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DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
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(54) Title: A DEVICE FOR ATOMISING A LIQUID

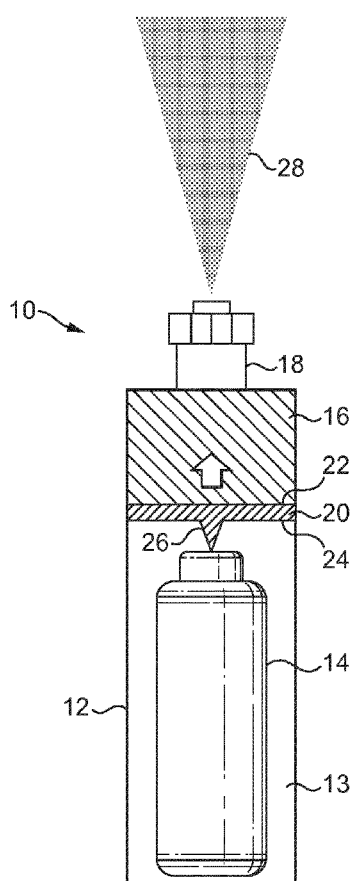


FIG. 1

(57) Abstract: A device (10) for atomising a liquid comprising a housing (12) having a reservoir (16) of liquid connected to a nebulising nozzle (18) and a sealed space (13) containing a cylinder (14) of pressurised gas. The housing also has a moveable barrier (20) which separates the reservoir from the sealed space. When operated, the device allows the pressurised gas to escape from the cylinder into the sealed space, and act on the moveable barrier, to force liquid in the reservoir to pass through the nozzle and be emitted as an aerosol.



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SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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A DEVICE FOR ATOMISING A LIQUID**BACKGROUND OF THE INVENTION**

5 The present invention relates to a device for atomising a liquid.

 Atomised liquids are used for many purposes. One such use is for therapy, for example, by application to the skin or by inhalation. One example is the atomisation of sodium
10 chloride for inhalation to assist with the removal of mucus and debris from the lungs. Another example is atomisation of hyaluronic acid for skin beauty purposes.

15 A device for atomising liquids to form a mist is disclosed in EP 2626052. It consists of a gas cylinder attached at its top end via a manifold to a separate cartridge containing a liquid to which gas is supplied in order to generate a mist. A face mask is attached at an
20 outlet port on the top of the cartridge by which a user inhales the vapour.

 In order to gain wider acceptance, there is a need for a single-use disposable version of such atomisers which are
25 simple to use.

SUMMARY OF THE INVENTION

 According to the present invention there is provided a
30 housing comprising a reservoir of liquid fluidly connected to a nebulising nozzle, a sealed space containing a cylinder of pressurised actuating gas, and a moveable barrier which

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separates the reservoir from the sealed space, wherein the device is operable in use to allow the pressurised actuating gas to escape from the cylinder into the sealed space and act on the moveable barrier to force liquid in the reservoir to pass through the nozzle and be emitted as an aerosol. The present invention thus provides a simple device for dispensing a liquid in aerosol form.

The moveable barrier may be a piston, or a resiliently deformable membrane.

The device may further comprise a piercing element for piercing the cylinder when the device is operated. In this case, the piercing element may be connected to the moveable barrier to reduce the number of moving components present during the operation of the device. A portion of the housing is preferably deformable to allow the size of the sealed space to be reduced such to move the cylinder into engagement with the piercing element when the device is operated.

The gas inside the cylinder is preferably at a pressure of up to 300 Bar. By containing gases at such high pressure, the cylinder can be made very small so as to minimise the overall size of the device.

The cylinder preferably has a water capacity less than or equal to 50ml, more preferably less than or equal to 20ml, and more preferably less than or equal to 10ml. In this way, the device contains only a small amount of gas so that the device can only be used once.

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The nozzle is preferably arranged to generate an aerosol which comprises droplets of a diameter of less than 10µm.

The nozzle is preferably a swirl nozzle.

