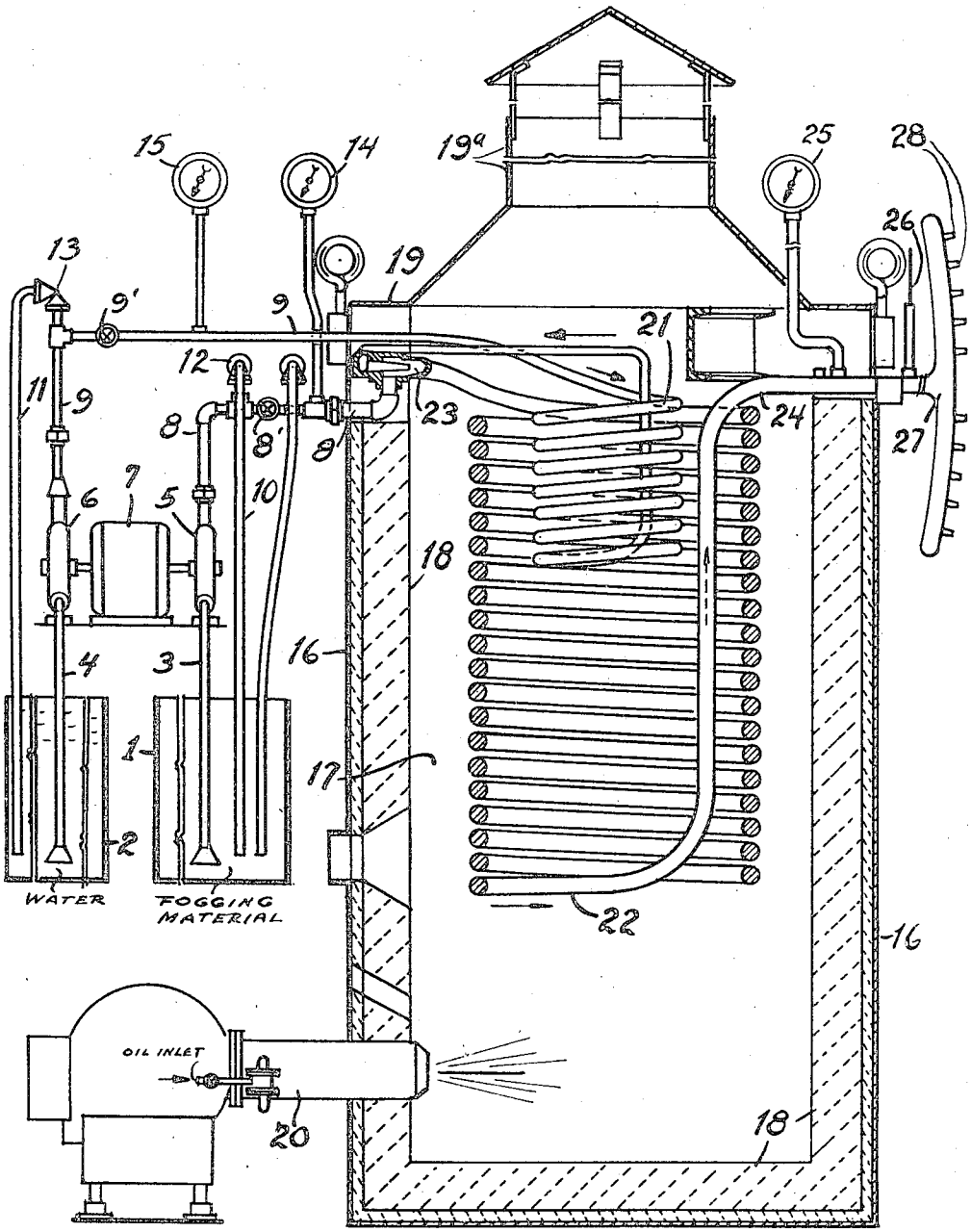
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APPARATUS FOR PRODUCING ARTIFICIAL FOG

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APPARATUS FOR PRODUCING ARTIFICIAL FOG

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The present invention relates to the art of producing fine dispersions of liquids in gaseous vehicles, fogs, mists and the like, which may be employed for various purposes, for example for obscuration in war time or for insect or other pest control and for prevention of frost in fields, orchards and the like. The invention relates not only to the improved method, but likewise to an apparatus for producing such fog. The invention will be fully understood from the following description and the drawing.

The drawing is a diagrammatic view in sectional elevation, showing the apparatus required and the flow of materials.

