for only three explosives are shown; the others are qualitatively similar.) It can be seen that with the least-square k_i, fairly good agreement is obtained. The values of the parameters thus determined are

$$\begin{aligned} \alpha &= 0.5, \\ \beta &= 0.09, \\ \kappa &= 1.0, \\ k_i &= \text{least-square set, Table III.} \end{aligned} \tag{16}$$

The C−J pressures calculated with this set of parameters are compared with the experimental values in Table IV. The variation of C−J temperature and pressure with loading density for three explosives is shown in Fig. 8. The calculated variation in C−J composition with loading density for 65/35 RDX/TNT is shown in Fig. 9. (The compositions shown may not be physically meaningful, but the figure does serve to show the types of equilibrium shifts predicted by our calculations.)

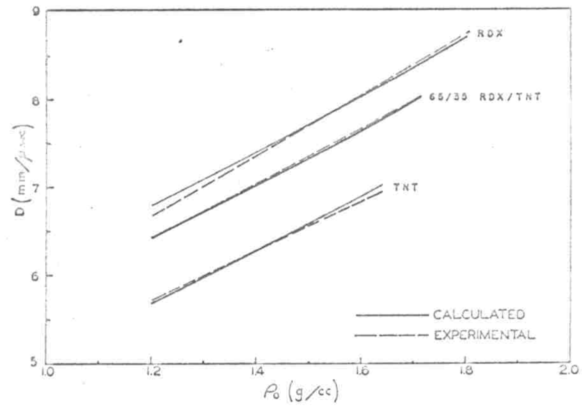

FIG. 7. Comparison of calculated and experimental $D-\rho_0$ curves for least-square k_i; $\alpha=0.5$, $\beta=0.09$, $\kappa=1$.

Table V gives (for 65/35 RDX/TNT) some points on the adiabat passing through the C−J point, and also points on the shock Hugoniot for the detonation products which originates at the C−J point. It can be seen that for all practical purposes the adiabat and shock curve are identical over the region which can be studied by the interaction of plane detonation waves with stationary metal plates.

6. DISCUSSION

As can be seen from Fig. 7 and Table IV the agreement with experiment is good in the case of D *vs* ρ_0, and, with the exception of TNT, fairly good in the case of p_{CJ}. The disagreement between calculated and experimental p_{CJ} for TNT is rather large. Perhaps a more enlightening comparison of theory and experiment[29] can be made with a quantity related to the adiabatic compressibility:

TABLE IV. Comparison of calculated and experimental results.

Explosive	C−J Pressure (Mb) Experimental	Calculated	Difference	γ^* Experimental	Calculated	V_g/V Calculated
RDX ($\rho_0=1.800$)	0.341	0.3488	+2.2%	3.05	2.908	0.0497
$C_{3.3}H_{6.2}O_6N_{5.6}$ ($\rho_0=1.748$)	0.316	0.3194	+1.1%	2.94	2.902	0.0633
78/22 RDX/TNT ($\rho_0=1.755$)	0.317	0.3106	−2.2%	2.82	2.899	0.0785
65/35 RDX/TNT ($\rho_0=1.715$)	0.292	0.2843	−2.8%	2.79	2.888	0.0945
TNT ($\rho_0=1.640$)	0.177	0.2066	+16.6%	3.48	2.913	0.1837

$$\gamma_{CJ}^* \equiv -\frac{V}{p}\left(\frac{\partial p}{\partial V}\right)_S = \frac{\rho_0 D^2}{p_{CJ}} - 1. \tag{17}$$

[This expression can be obtained from Eqs. (7) and (10) by neglecting p_0.] The values of γ^* obtained from the experimental ρ_0, D, and p, together with the calculated values of γ^* and the calculated fraction of total volume occupied by graphite are shown in Table IV.

It can be seen that both calculated and experimental γ^*'s have a minimum as a function of the percentage of RDX. This is probably due to the large γ^* of carbon. As the percentage of RDX decreases, γ^* tends to be lowered by the decrease in pressure, but this tendency will be overcome by the increase in the amount of solid carbon present, if its γ^* is sufficiently high. Thus it might be expected that increasing the γ^* of the solid carbon would increase the calculated p_{CJ} for TNT more than for the other explosives. Accordingly, some calculations were made with the less compressible graphite equation of state,[21] whose γ^* at the TNT C−J point is 10.1 as compared with 5.65 for our graphite equation of state (2). However, this raised the γ^* of the product mixture by only 3% and hence lowered the calculated p_{CJ} for TNT by only 3%, while at the same time lowering the calculated p_{CJ} for 65/35 RDX/TNT by 1%.

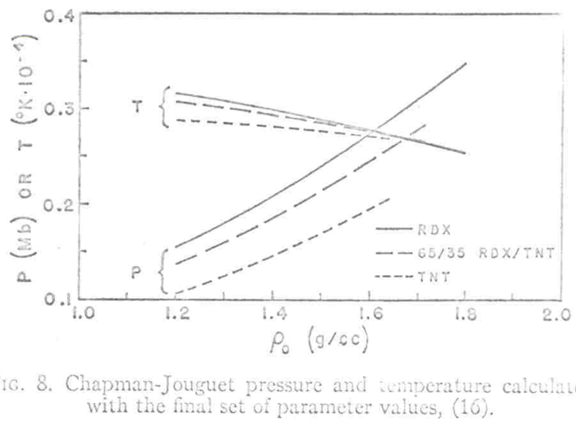

FIG. 8. Chapman-Jouguet pressure and temperature calculated with the final set of parameter values, (16).

[29] A similar comparison can be made for a quantity

$$\alpha^* \equiv (\partial E/\partial pV)_p^{-1} = \{(\gamma^*+1)/(1+d\ln D/d\ln\rho_0)\} - 2$$

discussed by H. Jones [*Third Symposium on Combustion and Flame and Explosion Phenomena* (Williams and Wilkins, Baltimore, 1949), p. 590]. The agreement is again singularly poor in the case of TNT.