

## Abstracts of Technical Articles by Bell System Authors

*Television Network Facilities.*<sup>1</sup> L. G. ABRAHAM and H. I. ROMNES. Television networks, like sound broadcasting networks, must be available to make distribution of high quality programs economical. For television circuits interconnecting studios in different cities, coaxial cable and radio relay are the most suitable methods. For short distance transmission balanced wire pairs also may be used. Local conditions will control the type circuit selected.

*Protective Coatings on Bell System Cables.*<sup>2</sup> V. J. ALBANO and ROBERT POPE. The practice of placing some Bell System cables directly in the ground without the use of conduit was introduced in about 1929. Since bare cable thus installed would be subject to the corrosive action of soils, or damage from lightning or gophers, suitable protective coatings to guard against these hazards had to be developed. Seven types of such coverings are described, and their particular field of application is indicated.

*Surface States and Rectification at a Metal Semi-Conductor Contact.*<sup>3</sup> JOHN BARDEEN. Localized states (Tamm levels), having energies distributed in the "forbidden" range between the filled band and the conduction band, may exist at the surface of a semi-conductor. A condition of no net charge on the surface atoms may correspond to a partial filling of these states. If the density of surface levels is sufficiently high, there will be an appreciable double layer at the free surface of a semi-conductor formed from a net charge from electrons in surface states and a space charge of opposite sign, similar to that at a rectifying junction, extending into the semi-conductor. This double layer tends to make the work function independent of the height of the Fermi level in the interior (which in turn depends on impurity content). If contact is made with a metal, the difference in work function between metal and semi-conductor is compensated by surface states charge, rather than by a space charge as is ordinarily assumed, so that the space charge layer is independent of the metal. Rectification characteristics are then independent of the metal. These ideas are used to explain results of Meyerhof and others on the relation between contact potential differences and rectification.

<sup>1</sup> *Electrical Engineering*, May 1947.

<sup>2</sup> *Corrosion*, May 1947.

<sup>3</sup> *Phys. Rev.*, May 15, 1947.

*Plating on Aluminum.*<sup>4</sup> R. A. EHRHARDT\* and J. M. GUTHRIE. This article describes tests made to develop a satisfactory process for producing adherent electrodeposits on aluminum alloys using a zincate immersion pretreatment.

Since the major interest was the fabrication of aluminum structures by the use of lead-tin solders the adherence of the deposit was determined by measuring the strength of soldered joints.

Excellent results were obtained with commercially pure aluminum and copper bearing alloys and satisfactory results with magnesium and silicon bearing alloys.

*Corrective Networks.*<sup>5</sup> F. L. HOPPER. A type of fully compensated constant resistance network is described which provides a larger family of equalization characteristics particularly suited to corrective use in rerecording as determined by aural monitoring.

*Spectrochemical Analysis of Ceramics and Other Non-Metallic Materials.*<sup>6</sup> EDWIN K. JAYCOX. The procedure described is applicable to the quantitative spectrochemical analysis of ceramics, ashes, ores, paints, and other non-metallic materials for the determination of most of the common metals and their oxides. These include: aluminum, boron, barium, beryllium, calcium, copper, chromium, iron, lithium, magnesium, manganese, sodium, lead, silicon, titanium, zinc, and zirconium, in the general range of 0.30–70.0 per cent. Samples in the form of a fine powder are mixed one part of sample to 10–100 parts of a suitable metal oxide which serves as a buffer, diluent, and internal control. Carbon dust is added to this mixture for its additional buffering effect. Spectra are obtained of the samples and of an appropriate series of standards. Determinations of the amount of element sought are made, in most cases by the well known internal standard technique, in others by the simple comparison standard procedure.

*The Spectrochemical Analysis of Nickel Alloys.*<sup>7</sup> EDWIN K. JAYCOX. A procedure is described for the analysis of nickel alloys for copper, iron, lead, magnesium, manganese, silicon, titanium, and zinc in the range 0.005–0.30 per cent and for boron in the range 0.0003–0.03 per cent. Samples are taken into solution with dilute nitric acid, evaporated to dryness, and baked at 400°C. The resulting dry nitrate-oxide powder is mixed with pure carbon dust which acts as a buffer and diluent. Aliquots of each sample and of a

<sup>4</sup> *The Monthly Review, American Electroplaters Society*, April 1947.

\* Of Bell Tel. Labs.

<sup>5</sup> *Jour. Soc. Motion Pic. Engrs.*, March 1947.

<sup>6</sup> *Jour. Optical Soc. Amer.*, March 1947.

<sup>7</sup> *Jour. Optical Soc. Amer.*, March 1947.

series of standards are excited in the direct current arc, and their spectra recorded on the same plate. Determinations of the amounts of constituent elements present in the sample are made by measuring the logarithm of the ratio of the relative intensities of a line of the element sought to that of a nickel control line by the general internal control technique.

*Measurement of the Viscosity and Shear Elasticity of Liquids by Means of a Torsionally Vibrating Crystal.*<sup>8</sup> W. P. MASON. This paper describes a method of measuring viscosities of liquids at high frequencies by means of oscillating cylinders, in which a torsionally vibrating crystal generates a viscous wave in the medium to be measured. Both a reactance and a resistance loading occur in the crystal which lowers its frequency and raises the measured resistance at resonance. The viscosity may then be determined by measuring the changes in the properties of the crystal. By varying the voltage on the crystal, the shearing displacement can be varied and hence the viscosity can be measured as a function of shearing stress. Measurements on light oils over a viscosity range from 0.01 poise to 10 poises check within a few per cent when made with rough temperature-control conditions.

*Considerations in the Design of Centimeter-Wave Radar Receivers.*<sup>9</sup> STEWART E. MILLER. A review of the radar duplexer and receiver, as developed during the war, is presented. Attention is devoted to the principles of operation and typical circuit arrangements employed in the duplexer, the crystal converter, the local-oscillator injection circuits, the intermediate-frequency amplifier, and the automatic-tuning unit. Emphasis is placed on methods found advantageous in the 1-centimeter and 3-centimeter wavelength regions. The interrelation between the various receiver components in determining the over-all receiver noise figure is shown analytically, and typical performance numbers are given.

*Experimental Rural Radiotelephony.*<sup>10</sup> J. HAROLD MOORE, PAUL K. SEYLER and S. B. WRIGHT. The first rural party-line telephone service utilizing radio installations operating on the subscribers' premises was undertaken experimentally in the vicinity of Cheyenne Wells, near the eastern border of Colorado. Radio links have been used to supply regular telephone service to eight ranches since August 20, 1946. The development of a standard rural radiotelephone system will be aided materially by the experience gained from these experiments.

<sup>8</sup> *Transactions A.S.M.E.*, May 1947.

<sup>9</sup> *Proc. I.R.E.*, April 1947.

<sup>10</sup> *Electrical Engineering*, April 1947.