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(54) A manually operable atomising spray device for liquids which uses air as the atomiser fluid

(57) An atomising spray device for liquids, such as insecticides, air fresheners and hair sprays, which is manually operable and uses air as the atomising fluid, comprises a container (1) for the liquid to be sprayed, a tubular body (25) associated with the liquid container (1) and having a free end, a swirl-chamber member (37) with a delivery nozzle (38) and vortex-forming means for causing the fluid to swirl mounted in correspondence with the free end of the tubular body, a first duct (4, 23) for conveying liquid from the container (1), a second duct (20, 24) for conveying air from outside, both of these ducts being housed, at least along part of their lengths (23, 24), within the tubular body (25), as well as respective pump members for pumping the liquid and the air. The tubular body (25) includes an air-liquid mixing chamber (35) upstream of the swirl-chamber (37) and its nozzle (38). The air and liquid are thus already mixed in the correct proportions before being atomised, thereby achieving a very high degree of atomisation.

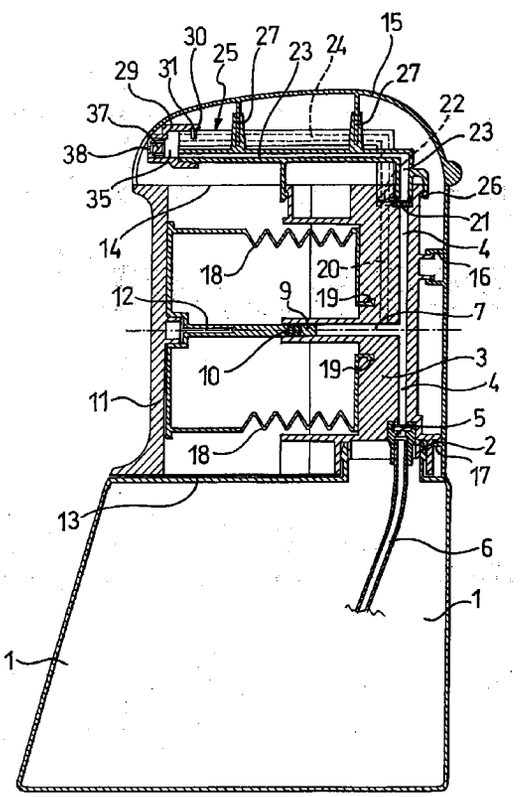

FIG.1

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Description

The present invention relates to an atomising spray device for liquids which is manually operable and uses air as the atomising fluid, comprising a container for the liquid to be sprayed, a tubular body associated with the liquid container and having a free end, a swirl chamber member with a delivery nozzle and vortex-forming means for causing fluid to swirl mounted in correspondence with the free end of the tubular body, a first duct for carrying liquid from the container, a second duct for conveying air from the outside, both of these ducts being housed, at least along part of their lengths, within the tubular body, as well as respective pump members arranged in the liquid duct and in the air duct, these pump members being manually operable at the same time.

Devices of the aforesaid type are already known in the art and their use is increasingly widespread, above all for ecological reasons as they do not use toxic gases as propellants.

An example of such prior art is described in United States Patent 3 945 574 in which the liquid to be sprayed and atomised into microscopic particles is pumped through a first duct to a delivery nozzle from which it exits in a vortex.

In the device described in the aforesaid document, a second swirl chamber is arranged around the outwardly-facing end of the delivery nozzle and, being supplied with air through a second duct, forms a swirling jet which collides with that of the liquid thereby greatly diminishing the size of the liquid droplets.

A further example of an atomiser of the type mentioned in the introduction is described in United States Patent 5 147 087.

In this device also, the air jet, pressurised by a manually-operated pump, is conveyed into the vicinity of the nozzle and impinges on the jet of liquid which is coming out of this nozzle already partially atomised by the vortex-forming members. In this way the droplets of liquid are further broken down, thereby obtaining very fine atomisation.

According to the aforementioned examples of the prior art, the liquid and the air are pumped by respective pumps which can be operated simultaneously by means of a single control.

Although prior art atomiser spray devices are theoretically able to produce flows of highly broken down, and therefore atomised, droplets, in practice they demonstrate serious operating problems.

