

April 13, 1954

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2,675,358

EXHAUST DRIVEN ATOMIZING AND SPREADING DEVICE

Filed Nov. 2, 1951

2 Sheets-Sheet 1

FIG. 1.

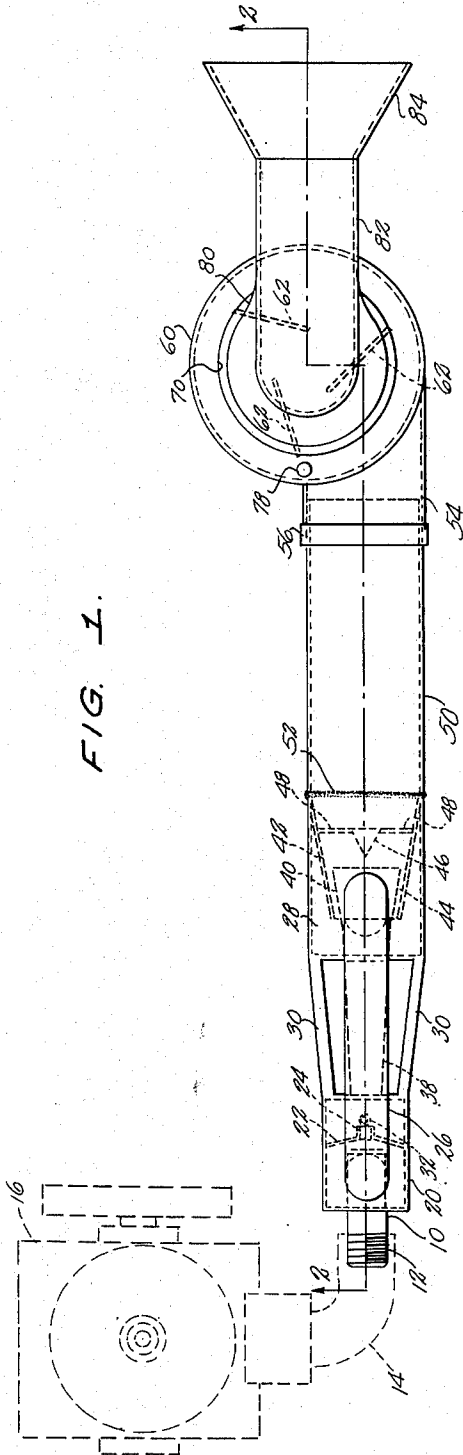
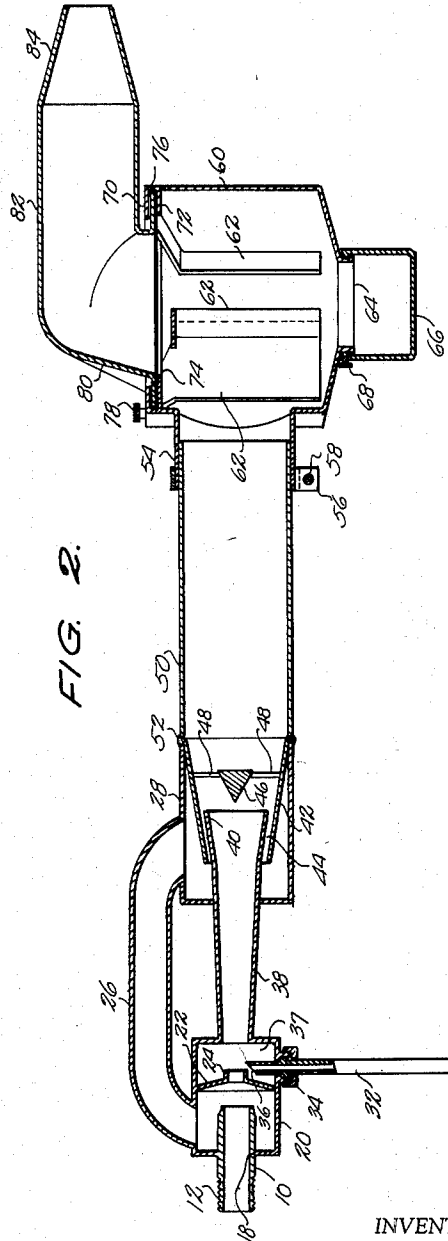


FIG. 2.



