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SPRAYING DEVICE WITH DILUTION CONTROL

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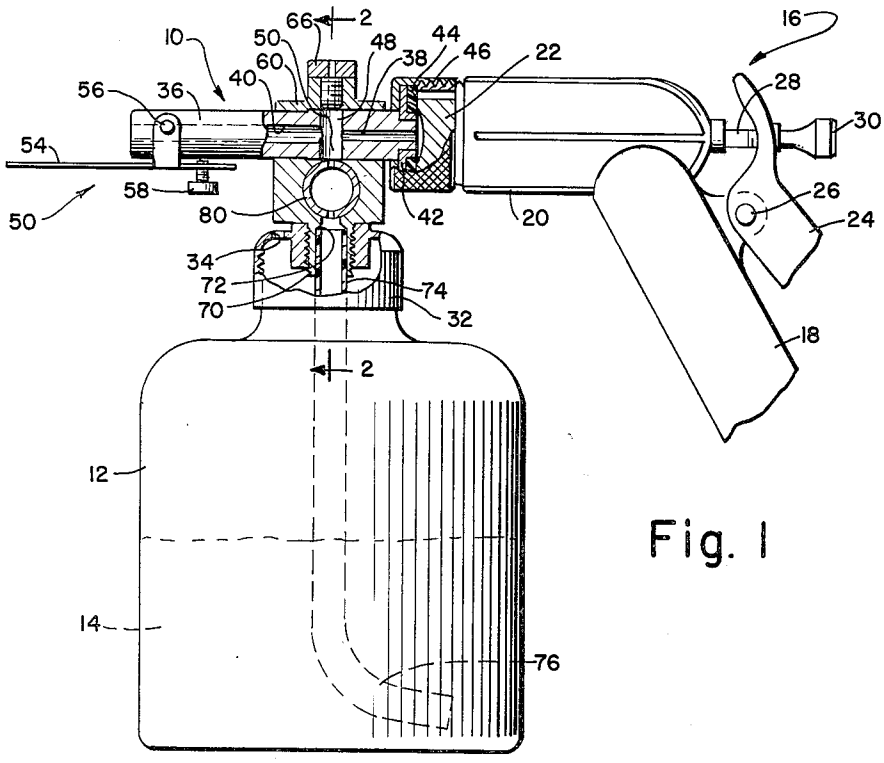


Fig. 1

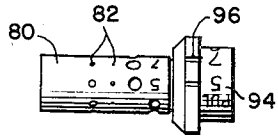
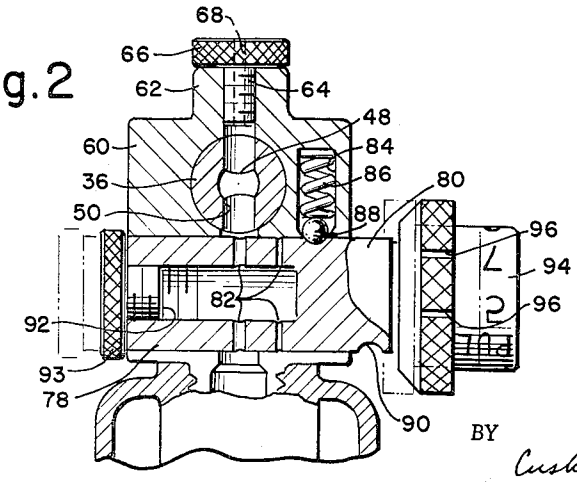


Fig. 3

Fig. 2



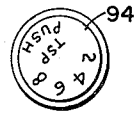


Fig. 4

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SPRAYING DEVICE WITH DILUTION CONTROL

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This invention relates to the control of sprayers of the type in which a fluid stream flowing through a passage creates a suction operable to draw into the passage a concentrate which is to be diluted with the fluid stream and ejected therewith from the passage. More in particular, it relates to improvements in the control of the dilution of the concentrate in the final spray mixture.

Conventional sprayers of the type contemplated for use with the present invention comprise a container for holding a liquid concentrate, a spray head having a passage therethrough for mixing the concentrate with a fluid stream and for spraying the mixture and a delivery tube for conducting the concentrate from the container to the spray head. A sprayer of this type in combination with a control means for controlling the dilution of the concentrate in the spray is disclosed in applicant's prior Patent No. 2,788,244 issued April 9, 1957. The dilution control means in the said prior patent comprises a slide valve located between the end of the delivery tube and the passage in the spray head. The slide valve has an elongated, longitudinally slidable member which passes horizontally through a vertical valve passage extending from one end of the delivery tube to the passage in the spray head. The slidable member has three different sized vertical holes therethrough each of which can be brought into registry with the vertical valve passage by moving the member to three respective horizontal positions. Each of the holes when in register with the valve passage permits concentrate to be drawn into the spray head at a different rate and thereby effects a different dilution of the concentrate in the final spray.

