i/I_0	0	0.33h	0.42h	0.67h	h
0.406	52	26	25	29	67
0.576	53	29	28	34	68
0.728	56	36	35	40	70
0.949	91	83	82	85	97

be considered a constant factor, but is rather a function of the coordinate $\xi = x/h$. As a result of this, in Eq. (5) the variables μ and ν cannot be separated and all the relationships subsequently given cannot be obtained. Thus, the expressions obtained in Ref. 1 are not, in fact, solutions of the equation for the volt-ampere characteristics of ionization chambers. This, of course, is the reason why the approximate expressions obtained by Steinbok differ from the approximate solutions of Mi and Seeliger.

Steinbok also gives a comparison of his experimental data which he obtained during the measurement of ionization by the compound $RaCl_2$. It is difficult to understand the fact that the experimental data for the ionization of α-particles do not conform to the dependence, characteristic for the ionization column, of the strength of the current on the difference in potential (see, for example, Ref. 3, Fig. 80) applied to the ionization chamber.

From the foregoing it follows that the volt-ampere characteristic of ionization chambers obtained in Ref. 1 and the description of the work of the ionization chambers on the basis of the characteristics derived by the author cannot pretend to rigor and accuracy. It is hardly possible to use these results in working with ionization chambers, since the question of the erroneousness of the equations is left open.

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Disintegration of Positive Ions in Collision with Molecules

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IN the mass spectra of some compounds broad peaks are observed whose centers of gravity do not coincide with the integral mass numbers. The apparent mass M^* is

$$M^* = M_K^2 / M_H,\qquad (1)$$

where M_H and M_K — are the ionic masses before and after disintegration. The observed peaks are caused either by spontaneous disintegration of metastable ions[1,2] or by disintegration caused by collisions with molecules or atoms.[3-7]

We investigated some broad peaks in the mass spectra of carbon monoxide, carbon dioxide, methyline iodide and bromide, acetylene and ethylene (see Table). The investigation was carried out on a standard equipment MS-1 with ionic energy 2500 ev, electron energy 70 ev and electron beam current 0.5 ma. The pressure in the analyzer was 3×10^{-5} mm Hg. Mass spectra were automatically scanned by change in magnetic field and recorded by an electronic potentiometer. Ionic currents were measured at the maximum of the peaks.

We found that the intensity of broad peaks I^* in the first approximation is

$$I^* = \alpha I p.\qquad (2)$$

where p is the pressure of the gas entering the analyzer of the apparatus, measured with an ionization gauge of the type LM-2, I is the intensity of the developed positive ions and α is a constant. As

No.	Disintegration scheme		M^*	Disintegration probability $\sigma \times 10^{17}$ cm^2					
				CO	CO$_2$	C$_2$H$_2$	C$_2$H$_4$	CH$_2$Br$_2$	CH$_2$J$_2$
1	CO$^+$	C$^+$	$5^{1}/_7$	1	2.8	—	—	—	—
2		O$^+$	$9^{1}/_7$	0.1	—	—	—	—	—
3		O$^-$	$9^{1}/_7$		0.6	—	—	—	—
4	CO$_2^+$	C$^+$	$3^{3}/_{11}$	—	4.2	—	—	—	—
5		O$^+$	$5^{9}/_{11}$	—	7.2	—	—	—	—
6	CH$^+ \longrightarrow$	C$^+$	$11^{1}/_{13}$	—	—	4.7	5	6.5	5
7	CH$_2^+ \longrightarrow$	C$^+$	$10^{2}/_7$	—	—	—	3	4	3

an example, relative peak intensities I^*/I are shown in Fig. 1, corresponding to the apparent masses $5^{1}/^7$ and $10^{2}/^7$ in the mass spectrum of carbon dioxide and methylene bromide in their dependence of the pressure in the analyzer.
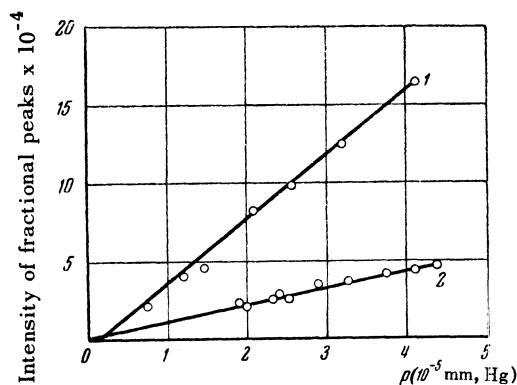

FIG. 1. $1 - (I_{5^{1}/_7} / I_{28})$ (CO)$\times 10$;
$2 - (I_{10^{2}/_7} / I_{14})$ (CH$_2$Br$_2$)

The data given in the Table which characterize the probability of disintegration were obtained as approximations from

$$\sigma = N^* kT / Npl, \qquad (3)$$

where N^* and N are the number of disintegrated and undisintegrated ions, K is the Boltzmann constant, T is the absolute temperature, and l is the distance from the source to the magnetic field analyser. The N^*/N was determined from the height of the secondary and primary peaks. Since the fractional peaks are broad the values turn out too small. Furthermore the difference in ionization was disregarded.

