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THE PLUMBER'S NIGHTMARE, KING SIZE

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During the last few years insecticidal fogs have been used extensively for the control of adult mosquitoes. Interest in this method of control has stimulated the initiative of many workers, all seeking the same end result. This search has been directed toward an efficient, low-cost fog generator that could cope with the many variables encountered in field operations, operating personnel and available materials. The fog generator described in this paper is Consolidated Mosquito Abatement District's contribution to that search. The Plumber's Nightmare, King Size, has been field-tested and is presented with pride by a group of experienced foggers.

The Plumber's Nightmare is a product of limited income and unlimited mosquito production (Raley, 1947). More odds and ends from the plumber's scrap pile, war-surplus material and discarded vehicle parts than new parts have been used in developing this fog generator. William

Miller, of the Sutter-Yuba Mosquito Abatement District, of California, deserves full credit for his determination and his ability to find necessary parts at little or no cost. The mosquitoes were a constant irritating reminder that needed us into many hours of scorched-finger labor.

As the Plumber's Nightmare gained favor as a vehicle exhaust generator, modifications were assembled in many parts of the world. Ralph Crowe expanded its use by building a portable unit for fogging the inside of buildings on Guam (Crowe, 1948). A. L. Fleming, at Sutter-Yuba, met the challenge by modifying the original (Fleming, 1950). This unit is perhaps the most efficient of any fog generator for use on a vehicle. Fleming's modification eliminated practically all "drag" on the truck motor and nearly doubled the rate of material discharge. These improvements made it possible to operate the vehicle in a higher gear, saving both time

and equipment. Other modifications have been installed on several types of trucks. One interesting model is the dual arrangement mounted on a $1\frac{1}{2}$ ton truck by the Bureau of Vector Control. The two "Nightmares" are fixed on the front bumper, pointed in opposite directions. Even passenger cars have been used as a medium for generating the necessary hot air.

Through the years, generators that produce larger volumes of fog than were being produced by vehicles have been used successfully. To my knowledge, Robert H. Peters, Manager of the Northern San Joaquin County M.A.D. of California, unveiled the first fog machine with a Plumber's Nightmare venturi (Peters, 1950). Several other agencies had modified or built fog machines, but the Peters model started a trend that is still resulting in different designs. These early machines had only one fog head and have given good results in all districts that have them.

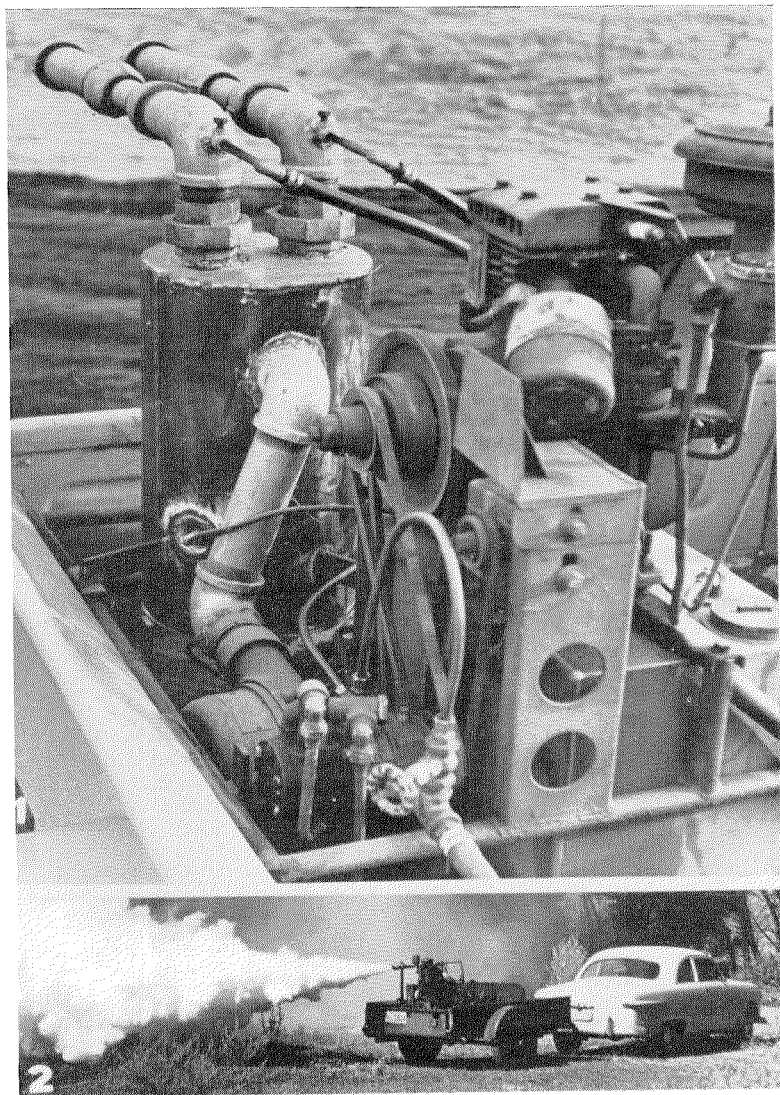
The two-barreled King Size machine (Fig. 1) is the end-product of several designs built by Consolidated M.A.D. One-barrel units were operating so successfully that it was suggested that two might give better results. Donald Merritt, Consolidated's builder extraordinary, somehow found time in mid-mosquito season to give substance to thought and came up with the control man's delight. This machine has met several tests with flying colors. Experience gained in building the one-barrel machines gave a good background for the basic design. The new modification turned out to be a simple change-over with no loss in mechanical efficiency. Adding the second orifice approximately doubled the output of previous machines built by the district. Only gross observations have been made on the killing qualities of fog produced by the King Size unit. Experience over the years with other Nightmares has shown them to be dependable under conditions suitable for fogging, so we have confidence in the new one. More precise testing is planned during the next mosquito season.

