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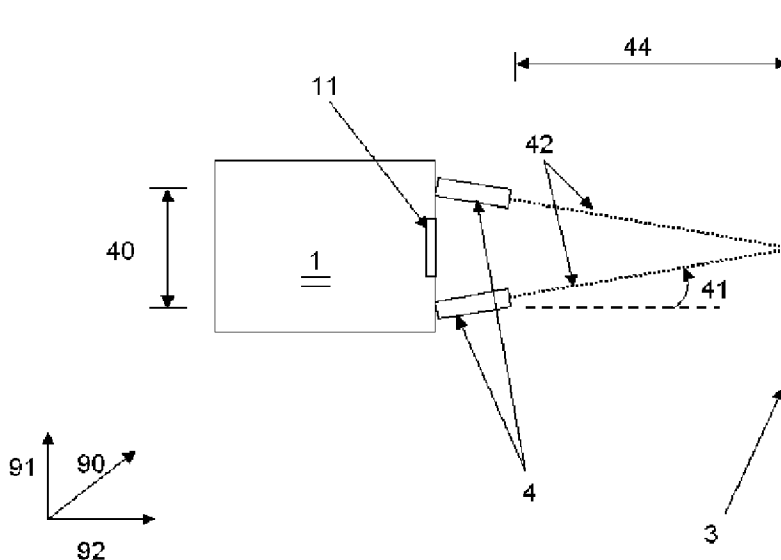
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(75) Inventor/Applicant (*for US only*): **WITHERS, Michael**, — *with international search report*

(54) Title: ATOMISER APPARATUS COMPRISING DISTANCE DETECTION MEANS

(57) Abstract: An apparatus for dispensing fluid comprising an electromechanical actuator that targets an application surface using light emitting diodes.



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Description

Technical Field

- [0001] This invention relates to an atomiser apparatus, for example, an aerosol container, where the dispensing of the fluid is by an electromechanical actuator.

Background Art

- [0002] Many products, such as hairspray, deodorants and insect repellent, are packaged within aerosol containers. The product is released from the container by the action of a propellant, which is often either a liquefied gas or a compressed gas. Both the product and the propellant are stored within a sealed metal container.
- [0003] In the earliest system, which uses a liquefied gas propellant, the propellant takes the form of a liquid when it is highly compressed, even if the temperature is well above its boiling point. During filling, the product is poured into the container before the can is sealed. The propellant however must be forced into the container at very high pressure such that it does not have enough room to expand into a gas. This propellant will remain in liquid form so long as the pressure is maintained; when the valve is open, the pressure of the liquid propellant is instantly reduced and the liquid propellant begins to boil. A gas layer is formed at the top of the container. This pressurised gas layer pushes the product, as well as some of the liquid propellant, up the dip tube to the nozzle. As the propellant/product mixture leaves the nozzle, the propellant rapidly expands into gas and the product is ready for application.
- [0004] In the simplest of aerosol-container designs, which employs a compressed gas propellant, the aerosol container is configured as follows: the container is first partially filled with product, the container is sealed, and then the gaseous propellant is pumped through the valve system at high-pressure. Inside the sealed container, this highly pressurised gas exerts a downward force on the product such that when the valve is opened, the propellant forces the product out of the container via a dip tube. A narrow nozzle serves to atomise the product, breaking it up into tiny droplets, which form a spray plume.
- [0005] The consistency of the sprayed product depends on several factors, most notably, the chemical constitution of the propellant and product, the ratio of propellant to product, the pressure of the propellant and the size and shape of the valve system. For example, the actual amount of propellant found in an aerosol container varies depending on the product: a higher percentage for fine sprays, a low percentage for foam or mousse.