The use of smoke and fogs for obscuring purposes is broadly old but it has recently been found that extremely efficient, stable dispersions can be prepared by forcing a stream of vaporized organic liquid, of relatively high boiling point, through a narrow orifice or jet into the air or other gas so that the vapor is rapidly chilled. If high discharge velocities are employed, approaching the velocity of sound, it has been found that the particles, while of such minute dimensions as not to be separately visible are so numerous they are capable of scattering light over large areas. Their size is remarkably uniform and it is for this reason such fogs are extremely efficient.

In employing the scientific facts outlined above, difficulty has been encountered in obtaining the proper materials which are available in sufficient quantities and at reasonable prices. Difficulties have also been encountered because of the chemical instability of the materials available, so that the prior devices have rapidly carbonized, requiring frequent cleaning and replacement. The present invention consists of an improved method, based in part on the facts set forth above and of an apparatus capable of being used for long periods of time, and which requires little or no time off for cleaning or repairing when proper fogging materials are used. The method and apparatus are simple and a small generator has been found to have a surprisingly large capacity. Furthermore the method produces a fog or mist of the organic material which suffers the least possible decomposition and in consequence is sweet and no more harmful to animals or plants than the original material.

Referring to the drawing, numeral 1 denotes a tank containing a supply of the fogging material which may be referred to hereinafter as a high boiling petroleum distillate. Its nature will be more fully set forth below. A separate tank 2 is supplied with water. These materials are

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separately withdrawn by pipes 3 and 4 respectively and fed by the pumps 5 and 6 which may be conveniently operated by a single motor 7, either electric or gasoline as is most convenient. Control valves 8' and 9', preferably needle valves, are used to regulate the flow of the materials through the discharge lines 8 and 9, and return lines 10 and 11 are provided for each of the tanks with relief valves 12 and 13. Pressure gauges 14 and 15 are likewise provided on each of the lines.

The vaporizing furnace is indicated generally at 16 and its consists of a lower fire chamber 17 which is preferably lined with fire brick or tile 18. The fire chamber is surmounted by a removable top 19 and a short stack 19a to take away the combustion gases. Heat is supplied by any suitable source, preferably by means of an oil burner of the common gun type 20, as shown in the drawing. It will be understood that the heat may be supplied by other fuel such as gas, coal, gasoline, or the like.

Within the fire chamber preferably suspended out of direct contact with the flame of the burner, are two pipe coils 21 and 22. The smaller of these coils 21 is connected with the water discharge pipe 9 and is employed for vaporizing water. The smaller coil discharges the steam produced directly into inlet end of the larger pipe coil 22 through an injector nozzle 23. The oil discharge pipe 8 is also connected to the nozzle 23 so that the oil is drawn into the injector and is intimately admixed with the steam, proceeding at a rapid rate through the larger of the two coils, 22.

This coil 22 is designed to effect the complete vaporization of the oil and the mixture of oil and steam passes so rapidly through the coil that little or no decomposition of the oil results. The pipe 24, which receives the vapor mixture from the vaporizing coil, is fitted with a pressure gauge 25 and a thermometer 26 and the vapors then pass through a distributor pipe 27 which is drilled with small holes 28 for the discharge of the oil, vapor and steam mixture directly into the atmosphere.

In the operation of the present process and apparatus, it is extremely important to obtain a proper fogging material and for that purpose any molten material, preferably a liquid organic substance, may be employed. In the case of low boiling materials, such as gasoline, kerosene and the like, it will be understood that the fog will not long persist because of the high volatility of the material which in consequence rapidly

vaporizes into the air and disappears. With higher boiling materials, such as oleic acid and other acids, alcohols, fatty oils and the like, the fog is far more persistent, and petroleum oils of high boiling range are extremely useful also. Of the various petroleum oils, the distillate types are much to be preferred, since they can be much more readily vaporized without decomposition than can residuals.

It will be understood that for many purposes, persistency of the fog is not a necessarily desired characteristic and where this is not necessary, low boiling liquids can be used, but for persistent fogs, higher boiling products are necessary, for example, materials having flash points above 300° F. are most satisfactory. The mid boiling points of such materials, particularly the petroleum type of oils, are of the order of 700 to 850° F., and have Saybolt viscosities from 40 to 60 seconds at 210° F. One very satisfactory oil for this purpose has the following characteristics:

Flash point ° F	415
Conradson carbon percent	.10
Saybolt viscosity @ 210° F sec	55
Pour point ° F	—25

While organic liquids are the preferred fogging materials, especially hydrocarbon oils, it is contemplated that solids, even inorganic solids, can be employed for particular purposes. Any such substances as naphthalene and other fumigants can be employed; sulfur can be employed for dusting orchards and gardens. Other inorganic substances can be used, even metals, and it is only required that they be readily melted for forcing through the heating coil and capable of complete vaporization.

