It is remarkable that for the sodium chloride type, c_{12} and c_{44}, as also the corresponding ε's and ρ's, depend on the lattice constant alone. This result, however, does not hold for the cæsium chloride type.

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Calibration of Geiger-Müller Liquid Counters by the Radioactivity of Potassium-40

IN recent clinical radioactive tracer studies using sodium-24, phosphorus-32 and iodine-131, it was found desirable to have a reliable and convenient radioactive standard, of similar beta- and gamma-ray energy, easily reproducible, of negligible radioactive decay and with adequate carrier protection against exchange reactions upon the glass walls of Geiger–Müller liquid counters[1]. The radioactive isotope, potassium-40 of normally occurring potassium, is present to one part in 9,000 and has a half-life of $12 \cdot 7 \pm 0 \cdot 5 \times 10^8$ years[2] with a beta-ray spectrum of maximum energy 1·38 MeV. and a gamma-ray of energy 1·5 MeV.

Some time ago, Barnes and Salley described[3] a method for the analysis of potassium by its natural radioactivity, using a Geiger–Müller liquid counter calibrated with standard potassium solutions. The time required, from statistical theory, for a measurement with probable error of ± 1 per cent for a 4 *N* potassium chloride solution in a 20-ml. counter was about 70–80 min. In my early experiments, concentrated solutions of potassium chloride were used for calibrating counters. Later it was found that concentrated solutions of potassium carbonate gave nearly three times the counting-rate of concentrated potassium chloride. The most convenient compound from the point of view of solubility and potassium concentration was found to be potassium carbonate, which at 20° C. has a solubility of 112 gm. per 100 ml. water.

A type *M*6 10-ml. Geiger–Müller liquid counter filled with standard potassium carbonate solution gives 550 counts/min. with the counter enclosed in a protective lead screen. The background count is by comparison 15 counts/min. Other solutions, of potassium bromide and iodide, have also been tried, but, owing to the lower solubility and small concentration of potassium, give lower counting-rates. Solutions of potassium hydroxide may be used to give a 20 per cent greater counting-rate than potassium carbonate, but are much less convenient in manipulation.

It is therefore suggested as a basis of international standardization of Geiger–Müller liquid counters that they may be calibrated with standard potassium carbonate solutions with an accuracy of ± 1 per cent in 8 min. counting time.

A standard solution can be made up from 100 gm. analytical reagent potassium carbonate anhydrous (after heating to 200–300° C.) dissolved in 100 ml. distilled water. The advantage over standard solutions of cobalt-60 hitherto used[4] for counter standardization is that there is low cost, and the carbonate is universally available, has negligible radioactive decay and gives no residual activity in the counter due to adequate carrier protection.

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Propagation of Very-High-Frequency Radio Waves

DURING the period autumn 1949 – spring 1950, a series of measurements of field-strength from a very-high-frequency airborne transmitter was made at the Royal Aircraft Establishment. The main purpose of the investigations was to examine the field-strengths obtained in varying weather conditions with one end of the propagation path at a height of 40,000 ft. above the earth (the other end being at a height of 90 ft.) and to compare them with the field-strengths calculated from conventional ray-theory for a smooth spherical earth for both ordinary and four-thirds earth radius. For this purpose the two frequencies 280·2 and 386·6 Mc./s. were chosen.

In the curves of field-strength, plotted against distance between transmitter and receiver for those cases where the indirect ray was reflected from land, the observed minima were in some cases shallower than the calculated values, as could be expected for reflexion from a rough surface, but in no case were they deeper. Fig. 1 is a typical curve for land reflexion. In all instances, however, where the indirect ray was reflected from the sea, as in Fig. 2, the observed minima were considerably deeper than the calculated values, and this feature was also present

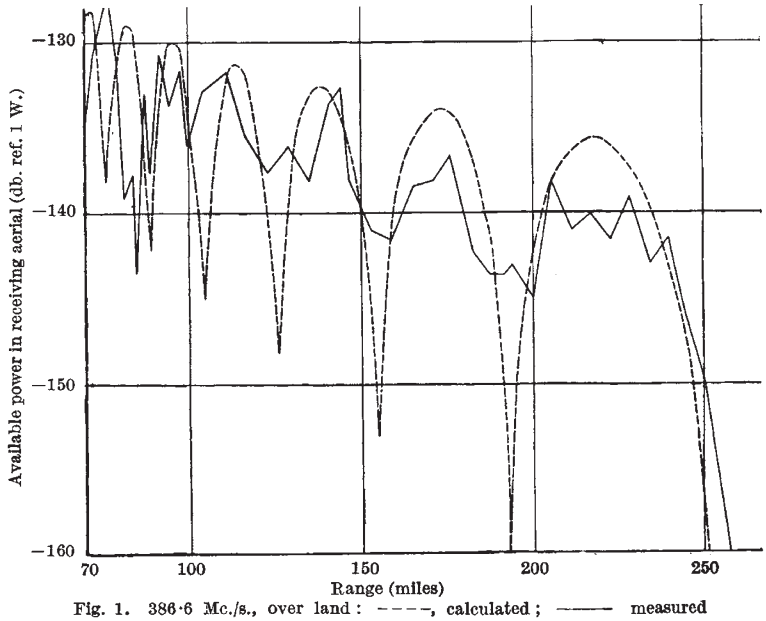

Fig. 1. 386·6 Mc./s., over land: ----, calculated; ——— measured