Since the unit is far from an engineer's

idea of a precision-built machine, no effort will be made to give more than a general description of the machine. Drawings and pictures have been reproduced and are available on request. (See also Figs. 1 and 2.) In principle, the mechanical features are similar to several other machines. A gasoline engine with a conveniently located fuel supply drives a vane-type blower. The air blast created by the blower is carried to a two-compartment chamber, circulated through the two sections, heated by a gasoline burner, and discharged through the two venturis; insecticides are introduced near the first constriction of the Nightmare. These venturis are oversized ($2" \times 1\frac{1}{4}"$) with an adjustable insecticide feed line for each. Pumps, gauges, pressure regulator, connecting lines, etc. are added to make the complete unit. Only the one King Size model has been completed. All machines have been remodeled war-surplus York-Hession smoke generators. Except for the frame and gasoline tank every part of the York-Hession has been replaced in one or another machine. This has demonstrated a practical solution for future construction. A new King Size fogger has been started and will be made from readily available standard parts. Full details will be recorded.

The principal features of the King Size Nightmare are favorable, but one bad feature is the lack of positive control of particle size. Adjustable feed lines give a certain degree of control but as yet it is not recommended for use in homes. There have been many hours of operation in and around populated centers with little complaint of automobile spotting or similar damage. When proper adjustments of heat and flow rate are made, the discharge is reasonably constant. Good features are low cost, ease of repair, light weight, quiet operation, low heat range, safety; and volume and quality of fog.

Fogging is, of course, only one phase of a well rounded mosquito control program. Circumstances dictate the part it plays in each particular agency, with the money available usually guiding the deci-



FIGS. 1 and 2. Plumber's Nightmare, King Size

sion. Regardless of the part it plays, cost, particularly the initial cost, is probably the prime concern of everyone involved. Oftentimes, too few machines will create a greater problem than none at all, so initial investment is of prime concern. Maintenance and operation costs then enter the picture and raise the question of repairs, availability of parts, personnel qualified both to make repairs and operate the machine. These factors govern the extent to which the machine can be used.

Practical experience in Consolidated M.A.D. indicates that the Plumber's Nightmare King Size is comparatively low in cost. From the experience gained in building eight fog generators that required making or purchasing every vital part, we consider that a new unit can be made ready for field use for less than \$500.00. Materials will cost from \$375.00 to \$400.00 and a qualified mechanic can put them together in 3 to 5 days. Ready accessibility to all parts plus simple construction means low maintenance expense. A good operator can learn to take it apart and make necessary repairs very quickly. As the unit is light in weight (approximately 200 pounds) it can be maneuvered into just about any type of situation, increasing the working time many hours beyond the heavier machine that is restricted to improved roads.

Safety was an important consideration in our approach to the problem of design. By circulating forced air from the blower through the outer chamber of the burner pot, outside temperatures are kept very low. Even after an hour of running time there is little danger of being burned on contact with the pot. The only extreme heat is at the bend in the discharge pipe. Releasing all the air produced by the blower prevents any build up of pressure within the heat chamber, so there seems little chance for an explosion. These features combine to make the machine's operation relatively quiet. The noise from the gasoline motor and the pulleys covers

all other sound. It sounds like a sewing machine. The position of the gasoline burner and the free flow of hot air and location of insecticide delivery both reduce the fire hazard.

The low heat and constant release of all air moved by the blower produces a good volume of fog. A few tests have indicated a fairly constant particle size with a very small percentage below one micron. Some smoke is produced, but the greatest amount of the material discharged is over ten microns. Breakdown is complete enough to keep the large droplets to a minimum. The ground directly below the orifice shows no sign of wetting unless the machine is in one spot for several minutes. The airborne fog is wet, and comes close to being a fine mist. The low temperature should make it possible to use a greater variety of insecticides than fog generators with higher temperatures. Pyrethrins have been used only casually as an addition to the standard fog mixture. In the coming season pyrethrum formulations alone will be tested to see how effective they are.

Summarizing, the machine described and illustrated has operated successfully in the field. The original Plumber's Nightmare has been proved by time; however, the King Size is still too new to make precise recommendations. Others who might become involved in building a unit will find the information useful as a guide to a good machine, but we sincerely hope that they will come up with many improvements.

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