May 28, 1968 J. H. TIDWELL 3,385,480

LIQUID MIXING AND DISPENSING APPARATUS

Filed June 15, 1967

FIG. 1

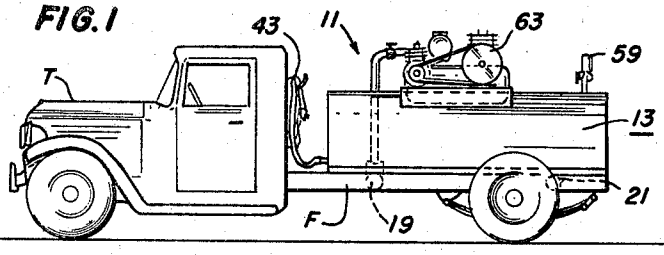


FIG. 2

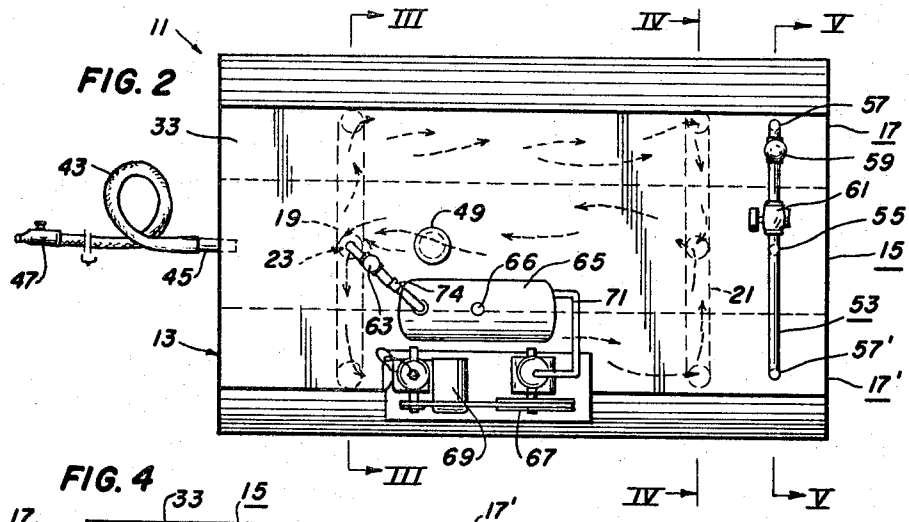


FIG. 4

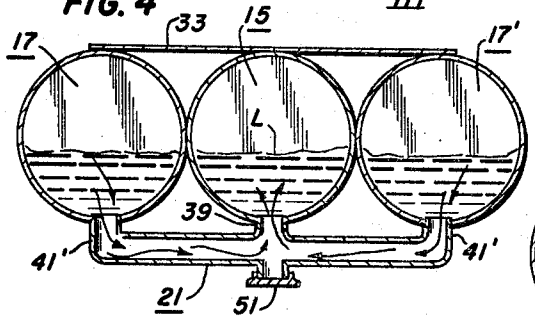


FIG. 5

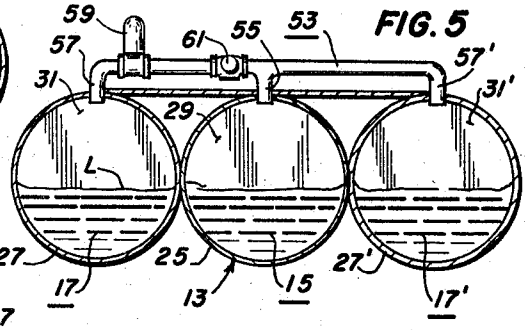
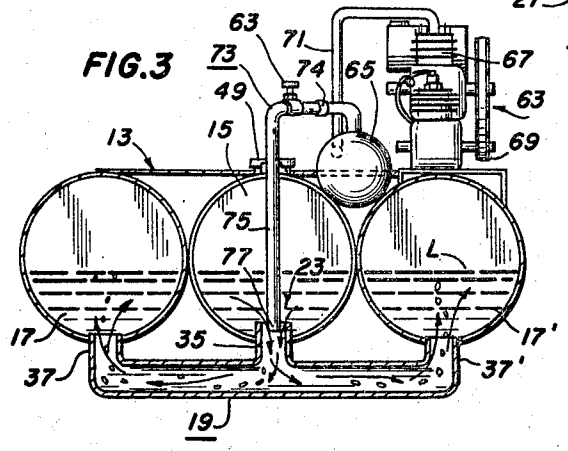


FIG. 3



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LIQUID MIXING AND DISPENSING APPARATUS

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ABSTRACT OF THE DISCLOSURE

Apparatus for mixing and dispensing liquids such as insecticide liquid, including at least two closed compartments, at least two separate passageways communicating the lower levels of the compartments and compressed air jet means directed into one of the passageways for causing liquid in one compartment to flow in the other compartment and the liquid to return under the force of gravity to the first-mentioned compartment—such action for causing the liquid to move in a continuous circular flow into and out of the compartments. Such actions being useful for mixing a liquid or powder insecticide concentrate with water or a base liquid—the mixing action also being adapted to be carried out while spraying or dispensing the insecticide material.

