volume expander. The results are:

Amplitude characters at 1,000 c. p. s.

Element / Ampl. of vibr.	I	II	III
$0.3 \cdot 10^{-3}$ (m.m.)	2.4 (mV.)	5.0	6.0
0.7	5.0	11.2	11.9
1.2	9.4	22.4	23.7
1.7	13.3	29.9	35.5

The output voltages in mV.

Lastly, the output voltage increased linearly as the number of the interfaces increased. (*This Bulletin*, **20**, 28 (1950)). This can be seen with the following figures which were obtained with element II at 500 c. p. s. and amplitude of vibration of $2.6 \cdot 10^{-3}$ mm.

Number of interface	4	8	12	16	20	24	28	32	36	40
Load (kΩ)	2	4	6	8	10	12	14	16	18	20
Output volt. (mV.)	4.5	10.6	15.8	22.4	26.6	33.5	37.6	42.2	50.1	59.6

The loads were matched to the inner impedances of the element in every case.

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16. Study on Surface Electricity. (XV)

On Counter U-effect

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Although U-effect is a phenomenon converting mechanical energy of vibration into electrical one, we can make a conversion device in inverse direction by exchanging its acoustic terminals with those of electrical.

(1) U-effect II. We used an element of dia. 0.37 mm. and of impedance 45 kΩ (at 600 c. p. s.), containing 18 Hg-n. HCl aq. interfaces with a piston and an ordinary electrodes. The piston electrode was fixed and the capillary wall was the vibrating part. When an alternating voltage of audio-frequency was fed to the element it began to vibrate and made a sound. The frequency character had a noted peak at 500——600 c. p. s., which seemed to be due to the high stiffness of the damper in this experiment. The me-

chanical amplitude— voltage curve at 600 c. p. s. showed a saturating tendency, also indicating over-damping.

Though we can select a proper matched damper, the power we can convert by this device is limited by the following reasons. As the Hg-solution interface forms an electrode at which electrolysis occurs by an anodic polarization as small as about +0.5 V., the approved range of alternating voltage is limited by this value. For instance, in case of the element used here, it must be smaller than about 17 V. If we enhance it by increasing the number of interfaces, the increase of the inner impedance limits the power fed to this element. Moreover, the increase of the stiffness of the piston also promotes the energy loss and the efficiency decreases.

For all the defects described, we could use this for radio-receiving. When we attached the element to a speaker-cone of rad. 5 inches and connected the electrodes to the plate of the last stage valve of a radio-receiving set and earth, we could barely catch the broadcasting. The music and speech could be understood.

(2) U-effect I. A glass filter was dipped in water and two rings of Cu-wire placed to both sides of the filter served as electrodes. In this case the mechanical amplitude of vibration produced by the application of alternating voltage was not measured and only the sound produced was heard by ears. The higher the frequency (in the range used here) and the finer the porosity of the filter, the higher the efficiency was. The finest porosity we used was No. 4, in which case we could hear the sound of frequency from 800 to 6,000 c. p. s. When the distances from the electrodes to the filter were reduced, the sound became larger, and when H_2SO_4 aq. was added to water, the sound died out.

Though the detailed examination of this effect was not performed and we could not determine the equation of this effect, we can decide from above this effect to be due to the so-called electro-osmosis. It is also expected that this can be applied to the generator of a supersonic wave, because the higher the frequency the larger the sonic wave was in the region used. We are now performing an experiment using as high a frequency as some ten thousand c. p. s.

The sensitivity of radio-receiving was larger and the fidelity was better in this case than in the former device (1).

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17. Measurement of Viscosity of Liquid Air

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(K. Kimura Laboratroy)

By observing the damping of the free rotating oscillation of a brass