The Redlich-Kwong two-constant equation of state has been used for integration of the right-hand side of Equation (19):

$$P = \frac{RT}{V - b_i} - \frac{a_i}{T^{0.5} V(V - b_i)}$$

$$a_i = \frac{0.4278\, R^2 T_c^{2.5}}{P_c}$$

$$b_i = \frac{0.0867\, RT_c}{P_c} \qquad (20)$$

After integration of Equation (19) with the Redlich-Kwong equation of state, the following expression is obtained:

$$\ln \frac{f_{i,v}}{P \cdot y_i} = (z-1)\frac{B_i}{B} - \ln(z - BP) - \frac{A^2}{B}\left(\frac{2A_i}{A} - \frac{B_i}{B}\right)\ln\left(1 + \frac{BP}{z}\right)$$

$$z = \frac{PV}{RT}; \quad A_i = \frac{0.6541}{T_r^{1.25} P_c^{0.5}}; \quad B_i = \frac{0.0867}{T_r P_c} \qquad (21)$$

The terms with i index refer to the single component and those without i index refer to the mixture.

$$A = \Sigma A_i y_i; \qquad B = \Sigma B_i y_i;$$

The value of z can be calculated by solution of the following equation, which represents a form of the Redlich-Kwong equation:

$$z = \frac{1}{(1-h)} - \frac{A^2}{B}\left(\frac{h}{1+h}\right)$$

where

$$h = BP/z$$

TRIAL AND ERROR EQUILIBRIUM CALCULATION FOR NONIDEAL SYSTEM

The method of calculating the terms of Equation (9) for equilibrium of a nonideal system has been presented. As can be seen it depends upon the phase compositions, which, in turn, are the unknowns to be calculated. A trial and error solution is suggested which makes use of the system of the following nine equations.

$$y_{NH_3} = \overset{\circ}{f}_{NH_3,L}\left(\frac{y_{NH_3} P}{f_{NH_3,v}}\right)\frac{\gamma_{NH_3,L}}{P} \cdot x_{NH_3} \qquad \text{[Eq. (9)]} \ (a)$$

$$y_{H_2O} = \overset{\circ}{f}_{H_2O,L}\left(\frac{y_{H_2O} P}{f_{H_2O,v}}\right)\frac{\gamma_{H_2O,L}}{P} \cdot (1 - x_{NH_3}) \qquad \text{[Eq. (9)]} \ (b)$$

$$y_{N_2} = N_{N_2}/G \qquad (c)$$

$$y_{H_2} = N_{H_2}/G \qquad (d)$$

$$y_{NH_3} + y_{H_2O} + y_{N_2} + y_{H_2} = 1 \qquad (e)$$

$$\overset{\circ}{f}_{NH_3,L,P} = \phi_1(P, T) \qquad \text{[Eq. (16)]} \ (f)$$

$$\overset{\circ}{f}_{H_2O,L,P} = \phi_2(P, T) \qquad \text{[Eq. (16)]} \ (g)$$

$$\gamma_{NH_3} = \phi_3(T, x_{NH_3}) \qquad \text{[Eq. (10)]} \ (h)$$

$$\gamma_{H_2O} = \phi_4(T, x_{NH_3}) \qquad \text{[Eq. (11)]} \ (i)$$

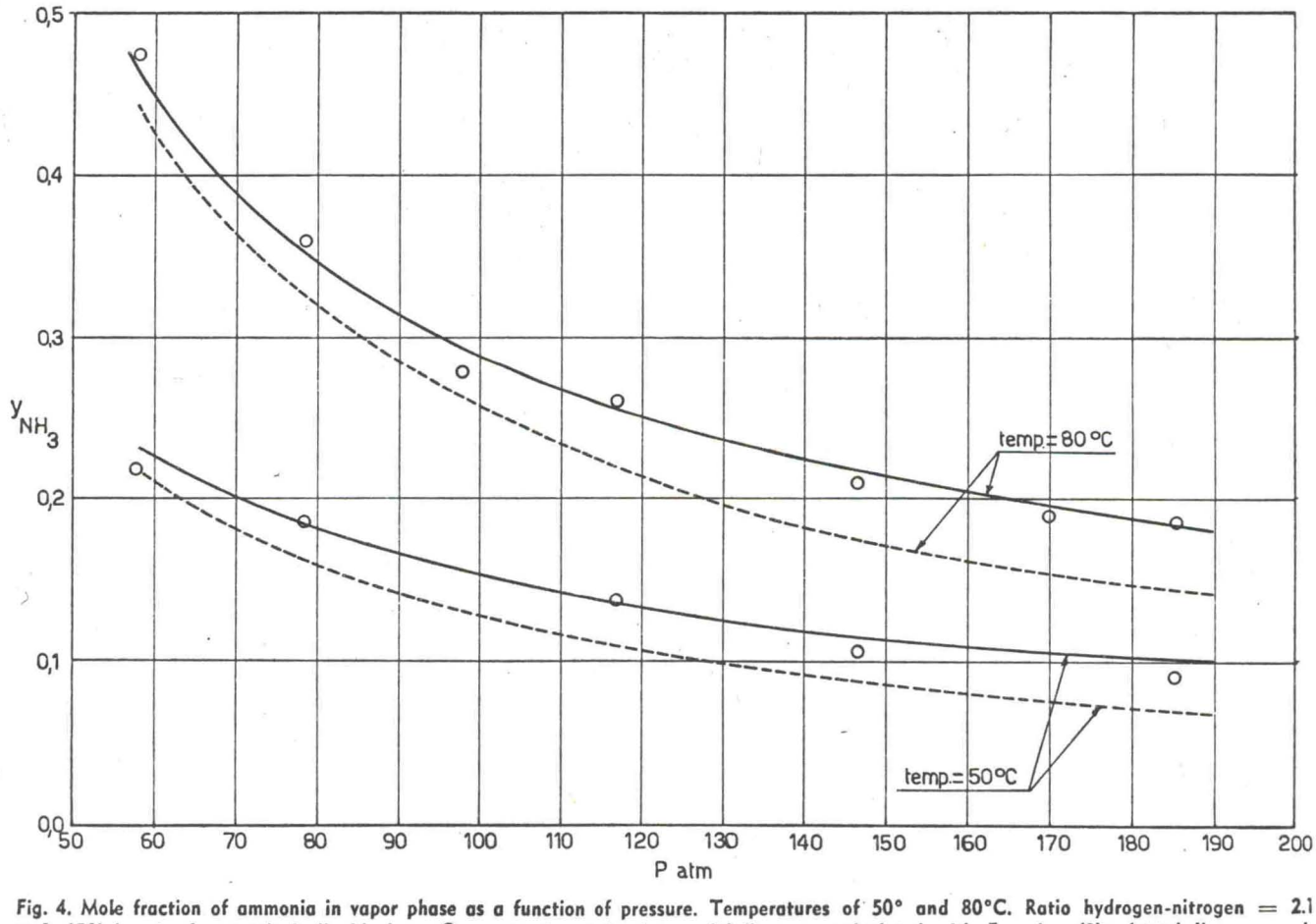

Fig. 4. Mole fraction of ammonia in vapor phase as a function of pressure. Temperatures of 50° and 80°C. Ratio hydrogen-nitrogen = 2.1 to 1.-65% by wt. of ammonia in liquid phase. ○ = experimental points; solid lines = calculated with Equation (9); dotted lines = calculated with Equation (8).