

Abstracts of Bell System Technical Papers Not Appearing in this Journal

*The Communication System of the Conowingo Development.*¹ W. B. BEALS and E. B. TUTTLE. This paper describes the communication system which has been installed to serve the power plant at Conowingo, Maryland, and its associated transmission line.

The important features to be considered in designing a telephone system for a power plant are pointed out. The types of telephone switchboard and telephone instruments chosen in this case to meet the special requirements of the generating station, together with the layout and cabling arrangement, are outlined.

The paper also discusses the possible ways of providing for the needs of the load dispatcher and the plan adopted at Conowingo; the facilities provided the patrolmen for calling from points along the transmission line; the connection from the private branch exchange to the general telephone system; and the special electrical protection installed on the long lines leaving the power house.

*Reflection and Refraction of Electrons by a Crystal of Nickel.*² C. J. DAVISSON and L. H. GERMER. This is a report of further observations on the regular reflection of electrons from the surface of a nickel crystal; an earlier report was published in the same journal.³ In the present report data are given of the selectivity of reflection for angles of incidence from 10 to 50 degrees, and for electrons of wave-lengths 0.6 to 1.5 Å. The previously found result is confirmed that to explain the occurrence of the intensity maxima of the reflected beam it is necessary to assume that electron waves are refracted on passing into the crystal. The data are used for calculating indices of refraction for nickel for electrons of various speeds or wave-lengths, and a dispersion curve is constructed. This curve displays a feature suggestive of the optical phenomenon of anomalous dispersion.

*Optical Experiments with Electrons.*⁴ L. H. GERMER. A semi-popular account of a series of experiments performed by C. J. Davisson and the author upon the scattering of electrons by single crystals of

¹ *Journal of the A. I. E. E.*, October 1928, pp. 737-741.

² *Proceedings of the National Academy of Sciences*, August 1928, pp. 619-627.

³ *Proceedings of the National Academy of Sciences*, April 1928, pp. 317-322.

⁴ *Journal of Chemical Education*, Part I, Sept. 1928, pp. 1041-1055. Part II, Oct. 1928, pp. 1255-1271.

nickel. These experiments establish the fact that under certain conditions moving electrons behave like trains of waves. In the interaction of these waves with a single crystal the optical phenomena of diffraction, reflection and refraction have been observed. Scientific accounts of these experiments are contained in the following papers: *Nature*, 119, 558 (1927); *Phys. Rev.*, 30, 705 (1927); *Proc. Nat. Acad. Sci.*, 14, 317 (1928); *Proc. Nat. Acad. Sci.*, 14, 619 (1928). Although the present paper is of a popular nature it aims to be quite comprehensive. It attempts to represent the status of this series of experiments in August 1928.

*Rubber Compression Testing Machine.*⁵ C. L. HIPPENSTEEL. This paper gives a brief account of a new compression test developed at the Bell Telephone Laboratories for more reliably judging the ability of rubber insulation on metallic conductors to withstand certain service conditions to which it is subjected. A recording compression testing machine, which has been built for applying the test, and typical results are illustrated. Other possible test uses for the machine are suggested.

*New Languages from Old—How Secrecy is Gained by the Inversion of Speech Sounds.*⁶ C. R. KEITH. The inversion of speech sounds may be accomplished with the aid of methods used in radio broadcasting and in carrier telephony. Among the possible applications, it is illustrative of methods used to achieve secrecy in electrical communications.

The character of speech sounds is determined by the frequencies and amplitudes of the component waves into which the sound may be resolved. The process of inversion consists effectively in altering the frequency distribution of these components so that low tones appear as high tones, while high tones appear as low tones. To the untrained observer, inverted speech is unintelligible, although the characteristic cadence is preserved. Inversion of the frequency scale is produced by modulating speech with a carrier wave which lies just above the highest speech frequency which is to be transmitted, and selecting the lower sideband. For practical reasons connected with undesired distortion, it is more desirable to break up the modulating process into two distinct steps. The original speech sounds may then be regained by repeating the process which led to its inversion.

⁵ *India Rubber World*, Sept. 1928, pp. 55-56.

⁶ *Scientific American*, October 1928, pp. 310-311.

