Feb. 20, 1951 E. W. JACOBSON ET AL 2,542,775

SPRAYING HEAD

Filed May 21, 1946 2 Sheets-Sheet 1

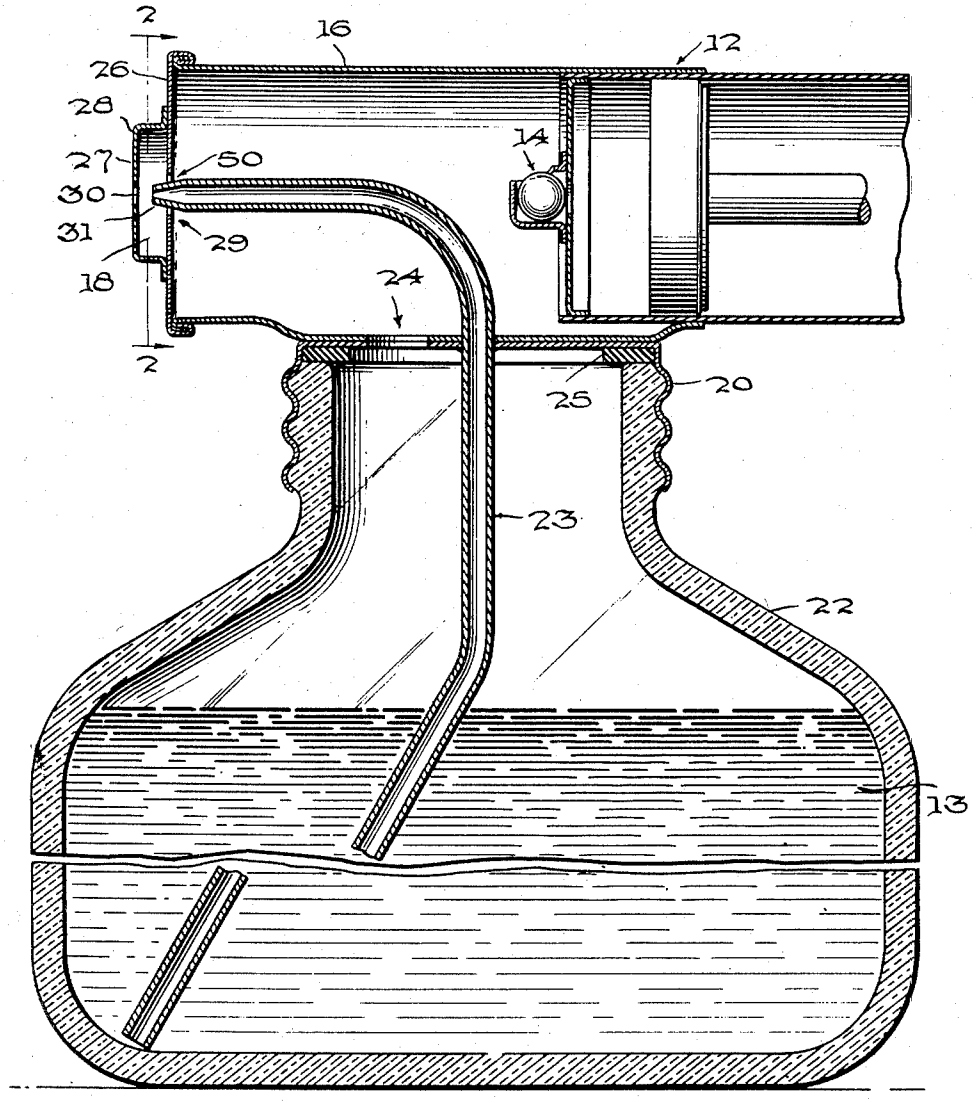


FIG. 1.

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Fig. 2.

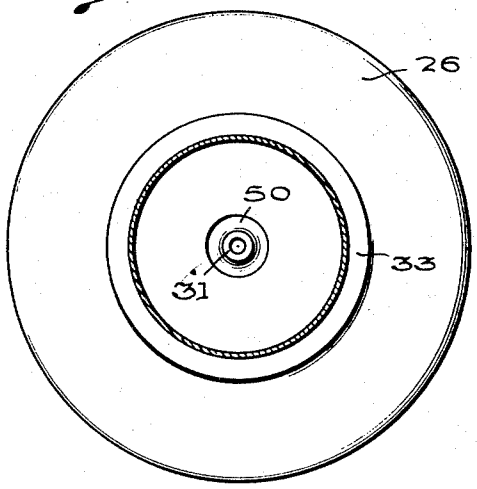


Fig. 3.

