ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 1

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 556–563.) Continuation of 2995 of 1949.

534.213.4 2

On the Propagation of Sound Waves in Narrow Conduits.—O. K. Mawardi. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 482–486.) An approximate solution of sufficient accuracy for narrow tubes of arbitrary shapes is derived and applied to the case of a wire-filled tube. Losses due to viscosity, radiation and thermal conduction are taken into account. Theoretical predictions are in satisfactory agreement with experimental results.

534.232 3

Theory of Focusing Radiators.—H. T. O'Neil. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 516–526.) The sound field due to a concave spherical radiator vibrating with uniform normal velocity is determined approximately. The radius of the circular boundary of the radiator is assumed to be large compared with λ and with the depth h of the concave surface. The point of greatest intensity is not at the centre of curvature but approaches it with increasing values of h/λ. The greatest intensity is not much greater than the intensity at the centre of curvature except when h/λ is small. The calculations are in reasonable agreement with Willard's experimental data (3003 of 1949). See also 8 below.

534.232 4

The Theory of Sound Vibrations in Open Tubes.—L. A. Weinstein. (*Zh. tekh. Fiz.*, Aug. 1949, Vol. 19, No. 8, pp. 911–930. In Russian.) The radiation of a symmetrical sound wave from the open end of a tube is discussed and a rigorous solution of the problem is given. The results obtained are also applied to the case of asymmetrical waves.

534.25 5

Refracting Sound Waves.—W. E. Kock & F. K. Harvey. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 471–481.) Refracting structures consisting of arrays of obstacles which are small compared with λ are described. These obstacles increase the effective density of the medium and thus reduce the velocity of sound passing through the array. When the dimensions of individual obstacles approach $\lambda/2$, the effective refractive index varies with λ and prisms then cause a dispersion of the waves. Path-length delay-type lenses for focusing sound waves are also described. A diverging lens is discussed which can be used in conjunction with an exponential horn loudspeaker to produce an approximately circular wave front at the higher audio frequencies. For e.m. lenses similar in principle see 2176 of 1948 (Kock). See also *Bell Lab. Rec.*, Oct. 1949, Vol. 27, No. 10, pp. 349–354.

534.321.9 6

Ultrasonics in Fluids.—E. G. Richardson. (*Nature, Lond.*, 5th Nov. 1949, Vol. 164, No. 4175, pp. 772–773.) Report of a British Association symposium. Most of the papers deal with applications of the ultrasonic interferometer.

534.321.9 : 534.833.4 7

An Optical Method for the Determination of Ultrasonic Absorption in Opaque Soft Media.—T. Hüter & R. Pohlman. (*Z. angew. Phys.*, June 1949, Vol. 1, No. 9, pp. 405–411.) Two methods are described which are particularly suitable for materials with low acoustic impedance and high absorption. The methods depend on the diffraction of light by ultrasonic waves and on the brightness distribution in the various orders of the diffraction spectrum. Results are given for various animal tissues and also for a few artificial insulating materials.

534.321.9 : 549.514.51 8

Ultrasonic Radiation from Curved Quartz Crystals.—L. Fein. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 511–516.) The electroacoustic efficiencies at 1 250 kc/s of four 1-in square x-cut quartz crystals are deduced from transmitting frequency responses in water, admittance measurements in air and water, and radiation patterns in water. One crystal is plane; the others have radii of curvature of 25, 7 and 4 cm respectively; their thicknesses are practically equal. Efficiency values deduced from acoustic measurements do not agree as well with calculated potential efficiencies as do those derived from admittance measurements;

the latter indicate that the radiation resistance is the same for the 4 crystals. The point of maximum acoustic intensity is not necessarily at the centre of curvature of the crystal. The admittance measurements in air indicate that the effective mass of a crystal decreases with increasing curvature. See also 3 above.

534.41 : 534.78 : 621.385.832 **9**
The Cathode-Ray Sound Spectroscope.—R. C. Mathes, A. C. Norwine & K. H. Davis. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 527–537.) A device for the rapid analysis of short samples of speech and other sounds. The energy/frequency distribution of the sound at a particular instant is displayed as a 2-dimensional pattern, and the distribution over an interval as a 3-dimensional pattern. The sample is recorded slowly on a magnetic disk, played back 200 times as fast, and analysed by a broad-band high-frequency system.

