

PATENT SPECIFICATION

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(54) GAS CYLINDERS CONTAINING ACTIVE SUBSTANCES

(71) We, BOC LIMITED, of Hammer-smith House, London W6 9DX, England, an English company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a gas cylinder containing an active substance and to a method of distributing the active substance from the gas cylinder. The active substance may typically be an insecticide, pesticide or deodoriser. The method according to the invention is particularly suitable for use in distributing the active substance on a larger scale, typically for industrial or agricultural purposes.

Conventional substances such as insecticides are distributed on a large scale by means of fogging machines. One major disadvantage of such conventional distribution of insecticide or other active substance results from the exposure of the operator to the substance, which is usually highly toxic. The operator must transfer the substance from its original container to the fogging machine, and must then dispose of the container which is still contaminated with dangerous amounts of the substance.

Active substances may alternatively be distributed by hand held or compressor-driven sprays which are only moderately efficient, in that they generally provide a fairly coarse fog which quickly precipitates out of the atmosphere. In this way, a large amount of the substance is wasted, and a greater amount needs to be used than would be necessary if the fog could be produced in a finer droplet size to remain airborne for longer.

The present invention provides a gas cylinder which contains, as a liquid phase, liquefied gas, in which liquefied gas an active substance (as herein defined) is in solution, and, as a gaseous phase, vapour of the liquefied gas, and which has means for supplying the liquid phase from the cylinder on opening the cylinder valve, the

liquid phase being stored in the cylinder under a pressure of at least 2000 kPa (if measured at 15°C), and the liquefied gas being liquid carbon dioxide.

The invention also provides a method of distributing an active substance (as herein defined), comprising (i) releasing the liquid phase from a gas cylinder containing, as a liquid phase, a liquefied gas, in which liquefied gas the active substance is in solution, and, as a gaseous phase, vapour of the liquefied gas, the liquid phase being stored in the cylinder under a pressure (if measured at 15°C) of at least 2000 kPa, and the liquefied gas being liquid carbon dioxide, and (ii) causing the liquid phase to pass through an orifice, whereby the liquefied gas evaporates on release from the orifice.

By the term "active substance" as used herein is meant an insecticide, pesticide, deodoriser or the like, particularly for agricultural and industrial use.

The relatively high pressure under which the liquid phase is stored helps to distribute the active substances over a relatively large area when liquid phase is released from the cylinder.

The liquefied gas functions as a solvent for the active substance, and its vapour as a propellant.

If the active substance is an insecticide or a pesticide, the use of carbon dioxide as the liquefied gas provides a further advantage in that it functions as a breathing stimulant, and thereby increases the effectiveness of the active ingredients.

The gas cylinder (i.e. a cylinder of the general type used for the transportation of pressurised industrial gases) is desirably provided with an educator tube to ensure that the liquid phase rather than the gaseous phase is expelled through the cylinder valve.

For many applications of the method according to the invention, it would be convenient to have a large cylinder which is too heavy for easy manipulation. In such cases, a spray may conveniently be formed using a conventional airless spray gun as it commonly used for spraying paint. Such

a spray gun produces a spray by allowing the liquid phase to pass through a restricted orifice, and also contains a finger operated valve for controlling the supply of liquid to that orifice.

With liquid carbon dioxide as the liquefied gas the vapour pressure is typically above 800 psig, and typically of the order of 830 psig.

The use of the present invention substantially reduces the risk of injury to the operator. The operator is not required to handle the active substance in bulk, since all mixing is performed by the supplier.

The present invention also makes it possible to regulate more closely the quantity of insecticide or other active substance dispersed. With conventional fogging systems, it is usual to disperse an unnecessarily great amount, until the fog can be seen.

The toxicity is also reduced by the fact that the job can be performed more quickly, leaving the operator in contact with the aerosol for a shorter period of time.

By way of example, however, a useful insecticide formulation may be made by dissolving 0.4% pyrethrins and 2.0% piperonyl butoxide in liquid carbon dioxide.

An alternative formulation may comprise a 20% solution of 2,2-dichlorovinyl dimethyl phosphate dissolved in liquid carbon dioxide.

Yet another formulation may contain lauryl methacrylate dissolved in liquid carbon dioxide. This substance may be dispersed (either directly or by feeding into an air-conditioning system) for use in hotels, clubs, motels, restaurants and factories, and functions as a deodorizer.

The substances referred to above may be dissolved in carbon dioxide to form a true solution. Any other active substance may be employed providing it will dissolve in liquid carbon dioxide, if necessary with the aid of up to, say, 10% by weight of an auxiliary solvent, for example, kerosene, ethyl alcohol or deodorised mineral spirits, to form a solution.

Thirty kilograms of such solutions may be loaded standard "G" size cylinder fitted with an educator tube.

