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SPRAYING DEVICE

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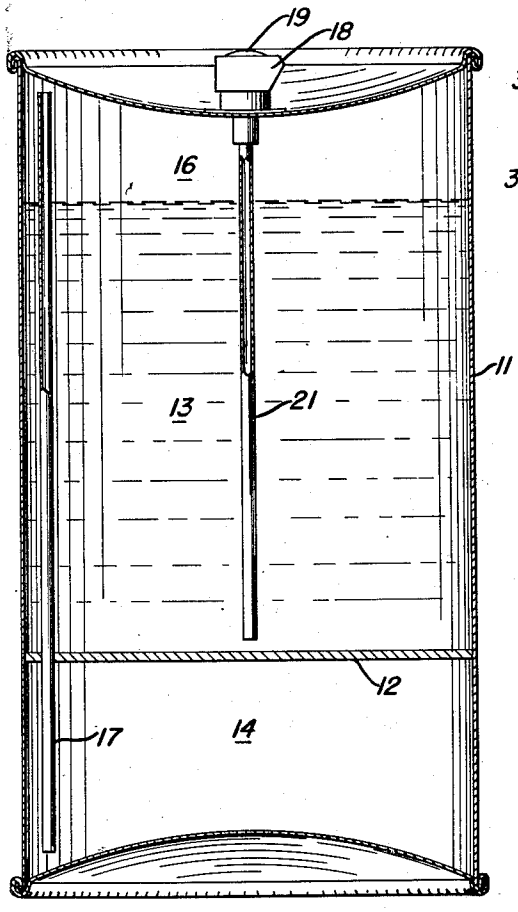


Fig. 1

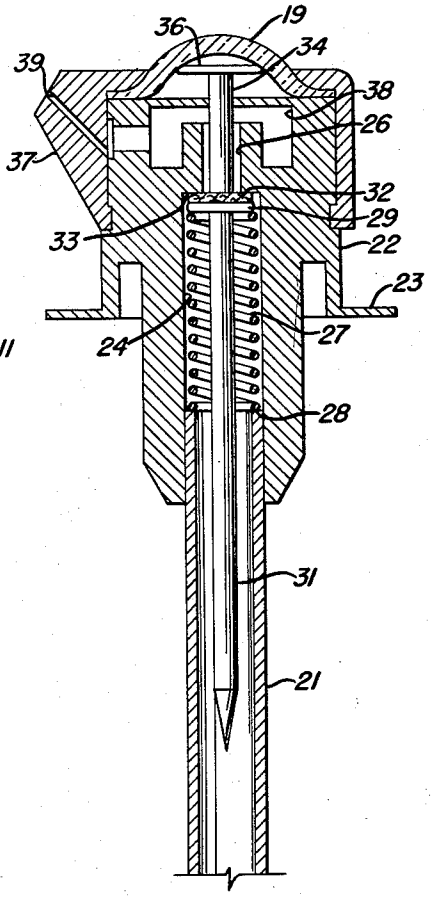


Fig. 2

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SPRAYING DEVICE

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1 Claim. (Cl. 299—95)

This invention relates to a spraying device in which a single container contains both the liquid to be expelled and the propellant and wherein propelling gas acts on the liquid to displace it through a discharge opening whenever a valve for the opening is moved to open position.

Spraying devices of the prior art have generally consisted of either of two types. The first type is one wherein both the liquid to be sprayed and the liquified propellant (which is normally gaseous) are placed in a container having attached thereto a discharge nozzle through which a mixture of liquid and propellant is sprayed. When such devices are used for residual spraying or aerosol spraying it is necessary to employ as much as three volumes of a propellant such as a mixture of Freon–11 and Freon–12 per volume of liquid to be sprayed. If a lower ratio of propellant to liquid (which is to be expelled) is employed the device will no longer expel a spray. Instead, the device expels a liquid stream such as is obtained when opening a water faucet. The inherent disadvantage of such a device is that it can deliver for its size only a small amount of the spraying liquid since the container is filled mostly with the propellant. Additionally, the propellant has a cooling effect and since it is expelled in large quantities together with the liquid, it may cause an undesired cooling effect on the material which the spray contacts. Attempts have been made to circumvent the inherent disadvantages of the above described type of device. This second type of device consists of two separate vessels, the first vessel contains a fluid to be expelled and the second vessel contains liquified propellant. A communication is provided between the two vessels so that upon actuating the spray nozzle the propellant gas is allowed to enter the vessel containing liquid and expel liquid through the nozzle. Devices of this type are usually large, cumbersome, complicated, and expensive.

