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than in the solid range. This is probably due to the fact that in the liquid range the highpressure capillaries connected to the calorimeter are filled with fluid up to a certain point beyond the adiabatic shield and this point will be temperature-dependent. It is therefore possible that a heat and mass transport through convection currents within the capillaries takes place. The volume of the capillaries up to the point where they are thermally anchored to the liquid helium can is about  $0.005 \text{ cm}^3$  as compared to  $1.46 \text{ cm}^3$  of the high pressure cell. It appears therefore that a mass transport alone would not seriously distort the results. The accompanying heat transport, however, could have such an effect. The accuracy can probably be estimated from the experimental scatter which is about 4%.

TABLE 5. SPECIFIC HEAT OF FLUID <sup>3</sup>He AT ROUNDED VALUES OF TEMPERATURE

V =	= 17.02	16.87	15.72	14.98	14.16	14.11	13.56	13.33	12.57
T (°K)	$C_{v}$	$C_v$	$C_v$						
6	1.38	1.40						· · · · · · · · ·	
7	1.56	1.55					· · · · · ·	_	
8	1.72	1.70	1.62						
9	1.86	1.84	1.75						
10	1.99	1.97	1.88	1.83					
11	$2 \cdot 11$	2.09	2.00	1.94	1.90	1.90	-		
12	2.22	$2 \cdot 20$	$2 \cdot 11$	2.04	1.99	1.99	-		
13	2.31	2.30	2.21	$2 \cdot 14$	2.08	2.07	2.04		
14	2.40	2.38	$2 \cdot 30$	$2 \cdot 23$	$2 \cdot 16$	$2 \cdot 16$	$2 \cdot 12$	2.09	
15	2.48	2.46	2.38	2.32	$2 \cdot 24$	$2 \cdot 24$	$2 \cdot 19$	2.17	
16	2.55	2.54	2.45	2.40	2.32	2.32	2.27	2.26	
17	2.61	2.61	2.53	2.47	2.40	$2 \cdot 40$	2.34	2.34	$2 \cdot 28$
18	2.66	2.67	2.60	2.54	2.46	2.47	2.41	2.41	2.34
19	2.72	2.72	2.66	2.61	2.53	2.54	2.48	2.48	2.40
21	2.82	2.81	2.77	2.72	2.65	2.66	2.61	2.61	2.51
23	2.90	2.89	2.86	2.81	2.76	2.76	2.72	2.72	$2 \cdot 62$
25	2.98	2.94	2.92	2.88	2.85	2.84	2.81	2.80	2.73
27		2.99	2.98	2.93	2.92	2.90	2.89	2.87	2.82
29		3.03	3.03	2.97	2.97	2.97	2.95	2.93	2.90

Units:  $V (\text{cm}^3/\text{mole})$ ;  $C_v$  (cal mole<sup>-1</sup> deg<sup>-1</sup>).

## 3.5. The thermal energy and entropy

The thermal internal energy,  $U-U_0$ , and the lattice entropy, S, were calculated from the smoothed experimental data by means of the relation

$$U - U_0 = \int_0^T C_v \,\mathrm{d}\,T \tag{5}$$
$$S = \int_0^T \frac{C_v}{T} \,\mathrm{d}\,T. \tag{6}\dagger$$

Here  $U_0$  is the internal energy of the solid at 0 °K at the specified volume.

Values of  $U-U_0$  and S for the solid at rounded values of temperatures are included in tables 1 and 2. Diagrams of the entropy over the whole temperature range investigated are given in figures 9 and 10. The melting entropy (at constant temperature),  $S_m$ , can be obtained from these figures and is plotted separately in figures 11 and 12. A comparison is made with the data of the melting entropy given by Grilly & Mills (1959) (obtained from

<sup>&</sup>lt;sup>†</sup> In <sup>3</sup>He we are assuming that the nuclear spins are completely random in orientation so that for all the temperatures and densities considered here there is an additional constant term in the entropy of <sup>3</sup>He of tempnitude  $R \ln 2$  (cf. discussion on p. 11).