in the tube in a time of the order of 10^{-5} sec, the determination of a possible constriction of the arc requires observation of the arc within times of the order of 10^{-6} sec. Therefore, the arc has been formed by a discharge of a condenser connected by short leads to the tube, the discharge occurring in τ=1-2 μsec. Under these conditions one could observe the arc constricted to a narrow channel.

In Fig. 1 an arc is shown in argon with a tube diameter of 32 mm, $p = 1\,\mu$Hg and $i_{max} = 450$ amp. We see that, notwithstanding the low pressure, the channel of the arc is constricted as compared to the diameter of the tube. The constriction is stronger in Fig. 2, which shows an arc in Hg-vapor with a tube diameter at 9 mm at τ=1.15 μsec, i_{max} = 425 amps. The arc is seen in the main part of the Figure to be a narrow channel, spirally curved and adjacent to the wall of the tube. A control experiment shown in Fig. 3 of an arc in the same tube at the same pressure but smaller current (i_{max}= 225 amp τ=2 μsec) does not have any constriction.

The conditions and results of these and numerous analogous experiments in Hg-vapor and in argon compel us to reject for all of them the known explanations for the constrictions of the region of current conduction(contraction of a high-pressure column, the phase of a gas-focused electron beam[4]). One must therefore accept the observed phenomena as being caused by the electrodynamic effects of the magnetic field of the arc.

We did not find a rupture of the arc, caused by the "pinch-effect". An arc sustained continuously in a straight tube without constriction or other obstacles does not rupture, but moves rapidly across the cross section of the tube. A complete description of these experiments will follow.

V. I. Pugacheva participated in these experiments.

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* The distance between points symmetric with respect to the axis, where the electron concentration is half that on the axis.

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The Relation of the Oscillator Strengths for the Components of the Resonance-Doublet of Aluminum and Copper

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THE experimental arrangement used in this paper has been described in detail in the papers of Rozhdestvenskii and Penkin[1] and Penkin[2]. It consists of a source of a continuous spectrum (an SVD tube with krypton), a large Rozhdestvenskii interferometer with a mirror separation of 30 cm, and a spectrometer (quartz-spectrograph E-1).

A column of vapor of the element to be investigated was obtained in a high temperature vacuum furnace with a graphite tube as a heater. The furnace was placed in one of the paths of the interferometer. When a compensation tube and a plane-parallel plate were simultaneously introduced in the other path of the interferometer, one could observe hooks in the spectrometer, coupled with the interferometer, near the absorption lines. The measurement of the distances between the summit of the hooks allows the determination of the oscillator strength of the corresponding transitions. With the help of this arrangement, spectrograms which consisted of photographs of the hooks at the absorption lines of aluminum and copper were obtained. These photographs are reproduced in Fig. 1.

The calculation of the relative values of the numbers f for the components were performed according to the formula of the method of hooks:

$$\frac{f_1}{f_2} = \frac{K_1}{K_2}\left(\frac{\Delta_1}{\Delta_2}\right)^2 \frac{N_2}{N_1}\left(\frac{\lambda_2}{\lambda_1}\right)^3.$$

The indices 1 and 2 relate to the short-wave and long-wave components of the doublet:

$$K = \left(\frac{n-1}{\lambda} - \frac{\partial n}{\partial \lambda}\right) d$$

Here d is a constant of the method, Δ the distance between the summits of the hooks, λ the wavelength of the absorption line, N the concentration of the atoms at the lower level.

For the resonance doublet of aluminum, the ratio

$$f_{3944}/f_{3962} = 3.44$$

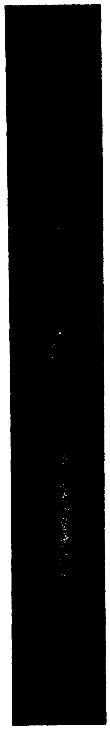

Fig. 1

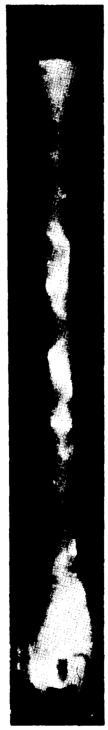

Fig. 2

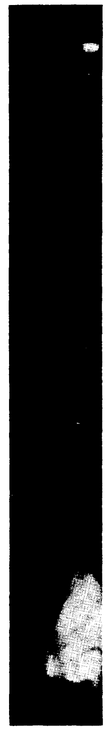

Fig. 3

(Granovskii and Timofeeva, No. 68)