Various addition agents may be added to the vehicles depending on the purpose for which the fog is produced. As an example of such materials may be mentioned treating agents such as insecticides, fungicides, fumigants and the like. These materials may be generally added to the oil vehicle before it is fed to the heating coils and velocity through the heating zone is so great that a little or no decomposition occurs. However, with materials of extremely high heat sensitivity, it is possible to add such materials at the outlet of the heating coil so that they will be exposed to heat for an extremely short time only.

The heating coils may be made conveniently from steel pipe, the size and length depending on the heating capacity required. As an example, a unit having a capacity of 100 gallons per hour requires a steam coil consisting of approximately 25 feet of half inch pipe, while the larger oil vaporizing coil will consist of about 150 feet of one inch pipe. The velocity within the steam coil is not particularly important, but in the oil vaporizing coil it should be at least 50 feet per second as measured at the outlet of the coil, where vaporization is complete, and it is preferable to provide velocities of at least 100 to 150 feet, but even higher velocities can be used. The proportion of steam to oil can be varied considerably. Under good conditions at least 4 gallons of water are to be used for each 100 gallons of petroleum oil and 5 to 6 are generally preferred. With low boiling oils, such as kerosene, and of the same general boiling range, the steam can be entirely eliminated but it becomes increasingly desirable and absolutely necessary with oils boiling in the range of 700 to 900° F., and with oils which have a tendency to be dirty.

The outlet temperature will differ with different fogging agents, but it should be at least high enough to insure complete vaporization of the particular fogging agent used. This can be estimated under the conditions employed where a substantial amount of steam is used and a back pressure of 5 to 25 pounds per square inch is held at the outlet pressure gauge.

In starting up the apparatus, water alone is fed to the small or steam coil, preferably at considerably higher than the normal rate, and usually twice the normal rate is desirable. When the coil outlet temperature reaches the desired point, oil is fed to the larger coil and the water rate is cut back to normal. It is convenient to connect the oil and water relief valves 12 and 13 so that a single movement will open the oil valve and half close the water pipe. In this way, the motor can be kept going at a constant rate and the materials will be fed in the proper proportions. On shutting down the unit, the same procedure is used in reverse, the water flow being continued sufficiently long to thoroughly remove all oil from the heating coil as the apparatus cools down.

As an example of the operation of the present method, an apparatus similar to the one shown in the drawing was employed. The steam coil was half inch and the oil evaporating coil one inch. Oil of the specification given above was fed at a rate of 100 gallons per hour and the water at 6 gallons per hour. At the start of the operation no oil was being fed and the water alone was employed at the rate of 12 gallons per hour, until the outlet temperature reached about 700° F. Thereupon the oil feed was commenced at the rate indicated above and the water rate was cut to 6 gallons per hour. The temperature gradually increased to 875° F. and remained continuously between about 875° and 925° F. thereafter. The outlet pressure was held between about 10 and 20 pounds per square inch. A dense white fog poured from the 10 small holes in the distributing pipe and became clearly formed about two inches from the pipe itself.

Variation of the discharge pressure and the proportion of water to oil provides some control of the nature and quality of the fog. When operated as described there was no substantial decomposition of the oil during the treatment and it came out in the fog sweet and without the familiar cracked or burned odor. By actual measurement, the decomposition was in all cases less than one or two percent.

The above described apparatus can be varied considerably without departing from the essential principles of the present invention. The source of heat may be electrical energy, gas, coal, gasoline or other fuel, and dispersion gases, such as nitrogen, carbon dioxide or other inert gas may be used instead of steam which is preferred simply because of cheapness and availability. The heating coils may be arranged quite differently and the water and oil may be admixed before heating or after preheating the oil instead of as shown in the drawing, the important point being that complete vaporization of the oil is accomplished in the presence of steam. The apparatus may be mounted on a truck or trailer or may be installed permanently for constant use in the same locality.

I claim:

1. Apparatus for producing an artificial fog comprising a portable fire chamber and a source for heating the same, a steam coil mounted there-

in, a second coil also mounted therein and adapted to heat and completely vaporize a distillable organic liquid, a nozzle connected with the discharge end of the first mentioned coil and connected with the inlet end of the second mentioned coil whereby steam is continuously supplied to the organic liquid, a means for discharging the completely vaporized mixture into the atmosphere at a velocity of at least 50 feet per second at the coil outlet.

2. An apparatus for producing an artificial fog, comprising a fire chamber and a source for heating the same, a steam coil mounted therein, a vaporizing coil likewise in the firing chamber, means for supplying water to the steam coil, means for supplying a liquid fogging agent to the second coil, a nozzle by which steam is fed into the vaporizing coil and admixed with liquid fogging agent, and a discharge orifice through which

the second coil discharges the mixed vapor directly to the atmosphere at high velocity.

GARLAND H. B. DAVIS.

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