In the list of publications cited appear those of more than thirty of his Filipino colleagues and students. By such institutional activity the task depicted in Dean Baker's foreword has been carried on.

E. B. COPELAND

Emile Berliner, The Maker of the Microphone. By FREDERICK WILLIAM WILE. New York, N. Y. Bobbs Merrill Co., 1926.

FREDERICK WILLIAM WILE has been known to the American public as a newspaper correspondent and radio broadcaster, but in this book he will make himself known as the interpreter of the difficult and abstruse technical aspects of certain features of our civilization. He has done for Emile Berliner, "The Maker of the Microphone," what Michael Pupin did for himself in "From Immigrant to Inventor," and in some ways it is better.

The book is full of the romance of science, weaving as it does the conditions of the times that influenced the inventor. In particular the story of his work with the Bell Telephone Company is most readable. The story of how Bell was rewarded with success in the use of the electro-magnetic coil in making the first telephone is probably new to nearly every American. If the contact point on the coil had not welded so that it did not operate as intended, Bell might never have been known as the author of "the telephone, America's greatest invention." While Bell made use of induced electricity he did not use an "induction coil," as such is known and often termed "transformer."

Likewise Berliner by almost an accident learned that a variable contact would produce an undulating current, and from this was able to produce an undulating current corresponding to the sound pressures developed in a telephone transmitter.

The history of the telephone is fascinating, not only because of the personalities involved, but also because it shows how so many masters of many arts are involved in a great invention.

The story of the gramophone as it evolved by and about Berliner is almost as interesting as that of the telephone. The public generally does not know that the common disc record in use to-day is the invention of Berliner.

This book is commended to those who like to read a good biography, to those who like to learn how important inventions are made, and to those who like to learn once again that America is a land of opportunity.

The introduction by Herbert Hoover is a gem to be prized in any library.

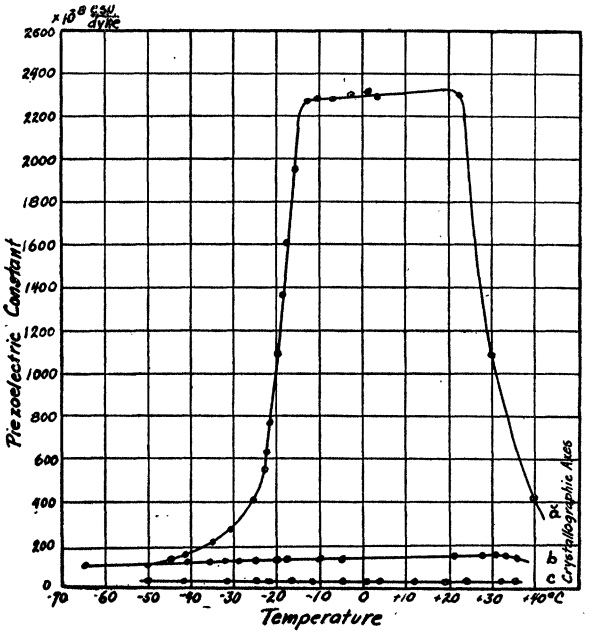
F. C. BROWN

BUREAU OF STANDARDS

SPECIAL ARTICLES

NOTE ON THE PIEZO-ELECTRIC EFFECT IN ROCHELLE SALT CRYSTALS

ALTHOUGH the piezo-electric effect in Rochelle salt crystals cut normal to the *a* crystallographic axis has been studied,[1] the only work on plates normal to the *b* and *c* axes consists of some old measurements by Pockels at room temperature. Because of the characteristic changes in piezo-electric activity at $-20°$ C. and at 25° C. observed in plates cut normal to the *a* axis, it was thought to be of interest to obtain corresponding observations on crystal plates of other orientations. Plates were cut from a large crystal perpendicular to each of the three crystallographic axes. Electrodes of tinfoil were attached by means of Canada balsam and the pressure was applied at 45° to the axes in the plane of the faces on which the charges produced were measured. The results of these measurements are shown in Fig. 1. The charges were measured by means of an electrometer null method, except for the last three points on the curve for the *a* direction, which were obtained by



means of a ballistic galvanometer. This change was necessitated by the rapidly increasing conductivity at these temperatures.[2] The piezo-electric constants are in electrostatic units per square centimeter of electrode per unit shearing stress in dynes per square centimeter. Their values for the *a*, *b* and *c* crystallographic directions are, respectively, 2300×10^{-8},

[1] Valasek, *Phys. Rev.*, *17*, 475 (1921) and *19*, 478 (1922).

[2] Valasek, *Phys. Rev.*, *20*, 653 (1922).