534.612.4 **10**
On the Reciprocity Free-Field Calibration of Microphones.—W. Wathen-Dunn. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 542–546.)

534.75 **11**
Some Determinants of Interaural Phase Effects.—I. J. Hirsh & F. A. Webster. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 496–501.) The binaural threshold for a pure tone presented against a background of noise depends on the interaural phase differences of the tone and the noise. Results of experiments in which a 250-c/s tone was presented against four different kinds of noise background indicate that the threshold for the tone in the presence of a periodic masking sound is not significantly dependent on interaural phase relations, but the masking and interaural phase effects increase as the frequency band of a random masking sound approaches the frequency of the tone.

534.78 **12**
Extraction and Portrayal of Pitch of Speech Sounds.—O. O. Gruenz, Jr, & L. O. Schott. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 487–495.) An improved method using a combination of gain control, double detection, voiced sound selection, unvoiced sound exclusion, and a means of counting the fundamental vibrations in the voiced sound intervals. Reliable indications of pitch have been obtained for frequencies in the range 100–600 c/s for a wide variety of voices. The pitch-indicating signals have been applied to a number of visual portrayal devices such as that noted in 3520 of 1946 (Riesz & Schott).

534.861 : 534.76 **13**
Stereophony.—K. de Boer. (*Tijdschr. ned. Radiogenoot.*, Sept. 1949, Vol. 14, No. 5, pp. 137–146.) General discussion of the basic principles of recording and of reproduction for an audience.

621.392.51 **14**
Theoretical Aspects of the Reciprocity Calibration of Electromechanical Transducers.—S. P. Thompson. (*J. acoust. Soc. Amer.*, Sept. 1949, Vol. 21, No. 5, pp. 538–542.) A unified theory is presented in a form from which particular calibration theories can be derived. Two types of calibration procedure are discussed as special cases.

621.395.61 **15**
Directional Microphone.—H. F. Olson & J. Preston. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 339–347.) The development of a second-order gradient system, with ribbon-type units, is described. The system has a uniform and narrow directivity pattern, and a smooth frequency-response characteristic between 50 and 15 000 c/s. In conventional studios, speech can be picked up at a distance of 12 ft. By using a monitoring console in conjunction with several of these microphones in fixed positions, so that each covers a section of the studio area, large and rapidly changing areas of action can be covered with less variation in output level than is possible with the conventional microphone and boom arrangement.

621.395.623.7 **16**
Third-Class Loudspeakers with Low Power Consumption.—P. V. Anan'ev. (*Radiotekhnika, Moscow*, July/Aug. 1949, Vol. 4, No. 4, pp. 18–27. In Russian.) Cheap loudspeakers, which would be effective in operation and whose construction would not require materials in short supply, are needed for remote collective farms. Loudspeakers using Rochelle salt crystals appear to meet the requirements. Such loudspeakers, provided with a volume control and a special correcting circuit, are described in detail; many performance curves are included.

621.395.623.7 **17**
New 15-Inch Duo-Cone Loudspeaker.—H. F. Olson, J. Preston & D. H. Cunningham. (*Audio Engng, N.Y.*, Oct. 1949, Vol. 33, No. 10, pp. 20–22..48.) Modifications of the R.C.A. loudspeaker Type LC1A which make mass production possible are discussed. See also 993 or 2664 of 1947 (Olson & Preston).

621.395.623.8 **18**
Ground Loudspeakers.—D. Scott. (*Audio Engng, N.Y.*, Oct. 1949, Vol. 33, No. 10, pp. 18–19.) See 19 below.

