Abstracts of Technical Articles from Bell System Sources

The Renaissance of Physics.[1] KARL K. DARROW. Intended for the general public, this book is chiefly a story of some of the great discoveries and some of the grand general principles achieved or confirmed in physics since the century began. The title is an allusion to this period, for, to quote from the beginning of the book: "ever since the turn of the century physics has been enjoying a veritable renaissance, fairly to be likened with that splendid flowering of the arts and humane letters four hundred years ago to which the name of Renaissance was first applied. In this contemporary age when the artists in so many fields are overshadowed by the work of masters long since dead, the physicist has had the glorious good fortune of sharing in a spirit, an ambition, a sense of novelty and limitless opportunity, such as (we are told) inspired the Elizabethans."

The chapter headings run: *Physics and the Physicist—Intimations of Electricity—Release of Electrons from Matter—Through Measuring to Knowing—Magnets and Moving Charges—The Atom Visible—Light in the Semblance of Waves—Mystery of Waves and Corpuscles—Structure of the Atom—Technique of Transmutation—Victory over the Elements—Unity of Nature.*

There are forty-five illustrations, many of them half-tones of apparatus, spectra of various kinds, and processes of transmutation. No previous knowledge of physics is required of the reader, and the use of mathematics is confined to a few formulae of the simplest algebraical type. Much of the content of the book figured in the course of Lowell Lectures delivered by the author in Boston during the autumn of 1935.

Gutta-Percha—Effect of Vulcanization of its X-Ray Diagram.[2] C. S. FULLER. The finding of previous investigators that gutta-percha and balata have identical x-ray patterns is verified. Experiments on the x-ray behavior of vulcanized and unvulcanized gutta-percha show that vulcanization (to the extent carried out here) has no effect in changing the lattice plane spacings of either the alpha or beta crystal modifications. Vulcanization does appear to increase the degree of orientation of the crystallites present in these substances as produced by stretching

[1] Published by Macmillan Company, New York, N. Y., September, 1936.
[2] *Indus. and Engg. Chem.*, August, 1936.

and to that extent allows a more accurate calculation of the identity periods of the crystalline forms to be made.

A partial transformation of the beta to the alpha form of gutta-percha results by stretching at 80° C., although the exact conditions under which this occurs have not been determined.

The identity period in the fiber direction of the beta modification is 4.77 ± 0.03 Å., or double this value, and the alpha modification presents an anomaly in that two identity periods are in best agreement with the data. These are 9.00 ± 0.05 and 8.70 ± 0.13 Å. In the case of the beta modification three possible orthorhombic unit cells which are in agreement with the observed lattice plane spacings are given.

Fields Caused by Remote Thunderstorms.[3] K. E. GOULD. The object of the studies described in this paper was to verify the supposition that certain types of short-duration longitudinal voltages appearing in communication circuits are caused by remote thunderstorms. By means of simultaneous directional measurements made in the frequency range below 40 kilocycles at two points as much as 900 miles apart, thunderstorms at distances of several hundred miles from one or both of these points have been located with a degree of accuracy great enough to permit conclusive correlation of the storm locations indicated by the directional measurements with the locations of recorded thunderstorms. Methods, equipment, and results are discussed.

Improved Types of Transmission Measuring Systems and Methods of Measurement.[4] W. H. HARDEN. The quantitative measurement of the electrical efficiency of telephone circuits as one of the important checks of the ability of these circuits to satisfactorily transmit speech has become an increasingly important maintenance function during the past twenty years. The function of transmission measuring equipment is not only to provide a convenient tool for quickly checking the electrical efficiency of telephone circuits, but also to serve as an aid in locating the cause of trouble when it is found to exist. It is the purpose of this paper to review briefly the progress which has been made in transmission testing technique and to describe some recent advances in the art which greatly facilitate this important part of telephone maintenance work. The discussion of these advances in the art will, we believe, be of interest to the railroads in connection with the operation and maintenance of their private telephone systems.

[3] *Elec. Engg.*, June, 1936.
[4] *Proc. Assoc. Amer. Railroads—Telegraph and Telephone Section*, June, 1935.

Some Improvements in Toll Circuit Design and Transmission.[5] GLEN IRELAND. Progress did not crash, along with the stock market, in 1929. Subsequent years have seen astonishing advances in many important businesses of the country as regards scientific developments, improved methods and better service. This is particularly true in the allied fields of transportation and communication where the service has been made more and more convenient, comfortable and accessible. Mr. Ireland's work lies in the field of communication and more specifically has to do with toll circuit design and transmission. In this paper he tells something of the progress in this field; first with respect to some new toll circuit instrumentalities that may be of direct interest in the work of the railroads, and secondly about some important and fundamental improvements, which are of general interest as indicating the trends in the art.

