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W. L. TENNEY
AEROSOL GENERATOR

2,821,986

Filed Dec. 24, 1953

2 Sheets-Sheet 1

FIG-1

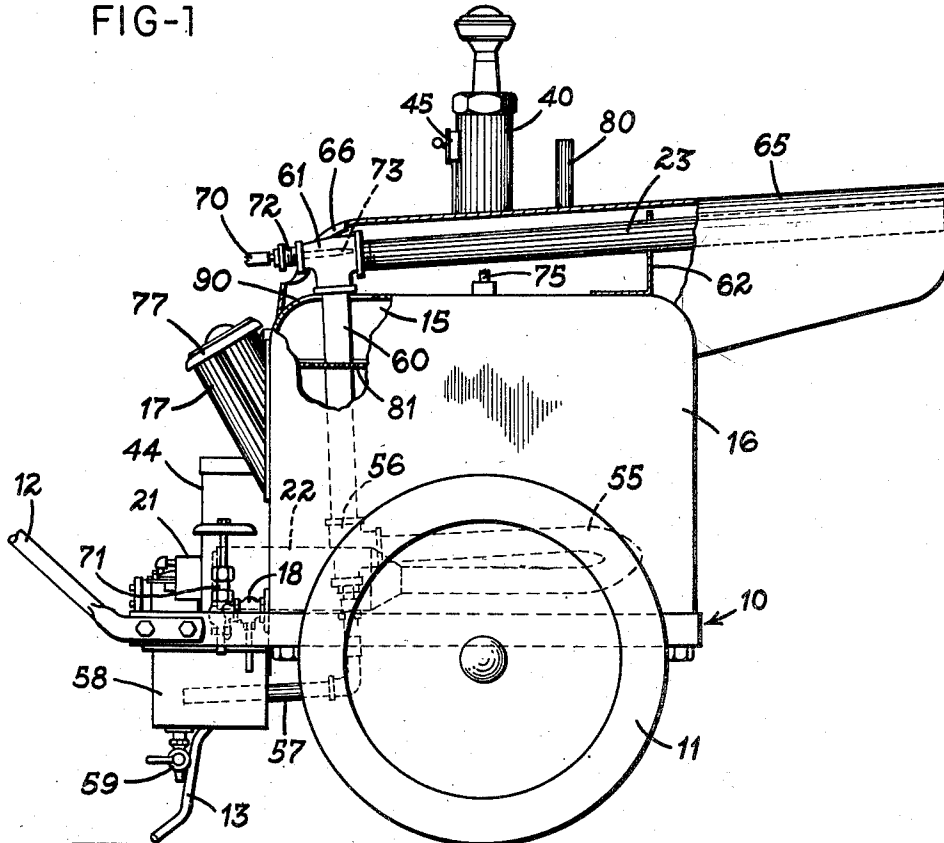
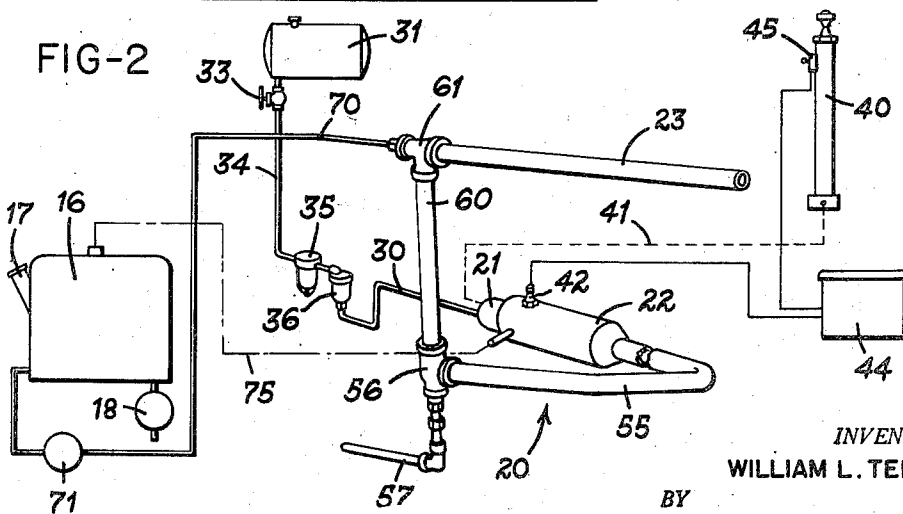


