Novel External Atomizing Nozzle for Domestic Household Aerosols

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Abstract

Domestic aerosols such as air fresheners, body sprays and anti-perspirants are commonly used all over the world. Aerosols generally consist of a pressurised canister containing a product and a liquified volatile propellant. The aerosols work consistently using the same principle; where the product and the propellant are actuated through a simple nozzle. Flash atomization of the propellant takes place to break up the product into a cloud of droplets.

Introduction

Current market interest is looking towards reducing the amounts of propellant or by replacing it completely with a lower cost and more environmentally friendly means of creating the spray. When a reduced amount or alternative propellant is employed, an unwanted and poor spray quality is obtained. Thus, by redesigning the spray nozzle, a good spray quality can be retained. This paper is related to an innovation patents WO2005005053 (A1) and WO2005005055 (A1) and WO2007015062 (A1), 1, 2, 3, 4 and 5.The actuators in the research programme have been specially machined and a method of unit construction has been developed so that combinations of different shapes and sizes of internal passages and flow control devices may be tested systematically. This paper describes the systematic development of such nozzle exit geometries that manipulate spray aspects, such as droplet size, spray angle and spray throw of domestic air fresheners with reduced volumes of propellant. Data is presented showing improved spray performance using droplet sizing and visualisation techniques. Design of the nozzle exit so it manipulates the fluid flow is also observed and described.

Materials and Methods

Droplet size was measured using a laser diffraction instrument (Malvern and Spray Tec.), an average of three tests had been taken for each data point; flow rate was measured by weighing the can, the spray time was on average of five seconds. Spray distances from the lenses is 500 mm for the air fresheners spray. The actuators in the research programme have been specially machined from Perspex (Plexiglas) and Brass, a method of unit construction has been developed so that combinations of different shapes and sizes of inlets and exists can be used. Internal passages and flow control devices may be tested systematically. Because of variation of temperature difference between summer and winter, all tests must be done at room temperature, 20 centigrade.

Results and discussions

It has been found that droplet size produced at the outlet orifice of a nozzle can be controlled by incorporating a number of different control features into the fluids flow passageway between the inlet and the outlet which modify the characteristics of the fluid as it flows through the passageway for example it has been found to be particularly beneficial to form two or more expansion chambers along the fluids passageway, each chamber having a constricted inlet opening arranged so that the fluids is sprayed into the chamber. By use of internal shaped chambers and channels in the spray nozzle the spray quality can be improved. By changing the geometry of the external exit of the nozzle spray, an improvement can be achieved. The experiments have shown that these flow control devices permit control of droplet size, control of flow rate, spray pattern manipulation, the production of narrower droplet size distributions, and reduction of can VOC content. More advanced designs of actuators have been made depending on the inventions related to shape chambers, multiple passages of flow and throttles. It is now possible to manufacture household can aerosols such as air fresheners, body sprays and hair sprays with massive reduction in hydrocarbons or volatile organic compounds (VOC). Internal features of Raj. designs and the cyclonic device have developed for spraying air fresheners, and other viscous and none viscous products, below results show a matched droplet size of the market nozzle, market propellant cans with an improved spray angle and spray penetration length.

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(A) (B)

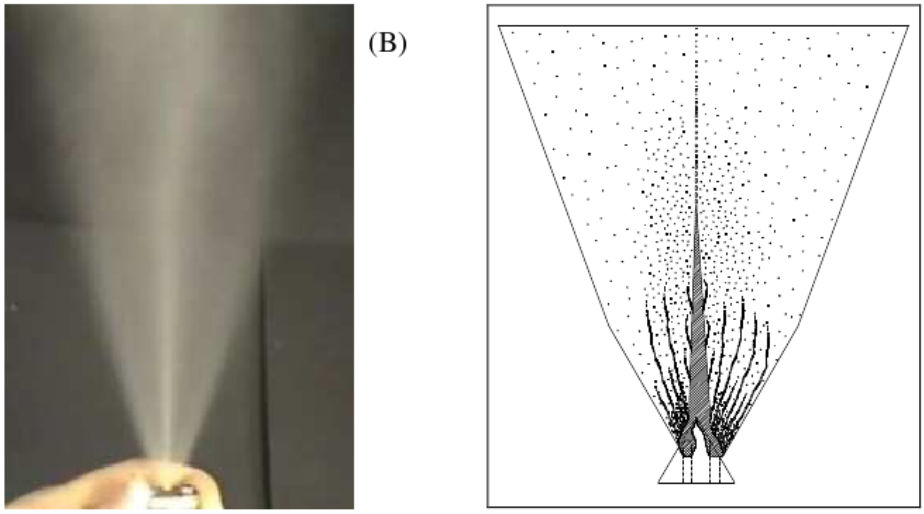

Figure 1. Flow visualisation of improved atomizing nozzle (A) Photograph of spray plume (B) Flow schematic of atomization

References

[1] Sharief, R. A., *Comprising an atomizing Nozzle*, UK patent publication No. WO2007015062 (A1), World Intellectual Property organization application No. W02006GB02745 20060720(2007-02-08)

[2] Laidler, K., Sharief, R. A. and Abduljailil, H. *Shaped Chamber, Nozzle arrangement*, UK patent Publication No. WO2005005053 (A1), World Intellectual Property organization application No. W02004GB02848 20040702 (2005-01-20)

[3] Laidler, K., Sharief, R. A. and Abduljailil, H. *Multiple Passages, Nozzle arrangement*, UK patent publication No. WO2005005055 (A1), world intellectual property organization Application No. W02004GB02898 20040702 (2005-01-20)

[4] Laidler, K., Sharief, R. A. and Abduljailil, H. *Flap Arrangement, Nozzle arrangement*, UK patent publication No. WO2005005054 (A1), world intellectual Property Organisation Application No.W02004GB02851 20040702(2005-01-20)

[5] Eales, G. and Laidler, K. *A nozzle and a dispenser having such a nozzle*, UK patent publication No. WO 2007/017626 (A1), world intellectual Property Organisation Application No.PCT/GB2006/002811