The present invention improves over the slide valve control means by providing a rotatable hollow sleeve between the concentrate inlet in the passage through the spray head and the concentrate delivery tube. Each of a plurality of graduated circumferentially spaced passages extending transversely through the sleeve can be brought into registry with the inlet aperture and with the delivery tube by rotation of the sleeve. The sleeve may also be movable longitudinally and have several groups of passages, each group being longitudinally spaced from the next. The sleeve improves over the prior slide valve by providing a compact, accurate valve for controlling a wide range of dilutions while maintaining simplicity of construction. In addition, the sleeve, being hollow is easily cleaned of foreign matter and permits the passages to be easily cleaned.

It is an object of the present invention to provide a spray head having a control valve which accurately and positively controls, over a wide range, the amount of concentrate added to the spraying mixture.

A further object of the present invention is the provision of a spray head having a simple and compact control valve for controlling the amount of concentrate added to the spraying mixture.

Another object of the present invention is the provision of a spray head having a rotatable and longitudinally movable sleeve valve for controlling the amount of concentrate added to the spraying mixture.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims. The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a side elevation, partly in section, of a sprayer embodying the principles of the present invention;

FIGURE 2 is a sectional view taken along the lines 2—2 of FIGURE 1 showing the rotatable sleeve valve of the invention;

FIGURE 3 is a side elevation of the rotatable sleeve valve of the invention; and

FIGURE 4 is an end view of the rotatable sleeve valve of FIGURE 3.

Referring now more particularly to the drawings, there is shown therein a sprayer which comprises a spray head 10 embodying the principles of the present invention, a container 12 for holding a concentrate 14 to be sprayed and a conventional pistol grip hose nozzle 16 for controllably delivering water to the spray head. The hose nozzle 16 is of the type shown in the before mentioned patent and comprises a hollow handle 18 which may be connected at its lower end to a garden hose (not shown) or other source of water pressure, a hollow body 20 and a plunger 22 within body 20. A lever 24 is pivoted by means of a pin 26 on the upper portion of handle 18 and has a slot in its upper end through which an end of a rod 28 passes. The end of rod 28 adjacent the lever 22 is provided with a nut 30 which prevents the rod from slipping out of the slot in the lever 24. The rod 28 passes through one end of the body 20 and is attached at its other end to plunger 22. A spring (not shown) inside the body 20 biases plunger 22 and rod 28 to the left as viewed in FIGURE 1. The end of the body 20 adjacent the plunger is exteriorly threaded for coupling to the spray head.

The container 12 may be of any size, shape and material suitable for holding the concentrate 14. In the embodiment described, the concentrate 14 is a concentrate of liquid fertilizer or insecticide, and a quart container made of plastic is suitable. The container is provided with a screw cap 32 which has an interiorly threaded central hole in the top thereof for coupling with the spray head 10. A vent opening 34 is provided in the top of cap 32 near the periphery thereof for venting the interior of the container 12 to the atmosphere.

The spray head 10 constructed in accordance with the invention includes a barrel 36, or other conduit-like member, the wall of which defines a flow passage therethrough having an inlet end and an outlet end. The flow passage in barrel 36 has a constricted portion 38 adjacent the inlet end and an enlarged portion 40 of greater diameter adjacent the outlet end. At the inlet end of the barrel 36 there is provided an outwardly extending flange 42 which is integral with the barrel. A conventional, internally threaded coupling 44 is rotatably mounted on the flange 42 and engages the threaded end of the body 20 of the water nozzle 16. The coupling is provided internally with a washer 46 for preventing leakage past plunger 22 and around the threads and is knurled on its outer peripheral surface to aid in gripping with the fingers. The wall of barrel 36, at the juncture of constricted passage 38 and enlarged passage 40, is provided with an upper vent aperture 48 and a lower concentrate inlet aperture 50. Near the outlet end of the barrel 36 is attached an adjustable spray spreader 52 which consists of a spreader plate 54 pivoted near one end thereof to the barrel 36 by a pin 56 and an adjusting screw 58 for adjusting the position of the plate 54.

