Abstracts of Technical Articles from Bell System Sources

What Electrons Can Tell Us about Metals.[1] C. J. DAVISSON. Some general statements are made about electron waves and electron diffraction, three typical investigations in which electron diffraction has been employed are described, and the technique of a new type of electron crystal analysis is discussed.

Relation between Loudness and Masking.[2] HARVEY FLETCHER and W. A. MUNSON. A functional relationship between the loudness of a sound and the degree to which it masks single frequency tones, that is, the masking audiogram of the sound, is developed. A loudness-masking function is determined experimentally. From this loudness-masking relationship the loudness of a sound can be computed by simply integrating the area under the masking audiogram plotted on a special chart. Comparisons of computed and observed loudness levels are shown for a number of sounds and serve to illustrate the precision to be expected from the method. Finally, the results of a large number of masking tests are given in the form of masking contours, which enable one to predict the masking audiogram of a sound from measurements of its intensity spectrum.

Coupling between Parallel Earth-Return Circuits under D.-C. Transient Conditions.[3] K. E. GOULD. In tests conducted in connection with several d.-c. railway electrifications, the induced voltages recorded in paralleling communication circuits at times of short circuit on the railway have shown marked divergences from values computed on the basis of uniform earth resistivity and a rate of change of earth current determined from measurements in trolley and rail circuits. Due to the numerous factors which might contribute to these divergences, such as non-uniform division of transient current along the tracks and associated return conductors, the presence of shielding conductors along or near the right-of-way, etc., it was felt that a better understanding of the problem of induction under d.-c. transient conditions could be obtained by experimental studies of the transient coupling between parallel earth-return circuits, free from the effects of shielding conductors, and with concentrated, rather than distributed, grounds. The study described in this paper was undertaken for this purpose.

[1] *Jour. of Applied Physics*, June 1937.
[2] *Jour. Acous. Soc. Amer.*, July 1937.
[3] *Electrical Engineering*, September 1937.

The locations for the tests were selected to provide a reasonably large range of earth resistivity; also, at one location it was known that the earth structure departed substantially from uniformity. At each of these locations d.-c. transient coupling tests were performed in which transient currents, approximately of the form encountered during faults on d.-c. railway electrifications, were produced in an earth-return circuit, herein referred to as the primary, and measurements were made of the resultant voltages in earth-return circuits, herein called secondary circuits, parallel to and at separations from the primary circuit of from 50 or 60 to 2,000 feet. In addition to the d.-c. transient tests, measurements were made at each location of the steady state a.-c. coupling, in magnitude and phase angle, over a range of frequencies from 20 or 30 cycles to 3,200 cycles. From these a.-c. measurements the transient voltages were computed for a number of cases by evaluating the Fourier integral. The results of the a.-c. coupling tests were useful also in helping to explain, in a general way, the departures of the measured transient voltages from the voltages computed for uniform earth resistivity.

The measured transient voltages and voltages computed (1) from the a.-c. coupling measurements and (2) on the basis of a uniform earth resistivity, are shown for several representative cases in figures accompanying the paper.

The Shunt-Excited Antenna.[4] J. F. MORRISON and P. H. SMITH. The paper describes an arrangement for exciting a vertical broadcast antenna with the base grounded. Construction economy results through the elimination of the base insulator, the tower lighting chokes, and the usual lightning protective devices. The coupling apparatus at the antenna end of the transmission line is reduced to an extent which may make unnecessary a separate building for its protection. Greater freedom from interruptions resulting from static discharges is expected. The performance of the design is substantially the same as that obtained from the antennas now in general use.

The paper describes experimental work done, results obtained, and inferences to be drawn from them. A mathematical appendix is attached.

Some Fundamental Experiments with Wave Guides.[5] G. C. SOUTHWORTH. This paper describes in considerable detail the early apparatus and methods used to verify some of the fundamental properties of wave guides. Cylinders of water about ten inches in diameter and

[4] *Proc. I. R. E.*, June 1937.
[5] *Proc. I. R. E.*, July 1937.

four feet long were used as the experimental guides. At one end of these guides were launched waves having frequencies of roughly 150 megacycles. The lengths of the standing waves so produced gave the velocity of propagation. Other experiments utilizing a probe made up of short pickup wires attached to a crystal detector and meter enabled the configuration of the lines of force in the wave front to be determined. This was done for each of four types of waves. For certain types the properties had already been predicted mathematically. For others the properties were determined experimentally in advance of analysis. In both cases analysis and experiment proved to be in good agreement.

The Dependence of Hearing Impairment on Sound Intensity.[6] JOHN C. STEINBERG and MARK B. GARDNER. This paper discusses the measurement of hearing loss for levels of sound that were well above the deafened threshold and hence were audible to the deafened person. In the tests, observers having unilateral deafness, i.e., one impaired and one normal ear, balanced a tone heard with the deafened ear against the tone heard with the normal ear. For some persons, the impaired ear heard less well than the normal ear for all sound levels. For others, tones which were well above the deafened threshold were heard about equally well with either ear. In other words, such deafened ears tended to hear loud sounds with normal loudness. It was found that this type of deafness could be represented quantitatively on the assumption that it was due to nerve atrophy. Loudness judgments for a normal ear in the presence of noise were found to be similar to judgments by a nerve deafened ear. Relations, based on the loudness properties of normal ears, have been extended to represent the loudness heard by deafened ears.

[6] *Jour. Acous. Soc. Amer.*, July 1937.