The general practices followed in connection with the design and installation of toll cables in the Bell System were described before the Telegraph and Telephone Section of the Association of American Railroads several years ago. There have been several specific changes in practices and some improved instrumentalities made available in this field which it is believed will be of interest to the railroads.

Calculated and Experimental Photoelectric Emission from Thin Films of Potassium.[6] HERBERT E. IVES and H. B. BRIGGS. Several years ago one of the writers proposed a theory of the photoelectric emission from thin films of alkali metals on supports of other metals, not photoelectrically active in the regions of the spectrum under observation. According to this theory the photoelectric emission is proportional to the rate of energy absorption by the thin film of alkali metal. The magnitude of the photoelectric current depends on the energy density immediately above the supporting metal, which is established from a knowledge of the optical constants of that metal, and upon the specific absorption of the alkali metal film. For its verification, the theory demands a knowledge of the optical constants of both supporting and alkali metals throughout the whole region of the spectrum where observations can be made. While optical constants have been determined for platinum, which is the metal most commonly used for a support for these thin films, no optical constants for the alkali metals have been available except in the visible region. In this region, a very satisfactory confirmation of the theory was obtained, particularly in respect to the variation of emission with the angle of incidence for the two principal planes of polarization (vectorial effect). One of the most characteristic phenomena of photoelectric

[5] *Proc. Assoc. Amer. Railroads—Telegraph and Telephone Section*, June, 1935.
[6] *Jour. Opt. Soc. Amer.*, June, 1936.

emission from thin films, namely, the occurrence of a pronounced maximum of emission in the spectrum, could not be compared with the predictions of this theory because these maxima in the case of the alkali metals lie in the ultra-violet. The theory of photoelectric emission from thin films has consequently had to stand unconfirmed in its entirety until such time as the optical constants of the alkali metals became available. In a separate paper the writers describe an experimental determination of the optical constants of potassium. In the present paper these constants are applied to the photoelectric theory, and the results are compared with experiment.

The Optical Constants of Potassium.[7] HERBERT E. IVES and H. B. BRIGGS. The importance of a knowledge of the optical constants of the alkali metals is emphasized by numerous recent theories of the metallic state and the optical properties of metals in general. In these theoretical treatments the alkali metals, because of their extraordinary properties, in particular their spectral region of transparency, have figured largely. There has, however, existed a serious gap in our experimental knowledge, in that optical constants have been entirely lacking for the region of extreme interest, namely, the ultra-violet. Without such knowledge theories must stand unchecked. Sufficient warrant for undertaking an experimental determination of the optical constants of the alkali metals, of which this study of potassium is the first, is therefore found on this ground alone. In addition, the writers have a special interest in these constants in connection with their work on the photoelectric effect. A theory of the photoelectric emission from thin films of alkali metals, proposed some years ago, which has been very successful in explaining the phenomena in the visible region of the spectrum, has urgently demanded optical data for its test in the ultra-violet region, where the most extreme and characteristic peculiarities of photoelectric emission are found.

Design and Equipment of a Fifty-Kilowatt Broadcast Station for WOR.[8] J. R. POPPELE, F. W. CUNNINGHAM, and A. W. KISHPAUGH. With its novel directional antenna, WOR produces a maximum field strength toward both New York and Philadelphia while limiting radiation in the direction of the ocean and sparsely populated areas. Radiation distribution measurements are given.

The layout of the station and the unique arrangements for lighting, heating, and ventilation of the building are described.

[7] *Jour. Opt. Soc. Amer.*, June, 1936.
[8] *Proc. I.R.E.*, August, 1936.

A serious attempt has been made to design and operate the equipment for a performance consistent with advanced ideas of high fidelity. Measurements from microphone to antenna of distortion, noise, and frequency response are presented.

Dial Switching of Connecticut Toll Calls.[9] W. F. ROBB, G. M. MCPHEE, and A. M. MILLARD. The special application of step-by-step dial switching equipment to the handling of short distance toll telephone traffic was introduced in Connecticut in 1929, and has been extended gradually until at present approximately 46,000 toll messages per day, comprising 70 per cent of the traffic between exchanges in this area, are dispatched over the 1,367 circuits of the dial switching network. The resulting service improvements and savings in operating efforts are discussed in this paper, and a brief description of the transmission and equipment characteristics of the system is given.

[9] *Elec. Engg.*, July, 1936.