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THERMAL AEROSOL DISPENSER

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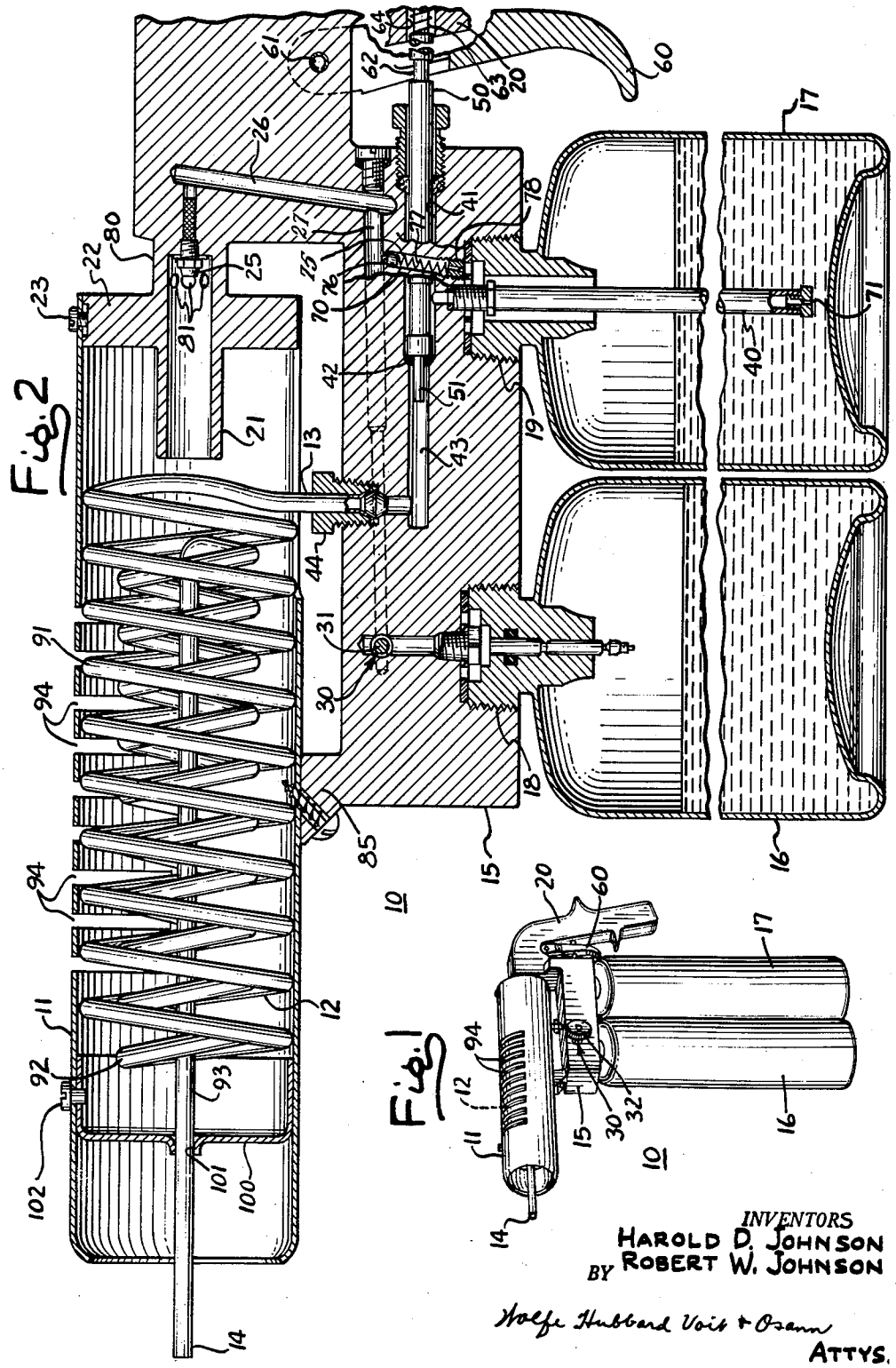

Fig. 2

Fig. 1

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THERMAL AEROSOL DISPENSER

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12 Claims. (Cl. 43—129)

The present invention relates to aerosol dispensers and more particularly to a self-contained, hand held dispenser of the thermal type for vaporizing liquid aerosol insecticides or the like.