The results given in the Table show that the disintegration probability of CO$^+$ ion according

to the scheme 1 is greater than according to the scheme 2, which is in agreement with the electron affinity of oxygen and carbon. This is also confirmed by the disintegration of CO$^+$ from carbon monoxide according to the scheme 1 and 3. The difference of probability in processes 4 and 5 is interpreted, apart from the electron affinity influence, by the difference of the number of dissociated particles and the loss of energy connected with it. This refers also to the disintegrations according to the scheme 6 and 7.

The investigation of the influence of the electron energy up to 140 ev on the character of the dissociation processes has shown that the disintegration probability depends on the electron energy. This dependence is evidenced in the investigated cases by a decrease of the relative intensity of the fractional peaks with the decrease of the electron energy, whereby the relative intensity close to the potentials of ionic emission decreases stronger than at higher energies. The results obtained for carbon dioxide are shown in Fig. 2. A similar dependence have also other disintegrations shown in the Table where an increase of the electron
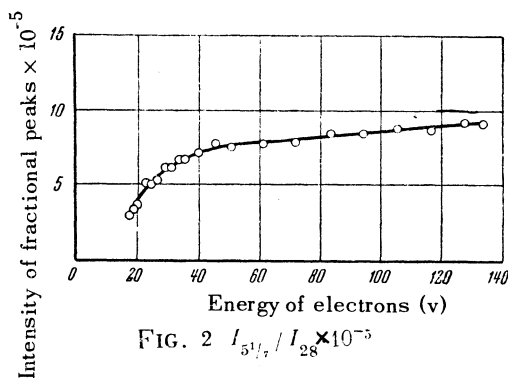

Energy of electrons (v)

FIG. 2 $I_{5^{1}/_7} / I_{28} \times 10^{-5}$

energy in the region close to the ionic emission causes a disintegration increase 2-4 times. The dependence shown in Fig. 2 is similar to that of the peak with the apparent mass 1/2 investigated in the paper [8] in hydrogen ionization. We would like to mention that the influence of the electron energy on the disintegration of CH^+ and CH_2^+ in the investigated cases is different from that in methane ionization.[9] . In the last case the disintegration probability increases strongly in the region of ionic emission potentials.

The observed increase of probability of processes forming fractional peaks in disintegrations shown in the Table with an increase of electron energy is probably connected with the number and degree of excitation of emission ions. The second possible cause seems to be the increase of the initial kinetic energies of the fragmentation ions with the increase of the electronic energy.[10] An increase of ionic energy up to 3000 ev increases the probability of disintegration. The character of this dependence is influenced by the type of disintegration and by the nature of molecules involved in the collision process.

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Beta-Spectrometer Investigation of Conversion Electrons with Aid of Nuclear Emulsions

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WITH present-day magnetic β-spectrometers, there are in use basically two methods for recording electrons --with the help of counters (gas discharge or luminescent) and photographically, by observing the intensity of darkening.[1] The photo-recording method possesses the well-known advantage that it can be used in the study of very short-lived radioactive isotopes, whereas this possibility is practically excluded in work with counters. However, the sensitivity of the photographic method is low and one must use β-emitting sources of high activity.

The requirements become particularly demanding in those cases where the energy range of the β-spectrum does not exceed several hundred kev. The combination of high source activity and small thickness requires the use of compounds with high specific activity, often very difficult to obtain. A further serious drawback of the photo-recording method appears to be the difficulty of measuring the relative intensities of the electron lines, due to the dependence of the intensity of darkening on the electron energy.

The above difficulties may be avoided by using thick electron-sensitive photographic emulsions and determining the number of electrons directly from the number of tracks, rather than from intensity variations. Analogous methods have been used earlier for investigating α-spectra with magnetic spectrometers, and have given positive results.*[2] The difficulty in using this method in β-spectroscopy is that the tracks are relatively thin and are quite tangled due to the strong scattering of the electrons. This makes it difficult to count the electrons against the granular background of the film.

The aim of the present work was to show the feasibility of using thick emulsions for recording electrons in a β-spectrometer, in particular for the study of conversion electrons. We employed a Danish-type spectrometer with semi-circular focussing and uniform transverse magnetic field. Its resolving power was 0.7 -1.0%. For recording