A spray nozzle bottle cap combination adapted for mixing a second fluid with a first carrier fluid. The nozzle is constructed and arranged so that it provides a dual function as a closure for a container filled with the second fluid during shipment or storage and proportioning spray device during use. Among other things, the nozzle includes a foolproof anti-suck-back feature, one piece construction, solid stream dispersing with fan spray option, clear water rinse and tangential feed hole connected to the aspirator or mixing chamber.

4 Claims, 6 Drawing Figures
SPRAY NOZZLE BOTTLE CAP

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a mixing device, with particular reference to a spray nozzle for mixing a second liquid with a first carrier liquid.

2. Description of the Prior Art

Many types of proportioning eductors for mixing a second fluid with a carrier stream of a first fluid have been widely used as, for example, to apply chemical solutions such as fertilizers, fungicides, insecticides, toxicants, soaps and detergents. A common device for such purposes is a spray nozzle adapted to communicate with a first and second fluids having educting means located therein to produce a suctional effect on the second fluid to educt it into the main stream of the first fluid and to mix it therewith, thereafter expelling the mixture through a discharge nozzle. These nozzles, usually adapted to be connected to a garden hose, function to educt a chemical solution into a stream of water under pressure from a garden hose connected to a pressurized water system. The nozzle maintains the ratio of educted chemical to water constant over a wide range of water pressure. This action of maintaining a constant ratio of educted chemical to water over a varying water pressure is called proportioning. Examples of this type nozzle are disclosed in U.S. Pat. Nos. 2,682,428; 2,264,539; 2,592,896; 2,951,645; 3,201,049 and 3,608,829.

The constant aim of manufacturers of these devices is to improve their operation and utility and at the same time reduce manufacturing costs. The present invention is directed to these ends.

SUMMARY

In general, the present invention provides a spray nozzle which differs from the known art in that it combines certain desirable features which heretofore were not available. The nozzle can be characterized as a simple, reliable, low cost, single unit which does not need a complicated, assembly procedure or testing and which is economically practical to dispose of after the second fluid has been exhausted. The nozzle is particularly useful for applying dilute chemical solutions such as fertilizers, fungicides, insecticides, toxicants, soaps, detergents and the like.

The nozzle may be injection molded or otherwise formed in a piece structure from any thermoplastic resinous material suitable for molding such as polyethylene, polypropylene, polystyrene, acrylonitrile butadiene styrene, nylon, polycetal resin, and the like. The nozzle may also be die cast from metals such as zinc but this is less desirable from a cost consideration.

The nozzle comprises means for supplying a stream of carrier fluid, means for educting a second fluid into the carrier fluid, means for mixing the second fluid with the carried fluid and means for discharging the mixture from the nozzle. The nozzle includes a positive air gap anti-suck-back feature, which in conjunction with a mixing or aspirator chamber, allows a solid stream discharged from the nozzle. An optional fan spray can be achieved with the nozzle, but an additional element providing an impinging surface for the solid stream is required. The nozzle also provides a clear water rinse and second fluid feed passageway or bore with a tangential opening connected to the aspirator or mixing chamber.

Since it is economically practical to consider the nozzle disposable, it can be constructed and arranged so that it provides a dual function as a closure for a container filled with a second fluid during shipment or storage as well as a proportioning spray device during use. When the nozzle functions as a closure and a conventional container or bottle with a threaded open mouth is used, it is necessary to provide a gasket to cover the mouth and prevent spilling of the container contents during shipment and storage. The gasket is then removed during use. In order to overcome the need for a gasket it has also been found that a special bottle, more fully described in the preferred embodiments, with an upper sealing portion can be used in combination with the nozzle. In order to affect a sealed closure, the special bottle is adapted to connect with the socket of the inlet extension for the carrier fluid where the upper sealing portion of the bottle engages an inner sealing edge to seal the bottle. During use the bottle is then connected with the socket of the inlet extension for the second fluid and holes in the upper sealing portion allow the second fluid to flow into the nozzle.