In the controlling of insects, for example mosquitoes, it has been found effective to generate a fog consisting of minute droplets conveniently referred to as an "aerosol." It is common practice to create an aerosol, for insect control purposes, by dissolving an insecticide, for example DDT, in a vaporizable mineral oil, or mixture of oils, heating the same to such high temperature that vaporization occurs. Devices for accomplishing this on a commercial scale have been designed; however, they are usually heavy and cumbersome, in many cases truck-mounted. It is a common practice, in vaporizing the oil, to mix the liquid aerosol with the products of combustion from the heat source so as to utilize a large proportion of the available heat. However, this tends to bring about harmful chemical reactions, particularly where the temperature is allowed to become excessive. Because of various operating difficulties, aerosol dispensers capable of high output are generally operated by commercial services or municipalities and under the control of a trained operator.

It is an object of the present invention to provide a portable aerosol dispenser of the thermal type capable of producing a fog having maximum effectiveness, with an optimum range of droplet size, and which permits generation of a dense fog insuring effective concentration in the space being treated while avoiding wasteful precipitation. It is another object to provide a portable aerosol dispenser in which the insecticide, or similar additive, is maintained fully effective and which avoids the deterioration to which such additives are subjected in dispensers of conventional design, either because of excess temperature or as a result of mixing with the products of combustion from the heat source. This permits use of relatively unstable but effective agents not usable or practical heretofore. More specifically, it is an object to provide an aerosol dispenser having a vaporizing coil in which the aerosol material is continuously vaporized from the liquid form but which nevertheless avoids destructive overheating as might be caused, for example, by obstructing the flow or by the existence of "hot spots" along the path of flow. On the contrary it is an object to provide an aerosol dispenser in which the temperature of the aerosol is progressively increased to the vaporization range, and with the temperature reaching a maximum just prior to discharge so as to avoid destructive superheating of the generated fog or vapor.

It is another object of the invention to provide an aerosol dispenser which, although portable and compact, nevertheless has a high heat-producing capability and which is able to produce fog or vapor at a rate which characterizes much larger, truck-transported apparatus. It is a further object in this connection to provide an aerosol dispenser which not only has a high production rate but which has a high efficiency as measured in cubic feet of fog per gallon of liquid used to produce the aerosol and which may be referred to for convenience as "aerosol liquid." It is a related object to provide an aerosol dispenser of the above type which is capable of being held,

by a convenient pistol grip, in one hand of the operator for easy manipulation. It is also an object to provide an aerosol dispenser which is not only light and compact but which has a comfortable "feel" and which may be held, where necessary, for long periods of time without fatigue.

It is another and related object to provide an aerosol dispenser which is not limited to use in the open air but which may be easily carried into buildings and other confined locations. The device is characterized by an elongated discharge nozzle which may, in fact, be thrust into cracks and openings containing, or suspected to contain, insect life. In this way the spaces between walls, the spaces between the ceiling and the floor above etc. may be treated with an exceedingly high fog concentration of insecticide or other agent.

It is yet another object to provide an aerosol dispenser which is not only easy to carry about but which does not require adjustment and which may be successfully used without any prior experience. Thus to put the device into operation, the fuel gas is simply turned full on without necessity for throttling adjustment. In this connection it is an object to provide an aerosol dispenser having a self-contained source of fuel gas under pressure and a self-contained source of aerosol liquid with provision for automatically controlling the rate of liquid flow and for automatically varying the rate of flow of the liquid in accordance with changes in the pressure of the gas. Such coordination of the fuel rate and aerosol rate tends to insure that where the device is operated either intermittently or over a long period of time the aerosol liquid will tend to be vaporized to the right degree, with the temperature being neither too high nor too low, without necessity for constant readjustment of the flow rate. It is also an object to provide an aerosol dispenser which, once the fuel has been lighted, need not be operated continuously and in which the flow of the aerosol liquid may be turned on and turned off by a convenient trigger valve during warm-up and to conserve the aerosol while, nevertheless, minimizing the effect of excessive temperatures during the time when the aerosol is not flowing.

It is still another object related to the foregoing to provide an aerosol dispenser in which the aerosol liquid is progressively heated and vaporized but which is free of any artificial restriction except that which results from the friction of the aerosol with the interior surface of the vaporizing coil so that the vapor is free to pass through the unit with a high velocity and minimum obstruction for discharge before excessive temperatures are reached.