621.395.623.8 **19**
Underground Loudspeakers.—J. Merhaut. (*Tesla tech. Rep., Prague*, March 1949, pp. 35–38.) Description of the loudspeakers set level with the ground in the Strahof stadium at Prague for use in connection with mass gymnastic and other displays in an arena 1 000 ft by 650 ft. The diaphragm is made of synthetic humidity-resisting material. The horn is of the folded exponential type. The complete unit is sealed and thus protected against humidity. Performance is unaffected even by rainwater. Arrangements are provided for easy maintenance or replacement of the loudspeaker unit without removal of the main cover, which is strong enough for a lorry to be driven over it.

621.395.625.2 **20**
Determination of the [stylus] Velocity Amplitude in 'Constant-Velocity' Recording, by Measurement of the Width of a Luminous Band.—J. H. (*Radio tech. Dig., Édn franç.*, Oct. 1949, Vol. 3, No. 5, pp. 303–305.) Short description of the method of Buchmann & Meyer, in which the disk groove is illuminated by a parallel beam of light and the pattern formed by the reflected beam on a screen a few metres away is examined.

621.395.625.3 **21**
New Type of Magnetic Recorder.—L. A. Fishoff. (*Radio tech. Dig., Édn franç.*, Oct. 1949, Vol. 3, No. 5, pp. 291–294.) Short description of the principal features of a tape recorder in which tape friction is avoided by using magnetic coupling. Some details of the mechanism, the amplifier and the motors are included.

621.395.625.3 **22**
Magnetic Recording.—M. Alixant. (*Radio tech. Dig., Édn franç.*, Oct. 1949, Vol. 3, No. 5, pp. 259–291. Bibliography, pp. 294–301.) Basic principles and modern tapes and recording heads are discussed. Details are given of many commercial instruments for recording on wire or tape. Most of these are of American manufacture, but some French, Swiss, German and English recorders are included.

621.395.625.3 : 621.395.813 **23**

Techniques for Improved Magnetic Recording.—L. C. Holmes. (*Elect. Engng, N.Y.*, Oct. 1949, Vol. 68, No. 10, pp. 836–841.) Essential substance of a 1948 National Electronics Conference paper. Summary noted in 2423 of 1949.

621.395.92 **24**

A Modern Hearing-Aid.—(*Radio Tech., Vienna*, Oct. 1949, Vol. 25, No. 10, pp. 613–615, 622.) Description, with detailed circuit diagram, of the 'Vienna' lightweight equipment using subminiature components. The frequency-response curve can be adjusted and a.g.c. is provided. The crystal microphone, amplifier and batteries are enclosed in a flat moulded case 12 × 6.5 × 2.5 cm which can easily be carried inside a coat or in a pocket. Four models are available, suitable for different degrees of deafness. One model is of a simpler type without tone adjustment.

621.395.625 **25**

Elements of Sound Recording. [Book Review]—J. G. Frayne & H. Wolfe. Publishers: J. Wiley & Sons, New York, 1949, 686 pp., $8.50. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 233–234.) The first 12 chapters review fundamental material on microphones, amplifiers, attenuators, equalizers etc. The main interest of the authors is in sound film recording. ". . . a very welcome addition to the literature of sound recording."

AERIALS AND TRANSMISSION LINES

621.315.2 **26**

Highly Balanced Radio-Frequency Transmission Lines.—K. H. Zimmermann. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 201–203.) The twinax line differs from a coaxial line in having two identical inner conductors which are insulated separately and then twisted. The same dielectric material is extruded over the inner conductors after twisting. The braided shield and thermoplastic jacket are then applied as for a coaxial line. Formulae and graphs are given for the characteristic impedance of twinax lines; the practical determination of various parameters is briefly discussed.

621.315.212 **27**

Coaxial Cable with Confocal Elliptical Cylindrical Conductors.—M. R. Shebes. (*Radiotekhnika, Moscow*, July/Aug. 1949, Vol. 4, No. 4, pp. 36–44. In Russian.) The effects of deformation of the cylindrical conductors of a coaxial cable on its parameters are discussed. The results obtained for the characteristic impedance and attenuation are compared with those obtained for cables with (*a*) non-concentric circular cylindrical conductors, (*b*) cylindrical conductors whose cross-sections are bounded by limaçons.

