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On the Piezoelectric Properties of Tourmaline

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interference method of measuring the motion of the long end of the lever makes it possible to detect a displacement of the short end of only 0.15 Angström unit. The changes in thickness of quartz plates about two mm thick were measured with potential differences up to 500 volts between the electrodes on the faces of the plates. The piezoelectric constant of quartz found by this method using the converse piezoelectric effect is in fair agreement with the results of previous observers using the direct effect. The quartz crystals were found to be very non-uniform even though they appeared homogeneous in polarized light. The chief difficulty found in the use of the apparatus is in eliminating disturbance from vibrations.

IOWA STATE COLLEGE,
AMES, IOWA.

A SHORT STUDY OF BARKHAUSEN-KURZ OSCILLATORS

L. F. DYRTT

In the field of ultra-short waves as used in radio communications, oscillators of the Barkhausen-Kurz type should play an important part. The wave-length of these is dependent on the potentials applied to the grid and plate, and on the magnitude of the filament current, and is only influenced to a small degree by the leads connected to the grid and plate electrodes. Since the oscillations are caused by a purely mechanical to and fro motion of electrons about the grid, they are somewhat weak. In order to study oscillators of this type, one was built in an attempt to confirm the work of other experimenters, and to determine their practical possibilities.

IOWA STATE COLLEGE,
AMES, IOWA.

ON THE PIEZOELECTRIC PROPERTIES OF TOURMALINE

MORRIS UNDERWOOD

Oscillating piezoelectric plates of different frequencies have been made from California and South African tourmaline. These plates have a frequency response of approximately 3770 kc per millimeter of thickness. The temperature coefficient for both *specimens* was found to be negative and is about 25.5 parts per

million per degree centigrade for the African specimen and 28.1 parts per million per degree centigrade for the California crystal. Comparison of the tourmaline plates with a Y-cut quartz plate of the same size and frequency shows the tourmaline oscillators decidedly inferior on the basis of power output.

IOWA STATE COLLEGE,
AMES, IOWA.

A NEW METHOD FOR DETERMINING THERMIONIC WORK FUNCTION OF METALS AND ITS APPLICATION TO NICKEL

GERALD W. FOX AND ROBERT M. BOWIE

A new method for determining thermionic work functions of metals has been developed and may be stated as follows: The metal sample has the approximate form of a sphere and is heated by electron bombardment from an auxiliary filament that is disconnected when measurements are made. As the sample cools the electron emission from it charges a condenser, which, at pre-determined times, is discharged through a ballistic galvanometer. A Pt, Pt + 10 per cent Rh thermocouple, spot welded to the sample, measures its temperatures. The values of the thermionic constants are obtained by use of the equation:

$$\log_{10} (T^2/SQ) = \log_{10} (2.3/aA) + \Phi / (1.988 \times 10^{-4}T)$$

where Q is the quantity of charge yet to flow on cooling the sample to absolute zero and $-S$ is the slope of the $\log Q$ -time curve. This equation is derived from Richardson's.

For thoroughly outgassed nickel, this method yields $\Phi = 5.03 \pm .05$ volts and $A = 1.38 \times 10^8$ amps/cm² degree². The value for Φ agrees well with photoelectric determinations.

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DETERMINATION OF LINEAR COEFFICIENTS OF THERMAL EXPANSION OF THIN SAMPLES BY OPTICAL LEVER

JOHN E. GORHAM AND GEORGE C. HIGGINS

In order to measure coefficients of thermal expansion of small samples varying from one to twenty millimeters in thickness an