It is a still further object of the present invention to provide an aerosol dispenser intended to be hand held and capable of employing high heat rates on the order of 25,000 B.t.u. per hour but which has novel cooling provisions permitting operation for long periods of time without the device becoming uncomfortable to the operator and without any progressive heat buildup in the handle or other parts of the device.

It is yet another object of the present invention to provide an aerosol dispenser of the thermal, hand held type which is safe to use and which does not require the taking of any special precautions. In operation the flame is simply turned on and the trigger is pressed to permit flow of the aerosol liquid into the vaporizing coil. It is a related object to provide an aerosol dispenser in which the vapor and products of combustion are separated by discharging them in different directions thereby substantially eliminating the risk that the aerosol vapor will "catch fire." Moreover, since the vapor is isolated from the products of combustion, the nozzle may be directed into closed spaces containing combustibles with out creating a fire hazard.

It is a detailed object of the present invention to pro-

vide an aerosol dispenser which is quiet in operation and which avoids the noisy percussion effect of internal combustion type dispensers of about the same thermal and volumetric capacity. It is another detailed object to provide an aerosol dispenser which uses readily available fuel (propane) and which is capable of employing oil-based liquid insecticides of widely varying composition and obtainable in many instances free of charge from municipal insect control authorities.

Finally it is an object of the invention to provide an aerosol dispenser which is simple and inexpensive to construct and which requires little or no maintenance even when operated over long periods of time.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a perspective of an aerosol dispenser constructed in accordance with the present invention.

FIG. 2 is a longitudinal section taken through the dispenser of FIG. 1 to bring out the details of construction.

While the invention has been described in connection with a preferred embodiment, it will be understood that we do not intend to be limited to the embodiment shown and intend to cover the various modifications and equivalent constructions which may be included within the spirit and scope of the appended claims.

Turning now to the drawings, an aerosol dispenser **10** constructed in accordance with the present invention includes a horizontally arranged burner tube **11** containing a vaporizing coil **12** having an inlet end **13** and a discharge end or nozzle **14**. Extending horizontally under the burner tube **11**, and spaced from it, is a valve body **15** having a fuel tank **16** charged with propane or the like and an aerosol tank **17** charged with aerosol liquid, for example, insecticide, suspended below it, side by side. The tanks are conveniently screwed into the valve body at screw connections **18**, **19**. Secured to the valve body and to the rear end of the burner tube is a handle **20** in the form of a pistol grip, enabling the dispenser to be supported and manipulated by the hand of the operator.

In carrying out the present invention, a burner is provided within the burner tube for heating the vaporizing coil using gas fed from the fuel tank **16**. In the present instance the burner, indicated at **21**, is axially located at the rear end of the tube, being mounted on a burner disc **22** fitted into the tube and which may be held in place by mounting screws **23**. Forming a part of the burner nozzle is a threaded insert **25** which defines a gas metering orifice. This orifice is in communication with a passage **26** within the handle and a longitudinal passage **27** within the valve body and which leads to the fuel tank **16**. For the purpose of turning the gas on and off, a gas valve **30** is provided of a type well known in the valve art having a threaded stem terminating in a tip or needle **31** which seats against a suitable seat in the valve body. The stem mounts a knob **32** at its outer end.

For the purpose of supplying aerosol liquid to the vaporizing coil **12**, a dip tube **40** is secured to the valve body so as to extend down to the bottom of the tank **17** and with the upper end of the tube being preferably threaded into the valve body. Horizontally bored in the valve body and communicating with the upper end of the dip tube is a valve recess or bore **41** having a valve seat **42**. Communicating with the bore **41** is a passageway **43** leading to a connection **44** with the inlet end **13** of the vaporizing coil. In order to control the flow of the aerosol liquid into the vaporizing coil, a valve plunger **50** having a stem or tip **51** is fitted into the bore **41** for seating on the valve seat **42**.

In accordance with one of the aspects of the present invention, a trigger operator is provided for the valve plunger **50** associated with the pistol grip **20**. Such operator is in the form of an elongated trigger **60** pivoted on a pin **61** and engaging a neck **62** formed on the rear end of the valve plunger **50**. In order to bias the valve plunger and trigger forwardly into the valve-seated position, a biasing spring **63** contained within a bore **64** in the handle presses against the end of the valve plunger. Pulling upon the trigger **60** retracts the valve plunger from the seat **42** to permit flow of the aerosol liquid from the tank **17** into the inlet end of the vaporizing coil. The arrangement is such that the trigger is "pulled" when the pistol grip is held in the normal way.