621.392.1 **28**

Terminal Impedance and Generalized Two-Wire-Line Theory.—R. King & K. Tomiyasu. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1134–1139.) Conventional transmission-line theory neglects variations in the parameters of the line, and coupling near a terminating impedor or near any other departure from uniformity. A theory is derived in which a simple terminal-zone network N of lumped series and shunt elements is introduced to allow for these effects. Such a network can be determined for each type of termination or discontinuity. The apparent terminal impedance Z_{sa}, which is the impedance actually measured on a lossless line at a distance $\lambda/2$ from the termination, is the impedance of the network formed by combining N with the theoretical isolated impedance Z_s of the load. For a fixed termination and given Z_s, Z_{sa} may vary greatly with the nature of the connection to the line, the relative orientation of line and load, and the type of line and its dimensions.

621.392.1 **29**

Energy Relationships for a High Frequency Transmission Line.—A. L. Fel'dshteyn. (*Radiotekhnika, Moscow*, July/Aug. 1949, Vol. 4, No. 4, pp. 45–50. In Russian.) Discussion taking account of losses and specified terminations. Conditions for optimum energy transfer are established and a conception of Q for the combination of oscillator, line and load is introduced.

621.392.26† **30**

Spatial Beating in Coupled Waveguides.—P. E. Krasnushkin & R. V. Khokhlov. (*Zh. tekh. Fiz.*, Aug. 1949, Vol. 19, No. 8, pp. 931–942. In Russian.) Spatial beating can be observed in two parallel coupled waveguides in each of which symmetrical waves are propagated. The phenomenon consists of a periodic transference of wave energy from one waveguide to the other. The phenomenon can be regarded as an analogy in space of the beating which takes place between two coupled oscillatory systems. The case of two semi-elliptical waveguides coupled through a slot is here investigated theoretically and experimental results are given.

621.392.26† : 517.54 **31**

Application of Conformal Representation to the Field Equations for Rectangular Waveguides of Non-Uniform Cross-Section.—R. Piloty, Jr. (*Z. angew. Phys.*, Aug. 1949, Vol. 1, No. 10, pp. 441–448.) By means of conformal transformation, the field at an irregularity in either the E-plane or the H-plane of a rectangular waveguide can be referred to the field in a plane-walled guide filled with a medium whose permeability or dielectric constant varies from point to point. For excitation by $H_{1,0}$ waves, a relatively simple partial differential equation for the field can be derived. It is also shown that by means of a simple frequency transformation the field at an E-irregularity in a rectangular waveguide can be referred to that at a corresponding irregularity in a band-pass transmission line. A method of solving the general equation, which among other things enables the impedance transformation of the waveguide quadripole to be determined, will be given in a later paper. See also 2427 and 2428 of 1949 (Rice).

621.392.26† : 621.392.5 **32**

Basis of the Application of Network Equations to Waveguide Problems.—Kerns. (*See* 56.)

621.392.3.012.1 **33**

A Simple Vector Diagram for High-Frequency Lines.—P. Cornelius. (*Commun. News*, June 1949, Vol. 10, No. 2, pp. 33–40.) The input impedance of a lossless h.f. transmission line can be determined, for a given terminating impedance, by means of a Smith chart; the attenuation is only given if the line is terminated by its characteristic impedance. The impedance of a line with losses, terminated arbitrarily, can be determined by the vector method here given, but the attenuation is only given for termination by the characteristic impedance. The vector method is also used to derive various well-known relations.

621.392.43 **34**

Two-Band Antenna-Matching Networks.—J. G. Marshall. (*QST*, Oct. & Nov. 1949, Vol. 33, Nos. 10 & 11, pp. 14–18 & 48–51 . . 114.) Continuation of 3869 of 1945. All practical cases of aerials working on two harmonically related amateur bands are discussed, with straightforward design formulae.

621.396.67 **35**

Short-Antenna Characteristics — Theoretical.—L. C. Smeby. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1185–1194.) A mathematical analysis of experimental data obtained by Smith & Johnson (651 of 1948) for aerials with umbrella top-loading. The theory developed agrees satisfactorily with the experimental results. For single-tower operation, the horizontally polarized radiation is negligible. With the optimum length of umbrella, the vertical radiation characteristic is the same as it would be from the radiator without top loading. The method of analysis can be extended to other kinds of top loading.