An object of this invention is to provide a new and improved spraying device which consists of a single container and which is capable of delivering fine sprays when filled with larger relative proportions of liquid to propellant than heretofore have been usable in single container spraying devices.

Another object of this invention is to provide a spraying device of unitary structure which is capable of producing residual sprays having a lower content of the propellant material.

A further object is to provide a hand-size single container spraying device of simple and inexpensive construction which is advantageously employed in producing residual sprays.

Other objects and advantages will be apparent from the detailed description of the invention.

The improved spraying device, which is usually of hand size, consists of a closed container which has a partition sealing the interior container into a lower chamber for liquified propellant and an upper chamber for liquid to be sprayed. A connecting conduit, which is disposed within the container, extends from near the top of the

upper chamber to near the bottom of the lower chamber. A spray nozzle is positioned outside the container and has a siphon conduit extending from the spray nozzle into the upper chamber to a point just above the partition. The conduit connecting the upper and lower chamber may contain a check valve which allows flow of propellant from the lower chamber into the upper chamber, but prevents the flow of liquid from the upper chamber into the lower chamber if the spraying device is placed on its side, inverted, or shaken. It has been found that if the connecting conduit is a capillary, for example, is a tubing of less than about 0.25 inch diameter, a check valve need not be associated with the conduit to prevent undesired mixing of liquified propellant and liquid to be sprayed.

The accompanying drawings illustrate, by way of example, a preferred embodiment of the spraying device of this invention.

Figure I represents a vertical cross section through the spraying device.

Figure II represents a detailed partial cross section in magnified form of a spray nozzle and attached siphon conduit which may be used.

Referring to Figure I, the spraying device comprises a hand-sized closed cylindrical container **11** which has dome-shaped top and bottom closures. The container is constructed so that it can withstand internal pressures of the order of 20 to 60 p. s. i. g. However, it may be so constructed as to withstand only lower pressures such as up to 20 p. s. i. g. or high pressures such as 200 p. s. i. g. It may be constructed of light gauge metal, glass, or other suitable materials, and is shown in the drawings as constructed of light gauge metal. A circular partition **12** having a continuous surface is horizontally disposed within said container perpendicularly to the side walls thereof and seals container **11** into two chambers. The manner in which partition **12** is sealed to the interior of the side walls of container **11** will depend to some extent upon the materials of construction. When metal is employed it may be soldered to the side walls. Another method of attaching the partition in the interior of container **11** and sealing the container into an upper chamber and a lower chamber consists of forming a continuous outwardly extending arch in the interior of the side wall and about its circumference. A gasket made of Teflon or other suitable material is disposed within the arch and a circular partition is positioned within the arch where it is supported and restrained from any movement and tightly abutts the gasket to form a continuous seal.