5

The liquid inside the reservoir may be a saline solution, for example a solution of sodium chloride. The device is then useable to assist with the removal of mucus and debris from the lungs. The liquid may instead contain
10 hyaluronic acid so that the device can be used for skin beauty purposes.

The pressurised actuating gas may be a non-breathing gas such as carbon dioxide. Alternatively, the pressurised
15 actuating gas may be a breathing gas such as compressed air or helium (a mixture of helium and oxygen).

The device may be provided as a single-use disposable cartridge. It may also be provided as part of an assembly
20 further comprising a base unit comprising an actuating means for operating the device.

BRIEF DESCRIPTION OF THE FIGURES

25 The invention will now be described with reference to the accompanying Figures in which:

Figure 1 which shows a cross section view of an atomiser device; and

Figure 2 shows a first side view and a second cross
30 section view of nozzle for use with the atomiser device of Figure 1.

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DETAILED DESCRIPTION

With reference to Figure 1, there is shown an atomiser device 10 which comprises a generally cylindrical housing 12 within which is located a reservoir 16 for liquid, and a cavity 13 for holding a container 14 of pressurised gas.

The container 14 is a gas cylinder. Depending on the liquid contained in the reservoir 16, the gas inside the cylinder 14 is pressurised at a pressure of up to a 300 Bar.

A nozzle 18 is connected to the housing 12 and is fluidly connected to the liquid contained in the reservoir 16 such to define an outlet for the liquid from the device 10. A closure means (not shown in the Figures), such as a valve or a peelable film, is located between the reservoir 16 and the nozzle 18 to control the flow of liquid through the nozzle 18 when the device is not in use.

The size of each of the reservoir 16 and the cavity 13 is controlled by a moveable barrier 20 located in the housing 12. As shown in Figure 1, the moveable barrier 20 is a piston which acts as a common wall for both the reservoir 16 and the cavity 13. A first face 22 of the piston is in contact with the liquid from the reservoir 16 whilst a second face 24 of the piston is in fluid communication with the gas contained in the cavity 13. In use, the piston is slideable along the length of the cylindrical housing to vary the size of each of the reservoir 16 and the cavity 13.

The second face 24 of the actuating member 20 comprises an element 26 for piercing the cylinder 14 when the device

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is used. The element 26 is actuated by an opening mechanism not shown in the Figures. The opening mechanism may take the form of anything which can move the piercing element 26 relative to the cylinder 14. For instance, the bottom of the housing 12 may be deformable to allow the cylinder 14 to be pushed into engagement with the piercing element 26.

Alternatively, the housing 12 may be provided as two parts which can be screwed together to push the cylinder 14 into engagement with the piercing element 26.

In use of the device 10, the opening mechanism is operated so that the piercing element 26 pierces the cylinder 14 to allow gas to escape therefrom. The escaped pressurised gas enters the cavity 13 which generates a force on the second face 24 of the piston 20, which forces the piston 20 to slide inside the housing 12 towards the nozzle 18. Due to the reduction in size of the reservoir, some of the liquid contained in the reservoir 16 forces open, and passes through, the closure means into the nozzle 18 and out of the device 10 as an aerosol spray 28.

An exemplary nozzle 18 for use with the device 10 is shown in Figure 2. The nozzle 18 is generally cylindrically shaped and comprises a screw thread 30 on a portion of its outer surface which engages with a corresponding thread (not shown) on the housing 12 so that the nozzle can be releasably connected to the housing.

The interior of the nozzle 18 defines a channel 32 into which liquid from the reservoir 16 enters (signified by the arrow shown in Figure 2) when the closure means is open. As the liquid flows through the nozzle, the nozzle induces a

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swirling motion on the liquid to generate an aerosol spray
28 with droplets having a diameter of less than 10µm.

It will be appreciated that other types of nozzle could
5 be used with the device 10, for instance a nozzle which
utilises an impingement pin, or a nozzle involving liquid
jet impingement technology (for instance the nozzle used on
the Respimat® Soft Mist™ Inhaler).

