Sept. 7, 1965 W. L. TENNEY 3,205,176

APPARATUS FOR PRODUCING FOGS AND THE LIKE

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FIG. 1

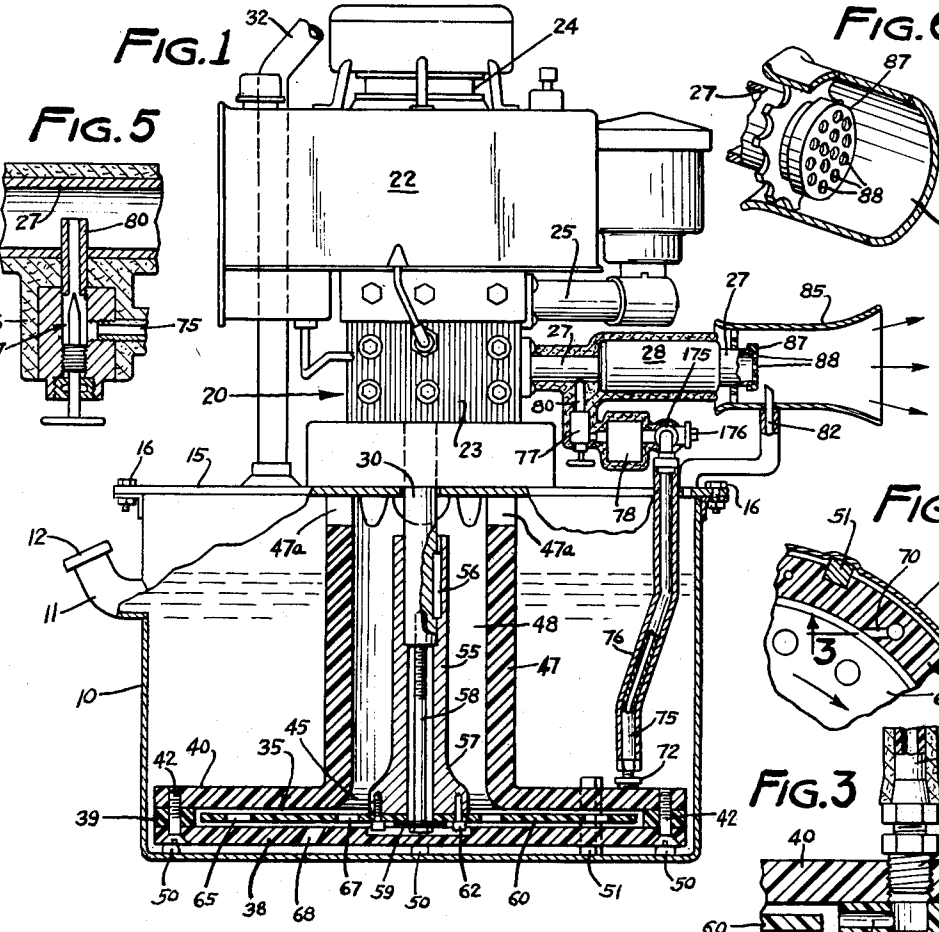


FIG. 6

FIG. 5

FIG. 2

FIG. 3

FIG. 4

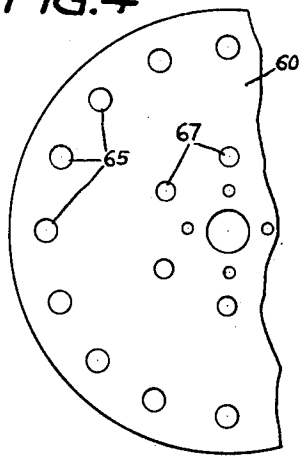
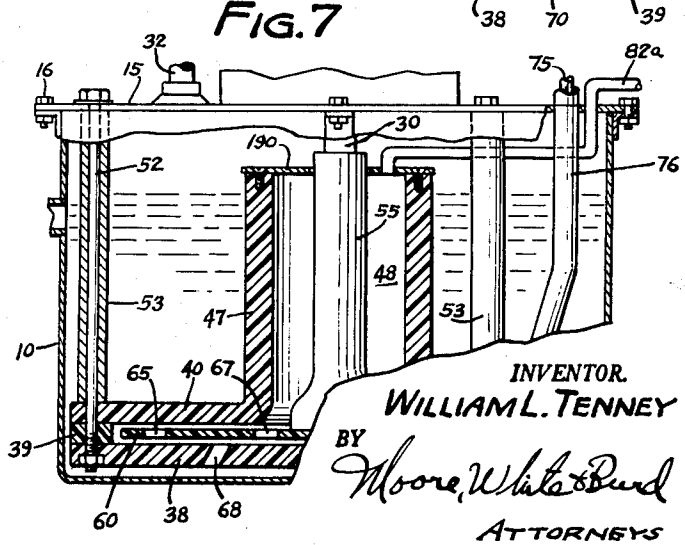