With the use of simultaneously operable, manual pumps it is difficult to form both an air flow having sufficient pressure to act on the liquid jet with sufficient force to break up the droplets and a liquid flow having a flow rate which is tailored to the flow rate and the pressure of the air flow so as to enable the liquid flow to be fully atomised.

In addition, the atomising effect of prior art devices is heavily compromised by the fact that the air and the liquid are mixed only after each has been given its swirling movement separately.

The object of the present invention is therefore to overcome problems encountered in prior art atomiser spray devices.

This object is achieved by a device characterised by the claims which follow.

The invention will now be described in greater detail with reference to embodiments thereof provided purely by way of non-limitative example with reference to the appended drawings, in which:

Figure 1 is a schematic longitudinal section of a spray device according to the invention complete with pump and container for the liquid to be sprayed;
Figure 2 shows, on an enlarged scale, the portion adjacent the nozzle of the spray device of Figure 1;
Figure 3 is a cross-section taken on the line III-III of Figure 2; and
Figure 4 is a longitudinal section of an alternative embodiment of the tubular body of the spray device with the air and liquid ducts arranged coaxially.

With reference to the drawings, reference 1 indicates a container for liquid to be delivered which may be of various types such as, insecticide, air freshener or hair spray.

The container 1 is connected by means of a coupling 2 to a column 3 which is an integral part of a pumping assembly with two pump members, one for the liquid in the container 1 and one for air.

With reference to Figure 1, it can be seen that the column 3 is traversed longitudinally by a duct 4 which is connected by a connector 5 to a tube 6 which dips into the liquid in the container 1.

A cylindrical body 8 defines a transverse duct 7 which communicates with the duct 4 and which houses a movable piston 9, fitted with seal rings 10, which is securely fixed to a control grip 11 by means of a pin 12 so as to form a first pump member.

The grip 11 is movable relative to the column 3, to which it is parallel, and is guided between a face 13 of the container 1 and a face 14 of a shell cover 15 fixed to the column 3 by snap means such as those indicated 16 and 17.

A bellows member 18 is also fixed to the grip 11 and is connected to the column 3 by an annular stem 19.

The bellows member 18 constitutes the pump member for the air which is pressurised at each movement of the grip 11 and forced into a duct 20 formed in the body of the column 3.

The ducts 4 and 20 communicate through respective connectors 21 and 22 with respective further ducts 23 and 24 formed in a tubular body 25 connected to the column 3 by means of a hook 26 and to the shell 15 by means of projections 27.

The connectors 5, 21 and 22 have one-way valves, not shown in detail as they are entirely conventional,

which are required for the pump members to operate and for the fluids to be conveyed correctly.

With reference to Figures 2 and 3, it can be seen that a cap 29 is fitted to the free end portion 28 of the tubular body 25 by snap engagement means 30, 31.

Inside the cap 29, a flat inner face 32 of which bears against the end face 33 of the end portion 28 of the tubular body 25, a channel 34 is formed which puts the outlet of the air duct 24 into communication with a mixing chamber 35 where the air flow is mixed with a flow of liquid arriving from the duct 23.

The transverse dimensions of the chamber 35 are greater than the diameter of the liquid duct 23.

The cap 29 has a tubular seat 36 housing a swirl-chamber insert 37 having a nozzle 38 and vortex-forming means, in themselves known, indicated 39.

The insert 37 is arranged adjacent the mixing chamber 35 so that this chamber is upstream of the delivery nozzle 38.

With reference to Figure 4, which shows an alternative embodiment of the invention, the tubular body is indicated 40, the liquid duct 41 and the air duct 42. It can be seen that the air duct 42 is coaxial with the liquid duct 41 which opens into a chamber 43 which communicates around its circumference directly with the outlet of the air duct 42.

The air and the liquid are mixed in this chamber 43.

The chamber 43 is defined at its opposite end from the outlet of the duct 41, by an end face 44 of a cylindrical appendage 45 projecting from a swirl-chamber insert 46.

The latter is provided, in conventional manner, with a delivery nozzle 47 and vortex-forming elements 48 and is housed directly inside the free end portion 49 of the tubular body 40.

