Aug. 29, 1967 C. M. RHEIN ET AL 3,338,524

FOG SPRAYING DEVICE

Filed March 22, 1965

Fig. 1

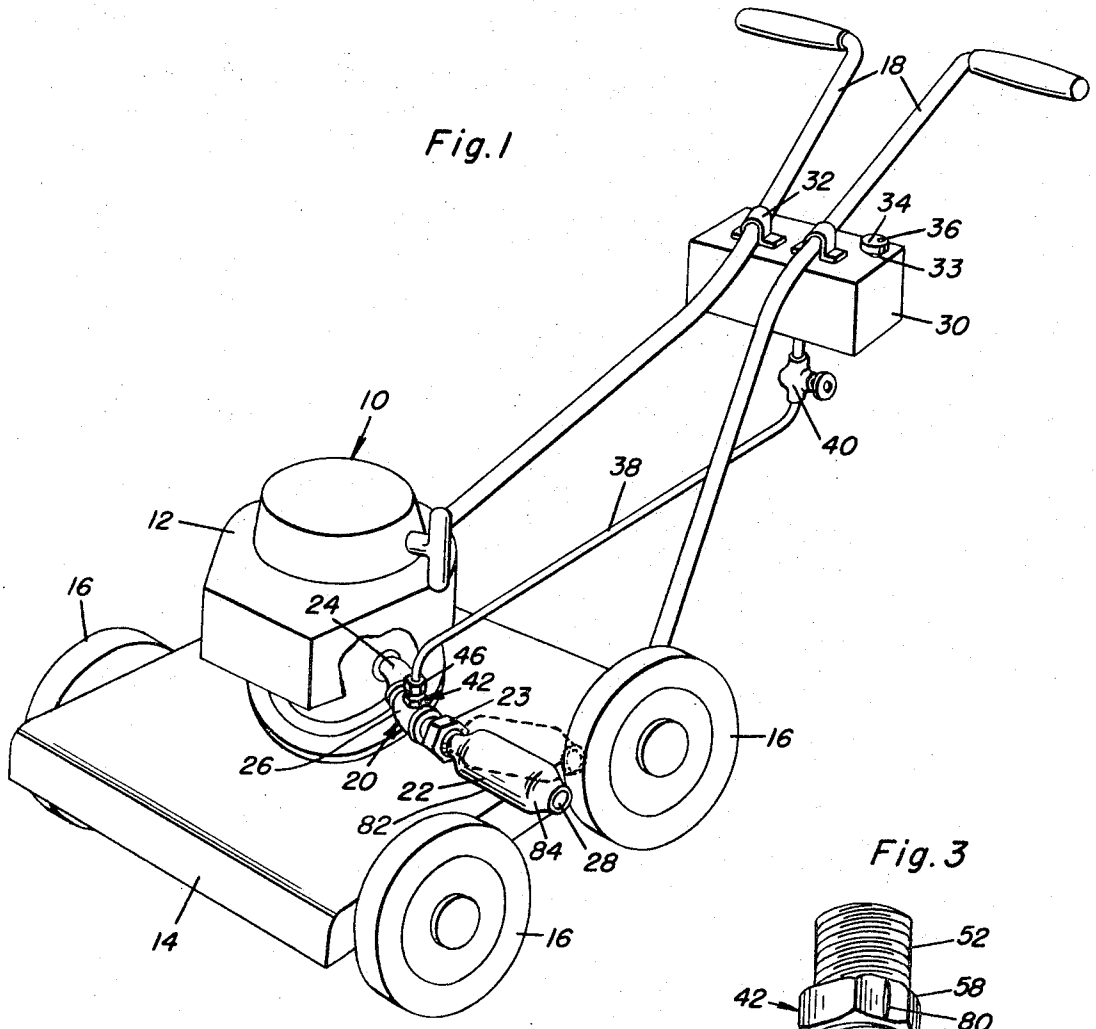


Fig. 3

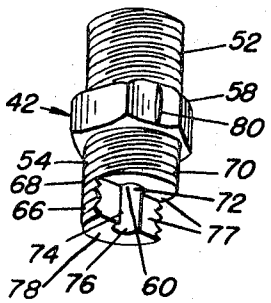
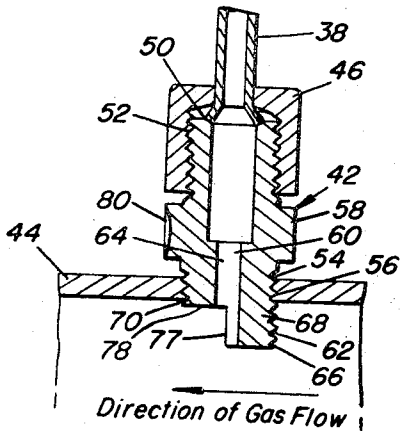


Fig. 2



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FOG SPRAYING DEVICE

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This invention relates to a fog spraying device for spraying insecticide, fungicide, and the like on ground, on trees, bushes, shrubbery, and the like, as well as inaccessible places where insects lodge or breed.

For a long time there has been a need for simplified fogging device for laying or spraying of insecticide and the like on grounds, lawns, etc., that could be operated as a part of the exhaust system of the simple garden variety of power tools, as well as part of the exhaust systems of trucks or other common internal combustion power equipment, so that more frequent spraying could be accomplished without the ardous task of manipulating heavy or expensive spraying equipment.

This invention contemplates an insecticide fog spraying device in which droplets or a small stream of insecticide is deposited continuously behind a shield, baffle or boss means positioned in an exhaust carrying the combustion gases flowing from an internal combustion engine so as to produce a dense, evenly dispersed, highly effective insecticide fog at the point of exit of the combustion gases to the atmosphere.

It has been found that the positioning of a shielding means so as protrude into a conduit carrying the hot exhaust gases from an internal combustion engine to the atmosphere will produce a high degree of atomization of insecticide that is continuously injected in small quantities behind the shielding means during the flow of the exhaust gases. It is believed that this shield means produces a low-pressure area at the point of entry of insecticide into the exhaust gas stream and also helps to produce a pronounced turbulence of the exhaust gas flow downstream from the shielding means so as to atomize the insecticide and disperse it uniformly throughout the exhaust gases, resulting in a dense, efficient fog having superior atomization of the insecticide particles therein being discharged from the exhaust of the combustion gases to the atmosphere.