Further in accordance with the present invention, means are provided for pressurizing the aerosol liquid and metering the same in accordance with the pressure of the gas supplied to the burner so that the pressure applied to the aerosol liquid varies in accordance with the variations in gas pressure. Thus the rate of flow of the aerosol liquid tends to vary with the amount of heat being liberated at the burner without necessity for constant adjustment of the dispenser by the operator. In the present instance this is accomplished by the simple expedient of providing communication between the gas passageway **27** and the interior of the aerosol tank **17** and by conducting the liquid from the tank through a metering orifice. Thus it will be noted in FIG. 2 that a vertical connection **70** is made, by drilling or otherwise, between the tapped receptacle **19** of the aerosol tank **17** and the gas passage **27**. Moreover, a metering orifice **71** is provided in the dip tube. In the present instance the metering orifice is located at the bottom end of the tube, but it may, if desired, be located elsewhere in the path of liquid flow, for example, at the top of the tube. For the purpose of preventing any escape of gas from the aerosol tank after the gas valve **30** is turned off and to cause a pressure differential between the gas passage **27** and the tank, a check valve **75** is provided having a poppet which is pressed against a seat **76** by a small coil spring **77**, having a threaded retainer **78**. It will be understood that the spring **77** exerts a relatively light pressure so that the check valve is readily unseated by the gas pressure which exists in the passageway **27** under normal operating conditions.

The spring pressure nevertheless is such as to establish a pressure differential between the gas line **27** and the tank of aerosol liquid, especially where the line pressure is more than is needed for effecting pressurized flow of the liquid. Adjustment of the spring by the retainer **78** provides a convenient means of adjusting fluid flow, other factors being held constant.

It will be apparent, then, that whenever the gas control valve **30** is turned on to supply gas to the burner, gas pressure is applied to the surface of the liquid aerosol tending to force the aerosol through the metering orifice **71**, up the dip tube **40** and through the vaporizing coil **12** at a rate which depends upon the gas pressure. At room temperature liquid propane exerts a pressure of about 125 p.s.i. However, it will be appreciated by one skilled in the art that the pressure of the gas may vary over rather wide limits with temperature. Thus as the gas is drawn off, the change of state, from liquid to gaseous, causes the temperature of the tank to drop which in turn causes the pressure of the gas to be lowered by a substantial percentage with consequent reduction of the amount of heat liberated at the burner. A short period of non-use causes the pressure to be restored to the original value. Turning the device on again lowers the pressure. Thus it can be seen that liquid propane, or similar fuel, is subject to relatively wide pressure variations particularly where, as here, the size of the tank is small as compared to the rate of fuel consumption. As stated, because of the novel coordination between the liquid and gas pressures, the present device enables efficient vaporization without adjustment regardless of whether the device is used constantly or intermittently.

It will be understood that the term "vaporization" is used herein in a general sense to denote conversion from the liquid state, not into gas, but rather into the form of fine droplets or fog. The selection of the proper orifice **71** is a matter well within the skill of the art, the orifice

being simply increased or decreased, maintaining all of the other parameters constant, until the droplet size is optimum, say, within the range of 10–12 microns. Too high a rate of flow of aerosol liquid results in insufficient vaporization and the production of large droplets which are inefficient and wasteful, while too small a flow produces over-vaporization or gasification with the result that the particles are too small to be effective. Once the proper diameter of orifice is established it can be used without change until the conditions are changed in some substantial respect, as, for example, by switching to a radically different aerosol.

In accordance with one of the aspects of the present invention the present device is constructed so that the valve body 15 and the pistol grip 20, particularly the latter, are maintained at a safe and comfortable temperature even when the dispenser is used over a long period of time and in spite of the large amount of heat liberated by the burner 21. This is accomplished in part by minimizing the heat conductive path between the burner tube and the pistol grip and by providing between them openings for aspirating the burner air. Thus in the present instance there is provided a relatively narrow stem or neck 80 having a plurality of radially directed aspirating openings 81 through which air is drawn by venturi action into the stream of gas. Since a substantial amount of air is required for combustion, this provides an effective barrier to direct heat flow from the burner tube. In order to provide additional cooling effect, the valve body 15 and the pistol grip or handle 20 are thermally coupled together and made of good conducting metal such as aluminum so that the change of state of the fuel from liquid to gaseous is effectively utilized to cool both the valve body and the handle. It will, moreover, be understood that passage of the relatively cool aerosol liquid from the tank 17 through the passage 43 of the valve body provides a cooling effect.