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FIG. 3.

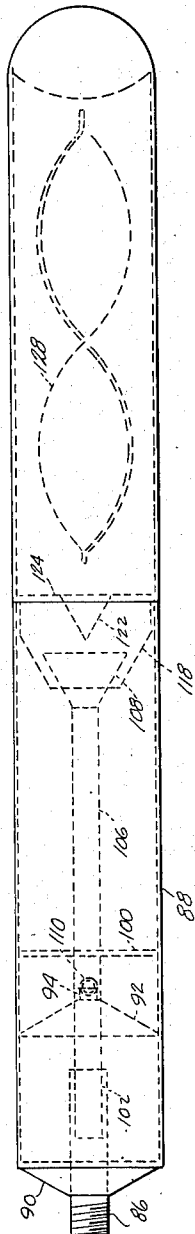


FIG. 4.

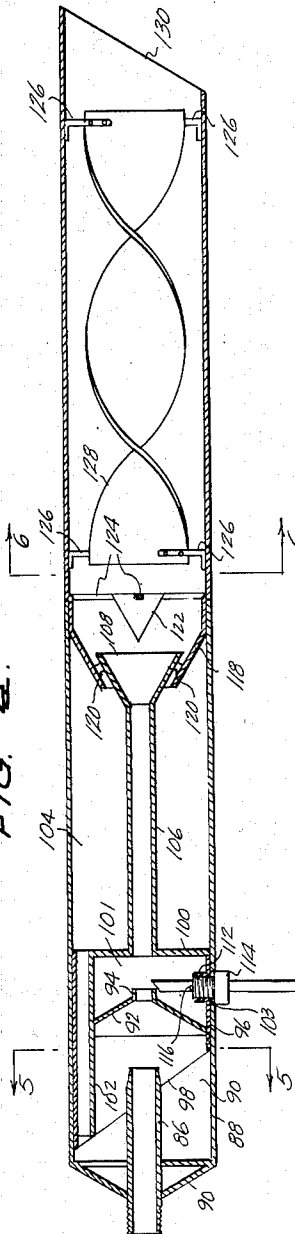


FIG. 5.

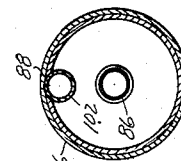
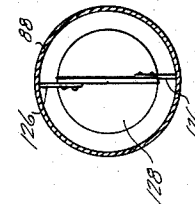


FIG. 6.



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EXHAUST DRIVEN ATOMIZING AND
SPREADING DEVICE

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4 Claims. (Cl. 252—359)

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This invention relates to a device adapted to be driven or operated by the exhaust gases from a conventional internal combustion engine, and so formed as to utilize vacuums and pressures created by the gases in such a way as to atomize a liquid substance such as an insecticide, and spread said substance in a fine fog.

Heretofore, atomizing devices or fogging jets have been used for spreading insecticides or for other purposes in which it is desired to blanket a given area with a fog such as, for example, when fighting a fire. And, in some instances, exhaust gases from an internal combustion engine or the like have been applied to create a materials-spreading force. However, to my knowledge it has not previously suggested itself to those skilled in the art to provide a device wherein the exhaust gases are first used to create a vacuum that is effective to draw a liquid substance upwardly through a supply tube and atomize it or break it into finely divided particles, and is then used to create a pressure tending to spread the fogging mixture over a wide area, the heat from the exhaust gases being at the same time applied to produce substantially full evaporation of the liquid material.

The main object of the present invention is to provide a device falling within the general category referred to, that will operate in the manner referred to above, thus to provide a fogging jet or atomizing mechanism which can be operated at low cost, and which will disseminate a mixture in a fine fog characterized by an almost complete absence of unvaporized particles.

Another important object is to provide a device as stated which will be of relatively simple construction, considering the benefits to be obtained thereby.