FIG-2



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2 Sheets-Sheet 2

FIG-3

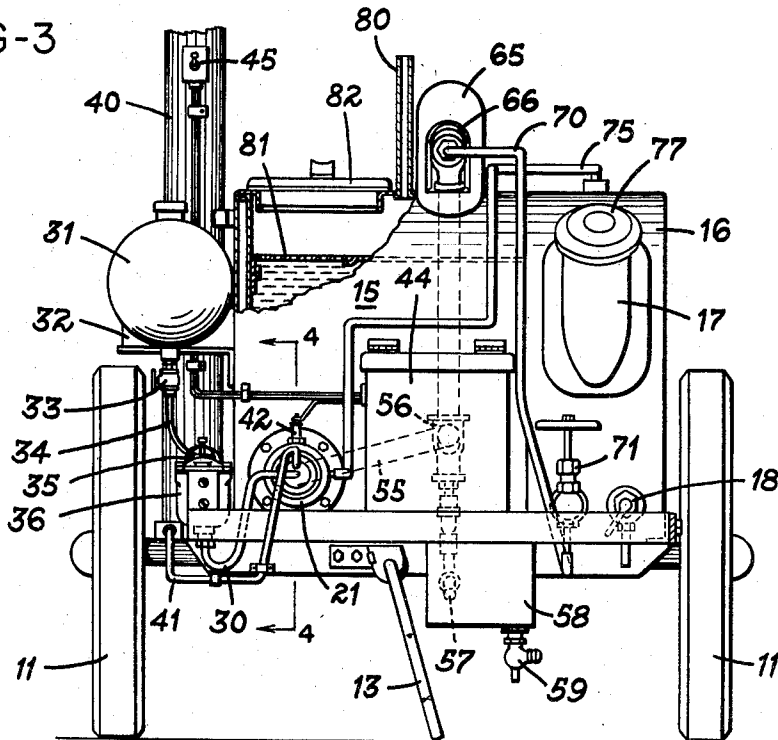


FIG-4

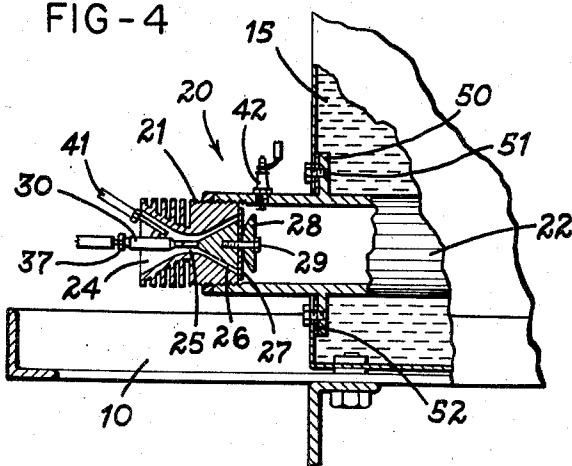
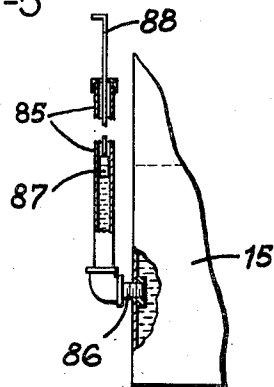


FIG-5



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2,821,986

AEROSOL GENERATOR

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7 Claims. (Cl. 131—129)

This invention relates to fog and spray generators and more particularly to such generators of the pulse jet engine type.

A pulse jet engine has certain advantages from the standpoint of simplicity of construction and operation, small number of moving parts, and economy in size, weight and expense. Where such an engine is incorporated in a device for vaporizing or atomizing and distributing a formulation in the form of a fog and including special materials such as an insecticide or the like for special purposes, it is important to retain these advantages which are associated with the engine itself. It is generally an objective of the present invention to provide such a fog and spray generator of simple construction adapted for incorporation in essentially self-contained portable form suitable for uses such as the fogging or spraying of insecticides while at the same time assuring maximum safety against overheating and possible hazards of fire.

A major object of the invention is to provide a fog and spray generator of the pulse jet engine type of simple and economical construction in which the engine portion of the unit is enclosed in a body of water for cooling purposes to assure maintenance of relatively low temperature conditions adjacent the engine.

Another object is to provide a water-cooled fog and spray generator of the pulse jet engine type in which provision is made for augmenting the fog or spray by addition of steam produced as the result of boiling of the cooling water.