FIG. 7



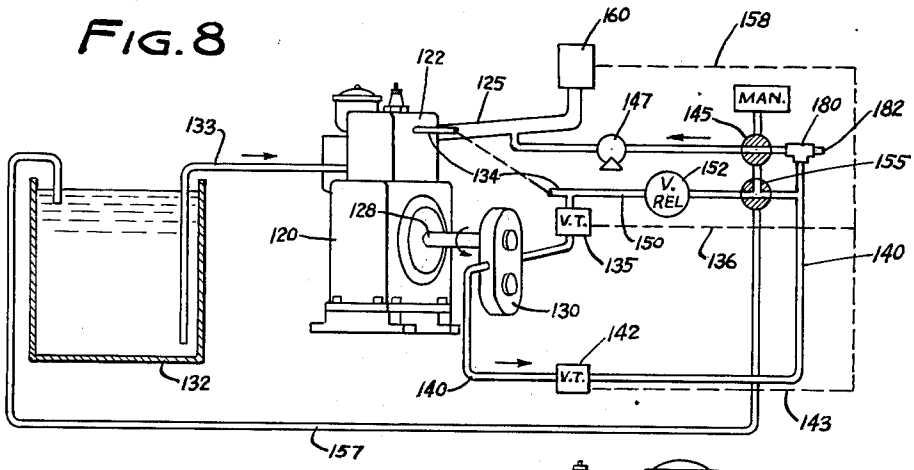
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APPARATUS FOR PRODUCING FOGS AND THE LIKE

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FIG. 8



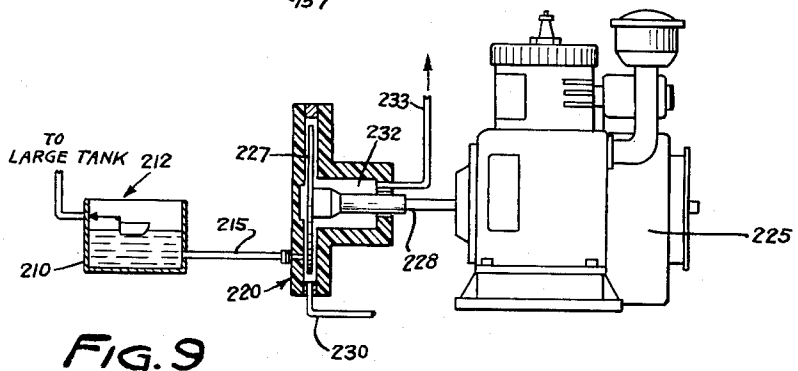


FIG. 9

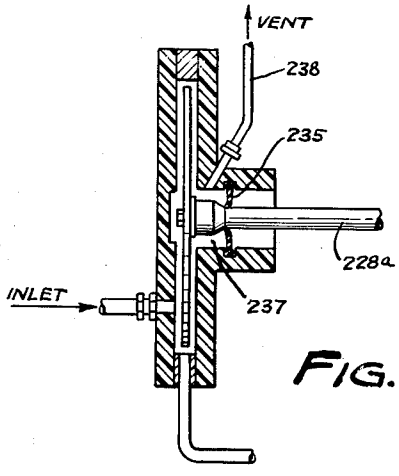


FIG. 10

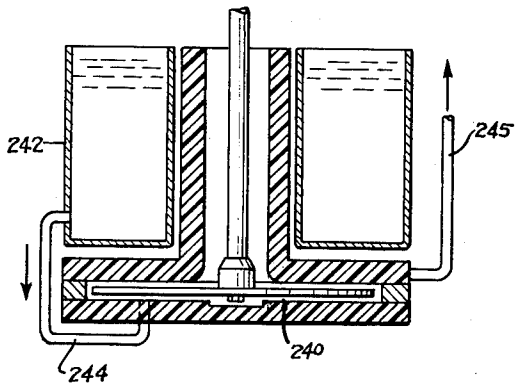


FIG. 11

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APPARATUS FOR PRODUCING FOGS AND THE LIKE

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Filed Feb. 27, 1961, Ser. No. 91,739
17 Claims. (Cl. 252—359)

This invention relates to the production of fogs for various purposes, such as to disperse insecticides, for screening effects, or the like, and to a novel apparatus for producing such fogs.

In the production of fogs from liquid materials (for example oils containing some percentage of liquid insecticide) it is desirable to heat the fogging formulation essentially to its boiling point, resulting in vaporization of the material. The vapor resulting from this process is then ejected into the relatively cooler surrounding air where it condenses to form a visible fog composed of myriads of microscopic fluid particles suspended in the atmosphere. The present invention concerns a novel, more efficient, and relatively inexpensive apparatus for performing this function.

In accordance with the invention a conventional reciprocating internal combustion engine is caused to operate at substantially full throttle and substantially full load with resultant maximum engine heat and horsepower output feasible with the particular engine utilized. The crankshaft power output produced by the engine is utilized to perform work upon the fogging formulation, with resultant heating of the liquid formulation, while at the same time such working of the formulation may provide a convenient load upon the engine which causes the engine to operate under substantially full load. Also, the hot, high velocity exhaust gases expelled from the engine are used to atomize the heated fogging formulation, whereby heat from such exhaust gases can effectively vaporize the atomized formulation.