Yet another object is to provide a fogging jet or atomizing device capable of being driven by exhaust gases, and which will have a minimum of moving parts or other component members that might otherwise tend to get out of order.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawing, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a top plan view of one form of exhaust driven atomizing device formed in accordance with the present invention, an internal combustion engine supplying gases to said device being illustrated in dotted lines;

Figure 2 is a longitudinal sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a top plan view of a modified form;

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Figure 4 is a longitudinal sectional view through the form of Figure 3;

Figure 5 is a transverse sectional view taken on line 5—5 of Figure 4; and

Figure 6 is a transverse sectional view taken on line 6—6 of Figure 4.

The form of the invention illustrated in Figures 1 and 2 will be first described. This includes an intake tube 10 the inlet end 12 of which is threaded for attachment to the exhaust manifold 14 of a conventional internal combustion engine 16. Obviously, some type of connection other than threads can be used to secure the intake tube 10 to the exhaust manifold. The threaded connection illustrated is merely intended as an example of one type of connection which can be utilized.

The intake tube 10 projects through a centrally disposed opening 18 formed in one end wall of a substantially short, cylindrical first pressure chamber 20. The outlet end of the intake tube 10 is disposed intermediate opposite ends of the first pressure chamber, so that the exhaust gases of the engine 16 are directed against a partition 22 disposed transversely of the first pressure chamber, between the opposite ends of said chamber. The partition 22 is of frusto-conical formation in the preferred form of the invention, and is formed with a center orifice 24. The orifice 24 is concentric with the first pressure chamber and with the intake tube 10, and is of substantially reduced diameter as compared to the diameter of the intake tube.

Preferably, the outlet end of the intake tube is disposed sufficiently close to the orifice 24 as to hold a constant pressure against the orifice tending to force some of the exhaust gases through said orifice at high velocity. At the same time, the outlet end of the intake tube is spaced rearwardly from the partition a distance sufficient to preclude the possibility of a back pressure being exerted against the valves of the motor 16 through the exhaust manifold.

Those exhaust gases not forced under high pressure through the orifice 24 are forced rearwardly by the partition 22 within the first pressure chamber, so as to be discharged through an opening formed in the side wall of the first pressure chamber, said opening being in communication with the inlet end of a pressure chamber connector duct 26. The connector duct 26 extends to a second pressure chamber 28 spaced forwardly from the first pressure chamber, and secured rigidly to the first pressure chamber by a plurality of braces 30.

A supply tube 32 extends inwardly from a suit-

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able tank or other container, not shown, wherein there is maintained a quantity of a liquid substance to be atomized and spread. The tube 32 is secured rigidly to the first pressure chamber by means of a suitable connector fitting 34, and extends into said chamber. The outlet end of the supply tube is beveled as at 36 and is in close proximity to the orifice 24. Thus, when the exhaust gases are discharged under heavy pressure through the orifice 24, they will create a vacuum in the forward portion of the chamber 20, which forward portion may be conveniently termed an atomizing space 37.

As a result, the liquid substance drawn inwardly through the supply tube 32 by reason of said vacuum is atomized or divided into fine particles, which are discharged from the atomizing space or chamber 37 into an atomized materials outlet tube 38. The tube 38 extends from the front end of the hollow housing 20 wherein the first pressure chamber and atomizing chamber are provided, and increases progressively in diameter, said outlet tube 38 having a belled end 40 disposed within a pressure-creating ring 42 mounted within the second pressure chamber 28. Ring 42 partitions the chamber 28 into a pair of communicating compartments.

The flared or belled outlet end 40 of the tube 38 extends parallel to, and is spaced from, the wall of the ring 42 at the smaller end of the ring, the tube 38 projecting into said smaller end of the ring. As a result, there is defined an annular passage 44 that surrounds the outlet end of the tube 38. Exhaust gases forced through the connector duct 26 into the second pressure chamber 28, are forced under high pressure through the annular passage 44, so as to act upon the vaporized liquid emitted from the tube 38.

In this connection, it will be appreciated that the exhaust gases from the motor 16 will be discharged into the intake tube 10 at high temperature, and the heat from said gases will expand the vapors resulting from atomizing of the liquid drawn upwardly through the supply tube 32. Subsequently, when the exhaust gases that have not passed through the orifice 24 are discharged into the second pressure chamber 28, and forced through the annular passage 44 within said second pressure chamber, the exhaust gases will act still further upon the vaporized material, tending to further expand the same by reason of the heat of said exhaust gases.

