lead one to believe that the maximum value of the small signal current gain, $\alpha=(\partial I_c/\partial I_e)_{V_c}$, for a Type A transistor is 2.5 as it is for a filamentary transistor.[1]

The region of a performance characteristic below saturation represents a combination of effects. Here the emitter may still be carrying a sufficiently large proportion of the total current that it must remove some electrons from the crystal as well as inject holes into it. Here also, the field set up in the crystal by the voltage on the collector may not be strong enough to bring all injected holes into the neighborhood of the collector before some of them disappear. This effect should only be noticed for collector voltages less than one or two volts however, since one would expect that the transit time of holes at higher collector voltages should be negligible in comparison with their average lifetime under these conditions. The performance characteristics are terminated on the low voltage end at the point where the collector and emitter currents are equal. (Only the solid portions of the output characteristics of Fig. 1 are used in plotting the performance characteristics.) At this point there is no current in the base lead of the transistor and the emitter efficiencies given by these points may approximate the hole injection efficiency of the emitter probe when it is carrying the total current.

In making measurements at power levels over 100 milliwatts it was found necessary to correct for the change in G due to heating. If the semiconductor temperature rises sufficiently in the neighborhood of the barrier to reach the range of intrinsic conductivity the number of holes present even in the absence of hole injection will rapidly increase and raise the value of G. This effect shows up in the performance characteristic as a failure to saturate at a constant $\gamma(1+b)$ value for high collector voltages.

[1] Shockley, Pearson, and Haynes, Bell Sys. Tech. J. **28**, 352 (1949).
[2] G. L. Pearson, Phys. Rev. **76**, 179 (1949).

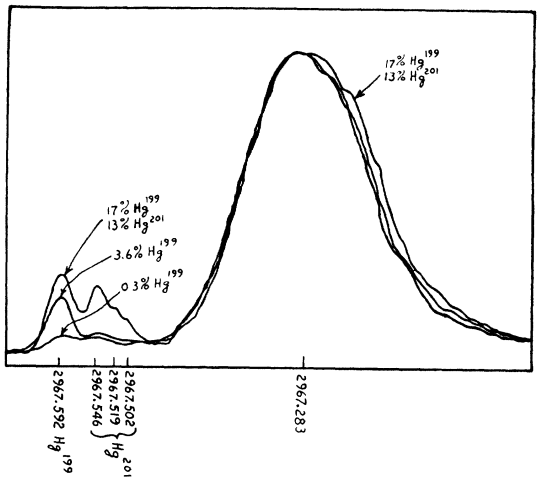

FIG. 1. Microphotometer traces of the 2967.5A forbidden lines and the allowed line 2967.3A for samples containing different concentrations of odd isotopes.

Forbidden Lines in the Spectra of Impure Hg^{198}

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MROZOWSKI[1] has shown that the observed structures of Hg 2967.5A ($6p\ ^3P_0-6d\ ^1D_2$) are explained as due to one line from Hg^{199} and three from Hg^{201}, the separations and intensities of all components being in complete agreement with the predicted pattern. Deloume and Holmes[2] have studied the lines 3320A ($5p\ ^3P_0-5s\ ^1S_0$) and 3141A ($5p\ ^3P_2-5s\ ^1S_0$) in natural and enriched Cd^{111} and found that the intensities of these forbidden lines increased in proportion to the increase in abundance of the odd isotope.

To corroborate Mrozowski's conclusion, three electrodeless discharge tubes were prepared, containing respectively natural Hg (17 percent Hg^{199}, 13 percent Hg^{201}, and remainder even-mass isotopes), Hg^{198} with a 3.6 percent contamination of Hg^{199}, and Hg^{198} with 0.3 percent Hg^{199} contamination. The last two were made by neutron bombardment of gold. Spectrograms were made with a large quartz spectrograph possessing at 2967A dispersive power of 1.7A/mm and practical resolving power exceeding 100,000. The forbidden lines from natural mercury could be photographed with exposures of two minutes duration. The resultant spectra show, in the case of natural Hg, clearly resolved components due to Hg^{199} and Hg^{201}. The component due to Hg^{201} is further resolved into three components corresponding to $\Delta F=-1, 0, +1$. In the spectrum of the 3.6 percent contaminated sample, the Hg^{201} components are almost absent and the Hg^{199} component has been greatly reduced in intensity. The 0.3 percent contaminated sample shows only a faint trace of the forbidden line ascribed to Hg^{199}. Spectrograms obtained with exposure times inversely proportional to the abundance of Hg^{199} show that the intensities of the forbidden lines are indeed proportional to the abundance of the odd isotopes, thus verifying the nuclear perturbational nature of the forbidden transitions.

Microphotometer traces of the permitted line, 2967A ($6p\ ^3P_0-6d\ ^3D_1$) and for forbidden lines from three samples of impure Hg^{198} are reproduced in Fig. 1.

[1] S. Mrozowski, Phys. Rev. **67**, 161 (1945); Rev. Mod. Phys. **16**, 153 (1944).
[2] F. F. Deloume and J. R. Holmes, Phys. Rev. **76**, 174 (1949).

Temperature Effects in the Spurious Discharge Mechanism of Parallel Plate Counters*

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AN outstanding limitation of the parallel plate spark counter is the large spurious counting rate which thus far has been suppressed only through operation at inconveniently long recovery times (>0.05 sec.). Investigations of this phenomena[1,2] have been limited to the observation that the spurious rate is appreciably influenced by the cathode material and its preparation. It also was pointed out that the clearance time for positive ions should be at the most 10^{-4} sec., and hence that the necessity for longer recovery times must be due to some mechanism associated with the cathode surface rather than the state of the gas. Such a mechanism giving rise to delayed electron emission from a surface (described by Malter[3] and Paetow[4]) was cited as a possible process in this connection.

During the preparation and testing of a number of such counters for use in investigation of short time delay phenomena, a marked dependence of counting rate upon temperature has been observed. The counters used consisted of copper plates, 9 cm^2 in area, spaced at 0.2 cm separation, and mounted in glass envelopes. After washing with acid solution and rinsing with distilled water, the counters were baked in vacuum at 425°C for two hours and allowed to cool slowly with one-half atmosphere of hydrogen admitted during this period. After complete cooling a premixed filling of 85 percent argon and 15 percent ethyl ether was admitted, the total filling pressure being 70 cm Hg.

In obtaining the data reported here a conventional Neher-Harper quench circuit was employed (Fig. 1). The counters were operated at approximately 200 volts over-voltage and held at various temperatures in an oven. Figure 1 shows the variation of counting rate with recovery time, t_r, at various temperatures.