pressure the temperature of the quantal fluid is greater than that of the classical fluid. On the other hand its relative volume V_1^*/V^* is always less, indicating that the compression " squeezes out " some of the quantal inflation of the volume. Unfortunately there are no experimental data to test these conclusions. Some measurements on, say, helium, neon, and argon would be highly desirable.

TABLE 2

THERMODYNAMIC PROPERTIES OF A QUANTAL LJD FLUID ($\Lambda^*=1$) UNDER SHOCK COMPRESSION, STARTING FROM $P^*=0$, $T^*=0\cdot 75$, $V^*=1\cdot 245$

The symbols are defined in Section II

Pressure	P_1^*	0	2·964	7·023	15·12
Volume	V_1^*	1·245 (= V^*)	1·1314	1·0607	0·9899
Temperature	T_1^*	0·75	0·979	1·221	1·671
Energy	E_1^*	−4·115	−3·946	−3·468	−2·185
Specific heat	$(C_V^*)_1$	2·480	2·589	2·650	2·689
Shock velocity	U_1^*	4·58	6·36	7·68	9·58
Flow velocity	w_1^*	0	0·581	1·138	1·964
Velocity of sound	u_1^*	4·58	6·85	8·26	11·51

(*c*) *Conditions after Adiabatic Expansion from a Shocked State*

Section III (*d*) described a method for arriving at conditions during the adiabatic expansion of a shock-compressed material. Our results for LJD fluids are shown as dotted curves in a P^*/V^* plot in Figure 3 and in a P^*/w^* plot in Figure 4. We have worked out a number of thermodynamic properties along the adiabats but there is no need to give the results here. It is sufficient to point out that the adiabats in Figure 3 intersect the zero-pressure line at considerably larger volumes and at higher temperatures than those at which the shock compression began. The highest adiabat only approaches the line at very large volumes, indicating that the liquid is partially vaporized in the final state.

In Figure 4 the adiabats are represented by the right-hand sections of the dotted curves crossing the original Hugoniot. It will be seen that the adiabatic expansion of a shocked fluid from $P_1^*=123\cdot 7$ to $P_2^*=0$ increases the flow velocity from $w_1^*=6\cdot 51$ to $w_1^*+w_2^*=13\cdot 69$.

Of course expansion into a vacuum ($P_2^*=0$) seldom occurs in practice : in most experimental work the shocked material expands into the surrounding air. We can determine the surface conditions here by the method outlined in the last paragraph of Section III (*d*). If we suppose that the LJD liquid is argon and assume that it is (hypothetically) thermally insulated from air at 25 °C and 1 atm, we find that the conditions of the argon at the starting point in Figure 4 are $P \approx 1$ atm, $\hat{V}=0\cdot 633$ cm^3/g, $T=90$ °K and in the shocked state at the point A are $P_1=51\,000$ atm, $\hat{V}_1=0\cdot 425$ cm^3/g, $T_1=860$ °K, $w_1=1029$ m/sec. The final conditions, given by the point of intersection of the expansion adiabat with the compression Hugoniot for air are $P_2=69$ atm, $\hat{V}_2=0\cdot 926$ cm^3/g, $T_2=144$ °K,

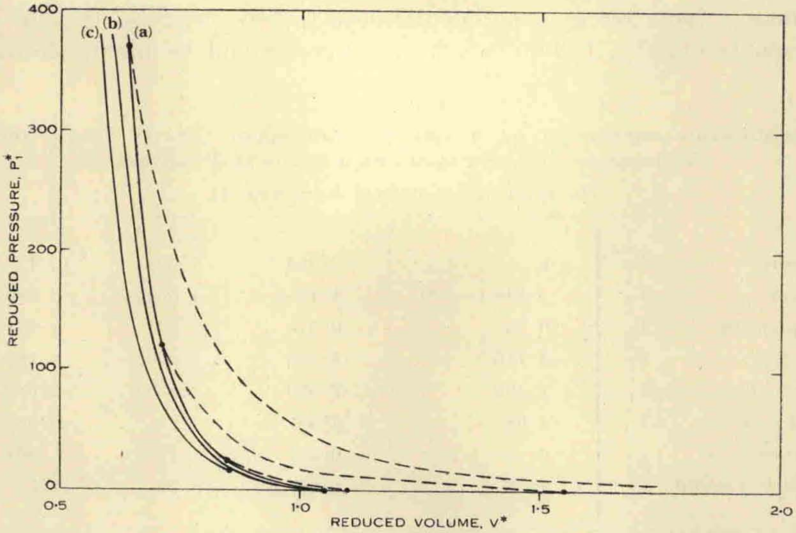

Fig. 3.—Hugoniot curves for normal and precompressed LJD liquids starting from $T^*=0\cdot75$. The starting pressures are (*a*) $P^*=0$; (*b*) $P^*=2\cdot041$; (*c*) $P^*=15\cdot15$. The dotted curves are those for adiabatic expansion from shocked states on the Hugoniot curve (*a*).

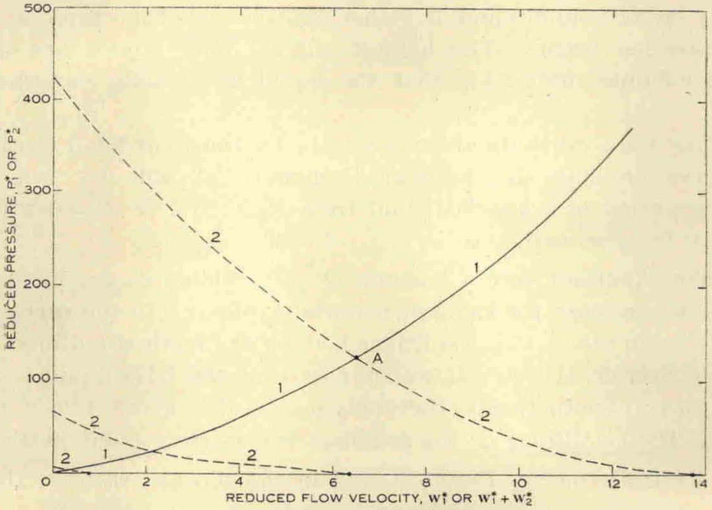

Fig. 4.—A pressure/flow-velocity diagram illustrating the interaction of forward-going shock waves 1 with backward-going shocks or rarefactions 2. The primary shocks 1 are based on the starting point $P^*=0$, $T^*=0\cdot75$.