[0006] The use of propellants in aerosol containers has long been associated with damage to the environment and the 'greenhouse effect', which is the rise in temperature that the Earth experiences caused by certain gases in the atmosphere trapping energy from the sun. These gases include carbon dioxide, nitrous oxide, methane, halogenated fluorocarbons (HCFCs) and hydrofluorocarbons (HFCs), some of which have been used as propellants in the past. One of the ways in which this damage can be avoided is by using a propellantless method of emitting the product from an aerosol container. A device capable of such a method has been disclosed in Patent Citation 0001: EP 0615470 B (THE TECHNOLOGY PARTNERSHIP PLC). 1992-12-04.

which describes a fluid droplet production apparatus, for example, for use as an atomizer spraying device, having a membrane which is vibrated by an actuator, which has a composite thin-walled structure and is arranged to operate in a bending mode. Fluid is supplied directly to a surface of the membrane and as the membrane vibrates, fluid is sprayed therefrom.

[0007] In practice, the above apparatus requires a power source, such as a battery. During development work it became apparent to the inventor that further use could be made of this power source.

[0008] The standard valve system of a traditional aerosol container affects the distribution of the product droplets within the spray plume. The regularity of the droplet distribution will reach an optimum at a particular distance from the nozzle. Away from this optimum distance, the spray plume will become increasingly non-uniform and consequently some areas of the application surface will receive more product than other areas. In practice, achieving this optimum distance is difficult, especially for the blind or partially blind. Equally, ensuring that the centre of the spray plume is aligned with the target surface requires excellent hand-to-eye coordination and for many it is not very easy to do. If not done, some areas of the target surface may even be missed altogether.

[0009] For relatively non-flat surfaces, such as ampits, finding the optimum distance and alignment position for spray application is made even more difficult since it is physically challenging to actually see the target without looking in a mirror.

[0010] It is the object of this invention to use the power source in a device for production of a fluid droplet spray that will overcome these difficulties.

Disclosure of Invention

[0011] Accordingly, the invention provides a device for production of a fluid droplet spray

comprising an electromechanical actuator, the device having an energy source, a membrane, and an actuator adapted to vibrate the membrane, characterised in that the device further includes a means to target an application surface powered by the energy source.

[0012] By using an electromechanical actuator to dispense product from the container, the device is not contributing to the 'greenhouse gas' effect and it is not damaging the environment. The targeting means assists the user in aiming the spray plume during normal usage. This combination benefits the environmentally aware user by reducing the amount of product wasted during inaccurate spraying of the product. Additionally, it also helps the user to avoid wasting money, since the product is only used where it is required.

[0013] In another embodiment of the invention, the targeting means comprises a plurality of light emitting diodes. The light beams emitted by the light emitting diodes are configured to coincide at an optimum distance from the device and this moment of coincidence provides feedback to the device. The device is especially useful for applying product, e.g. cosmetics, to the face.

[0014] If the distance for coincidence is the same as that for optimum spray distribution, then the product will be evenly distributed over the face. This is advantageous for those wishing a flawless application of cosmetics and even more advantageous for the blind or partially blind who normally require assistance in applying cosmetics, thereby giving them greater personal independence.

[0015] With feedback, the moment of light beam coincidence can be used to trigger a visual indication conveying to the user a signal that the device is ready for use. This is an excellent way of reassuring the user that the spray distribution is now at its optimum and that an even distribution of the product will result if the device is operated at this distance. An audible signal would make the apparatus particularly useful for partially sighted or blind people. Automatic dispensing of the product could further enhance the user experience.

[0016] In a further embodiment of the invention, the configuration of the light emitting diodes is determined by the angle of the diodes from the normal and the spacing between the diodes.

[0017] In yet another embodiment of the invention, the angle of the diodes is between 5-20 degrees from the normal and the spacing between the diodes is between 2-6cm.

[0018] Achieving the moment of coincidence of the light beams requires careful configuration of the light emitting diodes, in particular the angle of the light emitting

diodes from the normal and the spacing between them. The angle of a light emitting diode is measured from the spray plane (Z-plane). Preferably the angle will be set between 5-20 degrees and the light emitting diodes will be spaced between 2-6 cm apart as these figures provide the optimum set-up conditions required for the even spray application of cosmetic and personal care products when the distance to the application surface from the nozzle is set at 0.3m.

[0019] In another embodiment of the invention, the targeting means comprises a plurality of light emitting diodes arranged such that the light emitted by the light emitting diodes defines a generally circular area and one of the diodes is focusable on the application surface and upon accurate focus of the diode a feedback signal is sent to the device.

