the fact that the (large diameter) velocities of detonation of explosives of widely different types have been calculated with an accuracy comparable to the experimental methods of velocity measurements by simply using the α *vs.* v_2 data taken from this curve. For example, velocities of various liquid and cast explosives have been calculated agreeing in all cases within 3 percent with measured velocities providing the measured detonation velocities were obtained in large enough diameter so that the maximum or hydrodynamic velocities were obtained. It is of interest to note that many explosives require charge diameters of the order of 5 in. before the maximum (complete reaction) velocity is reached. Whether or not the velocity is a maximum can usually be decided experimentally from velocity *vs.* charge diameter data at constant ρ_1. Table II lists data taken from the solid curve of Fig. 1 which may be used in the calculation of velocity.

PROPERTIES OF EXPLOSIVES

Table III lists some detonation properties of several explosives calculated by method (a) using $\bar{C}_v = \bar{C}_v{}^*$ and comparisons with results computed by other investigators. It will be observed that in general the agreement in compressibilities (v_1/v_2), W and p_2 is fairly good. The sharp differences in detonation temperature between BW (Brinkley and Wilson) and the present studies are to be expected as discussed previously (since BW used $c = -\frac{1}{4}$ in Eq. (21)). Had BW adjusted the parameters of their equation of state to obtain better agreement between calculated and measured velocities in RDX, TNT, and picric acid the agreement between their studies and the present would have been even better (except for T_2), since $p_2 = \rho_1 DW \approx k\rho_1 D^2$. It is possible that the calculations by BW have been improved in later studies. The data of LS for PETN at $\rho_1 = 1.6$ are questionable, since they are inconsistent with the relation $D/W = v_1/(v_1 - v_2)$.

It is quite evident that the detonation temperature is really the only detonation property which may be used to provide experimental information on the accuracy of the various equations of state employed in studies of the hydrodynamic theory of detonation, all other quantities being relatively insensitive to the form of the particular equation of state employed. The detonation temperature, however, is so sensitive to the form of the equation of state that a good method for measuring it should provide a crucial test of the validity of the equation of state. Fox,[22] employing a special spectroscopic technique, measured the temperature from the side of the charge and his results for a number of military explosives correlated well with $T_3 - T_1 = Q/\bar{C}_v{}^*$. There is evidence from several types of experimental investigations that the conditions described as "detonation" conditions do not extend to the periphery of the charge, but that an "edge effect" exists. It is thus to be expected that the temperature at the edge of the charge adjacent to the detonation wave would correspond to the "adiabatic" temperature, (T_3), rather than "detonation" temperature, T_2. Cotter and Jacobs[23] measured by similar spectroscopic means the temperature of liquid nitroglycerin both at the side and down the end of the charge and obtained temperatures of 4600°K and >5500°K, respectively. Calculations of the "adiabatic" and "detonation" temperatures by the methods outlined in the present report for nitroglycerin gave 4780°K for T_3 and 5750°K for T_2, in good agreement with the measured values of Cotter and Jacobs. These measurements thus appear to provide evidence for the validity of the approximation $\bar{C}_v \simeq \bar{C}_v{}^*$ and the neglect of $(\partial E/\partial v_2)_T$ relative to p_2 in Eq. (9) for β.[24]

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[22] J. G. Fox, Navy Ordnance Report 200–45.

[23] T. P. Cotter and S. J. Jacobs, OSRD Report 5618.

[24] Since this article was prepared an interesting article by P. Caldirola [J. Chem. Phys. **14**, 738 (1946)] has appeared treating by another procedure the subject of this study. Caldirola's method leads to temperatures and pressures which in some cases differ rather sharply from the results reported here. However, his definition of σ (in his Eq. 11) seems to be in error by a factor $\frac{1}{2}$. Moreover it may not in many cases be correct to neglect dA/dv as he has done. The results of the present study do not support the linear relations between ρ and $1/\alpha$ claimed by Caldirola (his Eq. 13) although the discrepancies are not large.