Conveniently, and for the sake of safety, it is desirable that the cylinder valve be provided with a specially shaped key shank so that it can be operated only with a special key. This prevents confusion with cylinders of other gases. Of course, it is expected that commercially supplied cylinders would be painted and labelled in a distinctive manner also.

When straying large areas, such as warehouses, a standard airless spray gun may be used without a restrictor nozzle to deliver 50 grams per second. In confined

spaces, where small quantities are required to be precisely controlled a restrictor nozzle may be used which will deliver 50 grams every six seconds.

Because the carbon dioxide functions as a solvent as well as a propellant, the active substance is dispersed as discrete molecules throughout each droplet of solution released. Because of the high vapour (about 830 psig) of carbon dioxide at ambient temperature, each of these droplets vapourises almost immediately, dispersing the insecticide into the air as discrete molecules. Thus the active substance is dispersed in the air initially as a vapour, and will coalesce into droplets only if its partial pressure in the volume of air throughout which the spray is dispersed exceeds its vapour pressure. Even if the vapour pressure is exceeded, the air will remain saturated with the vapour of active substance. For this reason, the active substance penetrates very well behind and under furniture and fittings, throughout warehouses and wherever else the invention is employed.

WHAT WE CLAIM IS:—

1. A gas cylinder which contains, as a liquid phase, liquefied gas, in which liquefied gas an active (as hereinbefore defined) is in solution, and, as a gaseous phase, vapour of the liquefied gas, and which has means for supplying the liquid phase from the cylinder on opening the cylinder valves, the liquid phase being stored in the cylinder under a pressure of at least 2000 kPa (if measured at 15°C), and the liquefied gas being carbon dioxide.
2. A gas cylinder as claimed in claim 1, in which the active substance is one or more of a pyrethin, piperonyl butoxide, and 2,2-dichlorovinyl dimethyl phosphate.
3. A gas cylinder as claimed in claim 1, in which the active substance comprises lauryl methacrylate.
4. A gas cylinder as claimed in claim 1, in which an auxiliary solvent is included in the liquid phase.
5. A gas cylinder as claimed in any one of the preceding claims, in which the means for supplying the liquid phase from the cylinder comprises an educator tube.
6. A gas cylinder as claimed in claim 5, fitted with external spray means including an orifice which is able to be placed in communication with the educator tube.
7. A method of distributing an active substance (as hereinbefore defined), comprising (i) releasing the liquid phase from a gas cylinder containing, as a liquid phase, a liquefied gas, in which liquefied gas the active substance is in solution, and, as a gaseous phase, vapour of liquefied gas, the liquid phase being stored in the cylinder under a pressure of at least 2000 pKa (if

a spray gun produces a spray by allowing the liquid phase to pass through a restricted orifice, and also contains a finger operated valve for controlling the supply of liquid to that orifice.

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1. A gas cylinder which contains, as a liquid phase, liquefied gas, in which liquefied gas an active substance (as hereinbefore defined) is in solution, and, as a gaseous phase, vapour of the liquefied gas, and which has means for supplying the liquid phase from the cylinder on opening the cylinder valves, the liquid phase being stored in the cylinder under a pressure of at least 2000 kPa (if measured at 15°C), and the liquefied gas being carbon dioxide.

2. A gas cylinder as claimed in claim 1, in which the active substance is one or more of a pyrethin, piperonyl butoxide, and 2,2-dichlorovinyl dimethyl phosphate.

3. A gas cylinder as claimed in claim 1, in which the active substance comprises lauryl methacrylate.

4. A gas cylinder as claimed in claim 1, in which an auxiliary solvent is included in the liquid phase.

5. A gas cylinder as claimed in any one of the preceding claims, in which the means for supplying the liquid phase from the cylinder comprises an educator tube.

6. A gas cylinder as claimed in claim 5, fitted with external spray means including an orifice which is able to be placed in communication with the educator tube.

7. A method of distributing an active substance (as hereinbefore defined), comprising (i) releasing the liquid phase from a gas cylinder containing, as a liquid phase, a liquefied gas, in which liquefied gas the active substance is in solution, and, as a gaseous phase, vapour of liquefied gas, the liquid phase being stored in the cylinder under a pressure of at least 2000 pKa (if



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- 5 measured at 150°C), and the liquefied gas being liquid carbon dioxide, and (ii) causing the liquid phase to pass through an orifice, whereby the liquefied gas evaporates on release from the orifice.
8. A method of distributing an active substance, as claimed in claim 7, in which the active substance is one or more of a pyrethin, piperonyl butoxide, and 2,2-chlorovinyl dimethyl phosphate.
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9. A method of distributing an active substance as claimed in claim 7, in which the active substance is lauryl methacrylate.

19. A method of distributing an active substance as claimed in any one of claims 7 to 9, in which the liquid phase includes an auxiliary solvent.

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The following corrections were allowed under Section 76 on 7 November 1980:

Page 2, line 95, *after active insert substance*

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