[0020] This embodiment provides the user with the capacity to accurately align and focus the spray on an application surface. When directed at the application surface the light beams from the light emitting diodes define a generally round spray area where the product will be sprayed. When the application surface is totally within the lit area provided by the light emitting diodes, the product is ready to be sprayed. One of the light emitting diodes is also focusable on the application surface. When the application surface is at desired distance from the spray dispenser, the light beam that falls on the application surface is sharp and clear.

[0021] The advantage of this is that the user knows where the spray will travel when the aerosol container is activated and will avoid spraying the product onto surfaces where it is not required. This eliminates product wastage, avoids unwanted coverage on other surfaces and ensures that the spray covers the entire application surface and does not leave uncovered patches. Again, the feedback and consequent visual or audio signal reassures the user that the device is at the correct distance for optimum spray distribution.

[0022] In yet another embodiment of the invention, a device for production of a fluid droplet spray comprises an electromechanical actuator having an energy source, a membrane, and an actuator adapted to vibrate the membrane, characterised in that the energy source powers a sensor that is adapted to detect infra-red of wavelength between 5 and 20 μ m and upon such detection a feedback signal is sent to the device.

[0023] The advantage of this embodiment is that the device acts as a proximity sensor for application surfaces in difficult locations, analogous to car parking sensors. The device makes use of the fact that human skin emits infrared at a wavelength of 10 μ m; the device incorporates a passive short-range sensor that detects the presence of infrared and upon detection the sensor sends a feedback signal to the device. This feedback

informs the user that the device has detected the body's infrared and does so by providing an audible and/or visual signal. The feedback can even be used to trigger the device to automatically dispense the product from within.

[0024] The advantage of this is that the user is able to tell when he/she has held the device at a distance near enough to the body to apply the product, even when he/she cannot easily see the application surface. The automatic dispensing of the product is especially beneficial to the blind, partially blind and/or deaf or hard of hearing.

Brief Description of the Drawings

[0025] Prior art and the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0026] Figure 1 is a schematic of a prior art product dispenser, such as an aerosol can.

[0027] Figure 2 is a schematic of an embodiment of the invention.

[0028] Figure 3 is a schematic of another embodiment of the invention, as applied to the face of a mannequin.

[0029] Figure 4 is a schematic of a further embodiment of the invention.

[0030] As depicted in Figure 1, when in use, a typical product dispenser (1) will emit fluid in a plume (2) that contains both uniform (20) and non-uniform (21) spray distribution areas. In the uniform spray distribution area (20), fluid particles are evenly distributed in the X (90), Y (91) and Z (92) planes. The Z (92) plane is referenced as being the general direction that the fluid spray will travel. In non-uniform spray distribution areas (21), the fluid particles are decreasingly regular in their distribution and appear more and more randomly spaced apart as they travel away from the aerosol nozzle (11) in the Z-plane (92). If the application surface (3) is placed within the non-uniform spray distribution area (21), the fluid will be unevenly distributed on the application surface (3) and the product application will appear patchy and unattractive. However, if the application surface (3) is placed within the uniform spray distribution area (20), the finish of the product application will appear smooth and flawless.

[0031] Figure 2 shows an embodiment of the invention, which helps to determine the optimum distance that the application surface (3) should be placed at relative to the nozzle (11) to ensure that it is within the uniform spray distribution area (20). A plurality of light emitting diodes (4) is spaced a distance apart (40) and each is placed at an angle (41) relative to the Z-plane (92). At a particular distance (44) from the nozzle (11), the light beams (42) from the light emitting diodes (4) coincide. If this distance (44) is set to be the optimum distance for best product spray distribution, within the uniform spray distribution area (20), then the device can be used as an aid to

achieving a smooth and flawless product application upon an application surface (3) such as a face.