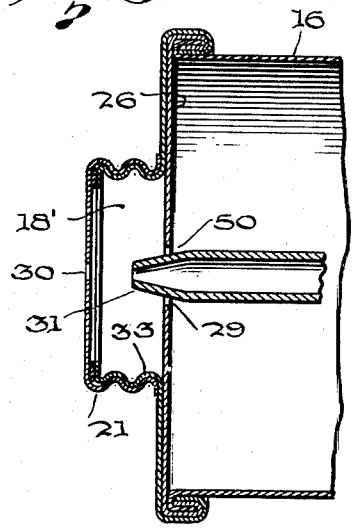


Fig. 4.

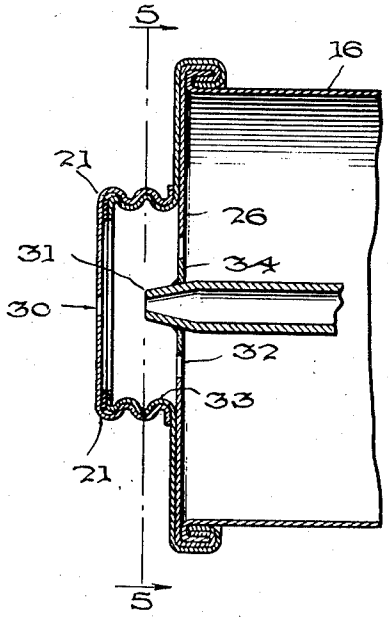
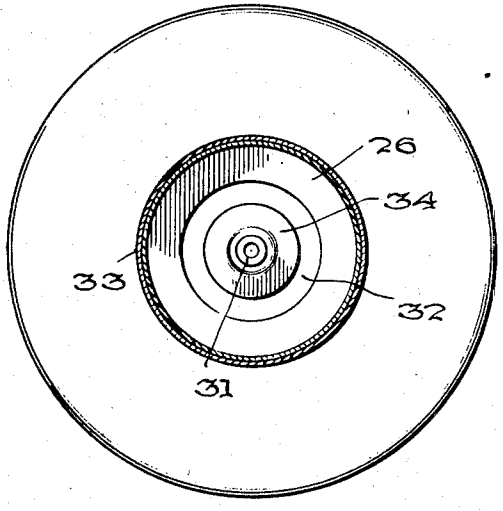


Fig. 5.



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SPRAYING HEAD

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8 Claims. (Cl. 299—88)

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This invention relates to an improvement in sprayer head, and more particularly to a nozzle construction which produces a fine mist comparable in character to an aerosol, in that it remains suspended in the air for a long time.

Hand and power operated sprayers which are fitted with nozzles of conventional type discharge droplets of insecticide or other liquid in a heavy wet mist, which rapidly settles and thus is only temporarily effective in producing an atmosphere toxic to insects. Such sprayers moreover have two principal objections, namely, that liquid drips from the nozzle and, further, the particle size of the spray is not uniform, the larger and heavier particles almost immediately falling out of suspension, thereby reducing the concentration of insecticide in the space being treated.

Our invention has among its objects to provide an improved nozzle which discharges a fine and uniform spray, which affords close control of particle size, and which eliminates the annoyance of liquid dripping from the nozzle while the sprayer is in use.

The foregoing and other objects are achieved by the improved nozzle which comprises a mixing chamber having a pair of spaced, thin discs as walls in one of which there is formed a circular opening through which the end of the eduction tube projects to form an annular, sharp-edged orifice, and in the other of which a sharp-edged orifice is provided for discharge of the spray into the atmosphere. Thorough mixing of the liquid and air results from high turbulence which is caused by surrounding the high velocity liquid stream by a high velocity air stream. In order to attain the desired results the orifice must constitute a continuous, unbroken annular opening extending around the eduction tube adjacent its end. It must also be sharp-edged and thin to avoid excessive energy loss which results if the air is impelled into the mixing chamber through passages or capillaries.

This combination has the peculiar characteristic of forming a dripless spray of uniform particle size. An examination of the nozzle just following its use shows that there is no liquid on the walls of the mixing chamber. The high velocity air stream emerging from the annular orifice into the mixing chamber very evidently prevents liquid from coming in contact with the mixing chamber inner walls. If the annular orifice were not thin and sharp-edged, but of appreciable length constituting it a passage, this effect would not be obtained; a dripless spray would not result and the particle size of the spray would not be uniform.

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The novel features embodied in this improved nozzle are shown by way of illustration in the accompanying drawings in which

Fig. 1 is a vertical section of a sprayer embodying the improved nozzle;

Fig. 2 is an enlarged vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view in section of a modified form of nozzle in which the outer orifice of the mixing chamber is removable;

Fig. 4 is a fragmentary view in section of a modified form of the inner orifice of the mixing chamber; and

Fig. 5 is a vertical section taken on line 5—5 of Fig. 4.

