

Abstracts of Bell System Technical Papers Not Appearing in this Journal

*Radioactivity.*¹ A. F. KOVARIK and L. W. MCKEEHAN. This review of progress in radioactivity forms one of a series of monographs prepared by committees of the National Research Council. It outlines the experimental and theoretical advances in the subject since 1916, the date of the last compendium. The section headings are: I. Introduction, II. Radioactive Transformations, III. Alpha-Rays, IV. Beta-Rays, V. Gamma-Rays, VI. Nuclear Structure and Radioactive Processes, VII. Radioactivity in Geology and Cosmology, VIII. The Effects of Radioactive Radiations upon Matter. The references to periodical literature are particularly detailed.

*Echo Suppressors for Long Distance Telephone Circuits.*² A. B. CLARK and R. C. MATHES. This paper gives a brief description of a device which has been developed by the Bell System for suppressing "echo" effects which may be encountered under certain conditions in telephone circuits which are electrically very long. The device has been given the name "echo suppressor" and consists of relays in combination with vacuum tubes which are operated by the voice currents so as to block the echoes without disturbing the main transmission.

A number of echo suppressors have been operated on commercial telephone circuits for a considerable period, so that their practicability has been demonstrated.

*The Telephone Transmission Unit.*³ DR. F. B. JEWETT. The adoption by the Bell System of the TU as a telephone transmission unit aroused considerable active discussion in foreign circles, namely, by Colonel Purves, Engineering Chief of the British Post Office Department, and Dr. Breisig of the German Telephone Administration. In this short paper, Dr. Jewett explains certain words and expressions which, when accurately defined, he believes will eliminate misinterpretations such as seem to have led to the controversies over the Bell System TU.

Dr. Jewett also points out that the numerical size for a transmission unit is controlled by two factors, first, the magnitude should be such that computation is convenient, and second, the magnitude should be such as to permit telephone engineers and operating people to most

¹ Bulletin National Research Council, Vol. 10, part 2, March, 1925, 203 pages.

² Journal A. I. E. E., Vol. 44, page 618, 1925.

³ London Electrician, Vol. 94, page 562, 1925

readily comprehend the ratios corresponding to any given number of units. Since it is desirable that every unit be based on a decimal system of notation, unless there is some very important reason why it should not, the TU based on the decimal system was chosen. Satisfactory experience during the past year and a half is pointed to as showing the wisdom of having chosen the TU.

*A Suspension for Supporting Delicate Instruments.*⁴ A. L. JOHNSRUD, Bell Telephone Laboratories, Incorporated, New York. A description, with diagram, is given of a modified Julius suspension designed especially to eliminate disturbances due to vertical vibrations from the building structure. The frame holding the instrument is supported by a system of tape-wound coil springs, which, because of the tightly wound friction tape, damp out mechanical vibrations. The frame with its balancing weights, is heavy (about 120 pounds), and so proportioned in mass that a twisting or tilting impulse, necessary at times in adjusting the instrument, disturbs its moving system only in a secondary degree. This is a second feature of this suspension. Surprisingly effective kinetic insulation is achieved. Quadrant electrometers and a moving magnet galvanometer have remained undisturbed even when heavy trucks were passing on the street seven floors below. This type of suspension, developed some years ago through the efforts of Mr. H. C. Harrison and Mr. J. P. Maxfield, has been adapted for use throughout the Bell Telephone Laboratories in a variety of ways.

*Power Amplifiers in Transatlantic Radio Telephony.*⁵ A. A. OSWALD and J. C. SCHELLENG. The paper describes the development of a 150-kilowatt (output) radio frequency amplifier installation built for transatlantic telephone tests. The characteristics of the single-sideband eliminated-carrier method of transmission are discussed with particular reference to its bearing upon the design of the power apparatus. A classification of amplifiers is proposed in which there are three types distinguished from each other by the particular portion of the tube characteristic used. The water-cooled tubes employed in these tests are briefly described, special consideration being given to their use in a large installation. The system is then shown in outline by means of a block diagram, the elements of which are subsequently discussed in greater detail. The theory, electrical design, and mechanical construction of the last two stages of the amplifier are outlined, including the output and antenna circuits. Means employed to prevent spurious oscillations are described. The method

⁴ Journal Opt. Soc. of Am., Vol. X, No. 5, pp. 609-611, May, 1925.