Advantageously, the shielding means may protrude through the wall of the conduit and have incorporated in it a fluid entry means in the form of a nozzle opening for injecting or depositing insecticide into the exhaust gas stream. In this arrangement, the insecticide is permtted to flow by gravty or is siphoned from a reservoir through the nozzle and deposited in the shielded area where turbulence of the stream produced by the protrusion of the shielding means causes immediately a high degree of atomization of the insecticide particles into the exit gas stream. This turbulence is believed to result from the shielded area's acting as a baffle in the flow path of the stream of exhaust gases so as to produce thorough mixing of the insecticide particles into the stream so that the exit gas, when dispersed to the atmosphere, has a high degree of atomization, thereby producing a dense, highly effiicent and potent insecticide fog. The hot exhaust gases in the tubulent flow also help to volatilize instantaneously the liquid insecticide so as to produce an effective and efficient fog.

It has also been found that the exhaust gas conduit containing the shielded area for introduction of the insecticide, when positioned at a level lower than the engine exit port for the exhaust gases, prevents creep-back of the insecticide into the engine, which prevents fouling of the engine thus adding to its life and continuous operation. The device of this invention also may be used with

stationary internal combustion engine equipment, or as a movable self-contained unit.

In combustion engine exhaust systems in which a muffler or expansion chamber is used, the atomization and mixing of the particles of insecticide with the exhaust gases due to the shield means is further enhanced by the muffler action and flow of gases through the muffler chamber. This produces a quieter operating spray as well as an efficient fog for spraying. The exit gas conduit also can be formed from flexible material or have in it universal-type joints so that the fog spray can be directed in various directions for spraying trees, high shrubbery, and the like.