The partition **12** separates the interior of closed container **11** into an upper chamber **13** and a lower chamber **14**. A liquified propellant gas is contained in chamber **14**. Any suitable commercial type such as Freon–12 (dichlorodifluoromethane), a 50–50 mixture of Freon–11 and 12 (dichlorodikuoromethane and trichloromonofluoromethane), Freon–21 (dichloromonofluoromethane), Freon–113 (trichlorotrifluoroethane), methylene chloride, nitrous oxide, or the like may be used. In upper chamber **13** is contained liquid which is to be sprayed. This liquid is usually comprised primarily of a liquid base such as oil or water or emulsions thereof which contain effective quantities of active agents such as herbicides, insecticides, fungicides, rust proofing agents, waxes, or the like. For example, the base liquid may be refined petroleum oil containing herbicides such as penthachlorophenol or esters of 2,4-D, insecticides such as DDT, Rhothane, or the like, fungicides such as quaternary amine salts or Phygon, or rust preventives such as the alkali salts of preferentially oil soluble sulfonic acids obtained in the treatment of pertoleum oils with sulfuric acid. Upper chamber **13** generally has a larger volume

than lower chamber 14, the volumetric ratio of upper chamber 13 to lower chamber 14 being about 1:1 to 15:1. Upper chamber 13 is initially not completely filled with the liquid which is to be sprayed. A small vapor space 16 is thus provided for propellant gas at the top of chamber 13.

The conduit 17 is vertically disposed within container 11. It extends to a lowermost point in chamber 14 and to an uppermost point in chamber 13. It provides the only communication for propellant gas, which vaporizes as needed during spraying, to pass from chamber 14 into the vapor space 16 above the liquid which is contained in upper chamber 13. The connecting conduit is a capillary tubing about 0.05 inch in diameter. It has been found that if this connecting conduit is a capillary, e. g., a tubing of about 0.02 to 0.25 inch in diameter, a check valve need not be associated with the connecting conduit to prevent the flow of liquid from upper chamber 13 into lower chamber 14 when the device is inverted, placed on its side, or shaken. If desired, however, a conventional check valve such as a ball-check valve or a spring valve may be associated with connecting conduit 17 at or near its top, especially when larger diameter tubing is used.

A spray nozzle 18 designed for residual spraying, having a valve actuated by pressure upon knob 19, is positioned outside the top closure and immediately adjacent thereto. The spray nozzle is described in detail later. To nozzle 18 is attached a siphon conduit 21 which extends down into the upper chamber to a point close to but just above partition 12. The spray nozzle is so attached to the top closure that liquid can be dispelled from chamber 13 only through the spray nozzle.

Referring to Figure II, the spray nozzle 18 is of a generally cylindrical shape and is comprised of a body portion 22 having an outwardly extending horizontal flange 23 which fits immediately above the top closure of container 11 and is sealed thereto. Body portion 22 has a centrally located vertical bore therethrough. A bore of larger diameter 24 is located in the lower section of the body portion and a bore of smaller diameter 26 is located in the upper section of body portion 22. Siphon conduit 21 is inserted within the lowest section of the bore 24 and sealed therein. Expansion spring 27 is positioned within the bore immediately above the siphon conduit. One end of spring 27 is seated on the end cross section 28 of siphon conduit 21. The other end of spring 27 bears against the bottom of the flange 29 of pin 31. Pin 31 rests by means of flange 29 on spring 27 and the body portion of pin 31 extends down through said spring into siphon conduit 21 to maintain the spring in proper alignment. Immediately above flange 29 is located a solid gasket 32. The gasket is of smaller diameter than the large bore 24 in body portion 22, but is of larger diameter than the small bore 26 in body portion 22. Expansion spring 27 forces flange 29 of pin 31 against gasket 32 which in turn is seated against shoulder 33 formed at the junction of the larger and smaller bores in body portion 22. Gasket 32 thus forms a valve which is seated on seat 33. Stem 34, which is of smaller diameter than bore 26, is vertically located therein. The lower end of stem 34 bears against the top of gasket 32. Attached to the top of stem 34 is button 36. Knob 19, which is made of flexible plastic material, is positioned above button 36 and surrounds the top of body portion 22. The orifice body portion 37 clamps down on knob 19 and the plastic knob 19 thus tightly seals the top of body portion 22. Expansion chamber 38 communicates with upper bore 26. Spray orifice 39, which is located in orifice body 37, communicates with expansion chamber 38.