Accordingly, the principal object of this invention is to provide a novel apparatus for the production of fogs, wherein an internal combustion engine is utilized to provide the heat necessary for vaporization of liquid fogging formulation, to provide a flow of gases by means of which the formulation may be atomized, and wherein the engine is loaded to extract maximum power with resultant maximum heat output for use in vaporizing the formulation.

A further object of the invention is to provide such a novel fog producing apparatus wherein the crankshaft power output of the engine is substantially converted into heat energy and utilized to heat the liquid fogging formulation.

An additional object of the invention is to provide such novel fogging apparatus wherein a more uniform particle size is obtained in the resultant fog.

A further object of the invention is to provide such fogging apparatus in which chemical changes of the fogging formulation are prevented by minimizing exposure of the liquid formulation to deleterious heating effects.

Another object of this invention is to provide such a novel fogging apparatus which is of simple and relatively inexpensive construction, and which is safe, versatile and reliable in operation.

Another object of the invention is to provide a novel portable fogging machine construction which may be mass produced at low cost, and which is readily transported to any site where its use may be desired.

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

In the drawings:

FIGURE 1 is a view partly in elevation and partly in section of one preferred construction of a fogging machine in accordance with the invention;

FIGURE 2 is an enlarged detail section of a portion of the apparatus shown in FIGURE 1;

FIGURE 3 is a sectional view on an enlarged scale, taken generally on line 3—3 of FIGURE 2;

FIGURE 4 is a partial plan view of a pumping and engine loading disk utilized in the apparatus shown in FIGURE 1;

FIGURE 5 is a detail sectional view of the metering valve construction and the tube supplying formulation into the engine exhaust;

FIGURE 6 is a partial section showing a modified discharge nozzle construction;

FIGURE 7 is a fragmentary view partly in elevation and partly in vertical section of a modified form of apparatus similar to that shown in FIGURE 1;

FIGURE 8 is a schematic view of a modified form of fogging apparatus;

FIGURES 9 and 10 are schematic illustrations of further modified apparatus; and

FIGURE 11 is a schematic showing of a modified construction similar to FIGURE 1. In FIGURES 9–11 certain features, as vent holes **67**, are omitted for clarity.

With reference to the drawings, which illustrate preferred embodiments of the invention, and particularly with reference to FIGURE 1, the fogging machine includes a main tank **10** which may be provided with a filler tube **11**, normally closed with a cap **12**, and a removable cover **15** for the tank which preferably is secured in sealing relation thereto by suitable means such as a plurality of bolts **16**. On the cover **15** is suitably mounted a conventional internal combustion engine indicated by the general reference numeral **20**. This engine may be of either 4-cycle or 2-cycle type, although 4-cycle may be somewhat preferred in some constructions.

The engine includes a fuel tank **22** mounted thereon in conventional fashion, and is preferably of the air cooled type having a finned cylinder head **23** which is cooled at least partially by air from a fan (not shown) having an air intake **24**. Fuel-air mixture is supplied to the engine through the usual intake manifold **25** from a suitable carburetor (not shown) and the hot products of combustion are expelled through an exhaust pipe **27** which, if desired, may discharge through a muffler **28**, as shown. The engine has a rotary output or power take-off shaft **30** which, in the form shown in FIGURE 1, is a vertically mounted shaft, with the piston and connecting rod of the engine reciprocating in a horizontal plane, in a manner well known in the art. The engine is mounted on the top **15**, and a handle, portions of which are shown at **32**, may also be connected to the top for providing a convenient carrying arrangement for the entire tank-engine assembly.

Within the tank **10** there are means which define a chamber **35** having a relatively small volume with respect to the volume of tank **10**. A preferred form of chamber construction is shown in FIGURE 1, including a circular bottom plate **38** of material which is preferably a relatively poor conductor of heat, for example, a synthetic resin or phenolic material as distinguished from relatively better heat conductors such as sheet metals. A spacer ring **39** of similar material is seated upon the bottom plate **38**, defining the height and diameter of chamber **35**, and a top plate **40** (likewise of similar material) is placed over the spacer, these three parts being connected by suitable screws **42**, or otherwise fastened together in any suitable manner.

The top plate **40** is provided with a central opening **45**, and around this opening, extending upwardly to the top of tank **10**, is a sleeve **47** of the same relatively non-heat conducting material, preferably integral with plate **40**. This sleeve includes openings or scallops **47***a* in its upper end from the interior of the sleeve **47** to the interior of

the top of the tank **10**. The sleeve **47** also defines a venting space **48** through which vapors may rise toward the top of the tank. The entire chamber and venting space defining structure is mounted adjacent the bottom of the tank, for example, raised slightly above the bottom as on the feet **50**, and is of course held against these feet by engagement of the top **15** with the upper edge of sleeve **47**. A plurality of centering and rotation preventing lugs or keys **51** are engaged between notches in the edge of the chamber member and recesses formed in the wall of tank **10** to center the chamber member and prevent its rotation within the tank.