It will be appreciated from the above that the spray device is operated by repeated pressure on and release of the grip which causes the simultaneous operation of the liquid pump members, that is the piston 9 in the duct 7, and of the air pump members, that is the bellows 18.

The liquid thus drawn from the container 1 enters the duct 23, or the duct 41, in the quantity determined by the structure and dimensions of the members 7 and 9 which form the pump.

At the same time, a predetermined quantity of air, dependent on the capacity of the bellows 18, is forced under pressure into the air duct 24, or 42 in the embodiment of Figure 4.

If the ratio of the diameter of the liquid duct, 23 or 41, to that of the air duct, 24 or 42, is maintained preferably between 1/2 and 1/3, a correctly proportioned liquid-air mix is achieved in the chamber 35, or 43 in the embodiment of Figure 4.

When this liquid-air mix passes through the vortex-forming members of the insert 37 or 46 and through the nozzle 39 or 47, it is virtually completely atomised and forms an aerosol from the moment of its delivery without the risk of large drops of liquid being sprayed which, while perhaps acceptable in the case of deodorants or insecticides, must be totally eliminated in the case of hair sprays.

The embodiment illustrated in Figures 2 and 3 is particularly suited to this final purpose since, as the liquid duct 23 is beneath the air duct 24, the natural direction of gravity prevents liquid from entering the air duct during pauses in the operation of the device, which would cause unwelcome dripping when pumping is resumed.

Claims

1. A manually operable atomising spray device for liquids which uses air as the atomising fluid, comprising a container (1) for the liquid to be sprayed, a tubular body (25, 40) associated with the liquid container and having a free end (28, 49), a swirl-chamber member (37, 46) with a delivery nozzle (38, 47) and vortex-forming means (39, 48) for causing fluid to swirl mounted in correspondence with the free end of the tubular body, a first duct (23, 41) for conveying liquid from the container, a second duct (24, 42) for conveying air from the outside, both of these ducts being housed, at least along part of their lengths, within the tubular body, (25, 40) and respective pump members (7,9 - 18) arranged in the liquid duct and in the air duct, the pump members being operable simultaneously by hand, characterised in that the tubular body (25, 40) includes an air-liquid mixing chamber (35, 43) upstream of the swirl-chamber member (37, 46) and in that the liquid and air ducts open freely into the mixing chamber, the diameters of the ducts being in a predetermined ratio to each other correlated with the air-liquid mixing ratio to be achieved in the mixing chamber (35, 40).

2. An atomising spray device according to Claim 1, characterised in that the ratio of the diameter of the liquid duct (23, 41) to the diameter of the air duct (24, 42) is between 1/2 and 1/3.

3. An atomising spray device according to Claims 1 and 2, characterised in that the liquid and air ducts extend parallel to each other and are transversely spaced within the tubular body.

4. An atomising spray device according to Claim 3, characterised in that the liquid duct (23) is beneath the air duct (24) in the direction of natural gravity.

5. An atomising spray device according to Claims 1 and 2, characterised in that the ducts for the liquid (41) and air (42) are coaxial, the air duct annularly surrounding the liquid duct.

6. An atomising spray device according to Claims 1 to 5, characterised in that the mixing chamber (35, 43) is arranged facing the outlet of the liquid duct (23, 41) thereinto, the transverse dimensions of this

chamber being greater than the diameter of the liquid duct, there being provided a connecting passage (34) between the mixing chamber itself and the air duct.

