TABLE VI. Summary of results.

	Benzene	Carbon disulfide	Carbon tetrachloride		Liquid nitrogen	
Lower segment						
C (km/sec)	1.50±0.10	1.18±0.22	1.11±0.08	1.17±0.17	1.19±0.06	1.12±0.50
S	1.67±0.04	1.67±0.14	1.67±0.05	1.72±0.06	1.56±0.03	1.68±0.11
T (km/sec)$^{-1}$	···	···	···	−0.06±0.01	···	−0.04±0.02
U_s limits (km/sec)	2.70–5.83	2.40–3.50	2.30–4.70	2.30–8.26	2.58–5.60	2.58–8.92
Middle segment			···	···	···	···
C (km/sec)	4.64±0.99	constant				
S	0.46±0.10	shock				
T (km/sec)$^{-1}$	···	velocity				
U_s limits (km/sec)	5.83–6.26	interval				
Upper segment				···		···
C (km/sec)	1.37±0.17	1.11±0.07	1.87±0.14		1.85±0.38	
S	1.39±0.03	1.35±0.02	1.32±0.03		1.32±0.08	
T (km/sec)$^{-1}$	···	···	···		···	
U_s limits (km/sec)	6.26–9.00	3.50–8.20	4.70–8.26		5.60–8.92	
Average initial temperature (°K)	293	293	293	293	75	75
Average initial density (g/cc)	0.879	1.264	1.594	1.594	0.820	0.820
Sound speed (km/sec)	1.31	1.16	0.93	0.93	0.88	0.88
Transition pressure (kbar)	133±5	62±4	164±5	···	135±3	···

$U_s - U_p$ plane. An adjustment of the potential parameters ($n=6.4$, $r^*=6.60$ Å, and $T^*=327$°K) would probably bring the two curves into better agreement.

E. Liquid Nitrogen

The Hugoniot data are presented in Table IV and in Figs. 10 and 11. The data reported by the Russian investigators[10] are also included in the $U_s - U_p$ plot. Since the initial temperature of the 2024 dural standard was the same as the liquid nitrogen, the equation of state of the 2024 dural had to be adjusted to 75°K, resulting in the equation,

$$U_s = 5.387 + 1.335 U_p \tag{14}$$

with $\rho_0(75°\text{K}) = 2.820$ g/cc and the Gruneisen ratio $\Gamma_0 = 2.0$.

The experimental assemblies were constructed and measured at room temperature. Distances and setbacks of pin contactors have been adjusted to allow for the thermal contraction to 75°K. The values listed in Table IV for the shock velocities reflect this adjustment.

Two straight lines fit the $U_s - U_p$ data with a change in slope occurring at about $U_s = 5.60$ and $U_p = 2.90$ km/sec. The lower line fits

$$U_s = 1.19 \pm 0.06 + (1.56 \pm 0.03) U_p \tag{15}$$

and the upper line fits

$$U_s = 1.85 \pm 0.38 + (1.32 \pm 0.08) U_p. \tag{16}$$

A smooth curve also provides a good fit of the data and is described by a quadratic in U_p,

$$U_p = 1.12 \pm 0.50 + (1.68 \pm 0.11) U_p - (0.04 \pm 0.02) U_p^2. \tag{17}$$

The present data agree reasonably well with the Russian results.

The intercept with the U_s axis defined by Eq. (15) is higher by nearly 35% than the reported sound speed[34] of 0.88 km/sec. This leads to the possibility of a transition occurring below 19 kbar, the lowest pressure used in this study.

The $P - V/V_0$ plot of Fig. 11 shows two concave upward curves with a cusp at 135 kbar. There is considerable scatter of the points, especially at the higher pressures. A temperature associated with 135-kbar pressure was calculated to be 3400°K. If a transition occurs at this pressure, the Hugoniot could cross into the solid phase below 19 kbar and then at 135 kbar recross the fusion line and remain in the solid–liquid mixed-phase region.

Liquid nitrogen shock Hugoniots have been calculated[35,36] using a Lennard-Jones and Devonshire and a modified Buckingham (exp-6) intermolecular potential which agree well with the experimental Hugoniot between 20 and 170 kbar. The calculations were performed with a computer code developed by Fickett of this laboratory. The code is based on the cell model and assumes: The pair potentials are additive; each cell has 12 nearest neighbors; there is one molecule per cell. The 12 nearest neighbors are uniformly smeared over a spherical surface whose radius cor-