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Sixteenth Quarterly Progress Report

on the

Mechanisms of Fire Ignition and Extinguishment

by

E. C. Creitz

Covering the period 1 May 1963 to 31 July 1963

for

Bureau of Ships

Department of the Navy

Code 638

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1. Summary

The mass spectrometer being designed for the study of electron attachment and ionic processes in flames is showing satisfactory progress. The new ion source has shown satisfactory performance on positive ions and, after considerable experimentation, has produced some negative ions. A report was written on the velocity modulation scheme. A theoretical resolution of 1,300 was predicted for a duty cycle of 75% compared to the presently realizable resolution of 60 at 80% duty cycle.

2. The Mass Spectrometer

The new electron source unit designed and installed by Mr. Mills resulted in quite satisfactory performance in producing positive ions. Electron currents of 100 microamperes were easily produced. However, the electron energies were too high to produce negative ions in any quantity. An electrostatic screen around the source made it possible to reduce the electron energies so that, by using a compound, perfluoryl chloride, known to produce large quantities of negative ions, it was possible to detect some negative ions. It will now be possible to optimize focusing and accelerating potentials to increase the number of ions subject to analysis.

Theoretical studies directed toward utilization of velocity modulation indicated that the resolution could be increased by a factor of about 20 without sacrifice of duty cycle. While it may not be possible to obtain saw-tooth voltage generators having the required characteristics, it appears that a practical increase of a factor of 10 is possible. The velocity modulation approach also offers the advantage that a large part of the interference caused by overlaping harmonics may be eliminated. A report has been written covering the theoretical development of the idea.