It is also an object of the invention to provide a fog and spray generator as outlined above in the form of a mobile self-contained unit of simple and light-weight construction adapted to be wheeled or otherwise transported for maximum convenience in the fogging and spraying of insecticides and like operations.

Additional objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

Fig. 1 is a side elevational view showing a portable fog and spray generator constructed in accordance with the invention and with portions broken away to illustrate details of internal construction;

Fig. 2 is a schematic diagram illustrating the operation of the apparatus of Fig. 1;

Fig. 3 is a rear view of the apparatus of Fig. 1 and with portions broken away to illustrate details of internal construction;

Fig. 4 is an enlarged fragmentary section on the line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary view partly in elevation and partly in section illustrating a liquid level indicator for the cooling liquid in the apparatus of Figs. 1—4.

Referring to the drawings, which illustrate a preferred embodiment of the invention, the fog and spray generator is shown as including a mobile base compris-

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ing a cart 10 having a pair of wheels 11 and a guiding handle 12. Means such as a conventional kickstand 13 for a bicycle provide for supporting the cart in upright position for use. A major portion of the cart is occupied by a tank 15 for water to act as coolant for the jet engine therewithin, and a smaller tank 16 on the cart forms the reservoir for the insecticide or other fog or spray producing formulation. The reservoir tank 16 has a filling spout 17 which as shown is located below the top of the reservoir to leave an air space above the liquid level therein, and the reservoir tank 16 also has a drain valve 18.

The fog and spray generator shown in the drawings embodies a resonant pulse jet engine indicated generally at 20, an engine of this type being disclosed in more detail in my Patent No. 2,609,660, issued September 9, 1952. In general, such an engine embodies a fuel and air inlet unit 21, a combustion chamber 22 and a discharge tube 23. The inlet unit 21 is shown in some detail in Fig. 4 and includes an inlet opening 24 through which the combustion air enters for passage through the throat 25 and passages 26 for discharge into the combustion chamber past the valve 27, which is mounted on the inner end of the inlet unit by means of a curved backup plate 28 and screw 29.

The fuel enters the throat 25 from the fuel tube 30, and the fuel supply system includes a tank 31 mounted by means of a bracket portion 32 on the side of the tank 15 and provided with a shutoff valve 33. The line 34 from the valve 33 leads through a filter 35 and float bowl 36 to the tube 30, which also incorporates a metering jet 37. Air for starting the engine is supplied to the throat 25 from a hand pump 40 mounted on the side of the cart 10 and connected by a line 41 to the inlet unit 21. The combustion chamber 22 is also provided with a spark plug 42 for initiating combustion, with the power being supplied thereto from a battery and spark coil indicated generally at 44. A control switch 45 is shown as mounted at a convenient location on the air pump 40, and this switch should be of a type requiring that it be held closed so that it will open automatically when released.

The combustion chamber 22 of the engine is mounted within the lower part of the water tank 15, being substantially completely immersed therein, with only the intake end thereof projecting through the wall of the tank to support the inlet unit 21 in position to receive charging air from outside. As shown in Fig. 4, the combustion chamber is mounted in position by means of a circumferential flange 50 bolted at 51 to the wall of tank 15 and provided with a suitable sealing gasket 52. An elongated connection is provided from the combustion chamber 22 to the discharge tube 23 which includes a pipe 55 leading from the end of the combustion chamber and doubled back on itself to a T-fitting 56, and the pipe 55 is shaped so that it lies entirely within the bottom portion of the tank in order to assure its complete immersion even at low levels of water within the tank.

The pipe 55 is so formed that it normally slopes downwardly toward its point of connection with the fitting 56, and this fitting is provided at its lower end with a drain outlet 57 into a collecting tank 58 mounted on the underside of cart 10 and provided with a drain valve 59, the outlet pipe 57 being of small inner diameter in comparison with the pipe 55 to minimize discharge therethrough of combustion gases. An upwardly extending section of pipe 60 leads from the lower T-fitting 56 to an upper T-fitting 61 located above the top of tank 15 and serving to connect the pipe 60 with the discharge tube 23. The discharge tube is thus supported entirely above the tank 15, by means of the pipe 60 and a bracket 62 on top of

the tank, and it is covered by a hood 65 which is open at the discharge end of tube 23 and also has an opening 66 at its opposite end overlying the T-fitting 61.