For the purpose of minimizing direct heat conduction from the burner tube to the valve body, the two are largely isolated from one another. Thus the mounting pad 85 used at the front end of the valve body is of limited cross section, sufficient only to provide the necessary mechanical strength and rigidity. It may be noted that such pad, being located at the extreme front end of the valve body, is closely adjacent the point of connection 18 of the gas tank 16 so that the heat transmitted by the pad is locally absorbed by the change of state of the gas, with little left over to reach the pistol grip. The heat which is transmitted through the pad 85, in fact, performs a useful purpose to the extent that it tends to counteract wide swings in the temperature of the tank 16, hence keeping the gas pressure more nearly constant. The coil itself is not effective to conduct heat to the valve body at connection 44 since it is constantly cooled by the aerosol liquid. Because of the above, the aerosol dispenser may be operated comfortably on a continuous basis at extremely high heat rates on the order of 25,000 B.t.u. per hour.

Not only is the pistol grip maintained at a relatively low temperature, but also the device includes novel provision for preventing overheating of the burner tube itself. Thus it will be noted in the drawings that the vaporizing coil has an initial set of helical convolutions 91 at the inlet end which are such diameter as to be closely adjacent the inside wall burner tube with good thermal coupling with the wall of the tube. It will therefore be apparent that, notwithstanding the liberation of a large amount of heat within the burner tube, the relatively cool aerosol liquid flowing through the initial convolutions 91 tends to maintain the tube at a lower temperature than would otherwise be possible. This tends to reduce the hazard of igniting something combustible by inadvertent contact with the wall of the tube. Preferably the inlet portion of the vaporizing coil, which is subjected to the major cooling action of the entering liquid, is located at the rear end of the tube and closely adjacent the handle of the device.

In accordance with one of the most important aspects of the present invention, means are provided for maintaining the products of combustion completely separate from discharged fog or effluent flowing from the vaporizing coil, with the products of combustion being discharged in one direction, for example, through vents provided at the top of the burner tube while the effluent is discharged in another direction, for example, forwardly through a discharge nozzle which extends some distance away from the burner tube. Moreover, in accordance with the present invention the burner tube has a barrier in the form of a cap at its forward end which is axially penetrated by the nozzle of the vaporizing coil for the purpose of providing positive isolation between the combustion chamber and the discharge nozzle. In the present instance the products of combustion are discharged through a series of vents 94 formed in the upper side of the burner tube, such vents being preferably in the form of spaced transverse slots machined in the wall of the burner tube. Such slots are distributed over a length which is an appreciable portion of the length of the outer convolutions 91 of the vaporizing coil so that all portions of the coil are vented to about the same degree. To isolate the discharge nozzle 14, a barrier or end cap 100 is provided at the forward end of the burner tube having a central access opening 101 through which the nozzle 14 of the vaporizing coil projects. The cap may be held in place by means of machine screws 102 or the like. The fit between the vaporizing nozzle 14 and the opening 101 is preferably rather snug so that the nozzle is effectively sealed. As a result of the isolation thus provided there is no possibility that the effluent will become contaminated by the products of combustion or that chemical reactions will occur with the products of combustion at the high temperature so that the insecticide or other aerosol is maintained at full effectiveness. Moreover, the point of discharge is sufficiently removed from the region of high temperature so that there is little or no possibility that the effluent will inadvertently "catch fire" which, while not, of itself, dangerous, may nevertheless be startling to the user and might cause him to drop the dispenser to create a fire hazard.

In accordance with one of the aspects of the present invention, a second or inner set of convolutions is provided in the vaporizing coil terminating in an axial, straight run portion leading to the discharge nozzle 14 of the coil. Thus, referring to FIG. 2 it will be noted that the outer convolutions 91 are integrally joined to a set of helical inner convolutions 92 which are in a "folded back" relation with respect to the convolutions 91 and which lie in a position to be directly acted upon by the flame, and to some extent to confine the flame which proceeds from the burner 20. The inner convolutions 92 are joined to a central, straight run of tubing 93. The tubing forming the vaporizing coil is preferably in one piece having a constant diameter all the way from the inlet end 13 to the discharge end 14. It is found that such a novel arrangement of vaporizing coil produces progressive heating and progressive vaporization of the aerosol liquid, with the coil being free of any artificial restriction so that the aerosol may proceed through the coil uninterruptedly and at a velocity which depends upon a number of factors including the inlet pressure and the friction to fluid flow provided by the inner walls of the coil. With regard to the progressive heating of the aerosol, it will be noted that the inlet end 13 and the first few convolutions 91 are in a relatively cool position so that the aerosol liquid is gradually brought up to a temperature where vaporizing commences without any possibility of sudden and unwanted "flashing." As the aerosol continues its passage through the inner convolutions, the temperature is further increased to the point where vaporization of the less volatile fractions occurs. The hottest portion of all is the portion

