or doping. Furthermore, since no significant changes are observed in the temperature dependence of the electric conductivity near 170°K (Fig. 2), the experimental data show that the action of the electric field does not reduce to Joule heating, as is the case, for example, in amorphous semiconducting materials [7].

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DETECTING PROPERTIES OF METAL-InSb POINT CONTACT AT A WAVELENGTH OF 337 μ and T = 300°K

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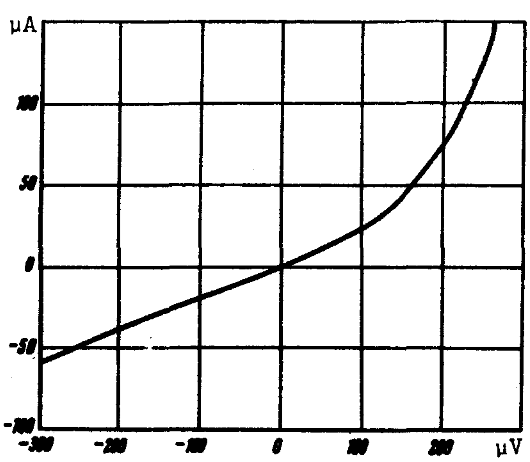
The radiation of an HCN laser at 337 μ wavelength was focused on a contact between an InSb crystal and a metal spring. The crystal measured 0.5 × 0.5 × 0.2 mm, had n-type conductivity, a carrier density 10^{14} cm^{-3} and a mobility $\mu = 6 \times 10^5$ (at T = 77°K). The crystal was etched in a mixture of nitric, hydrofluoric, and acetic acids and was soldered to the base with pure indium. The beryllium-bronze needle was 25 μ thick and 1.5 mm long. The needle was sharpened electrolytically in aqua regia. The detecting pair was mounted in a screening cylinder, on one end of which was screwed a teflon lens, and on the other a piston. The laser power was measured with a calorimeter accurate to ±10%. The laser signal was calibrated with a set of plane-parallel plates of vinyl plastic, and the attenuation in each plate was measured beforehand with the aid of a pyroelectric indicator. The signal was modulated with a semiconductor modulator at a frequency 1 kHz. The loss in the modulator and modulation coefficient were also measured accurately.

The best results are as follows: The tangential sensitivity at an amplifier bandwidth 1 MHz and signal/noise ratio 5 dB is 25 dBm. The threshold sensitivity with a U2-6 amplifier is 4×10^{-10} W-sec$^{1/2}$; the voltage-power sensitivity with a load resistance of 10 kΩ is 20 - 25 V/W. The contact resistance is of the order of several thousand ohms. The inertia of the contact apparently is not worse than 10^{-12} sec. Biassing the operating point with dc voltage made it possible to increase the voltage-power sensitivity by a factor of 3 - 4, but the level of the low-frequency current noise increased more rapidly, and it was therefore meaningless to use bias in the video detection regime.

Contacts with a sensitivity lower by one order of magntidue can be obtained very easily. The results presented here cannot apparently be regarded as ultimate, since we do not know how effectively the radiation is applied to



Current-voltage characteristic of contact.

the contact. The properties of the contact changed little when the needle was moved over the crystal, and therefore the sensitivity was determined primarily by the electrodynamic characteristics of the system. For comparison we indicate that the best detecting pairs used in detectors for the millimeter band, of the silicon-tungsten type, turned out to be less sensitive by two orders of magnitude when installed in our apparatus.

Cooling the contact with the indicated type of crystal to 77°K led to a sharp increase of the resistance and to a drop in the detecting properties, although the rectifying properties of the contact at low frequencies was considerably improved. A typical current-voltage characteristic of the contact is shown in the figure. The detection appears apparently at the Schottky barrier, through which considerable tunnel currents flow simultaneously in both directions. The opinion that detection is by the thermoelectric effect of the "heated" carriers in the region of the contact does not agree with the results of the measurement of the sensitivity upon cooling.

We are convinced that the metal-InSb contact is quite promising for video detectors and mixers for the submillimeter band, operating without cooling.

FIELDLESS TEMPERATURE RESONANCE IN RUBY (T-RESONANCE)

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The system of levels of the ground state of the Cr^{3+} ion in Al_2O_3 consists of two Kramers doublets separated by an energy gap 2D, where D is the constant of the axial crystal field in the spin Hamiltonian describing the behavior of these levels. The value of the constant D was determined many times at room temperature and below. We have found that above room temperature D depends on the temperature in the following manner:

$$2|D(T)| = 2|D_0| + D'T,$$

where D_0 = -5735 MHz is the known value of D at 300°K; D' = 0.6 MHz/deg.

The dependence of D on T makes it possible to observe in a paramagnetic crystal (ruby) a new form of fieldless resonance, under conditions when the frequency of the microwave radiation is fixed, and the "passage" through resonance is realized by slow variation of the temperature.

Experiments on temperature resonance were made on a sample with a chromium concentration 0.05%. The sample was placed in the resonator of a microwave spectrometer, where it could be heated up to 1000°K by means of a platinum oven. The resonator was tuned to a frequency exceeding $2|D_0|$ by several hundred MHz. The temperature of the sample was then slowly varied by varying the current heating the platinum oven.