

May 20, 1958

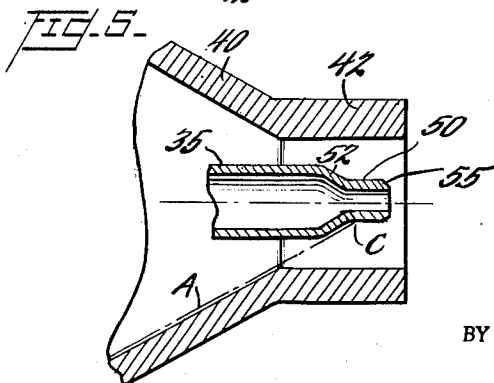
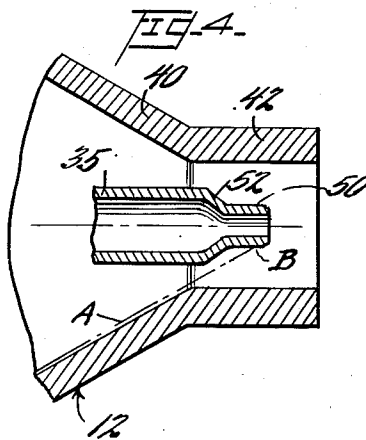
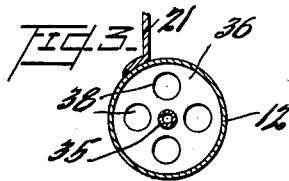
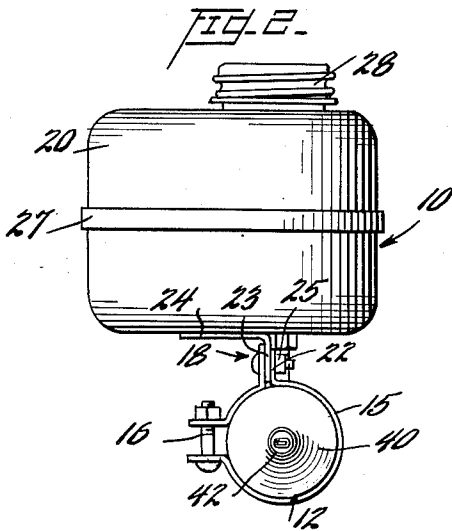
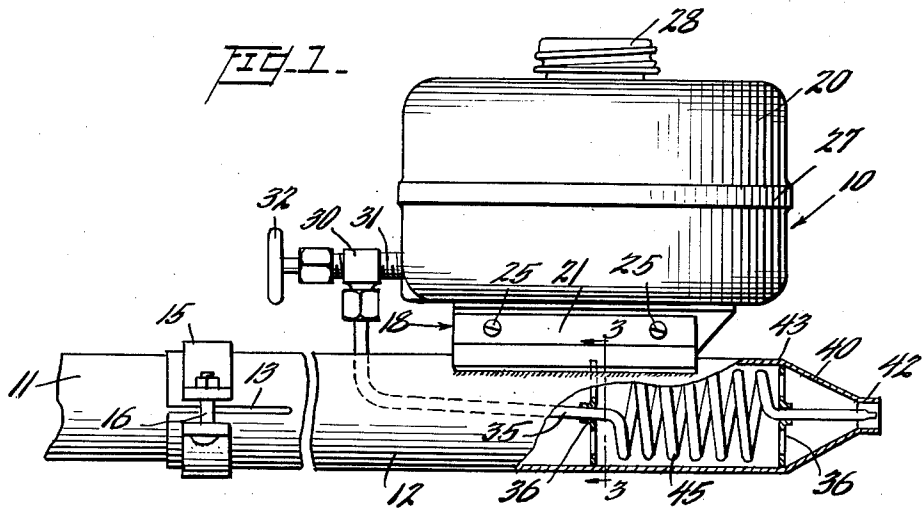
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2,835,533

