where m_B, m_p, and m_{hv} are the masses of helium in the volume of the gas balance, the piezometer, and the hot valve respectively. Since the method in question was developed for the study of gas mixtures, m_B may be determined by two methods. The first of these, described in [10], gives the mass in terms of the change in the buoyancy of the suspension system of the balance. Owing to the low density of the gas under consideration, however, this method gives a considerable error, greater than that given by the second method, which was actually employed. According to this second method m_B is found from the formula

$$m_B = \frac{p_B V_B}{z_1 R T_B}, \tag{3}$$

where z_1 and V_B are the compressibility of the helium and the volume of the balance for the parameters p_B and T_B. The volume of the gas balance was determined from the formula

$$V_B = V_{20} k, \tag{4}$$

where V_{20} = 18784.1 cm^3 is the volume of the gas balance at t = 20°C, and k is a coefficient allowing for the change in the volume of the balance as a function of the temperature and the pressure difference between the balance and the atmosphere. The volume of the balance V_{20} was determined by an absolute method, using the principle of weighing in an analytical balance and applying data relating to the density of water. The method of determining V_{20} and also calculating the masses of helium m_p and m_{hv} remaining in the piezometer proper and in the volume of the hot valve respectively after release is described in detail in [9, 10].

In order to measure the pressure in the balance, we used a standard absolute-pressure piston manometer of the MAD type with limits of measurement 0.01 to 3 kg/cm^2, developed and certified by the Piston-Manometer Laboratory of the All-Union Scientific-Research Institute of the Committee of Standards, Measurements, and Measuring Apparatus (Measuring Institute). The manometer has a limiting error of ±0.08 mm Hg over the pressure range 0.01 to 0.2 kg/cm^2 and ±0.05% of the measured quantity over the range 0.2 to 3 kg/cm^2. The gas balance was thermostated by means of a liquid thermostat. The error in measuring the temperature in the volume of the balance was 0.01°C.

Measurements were made with two piezometers (upper and right lower). The volumes of the piezometers V_{20} at atmospheric pressure and a temperature of 20°C were determined by several calibrations with respect to water, using a well-known method [11]; they equalled 374.44 cm^3 (upper) and 120.32 cm^3 (right lower). The mean square error in the calibrations of piezometer volume was 0.03%. All the piezometers were made from the heat-resistant alloy ÉI-607. The change in the volumes of the piezometers with temperature and pressure were determined by calculation. The temperature coefficient of the linear expansion of the ÉI-607 alloy α was taken from [12] and the Poisson coefficient μ and modulus of normal elasticity E from [13].

The temperature was measured by means of two standard platinum resistance thermometers, the constants of which were determined in the Measuring Institute as follows: for thermometer No. 1038: R_0 = 9.9735 abs. Ω, $\alpha = 0.003923_7$, $\delta = 1.495$, $\beta = 0.11_0$, for thermometer No. 1065: R_0 = 9.9355 abs. Ω, $\alpha = 0.003924_0$, $\delta = 1.493$, $\beta = 0.11_2$. The resistance of the thermometers was measured by means of a class-0.015 PMS-48 potentiometer and a standard resistance coil placed in an oil bath. The error in measuring the temperature was no greater than 0.02% of the temperature measured.

The pressure of the gas under consideration in the piezometers was measured by means of a piston manometer of the MP-600 type with limits of measurement 60 to 600 kg/cm^2. The manometer constants were determined in the Measuring Institute, and the accuracy of the manometer equalled 0.05% of the measured pressure.

In determining the specific volume of helium it is essential to introduce a correction for the mass of helium in the volumes of the piezometer and the hot valve remaining after the release of the gas from the piezometer. Thus for a pressure of p_B = 1.2 kg/cm^2 in the balance (density of helium 0.1915 kg/m^3) the mass of gas remaining in the right lower piezometer (V_{20} = 120.32 cm^3) was 0.01618 g and that in the volume of the hot valve 0.00338 g. The mass of gas in the volume of the gas balance equalled 3.59763 g. The maximum error in determining the specific volume of the helium was made up of the errors committed in determining the mass in the piezometer, the volume of the piezometer for the experimental parameters p and T, and the error in referring to the corresponding temperature and pressure; it equalled 0.2%.