Background of the invention

(1) Field of the invention.—Apparatus for mixing liquids or for mixing powder with a liquid and for agitating and maintaining a uniform mixture of the materials while spraying or pressure-dispensing the materials.

(2) Description of the prior art.—Various compressed air actuated means have been designed for mixing and maintaining a uniform mixture of liquid insecticide material in a portable spray rig. Such means typically includes a tank, compressor means supplying compressed air to the interior of the tank and a spray line or flexible feed line running from the tank to the work area. Typically, the outlet end of the air line from the compressor inside the tank is arranged near the bottom of the tank and is submerged in the liquid spray material. As liquid material is used from the tank, the incoming air from the compressor in addition to maintaining spray pressure, also agitates the liquid. Patents No. 2,424,468 and 2,923,440 illustrate such devices.

A problem in such devices as disclosed in Patent Nos. 2,424,468 and 2,923,440 is that the liquid work material was not maintained in uniform consistency while the material was being dispensed or sprayed: Only a substantially small amount of air enters the tank to replace the volume of spray material used in the work. In prior art spray apparatuses, such a small amount of air replacing the liquid spray material in a spray tank was not sufficient to maintain the spray material in an adequtely uniformly mixed consistency.

Summary of the invention

The basic concept of the present invention is to provide two or more tanks or compartments and to utilize jet pump or aspirating means in a passageway between the tanks for forcing the work liquid fron one tank to another tank thereby raising the level of the liquid in the last-mentioned tank and to provide another passageway for the gravitational return of the liquid to the first-mentioned tank: The circular flow of the liquid under the influence of compressed air jet pump means and the influence of gravity keeps the liquid work materials in a uniformly mixed consistency. Another desirable feature of the present invention is that only a small amount of compressed air is required to thoroughly mix the spray material. A further desirable feature resides in the fact that by utilizing a plurality of relatively low tanks or compartments

on a transporting vehicle, the load or center of gravity of the load is arranged in a relatively low elevation and thus is easily transported. Also, by utilizing a plurality of relatively low tanks or compartments for containing the insecticide liquid, the liquid does not have a tendency to slosh around in the tanks as the apparatus is being transported; in contrast to a single tank supply means, the plurality of tanks or compartments of the present invention provides baffle means for preventing the sloshing of the liquid in transportation. This is particularly advantageous when turning corners since it alleviates the possibility of the trucks turning over due to a shift of the center of gravity of the truck, as might otherwise occur if there were a large single tank. The low silhouette of the apparatus also permits the driver of the transporting vehicle to see over the apparatus when backing the vehicle. This feature permits the driver to accurately spot the apparatus in a desired position.

Brief description of the drawing

FIG. 1 is a side elevational view of the liquid dispensing apparatus of the present invention mounted on a motor truck.

FIG. 2 is a top view of the apparatus.

FIG. 3 is a vertical sectional view taken as on the line III—III of FIG. 2.

FIG. 4 is a vertical sectional view taken as on the line IV—IV of FIG. 2.

FIG. 5 is a vertical sectional view taken as on the line V—V of FIG. 2.

Description of the preferred embodiment

The apparatus of the present invention, indicated by numeral **11**, is preferably mounted on frame F of an automotive truck T. Apparatus **11** preferably includes tank means **13** including compartment structures **15**, **17**, **17'** respectively; liquid manifolds **19**, **21** communicating the interiors respectively of compartments **15**, **17**, **17'**; and jet pump means **23** for circulating the liquid through compartments **15**, **17**, **17'** and manifolds **19**, **21**.

In the drawings and in the following detailed description apparatus **11** will be described as utilizing three compartments **15**, **17**, **17'**; it will, of course, be understood that in certain applications of the invention, more or less than the three compartments illustrated and described may be utilized if desired. It will also be noted that although the following description is directed towards apparatus for dispensing insecticide liquid L, other liquids or liquid-powder solutions may be handled or dispensed with the same or slightly modified structure.

Middle, left and right compartments **15**, **17**, **17'** are alike and include respectively side walls **25**, **27**, **27'** and end walls **29**, **31**, **31'** respectively. Cylindrical compartments **15**, **17**, **17'** are correspondingly juxtaposedly arranged and mounted lengthwise on frame F of truck T. Tank means **13** preferably includes a flat top panel **33** secured over compartments **15**, **17**, **17'**. If desired, the end walls of the compartments **15**, **17**, **17'** may be formed of a single plate, without departing from the spirit and scope of the present invention. Also, if desired, transverse baffles, not shown, may be provided in the interior of the compartments.

