TABLE 1

SOME REDUCED PROPERTIES OF CLASSICAL AND "QUANTIZED" LJD LIQUIDS AT ZERO PRESSURE

LJD Liquids	Temperature T^*	Volume V^*	Coefficient of Thermal Expansion $\frac{1}{V^*}\left(\frac{\partial V^*}{\partial T^*}\right)_P$	Isothermal Compressibility $-\frac{1}{V^*}\left(\frac{\partial V^*}{\partial P^*}\right)_T$	Heat Capacity C_V^*	Speed of Sound u^*
(*a*) Classical: $\Lambda^*=0$	0	0·916	0	0·0133	0	8·30†
	0·70	1·037	0·244	0·0348	2·61	6·63
	0·75	1·050	0·261	0·0386	2·58	6·47
	0·80	1·065	0·287	0·0433	2·55	6·34
	0·85	1·081	0·316	0·0493	2·53	6·17
	0·90	1·099	0·352	0·0571	2·50	5·98
	0·95	1·120	0·405	0·0683	2·47	5·78
	1·00	1·145	0·491	0·0851	2·43	5·60
(*b*) Quantal: $\Lambda^*=0\cdot5$	0·70	1·090	0·319	0·0454	2·71	6·00
	0·75	1·109	0·358	0·0527	2·68	5·77
	0·80	1·130	0·408	0·0626	2·64	5·52
	0·85	1·155	0·477	0·0771	2·59	5·24
	0·90	1·186	0·584	0·1004	2·54	4·92
	0·95	1·226	0·784	0·1458	2·47	4·53
	1·00	1·290	1·366	0·286	2·38	3·99
(*c*) Quantal: $\Lambda^*=1\cdot0$	0·70	1·213	0·474	0·0819	2·46	4·87
	0·75	1·245	0·586	0·1061	2·47	4·58
	0·80	1·288	0·780	0·1516	2·45	4·22
	0·85	1·353	1·287	0·280	2·38	3·71

† This value was derived previously (Hamann 1960).

Our calculations on quantal liquids were limited to values of Λ^* less than 1·5 for two reasons:

(i) If Λ^* is much greater than one, the stable range of the liquid state is shifted to lower reduced temperatures than are covered by the tables of Wentorf *et al.* (1950).

(ii) Equations (12) and (15) were based on an Euler–Maclaurin expansion of the partition function (Hamann 1952) which is only valid when x^* is greater than 1·5. If Λ^* is large, x^* becomes less than this value. We have therefore not been able to apply the theory directly to H_2 and the helium isotopes, but the trend of the curves to $\Lambda^*=1$ is certainly sufficient to explain the behaviour of the lighter liquids.

(*b*) *Liquids at High Pressures*

The computation of u^* is easily extended to compressed liquids. Using the polynomial form (10) of the P^*-V^* relation, we can derive values of the derivative $(\partial P^*/\partial V^*)_T$ over a wide range of temperatures and densities. As before, the derivative $(\partial P^*/\partial T^*)_V$ and the corresponding values of P^* and C_V^* can be taken directly from the tables of Wentorf *et al.* (1950). The results are

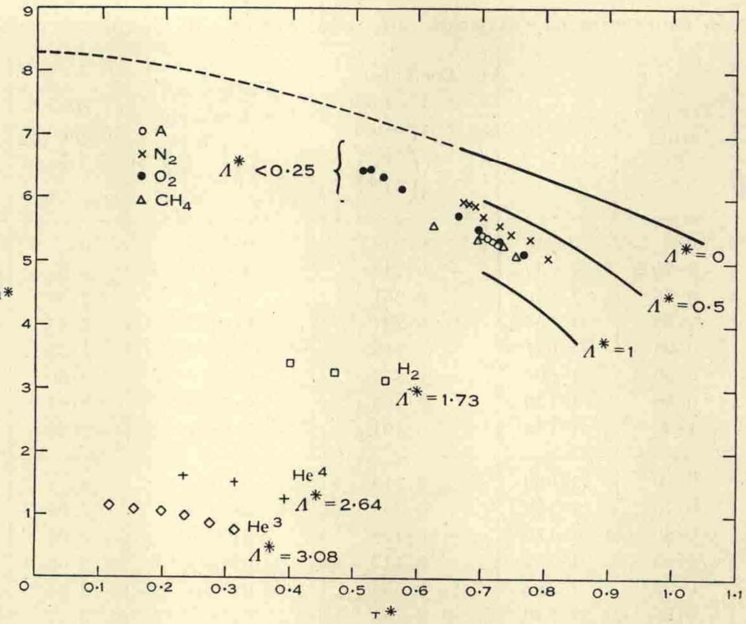

Fig. 1.—A comparison of the calculated and experimental speeds of sound in simple liquids. The sources of the experimental data for A, N_2, O_2, CH_4, H_2, and He^4 have been given in an earlier paper (Hamann 1960). The data for He^3 have been taken from a paper by Atkins and Flicker (1959).

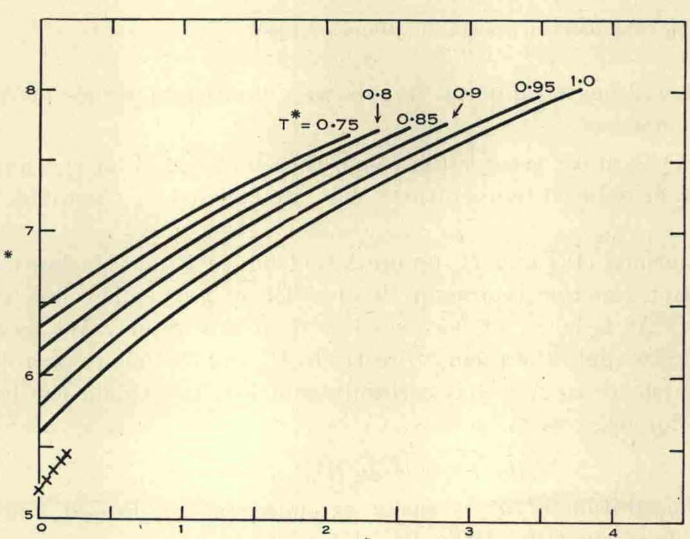

Fig. 2.—The effect of pressure on the speed of sound. The curves represent the theoretical Leonard-Jones–Devonshire relations and the crosses denote the experimental data for argon at $T^* = 0\cdot75$.