A cap 60 engages the wall of the barrel 36 intermediate its ends in fluid tight relationship. The upper surface of cap 60 is provided with a small central boss extending therefrom. A hole 64 passes downwardly through the center of the boss 62 and registers with vent aperture 48 in barrel 36. The upper portion of hole 64

is interiorly threaded and threadedly engages an exteriorly threaded vent plug 66 having a vent 68 therethrough. The lower surface of cap 60 has an exteriorly threaded nipple 70 integral therewith and projecting downwardly therefrom which threadedly engages the central hole in the top of cap 32 on container 12. Nipple 70 has a bore 72 formed therein into the lower end of which is inserted the upper end of a delivery tube 74 which extends into container 12. Near its lower end, the delivery tube 74 is bent, as indicated at 76, toward the periphery of the container so that the lower end may be kept below the level of concentrate 16 in the container by tipping the sprayer. The upper end of bore 72 in nipple 70 connects with a valve-receiving passage 78 which extends horizontally through the cap 60 at a position transversely below the barrel 36. Diametrically opposite the connection of the bore 72 with the passage 78, the inlet aperture 50 in the barrel 36 connects with the passage 78.

The valve means of the present invention comprises a hollow cylindrical sleeve 80 which passes through and snugly engages the passage 78 in the cap 60. A series of spaced graduated orifices 82 ranging from about 1/64 inch diameter to about 1/16 inch diameter is provided transversely through the wall of sleeve 80 to define eight different flow paths transversely through the sleeve. As shown, there are two parallel groups of orifices 82, each group being longitudinally spaced from the other group. Each group preferably includes eight orifices 82 circumferentially spaced so that each orifice is diametrically opposite another of the same size.

The sleeve 80 is longitudinally and rotatably movable in the passage 78 so that each pair of aligned orifices in the sleeve can be brought into registry with the inlet aperture 50 and the bore 72 of the nipple 70. The distance between the groups of orifices is such that only one pair of orifices register with aperture 50 and bore 72 in any position of movement. In order to retain the sleeve 80 in any of the eight positions described above, a spring biased indexing means is provided. As shown, such means includes a vertical cavity 84 in the cap 60 which connects with the passage 78 near one end thereof and has mounted therein a spiral spring 86 and an indexing ball 88 which projects out of the cavity. Two longitudinally spaced groups of four ball-receiving sockets 90 are provided in the outer periphery of sleeve 80 to selectively receive the ball 88. The sockets 90 of one group are located so that each pair of orifices 82 in one group are in register with the aperture 50 and the bore 72 when the ball 88 latches the sleeve in position. The sockets of the other group are located so that each pair of orifices in the other group align in the same manner when the ball latches the sleeve. One end of the sleeve 82 is closed with a screw plug 92 which has a head 93 of greater diameter than the passage 78. The other end is provided with a knurled knob 94 which is easily gripped with the fingers.

The operation of the sprayer is as follows. After a source of water pressure has been attached to the handle 18 of the hose nozzle 16, water flow through the barrel 36 is initiated by pressing lever 24 of the water nozzle 16 with the hand so as to retract rod 28 and plunger 22 against the action of the spring in the body 20. Plunger 22 in moving away from washer 46 permits water to flow through handle 18, through the annular space between plunger 22 and body 20 and into the inlet end of barrel 36. The water flowing from the constricted portion 38 of the barrel 36 to the enlarged portion 40 of the barrel 36 creates a suction at the juncture of the two portions causing a flow of concentrate 14 through the delivery tube 74, the bore 72, orifices 82 and the aperture 50, and pass into the barrel 36. At a given constant flow of water, the amount of flow of concentrate 14 into the barrel will be determined by the size of the orifices which are in registry with the bore 72 and the aperture 50. After entering the barrel 36, the concentrate 14 mixes with the water stream and is ejected from the outlet end of the barrel as a diluted mixture. A small amount of air is sucked into the barrel through vent plug 66 and is similarly mixed with the water and ejected. In order to further disperse the liquid and direct the spray, spreader plate 54 may be interposed in the ejected stream by the adjustment of screw 58.

The operation of the sleeve 80 to control the relative amount of concentrate 14 in the final stream is as follows. In order to produce a very dilute mixture of concentrate 14 in water, the knob 94 on the sleeve 80 is manually pushed until the knob engages the side of the cap 60. The knob is then rotated until the smallest of the orifices 82 in the sleeve 80 are in registry with the bore 72 and the aperture 50. The spring-biased ball 88 will be felt snapping into one of the sockets 90 in the sleeve and will hold the sleeve against longitudinal or rotational movement until the knob is again moved by the fingers. To increase the concentration of concentrate 14 in the final mixture, the knob 94 is rotated with the fingers in a counterclockwise direction, as viewed in FIGURE 1, until the next larger orifices 82 are in registry with bore 72 and aperture 50 at which time ball 88 will snap into another of the sockets 90 in sleeve 82. Since the group of orifices 82 which can be brought into registry with bore 72 and aperture 50 in this longitudinal position of sleeve 80 contains four pairs of opposed orifices, there are four positions in which sleeve 80 can be latched by ball 88. To increase the concentration of concentrate 14 in the final mixture still further, the knob 94 is pulled outwardly by the fingers until the head 92 of the screw plug 92 engages the side of the cap 60 and prevents further movement of the sleeve 80. The knob is then rotated to any of the four positions in which the ball 88 latches the sleeve so that the orifices 82 of the second group can be brought into registry with bore 72 and aperture 50.