Liquid manifold **19** is symmetrically formed and includes a center inlet branch **35** and right and left outlet branches **37**, **37'** (see FIG. 3). Liquid manifold **19** is arranged at the forward underportion of tank means **13** and with manifold branches **35**, **37**, **37'** sealingly fitted respectively in the underportions respectively of compartment cylindrical walls **25**, **27**, **27'** of compartments **15**, **17**, **17'**. Liquid manifold **21** is structurally substantially like manifold **19** and includes a center branch **39** and right and left branches **41**, **41'**. Manifold **21** is fitted on the rear-

ward underportion of tank means 13 with branches 39, 41, 41' sealingly fitted respectively in the rearward underportions of cylindrical walls 25, 27, 27' of compartments 15, 17, 17'. Liquid manifold 19 functions for conducting liquid from middle compartment 15 to right and left compartments 17, 17'; liquid manifold 21 functions for conducting the liquid from the right and left compartments 17, 17' back to middle compartment 15. For purposes of clarity, and to distinguish over the inlet and outlet branches of manifold 19, branches 39, 41, 41' of manifold 21 will be designated respectively outlet branch 39 and inlet branches 41, 41'.

Hose means is provided for conducting liquid insecticide from tank means 13 to the work area. A long hose 43 is connected at its inlet end by a fitting 45 to the lower front wall of middle compartment 15 and communicates with the interior of tank means 13. If desired, hose 43 may be connected to the rearward front wall of middle compartment 15, which would allow the tank means to be placed close to the cab of truck T. The outlet end of hose 43 is provided with a fixture or valved nozzle 47 adapted to be manually manipulated in directing the liquid on the work being treated with insecticide. A filler cap closure 49 is threadedly fitted in the top portion of middle compartment cylindrical wall 25 and provides access means into the interior of tank means 13. A drain cap closure 51 preferably is fitted in the lower portion of liquid conduit 19 for draining excess insecticide liquid or for cleaning the tank means of the apparatus.

An air manifold 53 communicates the interiors of compartments 15, 17, 17' together and provides means for maintaining static and equal pressures in the compartments. Manifold 53 includes a center branch 55 and left and right branches 57, 57' sealingly fitted respectively in the rearward upper portions respectively of compartments 15, 17, 17'. A spring-loaded safety valve 59 is fitted in air manifold 53 and is adapted to release the air in tank means 13 when it reaches a predetermined pressure. A manually operative exhaust valve 61 is operably fitted in manifold 53 for use in bleeding or exausting the air from tank means 13. Opening exhaust valve 61 releases the pressure in the tank means so that filler cap 49 may be removed and access gained into the interior of compartment 15.

Compressor means 63 including an air tank 65 is mounted on tank means 13 and provides compressed air for energizing jet pump means 23 in the interior of middle compartment 15. If desired, compressor means 63 may be mounted on the truck frame or bed at the end of tank means 13 instead of on the top thereof. A relief valve 66 is provided for air tank 65. Compressor means 63 is somewhat typical and includes a piston type compressor unit 67 belt-driven by a gasoline engine 69. A discharge conduit 71 conducts air from compressor unit 67 to tank 65 and a feed conduit 73 conducts compressed air from tank 65 into the interior of tank means 13. A vertical section 75 of feed conduit 73 sealingly projects through the upper cylindrical wall of middle compartment 15. The downwardly opening nozzle 77 of feed conduit 73 is arranged directly over and in axial alignment with the upwardly opening circular opening of center inlet branch 35 of liquid manifold 19. The downwardly rushing jet of compressed air issuing from nozzle 77 enters liquid manifold branch 35, draws or syphons the liquid from compartment 15 and propels it into compartments 17, 17'.

A manually operative control valve 63 is fitted in feed conduit 73 for regulating the passage of air through the feed conduit. In addition, a check valve 74 is preferably provided in conduit 73.

The flow path of the liquid as it is being circulated by jet pump means 23 of the apparatus is illustrated (by arrows) in FIGS. 2–4: insecticide liquid in middle compartment 15 is propelled by jet pump means 23 through inlet branch 35 of liquid manifold 19, in opposite directions in the liquid manifold and into left and right branch outlets 37, 37' respectively in left and right compartments 17, 17'. The flow of liquid L simultaneously into compartments 17, 17' raises the level of the liquid in these compartments above the level of liquid in middle compartment 15. The liquid in compartments 17, 17', seeking a lower level, flows simultaneously through inlet branches 41, 41' of liquid manifold 21 and, by passing through outlet branch 39 of manifold 21, returns again into middle compartment 15. Under the influence of jet pump means 23 and gravity, the insecticide liquid is continuously circulated and the insecticide material uniformly mixed.