621.396.67 : 621.397.6 **36**

"Supergain" TV Antenna developed by RCA.—(*Broadcast News*, Sept. 1949, No. 56, pp. 4–6.) An aerial consisting of dipoles mounted in front of reflecting screens $\frac{1}{2}\lambda$ wide and $\frac{5}{8}\lambda$ high fixed on the four sides of a tower. The screens are connected electrically to the tower and to each other at their vertical edges. Various methods of connection to obtain directional patterns of different shapes are possible; rectangular dipole shielding wings connected to the edges of the screens at an angle of 135° can be used to prevent undesired mutual coupling of the dipoles. The aerial is usually fed by a single transmission line. Radiators are spaced 0.9λ apart vertically, so that current distribution is nearly uniform. The power gain relative to a dipole, averaged over 360° azimuth, is 1.1*n*, where *n* is the number of bays of dipoles.

621.396.67 : 621.397.6 **37**

A Tunable Built-In TV Antenna.—R. B. Albright. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 134..150.) This Philco aerial is a λ/2 dipole consisting of two tapered sections of Al foil 0.005 in. thick. Signals can be received efficiently from all the 12 existing U.S. v.h.f. television channels. A tunable matching circuit, which includes a variable capacitor and three fixed inductors, enables the user to tune in to each channel so as to obtain the best response and to eliminate interference. The equivalent circuit of the complete system and resonance conditions are discussed for the high and the low television frequency bands. See also *Tele-Tech*, Oct. 1949, Vol. 8, No. 10, pp. 37, 60.

621.396.67.029.54 **38**

Mode of Action and Design of Modern Broadcasting Transmitting Aerials for the Medium-Wave Range.—K. Fischer. (*Elektrotech. u. Maschinenb.*, Sept. 1949, Vol. 66, No. 9, pp. 237–242.) Discussion of ground-wave and space-wave effects, radiation diagrams of ordinary aerials, and special aerials designed to minimize fading.

621.396.671 **39**

Vertical-Aerial Radiation Characteristics over Uneven Terrain.—H. Köhler. (*Elektrotechnik, Berlin*, Nov. 1948, Vol. 2, No. 11, pp. 297–304.) A detailed theory is given of the directional characteristics of arrays of vertical aerials over uneven ground. A d.f. system described by Stenzel, while giving good results for eliminating the effects of variations of earth constants in the case of level ground, does not give such good results over uneven ground. Measurements of directional characteristics which support the theory are described and the physical connection between measured reflection factors and the electrical properties of the ground is considered.

621.396.677.029.54 **40**

Design Considerations for Directive Antennae-Arrays at Medium-Wave Broadcast Frequencies, taking into account the Final Radio-Frequency Amplifier Circuits.—J. C. Nonnekens. (*HF, Brussels*, 1949, No. 3, p. 80. In English.) Correction to 1605 of 1949.

CIRCUITS AND CIRCUIT ELEMENTS

061.4 : [621.317.7 + 621.38 + 621.396.69 **41**

Radiolympia Review.—(*See* 145.)

621.3 : 512.974 **42**

Vectorial Space. Region of Representation for Electrotechnics.—Nasse. (*See* 132.)

621.314.3† **43**

The Direct-Current Choke.—W. Blankenburg. (*Elektrotechnik, Berlin*, May 1949, Vol. 3, No. 5, pp. 135–140.) Starting from the ordinary premagnetized choke, magnetic amplifier arrangements are developed and their properties are investigated. A null-current model is described with an amplification factor of about 10^7; this is controlled by a thermoelement and gives a load power of about 1 W.