*Joint Pole Use with Power Companies.*⁷ D. E. LOWELL. The relations between the telephone company and the other wire using companies, especially the power companies operating in the same area, are discussed in this paper. It recognizes the responsibility of the telephone company as well as that of the power company for good operating conditions in areas where both types of line are involved and also points out the necessity of close cooperation between Connecting and Bell Telephone Companies. The considerations involved in the joint use of poles by telephone and power companies are given with particular mention of the general joint use agreement. The importance of mutual advance notice of plans is developed. The reports of the Joint General Committee of the N. E. L. A. and Bell System form the background of the talk and are recommended to those who have not already read them.

*Adsorption of Gases by Graphitic Carbon. II—X-ray Investigation of the Adsorbents.*⁸ H. H. LOWRY and R. M. BOZORTH. This paper is supplementary to one by Lowry and Morgan appearing in the *Journal of Physical Chemistry* in 1925⁹ and gives direct evidence that the adsorbents studied were graphitic carbon. The X-ray data show that carbon prepared by the explosion of graphitic acid is graphitic in structure and that the individual particles are flakes averaging approximately 50 atom diameters in breadth and 10 atom layers in thickness. The significance of this finding is discussed in relation to current views of the nature of active carbon adsorbents.

*Recent Toll Cable Construction and its Problems.*¹⁰ H. S. PERCIVAL. One of the outstanding developments in the Bell System has been the rapid extension of toll cables. This has required the development of new methods and apparatus. Material is carried into rough right of way and installed through the use of tractors, with equipped trucks and various types of automotive equipment. The development of permalloy now allows the complete loading of a full-sized cable in two pots where six were required before. Crossings over rivers are made in submarine cable or by long span construction with catenary suspension. Cables are tested before completion for sheath damage, defective splices, etc., which might cause service failures, by means of dry gas under pressure.

⁷ *Telephony*, September 8, 1928, pp. 22-24.

⁸ *Journal of Physical Chemistry*, October 1928, pp. 1524-1527.

⁹ *Journal of Physical Chemistry*, Vol. 29 (1925), p. 1105.

¹⁰ *Telephone Engineer*, September 1928, pp. 31-33.

*Quality Control by Sampling.*¹¹ W. L. ROBERTSON. A discussion of the application of the mathematical theory of sampling to commercial shop inspection. Also gives tables illustrating numerically the results obtained from the various sampling plans in use.

*Problems in Power Line Carrier Telephony and Recent Developments to Meet Them.*¹² J. D. SARROS and W. V. WOLFE. Power transmission lines as commonly encountered present relatively complex networks having irregular and unstable attenuation-frequency characteristics within the 50–150 K.C. band employed for power line carrier telephony. The high frequency noise may be very high.

A single side band carrier suppressed system operating on a single frequency duplex basis has been developed to overcome these transmission difficulties.

A comparison of this system with other types shows its superiority.

The initial installation of this equipment was made on the 220 K.V. lines of the Pacific Gas and Electric Company.

*The Planning of Telephone Exchange Plants.*¹³ W. B. STEPHENSON. This paper discusses procedures followed in planning future extensions to telephone exchange plants to care for increased demand for telephone service. An outline is given of the methods employed in forecasting future demand for telephone service and in determining the most efficient design of the plant to meet the service requirements. The uses made of engineering comparisons in solving the economic phases of various kinds of telephone engineering problems are discussed, with particular reference to location and size or extent of major items of plant as well as the time when they should be ready to give service. Emphasis is placed upon the importance of those factors less readily evaluated, such as service factors, practicability from a construction and operating standpoint, flexibility, etc.

*The Effect of the Acoustics of an Auditorium on the Interpretation of Speech.*¹⁴ E. C. WENTE. Studies of speech sounds in the Bell Telephone Laboratories have shown that 60 per cent of the acoustic energy in speech lies below 500 c.p.s., although the intelligibility of individual speech sounds is reduced by only 2 per cent if all the

¹¹ *Factory and Industrial Management*, pp. 503–505, Sept. 1928; pp. 724–726, Oct. 1928.

¹² *Journal of the A. I. E. E.*, October 1928, pp. 727–731 (abridgment).

¹³ *Journal of the A. I. E. E.*, July 1928, pp. 500–503 (abridgment).

¹⁴ *The American Architect*, August 20, 1928, pp. 259–261.

energy below this frequency is completely suppressed. These results indicate that the sound absorption coefficient of materials placed in an auditorium for reducing the reverberation time should be high for tones of low frequency and low for those of high frequency. Most porous materials commonly used for this purpose have absorption characteristics quite the reverse. Rooms that have been treated with a rather large amount of such materials are therefore often unsatisfactory for speaking purposes, although the adjustment for reverberation time may have been carried out according to accepted standards.