This action is aided by deflection of the vaporized material by a conical spreader 46, whereby said vaporized material is deflected into the path of the exhaust gases forced out of the passage 44 and traveling along the wall of the ring 42. The conical spreader 46 is fixedly mounted in concentric relation to a ring 42, through the provision of a plurality of support rods 48 extending radially from the spreader to the side wall of the support ring.

A cylindrical, elongated main duct 50 is fixedly secured at one end to the second pressure chamber 28, by means of a weld seam 52. The exhaust gases emitted through passage 44 and the vaporized liquid discharged through the tube 38 are admixed within the main duct 50, and are discharged as a fog into a duct extension 54 receiving the outlet end of the main duct 50. A clamp 56 surrounds the extension 54, and is provided with a clamping screw 58, whereby the duct 50 and its associated extension 54 are fixedly connected in communicating relation.

The extension 54 is integral with a generally

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circular condensation collection chamber 60. The extension 54 is offset radially of the collecting chamber 60, discharging the intermixed exhaust gases and vaporized material into the marginal area of said chamber (Figure 1).

Thus, a whirling or spinning motion is imparted to the vaporized mixture, said motion being assured through the provision of a plurality of baffles 62 arranged in a circumferential series within the collecting chamber, and spaced equidistantly from one another. The baffles 62 are offset radially of the collecting chamber 60, and have their outer edges spaced inwardly from the side wall of the chamber so as to reduce interference with the whirling mixture to a minimum.

The chamber 60 is formed with a frusto-conical bottom wall, formed centrally with a depending neck 64, which extends into the open upper end of a sump 66. A set screw 68 is threadable through the side wall of the sump 66 adjacent the upper end of said sump, and is engageable against the depending neck or flange 64, so as to secure the sump fixedly but separably to the lower end of the collecting chamber 60.

When the vaporized mixture or fog is whirled at high speed within the chamber 60, any material not previously vaporized will be forced by centrifugal force against the side wall of the collecting chamber, and will move downwardly along said side wall, so as to collect within the sump 66. Periodically, the condensate collected within the sump can be drawn off by removal of the sump from the lower end of the collecting chamber.

The vaporized material, however, will move upwardly and will be forced out of the upper end of the collecting chamber, through a discharge spout or nozzle. To this end, the collecting chamber is integrally formed at its upper end with an inwardly directed guide flange 70, spaced vertically of the upper end wall 72 of the collecting chamber, said upper end wall 72 being formed with a large center opening 74.

An outwardly directed, annular flange 76 is integrally formed upon the nozzle member embodied in the invention, and is received in the annular groove defined between the guide flange 70 and upper end wall 72 of the collecting chamber. A set screw 78 is provided with a hand knob, and may be rotated for the purpose of fixedly holding the valve or nozzle member against movement relative to the collecting chamber, in selected positions to which said valve is rotatably adjusted upon the collecting chamber. Alternatively, the knob 78 may be rotated so as to leave the set screw out of gripping engagement with the flange 76, thus to permit the nozzle or spout to be freely rotatable upon the collecting chamber, and thus turned in various directions so as to direct the fog emitted therethrough along desired paths.

The nozzle or spout is provided with a riser 80, with which the bottom flange 76 is integral, the riser 80 being in communication with and being formed integrally with a lateral extension 82 provided at its free end with a nozzle 84.

The nozzle 84 is elongated or flared horizontally, as may be readily noted from Figure 1, while being at the same time formed to a reduced height, so as to form a nozzle or discharge opening upon the device that is of generally elongated, narrow configuration. The fog is discharged at high velocity through said opening of the nozzle, so as to be laid down over a wide area.

In the form of the invention illustrated in Figure 3, the intake tube 86 is adapted to be connected

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to an exhaust manifold of an internal combustion engine, not shown, in the same manner as the device illustrated in Figures 1 and 2.