The flow connection for the fog-producing formulation from the reservoir 16 to the discharge tube 23 includes a line 70 leading from a flow control valve 71 at the lower end of the reservoir and connected at 72 to the opposite end of the fitting 61 from discharge tube 23. This connection includes a tube portion 73 projecting into the interior of the fitting 61 as shown in Fig. 1 to avoid possible back pressure on line 70 from the change in direction of pipes 60 and 23 and to deliver the formulation directly into the outwardly flowing exhaust gases. There is also some preheating of the formulation by flow through this heated tube portion 73. The flow of formulation through this connection is effected by supplying the mean pressure from the combustion chamber 22 to the upper part of reservoir 16, by means of the tube 75 as best seen in Fig. 3. It is for the purpose of assuring an adequate pressure chamber in the top of the reservoir tank that its inlet spout 17 is constructed as previously described, and the closure cap 77 should accordingly be pressure-tight.

In operation the engine 20 develops high heat in its combustion chamber as a result of which the water within the tank 15 will be brought to a boil, but so long as the liquid level within the tank is sufficient to cover the combustion chamber and the connecting pipe 55, the temperature of the unit as a whole will remain within an adequately safe range. It is desirable to prevent possible splashing of the water resulting from too violent boiling, and the vent tube 80 for steam from the top of the tank is accordingly extended upwardly for a substantial distance. Also, it is desirable to provide a perforated baffle 81 near the top of the tank, especially in the area below the vent tube 80 and the filling opening and its cover 82 because this opening should be of substantial size to facilitate initial installation and assembly of the engine within the tank, and desirably the tank should not be filled to a level substantially above this baffle 81. As a safety measure, a liquid level indicator may be provided in tank 15, and a suitable such unit is shown in Fig. 5 as comprising a tube 85 connected at 86 to the side of the tank 15 and having therein a float 87 supporting an elongated wire or like indicator 88 projecting above the top of the tube 85.

The fog and spray generator constructed as shown has been found to be highly efficient and satisfactory both with oily fog-producing formulations and also with formulations such as insecticides having an aqueous base. It operates with an aqueous base formulation to produce a fine mist spray of desired extensive properties of coverage for the spraying of insecticides. Another operational feature which is afforded by the present invention is the augmenting of the spray by addition of steam from the tank 15 to the portion of the spray produced by the formulation. This is readily accomplished as shown in Fig. 1 by providing an opening 90 in the top of the tank 15 surrounding the pipe 60 and just below the opening 66 in the hood 65. Then with the discharge tube 23 located as shown with its discharge end within the hood 65, a venturi effect is produced which causes suction to be applied to the openings 66 and 90 and results in drawing a portion of the steam from opening 90 into the path of exhaust gases and fog from the discharge tube. The baffle 81 should extend as shown below the opening 90 to prevent splashing of the water out through this opening.

This fog generator accordingly provides major advantages from the standpoint of both structure and operation. For example, with the engine cooled by water, it is not necessary to form the combustion chamber and discharge tube of specially heat resistant and expensive

alloys, since satisfactory results are obtainable with these parts formed of conventional galvanized water pipe. This permits a substantial saving in the cost of construction, while at the same time the comparatively low operating temperatures of the parts gives maximum assurance against fire and other hazards of high temperatures.

It should also be noted that even when the apparatus operates with an oil base formulation, the possibility of accidental fire is very slight, since not only will the supply of formulation to the discharge tube cease promptly upon stopping of the engine due to immediate cessation of the pressure supply through line 75, but any oil which may flow into the discharge tube before this supply entirely terminates will drain down to the discharge outlet 57 by gravity action. There is therefore no necessity for automatic shut-off or pressurizing valves in this generator, which provides for further economy while eliminating additional possible sources of failure or maintenance requirements. It should also be noted that maintenance of this apparatus is further facilitated by the arrangement as shown of the discharge tube 23 in the form of a straight pipe section screwed into the fitting 61, since in the event of any deposits in this tube, it is easily removed and cleaned, as well as visually inspected.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water, means supporting said combustion chamber in the bottom portion of said tank and with said inlet unit projecting through the wall of said tank to the outside thereof, means supporting said discharge tube above said tank, an elongated pipe extending from said combustion chamber and doubled on itself adjacent the bottom of said tank to assure engagement thereof with the cooling liquid within said tank over a wide range of liquid levels within said tank, means forming an upwardly extending connection from said pipe to said discharge tube, a reservoir for storing a formulation for introduction into said discharge tube to produce the fog or spray, and means for effecting delivery of said formulation into said discharge tube.

