SELF-CONTAINED FOGGER

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7 Claims

ABSTRACT OF THE DISCLOSURE

A hand-carried self-contained fogger using an atmospheric pressure liquid supply, simple mechanical lift device for adding incremental quantities of liquid to a boiler, and a special boiler-coil configuration to assure relatively smooth, constant fogging in spite of incremental addition of liquid to the boiler.

BACKGROUND OF THE INVENTION

Foggers are widely used to distribute insecticide over relatively large areas. A great variety of liquid insecticides, particularly so-called oil-base liquid insecticide formulations, are available for use in foggers. However, foggers requiring high pressure dispersion of insecticide liquid are often cumbersome, require special skill and care in operation, and have all the disadvantages and risks inherent in high pressure equipment.

Foggers requiring blowers usually require electricity. Both of these disadvantages decrease the extent to which such foggers can be utilized.

It is an object of this invention to provide a convenient, completely portable, self-contained fogger which does not require electricity or pressurization of the liquid to be fogged. It is an object of this invention to provide a fogger which can be safely carried in automobiles or boats, and which can be used in camping areas, trailers, picnic sites, boats, trucks, boxcars, storage areas, garden areas, greenhouses and the like. It is another object of this invention to provide a fogger which can be carried in one hand, leaving the other hand free to open doors, or closets, and to move articles and the like while fogging is continuing. It is another object of this invention to provide a fogger which uses a simple finger-operated mechanical lift device to incrementally add small quantities of liquid to a boiler. It is also an object of this invention to provide a fogger which can utilize conventional widely available pressurized cans of fuel, such as the inexpensive butane cartridges, and which requires no special tool or skill in its use. It is the further object of this invention to provide a fogger which is relatively simple and economical to manufacture, thus having greater potential for widespread use. These and other objects will be apparent hereinafter.

SUMMARY OF THE INVENTION

This invention provides a hand-carried fogger dependent from a handle, having a burner, a boiler-coil, atmospheric pressure liquid tank, and finger operated lift means at the handle for lifting increments of liquid into the boiler. A preferred embodiment utilizes both a pressurized can cartridge fuel supply, and novel boiler-coil configuration for smooth efficient operation in spite of incremental liquid addition to boiler.

DESIGNATION OF THE FIGURES

FIG. 1 is an elevational view of a preferred embodiment of this invention.
FIG. 2 is a partially cross-sectional elevational view of the embodiment illustrated in FIG. 1, with the front half of the housing, or cover, removed therefrom.
FIG. 3 is an enlarged fragmentary, partially cross-sectional view of the center-most region of FIG. 2, as viewed in FIG. 2.
FIG. 4 is a fragmentary partially cross-sectional view taken along the line 4-4 of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

Although the following disclosure is offered for public dissemination, in return for the grant of a patent, it is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose; as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

In the illustrated embodiment the improved fogger, generally 10, includes the housing portion, generally 11, handle portion, generally 12, vaporizer section, generally 13, atmospheric pressure liquid reservoir 14, pressure can fuel supply 16, fuel dispensing regulator 18, liquid feed pump 20, feed pump operating handle 21, and nozzle 23.

FUEL CONTROL

The rate at which fuel is dispensed to vaporizer, generally 13, is regulated by regulator dia1 18. Regulator dial 18 controls valve assembly, generally 26, and is connected thereto by shaft or stem 25. Valve assembly 26 includes case or block 27, valve stem stuffing box 28, threaded section 30, regulating needle 31, valve seat 32, fine bore orifice 33, and venturi air intake portion 34. Valve assembly 26, in particular valve chamber 36, is in direct pneumatic communication with pressurized fuel can adapter 37. Adapter 37 includes can entry needle 38. Adapter 37 illustrated in the drawings is conventional and of the type in widespread use in conjunction with pressurized cans 16 of butane, propane, or mixtures of commercially available fuels. Such conventional systems are entirely satisfactory for use in accordance with this invention. However, in its broader aspect any pressurized fuel supply can be used in accordance with this invention.