The tube 86 extends into one end of an elongated cylinder 88, the cylinder or housing 88 being formed at said end with an end wall in which a center opening is provided, the intake tube 86 extending through said center opening. A frusto-conical collar 90 is applied to the intake tube, to rigidify said tube relative to the housing 88.

The exhaust gases fed through the tube 86 are discharged into the housing 88, into a first pressure chamber 92 disposed at said end of the housing. The first pressure chamber 92 is defined within the housing 88, through the provision of a transverse, generally conical partition 92 having a center orifice 94 through which the exhaust gases are discharged at high velocity, in the same manner as the gases are discharged through the orifice 24 in the first form of the invention.

The partition 92 is mounted within a cylindrical support 96, that is disposed within the housing 88, the support 96 having one end formed open and beveled as at 98, and having an end wall 100 at its other end, the end wall 100 being spaced from the partition 92 longitudinally of the housing 88, so as to define an atomizing chamber 101 contiguous to the first pressure chamber and spaced from the first pressure chamber by the partition 92.

A connector duct 102 is mounted within the partition 92, and has its inlet end disposed within the first pressure chamber 92. The outlet end of the connector duct opens through the end wall 100, into a second pressure chamber 104.

It will be understood that the connector duct 102 is analogous to the duct 26, so that some of the exhaust gases are forced directly through the duct 102 by back pressure created within the first pressure chamber, and are fed into the second pressure chamber 104.

An outlet tube 106 for vaporized material is arranged coaxially with the housing 88, extending longitudinally of said housing within the second pressure chamber. The outlet tube 106 is in communication at its inlet end with the atomizing chamber 101, and has a belled or flared outlet end 108 spaced a substantial distance from said atomizing chamber.

The liquid to be vaporized is fed inwardly into the atomizing chamber 101, through a supply tube 110, that extends from a suitable tank or receptacle, not shown. The supply tube 110 is substantially identical to the tube 32 in the first form of the invention, and is extended through a female member 112 formed in the cylindrical support 96 in registration with an opening 113 provided in the side wall of the housing 88.

A male fitting or collar 114 is provided upon the supply tube 110, and is threadably engaged in the female fitting 112, so as to secure the supply tube 110 in a fixed relationship relative to the orifice 94, at the outlet end of said supply tube.

Thus, when exhaust gases are discharged under high pressure through the orifice 94, a vacuum is created within the atomizing chamber 101, tending to draw liquid inwardly within the supply tube 110 and vaporize the same.

A port 116 may be formed in the wall of the supply tube 110, within the atomizing chamber 101. This port is provided, so as to draw back into the tube any raw material which may collect within the bottom of the atomizing chamber 101.

The flared end of the outlet tube 106 is disposed within the smaller end portion of a frusto-conical

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ring 118. The pressure ring 118 is spaced from the flared end 108 of the tube 106, so as to define an annular pressure chamber of progressively increased diameter, through which exhaust gases fed through the pipe 102 will be forced under high pressure, for admixture with the vaporized liquid discharged through the flared end 108 of the tube 106. So as to rigidly secure the tube 106 in concentric relationship to the pressure ring, radial braces 120 may extend from the end portion 108 to the side wall of the pressure ring.

The vaporized mixture discharged from tube 106 is deflected into the path of the exhaust gases moving through the annular passage referred to above, by a conical spreader 122 secured in a centered position within the housing 88 by radial support rods 124 extending to the side wall of the housing from said spreader.

In closely spaced relation to the conical spreader 122, there is mounted one end of a spirally formed baffle 128, disposed longitudinally of the housing 88, and secured fixedly within said housing by braces or supports 126 at opposite ends thereof. The spiral baffle 128 may be readily formed from a single piece of flat bar material, twisted axially from end to end thereof to provide a desired number of spirals, disposed at a selected pitch. The admixed exhaust gases and vaporized liquid, after having been given a whirling motion by the spiral baffle 128, are discharged in the form of a fog through the beveled end 130 of the housing 88.

In this connection, the spiral baffle 128 is analogous to the means provided in the first form of the invention, whereby a whirling motion is given to the admixed exhaust gases and vaporized mixture. This means serves to cause solid materials to condense against the wall of the housing, so as to prevent the discharge of unvaporized particles from the outlet end or nozzle of the device.

