

### Irradiation Effects

The Massachusetts Institute of Technology has applied its particle-accelerating techniques to the study of the biological, photochemical, and germicidal effects of intense ionizing radiations. In this work Roentgen rays and cathode rays of several million volts' energy have been applied to the destruction of bacteria and viruses, to the inactivation of enzymes and yeasts, and to other biological and chemical processes. A constant-potential electrostatic generator of the Van de Graaff type was used to produce continuous streams of electrons with homogeneous and controllable energy. These high-energy electrons were used for both the production of penetrating Roentgen rays and the direct irradiation of materials.

The biological action of these radiations results from excitation and ionization of the constituent atoms of the absorbing materials. In both Roentgen-ray and cathode-ray irradiation the response of the material is produced by the secondary electrons accelerated in the absorber, and is proportional to the absorbed energy.

It was observed that substantial differences in the sterilizing dose exist for different microorganisms. Spore-forming bacteria require several times more dose than yeasts, molds, and non-spore-forming bacteria. The complete sterilization of the most resistant bacteria could be accomplished by the absorption of ionizing energy sufficient to raise its temperature about 4° C. Roentgen rays and cathode rays produce biological effects which are in all respects similar for a given amount of energy absorbed, but the direct utilization of cathode-ray energy is a far more efficient process. A compact two-million-volt electrostatic accelerator, for example, can deliver a sterilizing dose of cathode rays to over 10,000 pounds of material in a full day's operation. The maximum penetration of cathode rays is about 1 centimeter for each two million volts of energy. J.G.T.

Irradiation of Biological Materials by High-Energy Roentgen Rays and Cathode Rays. By J. G. Trump and R. J. Van de Graaff. *J. App. Phys.* 19: 599, July, 1948. Biological and Photochemical Effects of High-Energy Electrostatically Produced Roentgen Rays and Cathode Rays. By C. G. Dunn, W. L. Campbell, Harvey Fram, and Ardelia Hutchins. *J. App. Phys.* 19: 605, July, 1948.

### Radiation and Rockets

The hot radiating gases formed during normal combustion in liquid-fuel rocket motors are responsible for radiant heat transfer to the chamber walls and to the

liquid or gaseous reactants which are injected at the head end of the rocket chamber. Absorption of radiant energy by the propellants increases the temperature of the reactants and therefore modifies the combustion process. It has been shown previously that the burning rate of powders in solid-fuel rockets is similarly affected by the absorption of radiant energy.

This paper is concerned with the determination of radiant heat transfer to a small volume of liquid or gas moving with constant velocity along the axis of a rocket chamber. Solution of the mathematical problem does not depend on the wave-length distribution of the radiant intensity or on the absorption coefficient of the moving fluid. For the purposes of numerical calculations, however, it is necessary to make the simplifying assumption that the emitters of radiation are gray-bodies. Representative calculations for the Wac Corporal high-altitude rocket are discussed.

Current experimental studies on the nature of the radiation from rocket flames will permit more accurate evaluation of radiant heat transfer in rockets by calculations similar to those discussed in this paper. S.S.P.

Some Considerations of the Effect of Radiation on the Performance of Liquid Fuel Rockets. By S. S. Penner and S. Weinbaum. *J. Opt. Soc. Am.* 38: 599, July, 1948.

### Wide-Range Microphone

The growing need for making acoustic measurements in air in the supersonic frequency range has resulted in the development of new equipment which permits the absolute measurement of sound pressure from 50 cycles to 250 kilocycles. One of the important applications being made of this newly developed instrument is in analyzing the sound spectrum in jet engine exhausts in connection with investigations being carried on by the Aero-Medical Laboratory at Wright Field to learn of the effects of these sound fields on living organisms. The measurement microphone which is a part of this instrument is the smallest known true microphone in existence and it behaves as a point throughout the entire audible frequency range to beyond 20 kilocycles, thereby permitting free field measurements without diffraction errors. Sound pressure magnitudes from a few dynes to one million dynes per square centimeter are directly measurable and changes in pressure occurring over a period of a few microseconds can be readily reproduced. The new equipment will open up new possibilities in the science of acoustics by permitting true 'pin-point' measurements as well as by permitting absolute measurements over a large portion of the supersonic frequency region. F.M.

Sound Pressure Measurement Equipment for the Range 50 Cycles to 250 Kilocycles. By Frank Massa. *J. Acous. Soc. Am.* 20: 451, July, 1948.