10 The liquid contained within the reservoir is any liquid
which can be atomised. Exemplary liquids which can be used
include a solution of sodium chloride for when the device is
used assisting with the removal of mucus and debris from the
lungs, and hyaluronic acid for use in skin beauty purposes.

15

The device 10 preferably takes the form of a disposable
cartridge which comes pre-filled with a liquid in the
reservoir 16 and a cylinder 14 of pressurised gas in the
cavity 13. The cylinder 14 from the device 10 preferably has
20 a water capacity less than or equal to 50ml, more preferably
less than or equal to 20ml, and even more preferably a water
capacity less than or equal to 10ml.

The cartridge may be supplied together with a base unit
25 comprising an actuating means for operating the opening
mechanism of the cartridge.

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CLAIMS

1. A device for atomising a liquid, the device comprising a housing comprising a reservoir of liquid fluidly connected to a nebulising nozzle, a sealed space containing a cylinder of pressurised actuating gas, and a moveable barrier which separates the reservoir from the sealed space, wherein the device is operable in use to allow the pressurised actuating gas to escape from the cylinder into the sealed space and act on the moveable barrier to force liquid in the reservoir to pass through the nozzle and be emitted as an aerosol.
2. A device according to any preceding claim wherein the moveable barrier is a piston.
3. A device according to claim 1 wherein the moveable barrier is a resiliently deformable membrane.
4. A device according to any preceding claim wherein the device further comprises a piercing element for piercing the cylinder when the device is operated.
5. A device according to claim 4 wherein the piercing element is connected to the moveable barrier.
6. A device according to any preceding claim wherein the gas inside the cylinder is at a pressure of up to 300 Bar.
7. A device according to any preceding claim wherein the cylinder has a water capacity less than or equal to 50ml.

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8. A device according to any preceding claim wherein the cylinder has a water capacity less than or equal to 20ml.

9. A device according to any preceding claim wherein the
5 cylinder has a water capacity less than or equal to 10ml.

10. A device according to any preceding claim wherein the nozzle is arranged to generate an aerosol which comprises droplets of a diameter of less than 10 μ m.

10

11. A device according to any preceding claim wherein the nozzle is a swirl nozzle.

12. A device according to any preceding claim wherein the
15 liquid inside the reservoir is a saline solution.

13. A device according to any preceding claim wherein the pressurised actuating gas is a non-breathing gas.

20 14. A device according to claims 1-12 wherein the pressurised actuating gas is a breathing gas.

15. A device according to any preceding claim wherein the device is a single-use disposable cartridge.

25

16. An assembly comprising the device of any preceding claim and a base unit comprising an actuating means for operating the device.

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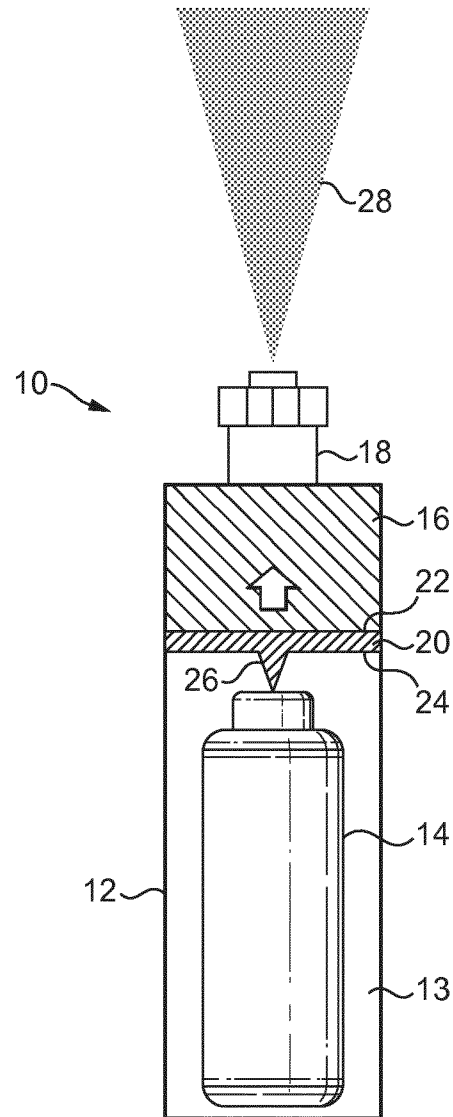