I believe it will be apparent from what has been illustrated and described herein that the device forming the present invention will be conveniently driven by the exhaust gases emanating from a conventional internal combustion engine. These exhaust gases, in both forms of the invention, are divided into two parts, one part of the exhaust gases being utilized to form a vacuum whereby a liquid is drawn upwardly through a supply tube and atomized. The other part of said gases is by-passed around the location at which the liquid material is atomized, but is admixed with said material at a location remote from the atomizing point, while at the same time giving added velocity to said material for the purpose of discharging the material as a fog. The feeding of the second named part of the exhaust gases to the atomized material assists in further vaporizing the material, due to the expanding nature of the exhaust gases and the heat thereof.

Further, in both forms of the invention, after the exhaust gases have acted upon the material to atomize the same and evaporate the material almost completely, the vaporized material is whirled by suitable means, so as to collect condensate or unvaporized particles thereof. Thereafter, the material is discharged as a fog, and can be used for any desired purpose.

For example, one purpose to which the device would be suited would be the application of insecticides to fields or, for that matter, to the interiors of structures. Or, the device may advantageously be used in fire-fighting equipment,

for the purpose of laying down fire-blanketing fog.

Other uses might of course suggest themselves and by experimentation, I have found that the device can be used as a mixing jet, wherein different liquid materials can be admixed for any desired purpose.

The form of the invention illustrated in Figures 3 and 4, allows operation on the same principles as the first form of the invention, is of a more compact construction, and may in many instances be fabricated with more ease and at less expense than the device first shown. For example, a single elongated housing 88 is provided, which may be formed from conventional pipe stock, due to its being of constant diameter from end to end thereof.

Also, the cylindrical support 96, partition 92, duct 102, tube 106, ring 118, and spreader 122 can all be preassembled as a unitary assembly, prior to insertion of said assembly within the housing 88. This is a desirable feature tending to reduce manufacturing costs.

It is believed clear that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles of operation and the means presently devised to carry out said principles, it being considered that the invention comprehends any minor changes in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. An exhaust driven atomizing and spreading device for liquid materials, comprising a housing partitioned to define therein a pressure chamber and an atomizing chamber, the pressure chamber having an inlet through which exhaust gases from an internal combustion engine or the like may be forced into the pressure chamber, the chambers having a communicating orifice proportioned for movement of the exhaust gases under pressure from the pressure chamber into the atomizing chamber; a supply tube for liquid material having an apertured outlet end portion extending into the atomizing chamber and opening immediately subjacent the orifice, the atomizing chamber having an outlet opening for the formation of a partial vacuum within the atomizing chamber on passage of the gases there-through tending to cause liquid to be drawn inwardly within the supply tube and atomized by the gases for discharge in a vaporized condition through the outlet opening; a second pressure chamber spaced from the first pressure chamber and from the atomizing chamber; a connector duct arranged to provide direct communication between the first and second pressure chambers, for diverting a portion of the exhaust gases forced into the first pressure chamber to the second pressure chamber concurrently with movement of the remaining portion of the gases into the atomizing chamber; a flared ring mounted in one end of the second pressure chamber and having an opening in its smaller end defining an outlet opening for the second pressure chamber; and an outlet tube arranged to conduct the vaporized liquid material from the outlet opening of the atomizing chamber to the ring, the discharge end of the outlet tube being flared correspondingly to the ring and being spaced from the

ring to define an annular, flaring passage for the first portion of the exhaust gases when said first portion of the exhaust gases is forced out of the second pressure chamber, thus to subject said vaporized liquid material to heat from the first-named portion of the exhaust gases for further evaporation of said liquid material.

