is the same as the d-c. resistance (within a specified accuracy) over the frequency interval in which the measurements are performed. Many resistors have been tried at helium temperatures. The ones found most suitable are those manufactured by the Daven Co., series 850. They are hermetically sealed precision metal film type resistors composed of an alloy of pure, noble metals. They are stable over a period of at least 7 hours to better than 1 part in 10^4 and they are reproducible to that accuracy for several experiments. A 20-kΩ resistor has a resistive component of 20kΩ±1% at 3 Mc/sec. The resistance values used in equation (5) should be those appropriate to the frequency range in which the noise measurements are performed. Because no sufficiently accurate audio-frequency bridge was available the metal film deposit resistors were measured at d-c. and at 3 Mc/sec. Since the 3-Mc/sec values differed from the d-c. values by less than 1%, it seems reasonable to conclude that the deviation of the resistance in the audio-frequency range from the d-c. value was less than 0.1% for the above resistors. A 20-kΩ Davohm resistor has a resistance of approximately 17.9 kΩ at liquid helium temperatures (1.3° K to 4.3° K) and the resistance value over this range varies less than 0.05%.

R_1 was a precision wire wound resistance box and C_1 a variable condenser, both kept at room temperature. C_0 and C_2 were the parasitic capacitance between the wires and the shielding, and the input to the amplifiers (including effects due to Miller capacitances), and they were equal within 3%. Unfortunately the parasitic capacity to ground was very large (~220 μμf), and about three-fifths of this was due to the shielding of C_1 and R_1 which was reflected into the input of each amplifier.

Figure 2 shows the block diagram of the thermometer. The shielding requirements of the input circuit and the preamplifiers were very stringent and great care was required to avoid ground loops and to eliminate magnetic pickup in

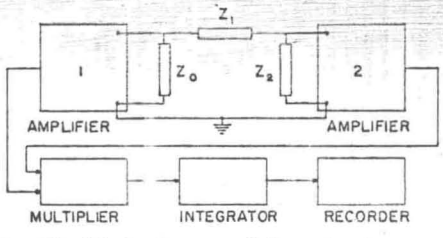

FIG. 2. The block diagram of the noise thermometer.

the π network which in effect act like a loop. The first tube of the preamplifier was a 6922 (American equivalent to the Philips E88CC) double triode connected as a grounded-cathode-grounded-grid amplifier (cascode) followed by two RC coupled stages (7025 double triode). The cascode and the first RC coupled stage were constructed of wire wound resistors, and their filament currents were supplied by batteries. The lower and upper half power points of the amplifiers were approximately 3 and 7 kc/sec respectively. Both input voltages to the multiplier were constantly monitored by two oscilloscopes and two r.m.s. voltmeters to check the randomness of the noise spectrum and