138×10^{-8} and 28.3×10^{-8} e.s.u. per dyne at 0° C. The changes in the values for the *b* and *c* directions per degree rise in temperature are, respectively, $+ 6.8 \times 10^{-9}$ and 3.1×10^{-10} between -60 and $+30$° C. The figure shows that the ions which produce the piezo-electric polarization move much more freely in the *a* direction in the crystal, especially in the temperature range from -20° C. to $+25$° C. Measurements of the dielectric constants also give results of the same nature. It was found, moreover, that the electrical anomalies, such as fatigue, hysteresis and residual charges, are relatively much smaller in the *b* and *c* directions. Although the crystal cut normal to the *b* direction is much less active than one cut normal to the *a* direction, the absence of these irregularities and of the large temperature coefficient just above ordinary room temperature would make the crystal cut in this way more useful in practical applications of the piezo-electric effect. It is still about twenty times as active as quartz.

JOSEPH VALASEK

UNIVERSITY OF MINNESOTA

THE INFLUENCE OF EPINEPHRIN AND OF THE SYMPATHETIC SYSTEM ON SKELETAL MUSCLE FIBERS AND CAPILLARIES

IT is possible to observe skeletal muscle fibers and their circulation under the high power of the microscope, by a method which will be described later. Cats have been used in these observations.

Epinephrin in small doses (.2 to .4 cc, 1:100,000) causes muscle capillaries and venules to dilate. New capillaries open while those already open may dilate further. The field becomes brighter, individual fibers show more clearly and the striations of the fibers appear or become clearer if already visible.

Larger doses (.8 cc to 3 cc, 1:100,000) cause constriction of capillaries, some of which entirely disappear. Stronger doses than these cause closing of many more capillaries and much more marked constriction.

Epinephrin caused twitching of the muscle fibers sometimes even with the small doses, although the larger doses cause more marked and more lasting effects. The twitching is at right angles with the longitudinal axis of the fibers.

Epinephrin also causes the intestinal villi to become more transparent. It has a similar action upon the bladder.

Stimulation of the lumbar sympathetic with weak induction shocks causes the field to become more opaque. Many new capillaries and venules open (skeletal muscle) and those already open dilate. As the stimulation is increased the field becomes more transparent, striations of the muscle fibers become visible or if already visible they become clearer. The fibers also respond by rapid transverse vibration which changes to twitching when the stimulus is increased.

FRANK A. HARTMAN
JAY I. EVANS
HELEN G. WALKER

UNIVERSITY OF BUFFALO

THE INDIANA ACADEMY OF SCIENCE

THE Indiana Academy of Science held its forty-second annual meeting at Ball Teachers College, Muncie, Indiana, on December 2, 3 and 4. A total of 80 papers was presented. These were distributed among the various sections as follows: General meeting, 8; Botany, 22; Zoology, 19; Chemistry-Physics-Mathematics, 15; Geography-Geology, 12, and special meeting on the Teaching of Science in the High School, 4.

The officers in charge of the meeting were:

President, Dr. W. M. Blanchard, De Pauw University, Greencastle; *Vice-president,* L. J. Rettger, Indiana State Normal, Terre Haute; *Secretary,* Dr. Ray C. Friesner, Butler College, Indianapolis; *Assistant Secretary,* Dr. W. P. Morgan, Indiana Central University, Indianapolis; *Acting Treasurer,* Dr. H. E. Enders, Purdue University, Lafayette; *Editor,* J. J. Davis, Purdue University, Lafayette.

The public lecture of the academy on the evening of December 3 was given by Professor W. H. Hobbs, of the department of geology, University of Michigan, who spoke on "The First Greenland Expedition of the University of Michigan." This talk was illustrated by two reels of motion pictures of the expedition.

Preceding the regular meetings of the academy, the entomologists of Indiana held their annual informal round table and discussed the scientific and economic problems of current interest in the state.

The newly elected officers for the year 1927 are as follows:

President, Frank B. Wade, Shortridge High School, Indianapolis; *Vice-president,* Fred J. Breeze, Ball Teachers College, Muncie; *Secretary,* Dr. Ray C. Friesner, Butler College, Indianapolis; *Assistant Secretary,* Dr. W. P. Morgan, Indiana Central University, Indianapolis; *Treasurer,* Dr. Marcus W. Lyon, Jr., South Bend; *Editor,* J. J. Davis, Purdue University, Lafayette; *Assistant Press Secretary,* Dr. J. A. Nieuwland, Notre Dame University, South Bend.

Notre Dame University was chosen as the place for the next annual meeting.

HARRY F. DIETZ,
Press Secretary