In operating the spraying device, finger pressure on knob 19 actuates stem 34 which depresses gasket 32, thus forming an open passageway for liquid to travel from upper chamber 13 up siphon conduit 21. The liquid, which is propelled by the propellant gas in vapor space 16 of the upper chamber 13, is forced up siphon conduit 21 into lower bore 24 around gasket 32 into upper bore 26. It then passes into expansion chamber 38 and out spray orifice 39 to form a fine residual type spray. When pressure is no longer applied to knob 19, expansion spring 27 forces flange 29 of pin 31 against gasket 32. The gasket then seats itself against shoulder 33 to seal off the further flow of liquid.

The above described spraying device was tested for residual spraying and compared with a conventional hand-operated device. The conventional device had no partition separating liquified propellant gas from liquid to be sprayed. Thus, in the conventional device the propellant and liquid to be sprayed were mixed together. Both the spraying device of this invention and the conventional spraying device were of the same size and had identical spray nozzle mechanisms for residual spraying. The same composition of propellant, i. e., a 50–50 mixture of Freon–11 (trichloromonofluoromethane) and Freon–12 (dichlorodifluoromethane) were employed. A number of the conventional spraying devices were filled with varying proportions of refined petroleum oil (to be sprayed) and the propellant mixture. The conventional spraying devices were then tested and the quality of the spray produced was examined. When the convenitional spraying device contained 1 part of oil per part of propellant, a good quality residual spray was obtained. However, when the conventional spraying device was filled with 3 parts of oil per 1 part of propellant, a liquid stream issued forth from the spray orifice. The same results were obtained when a higher ratio of oil to propellant, i. e., 9:1, was employed. The liquid stream which was ejected from the spray orifice was similar to that obtained when opening a water faucet. The oil did not issue from the spray orifice in the form of a spray. Hence, a conventional type hand-sized spraying device could not be employed to spray compositions which contained a high ratio of oil to propellant. The liquid stream produced at ratios of oil to propellant higher than 1:1, is completely unsuitable for residual spraying. Surprisingly, it was found that the spraying device of this invention was useful in producing residual sprays of good quality when the upper chamber contained 9 parts of oil and the lower chamber was filled with 1 part of propellant. Even larger ratios of oil to propellant (or lower ratios if desired) could be employed.

By using the spraying device of this invention, it is possible to obtain a good quality residual spray even when employing a high proportion of liquid to be sprayed and a low proportion of propellant in the container. For a given container size, it is possible to expel as much as 10 times the amount of liquid to be sprayed as could be expelled in a suitable spray from a conventional hand-sized container where the propellant and liquid to be sprayed are mixed. The device of this invention enables the spraying of much larger areas than were previously possible with a single-container spraying device of the same size. In addition, the spraying device of this invention expels much less propellant and the spray, therefore, does not have the disadvantageous great cooling effect of the prior art single-container spraying devices. The described invention is of simple and inexpensive construction and enables the production of hand-sized spraying devices which are more economical and useful.

Thus having described the invention what is claimed is:

A hand spraying device for spraying a liquid by means of a liquefied propellant, which device comprises a vertical, closed container having top and bottom closures, a substantially horizontal partition for sealing the interior of the container into a relatively small lower chamber for liquefied propellant and a relatively large upper chamber for liquid to be sprayed, a capillary tube having an internal diameter of at least about 0.02 inch but less than 0.25 inch extending from a point adjacent the bottom of the lower chamber through said partition to a point adjacent the top of the upper chamber, a spray nozzle positioned above the top closure and connected to a conduit which extends through the top closure to a point

in the upper chamber adjacent the partition and a valve mechanism interposed between said spray nozzle and the lower end of said conduit for initiating, stopping and controlling discharge of spray liquid from the nozzle, said capillary tube substantially preventing intermingling of liquefied propellant with liquid to be sprayed whereby a much smaller amount of liquefied propellant is required for spraying a given amount of liquid than is required when liquid to be sprayed and liquefied propellant are admixed.

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