When the apparatus is in use, and the operator is dispensing liquid through hose 43, more vigorous circulation or agitation of the liquid may be obtained by slightly opening exhaust valve 61; opening the valve permits a greater volume passage of air through nozzle 77 and causes a stronger jet pump action than is obtainable by operating the apparatus with valve 61 in a closed disposition.

Insecticide solutions are typically "made" by mixing a relatively small amount of insecticide concentrate or powder with a large amount of water or other base liquid: The user of apparatus 11 may fill or charge compartments 15, 17, 17' by first introducing the insecticide concentrate or powder through filler cap closure 49 and then filling the compartments to a desired level with water or other base liquid. With filler cap closure 49 removed and with the compressor means operating, the liquid may be forcibly agitated or circulated by intermittently opening and closing control valve 63 in feed conduit 73. With control valve 63 closed, air pressure builds up in tank 65 and then upon opening control valve 63 a large flow of compressed air will exhaust through nozzle 77; the accumulated compressed air in tank 65 rapidly exhausts through nozzle 77 and causes a strong impulsive agitating action on the liquid. Such intermittent opening and closing of control valve 63 is particularly useful in mixing an insecticide powder with the base liquid. After the insecticide concentrate and base liquid has been mixed sufficiently, filler cap closure 49 is installed on middle compartment 15. When the pressure of the air in tank means 13 has been brought up to operating pressure, the user dispenses the material by manipulating hose nozzle 47 and directing the spray or stream on the work being treated. Also, if desired, the fixture 47 may be in the form of a connector so that the device can be used as a pressure treating device for termites, in which case the liquid is pumped under pressure into the permanently installed termite piping ssytem, with fixture 47 being connected to the inlet of the piping system.

Now, while I have shown and described an exemplary embodiment of the present invention, it will be understood that various modifications and rearrangements of components and elements of structure may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. Liquid dispensing apparatus particularly for dispensing liquid insecticide comprising tank means including structure defining a plurality of compartments including at least a first compartment and a second compartment, first liquid manifold means communicating said first and second compartments and having an inlet opening in a lower level of the interior of said first compartment and having an outlet opening in the lower level of the interior of said second compartment, second manifold means communicating said first and second compartments and having an inlet opening in a lower level of the interior of said second compartment and having an outlet opening in a lower level of the interior of said first compartment, means for conducting liquid from said tank means to a work area, and compressed air energized jet pump means

operatively fitted in said first manifold means for circulating the insecticide liquid in a circular flow from said first compartment through said first manifold means, into said second compartment, through said second manifold means and back into said first compartment.

2. The liquid dispensing apparatus of claim 1 in which said jet pump means includes a downwardly directed outlet nozzle directed over said inlet opening of said first liquid manifold means and in which said jet pump means is defined by the arrangement of said nozzle and said inlet opening of said first liquid manifold means; and in which said liquid dispensing apparatus includes cap closure means for gaining access to the interior of said tank means for introducing liquid into said tank means, air manifold means connecting said first and second compartments for maintaining static and equal pressures in said first and second compartments, compressed air supply means, and air conduit means communicating said compressed air supply means with said downwardly directed outlet nozzle.

3. Liquid dispensing apparatus particularly for dispensing liquid insecticide comprising a ground-running carriage having a frame, tank means supported on said frame adapted to contain a quantity of insecticide liquid, said tank means including structure defining a plurality of compartments including at least a first compartment and a second compartment juxtaposedly arranged, first liquid manifold means communicating said first and second compartments and having an inlet opening upwardly in a lower level of the interior of said first compartment and having an outlet opening upwardly in a lower level of the interior of said second compartment, second liquid manifold means communicating said first and second compartments and having an inlet opening upwardly in a lower level of the interior of said second compartment and having an outlet opening upwardly in a lower level of the interior of said first compartment, hose means for conducting liquid from said tank means to a work area, said hose means including an inlet end communicating with the lower interior level of said tank means and including an outlet end adapted to be manually manipulated for directing the liquid to a desired place, filler cap closure means for gaining access into the interior of said tank means for introducing liquid into said tank means, air manifold means connecting said first and second compartments for maintaining static and equal pressures in said first and second compartments, compressed air supply means including an air tank for accumulating compressed air, feed air conduit means communicating the interiors respectively of said tank and said first compartment and including a downwardly directed outlet nozzle arranged directly over said inlet opening of said first manifold means, the arrangement of said nozzle and said inlet opening of said first manifold means defining substantially jet pump means for circulating the insecticide liquid in a continuous circular flow progressively from said first compartment through said first manifold means, into said second compartment, through said second manifold means and back into said first compartment.

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