EXHAUST ATOMIZING DISTRIBUTOR

Filed March 30, 1956

2 Sheets-Sheet 1



INVENTOR

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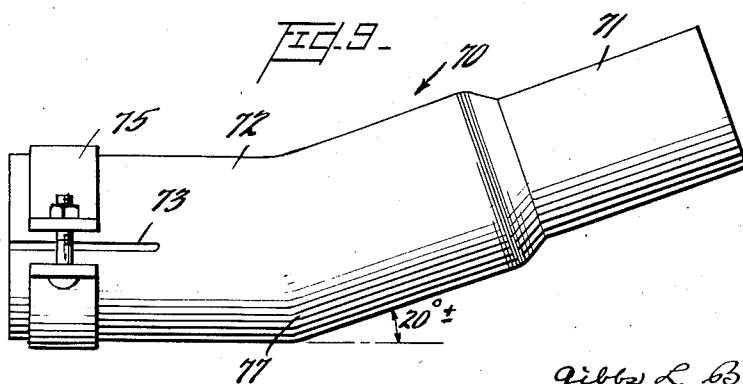
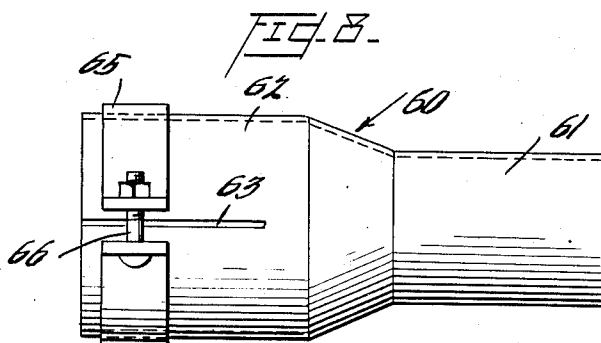
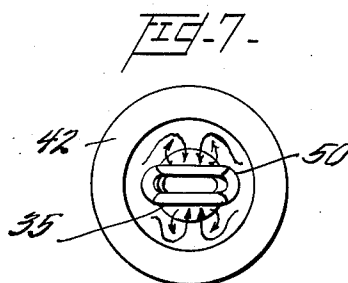
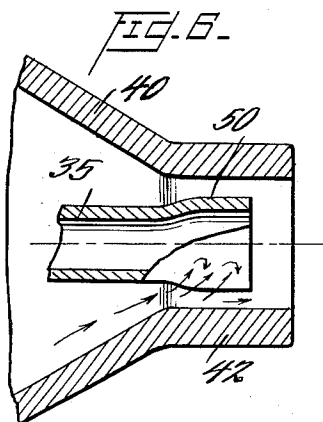
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EXHAUST ATOMIZING DISTRIBUTOR

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EXHAUST ATOMIZING DISTRIBUTOR

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Application March 30, 1956, Serial No. 575,187

2 Claims. (Cl. 299—86)

This invention relates to devices for atomizing and distributing liquid compositions and more particularly to devices of this class which are ambulatory and well adapted for distributing insecticides or other materials which are to be broadcast in finely divided form.

The general object of invention is to provide a novel and improved device of this type which is economical in construction, efficient in operation, and comprises a self-contained unit adapted for ready attachment to the exhaust pipe of an automotive vehicle.

A more specific purpose is the provision in such a unit of a novel nozzle construction for the efficient aspiration, atomization, and vaporization of the liquid composition by the use of the exhaust gases of an internal combustion engine, at the pressures and temperatures at which they ordinarily issue from the exhaust system.

It has already been suggested to use the exhaust gases of an internal combustion engine as the vehicle or means for atomizing, vaporizing and distributing liquids of various kinds for fumigating, for distributing insecticides, for generating fog or smoke screens, and for various other purposes. Some of these prior efforts have been directed to providing tractor-like carts built especially for this purpose, and many of them have involved certain proposals to utilize the heat of the exhaust gases as the principal agent in vaporizing the liquid compositions. Most of these devices have involved complicated arrangements of baffles, jackets, funnels, and even cyclone separators, and the expense of production and consequent price ranges, as well as inefficient operation, has prevented the widespread utilization of devices of this general character.

The present invention, on the other hand, contemplates the provision of a compact, relatively easily produced, self-contained unit which can be readily attached to the tail end of the exhaust pipe of an automobile, truck, or tractor. To adapt the device for use on almost all types of automotive vehicles, there is provided an adaptor-coupling for accommodating the unit to differences in size or angularity of the exhaust pipe.

