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THEORETICAL INVESTIGATION OF ONE-DIMENSIONAL FLAME PROPAGATION

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During the quarter ending 31 December 1955, the work proceeded along two general lines. These were:

- (a) solution of the steady-state flame-propagation equations on the analog computer, and
- (b) investigations of suitable models and computational procedures for the unsteady problem.

The work in (a) had two objectives: first, simply to determine if the results previously obtained by Hirschfelder on the digital computer could be duplicated on an analog machine, and second, to obtain information to guide the work in (b).

The equations formulated by Hirschfelder, et al. (The Journal of Physical Chemistry, April, 1953) for the decomposition of hydrazine were solved for several values of the diffusion parameter. The flame speeds obtained were within a percent of two of those of Hirschfelder and von Karman and Penner (Selected Combustion Problems, AGARD Publication, 1954). In addition to the propagation speed, the distribution of properties in x , and hence the flame thickness, is a direct result of the analog integration. It should be mentioned that while no difficulties were encountered for reasonable values of the diffusion parameter or for zero diffusion, solutions for extremely small amounts of diffusion were difficult to obtain.

Several methods are under consideration for solving the unsteady propagation problem. All of these, at present, make use of the analog computer. The governing partial differential equations may be integrated on this kind of machine if the x derivatives are written as finite differences. To limit the amount of computing equipment required, attention is centered, for the present, on models involving a simplified reaction rate, but which retain, however, the essential nonlinear features of the problem.

The total expenditure to 30 November 1954 was \$2,516.23; the balance at that date was \$12,483.77.

