TEMPERATURE COEFFICIENT OF CONTACT POTENTIAL. A REJOINDER.

BY K. T. COMPTON.

PROFESSOR SANFORD has recently published in this journal[1] a criticism of work reported by the writer in an earlier issue.[2]

Professor Sanford first suggests that, in the attempt to measure the contact difference of potential between "the opposing nickel and iron faces, respectively, of two hollow metal boxes," the metal of which the remaining parts of the boxes are constructed would influence the results through the formation of electrolytic cells when the boxes are filled with water. He neglects the fact, however, that the internal resistance of such a cell so far exceeds its external resistance that the resulting potential difference between metal parts of a box is entirely inappreciable. A simple calculation shows that in our apparatus the error introduced would not exceed $4(10)^{-9}$ volt, which is about a million times smaller than the variation in contact difference of potential which we measured.

The second criticism is based on the assumption that we allowed the boxes to remain connected, through tubes, with the water reservoir while making measurements, and that we consequently measured the temperature variation of the electrolytic contact potential. "If this were so it were a grievous fault." I had not thought it necessary to state that both boxes were disconnected from the reservoir while measurements were in progress, and the diagram shows plainly that the earthing connections were made directly to the metal boxes and not to the water reservoir.

Finally, Professor Sanford states that, in deriving Professor Richardson's formula $V_m - V_s = (1/e)(\phi_m - \phi_s) + P$, the constancy of the term $(\phi_m - \phi_s)$ as the temperature varies is *assumed*, contrary to apparently reliable experimental evidence regarding the temperature variation of contact potentials. This is, of course, part of the very theory being tested; but the sufficient constancy of the term $(\phi_m - \phi_s)$ is not assumed, but is a logical consequence, according to the theory, of experi-

[1] PHYS. REV., N. S., 8, p. 95, 1916.

[2] PHYS. REV., N. S., 7, p. 209, 1916.

mental evidence regarding the magnitude of the Thomson coefficient for metals.[1]

It appears, therefore, that Professor Sanford's criticisms are without foundation. The essential similarity of results obtained with different experimental conditions, and direct evidence cited in the writer's original paper, indicate that the discrepancy between theory and experiment is probably due to the presence on the metal of surface films of gas or oxide. To make a valid test it is therefore necessary to devise experimental arrangements to eliminate the films or to extend the theory to include the effect of the films.

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[1] Richardson, "Electron Theory of Matter," p. 452 et seq.