For $B = 4$ kc/sec and $\beta = 5\times 10^{-3}(0.5\%)$ τ should be at least 5 seconds. Integration times from 22.5 to 90 seconds were used. The band widths of both amplifiers were approximately equal.

7. Lead Corrections

If one assumes that the temperature of the leads going to R_0 and R_2 are at room temperature (worst possible case), then the lead resistance should be less than 0.3 ohm for errors smaller than 0.5%, a requirement not difficult to satisfy.

8. Pickup

To avoid errors due to 60 c.p.s. pickup the lower half power points of the amplifiers were designed at approximately 5 kc/sec. Because no shielded room was available experiments could be performed only at night with fluorescent light, thyratron rectifiers, d-c. motors, etc. turned off. Although the amplifiers were protected against shock, audio noise was easily picked up. The voltages were constantly monitored oscillographically at the inputs of the multiplier, to check the randomness of the noise.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

Table I shows the boiling points of liquid oxygen and liquid nitrogen measured with approximately 4.48 kΩ metal film deposit resistors (R_0 and R_2) at barometric pressure with an integration time of 90 seconds. They were

TABLE I

Temperatures derived from the vapor pressure, T, measured noise temperatures, T_0, and their ratios for the boiling points of oxygen and nitrogen at barometric pressure

T, °K	T_0, °K(meas.)	T_0/T
90.23	90.26 ± 0.06	1.000 ± 0.001
77.33	77.25 ± 0.08	0.999 ± 0.001

found to be within 0.2% of the temperatures determined from the vapor pressure. The results of the noise–temperature measurements at helium temperatures are shown in Fig. 3. Because, as pointed out in the introduction, the noise power of the real part of an impedance is a universal function of frequency and temperature, any systematic deviation of the noise–temperature can only be due to experimental error of the equipment. The plot in Fig. 3(a) can be fitted best by an equation of the form:

$$\frac{T_0}{T} = \frac{A}{T} + b, \tag{9}$$

where $A = 0.385°$ K and $b = 1$ for this thermometer. The term A/T can be explained due to errors which can be represented by noise-current sources in shunt with the π network. Equation (7) shows that this error must be proportional to $1/T$ and the constant of proportionality is $[e(I_1+I_2+I_3)+2k\alpha T_1/R_g]R_0/2k$. If errors due to R_g are neglected, then in the above experi-