4. Study on Surface Electricity. (XI)

On the Mechano-electrical Efficiency of U-effect

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When we want to make electro-acoustic devices, such as the pick-up of electrophonograph, microphone, transducer etc., as practical applications of U-effect (this Bull., **20**, 28 (1950)), it is important to determine the mechano-electrical efficiency of this effect and the inner impedance of the element. The former is indicated by the relation between the output voltage and the amplitude of the mechanical vibration of the element. As the former is very small and also is a dynamic one, ordinary microscopic measurement cannot be used, and we applied frequency-modulation method to determine this. The latter, which controls the load, was measured by the impedance maching method (*ibid.*, **24**, 12 (1951), **25**, 30 (1951)).

The experiments were performed with an element of 0.9 mm. dia., containing 40 Hg–$N.H_2SO_4$ aq. interfaces. According to the experiments the inner impedance was 6,000 ohms (at 400$\sim$), and the output-amplitude and-frequency relations were as follows:

Frequency : 400 $\sim$, Load : 6,000 ohms.

Amplitude (mm.)	0.0255	1.0159	0.0076	0.0063
Output (mV.)	54.0	22.5	9.0	5.3

Amplitude : 0.0015 mm.

Frequency ($\sim$)	2,000	1,000	500	100
Output (mV.)	3.9	1.7	0.65	0.18
(matched) Load (ohms)	1,200	2,400	4,800	24,000

The output-amplitude curve at constant frequency was quadratic. This seems to be due to the fact that the surface area change is proportional to the square of the amplitude. The output-frequency curve at constant amplitude was almost linear, but below 500 $\sim$ it saturated. This seems to be due to the fact that the actual relative motion at interfaces is smaller than the observed vibration of the element at low frequencies.