Another and somewhat more convenient arrangement for mounting of the chamber may be as shown in FIGURE 7, including elongated bolts **52**, which bolts pass through spacer sleeves or the like **52** and the plate **40**, through ring **39** and bottom plate **38**, spacing the sleeve **47** from the tank top **15** as desired. It will be understood that in such a construction the dimensions of the parts and of the tank **10** will be related such that the chamber defining parts are suspended adjacent the bottom of the tank in operative position.

Reference to FIGURE 1 shows an extension shaft **55** secured to the engine shaft **30**, for driving thereby through a key **56** or the like, and this shaft **55** terminates in a hub **57** through which is passed a mounting bolt **58** carrying washers **59** which engage a loading disk and impeller **60** which is fastened to the hub, as by the bolts **62**. This disk preferably is provided with two rows of holes **65** and **67** and acts as a combined dynamic braking device and a pumping device of the centrifugal type. Liquid fogging formulation contained in tank **10** is admitted to chamber **35** through an opening **68** in the bottom plate **38**, such opening preferably being located well inwardly from the periphery of the disk or plate **60**, and between the holes **65** and **67**.

Thus, as the engine is operated and the plate or disk **60** is rotated, it will act upon formulation admitted to the chamber **35** through opening **68** and will tend to force the liquid formulation radially outward toward the periphery of the chamber **35**, forming a ring of liquid through which the outer portion of the plate, including the ring of holes **65**, rotates. With the disk rotating, any liquid which might tend to enter opening **68** and flow toward the center of the disk will be either pumped into such ring of liquid, or, if this ring is full, the liquid will be pumped back out opening **68**. On starting, any formulation in the center of the chamber and in the space **48** will be initially pumped out opening **68**. Thus, the area surrounding the center of the disk, i.e., approximately radially inward from the opening **68**, will be essentially free of liquid when the disk is rotating, and will provide a path for vapors, including the innermost holes **67** in the disk, for conducting such vapors upward through the venting space **48** to the top of the tank. At the same time, the formation of such a ring of liquid of essentially constant width or diametric dimension will result in an essentially constant load upon the engine.

The viscous liquid formulation also will provide a braking effect upon the disk, by reason of the friction between the liquid and the disk surface, and of course this frictional resistance is enhanced by the holes **65**. Even without these holes there is substantial resistance to disk rotation by the liquid, and therefore the holes **65** may be considered as desirable but not essential. As the disk rotates it will circulate the liquid formulation within chamber **35** and will cause substantial heating thereof. Various fogging oils or formulations have somewhat different ranges of boiling points, and those with wider ranges may, for example, have lighter fractions boiling below 300° F., and heavier fractions boiling in the neighborhood of 450° to 500° F. or higher. These temperatures of course may be taken into consideration in selecting the materials used in construction of the chamber.

The lower fractions may vaporize in the chamber **35**, and the resultant vapor or gas will collect at the low pressure area or center of the chamber, adjacent the opening **45** and vapor vent passage **48**, since the heavier, still-liquid parts will be subjected to the centrifugal force and urged outwardly within chamber **35**. Such resultant vapors may pass up the vent **48** and into the top of tank **10**, and a portion of such vapors may condense back into the tank by reason of the substantially lower temperatures in the tank as compared to the internal temperatures within the chamber **35**.

The heated liquid fogging formulation is expelled from chamber **35** at a controlled rate through a passage **70** (FIGURES 2 and 3) formed in the spacer **39** and opening into a fitting **72** which is mounted in the top plate **40**. This fitting is connected to a supply tube **75**, preferably surrounded by insulation material **76**, which extends upwardly through the tank top wall **15** to a metering valve **77**, such as a manually controllable needle valve, with the flow preferably directed through a filter **78**. These parts also may be insulated, as shown in FIGURES 1 and 5, as may the exhaust pipe **27** and muffler **28**. From the needle valve **77**, the non-atomized flow of the heated liquid fogging formulation is directed through a connecting tube **80** into the engine exhaust pipe **27**, and since the formulation is heated to near its vaporization temperature, by reason of the work performed on the formulation by the disk **60**, it is readily atomized and vaporized by the rapidly flowing, hot exhaust gases from the engine which pass across the tube **80**, and the vapors and gases are expelled into the surrounding atmosphere. As previously explained, these vapors are expelled in the relatively cooler surrounding air, and thus the vapor condenses to produce a fine particle fog which will disperse over the desired area.

In the event that all the vapors formed within the chamber **35** are not condensed back into liquid form within tank **10**, these vapors may form a fog, which may be added to the expelled exhaust gases and vaporized fogging formulation through a tube or pipe **82** leading from the top of tank **10** and which opens into a venturi-like sleeve **85** mounted to surround the end of exhaust pipe **27**, as by frictional engagement thereon, or the like, and through which a flow of air is induced by the ejector effect of the expelled exhaust gases, thus entraining vapors or fog from pipe **82** into such gases. Tube **82** may also be covered with insulation if desired. The end of pipe **27** may be covered with a cap **87** secured thereon by friction or otherwise and having a plurality of holes **88** through which the gases are expelled, since such a cap will, at least to some extent, promote efficient formation of the desired fog.