621.314.3† **44**

An Experimental Study of the Magnetic Amplifier and the Effects of Supply Frequency on Performance.—E. H. Frost Smith. (*J. Brit. Instn Radio Engrs*, Oct. 1949, Vol. 9, No. 10, pp. 358–373.) Magnetic amplifiers have hitherto been used mainly for amplifying small d.c. powers. The a.c. supply to the amplifier then operates normally at power frequencies. The time constant of the amplifier is limited by the supply frequency; the possibility of reducing response time by using a supply frequency of about 20 kc/s is considered. For a given frequency and power output, there is an optimum core size, which becomes more critical as the supply frequency is increased. Experimental results show that the magnetic amplifier has distinct possibilities as an a.f. amplifier.

621.314.3† **45**

Magnetic Amplifiers.—(*Proc. Instn elect. Engrs*, Part II, Oct. 1949, Vol. 96, No. 53, pp. 767–768.) Report of an I.E.E. Measurements Section discussion on 2728 of 1949 (Milnes) and 2729 of 1949 (Gale & Atkinson).

621.314.3† **46**

The Magnetic Amplifier.—P. M. Kintner & G. H. Fett. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Aug. 1949, Vol. 13, No. 2, pp. 14–18..28.) An analysis from first principles, with discussion of factors affecting design.

621.314.3† **47**

Magnetic Amplifiers.—M. Alixant. (*Radio tech. Dig., Édn franç.*, June 1949, Vol. 3, No. 3, pp. 153–159. Bibliography, pp. 159–163.) Short account of basic principles, practical construction and applications.

621.316.86 **48**

Electrolytic Thermistors.—F. Gutmann & L. M. Simmons. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, pp. 674–675.) A thermistor for use with a.c. is easily constructed by immersing Pt electrodes in a viscous solution of waterglass. A temperature change of only 7.2° at 300° K will double or halve the resistance. This thermistor is three times as sensitive as commercial thermistors, withstands alternating potentials of more than 240 V, and its resistance and sensitivity when cold are easily controlled. Other solutions were tested; they could withstand high alternating potentials, but were less sensitive.

621.316.86.001.8 **49**

Properties and Applications of Thermistors.—E. Ancel. (*Radio franç.*, Sept. 1949, No. 9, pp. 3–10.) Applications to thermometry, temperature compensation and control, power measurement, voltage regulation, a.g.c., and in relays, oscillators and modulators, are outlined.

621.318.2 : 621-23 50

Permanent Magnets in Drag Devices and Torque-Transmitting Couplings.—R. J. Parker. (*Gen. elect. Rev.*, Sept. 1949, Vol. 52, No. 9, pp. 16–20.) Permanent magnets are used in four principal types of torque-transmitting device, namely: (*a*) eddy-current current devices, (*b*) hysteresis devices, (*c*) iron/oil magnetic couplings, (*d*) salient-pole synchronous couplings. Specimens of each of these types are briefly described, and formulae for the torque are obtained.

621.318.42 : 621.314.263 : 621.314.3† 51

The Use of Ferrite-Cored Coils as Converters, Amplifiers and Oscillators.—V. D. Landon. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 387–396.) Theoretical treatment of the behaviour of nonlinear inductors used as frequency converters up to a few Mc/s shows that (*a*) if the excitation frequency is higher than the signal frequency and the i.f., the circuit regenerates; (*b*) if the excitation is sufficient, the circuit may oscillate at the signal frequency and i.f. simultaneously; (*c*) if either the r.f. or the i.f. circuit is tuned to a frequency above the oscillator frequency, the circuit is degenerative. Experimental results and transformer specifications are given, and possible applications are noted.

621.318.423.011.3 52

Inductance of Air-Cored Single-Layer Cylindrical Coils.—K. Schönbacher. (*Elektrotechnik, Berlin*, Oct. 1949, Vol. 3, No. 10, pp. 327–329.) A simple formula involving the ratio of the coil diameter d to its length l is derived from expressions given by Rayleigh and by Lorenz. For all practical cases the use of correction formulae can be avoided by replacing l by $l + 0.45d$.