These and other objects and advantages of the invention will be understood when read in light of the accompanying description and drawings of a preferred embodiment thereof, which are only by way of illustration of the inventive concepts herein, and not as limitations thereof, and in which:

FIGURE 1 is a view in perspective, showing the spray fogging device of my invention in combination with a power lawn mower;

FIGURE 2 is a cross-sectional view showing the construction of the insecticide nozzle and shield protruding through the wall of the exhaust gas conduit; and

FIGURE 3 is a view in perspective of the injection nozzle showing construction of the discharge end thereof.

Referring to the drawings, numeral **10** illustrates a lawn mower having an internal combustion engine **12** mounted on lawn mower frame **14**, which is supported on wheels **16**. Attached to the frame are a pair of handle members **18** for pushing and guiding the mower when in use.

Extending from engine **12** is an exhaust gas conduit **20** for conducting the exhaust gases from the engine operation. To the outer end of the conduit is attached a gas expansion chamber or muffler **22** for controlling the gases exiting from the engine, and for providing the necessary back pressure on the engine. If desired, a universal joint **23** may be used as a connection between the muffler and the conduit so that the end of the muffler can be positioned in various directions so that the fog can be sprayed upwardly, downwardly or at angles to the horizontal (see FIGURE 1).

The exhaust gas conduit **20** is formed from muffler **22** and sections **24** and **26**. Sections **24** and **26** are 45° male to female adapter type screwed pipe fittings which construction provides for a portion of the conduit to be at a level below that of the exit port in the engine into which fitting **4** is screwfitted so that there can be no leak-back of insecticide when it is introduced into the conduit. It will be appreciated that the muffler may be provded with a universal type of joint connection with the conduit so that its end **28** may be directed in an arc of 360°. As mentioned above, this allows the muffler discharge to be pointed in any direction desired so the fog can be played upon the group or to the side onto shrubbery or into trees and vines. It will be appreciated that the discharge end of the muffler may be positioned in many directions; however, it has been found to give good results when it extends approximately to the outer periphery of the mower and the spray action can be brought to bear on a desired object from any location which the mower may enter.

Insecticide to be sprayed is contained within reservoir tank **30** which is secured by brackets **32** to handle members **18**. In this position, the tank is above the exhaust gas conduit thereby providing a gravity head pressure on the insecticide supplied from the tank to the conduit. The tank can, however, be located elsewhere on the lawn mower, for examle on the engine or even below the exhaust gas conduit, in which case the insecticide is

siphoned into the low-pressure area behind the shield. The tank has a filling connection **33** which is provided with a closure cap **34** vented at **36**, thereby permitting entrance of atmospheric pressure above the insecticide so that, when the apparatus is in use, formation of a partial vacuum in the tank is avoided. Leading from the tank to the conduit is tubular liquid feed line **38** (which may be standard copper tubing, neoprene rubber hose, or the like) under control of manual feed line control valve **40**, preferably of the needle type for close manual control or metering by the operator of the amount of insecticide to be fed through the line into the exhaust gas conduit.

The insecticide from the tank passes through the feed line **38** and enters the conduit through means comprising a liquid entry or injection nozzle **42** (shown in FIGURES 2 and 3) positioned through wall **44** of the conduit and which is connected to the feed line by means of internally threaded cap connector **46**. The feed line **38** is attached to the nozzle **42** by flare and bevel fitting **50** and held in tight connection with the nozzle by the cap connector **46**. The nozzle also has external threads **52** so the feed line can be drawn by the connector tight to the nozzle. In addition, the nozzle is also provided with external threads **54** which match the threaded aperture **56** through the exhaust gas conduit wall. A nut enlargement **58** midway of the ends of the nozzle serves to provide a grip for screwing the nozzle into the aperture. It will be understood that this construction provides for securely positioning the nozzle in the aperture to protrude through the conduit wall into the exhaust gas stream so that liquid passing from the tank and through the feed line can enter the conduit through the nozzle liquid feed passage **60**. The nozzle liquid feed passage is open at both ends and extends through the longitudinal central axis of the nozzle. The passage is narrowed toward nozzle discharge end **62** so as to form a restricted discharged bore **64** (see FIGURE 2).