As shown in Fig. 1, the spraying device comprises an air pump 12 which may be conventional design, adapted for manual operation, having a check valve 14, admitting air under compression to an air chamber 16 which is provided with a mixing chamber 18 at its forward end.

The air chamber 16 carries a screw cap 20 by which the spray device is removably secured to a liquid container 22, such as a glass jar or bottle.

An eduction tube 23 extends through the cap 20, with one of its ends immersed in the liquid in container 22 and the other end bent to extend forwardly into the mixing chamber 18. An opening 24 in the bottom of the air chamber 16 and the screw cap 20 is provided for admitting air under pressure into container 22, to force the liquid therein through the eduction tube 23 and to eject it in a high velocity stream into the mixing chamber. A gasket 25 may be employed to seal the joint between the screw cap and the top of the container 22.

The mixing chamber 18 is formed by the thin end wall 26 of the air chamber 16 and a thin cap-like member 28 secured thereto. The inner wall 26 of the mixing chamber has a sharp-edged orifice 29 of such diameter that a continuous annular opening 50 is left around the tip of the eduction tube projecting through it. The outermost wall 27 of the cap-like member 28 also has a sharp-edged orifice 30 which forms the outer orifice of the mixing chamber. The size of the annular orifice 50 and the diameter of the eduction tube passage at the tip control the ratio of air and insecticide solution, whereas the size of the orifice 30 controls the size of the spray particles. Thus, the high velocity air stream emerging from the inner annular orifice produces an inwardly revolving doughnut type of turbulent flow in the mixing chamber and prevents the formation of drops of liquid on the inner walls of

the chamber and consequently prevents dripping of the liquid during a spraying operation.

In the modified form of the invention illustrated in Fig. 3, the mixing chamber 18' comprises a circular screw threaded flange 33 secured to the wall 26 of the air chamber 16 and a screw cap 21 which is provided with an orifice 30. This construction makes it possible to remove the screw cap containing the outer orifice for the purpose of cleaning the inner orifice 29 and the eduction tube tip 31.

The modified form of mixing chamber shown in Fig. 4 has an inner orifice which is defined by an annular space 32 between a disc 34 carried on the tip of the eduction tube and an opening in the wall 26 which is of larger diameter than the disc.

In operation of our invention, the container 22 is filled with liquid and the screw cap 20 is screwed into place forming an airtight seal against the gasket 25 and submerging the lower end of the insecticide eduction tube 23 in the insecticide solution 13. Air which is compressed by power, or by a hand operated pump 12 enters the compression chamber 16 through the check valve 14 and flows into the liquid container through hole 24 and into the mixing chamber through orifice 29 in a high velocity stream. The air under pressure forces the insecticide solution through the eduction tube 23 and through the restricted end of the eduction tube 23 into the mixing chamber 18, also in a high velocity stream. The resulting turbulent mixture of air and insecticide solution emerges in a fine mist from the mixing chamber 18 through outer orifice 30.

The sizes of the inner and outer orifices, and the size of the end of the eduction tube will of course be dependent largely upon the viscosity of the particular spraying liquid which the spray device is designed to use and the air pressure at which it is to be operated. It will readily be apparent that the proportion between the sizes of these parts can be adjusted in order to provide a proper balance between the air pressure and the viscosity of the liquid for most efficient operation, and it is to be understood that our invention contemplates such variations in size and dimensions as may be expedient for various purposes, and that although for purposes of illustration we have shown an eduction tube having a tapered tip, our invention includes, as well, an eduction tube with an unrestricted bore. It will thus be understood that various changes may be made in the form, details, arrangement and proportion of the parts, without departing from the scope of our invention.

What we claim is:

1. In a sprayer having in combination a source of air under pressure, an air pressure chamber, a liquid receptacle communicating with said air pressure chamber, and an eduction tube extending into the receptacle at its one end and projecting through the wall of said air pressure chamber at its other end, the improvement comprising an annular sharp-edged orifice in the wall of said pressure chamber surrounding said eduction tube, a cap enclosing the end of said eduction tube and orifice thereby to define a mixing chamber for high velocity streams of liquid and air discharged thereinto from the eduction tube and the surrounding annular orifice, respectively, and a sharp-edged orifice formed in said cap for discharging the highly turbulent mixture of liquid and air into the atmosphere as a fine spray.