[0032] In Figure 3, a further embodiment of the invention is shown. When lit, light shining from the light emitting diodes (4) illuminates a generally circular area (43). The geometry of this illuminated area (43) is configured to correspond to the geometry of the spray plume (2) (see Fig 1). This means that when the spray plume (2) is directed towards a face (6), the user can align the illuminate area (43) with the outline of his/her face and be confident that the spray plume (2) will reach the face (6).

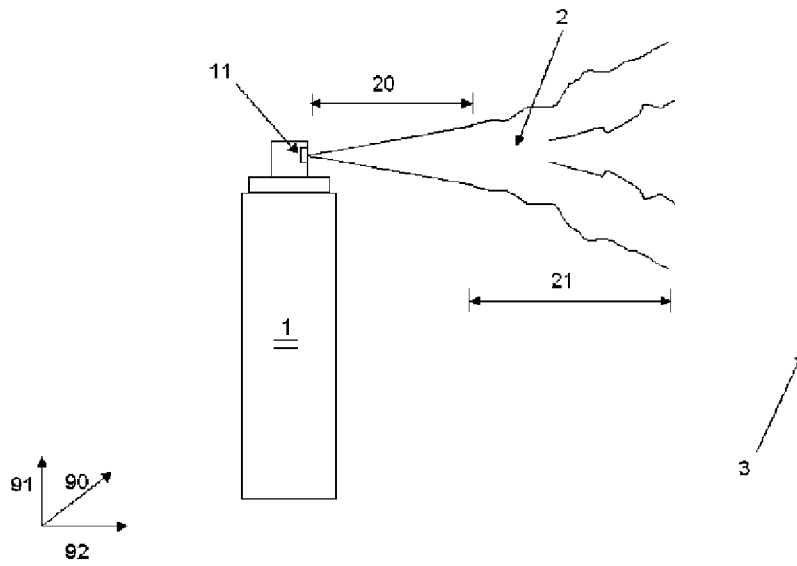
[0033] Figure 4 shows a schematic of infrared rays (5) being emitted by the surface of the body (31). These rays are detectable up to a distance (50) from the application surface, after which the energy of the waves generally dissipates into the surrounding environment. In an additional embodiment of the invention, the device contains an infrared sensor. If the device is placed at a distance (50) from the application surface, then it will detect the presence of infrared. With feedback, this detection can be used to transmit a signal to the user that the device is at an appropriate distance from the body for product to be dispensed. This feedback can be audible or visual and can even be used to automatically activate the dispensing of the product from the device.

Claims

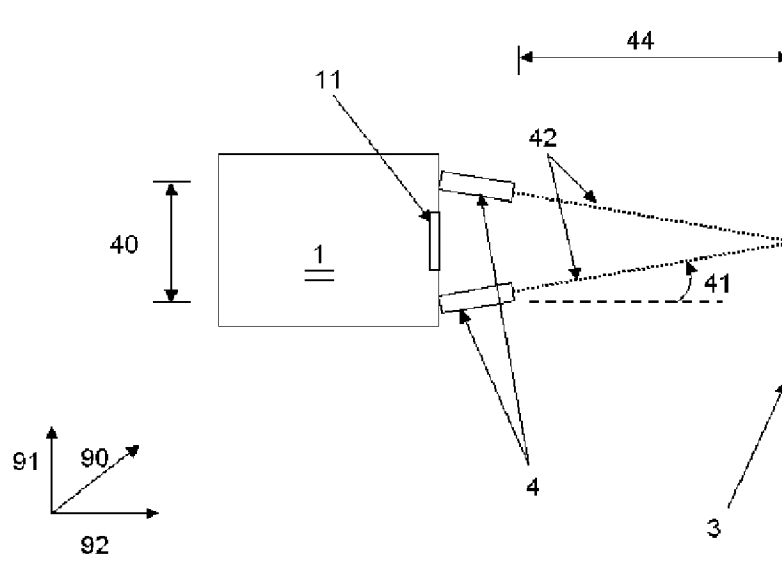
- [0001] A device for production of a fluid droplet spray comprising an electromechanical actuator, the device having
- an energy source
 - a membrane, and
 - an actuator adapted to vibrate the membrane
- characterised in that the device further includes a means to target an application surface powered by the energy source.
- [0002] A device according to Claim 1, wherein the targeting means comprises a plurality of light emitting diodes and the light beams emitted by the light emitting diodes are configured to coincide at an optimum distance from the device at which time a feedback signal is sent to the device.
- [0003] A device according to Claim 2, wherein the configuration of the light emitting diodes is determined by the angle of the diodes from the normal and the spacing between the diodes.
- [0004] A device according to Claim 3, wherein the angle of the diodes is between 5 and 20 degrees, and the spacing is between 2 and 6cm.
- [0005] A device according to Claim 1, wherein the targeting means comprises a plurality of light emitting diodes so arranged that the light emitted by the light emitting diodes defines a generally circular area and one of the diodes is focusable on the application surface and with an accurate focus of the diode a feedback signal is sent to the device.
- [0006] A device for production of a fluid droplet spray comprising an electromechanical actuator having
- an energy source
 - a membrane, and
 - an actuator adapted to vibrate the membrane
- characterised in that the energy source powers a sensor that is adapted to detect infra-red of wavelength between 5 and 20 μ m and upon such detection a feedback signal is sent to the device.
- [0007] A device according to any of the preceding claims, wherein the feedback signal acts as a trigger to effect an action from the device.
- [0008] A device according to Claim 7, wherein the trigger effects an audible and/or a visual signal.