VAPORIZER

Vaporizer section 13 includes housing 40, having air intake perforations 41 near housing 11 and exhaust discharge openings 12. Housing 40 is secured to housing 11 by suitable fastening means such as screw 44. Vaporizer section 13 is divided into two main compartments by vertical section 45 which fits closely around burner 47 and liquid feed line 48. It is preferred that housing 40 have minimum contact with housing 11 and in the illustrated embodiment, housing 40 contacts only a small portion of housing 40 in the region in which housing 40 is fastened to housing 11. End 50 is spaced apart from housing 11 to permit air to pass therebetween. Thus,
incoming air passing through perforations 41 and between end 50 and housing 11 serves to continually cool housing which in the region most closely adjacent housing 11. Air is drawn into chamber 51 by venturi air orifices 52 and burner orifices 53. However, except for heat conducted through metal parts, most of the heat generated by the burning fuel is kept on the far side of divider 45 in chamber 55. The hot combustion gases from burner 47 pass through housing 11, then through the interior of coil 57 formed by multiple winding of the tubing integral with feed supply tube 48. The exhaust gases thence pass out of burner section 13 through front orifices 42. Cap 58, through which nozzle 23 passes, otherwise closes the end of chamber 55 and prevents direct mixing of exhaust gases leaving chamber 55 with the material being discharged from nozzle 23. The shown configuration of conduit 48 in burner section 40, particularly within coil 57, is important and will be discussed in greater detail under “Overall Operation” hereinafter.

**LIQUID SUPPLY**

The liquid materials to be atomized or fogged is stored under atmospheric pressure in liquid tank 14 which is secured to housing 11 by threads 60 or other suitable fastening means. It is preferred that tank 14 be made of unbreakable plastic for safety. Mouth 61 of tank 14 bears against sealing element 62 which seals mouth 61 against liquid leakage. As illustrated in FIG. 4 it is preferred that sealing element 62 include a relatively strong backing layer 63 and a chemical resistant gasket layer 64.

Feed conduit 48 passes through a snugly fitting opening 66 in seal 62. Also, tie rod 68 passes through a snugly fitting opening 69. Upper end 72 of the rod 68 is pivotally attached to trigger-like activating means 21 which, in turn, is pivotally attached to housing 11 by insertion of handle 21 over post 70, as best seen in FIG. 2. Lower end 73 of tie rod 68 is fixed to ear 75 which extends laterally from cylinder 76. Cylinder 76 extends through lift pump 70. Cylinder 76 is fitted closely, but slidably around stationary piston portion 78. Cylinder 76 has an inwardly tapering opening 79 at the bottom thereof which serves as a seat for metal ball 80 and this arrangement permits flow into interior 82 of cylinder 76, but prevents flow in the reverse direction through opening 79. The interior wall of cylinder 76 also includes shoulder or other stop means 84 for spring 86. Since spring 86 rests on shoulder 84, and not on ball 80, it merely biases piston 76 downwardly and does not interfere with ball 80.

Stationary portion 78 includes opening 88 for hydraulically connecting interior 82 of cylinder 76 with the interior 90 of conduit 48. Ball 92 is biased against opening 88 by spring 94 positioned between ball 92 and the end of conduit 48. Spring 86 is thus positioned between shoulder 84 and stationary piston portion 78. Thus, movement of lever 21 upwardly raises tie rod 68 and slidable cylinder 76 against spring 86. Liquid in chamber 82 of cylinder 76 is thus lifted upwardly through opening 88 past check valve mechanism including ball 92 and spring 94 into interior 90 of conduit 48. Upon release of lever 21 the downwardly biasing effect of spring 86 urges cylinder 76 and, along with it tie rod 68 and lever 21, in a downward direction. As cylinder 76 moves downwardly through liquid in tank 14 downwardly biased ball 92 prevents return of liquid from interior 90 of conduit 48 into chamber 82 of cylinder 76. Instead, ball 80 is lifted from its seat 79, and atmospheric pressure within the tank 48 moves liquid (not shown for the purpose of clarity) from tank 14 into interior 82. If the above operation is repeated beginning with the lifting of lever 21, an additional increment of liquid is added to interior 90 of conduit 48. Thus, each lift of lever 21 raises an additional increment of liquid past ball 92 into interior 90 of conduit 48 and ball 92 prevents return of that increment into movable piston 76.

