In the present case we have to consider also the influence of pressure which was not considered in paper [2]. The relation (6) was derived under the assumption of a constant energy gap [5]. As mentioned above, we suppose a change of the energy gap W' or a change of the activation energy W caused by pressure. At the first approximation, in accordance with the relation (4) it follows

$$W(p) = W_0 - Cp \,. \tag{8}$$

Consequently in our case we can not make use of relation (6), but apply the more general

$$\sigma = \sigma_0 \exp\left[-W(p)/kT\right]. \tag{9}$$

Developing the function $f(p, T) = W(p)/kT$ into the Taylor polynom in the environment of the point (p_0, T_0), and consider only the terms linearly dependent on temperature and pressure $p = \Delta p$, respectively, we receive with regard to (7) the expression

$$f(p, T) = \frac{W(p)}{kT} = \frac{W(p_0)}{kT_0} + \frac{1}{kT_0}\frac{\partial W(p)}{\partial p}\, p - \alpha(T - T_0)\,. \tag{10}$$

As according to (4) $\partial W(p)/\partial p = -C$, hence from (9) and (10) follows the expression

$$\sigma = \sigma_{0p} \exp \alpha(T - T_0)\,, \tag{11}$$

where

$$\sigma_{0p} = \sigma_{00} \exp\left[-\frac{W(p_0)}{kT_0} + \frac{C}{kT_0}\cdot p\right], \tag{12}$$

where σ_{0p} is the conductivity at temperature T_0 and pressure p and σ_{00} is the pre-exponential factor. In agreement with the relations (6) and (12) it will be

$$\sigma_{0p} = \sigma_0 \exp\left[\frac{C}{kT_0}\, p\right] \tag{13}$$

where σ_0 is the conductivity at $p = 0$ bar and $T = T_0$.

As it can be seen considering the pressure it becomes evident that relation (11) results instead of (6). Analogously with paper [2], taking in every case σ_{0p} instead of σ_0, the following expression of V-A characteristic can be obtained

$$I = \frac{U}{R_{0p}} \exp\left[mU - nU^2\right], \tag{14}$$

where

$$m = M\alpha d_i\,, \quad n = N\alpha d_i\,, \quad d_i = D\sigma_{0p}\,. \tag{15}$$

The constants M, N, D are positive. The resistance R_{0p} occurring instead of R_0 from [2] is the resistance of the sample at the temperature $T = T_0$ and the pressure p.

Let us now investigate the dependence of the parameter m in the equation (14) on the pressure. It follows from the relations (7) and (8) that

$$\alpha = \frac{W_0 - Cp}{kT_0^2}\,. \tag{16}$$

Developing the exponential function in the relation (13), we shall obtain in the first approximation the expression

$$\sigma_{0p} = \sigma_0 \left(1 + \frac{C}{kT_0} \cdot p\right). \tag{17}$$

Using the relations (15), (16), (17) we shall arrive to the expression for m.

$$m = b(1 + k_1 p + k_2 p^2)\,, \tag{18}$$

where

$$b = \frac{MD\sigma_0 W_0}{kT_0^2}\,, \quad k_1 = C\left(\frac{1}{kT_0} - \frac{1}{W_0}\right), \quad k_2 = -\frac{C^2}{kT_0 W_0}\,.$$

Assuming $nU^2 \ll mU$, [2] and taking into account the relation

$$\frac{1}{R_{0p}} = \frac{1}{R_{00}}(1 + Kp) \tag{19}$$

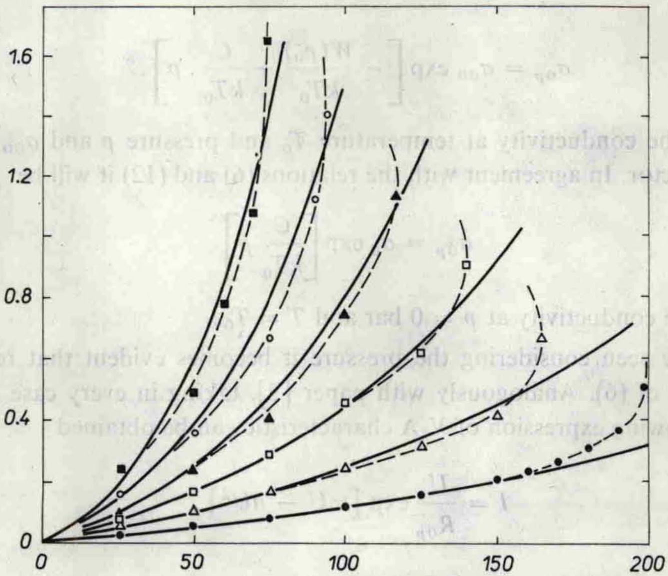

Fig. 1. The comparison of measured V-A characteristics with those expressed by relation (2) using suitable constants. ● — atmospheric pressure, △ — 1 kbar, □ — 2 kbar, ▲ — 3 kbar, ○ — 4 kbar, ■ — 5 kbar.