FIG. 1

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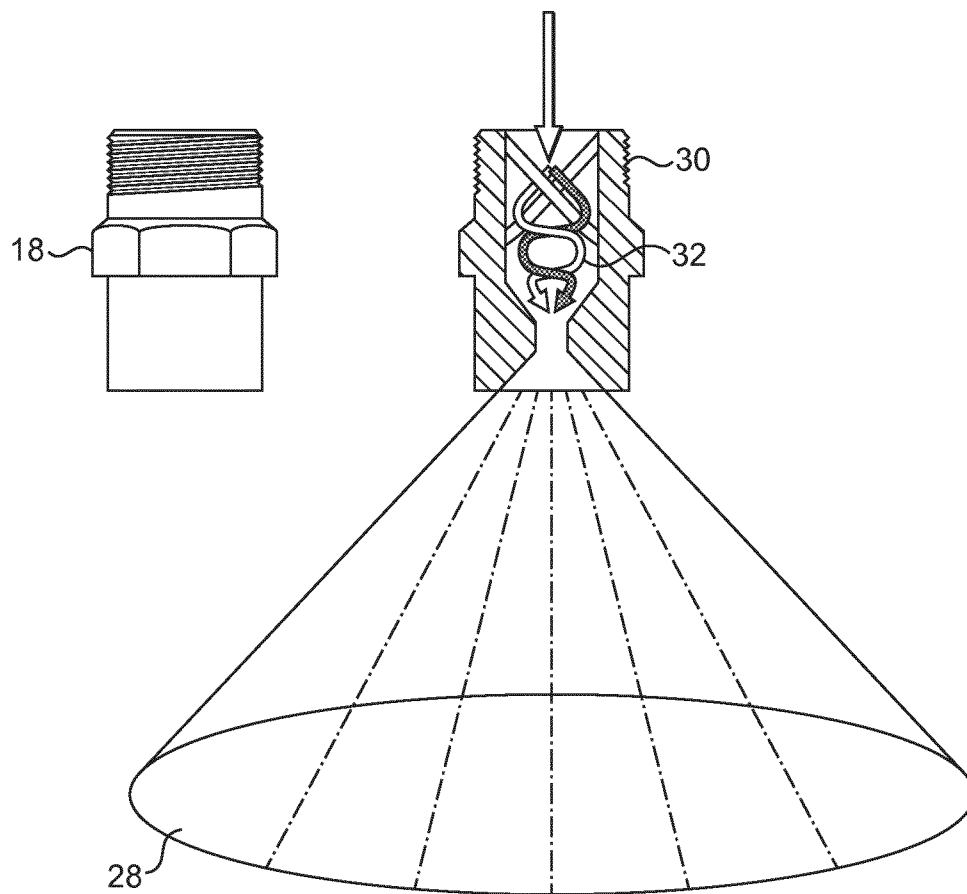


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. A61M11/00 A61M35/00 B05B11/00 B05B1/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61M B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/151840 A1 (CASTELLANO THOMAS P [US]) 17 October 2002 (2002-10-17) the whole document, and especially figure 1b -----	1-16
X	US 6 406 455 B1 (WILLIS JOHN [US] ET AL) 18 June 2002 (2002-06-18) the whole document, and especially figures 3-4 -----	1-3,5-16
X	US 2 680 439 A (SUTERMEISTER ARNOLD K) 8 June 1954 (1954-06-08) the whole document, and especially figures 1, 5 and 6 ----- -/-	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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