If, for some reason, it is undesirable to incorporate this additional tube **82** and sleeve **85**, it is of course possible merely to vent the vapors from the interior of the tank, so as to avoid an internal pressure build-up and avoid the likelihood that vapors may be entrained in the liquid. In an actual construction this has been accomplished merely by making handle **32** hollow and providing an opening thereto from inside lid **15**. Further, where only a small volume of vaporized fogging formulation is desired, tube **82** may discharge directly to atmosphere, providing a small volume of fog, even though valve **77** is not opened. Likewise, it may discharge through sleeve **85** with valve **77** closed to provide a small volume of fog.

It has been estimated that in small internal combustion engines, of the type shown in FIGURE 1, approximately one-third of the total power available from combustion of the fuel-air mixture is used to overcome friction or is dissipated as heat through the engine coolant medium, approximately another third is delivered by the crankshaft as useful crankshaft power output, and the remainder, approximately the final third, passes out as heat in the expelled exhaust gases.

Therefore, in an apparatus as provided by the present invention the exhaust gas heat is utilized in vaporizing

the formulation, and so also is the power delivered by the crank shaft, by means of work performed on the fogging formulation, which results in heating thereof as previously explained. By containing the heated fogging formulation within a chamber preferably insulated from the main supply of formulation, it is possible to transfer a substantial amount of the heat resulting from "working" of the formulation into the formulation which is being supplied directly to the atomizing apparatus, thus raising its temperature substantially toward the temperature of vaporization, and in some cases, raising the heat of the formulation actually into its range of boiling temperatures.

Since the highest temperatures which will be reached within the disk chamber are in the neighborhood of the boiling point of the formulation, high temperatures at this point will not damage insecticide which may be mixed into the fogging formulation. Thus the formulation is heated close to the boiling point prior to its introduction into the hot engine exhaust and prior to any exposure to high temperature exhaust gases. This "two-stage" process greatly reduces the temperature differences to which any part of the formulation is exposed, as compared with processes whereby relatively cool formulation is exposed directly to high temperature gases in order to carry out both the heating and vaporization processes. As a result, not only is the likelihood of overheating or "burning" part of the formulation reduced, but also the uniformity of fog particle size is improved. The importance of these two results will be readily apparent to those skilled in the art.

It should also be noted that the structure described and illustrated provides a thermal fog or aerosol generator which is safer and more reliable in operation than other machines of its class. Reliability is attained through the simplicity of mechanism. Safety against fire hazard is similarly attained.

In other machines of this class, the formulation is fed into a chamber containing flowing hot gases for the purpose of heating and vaporization of the formulation. The hot gas flow prevents ignition of the formulation during normal operation. If, however, the hot gases cease to flow for any reason, then a continued flow of formulation tends to ignite due to contact with the heated chamber wall, causing a definite fire hazard. Some machines of this class utilize automatic formulation shut-off valves, or the like, to insure that formulation flow will stop immediately when hot gas flow stops. Others rely on manually operated means or else offer no protection at all. The automatic means are subject to mechanical failure and the manual means are subject to human error.

The machine of the present invention is inherently "fail safe" without the addition of any safety devices. The hot exhaust gases are caused to flow solely by operation of the engine itself. If the engine ceases to operate and thus the flow of hot gases also ceases, then the pumping and loading disk simultaneously ceases to operate. Thus no formulation can be pumped into the hot gas chamber unless the engine is running and supplying a flow of gases which of itself prevents ignition of the formulation.

It has been demonstrateed by actual test that machines built in accordance with the present invention are safe with regard to fire hazard despite normal mechanical failures or normal human error. This fact is of first importance when usage by the public, rather than by professional operators, is contemplated.

With reference to FIGURE 2, it should be noted that the outlet opening **70** is directed against the direction of rotation of the disk **65**. In other words, the disk revolves and tends to "fling" liquid formulation into the opening **70**. In some instances it may be desirable to reverse this relationship, for example, by reversing the direction of rotation of the disk. This will tend to reduce the pressure in the line **75** and permit use of a larger opening in needle valve **77**. Such larger opening in turn will minimize clogging of the line at this point while maintaining an effective flow of liquid formulation.

FIGURE 8 shows a modified form of fogging machine in accordance with the invention, wherein the engine **120** is of the type having a liquid cooling system, including the usual jacket shown schematically at **122** surrounding the engine cylinder and through which cooling liquid is circulated when the engine is running. The engine includes an exhaust pipe **125** which may be directed through a conventional muffler, not shown. An output shaft **128** extends along a horizontal axis from the engine, and is connected to drive a suitable pump, shown for purposes of example as a gear type positive displacement pump **130**. A tank **132** is connected by lines **133** and **134** to supply fogging formulation through the cooling jacket **122** to pump **130**.

Line **134** includes, in the supply side of pump **130**, a vapor trap **135** of conventional construction, which will function to separate any vapor formed in liquid in the line and to direct this vapor away separately through a line shown schematically at **136**. Similarly, the formulation delivery line **140** from the outlet of pump **130** also contains a vapor trap **142** having a vapor escape line **143**. From the trap **142** line **140** passes through a normally open manually controllable valve **145**, and thence through a metering valve (such as a needle valve) **147** from whence the heated liquid formulation passes into the engine exhaust **125**.