93 of the vaporizing coil which lies in the direct path of the flame and which leads directly to the discharge end of the coil. Since the aerosol is progressively raised to the point of maximum temperature and maximum vaporization just prior to discharge, and since the velocity of discharge varies with the heat which is applied, the present construction minimizes the possibility that the aerosol will be deteriorated by subjecting it to excessive temperatures. This is particularly important when employing aerosol liquids containing pyrethrins which may be broken down when subjected to temperatures greater than, say, 600° F. The carrier liquid should preferably consist of fractions having a vaporization range of which is safely below the point at which a breaking down of the active ingredients may take place. For example, where pyrethrins are used, a carrier should be selected having components which vaporize between 450° F. and 550° F.

Not only does the present device tend to protect heat-sensitive insecticides or the like from overheating, but studies indicate that the operation within the vaporizing coil is such as to promote formation of fog droplets of optimum size. Thus the low boiling point fractions, because of the progressive heating, tend to be vaporized first. The vapor thus formed propels the remaining, higher boiling point fractions, which are still in liquid form, through the tube at high velocity and with a high degree of turbulence, breaking the liquid up into tiny droplets. Such droplets in turn suffer vaporization as higher temperatures are reached, further increasing the velocity and turbulence. Depending upon the ratio of heat to amount of aerosol liquid flowing, and upon the length and diameter of the tube, this process is in the present device, carried to a degree where the resulting droplets have a range of between 10 and 12 microns which has been found to be optimum. It is possible that a certain proportion of droplets in this range are formed by vapor condensation after ejection. Droplets of such size remain air borne for long periods and are thus able to penetrate wherever air can penetrate and yet the droplets are, predominately, of a size large enough to be effective when brought into contact with any common insect. The low boiling point vapors upon ejection may recondense into droplets having a size which may lie below the above range, but such recondensed material forms only a small proportion of the total and hence is not particularly significant.

While the temperature of the effluent is maximum just prior to discharge, it is immediately cooled upon striking the atmosphere so the effluent, as little as a foot or so away from the nozzle, may be termed "cool."

Operation is simplicity itself. The gas valve **30** is turned on by unscrewing it a predetermined amount, say one turn. The flame is lighted. The aspirating openings **81** may be covered by the fingertips to facilitate lighting and warmup. When the temperature of the coil is high enough to produce vaporization, which takes 5 to 10 seconds, the trigger is pressed to produce copious volumes of a fog. The device may be used without further adjustment until a falling off in the amount of fog indicates replenishment of the aerosol tank is necessary. The device is capable of operating successfully even though the temperature and hence pressure of the fuel tank drops due to "boil off" of the liquid fuel because the fuel rate and insecticide rate both vary in the same direction upon variations in pressure. However, if it is desired to substitute a fresh tank, at ambient temperature, this is but a simple matter of twisting one tank out, another in. No trained operator is needed and the device may be operated safely by the average householder.

When it is desired to terminate the flow for a short time, the trigger is released. While this will of course cause the temperature of the coil to go up, subsequent pressing of the trigger, releasing aerosol liquid into the coil has a quenching effect so that the temperature is immediately and automatically restored to the proper operating range. For longer standby periods, the gas valve may be turned down.

It is found that the volume of fog produced by the present device in spite of its portability and compactness nevertheless approaches the volume produced by much larger vaporizing machines. Thus the relatively small hand held device, having a 15 inch maximum dimension and weighing about eight pounds fully loaded, is capable of generating up to 3300 cubic feet of fog each second. As a measure of efficiency the device is capable of converting a single gallon of insecticide into approximately 6½ million cubic feet of pest-killing fog.

Use of the device is not restricted to the out-of-doors. On the contrary, because of its safety, portability and compactness, the device may be used indoors, especially for the purpose of injecting the effluent through small cracks and openings. Sufficient pressure and velocity are developed at the nozzle so that the fog is literally "pumped" into an enclosed space, with the products of combustion being safely diverted as described.