2. An exhaust driven atomizing and spreading device for liquid materials, comprising a housing partitioned to define therein a pressure chamber and an atomizing chamber, the pressure chamber having an inlet through which exhaust gases from an internal combustion engine or the like may be forced into the pressure chamber, the chambers having a communicating orifice proportioned for movement of the exhaust gases under pressure from the pressure chamber into the atomizing chamber; a supply tube for liquid material having an apertured outlet end portion extending into the atomizing chamber and opening immediately subjacent the orifice, the atomizing chamber having an outlet opening for the formation of a partial vacuum within the atomizing chamber on passage of the gases there-through, tending to cause liquid to be drawn inwardly within the supply tube and atomized by the gases for discharge in a vaporized condition through the outlet opening; a second pressure chamber spaced from the first pressure chamber and from the atomizing chamber; a connector duct arranged to provide direct communication between the first and second pressure chambers, for diverting a portion of the exhaust gases forced into the first pressure chamber to the second pressure chamber concurrently with movement of the remaining portion of the gases into the atomizing chamber; a flared ring mounted in one end of the second pressure chamber and having an opening in its smaller end defining an outlet opening for the second pressure chamber; an outlet tube arranged to conduct the vaporized liquid material from the outlet opening of the atomizing chamber to the ring, the discharge end of the outlet tube being flared correspondingly to the ring and being spaced from the ring to define an annular, flaring passage for exhaust gases forced out of the second pressure chamber, thus to subject said vaporized liquid material to heat from the first-named portion of the exhaust gases for further evaporation of said liquid material; and a condensate collecting chamber arranged to receive the admixed exhaust gases and vaporized material after passage thereof through the ring and adapted to impart a whirling movement to the gases and liquid material, for collection of unvaporized liquid particles by centrifugal force against the wall of said collecting chamber.

3. An atomizing and spreading device for liquid materials comprising, in combination, a first pressure chamber having one inlet for connection to a source of exhaust gases, said chamber having a pair of outlets; an atomizing chamber into which one of said outlets opens and having means for atomizing a liquid material under the action of that part of the carrier gas forced through said one outlet; a second pressure chamber including a flared ring partitioning the same into communicating compartments, the second pressure chamber having an inlet in one compartment, at one side of the ring, and an outlet in the other compartment at the other side of the ring; a tube leading the atomized material through the ring for discharge into said other compartment and subsequent passage out of the second pressure

chamber outlet; a bypass extending from the other outlet of the first pressure chamber to the second pressure chamber inlet, for discharge of the remaining part of the carrier gas into the first named compartment, said ring and tube being relatively arranged to define therebetween a passage providing communication between the compartments and arranged for flow of said second named part of the carrier gas therethrough in an annular column along lines generally paralleling the path of the atomized material discharged from the tubes; and a conical spreader in the path of material flowing out of said tube, the tube having a belled end proportioned relative to said spreader to form the material into an annular column extending into convergence in said other compartment with the first named column.

4. An atomizing and spreading device for liquid materials comprising, in combination, a first pressure chamber having one inlet for connection to a source of exhaust gases, said chamber having a pair of outlets; an atomizing chamber into which one of said outlets opens and having means for atomizing a liquid material under the action of that part of the carrier gas forced through said one outlet; a second pressure chamber including a flared ring partitioning the same into communicating compartments, the second pressure chamber having an inlet in one compartment, at one side of the ring, and an outlet in the other compartment at the other side of the ring; a tube leading the atomized material through the ring for discharge into said other compartment and subsequent passage out of the second pressure chamber outlet; a bypass extending from the other outlet of the first pressure chamber to the second pressure chamber inlet, for discharge of the remaining part of the carrier gas into the first named compartment, said ring and tube

being relatively arranged to define therebetween a passage providing communication between the compartments and arranged for flow of said second named part of the carrier gas therethrough in an annular column along lines generally paralleling the path of the atomized material discharged from the tubes; a conical spreader in the path of material flowing out of said tube, the tube having a belled end proportioned relative to said spreader to form the material into an annular column extending into convergence in said other compartment with the first named column; a circular condensation collection chamber in communication with the second pressure chamber outlet, the second pressure chamber discharging the atomized material and carrier gas into and tangentially of the condensation collection chamber for movement thereof in a circular path about the periphery of the collection chamber; a circumferential series of baffles within and offset radially of the collection chamber, said baffles being spaced inwardly of the collection chamber from the periphery thereof and of said circular path to contain the flow to said path; a condensate collection sump in the bottom of said collection chamber; and a discharge nozzle extending outwardly from the collection chamber at the upper end thereof.

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