

## Abstracts of Technical Articles by Bell System Authors

*The Transistor—A New Semiconductor Amplifier.*<sup>1</sup> J. A. BECKER and J. N. SHRIVE. This article describes the construction, characteristics, and behavior of the newly discovered device, the transistor. Used as a semiconductor amplifier, it works on an entirely different principle and is capable of performing the same tasks now done by the vacuum tube triode.

*A Review of Magnetic Materials.*<sup>2</sup> R. A. CHEGWIDDEN. Significant advances have been made within recent years in the development of new and better magnetic materials, and in the theories of magnetism. High permeability materials that may be classed as non-conductors, materials with greatly improved initial permeabilities, and permanent magnet alloys capable of storing four or five times as much energy as those obtainable ten years ago are now available. Descriptions of some of these developments are given. The paper gives compilations of data and curve sheets showing some of the typical characteristics of many of these materials.

*Ratio of Frequency Swing to Phase Swing in Phase- and Frequency-Modulation Systems Transmitting Speech.*<sup>3</sup> D. K. GANNETT and W. R. YOUNG. Computed and measured data are presented bearing on the relation between the phase and the frequency swing in phase- and frequency-modulation systems when transmitting speech. The results were found to vary with different voices, with the microphone and circuit characteristics, and with the kind of volume regulation used. With a particular carbon microphone, it was found that a phase deviation of 10 radians corresponds to a frequency deviation of between 11 and 15 kc in a phase-modulation system, and between 6 and 12 kc in a frequency-modulation system, depending on conditions.

*Design and Performance of Ethylene Diamine Tartrate Crystal Units.*<sup>4</sup> J. P. GRIFFIN and E. S. PENNELL. A research program on synthetic crystals has resulted in the development and adoption of EDT for carrier telephone filters. Some unusual physical properties of the crystalline material give rise to novelty in the processing methods and mechanical design of the units. These properties include anisotropic expansion coefficients, fragility, natural cleavages and water solubility. The electrical properties of EDT result in filters with wider pass bands and lower impedance levels than commercially obtainable with quartz.

<sup>1</sup> *Electrical Engineering*, v. 68, pp. 215-221, March 1949.

<sup>2</sup> *Metal Progress*, November 1948.

<sup>3</sup> *Proc. I. R. E.*, v. 37, pp. 258-263, March 1949.

<sup>4</sup> *A. I. E. E. Transactions*, v. 67, pt. 1, pp. 557-561, 1948.

*Recent Improvements in Loading Apparatus for Telephone Cables.*<sup>5</sup> S. G. HALE, A. L. QUINLAN, and J. E. RANGES. Through the use of improved materials, manufacturing techniques, and designs, a series of exchange-area loading coils has been provided which is equivalent electrically to the superseded types but requires one-third less copper and has considerably smaller overall dimensions. Similarly, 3-coil toll cable loading units have been provided with a saving of one-half in both copper and core material, with a small sacrifice in electrical behavior as compared with superseded types. The reduced size of the new coils and units, together with improved assembly arrangements, made possible a 65 per cent saving in the volume and weight of the cases housing them.

*The Coaxial Transistor.*<sup>6</sup> WINSTON E. KOCK and R. L. WALLACE, JR. The success of the earlier types of transistors led to the exploration of other forms of similar amplifiers, one of which is the coaxial transistor. A description of its construction, characteristics, and many advantages is contained in this article.

*Paralleled-Resonator Filters.*<sup>7</sup> J. R. PIERCE. This paper describes a class of microwave filters in which input and output waveguides are connected by a number of resonators, each coupled directly to both guides. Signal components of different frequencies can pass from the input to the output largely through different resonators. This type of filter is a realization of a lattice network. An experimental filter is described.

*A Broad-Band Microwave Relay System between New York and Boston.*<sup>8</sup> G. N. THAYER, A. A. ROETKEN, R. W. FRIIS, and A. L. DURKEE. This paper describes the principal features of a broad-band microwave relay system which has recently been installed between New York and Boston. The system operates at frequencies around 4,000 Mc and provides two two-way channels, each accommodating a signal-frequency band extending from 30 cps to 4.5 Mc. Noise and distortion characteristics are satisfactory for the transmission of several hundred simultaneous telephone conversations or a standard black-and-white television program.

*Growing Crystals of Ethylene Diamine Tartrate.*<sup>9</sup> A. C. WALKER and G. T. KOHMAN. The need for a synthetic piezoelectric crystal to relieve the critical quartz supply situation has resulted in the development by the Bell Telephone Laboratories of a new organic salt crystal, ethylene diamine tartrate, which is being used in place of quartz in telephone circuits.

This crystal is grown from a supersaturated aqueous solution of its salt by an entirely new method known as the constant temperature process. It

<sup>5</sup> *A. I. E. E. Transactions*, v. 67, pt. 1, pp. 385-392, 1948.

<sup>6</sup> *Electrical Engineering*, v. 68, pp. 222-223, March 1949.

<sup>7</sup> *Proc. I. R. E.*, v. 37, pp. 152-155, February 1949.

<sup>8</sup> *Proc. I. R. E.—Waves and Electrons Section*, v. 37, pp. 183-188, February 1949.

<sup>9</sup> *A. I. E. E. Transactions*, v. 67, pt. 1, pp. 565-570, 1948.

differs from previous methods used for growing large single crystals from solution, in that the solution saturated at one temperature is continuously fed into a crystallizer tank maintained at a slightly lower temperature, thus providing the supersaturation condition necessary for crystal growth. Further, the solution is circulated in such a manner that the partially impoverished mother liquor overflows from the growing tank back into the saturator where it is refortified and filtered. It is then heated and returned to the growing tank in such a way as to avoid the formation of undesirable crystal nuclei.

The paper contains a description of the new method which is now in commercial operation, together with a general discussion of some of the important principles involved in the successful growth of large single crystals of water soluble salts.

*Crystal Filters Using Ethylene Diamine Tartrate in Place of Quartz.*<sup>10</sup> E. S. WILLIS. Ethylene diamine tartrate (EDT) crystal filters were developed to replace the earlier quartz type channel filters in the broad-band carrier telephone systems, because of the threatened scarcity of quartz. These new filters give performance comparable to that of the earlier design. The growth of the EDT crystals from seeds and their fabrication into crystal units for use in filters are covered in companion papers on "Design and Performance of Ethylene Diamine Tartrate Crystal Units" and "Growing Crystals of Ethylene Diamine Tartrate" in this same volume of the *Transactions*

<sup>10</sup> A. I. E. E. *Transactions*, v. 67, pt. 1, pp. 552-556, 1948