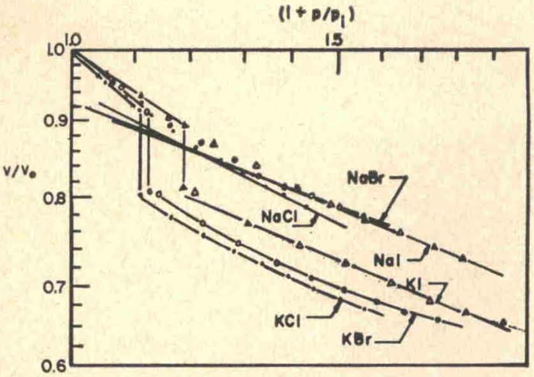

FIG. 9. Log–log plot for isothermal compression of some alkali halides. Data from Ref. 6.

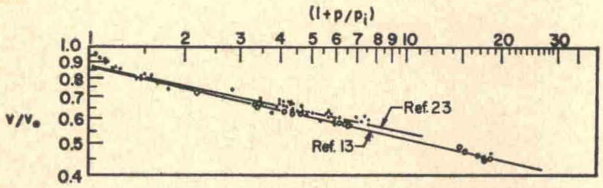

FIG. 10. Log–log plot for shock compression of water. Data from Refs. 13 and 23.

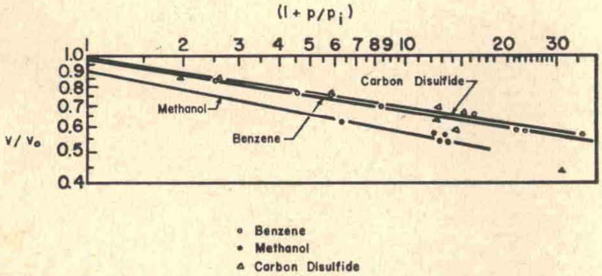

FIG. 11. Log–log plots for shock compression of several liquids. Data from Ref. 13 and Table IV.

TABLE IV.

A. Experimental data for shock compression of four liquids.

Liquid	Shock velocity km/sec	Particle velocity km/sec	p kbars	v/v_0
Methyl alcohol	5.50	2.46	107	0.552
	5.30	2.30	96	0.566
	5.34	2.42	102	0.546
Carbon tetrachloride	4.20	1.93	129	0.542
	3.29	1.36	72	0.588
	2.85	1.10	50	0.614
	2.18	0.605	21	0.712
	1.93	0.390	12	0.798
Benzene	4.59	1.92	78	0.581
	4.59	1.88	74	0.590
	3.16	0.980	25	0.690
	2.77	0.670	16	0.758
	2.47	0.560	12	0.774
	1.97	0.28	4.8	0.858
Carbon disulfide	3.83	1.28	62	0.666
	3.75	1.46	67	0.610
	3.63	1.12	51	0.692
	3.29	1.21	50	0.632
	3.18	1.68	43	0.660
	2.70	0.63	21	0.767
	1.91	0.30	7.3	0.843
	1.90	0.28	7.0	0.853
	1.65	0.19	4.0	0.885

B. Information for log–log plots of liquids used. (See Fig. 11.)

Liquid	p_i (kbars)	$\Delta v'/v_0$	a_H[a]
H_2O	24.3	0.15	4.4
CCl_4	3.07	0.11	7.9
CS_2	4.40	0.02	5.6
C_6H_6	3.44	0.03	6.1
CH_3OH	8.68	0.10	5.1

[a] High-pressure region where straight-line results.

tion of void space in the liquid is in excellent agreement with the Eyring theory of holes in liquids.[22]

Figure 11 presents log–log plots for methanol, benzene, and carbon disulfide. Additional shock compression data, using the aquarium method,[14] were obtained in this study, and the results are given in Table IV along with those obtained from the log–log plots. Again, straight lines characterized the log–log plots at high pressures.

Murnaghan Equation Comparison

Finally, it is of interest to compare Eq. (13) to the Murnaghan equation of state[23] derived from finite strain theory, namely,

$$v_0/v=[1+kp/(\lambda_0+\tfrac{2}{3}\mu_0)]^{1/k}, \tag{23}$$

where λ_0 and μ_0 are the Lamé elastic constants, and k is a constant which was assumed to be $\frac{1}{3}$ from the "(drastic) assumption that λ and μ are independent of p_0." Equation (23) becomes identical with Eq. (13) if one assumes that $a=1/k$ and $p_i=(\lambda_0+\frac{2}{3}\mu_0)/k$. Murnaghan also points out that as $v\rightarrow\infty$, $p\rightarrow-(\lambda_0+\frac{2}{3}\mu_0)/k$, and that the medium in theory would support a hydrostatic tension of $(\lambda_0+\frac{2}{3}\mu_0)/k$ before rupture. This is the force required to overcome the cohesive forces of the medium, and one can conclude that the assumption of $p_i=\epsilon_c/v_0=(\lambda_0+\frac{2}{3}\mu_0)/k$ is not unreasonable. On the other hand, obtaining good workable values for k has presented some difficulty and empirical values are generally used. From the values of a given in Table I, one observes that the rough assumption of $k=\frac{1}{3}$ is quite good in many cases, but is also seriously in error for many cases compared to the present work. The fact that the present theory yields an equation of state of the same form as that of Murnaghan, however, lends support to the validity of the present theory.

[22] H. Eyring, B. J. Stover, E. M. Eyring, and D. J. Henderson, *Statistical Mechanics and Dynamics* (John Wiley & Sons, Inc., New York, to be published).

[23] F. D. Murnaghan, *Finite Deformation of an Elastic Solid* (John Wiley & Sons, Inc., New York, 1951).