Commensurate with the scope of the invention, the previously noted feed passageway with a tangential opening into the aspirator or mixing chamber can be used with many types of nozzles where increased flow of the second fluid is desired or where initial contact between the carrier stream and second fluid is difficult to achieve. When an air gap anti-suck-back feature is used, the inlet opening into the aspirator chamber must have a larger diameter than the diameter of the exit hole from the carrier fluid extension, since the stream of carrier fluid passing through the air gap decelerates and expands in diameter. When the aspirator chamber is made large enough to insure no impingement of carrier fluid on the inlet opening of the same, the carrier fluid can lose contact with the inner walls of the chamber and a normal aspirator passageway, bored radial to the chamber, will not educt the second fluid into the chamber, even when bored oversize. This problem can be minimized by tapering the aspirator chamber toward its outlet, but this approach to the problem is limited since only a slight taper can be achieved without the carrier fluid backing up and spilling out into the air gap.

To accomplish good aspiration it has been found that a second fluid feed passageway formed with a tangential opening into the aspirator chamber provides a greater area for contact between the first carrier fluid and second fluid than can be achieved with a radial hole of equal diameter. The tangential feed passageway opening can also be extended into the aspirator chamber with tubing means to insure better contact with the first carrier fluid. As herein defined, the feed passageway opening is disposed generally tangentially to the periphery of the aspirator chamber. In addition to insuring contact between the carrier fluid and second fluid, the tangential feed passageway opening can also provide increased flow of the second fluid as compared to a radial passageway of equal diameter.
3,897,004

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention are even more apparent when taken in conjunction with the accompanying drawings in which like characters of reference designate corresponding materials and parts throughout the several views thereof, in which:

FIG. 1 is a partial side elevational view illustrating a spray nozzle and container in position for shipment and storage according to the principles of the present invention;

FIG. 2 is a partial side elevational view showing the spray nozzle and container of FIG. 1 in position for use;

FIG. 3 is a partial cross-sectional view of the spray nozzle and container shown in FIG. 2;

FIG. 4 is an enlarged fragmentary section taken on the line 4—4 of FIG. 3 showing the tangential second fluid feed passageway;

FIG. 5 is an enlarged fragmentary section similar to FIG. 4 illustrating extension of the tangential feed passageway into the aspirator chamber; and

FIG. 6 is a partial cross-sectional view illustrating a modified spray nozzle used with a conventional open mouthed threaded container.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the following description and terminology illustrates the manner in which the principles of the invention are applied but are not to be construed as limiting the scope of the invention.

More specifically referring to FIGS. 1—3, a spray nozzle 10 connected to a container or bottle 12 for holding a concentrated chemical solution such as a fertilizer, fungicide, insecticide, toxicant, soap, detergent or the like is illustrated. FIG. 1 illustrates the nozzle 10 functioning as a sealing closure on container 12 for shipment and storage and FIG. 2 illustrates the same in position for use. The nozzle 10 includes a first extension 14 with a socket 16 which is internally threaded at 18 to receive a conventional garden hose 20. Extension 14 includes a jet passageway 22 communicating with the socket 16 and an air gap 24. The nozzle 10 also includes a second extension 26 with a socket 28 which is threaded at 30 to receive container 12 and a discharge nozzle 32 having an aspirator chamber 34 therein. The inlet 36 of chamber 34 has a larger diameter than the jet passageway 22 in order to prevent impingement of water from the jet passageway 22 on the outside edge of inlet 36. A feed passageway 38 communicates with socket 28 and the aspirator chamber 34 so that concentrated chemical solution can be euted into aspirator chamber 34. Feed passageway 38 is formed tangentially into aspirator chamber 34.

An air bleed hole 40 which allows air to bubble into container 12 to replace the chemical solution euted into aspirator chamber 34 is also included in spray nozzle 10. Air bleed hole 40 can be the same diameter as feed passageway 38 or smaller if desired, since there is no tendency for chemical solution to leak through hole 40 when nozzle 10 is operated. If desired, air bleed hole 40 can be used to meter chemical solution by restricting the same.

