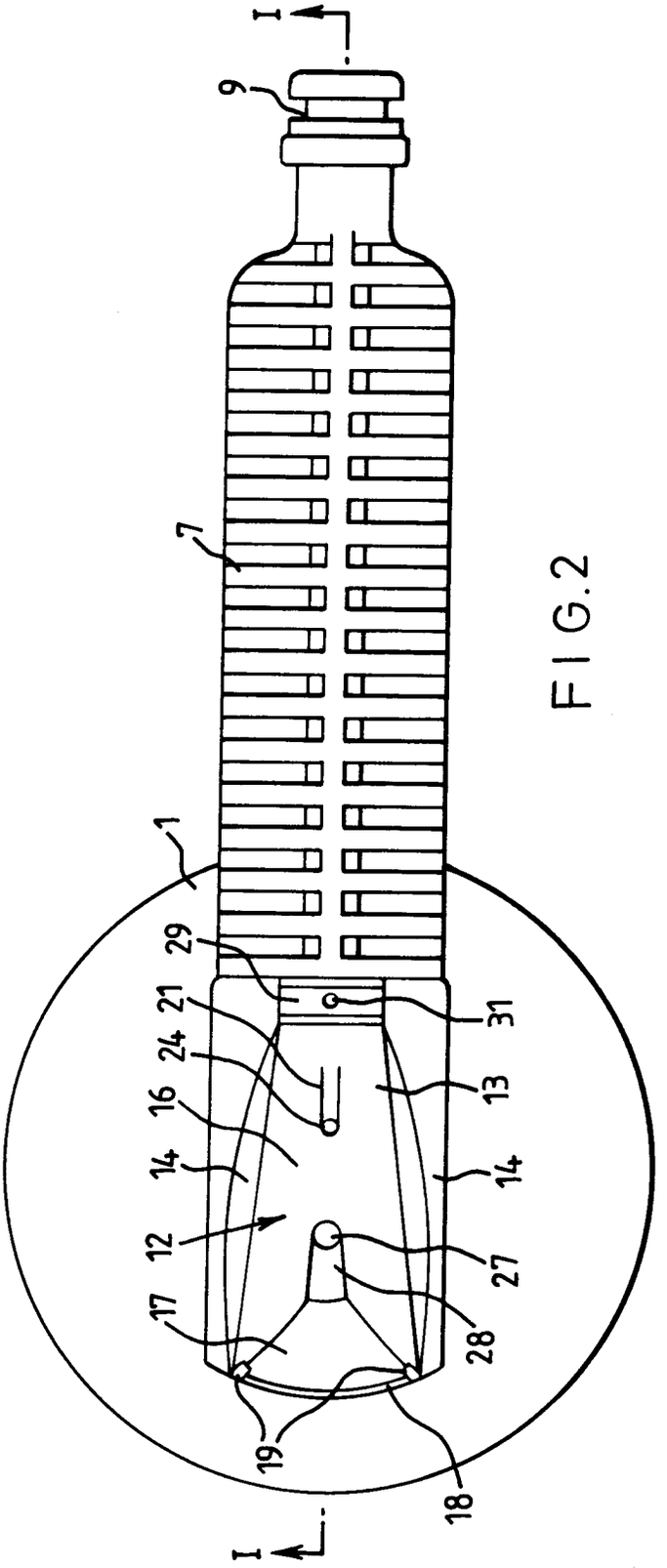

FIG.2

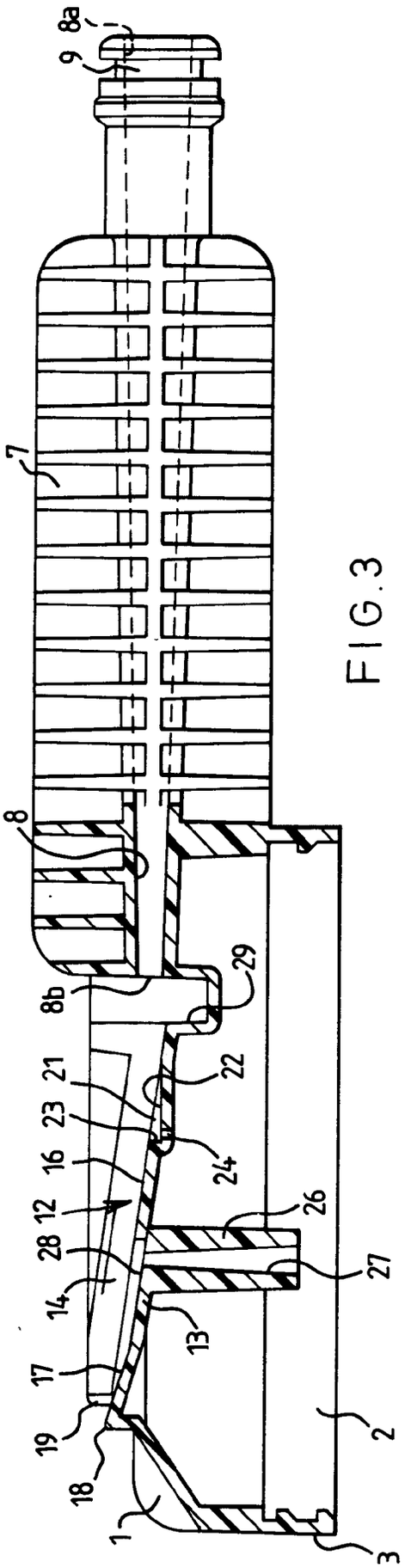

FIG.3

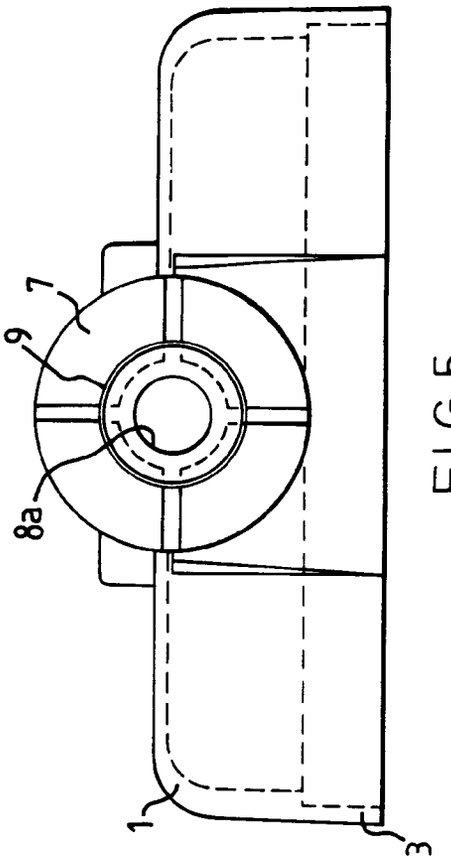

FIG.5

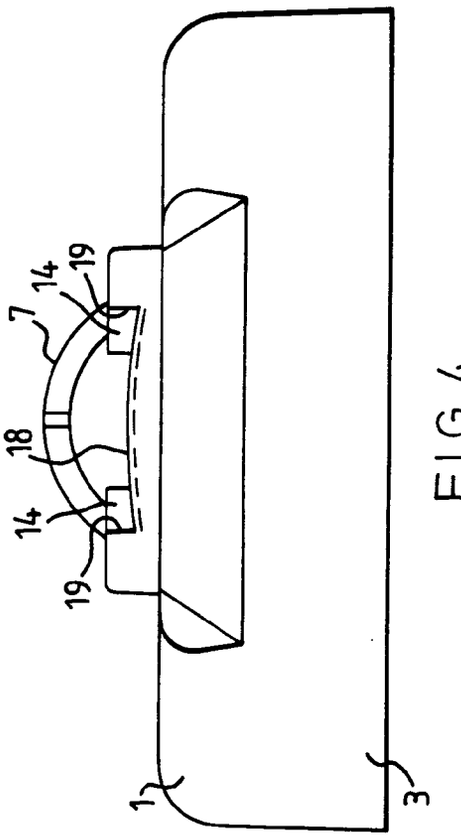

FIG.4

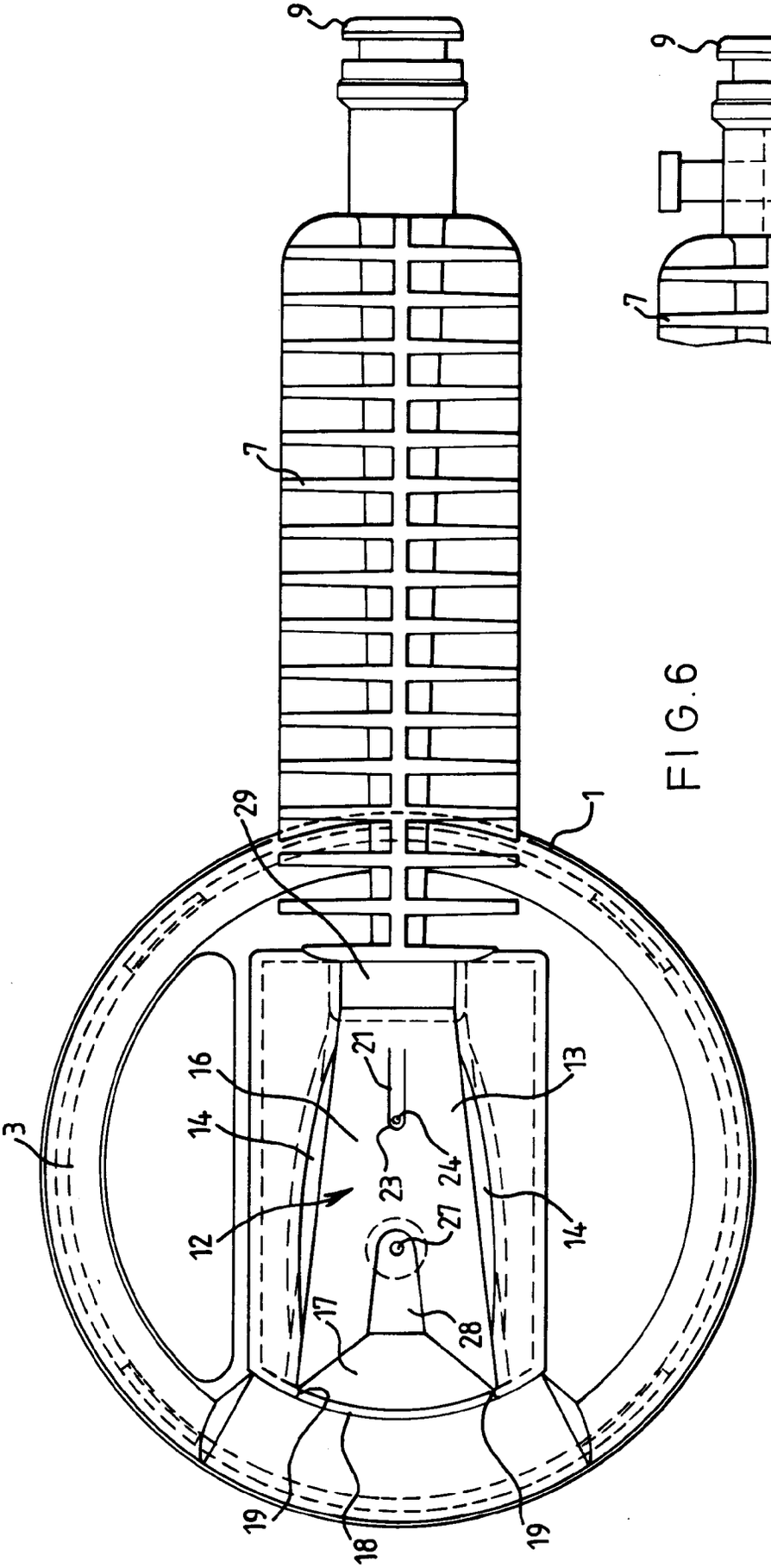

FIG.6

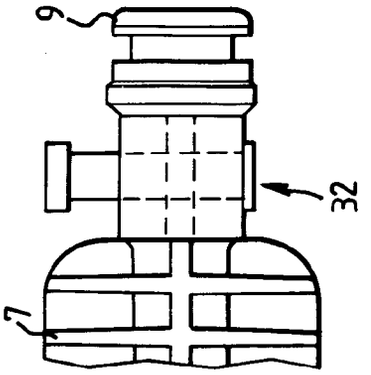

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 0899

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-2 926 857 (SNYDER)	1-17	B05B7/24
A	EP-A-0 138 380 (PHROSTROGEN)	1-17	
A	US-A-5 100 059 (ENGLHARD)		
A	US-A-2 744 791 (BUDWIG)		
A	US-A-2 061 932 (BUDWIG)		
A	US-A-2 753 213 (OFFUTT)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A01C
B01F
B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 June 1995	Peeters, S

CATEGORY OF CITED DOCUMENTS

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