Also, the movement of tie rod 68 in and out opening

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**OVERALL OPERATION**

A liquid solution of insecticide, for example, solutions of insecticides in volatile organic solvents with or without various dissolved additives or charged to liquid tank 14. Tank 14 is then threaded securely into housing 11 to seal the liquid contents of tank 14 at substantially atmospheric pressure from significant leakage. A pressurized can of fuel, e.g., propane, butane or similar conventional fuels of the type conventionally used in camp stoves, camp lanterns, etc., is hand-forced into adapter 27 where it can enter nozzle 38 pneumatically connects the contents of can 16 with interior chamber 36 of valve assembly 26. Rotation of regulator 18 back valve needle 31 away from seat 32 thereby releasing a regulated quantity of fuel into fine bore conduit 33. Fuel leaving fine bore conduit 33 passes through partially adjustable orifices of substantially high velocity thus drawing air from chamber 51 into admixture with the fuel. A match or other ignition device ignites the combustible fuel venting initially from perforations 42 whereupon the flame front returns to the area immediately adjacent burner 47. Gases passing openings 53 in burner 47 are also moving at a relatively high velocity and consequently additional air is drawn from chamber 51 into burner 47 through openings 53. Thus, flame and/or hot gas passes from mouth 54 of burner 47 into chamber 55, and specifically along conduit 48 within coil 57. As handle 21 is lifted, the rod 68 elevates slidable cylinder 76 which lifts an increment of liquid into interior 90 of conduit 48 as described in detail above. Since nozzle 23 is always open, lifting liquid into conduit 48 generates no substantial pressure increase herein. Any slight momentary increase is relieved by passing of air and/or vapor out of nozzle 23. Repeated lifting of handle 21 thus repeatedly lifts increments of liquid into conduit 48 at atmospheric pressure.

With incremental addition of liquid, the liquid front or top surface moves within conduit 48, entering the interior of coil 57 near the bottom thereof, and moving a substantial distance into the interior of coil 57 before being lifted upwardly at bend 95. Conduit 48, still remaining within coil 57 then passes rearwardly to a point closely adjacent mouth 54 of burner 47, to region 94 where conduit 48 bends abruptly and is cooled to provide coil 57. The flame and hot gases emanating from burner 47 thus play over substantial horizontal lengths of conduit 48 located within interior of coil 57, as well as over the interior of coil 57, and to a lesser extent over the exterior of coil 57. Thus, the material in conduit 48 is rapidly pre-heated, particularly in the horizontal positions immediately before and after the bend at 95, and in bend 95.

As initial additional increments of liquid are lifted into conduit 48, some liquid may proceed rearwardly to point 94 and actually enter the helical portion of coil 57. It is noted that although some of the liquid in conduit 48 between housing 11 and bend 95 is not doubt heated substantially and may well vaporize to some extent, the liquid would naturally tend to remain an integral mass, save for...
formation of gas bubbles, until it reached the upper horizontal leg of conduit 48 between bend 95 and 94. In top horizontal leg between bend 95 and 94 liquid naturally tends to physically, or mechanically, break up and drain or flow along conduit 48 down into the first loop of coil 57. At such an occurrence it will be appreciated that there is obtained a sudden vast increase in the ratio of heated surface to liquid mass; hence, as a consequence of the configuration provided in the illustrated embodiment, an extremely high efficiency is achieved in the vaporization of the liquid being lifted into vaporizing section 13. Moreover, due to the novel configuration of the boiler tubing, the flow of vaporized material from the nozzle 23 is surprisingly smooth and steady in spite of the incremental addition of liquid. If the device is dispensing at too high a rate, as evidenced by excessive surging of fog when more liquid is added to the boiler, regulator 18 is used to decrease the heat input. Thus, a wide range in dispersion rates is possible.

Needless to say, inadvertent filling of a substantial portion of coil 57 with liquid does not render the fogger inoperative, and in fact, such a condition may under some circumstances be desirable. For example, an operator can use the fogger to operate the fogger of this invention to provide either a relatively "dry" fog or a relatively "wet" fog by decreasing, or increasing, the rate of lifting of liquid from tank 14 into burner section 13.

A fine high velocity steam stream of vaporized liquid, and vaporized and/or non-vaporized dissolved solids, depending on the make-up of the liquid in tank 14, thus passes from nozzle 23. Immediately upon mixing with the relatively cold atmospheric air the steam forms a fog, or a mist, which has been found eminently satisfactory in combating insects and other pests when conventional solutions of insecticides are employed in tank 14.

