In [1, 2] the laws of ignition of various condensed substances in a flow of hot gas were experimentally investigated. The dependence of the ignition lag on the parameters characterizing the experimental conditions was represented in the form

$$t_{ig} = C \alpha^{-m} (T_0 - T_{in})^n \exp \left( \frac{A}{RT_0} \right),$$

where $\alpha$ is the coefficient of heat transfer between the specimen and the gas flow; $T_0$ is the flow temperature; $T_{in}$ the initial temperature of the substance; and $R$ the universal gas constant.

*Deceased.
TABLE 1

<table>
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<tr>
<td>A</td>
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</table>

Fig. 2. Ignition lag as a function of flow temperature ($T_{in} = 25^\circ C; R_0 = 0.4$ cm). 1) Machine computation for plate model; 2) machine computation for a cylinder; 3) calculation based on the approximate formulas for a cylinder (the points represent the experimental data).

In [2, 3] these experimental laws were compared with those calculated on the basis of the thermal theory of ignition. Reasonable agreement between the experimental and calculated data was obtained for the quantities $m$, $n$, and $A$. However, a comparison of the absolute values of the ignition lags revealed a considerable discrepancy (by a factor 2-2.5) at relatively low gas flow temperatures. As the temperature increased, the agreement improved. Since the relations of the thermal theory were obtained for a semi-infinite model, while the experiments were conducted on cylindrical specimens, it may be assumed that this discrepancy is attributable to the failure to take the effect of the specimen geometry into account.

We have tested this assumption by means of computer calculations of the ignition lags of a cylindrical specimen of pyroxylin.

We solved the equation of heat conduction with chemical heat sources for an infinite cylinder:

$$\epsilon \rho \frac{\partial T}{\partial t} = \lambda \left( \frac{\partial^2 T}{\partial r^2} + \frac{1}{r} \frac{\partial T}{\partial r} \right) + Q k_0 \exp(-E/RT(r, t)),$$

$$t = 0, T = T_{in} - \lambda \frac{\partial T}{\partial r} \bigg|_{r=R_0} = \alpha (T_0 - T); \frac{\partial T}{\partial r} \bigg|_{r=R_0} = 0. \quad (1)$$

Here, $R_0$ is the specimen radius; $r$ a coordinate; $T$ temperature; $t$ time; $\lambda$ thermal conductivity, $Qk_0 = 6.35 \cdot 10^{21}$ cal/cm$^3$·sec; $E = 48,500$ cal/mole [4]; $\lambda = 3 \cdot 10^{-4}$ cal/cm·sec·deg; and $c_p = 0.465$ cal/cm$^3$·deg$^1$.

Equation (1) was solved on a computer by the pivotal method [5]. The range of variation of the parameters $\alpha$, $T_0$, $T_{in}$, and $R_0$ corresponded to that experimentally investigated in [1].

The nonstationary temperature profiles for two extreme values of $T_0$ are presented in Fig. 1. As may be seen from the figure, at $T_0 = 300^\circ C$ the thermal wave is able to reach the center of the specimen during the ignition lag and even heat it slightly; however, at $T_0 = 600^\circ C$ the thermal wave penetrates to a much smaller depth, and the center of the specimen and the adjacent material remain cold. At a moment $t$ close...