[0009] A device according to Claim 7 or Claim 8, wherein the trigger causes the fluid to be automatically dispersed from the device.

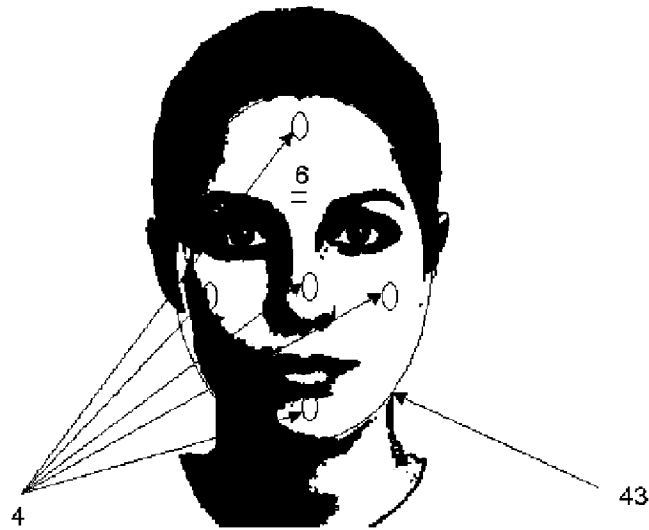
[Fig. 0001]



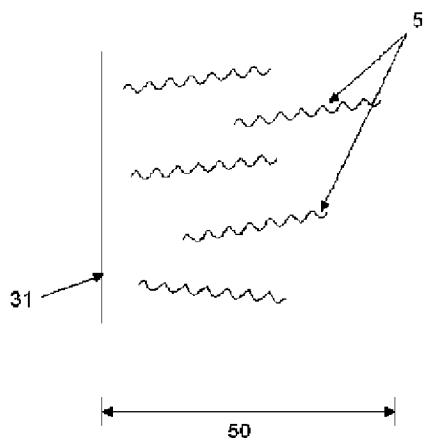
[Fig. 0002]



[Fig. 0003]



[Fig. 0004]



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/057722

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B12/12

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)
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 practical, 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.
Y	EP 0 389 665 A (SIEMENS AG) 3 October 1990 (1990-10-03) column 4, line 3 - column 6, line 15; figures 1,2	1-4,6-9
Y	WO 03/064969 A (LASER TOUCH & TECHNOLOGIES LLC) 7 August 2003 (2003-08-07) page 5, line 6 - page 11, line 25; figures 1-9	1-4
Y	EP 0 615 470 B (THE TECHNOLOGY PARTNERSHIP PLC) 13 December 1995 (1995-12-13) cited in the application page 6, line 25 - page 7, line 4; figures 1-3	1-4
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2007/057722

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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International application No

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