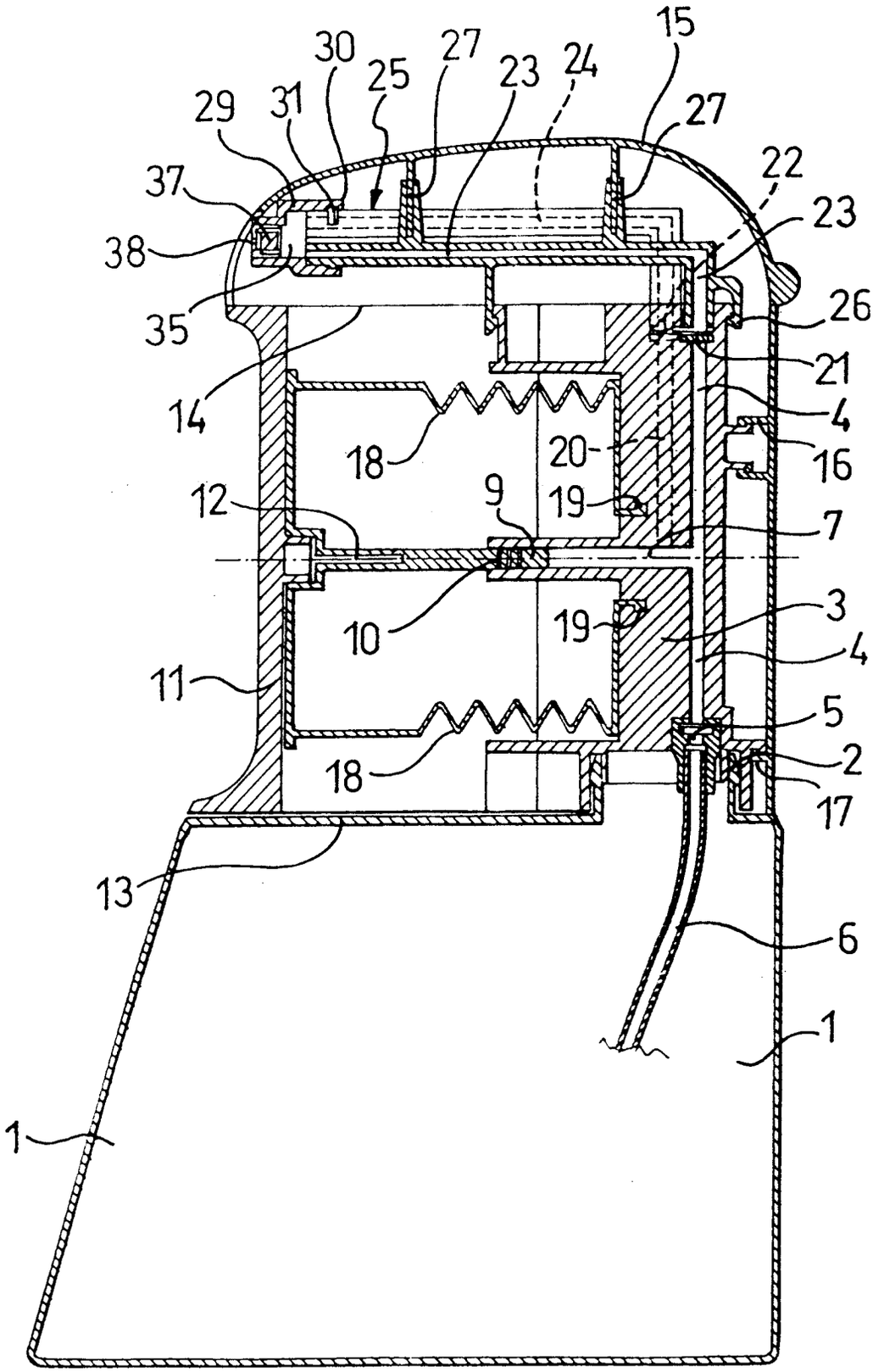
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FIG.1

