Abstracts of Technical Articles From Bell System Sources

Scattering of Quanta with Diminution of Frequency.[1] KARL K. DARROW. In this article the author points out that certain phenomena of X-rays recently reported were illustrations of the general process of scattering of light with change in frequency, which had just begun to attract attention owing to important observations made by Raman and others with visible and ultra-violet light. The content was amplified and restated in Dr. Darrow's article entitled "Contemporary Advances in Physics, XVII—The Scattering of Light with Change of Frequency," which appeared in the January, 1929, issue of the *Bell System Technical Journal.*

Dissociation of Molecules as Disclosed by Band-Spectra.[2] KARL K. DARROW. This lecture was a contribution to a Symposium on Atomic Structure of the American Chemical Society. It is an elementary account of the way in which the band-spectra of molecular gases are interpreted so as to disclose the laws and details of the dissociation of their molecules into atoms, a process of great scientific and some practical importance.

Using Inspection Data to Control Quality.[3] H. F. DODGE. This paper outlines a method of using inspection data to improve the technique of controlling at economic levels the quality of product in the various stages of manufacture. Essentially, the method rests on the application of statistical methods of analysis, employing the viewpoint that every batch of manufactured product constitutes a sample from a much larger universe and as such is subject to random of chance variations in quality. The variations in quality as observed in inspection data may thus be the result of either chance causes or of fundamental production causes whose presence is undesirable.

Speech and Hearing.[4] HARVEY FLETCHER. This book is concerned mainly with the results of Bell System research work on speech and hearing. These results, however, can be understood and appreciated better when their relationship to similar work is shown. Conse-

[1] *Science*, Vol. 68, November 16, 1928, pp. 488–490.
[2] *Chemical Reviews*, Vol. V, December, 1928, pp. 451–466.
[3] *Manufacturing Industries*, Volume XVI, November, 1928, pp. 517–519, and December, 1928, pp. 613–615.
[4] D. Van Nostrand Co., Inc., New York, 1929.

quently, copious references to the experimental results of other workers have been included. The material is grouped under four headings: (1) Speech, (2) Music and Noise, (3) Hearing, and (4) Perception of Speech and Hearing.

The first part is concerned with the mechanism of speaking, the classification of the fundamental English speech sounds, and with the wave forms of such sounds. It includes a description of various types of apparatus which can be used for making permanent records of speech waves and gives a large number of accurate wave pictures of the speech sounds together with the power contained in such waves.

In the second part similar data are given for musical sounds and noise.

The third part begins with a discussion of a theory of hearing which is proposed to explain the experimental facts of audition. This is followed by a discussion of the known facts of audition such as the limits of audition, the minimum perceptible differences in sound, masking effects, binaural effects, methods of testing the acuity of hearing, etc. Along with this discussion is given a description of the apparatus and experimental methods used for determining these facts.

The fourth part is concerned with those phases of the subject that involve personal judgment, that is, the psychological element. A scale for measuring the loudness and the pitch of complex sounds is defined. Experimental data are given which show how these two subjective quantities depend upon external physical quantities. Methods of measuring the recognition of speech sounds are described and experimental results using such methods are given to show the effect of various types of distortion upon the ability of persons to recognize such distorted sounds.

Elementary Differential Equations.[5] THORNTON C. FRY. In this book Dr. Fry has covered the field of differential equations as usually offered in elementary courses in universities and technical schools. The mathematical ideas are first presented as mathematical entities in themselves and not as the symbolic formulation of physical concepts. With this accomplished, these ideas are broadened and illustrated by live scientific examples and problems, which are drawn from a wide variety of fields. The inclusion of such technical material does not presuppose a wider knowledge of technical subjects than the reader can reasonably be expected to possess, nor does it interfere with the clarity of the mathematical presentation.

[5] D. Van Nostrand Company, Inc., New York, 1929.

Optical Conditions for Direct Scanning in Television.[6] FRANK GRAY and HERBERT E. IVES. This paper discusses the conditions for securing the maximum amount of light in a photoelectric cell placed behind a television scanning disc when an image is formed on the disc by a lens. Results obtained with a large scanning disc and a lens forming images of sunlit objects are described.