While the present fogging device is particularly suited for use with insecticide, it will be understood that it is not limited thereto but may be used for dispensing various substances for a wide variety of purposes including fumigants, deodorizers and bird and animal repellants, to name a few.

Conveniently, propane or similar liquified hydrocarbon available in charged tanks of the type illustrated may be used as the fuel.

As to materials of construction, any heat resistant metal may be used for the burner tube and coil. However, metals should not be used in the coil which have a catalytic effect upon any component of the aerosol liquid being used.

In the following claims the term "burner tube" has been used for convenience to designate means defining a combustion chamber; however, it is to be understood that the term is not necessarily limited to use of a tube or cylinder whether horizontally or vertically disposed, but shall be broadly construed to cover equivalent enclosures which may differ therefrom in specific geometric shape. Moreover, where the outer coil convolutions are spaced so close together as to form a chamber to confine the flame, it will be apparent to one skilled in the art that the outer surfaces of such convolutions perform the function of the burner tube and can, accordingly, be considered to be the "burner tube" for the purpose of reading the claims.

This is a continuation of application Serial No. 29,429 filed May 16, 1960, now abandoned.

We claim as our invention:

1. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said burner tube and occupying a substantial portion of the length thereof, said vaporizing coil having an inlet end and a discharge end together with means for supplying aerosol liquid to the inlet end under pressure, a disk at one end of said tube and having a burner nozzle centered therein, a stem on said disc for supplying combustible gas to the nozzle for heating of the vaporizing coil, a handle secured to the stem and means having aspirating openings in said stem for aspirating combustion air to said burner thereby to maintain the handle at a cool operating temperature.

2. In an aerosol dispenser the combination comprising a horizontal burner tube, a vaporizing coil in said burner tube having an inlet end and a discharge end, means for supplying aerosol liquid to the inlet end, a valve body under said tube and in heat transferring relation with the latter, a handle on said valve body for manually supporting the dispenser, a burner nozzle in said tube adjacent said handle, means including a tank of liquified combustible gas secured to the valve body, means defining a gas passageway in the valve body interconnecting the

tank and the burner nozzle, said valve body being of good conducting metal and in good heat transferring relationship with respect to said handle so that the handle and valve body are maintained at a safely low temperature by the change of state of the liquified gas and notwithstanding transfer of heat from the adjacent burner tube.

3. In an aerosol dispenser the combination comprising a frame, a burner tube mounted thereon, a vaporizing coil in said burner tube having an inlet at one end and having a discharge nozzle at the other end, means secured to the frame for supplying liquid aerosol under pressure to the inlet end of said vaporizing coil, means secured to the frame for delivering combustible gas to said burner tube for combustion therein so that the aerosol liquid is progressively vaporized to vapor form for discharge from the nozzle of the vaporizing coil, said burner tube having vents for escape of the products of combustion, a handle secured to the frame, valve means in said frame at the inlet end of the vaporizing coil for controlling admission of aerosol liquid to said coil, and valve means in said frame for controlling the flow of combustible gas to the burner tube.

4. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, means for supplying aerosol liquid to the inlet end of the coil, means for pressurizing the aerosol liquid supplied to the inlet end of the coil, a burner nozzle in said burner tube, means for delivering combustible gas to said burner nozzle under pressure so that the combustion thereof vaporizes the aerosol liquid in said coil for discharge from the discharge end thereof in vapor form, and means for coordinating the pressure of the combustible gas with the pressure on the liquid so that the rate of flow of the aerosol is varied in accordance with the amount of heat liberated in the burner tube.

5. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, a tank of aerosol liquid having a dip tube connected to the inlet end of the coil, a burner nozzle in said burner tube, means including a gas supply line for delivering combustible gas to said burner nozzle under pressure so that the combustion thereof vaporizes the aerosol liquid in said coil for discharge from the discharge end thereof in vapor form, and means for connecting the gas supply line to the tank of aerosol liquid for pressurizing the latter so that the rate of flow of the aerosol liquid into the coil is coordinated with the amount of heat liberated in the burner tube.

6. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, a tank of aerosol liquid connected to the inlet end of the tube, a tank of liquified gas, a burner nozzle in said burner tube having an orifice and having a gas supply line connecting the same to the tank, a gas valve in said line adjacent said tank, and means for connecting the gas supply line to the tank of aerosol liquid so that the pressure from the line forces the liquid into the coil for vaporization and at a rate depending upon said pressure.

7. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, a tank of aerosol liquid connected to the inlet end of the tube, a tank of liquified gas, a burner nozzle in said burner tube having an orifice and having a gas supply line connecting the same to the tank, a gas valve in said line adjacent said tank, means for connecting the gas supply line to the tank of aerosol liquid so that the pressure from the line forces the liquid into the coil for vaporization and at a rate depending upon said pressure, and a check valve in said connecting means for preventing reverse flow into the gas supply line when the gas valve is turned off.

8. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, a tank of aerosol liquid connected to the inlet end of the tube, a tank of liquified gas, a burner nozzle in said burner tube having an orifice and having a gas supply line connecting the same to the tank, a gas valve in said line adjacent said tank, means for connecting the gas supply line to the tank of aerosol liquid so that the pressure from the line forces the liquid into the coil for vaporization and at a rate depending upon said pressure, and a spring biased check valve in said connecting means having a spring pressure which is sufficient to establish a pressure differential between the gas line and the tank of liquid.

9. In an aerosol dispenser the combination comprising a burner tube, a vaporizing coil in said tube and having an inlet end and a discharge end, a tank of aerosol liquid having a dip tube connected to the inlet end of the coil, a burner nozzle in said burner tube, means including a gas tank and gas line for delivering combustible gas to said burner nozzle, means for pressurizing the tank of aerosol liquid at a pressure coordinated with the pressure in the gas line, and means defining a restricted metering orifice associated with the dip tube for metering the flow of the aerosol liquid.

10. In an aerosol dispenser intended for hand support the combination comprising a horizontal burner tube having a front end and a rear end, a vaporizing coil in said burner tube occupying a substantial portion of the length thereof, said vaporizing tube having an inlet end and a discharge end, a burner nozzle at the rear end of said burner tube, said burner tube having vents distributed along the length thereof for vertical discharge of the products of combustion, a pistol grip handle at the rear end of said burner tube for supporting the latter, an elongated horizontally arranged valve body spaced below the burner tube and secured to said pistol grip handle, a tank for gas and a tank for aerosol liquid arranged side by side and secured to the underside of the valve body, said valve body having porting so that gas is supplied from said gas tank to said burner nozzle and so that said aerosol liquid is supplied from said aerosol tank to the inlet end of said vaporizing coil.

11. In an aerosol dispenser intended for hand support the combination comprising a horizontal burner tube having a front end and a rear end, a vaporizing coil in said burner tube occupying a substantial portion of the length thereof, said vaporizing tube having an inlet end and a discharge end, a burner nozzle at the rear end of said burner tube, said burner tube having vents distributed along the length thereof for vertical discharge of the products of combustion, a pistol grip handle at the rear end of said burner tube for supporting the same, an elongated horizontally arranged valve body spaced below the burner tube and secured to said pistol grip handle, a tank for gas and a tank for aerosol liquid arranged side by side and secured to the underside of the valve body, said valve body having a gas valve interposed between the gas tank and the burner for controlling the flow of gas to the latter, said valve body further having a digitally operated control valve interposed between the aerosol liquid tank and the inlet end of said vaporizing coil for controlling the flow of aerosol liquid to the latter.

12. In an aerosol dispenser the combination comprising a horizontal burner tube of heat resistant material forming a combustion chamber having a front end and a rear end, a vaporizer coil in said tube extending horizontally over a substantial portion of the length thereof having an outlet terminating at the front end of the tube and having an inlet, means for supplying to the inlet end of said coil an aerosol liquid under pressure, means including a burner for injecting into the rear end of the tube a mixture of air and combustible gas for combustion thereof within the confines of the vaporizing coil and in direct contact with the latter thereby to progressively vaporize the aerosol liquid to vapor form, said burner tube having vent means for lateral and upward discharge of the products of combustion but having an imperforate cap

secured to the front end of the tube for substantially blocking the products of combustion against forward discharge, the outlet end of the coil being extended forwardly beyond the cap and substantially sealed with respect to the latter for discharge of the aerosol vapor axially away from said tube and in a horizontal direction which is substantially at right angles to the direction taken by the products of combustion, said coil terminating in a straight run tip portion projecting beyond the cap a sufficient distance and of such limited and constant diameter as to enable insertion of said tip portion into cracks and enclosed spaces for discharge of vapor therein free of contamination by the products of combustion.

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