2. In a sprayer having in combination a source of air under pressure, an air pressure chamber, a liquid receptacle communicating with said air pressure chamber, and an eduction tube extending into the receptacle at its one end and projecting through the wall of said air pressure chamber at its other end, the improvement comprising a pair of thin, sharp-edged orifices formed respectively by an opening in the wall of said air pressure chamber and an opening in a member which is spaced outwardly therefrom by means enclosing the end of the eduction tube and surrounding the orifice in the wall of the pressure chamber, the orifice in the wall of said air pressure chamber being annular about the projecting end of the eduction tube and uninterrupted to the extent that energy losses of the air stream entering the mixing chamber are low, thereby creating a highly turbulent mixture of the high velocity liquid and air streams, and the thin, sharp-edged orifice in the member spaced from said wall serving to discharge such mixture in a spray of substantially uniform particle size.

3. A nozzle for sprayers comprising a mixing chamber communicating with an air pressure chamber by means of a thin, sharp-edged orifice in the wall thereof, for admission of air under pressure to the mixing chamber with low energy loss, a spaced member formed with a thin, sharp-edged orifice for discharging a mixture of air and liquid particles into the atmosphere, means enclosing the space between said member and the wall of said air pressure chamber, a liquid eduction tube projecting through the air admission orifice to define an annular sharp-edged orifice there-around, and means for ejecting liquid in a stream from said eduction tube into said mixing chamber, to mix therein with the highly turbulent air stream created by high velocity flow through said admission orifice, the mixture then flowing through the orifice in said spaced member in a spray of substantially uniform particle size.

4. A nozzle for sprayers comprising a mixing chamber communicating with an air pressure chamber by means of a thin, sharp-edged orifice in the wall thereof for admission of air under pressure to the mixing chamber with low energy loss, a circular flanged cap covering such orifice and formed with a sharp-edged orifice for discharge of the mixture of air and liquid to atmosphere, an eduction tube extending from a receptacle for liquid through the orifice in the wall of said pressure chamber, a disc of a diameter less than that of the orifice in the wall of said air pressure chamber, mounted on the eduction tube adjacent its end and centered to define an annular orifice having opposed sharp-edges surrounding the eduction tube, whereby high velocity streams of air and liquid entering the mixing chamber produce a highly turbulent mixture which is discharged through the orifice in said circularly flanged cap in a spray of uniform particle size.

5. In an insecticide sprayer having a container for insecticide and an eduction tube through which a high velocity stream of liquid insecticide is ejected under pressure of compressed air from a pump communicating with the container, the improvement comprising a mixing chamber surrounding and enclosing the end of the eduction tube and constituting a spray nozzle, the opposite spaced walls of said mixing chamber being formed with openings which are small as compared to the chamber dimensions, one such open-

ing being of a diameter sufficient to define a thin, sharp-edged orifice radially outward of the eduction tube projecting therethrough, and the opening in the opposite wall constituting a sharp-edged orifice discharging to atmosphere.

6. In a sprayer having a container adapted to contain a liquid and an eduction tube leading therefrom for discharging a stream of liquid under pressure of compressed air, the improvement comprising a nozzle formed as a mixing chamber with spaced walls, a sharp-edged orifice formed in each of the spaced walls, one such orifice being of a diameter permitting the end of the eduction tube to project therethrough with sufficient clearance to constitute the same an annular thin and sharp-edged orifice through which a high velocity stream of compressed air flows into the mixing chamber with low energy loss, thereby creating turbulence within said chamber, the turbulent mixture thereupon discharging through the other thin and sharp-edged orifice to atmosphere.

7. In a sprayer, a nozzle comprising a mixing chamber into which an eduction tube discharges a high velocity stream of liquid, one wall of such chamber being formed with an opening of larger diameter than the eduction tube, and through which the eduction tube extends, thereby to define an annular, sharp-edged orifice surrounding the eduction tube, a source of air under pressure communicating with such orifice to produce a high velocity and highly turbulent stream of air therethrough, and a thin, sharp-edged orifice in the opposite wall of said mixing chamber through which the turbulent mixture of liquid and air is discharged as a fine spray.

8. In a sprayer having an eduction tube extending through the forward wall of an air pressure chamber, sharp-edged orifice means in the

forward wall of said air pressure chamber surrounding the projecting end of the eduction tube, means for compressing air and supplying the same to said air pressure chamber, a screwthreaded neck secured to the forward wall of said air pressure chamber and extending outwardly therefrom, a screwthreaded cap received upon said neck and provided with a thin, sharp-edged orifice spaced from the orifice in the forward wall of said air pressure chamber, thereby to constitute a mixing chamber having an annular orifice for admitting air in high velocity flow around the liquid eduction tube with low energy loss, and a spaced discharge orifice through which the highly turbulent mixture is ejected in a spray of uniform particle size.

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