From the supply line **134** there is also a branch line **150** including a relief valve **152** of conventional construction which is designed to open in response to a predetermined pressure within the line **140**. In other words, once the pressure in line **140** eexceeds the predetermined setting of valve **152**, formulation will pass through this valve and be recirculated through pump **130**.

When the machine is operating normally, to produce a fog, there is a constant recirculation of the fogging formulation through line **140**, valve **152**, and the vapor traps **135** and **142**, by the pump **130**. The setting of relief valve **152** thus serves to determine the loading for dynamic braking on the engine, since the pressure in line **140** will be directly related to the amount of work performed by the pump. Of course, the setting of the metering valve **147** may have some effect on loading of the engine, however, the proportion of fluid pumped through metering valve **147** in a system designed in accordance with this invention will be relatively small as compared with the amount of formulation pumped through relief valve **152**. Thus, in normal operation the above described circuit provides, in actuality, a chamber, by reason of the volume thereof, through which the formulation is recirculated.

Such pumping of the formulation through this circuit or chamber provides a dynamic brake for the engine which effectively loads the engine for full power operation, and serves also to add heat to the formulation by reason of such pumping and recirculation. The flow through metering valve **147** will regulate the amount of heated formulation extracted from such circuit or chamber, and of course this amount is equal to the amount of formulation pumped through the engine cooling jacket. Therefore, in normal operation valve **147** is set such that at least a sufficient amount of formulation is extracted to cool the engine without undue or excessive vaporization of the formulation. In the event that a particular system presents requirements which this arrangement is unable to satisfy, then instead of passing the formulation directly through the engine cooling chamber, the engine can be cooled by the ordinary well known coolant means, and a heat exchanger in the coolant circuit can be used to effect additional heating of the formulation as it is supplied to pump **130**.

In line **150**, between relief valve **152** and the connection thereof with line **140**, is a manually operable three-

way valve **155** which preferably is controlled concurrently, and by the same manual operator, as valve **145**, as shown in FIGURE 8. When valve **145** is opened, for normal fogging operation, valve **155** provides a through connection from line **140** to relief valve **152**. When valve **145** is closed, for example to permit occasional shutdown of fogging without stopping the engine, valve **155** connects line **140** with a return line **157** leading directly back to tank **132**. This arrangement may also be used during engine starting and for warm-up purposes.

The vapors from lines **136** and **143** are directed into a vapor delivery line **158**, which in turn is connected into a mixing venturi shown schematically at **160**, and of essentially the same construction as the member **85** shown in FIGURE 1 and previously described herein.

The machine shown in FIGURE 8 functions in essentially the same fashion as the machines previously described and shown in FIGURES 1–7. The same type of two-stage operation is provided, with crankshaft energy from the engine being used to heat the formulation, and to supply the heated formulation into the hot high velocity exhaust gases from the engine to form the fog as described. Additional useful energy is extracted from the engine by reason of the heat exchange using the formulation (directly or indirectly) as a coolant for the engine. This arrangement also serves to illustrate that the present invention may be practiced through the use of conventional readily obtainable items as shown in FIGURE 8, although the apparatus shown in FIGURES 1–7 is preferred due to its relative simplicity of construction and operation.

In the case of both machines described above, it is possible to use the machine as a spraying device, thereby increasing the usefulness thereof without adding greatly to the structure of the machine. Thus, for example, in FIGURE 1 the supply tube **75** may include a T **175** which is connected in the line, and is provided with a plug **176** in its branch. If it is desirable to use the machine as a sprayer, needle valve **77** may be completely closed and a hose with a conventional spray nozzle on the end thereof may be connected into T **175** in place of plug **176**. The machine will then pump liquid to be sprayed through the supply tube **75** and such attached spraying hose and nozzle. In like manner, the machine shown in FIGURE 8 includes a T **180** in its delivery line or tube **140**, and the arm of the T is normally closed by means of a plug **182**. A spray hose and nozzle can be connected thereto in like manner.

As noted previously, particularly with regard to the apparatus shown in FIGURES 1–6 and in FIGURE 7, vapors formed within the tank, and conducted to the top thereof, are directed into the venturi-like sleeve **85**. In connection particularly with FIGURE 7, it is possible to place a lid **190** over the top of the sleeve section **47**, and extending into close fitting relation with the extension shaft **55**. The vapor line **82***a* is then extended to open into the passage **48** through such lid, and this arrangement makes it possible to create an effective fog without introducing liquid formulation into the engine exhaust line. In other words, the loading and pumping disk **65** will heat the formulation to a temperature sufficient to provide vapors in the passage **48** of sufficient quantity to form an effective fog when mixed with the engine exhaust discharging through the sleeve **85**. Such an arrangement may be used effectively with insecticides which cannot be exposed to the higher temperatures existing within the engine exhaust line.

