The quantity B in Eq. (13) is defined as

$$B=\frac{H_0(dT_c/dP)}{T_c(dH_0/dP)}.$$

Substituting experimental values yields $B=0.545\pm0.037$ from the data of the present work, and $B=0.580\pm0.041$ using the data of the earlier measurements. The cumulative effect of experimental uncertainty in the quantities used in the calculations has magnified the uncertainty in B to a point where the errors overlap. Under the circumstances, it seems reasonable to use the average value of $B=0.562$, which is what was done in computing curve I in Fig. 7. The average value of dT_c/dP becomes $-(3.97\pm0.10)\times10^{-5}$ deg/atm.

(c) *Derivation of* $(1/\gamma^*)(d\gamma^*/dP)$ *from the* H_c-T-P *surface.* The internal consistency of our representation of the H_c-T-P surface for Pb may also be exhibited by calculation of $(1/\gamma^*)(d\gamma^*/dP)$ from (10). By comparison of coefficients in (6) and (9) it is seen that

$$A_1=H_0a_1/T_c^2. \tag{15}$$

The quantity $(1/A_1)(dA_1/dP)$ may be evaluated by differentiation of (15) and inserted in (7) to give

$$(1/\gamma^*)(d\gamma^*/dP)=2[(1/H_0)(dH_0/dP)-(1/T_c)(dT_c/dP)]+(1/a_1)(da_1/dP). \tag{16}$$

According to (10) we set $da_1/dP=0$, and substituting the average of the (dT_c/dP) values from the previous section, we obtain

$$(1/\gamma^*)(d\gamma^*/dP)=-(5.88\pm0.80)\times10^{-7}\ (\text{psi})^{-1},$$

which, aside from the appreciable uncertainties involved, is within 4% of the value obtained by experimental determination of dA_1/dP at the lowest temperature.

It must be emphasized that this agreement does not improve the accuracy of our knowledge of the pressure variation of γ^*. It only shows that the assumption, $da_1/dP=0$, is consistent with the best experimental determination of (dA_1/dP). A more rigorous experimental test of the pressure independence of a_1 encounters the same problems and is, in fact, identical with the problem of more accurate measurement of (dA_1/dP).

4. *Comparison with Other Measurements*

Values of $(\partial H_c/\partial P)_T$ may also be deduced from measurements of the change in length which occurs at the superconducting transition. Results of such measurements on Pb have been previously reported by other workers and are listed below for comparison.

Olsen and Rohrer report[20]

$$(dH_0/dP)=-(6.4\pm0.3)\times10^{-3}\text{ gauss/atm}$$
$$(\partial H_c/\partial P)_{T_c}=-(11.2\pm1.0)\times10^{-3}\text{ gauss/atm}$$

while Cody gives[21]

$$(dH_0/dP)=-(9.23\pm0.5)\times10^{-3}\text{ gauss/atm}$$
$$(\partial H_c/\partial P)_{T_c}=-(11.0\pm1.1)\times10^{-3}\text{ gauss/atm.}$$

As described above we obtain

$$(dH_0/dP)=-(7.90\pm0.21)\times10^{-3}\text{ gauss/atm}$$
$$(\partial H_c/\partial P)_{T_c}=-(9.45\pm0.30)\times10^{-3}\text{ gauss/atm,}$$

where the latter value is obtained by averaging the values of $(\partial H_c/\partial P)_{T_c}$ from the two available measurements of the pressure effect near T_c.

The values derived from the length change observations are obtained by extrapolation of data observed in the temperature range from about 1.5 to 4.7°K, using the relation $(\partial H_c/\partial P)_T=a+bt^2$, where a and b are experimental constants. While the best available expression for $f(t)$ of Pb which was used in (14) shows small departures from a linear dependence of $(\partial H_c/\partial P)_T$ upon t^2, such deviations are beyond the limit of accuracy of any experimental measurements undertaken thus far and thus $(\partial H_c/\partial P)_T=a+bt^2$ is an adequate approximation.

Comparing values of dH_0/dP, the agreement between the present directly measured values and those deduced from length changes is fair. Olsen and Rohrer's value is about 19% smaller, while Cody's value is about 15% larger than our value. The temperature dependence of $(\partial H_c/\partial P)_T$ is roughly indicated by the ratio $(\partial H_c/\partial P)_{T_c}/(dH_0/dP)$ which has the value 1.76 from Olsen and Rohrer and 1.20 from Cody. The average value obtained from curve I of Fig. 7 is 1.20 which agrees very well with Cody's result though not with Olsen and Rohrer's.

We believe that the values obtained from our direct measurements are more reliable than those deduced from the length changes. However, it must be realized that the length change in the superconducting transition is extraordinarily small ($\Delta L/L\sim10^{-7}$) and therefore very difficult to measure with precision. In view of this, we think that the agreement between the two types of measurement is remarkably good.

IV. DISCUSSION

The experimental values for lead, expressed in terms of both pressure and volume derivatives, have been collected in Table I. In converting the observed pressure

TABLE I. Summary of results.

X	$(d\ln X/dP)\times10^{-6}$ $(\text{atm})^{-1}$	$d\ln X/d\ln v$
H_0	-9.85 ± 0.26	$+5.90\pm0.16$
T_c	-5.53 ± 0.15	$+3.31\pm0.09$
γ^*	-8.31 ± 1.54	$+4.97\pm0.92$
θ_D	$+2.79$	-1.67

[20] J. L. Olsen and H. Rohrer, Helv. Physics Acta. 30, 49 (1957).

[21] G. D. Cody, Phys. Rev. 111, 1078 (1958).