

Abstracts of Technical Articles by Bell System Authors

*Computation of Interfacial Angles, Interzonal Angles, and Clinographic Projection by Matrix Methods.*¹ W. L. BOND. A way of setting up the general crystallographic axes a, b, c on unit orthogonal axes x, y, z is used to afford a matrix method of computing interfacial angles and zonal angles. It also affords a method of making clinographic projections.

*A Current Distribution for Broadside Arrays which Optimizes the Relationship between Beam Width and Side-Lobe Level.*² C. L. DOLPH. A one-parameter family of current distributions is derived for symmetric broadside arrays of equally spaced point sources energized in phase. For each value of the parameter, the corresponding current distribution gives rise to a pattern in which (1) all the side lobes are at the same level; and (2) the beam width to the first null is a minimum for all patterns arising from symmetric distributions of in-phase currents none of whose side lobes exceeds that level.

Design curves relating the value of the parameter to side-lobe level as well as the relative current values expressed as a function of side-lobe level are given for the cases of 8-, 12-, 16-, 20-, and 24-element linear arrays.

*Paper Capacitors Containing Chlorinated Impregnants—Mechanism of Stabilization.*³ L. EGERTON and D. A. MCLEAN. The stabilization of paper capacitors containing chlorinated aromatic impregnants with small quantities of organic additives is well established commercially. Although for practical reasons anthraquinone was chosen for initial commercial application, other quinones are also effective, as are the nitroaromatics, maleic anhydride, and sulfur. Evidence is given that the mechanism of stabilization consists of the formation of barrier films on the electrodes. These barrier films, which in certain cases may cover only the active points on the electrode surface, reduce the catalytic decomposition of the chlorinated impregnant by the electrode metal, prevent attack of the electrodes by liberated hydrogen chloride, and hinder electrolytic action. It appears likely that the film-forming properties of the stabilizers are dependent upon their oxidizing power. A secondary effect of stabilizers may be the formation of complexes with aluminum chloride to diminish the activity of the latter or change the nature of the reactions which it induces. Conductivity measurements in

¹ *American Mineralogist*, Vol. 31, pp. 31-42 (1946).

² *Proc. I.R.E. and Waves and Electrons*, June 1946.

³ *Indus. and Engg. Chemistry*, May 1946.

HCl-saturated chlorinated diphenyl containing soluble additives are in line with known hydrogen-bonding tendencies of the additives. Compounds which are strong organic bases do not stabilize capacitors.

*Quartz Crystals for Electrical Circuits.*⁴ R. A. HEISING. This book is a compendium of information, both theoretical and practical, on quartz crystal plates, their design and manufacture. It embodies the vast experience of the Bell Telephone Laboratories in research and in manufacture of quartz crystals. It originated from a series of lectures given by the members of the Laboratories technical staff who had carried out the early studies and developments in this field. By this means, engineers were trained for the immense expansion in crystal manufacture required to meet the demand of our military forces during the War. These lectures have been reorganized and rewritten, and are published together in this comprehensive book. Articles covering some of the various chapters have appeared in the Bell System Technical Journal.

The treatment covers in full the theory and practice of the preparation of quartz crystals, the instruments used, including new types developed for special purposes, the problems encountered in the various uses of quartz crystals, and the full details of the methods devised for their solution. The various processing chapters, dealing with cutting and grinding, plating and other topics of equal importance, include much information that appears for the first time in any book. The account of the manufacturing process is most complete. There are discussions of new practical methods of adjustment to frequency, of the new performance indicator, of a new type of crystal cut that operates at very low frequencies, and many new developments that represent notable advances in crystal technology.

*Geometrical Characterizations of Some Families of Dynamical Trajectories.*⁵ L. A. MACCOLL. The chief problem considered in this paper is that of obtaining a set of geometrical properties which shall completely characterize the five-parameter family of trajectories of an electrified particle moving in an arbitrary static magnetic field. A solution of the problem is found in the form of a set of four principal and four subsidiary properties. A geometrical characterization, in the form of a set of two properties, is also given of the four-parameter family of trajectories of an electrified particle moving in an arbitrary static magnetic field with an arbitrarily prescribed value of the total energy. Various other properties of the families of curves are discussed, and the paper closes with a brief consideration of some analogous problems in which the particle moves in a fixed plane.

⁴Published by D. Van Nostrand Company, Inc., New York, N. Y., 1946.

⁵*Amer. Math. Soc. Trans.*, July 1946.

*Comparison of Natural and Synthetic Hard Rubbers.*⁶ G. G. WINSPEAR, D. B. HERRMANN, F. S. MALM, and A. R. KEMP. GR-S, nitrile, and natural hard rubbers are compared as regards compounding, processing, vulcanization, and physical and dielectric properties. Natural rubber and GR-S compounds intermediate in sulfur content between hard and soft rubber also are compared. GR-S and nitrile rubber compositions suitable for commercial ebonite fabrication are described. Extensive breakdown of the basic copolymers has little effect on the physical properties of synthetic ebonites. The time required for the beginning of exothermic reaction in vulcanization is longer for GR-S than for natural rubber ebonites. Rockwell hardness is greater for GR-S. Some GR-S ebonites are penetrated to the same depth as natural ebonites, with a greater tendency toward instantaneous recovery. The two are similar in impact strength, but the ability to withstand a sharp bend is characteristic of natural ebonites alone. The latter are superior to GR-S ebonites in heat deformation below 60° C., but above this temperature the reverse is true and nitrile ebonites are superior to both. GR-S ebonites are more stable and nitrile ebonites less stable chemically than natural ebonites. GR-S ebonite dust as a filler increases brittleness. A diatomaceous earth improves the processing properties of GR-S hard rubbers. The adverse effect of ultraviolet light on surface resistivity is reduced when a GR-S hard rubber is filled with whiting. Natural and GR-S hard rubbers are alike in dielectric behavior.

*Signal and Noise Levels in Magnetic Tape Recording.*⁷ D. E. WOOLDRIDGE. The primary object of the work described here was to determine what properties of the tape and associated magnetic elements are responsible for the noise and signal output levels of magnetic recordings and, if possible, to display in specific equations the pertinent relationships connecting noise and signal levels with the physical properties of the tape and polepieces. In the course of the study, methods appeared for decreasing the noise and increasing the useful signal reproduced from magnetic tape. These methods and some of the use that Bell Telephone Laboratories and Western Electric have made of them are mentioned in the discussion. While some of the work described in this paper has implications for more than one type of magnetic recording process, perpendicular recording on tape is the actual subject matter dealt with. In every case discussed, the record medium was 0.050 inch wide and 0.0022 inch thick. Except where otherwise noted, a chrome-steel tape was used at a speed of 16 inches per second.

⁶ *Indus. and Engg. Chemistry*, July 1946.

⁷ *Elec. Engg., Trans. Sec.*, June 1946.