FIGURES 9 and 10 illustrate further modified forms of apparatus wherein the pumping and loading disk device is combined with an internal combustion engine having a horizontal output shaft. In such arrangements, a relatively large supply tank (such as tank **132**) provides a supply of liquid fogging formulation, and the liquid is withdrawn from this tank by a conventional pump (not shown), or by gravity, and directed to a chamber **210** which includes a float operated valve shown schematically at **212**, functioning to maintain a constant level within the chamber, and of course to prevent liquid from rising above this level in the pumping chamber **220**. The outlet line **215** from this chamber is directed into a pumping and loading chamber **220**, which is of essentially the same construction as shown in FIGURE 1, except that it is mounted on a horizontal rather than a vertical axis, and is not submerged within a tank as in FIGURE 1, but is provided with appropriate inlet and outlet means in the form of lines. The line **215** opens into chamber **220** radially inward from the periphery thereof, in the same manner as the previously described opening **68**. Float chamber **210** has sufficient capacity above the valve shut-off level of the float to handle fluid which may be pumped back through line **215** when the machine is started.

Engine **225** drives the pumping and loading disk **227** through shaft **228**, and the outlet line to the engine exhaust is shown schematically at **230**. It is understood that this line will contain a metering valve, and may also contain suitable shut-off valves or by-pass connections in the same manner as previously described. Vapors formed in chamber **220** during operation will pass through the central opening **232** around shaft **228** and may be conducted away through a line **233** into a mixing sleeve surrounding the engine exhaust as previously described or may simply be vented to the surrounding atmosphere.

The arrangement shown in FIGURE 10 is of essentially the same construction as that shown in FIGURE 9, except that a seal **235** is provided to engage the shaft **228***a* and form a closed vapor collecting chamber **237** from which collected vapors are conducted by a vent line **238**.

The arrangement shown in FIGURE 11 is a modification of the construction shown in FIGURE 1, wherein the loading and pumping chamber **240** is located outside the tank, and thus this chamber **240** extends below, and somewhat into, a separate tank **242** which may be of generally toroidal configuration, or merely a pair of connected tank members in the form of a saddle. The liquid formulation is supplied from the tank to the chamber **240** by a supply line **244**, and the outlet line **245** extends from chamber **240** to the engine exhaust as previously described. Tank **240** may vent to atmosphere at the top, as shown, or be constructed to be closed and vented as in FIGURES 1, 7, 9 or 10.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms 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:

1. Apparatus for production of fogs, comprising an internal combustion engine having a power take-off means and an exhaust means through which hot products of combustion are expelled, tank means providing a supply of liquid fogging formulation, power consuming means driven by said power take-off means and operative to perform work on said fogging formulation to load said engine for substantially full power operation and to convert a major portion of the mechanical power produced by said engine into heat energy transferred to said formulation, means communicating with said tank means to direct a flow of the formulation into said power consuming means, and said power consuming means comprising a rotary impeller means secured to the end of an extending drive shaft of said power take-off means, a generally cylindrical means enclosing said impeller means, said communicating means including a liquid inlet means positioned in said generally cylindrical means and adapted to deliver liquid thereinto at a position spaced from the periphery of said impeller means and toward the

axis thereof, and outlet means positioned adjacent the periphery of said impeller means and connected to said exhaust means, and vent means from said generally cylindrical means for discharging vapors formed therein.

2. Apparatus for production of fogs, comprising an internal combustion engine having a rotary mechanical power output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of liquid fogging formulation, power consuming and pumping means driven by and comprising substantially the entire loading of said output shaft and operative to perform work by relative rotary movement and engagement with said fogging formulation to load said engine for operation at a major portion of its maximum power output and to convert a major portion of the mechanical power produced by said engine into heat energy transferred to said formulation, said power consuming and pumping means including a chamber communicating with said supply means and containing a limited quantity of said formulation to be acted on by said power consuming and pumping means to cause heating of such limited quantity of formulation, and means connected to direct a flow of the heated formulation from said chamber into said exhaust pipe.

3. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of fluid fogging formulation including a supply tank, means defining a pre-heating chamber having a relatively small volume with respect to the volume of said tank, means communicating between said chamber and said tank for supplying formulation from said tank into said chamber, power consuming means driven by said engine output shaft and arranged to work on the formulation suplied to said chamber to convert a major portion of the engine output power into heat energy transferred to the formulation within said chamber while simultaneously providing dynamic braking on said engine to cause operation thereof at a major portion of its maximum power output, and an output tube extending from said chamber to said exhaust pipe to convey the heated formulation into said exhaust pipe.

4. The structure of claim 3 in which said means defining a chamber is disposed within said tank.

5. The structure of claim 3 in which said means defining a chamber is disposed exterior of said tank.

6. The structure of claim 3 in which said rotary member is mounted for rotation about a vertical axis.

7. The structure of claim 3 in which said rotary member is mounted for rotation about a horizontal axis.

8. The structure of claim 7 together with shut-off valve means for determining and maintaining the level of fluid in said chamber at a predetermined level to prevent overflow when said engine is not operating.

9. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of fluid fogging formulation including a supply tank, means defining a chamber separate from said tank and having a relatively small volume with respect to the volume of said tank, means communicating between said chamber and said tank for supplying formulation from said tank into said chamber, means for maintaining a quantity of liquid fogging formulation in said chamber during normal operation of said apparatus, a pumping member within said chamber and driven by said engine output shaft to provide a dynamic brake for substantially full power operation of said engine and to recirculate in large part the formulation in said chamber through a closed system to thereby convert a major portion of the engine shaft output power into heat energy transferred to the formulation within said chamber, and an output tube connected into said system and opening into said exhaust pipe for conveying the heated formulation into said exhaust pipe.

10. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of fluid fogging formulation including a supply tank, means mounting said engine on said tank, means defining a chamber within said tank having a relatively small volume with respect to the volume of said tank, power consuming means driven by said engine output shaft including a rotary member mounted in said chamber to rotate in the formulation supplied to said chamber to load said engine for operation at a major portion of its full power output and to convert a major portion of the engine output power into heat energy transferred to the formulation within said chamber, means communicating between said chamber and said tank for supplying formulation from said tank into said chamber at a location radially outward of the axis of rotation of said chamber to maintain a substantially liquid free area adjacent the center of said member, means for conducting away vapors from said area, and means for conducting heated formulation to said exhaust pipe.

11. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of fluid fogging formulation including a supply tank, means mounting said engine on said tank, means defining a chamber within said tank having a relatively small volume with respect to the volume of said tank, power consuming means driven by said engine output shaft including a rotary member mounted in said chamber to rotate in the formulation supplied to said chamber to provide a dynamic brake to load said engine for substantially full power operation and to convert a major portion of the engine output power into heat energy transferred to the formulation within said chamber, means communicating between said chamber and said tank for supplying formulation from said tank into said chamber at a location radially outward of the axis of rotation of said member to maintain a liquid free area adjacent the center of said member, means for conducting away vapors from said area, an output tube extending from said chamber to said exhaust pipe to convey heated formulation into said exhaust pipe, and valve means in said tube controlling the flow of liquid into said pipe.

12. The structure of claim 11 further characterized by means for mixing said vapors with the gases discharged from said exhaust pipe.

13. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe through which hot products of combustion are expelled, means providing a supply of fluid fogging formulation including a supply tank, means defining a chamber communicating with said tank and having a relatively small volume with respect to the volume of said tank, power consuming means driven by said engine output shaft including a pumping member located in said chamber to act on the formulation in said chamber to load said engine for substantially full power operation and to convert a major portion of the output power of said engine into heat energy transferred to the formulation, an output tube extending from said chamber to said exhaust pipe to convey the heated formulation into said exhaust pipe with the gaseous products of combustion therein, and valve means controlling flow through said tube.

14. Apparatus for production of fogs and the like, comprising an internal combustion engine having a rotary output shaft and an exhaust pipe, means providing a supply of fluid fogging formulation including a supply tank, means defining a chamber separate from said tank and having a relatively small volume with respect to the volume of said tank, pump impeller means driven by said engine output shaft within said chamber to receive formu-

lation from said supply tank and to recirculate a large part of the formulation through a circulation line back to said chamber, a valve in said circulation line controlling the load against which said pump impeller is operated, said circulation line also including means for separating vapors formed during circulation of said formulation in said chamber means, said valve acting to hold liquid fogging formulation in said chamber means up to a predetermined pressure during normal operation of said apparatus to maintain a substantially constant load on said engine for substantially full power operation thereof and to convert a major portion of the engine shaft output power into heat energy to heat said formulation by reason of the circulation thereof through said chamber means, and an output tube connected to said chamber means and opening into said exhaust pipe.

15. Apparatus for production of fogs, comprising an internal combustion engine having an output means and an exhaust means through which hot products of combustion are expelled, means providing a supply of liquid fogging formulation, rotary power consuming means driven by said output means and engageable with and operative to perform work on said fogging formulation to load said engine for operation at a major portion of its maximum power output and to convert a major portion of the mechanical power produced by said engine into heat energy transferred to said formulation, said power consuming means serving as preheating means for said formulation and means communicating with said power consuming means to direct a flow of the heated formulation into said exhaust means.

16. The structure of claim **15** in which means is provided to form a vapor vent and in which said means connected to direct the flow of the heated formulation comprises a liquid conveying conduit.

17. Apparatus for production of fogs, comprising a motor means having a rotary mechanical power output shaft, means providing a supply of liquid fogging formulation, power consuming and pumping means driven by and comprising substantially the entire loading of said output shaft, said power consuming and pumping means being operative to perform work by relative rotary movement and engagement with said fogging formulation to load said engine for operation at a major portion of its maximum power output and to convert a major portion of the mechanical power produced by said motor means into heat energy transferred to said formulation, said power consuming and pumping means including a chamber communicating with said supply means and containing a limited quantity of said formulation to be acted on by said power consuming and pumping means to cause heating of such limited quantity of formulation, and means connected to direct a flow of the heated formulation from said chamber.

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