In order that the operator may rapidly select the orifice 82 which he desires to employ, indexing marks are preferably applied to the described embodiment as follows. An indexing line is stamped on the exterior of the cap 60 adjacent the knob 94 and an indexing mark 96 corresponding to each pair of orifices is stamped on the periphery of the knob 94. The marks on the knob are so located and spaced that when any mark on the knob coincides with the line on the cap, a pair of orifices 82 form a flow path between bore 72 and aperture 50. Since each different orifice pair produces a different dilution of concentrate 14 in the final stream, the indexing marks on knob 94 may be identified in terms of the dilution produced by the respective orifice pairs. In the embodiment described, the smaller orifice pairs, which are latched in position by the ball 88 after the knob 94 has been pushed, result in 2, 4, 6 and 8 teaspoons of concentrate per gallon of water respectively in the final mixture, and the outer end of the knob 94 (FIGURE 4) is stamped with these calibrations adjacent the respective index mark on the periphery of the knob. In addition, the outer end of the knob 94 is stamped with the word Push to indicate that the calibrations apply to those orifices employed when the knob 94 has been pushed in. The four larger orifice pairs in the sleeve 80 result in 5, 7, 9 and 11 tablespoons of concentrate per gallon of water and these figures are stamped, together with the word Pull, on the periphery of knob 94 adjacent the appropriate index mark (FIGURES 2 and 3). The sleeve 80 can be removed from the spray head for cleaning by unscrewing the plug 92 and pulling on knob 94 until the sleeve slips out of passage 78.

While eight pair of orifices 82 divided into two groups of four have been shown as forming eight flow passages through the sleeve 80, it should be understood that the number and groupings of the flow passages can be varied. It should be understood also that the range of sizes of the orifices may vary from those of the disclosed embodiment.

In addition the diameter of the orifices may be varied from those disclosed. While the sleeve valve has been shown in combination with a water-operated spray head attached to a conventional hose nozzle, it is contemplated that the valve can be employed with an air-operated spray head also.

It is to be understood that the invention is not limited to the precise embodiment described above and that minor modifications may be made within the scope of the invention.

What is claimed is:

1. In a spraying device of the type which includes an elongated conduit, the wall of which defines a fluid inlet end for receiving a supply of pressurized fluid, a fluid outlet end, an internal bore which has a portion of relatively restricted diameter intermediate said ends so as to form a suction zone, and a suction passage communicating through the wall with the suction zone for introducing fluid into said suction zone, said spraying device further including adjustable orifice means associated with said suction passage for selectively positioning different-sized orifices across said passage, the improved construction for said adjustable orifice means which comprises a cylinder having a longitudinal axis and a plurality of longitudinally spaced groups of different-sized passageways extending transversely therethrough, the extremities of said passageways of each group being circumferentially spaced from each other; and means mounting said cylinder transversely of said suction passage for rotation about the longitudinal axis of said cylinder and for longitudinal movement along said axis whereby one end of each of said passageways through said cylinder may be placed in register with said suction passage.

2. A spraying device as in claim 1 in which said cylinder is a hollow cylinder closed at its ends and in which each of said passageways through said cylinder is formed by a pair of holes through the wall of said hollow cylinder.

3. A spraying device as in claim 1 in which said mounting means further includes a latching member for said cylinder and means biasing said latching member into engagement with said cylinder and in which the exterior of said cylinder is provided with a plurality of cavities for receiving said latching member, said cavities being so spaced that said latching member is operable to latch said cylinder in a variety of positions each of which aligns one of said passageways with said suction passage.

4. A spraying device as in claim 3 in which said cavities are arranged in longitudinally spaced groups on the periphery of said cylinder and in which the cavities of each group are circumferentially spaced from each other.

5. A spraying device as in claim 3 in which indexing indicia are provided on the exterior of said cylinder for indicating which of said passageways is in alignment with said suction passage.

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