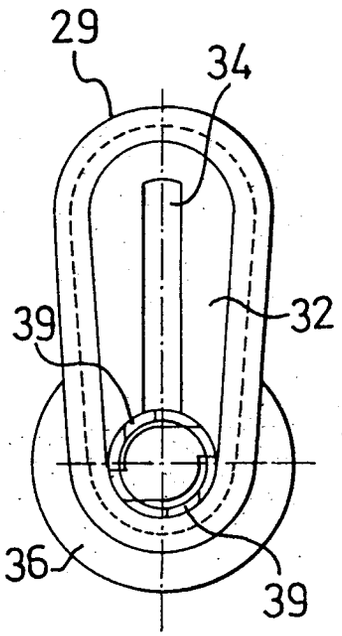

FIG.3

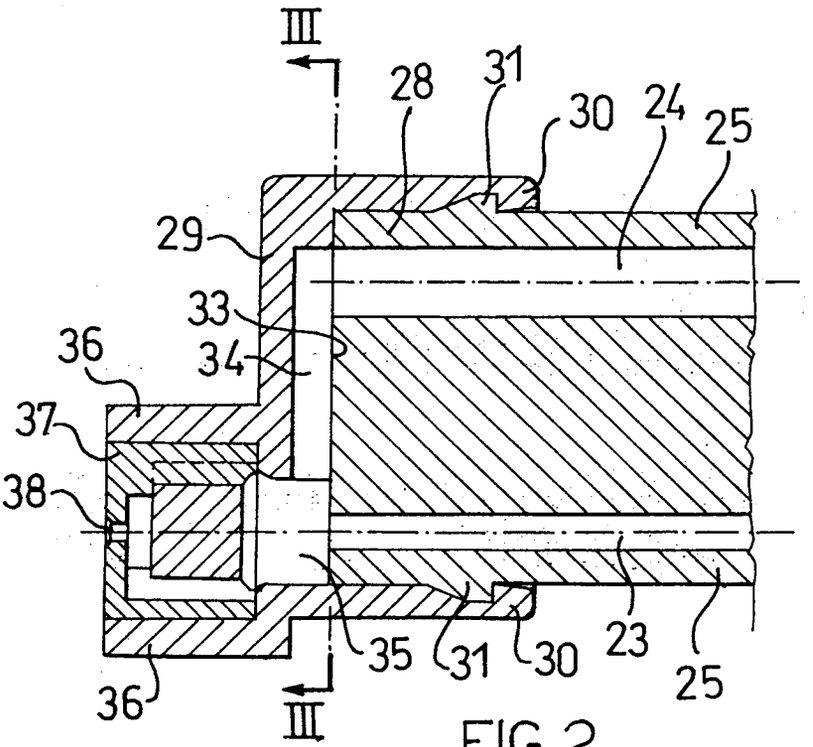

FIG.2

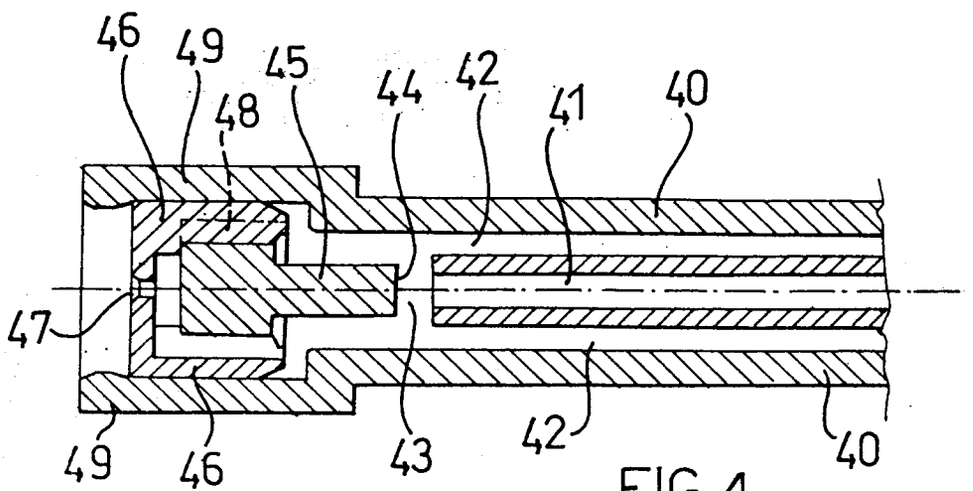

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0434

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	GB-A-1 008 612 (SOCIÉTÉ TECHNIQUE DE PULVÉRISATION) * page 2, line 79 - line 110; figures 3,4 * ---	1	B05B1/00 B05B11/00 B05B7/10 B05B7/04
A	FR-A-2 353 458 (LAAUWE) * the whole document * ---	1	
A	EP-A-0 510 469 (SUPERMATIC KUNSTSTOFF AG) * abstract; figures 7-11 * ---	1	
A	EP-A-0 497 255 (PFEIFFER) * abstract; figure 3 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 February 1995	Guastavino, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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