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Third
Progress Report
on

FIRE DETECTION IN AIRCRAFT ENGINE NACELLES

by

C. S. McCamy and Wm. F. Roeser

Covering period 25 October, 1952 to 25 January, 1953

for
Headquarters
Wright Air Development Center
Wright-Patterson Air Force Base
Dayton, Ohio
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WCLEM-3

2233

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1. Summary

Work on the construction of a spectroradiometer to be used in analyzing the radiation from flames has been delayed because of late delivery of some of the essential components. These have been delivered recently and are now being tested and calibrated.

Some study is being made of the technical feasibility of the development of fire detection systems in which the change in the permeability of a ferromagnetic material at the Curie temperature is utilized. Several preliminary experiments, using Ferromagnetic Ceramics as the cores of inductance coils, indicate that these materials might be used to advantage in a "spot" fire detection system.

2. Radiation from Flames

Work is continuing on the construction of a spectroradiometer to be used in analyzing the emissions from flames. Some delay has been involved in procuring suitable filters and radiation detectors for the instrument but these have now been received. The various components are being tested and calibrated.

The spectral region below 0.29u is of special interest since practically no radiation of these wavelengths is found in the emissions from hot engine parts or in the sunlight reaching the earth's surface. The instrument referred to above employs photomultiplier tubes and a photoconductive cell for studying this spectral region as well as others. A flame detector operating on radiation of these wavelengths is expected to have little "background noise" or interference. In view of the fact that the use of Geiger-Muller tubes has been proposed for this specific purpose, such a tube has been obtained and plans are being made to study some of the problems inherent in its application to fire detection. Factors to be considered would be: transmittance of oil films, stability of the counter tube, quenching characteristics of the tube, and the size, weight, and maintenance requirements of accessory equipment.

Combustion studies were made to determine the type of flame that might be expected in an aircraft engine nacelle as the result of burning aircraft hydraulic fluid or lubricating oil. The observations indicate that such flames are almost certain to be luminous flames typical of open gasoline fires or very rich fuel-air mixtures. The characteristic yellow color persisted in the diffusion flames even when they were subjected to high velocity air streams almost sufficient to extinguish them.

3. Curie Temperature Fire Detection Systems

While the work on the study of flame characteristics was being delayed by procurement difficulties, some study was made of the technical feasibility of the development of fire detection systems in which the change in the permeability of a ferromagnetic material at the Curie temperature is utilized. Particular attention was directed toward the use of Ferromagnetic Ceramics because it is reported that these materials undergo a much sharper change in permeability at the Curie temperature than do metals.

Several preliminary experiments, using Ferromagnetic Ceramics as the cores of inductance coils, indicate that these materials might be used to advantage in a "spot" fire detection system. However, little is known regarding the degree to which these materials can be reproduced with specified magnetic properties. Further experiments with these materials are planned.

4. Financial Condition

Expenditures and commitments on this project:

April 25 through September 30, 1952	$ 6,968.82
October 1 through December 31, 1952	3,764.55
Total through December 31, 1952	$10,733.37

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