The sockets 16 and 28 with threads 18 and 30 are the same size so that container 12 can be received by either of the same. Container 12 is specially designed with an integral conical upper member 42 having a truncated top end sealing portion 44 which engages a sealing surface 46 in nozzle 10 when placed in socket 14 to effect a sealed closure on container 12. Thus when container 12 is positioned in socket 14 it is sealed and ready for shipment or storage as shown in FIG. 1. When container 12 is transferred to socket 26, the nozzle 10 is in position for use since holes 48 in conical member 42 allow chemical solution in container 12 to pass into feed passageway 38.

Referring now to FIGS. 4 and 5, the tangential nature of feed passageway 38 formed into aspirator chamber 34 is clearly illustrated. The feed passageway 38 is disposed generally tangentially to the periphery of aspirator chamber 34. FIG. 5 also illustrates that feed passageway 38 can be extended into the chamber 34 with tubing means 39. This insures better contact between the water from hose 20 and the chemical solution euted through passageway 38 because of a larger area of contact and the extension provided by tubing means 39. An increased flow of chemical solution can also be achieved because of the larger area of contact as compared to a radial feed passageway of equal diameter.

Referring to FIG. 6, a modified nozzle 50 with a conventional threaded open mouth container 52 is illustrated. As shown in FIG. 6, when a conventional container 52 is used, it is necessary to provide a sealing gas ket 54 if the nozzle 50 is to also function as a closure for container 52 during shipment and storage. Container 52 is shown connected to socket 14 which is the hose 20 connection during use. This will minimize shipping space since the nozzle 50 is placed in an upright position. However, if it is desired to use a container 52 with a larger mouth diameter, the nozzle 50 can still function as a closure by connecting container 52 to socket 26 and using a gasket similar to that shown at 54.

The operation nozzles 10 and 50 are extremely simple since no dip tube is required for containers 12 and 52. A common garden hose 20 is first attached to socket 14 and containers 12 and 52 are attached to socket 26. Water supplied to the hose 20 is then turned on to provide a stream of clear water through nozzles 10 and 50. To eute a concentrated chemical solution into the water stream, the containers 12 and 52 are raised above the level of the nozzles 10 and 50 so that the chemical solution gravity flows into feed passageway 38.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A one-piece spray nozzle for mixing a second fluid with a first carrier fluid comprising a first extension adapted for connection with a source of first carrier fluid, a dip tube free second extension adapted for connection with a source of second fluid and a discharge nozzle having an aspirator chamber therein, said first
extension and discharge nozzle having an air gap therebetween, said first extension having a jet passageway communicating with the source of first carrier fluid and the air gap, said aspirator chamber having an inlet opening disposed adjacent the air gap and an exit opening to the exterior of said spray nozzle, said inlet opening being larger than the exit hole of the jet passageway and being disposed in line therewith, said second extension having a dip tube free feed passageway in communication with the source of second fluid and the aspirator chamber and adapted to educt the second fluid into the aspirator chamber as the first carrier fluid passes through the aspirator chamber, said first extension and said second extension having like sockets so that the first extension can be connected to the dispensing end of a container of second fluid as a sealing closure and alternatively to the source for said first carrier fluid, said first extension including a sealing edge adapted to engage a sealing portion at the dispensing end of the container extending further into the socket portion than the comparable portion of the second extension such that when the socket of the second extension is engaged with the container a gap is formed, said gap communicating with an opening in the second extension and forming an air bleed hole.

2. The spray nozzle of claim 1 wherein said feed passageway is formed with an opening fully tangential to the periphery of said aspirator chamber to maximize contact between the mixing fluids.

3. The spray nozzle of claim 2 wherein said tangential opening is extended into said aspirator chamber with tubing means.

4. The spray nozzle of claim 1 wherein said spray nozzle is formed from a thermoplastic resinous material.

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