⁵ Proc. of I. R. E., Vol. 13, page 313, June, 1925.

used in increasing the transmission band width to a value much greater than that of the antenna is explained. The power requirements of a single sideband installation are outlined and a description of the six-phase rectifier, used as a source of high potential direct current is given, together with a brief theoretical treatment of its operation. Circuit diagrams, photographs, and a number of characteristic curves are discussed.

*Production of Single Sideband for Transatlantic Radio Telephony.*⁶

R. A. HEISING. This paper describes in detail the equipment and circuit used in the production of the single sideband for transatlantic radio telephony in the experiments at Rocky Point. The set consists of two oscillators, two sets of modulators, two filters, and a three-stage amplifier. The oscillators and modulators operate at power levels similar to those in high-frequency communication on land wires. The three-stage amplifier amplifies the sideband produced by these modulators to about a 500-watt level for delivery to the water-cooled tube amplifiers.

The first oscillator operates at about 33,700 cycles. The modulator is balanced to eliminate the carrier; and the first filter selects the lower sideband. In these transatlantic experiments the second oscillator operated at 89,200 cycles, but might operate anywhere between 74,000 and 102,000 cycles. The second modulator, which is also balanced, is supplied with a carrier by the second oscillator and with modulating currents by the first modulator and first filter. The second filter is built to transmit between 41,000 and 71,000 cycles, so that by varying the second oscillator, the resulting sideband, which is the lower sideband produced in the second modulating process, may be placed anywhere between these two figures. Transmission curves for the filters are given as well as some amplitude-frequency performance curves of the set.

*A Null-Reading Astatic Magnetometer of Novel Design.*⁷ RICHARD M. BOZORTH. This instrument is designed for measuring the magnetic properties of very small amounts of material in the form of fine wires, thin tapes, or as thin deposits (electrolytic, evaporated, sputtered) supported on non-magnetic forms. The specimen, 4 cm. long, is mounted parallel to the line joining the two needles, so that its poles produce the maximum torque on the suspended needle system, the position of which is read by mirror and scale. The effect of the magnetizing coil on the needles is annulled once for all by the suitably placing of an auxiliary coil, and the magnetic effect of the

⁶ Proc. of I. R. E., Vol. 13, page 291, 1925.

⁷ J. O. S. A. and R. S. I. 10, 591-8 (May, 1925).

sample itself is balanced by passing a measured current through a third coil. The applied field and the induced magnetization are then proportional to the electric currents passed through the magnetizing coil and the balancing coil, respectively. A hysteresis loop is shown, obtained from an iron wire weighing 3 mg.

*An Explanation of Peculiar Reflections Observed on X-Ray Powder Photographs.*⁸ RICHARD M. BOZORTH. There has been previously reported (J. O. S. A. and R. S. I. 6,989-97; 1922) the existence of "anomalous" reflections of X-rays, observed when analyzing substances by the method of Debye-Scherrer and Hull. These reflections are now explained in accordance with the well-known laws governing X-ray reflections. It is shown that the molybdenum X-ray spectrum as ordinarily used, although it is filtered by zirconium screens, contains in addition to the characteristic $K\alpha$ radiation a considerable amount of general radiation. Although usually not effective, this general radiation becomes important when the sample being analyzed is composed of crystal grains of certain sizes. The effect under discussion is caused by reflection of this general radiation from the principal atom planes of these crystals. Several experiments, and a geometrical analysis of the positions and orientations of the diffraction effects, confirm this conclusion.

⁸ J. O. S. A. and R. S. I. 9, 123-7 (August, 1924).