A Camera for Making Parallax Panoramagrams.[7] HERBERT E. IVES. This paper describes a camera for making transparencies which when viewed through an opaque line grating show stereoscopic relief through a wide range of distances and angles. The essential feature of the camera is a mechanical coupling by means of which the camera lens, the sensitive plate and grating, and the object photographed, are kept in line as the camera moves from one side to the other of the normal from the camera track to the object.

European Factory Methods and Equipment in the Manufacture of Metals.[8] DAVID LEVINGER. In this paper the author outlines his observations of the metal-working industries of Europe, based on a three months' tour of eight countries during the summer of 1927, in which seventy-five industrial establishments were visited in England, France, Germany, Belgium, Holland, Italy, Austria and Switzerland.

Electrical Conduction in Textiles. Part I—The Dependence of the Resistivity of Cotton, Silk and Wool on Relative Humidity and Moisture Content.[9] E. J. MURPHY and A. C. WALKER. The data reported show that the resistivity of cotton is about 10^{12} times greater at 1 per cent humidity than at 99 per cent, that it is an exponential function of relative humidity in the range 20–80 per cent and a power function of moisture content over the whole range investigated. By means of the equations expressing these relationships the resistance of a cotton sample can be calculated for any moisture content (or the relative humidities corresponding to it) provided a measurement has been made at a single moisture content. The curves for the logarithm of resistance vs. relative humidity (or moisture content) for samples of cotton containing different amounts of electrolytic material are parallel, low electrolyte content corresponding to high resistance. Similar but less extensive measurements were made on silk and wool.

[6] *Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. 17, December, 1928, pp. 428–434.
[7] *Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. 17, December, 1928, pp. 435–439.
[8] *Mining and Metallurgy*, Vol. 9, November, 1928, pp. 483–486.
[9] *Journal of Physical Chemistry*, Vol. 32, December, 1928, pp. 1761–1786.

The results indicate that the conductivity of a textile is practically completely determined by three factors, the amount of absorbed water, its specific conductance (as determined by the amount of electrolytic material present in the textile) and its distribution.

The Effect of Gases on the Resistance of Granular Carbon Contacts.[10] P. S. OLMSTEAD. This paper describes a method whereby reproducible measurements of the resistance of granular carbon contacts can be made. The experimental arrangements were such that the resistance could be measured as a function of gas pressure, applied voltage, or time.

Note on the Determination of the Ionization in the Upper Atmosphere.[11] J. C. SCHELLENG. This paper describes a method of estimating the distribution of ionization in the upper atmosphere, based upon measurements of the effective height determined by interference or echo experiments. These two types of experiment are shown to give identical results.

Lead-Tin-Cadmium as a Substitute for Lead-Tin Wiping Solder.[12] EARLE E. SCHUMACHER and EDWARD J. BASCH. In this paper data are presented which show that certain lead-tin-cadmium alloys may be advantageously substituted as solders for lead-tin alloys. Data are given showing the physical and chemical properties of these alloys.

New Specifications for Raw Materials.[13] J. R. TOWNSEND. In this article the author points out that the annual demand for new telephone apparatus by the Bell System requires a steady flow of materials of the proper quality and uniformity into its manufacturing plants. To meet this demand, a new set of engineering specifications has been inaugurated to control these raw materials. A notable example of this specification work is the preparation of Rockwell hardness and tensile strength requirements for sheet brass, nickel silver and phosphor bronze. The Western Electric Company, the Northern Electric Company and one of the suppliers, the American Brass Company, cooperated in this work. Rolling series were prepared covering all grades, thicknesses and tempers. The requirements were based on the data furnished by producer and consumer, and on experience over a long period with commercial material.

[10] *Journal of Physical Chemistry*, Vol. 33, January, 1929, pp. 69–80.
[11] *Proceedings of the I. R. E.*, Vol. 16, November, 1928, pp. 1471–1476.
[12] *Industrial and Engineering Chemistry*, Vol. 21, January, 1929, pp. 16–19.
[13] *Instruments*, Vol. 1, December, 1928, pp. 519–521.