In its more specific aspects, the invention includes the provision of a tubular element which constitutes, in effect, a continuation or prolongation of the exhaust pipe to which it is attached; a container for the insecticide or other liquid to be distributed, which container is supported upon such tubular element; and a valved tube or pipe for conducting the liquid into and through the tubular element. The tubular extension element is constricted at its rearwardly projecting end to provide a jet or nozzle construction, and the liquid conducting tube is provided with a limited number of convolutions within the element whereby the temperature of the liquid passing therethrough is raised somewhat to decrease the viscosity of the liquid to some degree. The liquid tube terminates with an inner nozzle which is situated with respect to the first mentioned nozzle in such a way as to insure the most efficient atomization of the liquid. The configuration of the inner nozzle as well as the taper of

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the outer nozzle is also modified, within the broad concept of the present invention, to give an optimum atomization and mixing of the sprayed material.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which certain embodiments of the invention are illustrated by way of example.

In the drawings:

Figure 1 is a view in side elevation of a device embodying the principles of the invention, the atomizing unit being applied to the end of the exhaust pipe of a motor vehicle; a portion of the figure being shown in vertical section for clearness of illustration;

Figure 2 is a rear end elevation of the same unit;

Figure 3 is a vertical sectional view taken on line 3—3 of Figure 1;

Figure 4 is a fragmentary vertical longitudinal sectional view on an enlarged scale through the tip of the discharge nozzle; the orifice end of the liquid tube being at its farthest retracted position with respect to the enveloping gas tube within the range of optimum effectiveness;

Figure 5 is a similar view illustrating the farthest advanced position of the liquid tube within such range;

Figure 6 is a view in horizontal longitudinal section of the nozzles;

Figure 7 is a view in rear elevation of the nozzles, the swirl of the mixing fluids being suggested diagrammatically;

Figure 8 is a view in side elevation of an adaptor for applying the device to exhaust pipes of differing diameter; and

Figure 9 is a similar view of another form of adaptor for use in application of the device to exhaust pipes of varying inclinations.

As illustrated for purposes of example, there is shown in Figure 1 of the drawings a self-contained unit designated generally by the reference numeral 10 which is adapted to be connected to and either partly or wholly supported by the tail end of the exhaust pipe 11. The unit 10 comprises essentially a tubular conduit element 12 of approximately the diameter of the exhaust pipe 11, the element being slotted as at 13 and clamped to the exhaust pipe by means of the strap clamp 15, the flanged ends of which are adapted to be drawn together by the bolt-and-nut fastening device 16. The band 15 may be welded to the tube throughout say one quadrant of its extent, for example, the upper right-hand quadrant as viewed in Figure 2 of the drawings.

Secured to the upper portion of the tubular element 12, as by means of the bracket device indicated generally at 18 is the liquid containing tank 20. The bracket means 18 comprises the pair of upwardly extending blades or fins 21 and 22 which are welded in spaced apart position to the tube 12. A downwardly extending fin or plate 23 has a horizontal flange 24 secured as by welding or otherwise to the bottom of a tank 20, and this fin 23 is seized between the plates or fins 21 and 22 and securely clamped in position by means of the bolt-and-nut fastening means 25.

In the example illustrated, the tank 20 is made in two parts with overlapping joined flanges 27, and may be furnished with a filling opening to which a screw cap 28 is applied.

A valve fitting 30 has a threaded portion 31 which enters the tank and the valve is adapted to be controlled by the handle 32 so that the flow of liquid from the tank is controlled as it enters the tortuous liquid tube 35. The tube 35 passes through an opening in the top of the tubular element 12 in the rear half thereof and then extends forwardly to a substantially axial position where it is supported by the perforated disc 36, this disc being

shown in elevation in Figure 3 of the drawings and the openings in the disc for the passage of exhaust gases being indicated at 38. The disc may be secured in position within the tube 12 in any suitable way.

The tubular conduit 12 adjacent its forward end is provided with a conical tapering nozzle portion indicated at 40 which in turn terminates in a substantially cylindrical orifice portion 42. At the point 43 where the conical portion 40 joins the main cylindrical portion of the tubular element 12 there is provided a second disc 36 which is the counterpart of the one previously described. Between the two discs 36 the liquid tube 35 is formed in a series of helical convolutions as suggested at 45. Six of these convolutions are shown in the specific example presented, but this number may vary within certain limits, the purpose being merely to thin out the liquid to aid its atomization by the aspirating pressure of the exhaust gases. Too few convolutions might in cold weather be insufficient to reduce the viscosity of the liquid to the desired extent, while the provision of too many convolutions would apply an excessive heat to the liquid and the resulting cloud of vapor would have a bluish cast which is indicative of too fine atomization.