Thus, the operation of this invention does not require complex blowers. The apparatus of this invention, furthermore, completely separates the fuel system from the insecticides or other solutions being fogged. In addition, the convenience and degree of control provided by this apparatus have, in my opinion, been heretofore unavailable in conventional foggers. It is noteworthy that not only does tank 14 not communicate with the pressurized fuel system, but moreover it is under atmospheric pressure. It is also noteworthy that pump mechanism, generally 20, is not of the type necessary to develop liquid pressures which are necessary for pressure-atomizing liquids. Thus, pump mechanism, generally 20, is simply a means for mechanically lifting solution from tank 14 into conduit 48. Because of the unique arrangement and configuration of conduit 48 in burner portion 13, a degree of efficiency, and smoothness of operation which has here- }

Therefore, I claim:  

1. In a vaporizable liquid fogging device of the type which is dependent from a handle, the improvement including: an atmospheric pressure liquid storage tank; a vaporizer including a boiler having open communication to the atmosphere; hydraulic communication means connecting said boiler and said atmospheric pressure tank for transferring liquid from the tank to the boiler, said communication means including first check valve means for permitting liquid flow only in the direction toward the boiler and means for lifting incremental quantities of liquid from said tank into said boiler; operating means for operating said lift means, said operating means including: a) finger operated element associated with said handle; and fuel burner means for heating said vaporizer, said burner means including a burner having a longitudinal axis.

2. The improvement of claim 1 in which the boiler includes a coiled section of conduit connected to a U-shaped section of conduit, said coiled section having a longitudinal axis which is coaxial with said burner, the open end of the U-shaped section being situated above and below the axis of the burner near the mouth of the burner, the rounded portion of the U-shaped section lying across the axis of the burner, said U-shaped section lying within said coiled section, one leg of said U-shaped section being in hydraulic communication with said lift means, said cylinder being hydraulically connected to one end of said coiled section, the other end of said coil being pneumatically connected to an open nozzle.

3. The improvement of claim 1 in which said finger operated element comprises a pivoted lever situated on an underside of said handle, and in which said lift means includes a slidable cylinder having an opening at the bottom thereof, said opening being tapered downwardly and inwardly, second check valve means for permitting liquid to flow into said cylinder through said bottom opening, but not in the reverse direction, said cylinder having an elongated vertical axis, said slidable cylinder being snugly fitted and slidable around a stationary portion of said communication means, whereby said cylinder is in hydraulic communication with said communication means; means for attaching said cylinder to said lever, whereby lifting of the lever by the hand gripping the handle lifts the cylinder slidably upwardly over the station- ary portion of the communication means, thereby lifting liquid into the hydraulic communication means.

4. A vaporizable liquid fogging device including: an atmospheric pressure tank for storing the vaporizable liquid; vaporizer means for vaporizing the liquid; conduit means for conveying said vapor to storage tank for the vaporizer; a check valve means for converting said storage tank to the vaporizer means, said conduit means including a conduit check valve permitting flow only in the direction toward the vaporizer means; mechanical lift means for lifting incremental quantities of liquid from said tank into said conduit, said lift means including finger operated moving means for moving said lift means; and heater means for heating said vaporizer means.

5. The improvement of claim 4 in which the heater means includes a burner having a longitudinal axis and in which the vaporizer means includes (a) a coil formed of tubing, said coil having a longitudinal axis which is coaxial with said burner, and (b) a U-shaped section of conduit, the open end of the U-shaped section being situated above and below the axis of the burner near the mouth of the burner, the bottom portion of the U-shaped section lying within said coil, one leg of the U-shaped section being in hydraulic communication with the lift means, the other leg of the U-shaped section being hydraulically connected to one end of said coil, the other end of the coil being pneumatically connected to an open nozzle.

6. The improvement of claim 4 in which the lift means includes a slidable cylinder having an opening at the bottom thereof, cylinder check valve means for permitting said liquid to flow into said cylinder to said bottom opening, but not in the reverse direction, said cylinder having an
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7. Elongated vertical axis, stationary conduit means around which said slidable cylinder is snugly fitted, said stationary conduit means including an opening hydraulically connecting the interior of the cylinder and the hydraulic communications means.

7. The improvement of claim 4 in which the heater means includes adapter means for receiving, retaining, and pneumatically connecting a prepressurized cartridge fuel supply to said heater means.

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References Cited
UNITED STATES PATENTS
574,049 12/1896 Trigg ---------------- 43—57
3,074,199 1/1963 Johnson et al. ------- 43—129
3,229,409 1/1966 Johnson ------------ 43—129

WARNER H. CAMP, Primary Examiner