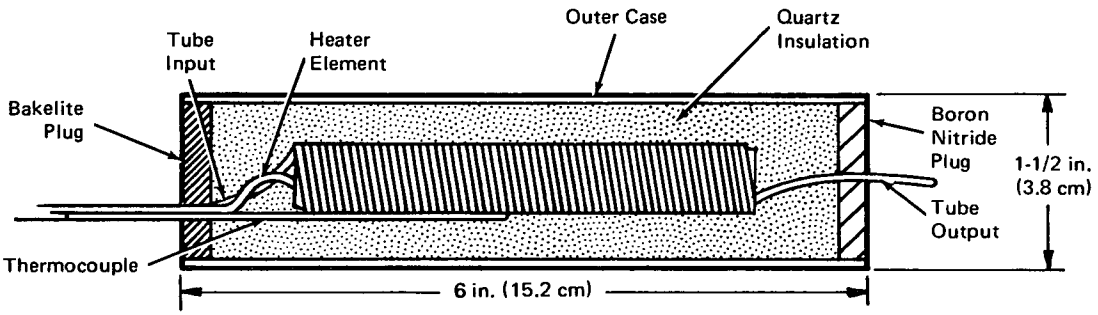
NASA TECH BRIEF

Langley Research Center

Smoke Generator



Smoke Generator

A smoke generator used at Langley Research Center wind tunnel for visualizing the air flow could be utilized as a fogger for insect control. While air-pressurized foggers are available commercially, they are charged with insecticides which vaporize rapidly at warm outdoor temperatures. The result is that insecticides must be frequently applied to maintain proper insect control. The smoke generator, on the other hand, could be charged with an insecticide that vaporizes at higher than outdoor temperatures. One spraying then would be sufficient to provide a lasting insect control. In use, such an insecticide could be mixed with the fuel, or even used as fuel to feed the smoke generator.

The components of a smoke generator of this type are shown in the illustration. The size can be changed to suit needs, as long as operating temperatures can be attained and identified controls are utilized.

The generator shown is 1-1/2 inches (3.8 cm) in diameter and 6 inches (15.2 cm) long. It consists of tubing coiled around a heating element, a thermocouple, insulation, and an outer case. The heating element is rated at 300 watts and is 3/8 inch (1 cm) in diameter by 4 inches (10.1 cm) long. Seven feet (2.1 m) of Monel tubing (0.060-inch, 1.5-mm, diameter) is tightly coiled around the heating element and extends 4 inches (10.1 cm) beyond the element on the input side and 2 inches (5.1 cm) on the output side. The tube is spot welded to the heating unit with Nichrome strips. A ceramic-insulated Chromel-Alumel thermocouple is spot welded to the tubing at the center of the coil and extends past the heater end with the heater leads. A 1/2-inch (1.3-cm) layer of quartz batting insulation is placed around the heater and coil, to reduce heat loss and concentrate heat in the coil; and the assembly is installed in the case. A boron nitride plug 1/4-inch (0.6-cm) thick is installed in the case with the output tube end extending through it, and a Bakelite plug is placed in the other end of the case.

Temperature is controlled by a 0- to 140-volt variable transformer which supplies power to the heating element. Fuel is supplied by a pump or a pressure tank that will maintain 50 lb/in.^{2} (345 x 10^3 N/m^2) of pressure, and a needle valve is inserted between the supply and the generator assembly to regulate fuel flow. The fuel used, in this instance, is a silicone diffusion pump oil, which is nontoxic, noncorrosive, nonorganic, chemically inert, and dielectric; but this does not preclude the use of other fuels. This oil does not decompose at operating temperatures and emits a large volume of smoke per quantity of fuel used. The thermocouple output may be monitored by any meter designed for this purpose.

(continued overleaf)

In operation, the fuel needle valve is opened until the tube is filled with oil and is then closed. Approximately 110 volts of power are supplied to the heater and maintained until the temperature reaches 800° F (698 K). (The temperatures given are for Dow Corning 704 fluid and normally would be different for other fuels.) The fuel valve is reopened, and the voltage is increased and adjusted to hold the temperature near 900° F (755 K). As oil is forced through the tubing coil, it is vaporized and produces a dense smoke when forced out of the tube. To reduce the smoke rate, the fuel supply is decreased while maintaining temperature near 900° F (755 K). The generator is turned off by removing the heater voltage and closing the fuel valve, when temperature drops below 300° F (422 K).

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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