The particular construction of the nozzle portions of the device for attaining the purposes described will now be described with particular reference to Figures 4, 5, 6 and 7 of the drawings. First of all, the conical taper of the portion 40 of the nozzle is shown as embracing an angle of about 30° with the axis, and the orifice portion 42 is again cylindrical but of a quite constricted cross-sectional area. The angularity of the taper of the part 40 with respect to the axis of the nozzle may vary between about 30° and about 60°. The liquid tube 35 is preferably of generally cylindrical configuration as it passes axially through the tapered portion 40 of the outer gas tube, but within the confines of the nozzle portion 42 of the gas tube, the liquid tube is flattened to a substantially oval cross-section as at 50. At the same time that the portion 50 is flattened in a vertical direction it is widened in a horizontal direction as clearly shown in Figure 6 of the drawings, although the net result is to restrict to a very slight degree the orifice cross-sectional area as compared with the general cross-sectional area of the tube 35. The portion between the cylindrical main part of the liquid tube 35 and the flattened approximately oval nozzle portion 50, which portion is designated by the numeral 52, is of a smooth tapering configuration gradually merging from the cylindrical shape to the oval configuration.

In order to prevent or minimize possible drip from the end of the liquid tube, at least the upper and lower lips thereof are provided with a bevel as indicated at 55, the angle of the bevel preferably being between about 30° and 60°, with a preferred bevel of about 45°, with the axis.

The turbulence of the mixture of gaseous and liquid streams at the point of aspiration between the two nozzle members is suggested by the arrows in Figures 6 and 7 of the drawings. The gases converging through the portion 40 of the outer nozzle enter the orifice portion 42 through an annular space which is substantially circular, and almost immediately the widening of the flattened jet 50 of the liquid tube 35 restricts the lateral clearance for the gases while at the same time the vertical clearance is increased. This causes an immediate swirl of gas inwardly above and below the flattened liquid tip and at the same time a very slight increase in total cross-sectional area of the gas stream, say in the neighborhood of possibly 12%. This results in a very slight pressure drop which, together with the change of direction of the gases gives rise to increased turbulence which aids in the atomization of the liquid composition.

There are also certain limits for optimum operation in the relative longitudinal positioning of the inner liquid

nozzle with respect to the outer gas nozzle. These limits are suggested approximately in Figures 4 and 5 of the drawings. In Figure 4 the inner liquid nozzle 50 is about in its rearmost effective position and in Figure 5 it is substantially in its foremost optimum position. The criteria of the positioning of the flattened inner nozzle with respect to the outer nozzle may be set forth as follows: (1) the gradual ovaling or flattening of the liquid tube must commence within the aperture portion 42, as already mentioned; (2) the rearward shoulder at the junction of the cylindrical and tapered portion 52 of the liquid nozzle should not project forwardly of the line of taper of the portion 40 of the gas conduit 12 (see Figure 5); (3) the forward end of the liquid tip 50 should not be positioned rearwardly of the same line of bevelling; and (4) the end of the liquid tube tip 50 should not project beyond the mouth of the exhaust gas nozzle 42.

As exemplifying certain of these qualifications, the construction line A in Figure 4, following substantially the bevel of the inner surface of the portion 40 of the gas tube intersects the liquid nozzle tip 50 at the point B near its outer end. Similarly, the same line A, in Figure 5, intersects the liquid tip 50 at the point C which is just slightly forward of the tapering shoulder portion 52. If the liquid tube tip is projected too far with respect to the mouth of the gas conduit end, the atomization and distribution will be much less effective, and on the other hand, if it is retracted too far inwardly, a pressure will be generated which will tend to back up the liquid until finally none will flow.

Although no limitation of scope in the protection afforded by this patent is intended by the following data, it may be well, in order to give an approximate idea of the relative proportions of the device, at least in its preferred embodiment, to set forth certain exemplary dimensions. The exhaust pipes of the average automobile approximate about 1 3/4" in outside diameter and the tubular gas conduit of the present attachment will be of about this same internal diameter. At the forward end of the device the conduit is constricted through a tapering nose portion 40 to the cylindrical orifice portion 42, which latter portion is preferably of an internal diameter of approximately .3". The liquid tube in this particular embodiment has an internal diameter of approximately 1/8" and at its flattened oval end the optimum vertical internal dimension may well vary from about 0.04" to 0.05", while the width of the oval opening can be in the neighborhood of approximately 1/4".