As shown in FIGURES 2 and 3, the discharge end of the feed nozzle is formed to have a boss or baffle **66** extending downwardly into conduit **20**. The baffle is in the nature of a protruding apron-like shield so that a portion of one lower half side **68** of the volume of the nozzle discharge end projects beyond the adjacent lower half side **70** of the same end of the nozzle. The nozzle protruding through the conduit wall is placed so the baffle is interposed upstream of the insecticide entering from the nozzle into the exhaust gas stream. The construction provides a discharge bore opening **72** and also exposes a longitudinal length of the discharge bore in the form of an elongated open semi-circular recess **74** into which liquid can flow and thereby enter the exhaust gas conduit shielded and protected by the baffle from direct initial impingement by the stream of gases. It is believed that this arrangement helps the entering liquid to be exposed for entrainment and dispersal into the exhaust gases first from the bore opening and then from the bore recess as well as from nozzle tip **76**. It is also believed that the nozzle construction, which provides a cutaway or step construction at the tip, produces a liquid feed passage utilizing a liquid discharge or entry which is directed both downwardly and outwardly relative to the direction of gas movement for distributing liquid thereover. This, liquid can flow out of the nozzle into the gas stream in directions both longitudinally and laterally of the nozzle. The cutaway construction also provides trailing surfaces **77** at the nozzle tip which include components extending substantially transversely and longitudinally of the gas flow.

The portion of the nozzle forming the baffle acts to divert the gas stream and provides a shielded or protected spacial area **78** downstream of the baffle into which the insecticide is drawn or induced as a positive flow by action of the gases flowing over the baffle. Smooth, uninterrupted production of a fogging mixture of insecticide and gases is thereby assured during engine operation. Turbulene of the gas flow downstream of the shielded area adjacent to the nozzle tip is also produced by the baffle and the liquid flowing from the nozzle is caught up into the turbulence thus produced and thereby more completely atomized and dispersed into the gases than would be the case were atomization to occur in a non-turbulent flow.

An alignment mark **80** is cut into the nut enlargement of the nozzle for indicating the position of the nozzle baffle relative to the bore opening so the nozzle can be correctly positioned through the conduit wall with the baffle upstream of the entering liquid.

Exhaust gas muffler **22** is formed with a generally cylindrical hollow shell **82** and is provided at both its inlet and exit ends with tapering frusto conical portions **84**. The muffler inlet end is extended and exteriorly threaded so it can be readily connected into the interiorly threaded outer end of the exhaust gas conduit. A separate lock collar of known construction (not shown) can be used in making this connection or in connecting other sections of the conduit together so that the muffler can be secured in any desired adjusted position for directionally pointing the spray as desired. The pronounced conical taper and reduced diameter of the muffler at its outer end forms an effective spray head for directionally concentrating the fog stream. The muffler shell provides a chamber of an interior volume substantially greater than comparable lengths of other portions of the conduit and is provided at its interior with perforated baffle plates (not shown) whereby the mixture of exhaust gases containing particles of the insecticide is subjected to muffler action, being expanded in the chamber and slowed and some of the gas stream changed in direction so that additional atomization and dispersion of liquid particles in the mixture occur.

It has been found that the arrangement above described provides a positive entry of liquid insecticide from the tank and through the nozzle into the hot exhaust gases without necessitating resort to means for supplying pressure above the liquid level in the tank.

In operation with the arrangement shown in FIGURE 1, liquid insecticide is placed in reservoir **30** and valve **40** is adjusted to meter the amount of insecticide desired. The metered insecticide enters the exhaust gas stream through nozzle **42** (shown in FIGURES 2 and 3) located in conduit section **20**. The nozzle is thus closely adjacent the engine exhaust gas outlet where the gases are hottest. The insecticide enters the conduit, is entrained from the nozzle and atomized and dispersed as fine particles into the exhaust stream, and the resulting mixture is subjected to muffler action as the hot combustion gases having the insecticide dispersed therein passes, thereby increasing atomization and dispersal of the insecticide throughout the exhaust gases. Superior atomization and dispersion or suspension of the insecticide in the gases is thereby achieved so that a thick cloud of finely divided liquid particles suspended in the exhaust gases is released to the atmosphere from the muffler discharge end **28** as a high quality stream of outwardly directed fog.

