temperatures, possibly giving too low a value for $r_p(T,T_0)$.

The measurements at atmospheric pressure shown by the triangles in Fig. 5 were made in a muffle furnace in an air atmosphere. These data are about 3% larger than those reported by Meechan and Eggleston.[27]

An independent measurement of $R(P,T)$ in a liquid system was made for temperatures up to 650°C and pressures to just above 50 kbar. The sample consisted of a 3.0-cm length of 3-mil gold wire with 1-mil potential leads 2.3 cm apart, immersed in petroleum ether. The gold wire and petroleum ether were contained in a $\frac{3}{16}$-in.-diam thin-walled monel heater tube 0.45 in. long with a Teflon plug in each end. Values of $R_p(T)/R_p(30)$ agreed well with the data of Fig. 5 for all temperatures. The measurement of $R(P)$ at room temperature, however, has a negative curvature in contrast to Bridgman's data which has positive curvature over the same pressure range.[3] It is believed that this data as tabulated in Table I is quite reliable, inasmuch as the sample showed no apparent deformation upon microscopic examination after removal from the press. Values calculated from Eq. (1) along with Bridgman's data are also shown in Table I for comparison.

TABLE I. Variation of resistance of gold with pressure at room temperature.

Pressure kbar	$R(P)/R(0)$ Present measurement	Bridgman[a]	Calculated from compressibility
0	1.000	1.000	1.000
10	0.981	0.970	0.972
20	0.950	0.945	0.944
30	0.918	0.920	0.916
40	0.886	0.895	0.889
50	0.853	0.875	0.862

[a] See Ref. 3.

The resistance at any point can be determined relative to that at atmospheric pressure and 30°C by determining the ratio

$$\frac{R(P,T)}{R(0,T_0)}=\left[\frac{R(P,T)}{R(P,T_0)}\right]\left[\frac{R(P,T_0)}{R(0,T_0)}\right]. \tag{11}$$

The first factor on the right is given by the data in Fig. 5 and the second factor is obtained from Table I. From the experimental results we find that the ratio $R(P,T_m)/R(0,T_0)$ at the melting point is constant to within about ±2% at all pressures. Thus to within the accuracy of these measurements the resistance at the melting point is a constant independent of pressure.

V. CONCLUSIONS

This method of measuring melting temperatures at high pressures is more sensitive than other methods previously tried. The melting temperature can be measured both on increasing and decreasing temperature with good reproducibility and the transition region is generally narrower than with other techniques. The results are also independent of the rate at which the temperature is changed. The melting curve of gold, reported here, is felt to be quite accurate even though the raw data had to be corrected. The correction amounted to less than 14°C in temperature and less than 9% in pressure for any point. These corrections make very little change in the position of the melting curve but they do affect the coefficient c in Simon's equation. It is possible to fit the uncorrected data reasonably well to the form of Simon's equation but the resulting expression has an unreasonably large initial slope and does not pass through the correct melting temperature at zero pressure. The coefficient c for the uncorrected data was about twice as large as that calculated from the data after correction. Our experimental value of $c=2.2\pm0.1$ agrees very well with the value 2.1 estimated theoretically. No corrections were attempted to account for pressure effects on the thermocouple emf but it is felt that the method of analysis and the other corrections will partially compensate for any errors introduced here. To our knowledge no other melting curves measured to high pressures have been corrected for thermal-expansion effects. This correction would alter the Simon's coefficients calculated from these measurements and probably improve the agreement with theory.

This is one of the first attempts to make accurate resistance measurements at high pressures and temperatures. Measurements on the resistance of iron have been published by Clougherty and Kaufman,[28] but there is considerable scatter in their results and the ratio $R(R,T)/R(P,T_0)$ is very erratic. One of the greatest difficulties proved to be that of finding a good insulating material, that conducts heat rather well, whose electrical resistance is not adversely affected by the high temperatures. The results show relatively little scatter and follow the expected slight decrease of temperature coefficient of resistance with increasing pressure. However, our results show a more rapid initial decrease in this coefficient than one would expect from Eq. (4) but agree reasonally well with the analysis of Eq. (4) if one considers the rapid decrease in the equilibrium concentration of vacancies at high pressures.

From the result that the resistance at the melting point is constant one can show a very simple relation between the volume and temperature at the melting point. Inserting $T=T_m$ into Eq. (1) one arrives at the conclusion that $T_mV_m^{2\gamma-4/3}=\text{constant}$. It would be interesting to check out this relation using high-pressure x-ray techniques.

[28] E. V. Clougherty and L. Kaufman, in *The Physics and Chemistry of High Pressures* (The Society of Chemical Industry, London, 1963).