In Figure 8 of the drawings there is shown an adaptor element designated 60 which has a narrowed cylindrical portion 61 upon which the rear end of the tubular member 12 may be clamped in the same manner as described in connection with the clamping of this element directly to the exhaust pipe. The larger end 62 of the adaptor is made of a size to fit exhaust pipes of larger diameter. The adaptor is provided with one or more slots 63 and a clamping strap 65 is welded to the rearward portion of the adaptor throughout an arc of its periphery (preferably through a 90° arc) and the same type of bolt and nut connection 66 is employed to apply the clamp as in the case of the direct application of the device to an exhaust pipe.

In Figure 9 of the drawings a combined diameter and angular adaptor is shown with the general designation 70. The narrowed portion 71 is designed to fit within the tube 12 of the distributor and the larger portion 72 is angled as at 77 and is slotted as at 73 and a strap connection 75 is utilized as in the other cases. The angularity of the portion 72 of the adaptor 70 is suggested to be in the neighborhood of about 20°. Thus, the adaptor can approximately compensate for any slight horizontal or vertical inclination of the exhaust pipe and position the atomizing and distributing unit so that it may discharge the spray in an approximate horizontal rearward direction.

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It will be understood that various changes and modifications may be made in the construction and dimensioning of the embodiment illustrated and described herein without departing from the scope of the invention as defined by the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. As an article of manufacture, a self-contained portable attachment for application to the discharge end of an exhaust pipe of an internal combustion engine such as that of an automotive vehicle for the atomization, vaporization, and distributing of liquid insecticides or the like, said attachment comprising, in combination, a tubular exhaust gas conduit having an open receiving end and a nozzle structure at the opposite end; quick detachable means for clamping the receiving end of said conduit to said exhaust pipe; a tank for containing a quantity of liquid material to be distributed; means for fixedly supporting said tank upon said conduit for ready unitary portability therewith; a liquid conveying tube of substantially cylindrical configuration leading from said tank, entering said conduit at an intermediate point therealong, and terminating substantially axially thereof in a discharge end within the nozzle structure of the propellant gas conduit so as to be surrounded by the propellant exhaust gases therein; said nozzle structure comprising a frusto-conical portion of the conduit which converges to a short cylindrical discharge tip portion of uniform cross-section throughout, the frusto-conical inner surface and the cylindrical inner surface of said nozzle tip portion merging at an obtuse angle to form a blunt annular shoulder, the tip of the axial inner liquid tube disposed within the said cylindrical tip portion of the gas conduit nozzle, said liquid tip terminating short of the extreme end of the conduit nozzle discharge tip portion and no further inwardly of the nozzle than the point of intersection of the liquid tube with the forward projection of the frusto-conical inner surface of the gas conduit nozzle.

2. As an article of manufacture, a self-contained portable attachment for application to the discharge end of an exhaust pipe of an internal combustion engine such as that of an automotive vehicle for the atomization, vaporization, and distributing of liquid insecticides or the like,

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said attachment comprising, in combination, a tubular exhaust gas conduit of uniform cross-section substantially throughout its length and having an open receiving end and a nozzle structure at the opposite end; quick detachable means for clamping the receiving end of said conduit to said exhaust pipe; a tank for containing a quantity of liquid material to be distributed; means for fixedly supporting said tank upon said conduit for ready unitary portability therewith; a liquid conveying tube of substantially cylindrical configuration leading from said tank, entering said conduit at an intermediate point therealong, and terminating substantially axially thereof in a discharge end within the nozzle structure of the propellant gas conduit so as to be surrounded by the propellant exhaust gases therein, said nozzle structure comprising a frusto-conical portion of the conduit which converges to a short cylindrical discharge tip portion of uniform cross-section, the throughout frusto-conical inner surface and the cylindrical inner surface of said nozzle tip portion merging at an obtuse angle to form a blunt annular shoulder, the tip of the axial inner liquid tube disposed within the said cylindrical tip portion of the gas conduit nozzle, said liquid tip being flattened to an approximately elliptical cross-section and terminating short of the extreme end of the conduit nozzle discharge tip portion and no further inwardly of the nozzle than the point of intersection of the liquid tube with the forward projection of the frusto-conical inner surface of the gas conduit nozzle, the point of junction of the flattened tip and the normally cylindrical body portion of the liquid tube being disposed no further outwardly than the point of intersection of the projection of the frusto-conical nozzle surface with the liquid tube.

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