We have discovered that with the present invention, the injection nozzle can also be inserted into the conduit in any suitable position radial thereto and will operate well to produce a high quality fog. Very good results have been obtained when the nozzle is located close to the engine and preferably ahead of the muffler and in a vertical positon so that gravity can aid in the introduction of the insecticide into the exit gas stream. However, good results can also be obtained by locating the nozzle at other locations along the gas stream, preferably so the gas and particle mixture will be acted on by the functions occurring in the muffler. The conduit may also be of other size or type of pipe sections and constructed in only one or any number of sections and from any suitable metal by fabrication or by casting. Additionally, any type of valve can be employed as the feed line control valve, as for

example: disc, plug, sleeve, or gate valves. It is important to note that the spray of fog issuing from the device to atmosphere can be made wet, medium, or dry by proper adjustment of the control valve in the feed line from the tank. Consequently, the invention can be used for spraying indoors or in an office where moisture is not wanted. Also, the diameter of the feed line, the nozzle opening, and the diameter of the exhaust conduit can be varied to produce the desired range of fog density for a particular spray treatment.

It has been found that excellent fog production results when the cross-sectional area of the conduit is at least four times greater than the shielded area.

The discharge end of the nozzle or the baffle may be of a size relative to the interior diameter of the exhaust gas conduit so that it restricts substantially the interior diameter of the conduit resulting in increased Venturi action under gas flow for strongly inducing discharge of liquid into the conduit from the nozzle.

It will be appreciated that the device of this invention can be used to spread other sprayable materials, such as fungicides, liquid fertilizers, and the like.

While the invention has been described with particularity with reference to a preferred embodiment thereof, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A spray fogging device for dispersing minute particles of a sprayable material in the hot exhaust gases from an internal combustion engine to produce a fog containing the material on exit of the exhaust gases to the atomsphere comprising an internal combustion engine; exhaust gas conduit means operatively connected to said engine for carrying the exhaust gases from said engine and having a discharge end; a reservoir for material to be sprayed; a nozzle having an opening positioned in said conduit means upstream of said discharge end; a conduit shield means protruding radially into the conduit from the wall thereof immediately adjacent and upstream of said nozzle opening, said shield means being integral with said nozzle and presenting a flat surface for distributing thereover the sprayable material the flat surface portion extended into the conduit beyond the said opening in unopposed relation thereto for shielding the sprayable material while it is being distributed during its entry into the conduit whereby the said material is vaporized and dispersed by exhaust gas action adjacent the nozzle opening; and an expansion muffler means

downstream of said conduit sheild means for further mixing and atomization; a material feed line operatively connecting said nozzle and said reservoir; and a valve means for controlling the flow of material from said reservoir through said nozzle opening.

2. The spray device of claim 1 in which the material to be sprayed in fog form is a liquid insecticide.

3. The spray device of claim 1 in which the material to be sprayed in fog form is a liquid fertilizer.

4. The spray device of claim 1 in which the cross-sectional area of the conduit at the point of entry of the material to be sprayed is at least four times greater than the shielded area.

5. The spray device of claim 1 in which the nozzle opening and the shield means extend into the cross-sectional area of the flow path of the exhaust gases near the wall of the conduit.

6. The spray fogging device of claim 1 in which the end of said conduit means is adjustable to several vertical and horizontal positions for directing the exit flow of fog in various directions.

7. The spray fogging device of claim 1 in which a portion of the conduit containing the nozzle opening has its flow path at a level below the exit port of said engine so that the material to be sprayed cannot creep back into the engine.

8. The spray fogging device of claim 1 in which the exhaust gas conduit means has a universal adjustable means for rotatably orienting the discharge of the spray of fog in the desired direction with respect to the vertical and horizontal.

9. The spray fogging device of claim 1 in which said nozzle opening and shield means are positioned in the exhaust conduit means of a lawn mower.

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