2. A portable fog and spray generator comprising a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, a mobile base, a tank on said base adapted to be filled with water, means supporting said combustion chamber in the bottom portion of said tank and with said inlet unit projecting through the wall of said tank to the outside thereof, means supporting said discharge tube above said tank, an elongated pipe extending from said combustion chamber and doubled on itself adjacent the bottom of said tank to assure engagement thereof with the cooling liquid within said tank over a wide range of liquid levels within said tank, means forming an upwardly extending connection from said pipe to said discharge tube, a reservoir on said base for storing a formulation for introduction into said discharge tube to produce the fog or spray, and means for effecting delivery of said formulation into said discharge tube.

3. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water,

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means supporting said combustion chamber in the bottom portion of said tank and with said inlet unit projecting through the wall of said tank to the outside thereof, means supporting said discharge tube above said tank, an elongated pipe extending from said combustion chamber and doubled on itself adjacent the bottom of said tank to assure engagement thereof with the cooling liquid within said tank over a wide range of liquid levels within said tank, means forming an upwardly extending connection from said pipe to said discharge tube, a reservoir for storing a formulation for introduction into said discharge tube to produce the fog or spray, means for effecting delivery of said formulation into said discharge tube above said upwardly extending connection, said pipe being inclined downwardly in the direction of flow of exhaust gases from said combustion chamber to said upwardly extending connection, and means forming a drain from said connection to prevent accumulation of said formulation in said engine.

4. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water, means supporting said combustion chamber in the bottom portion of said tank and with said inlet unit projecting through the wall of said tank to the outside thereof, means supporting said discharge tube above said tank, an elongated pipe extending from said combustion chamber and doubled on itself adjacent the bottom of said tank to assure engagement thereof with the cooling liquid within said tank over a wide range of liquid levels within said tank, a connecting pipe extending upwardly from said doubled pipe to said discharge tube, an upper fitting joining said connecting pipe with said discharge tube, a lower fitting joining said connecting pipe with said doubled pipe, a reservoir for storing a formulation for introduction into said discharge tube to produce the fog or spray, a connection from said reservoir to said upper fitting, means responsive to the pressures developed in said combustion chamber for effecting delivery of said formulation through said connection into said discharge tube, said doubled tube being inclined upwardly away from said lower fitting to prevent passage to said combustion chamber of liquid draining down said connecting pipe, and means for draining such liquid from said lower fitting.

5. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water, means supporting said engine with said combustion chamber thereof within said tank for intimate cooling engagement with the cooling liquid therein and with said inlet unit projecting through the wall of said tank to the outside thereof and said discharge tube projecting above said tank, a reservoir for storing a formulation for introduction into said tube to produce the fog or spray, a connection from said reservoir to said discharge tube, means for effecting delivery of said formulation from said reservoir through said connection to said discharge tube for discharge with the exhaust gases from said combustion

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tion chamber, and means for introducing into said exhaust gases steam produced by boiling of the water in said tank as the result of the heat generated in said water by operation of said engine.

6. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water, means supporting said engine with said combustion chamber thereof within said tank for intimate cooling engagement with the cooling liquid therein and with said inlet unit projecting through the wall of said tank to the outside thereof and said discharge tube projecting above said tank, a reservoir for storing a formulation for introduction into said tube to produce the fog or spray, a connection from said reservoir to said discharge tube, means for effecting delivery of said formulation from said reservoir through said connection to said discharge tube for discharge with the exhaust gases from said combustion chamber, a hood substantially enclosing said discharge tube and open at both ends thereof, means forming a vent from said tank within said hood for admitting into the space within said hood steam emanating from said tank as the result of boiling of the water therein from the heat generated by the operation of said engine, and said discharge tube terminating short of the adjacent open end of said hood to provide suction effective on said space within said hood for drawing said steam into said exhaust gases for mixture and spraying therewith.

7. In a fog and spray generator having a pulse jet engine including a combustion chamber having a fuel and air inlet unit and a discharge tube and adapted to develop a pulsating discharge pressure through the tube, the combination of a tank adapted to be filled with water, means supporting said combustion chamber in the bottom portion of said tank and with said inlet unit projecting through the wall of said tank to the outside thereof, means including an upwardly extending pipe leading from said combustion chamber and forming a portion of the discharge tube, a fitting at the upper end of said upwardly extending pipe, a reservoir for storing a formulation for producing the fog or spray, means including a connection from said reservoir to said fitting for effecting delivery of said formulation thereto, and a substantially straight pipe forming the discharge end of the discharge tube and having a detachable connection with said fitting to facilitate removal thereof for cleaning in the event of deposit of formulation therein.

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