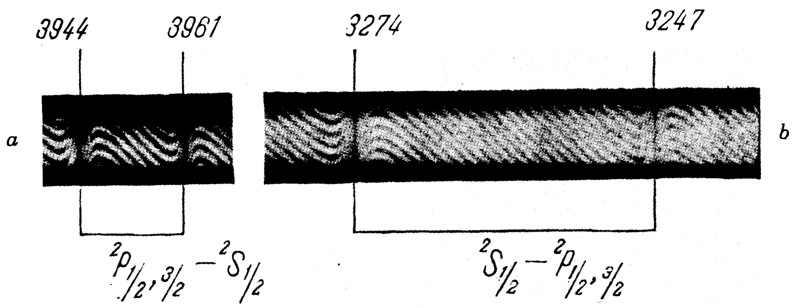

Fig. 1. Hooks near resonance doublets:
a. aluminum; *b.* copper
(Parchevskii and Penkin, No. 69)

with an error of 1.7% was obtained.

For the resonance doublet of copper we have

$$f_{3248}/f_{3274}=1.98$$

with an error of the order of 1%.

The ratio of the f-numbers for the components of the doublet of copper was obtained also by King and Stockbarger[3]. Using the method of total absorption the authors of that paper obtained for this ratio

$$f_{3248}/f_{3274}=1.94,$$

with estimated error of 10%.

In the error-limits of the experiments the results obtained by the methods of hooks and the method of absorption are identical.

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Translated by W. Philipoff
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The Effect of a Uniform Compression Upon the Galvanomagnetic Effects in Bismuth and Its Alloys

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A large number of studies have been devoted to the investigation of galvanomagnetic properties of metals. Recently, a broad and systematic investigation of the galvanomagnetic properties of pure metals was carried out by Borovik[1-4]. Utilizing the results of certain theoretical studies[5,6] Borovik obtained values for the density of conduction electrons, calculated on the basis of results of measurements of the Hall effect and the variation of the electrical resistance in the magnetic field.

In connection with our earlier considerations on the influence of the density of conduction electrons upon the nature of shift of the transition temperature of superconductors under elastic deformation[7,8], it was of interest to investigate the influence of uniform compression upon the electron concentration. For this purpose, measurements were undertaken of the Hall effect and of the variation of the electrical resistance in the magnetic field, for bismuth and for certain compounds of bismuth with other non-superconducting metals. We also investigated the temperature dependence of their electrical conductivity in a compressed as well as in a non-compressed state. The present communication presents the results obtained with bismuth.

The investigation of the influence of pressure upon galvanomagnetic properties in the region of low temperatures, as far as we know, has not been conducted by anyone and has therefore an intrinsic interest.

The study of galvanomagnetic phenomena was conducted on single crystal samples of bismuth having different purity and possessing in the most cases a spherical shape. This shape was convenient in that it assured a minimum of the irreversible processes connected with the possible deformation of the sample. Terminals were welded to the sample by the spark method.

For the investigation of samples under pressure we used a method which had been proposed by Lazarev and his collaborators[9], which we had already used sucessfully in our former studies. All temperature measurements were made in the broad range of temperatures from 1.5 to 300° K. The dependence of the electrical resistance upon temperature in zero magnetic field was measured during the heating-up of the apparatus, which had first been cooled down by liquid hydrogen or helium. The heating-up of the apparatus from 14 to 273° K lasted usually 5-6 hours, which permitted the measurement of the resistance with sufficient precision. The temperature was measured with the aid of a copper-constantan thermocouple, soldered to the external wall of the bomb opposite the center of the sample.

During the investigation of bismuth, 14 samples were investigated. The samples were prepared from Bi Hilger of a 99.9996% purity without preliminary recrystallization; and also from bismuth containing 0.02% of lead, some of the latter samples having been submitted to a purification process by recrystallization. Figure 1 shows the curves of the dependence of the ratio of the Hall field to the electrical field in the direction of the current, E_y/E_x, and the electrical resistance, r, upon the magnitude of the magnetic field, H, for a sample prepared from bismuth with 0.02 % lead, at a temperature of 20.4° K. Analogous results for the sample of bismuth No. 14, of the same purity, for a temperature of 4.2° K, and for two orientations in the field, are shown in Fig. 2. Uniform compression, as a rule, did not lead to a change in the