621.318.572 : 621.396.645 : 537.311.33 : 621.315.59 53

A Transistor Trigger Circuit.—H. J. Reich & R. L. Ungvary. (*Rev. sci. Instrum.*, Aug. 1949, Vol. 20, No. 8, pp. 586–588.) A trigger circuit may be formed by inserting a suitable resistor in the lead connected to the base of a transistor. Such circuits are in many ways superior to valve circuits; a circuit with a triggering time of 0.1 μs giving an output of 5–6 V was found to be stable at frequencies up to 1 Mc/s; stability at frequencies up to at least 10 Mc/s is probable. The circuit may be converted into a relaxation oscillator or a pulse generator.

621.392 54

A Network Bisection Theorem.—V. D. Landon. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 448–450.) It is shown how any given symmetrical ladder network may be split into two simpler networks such that the transfer factor of the whole is equal to half the product of the transfer factors of the parts, as here defined.

621.392 : 621.3.015.3 55

The Effect of Pole and Zero Locations on the Transient Response of Linear Dynamic Systems.—J. H. Mulligan, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, p. 1181.) Corrections to 2165 of 1949.

621.392.5 : 621.392.26† 56

Basis of the Application of Network Equations to Waveguide Problems.—D. M. Kerns. (*Bur. Stand. J. Res.*, May 1949, Vol. 42, No. 5, pp. 515–540.) A mathematical and fundamental paper. The solution of network problems can be effected by means of a matrix equation in which the constants are parameters characteristic of the components, and the variables are currents and voltages. The physical processes inside the components are not explicitly considered. A matrix equation is developed to enable this technique to be extended to waveguide and transmission-line problems; here tangential electric and magnetic fields replace the currents and voltages as variables. Many of the results obtained are identical with those of the theory of quadripoles. In particular, a reciprocity theorem and Foster's reactance theorem are considered.

621.392.52 57

Error-Actuated Power Filters.—G. Newstead & D. L. H. Gibbings. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1115–1119.) Voltages derived from the harmonic voltages of an a.c. source of impure waveform are applied through a negative-feedback path to cancel unwanted harmonics. The method could be extended to apply to a given band of frequencies. Large powers can thus be controlled by means of components of much lower rating. Design equations are given and the operation of a typical filter circuit is examined.

621.392.52 58

Smoothing Circuits : Part 2 — Inductance-Capacitance.—"Cathode Ray". (*Wireless World*, Nov. 1949, Vol. 55, No. 11, pp. 418–422.) Continuation of 3371 of 1949. The calculation of hum voltages is discussed.

621.392.52 59

Mechanical Filters for Radio Frequencies.—W. van B. Roberts & L. L. Burns, Jr. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 348–365.) The theory of neck-type and slug-type filters is discussed. A simple type of band-pass filter composed of loosely-coupled metal resonators with magnetostrictive drive and take-off has very sharp frequency discrimination and is readily constructed for frequencies up to ½ Mc/s and band-width less than 3% of the mid-frequency. The voltage gain of an amplifier stage using such a filter is generally considerably lower than that of a stage using electrical circuit coupling.

621.392.52 : 621.3.015.3 60

Transient Response of Filters.—M. S. Corrington. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 397–429.) The ideal low-pass filter is defined as one whose amplitude response is constant at all frequencies between zero and cut-off, and falls off at a fixed rate beyond cut-off. The flat characteristic of such a filter is not necessarily desirable when the rise time and the amount of over-shoot are important. The transient response of an ideal filter has been computed, and the results applied to the determination of the transient response for systems with selectivity curves composed of straight-line segments. Relations between the transient response of a low-pass filter and that of the corresponding high-pass filter are considered.

621.392.52.012.8 61

Generalized Theory of the Band-Pass Low-Pass Analogy.—P. R. Aigrain, B. R. Teare, Jr, & E. M. Williams. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1152–1155.) Laplace transforms are used. Video-circuit equivalents are shown to exist for asymmetrical systems with low-level modulation as well as for symmetrical systems. Several illustrations are given.

621.392.6 62

Synthesis of Passive Networks with Any Number of Pairs of Terminals, given their Impedance or Admittance Matrices.—M. Bayard. (*Bull. Soc. franç. Élect.*, Sept. 1949, Vol. 9, No. 96, pp. 497–502.) The necessary and sufficient condition is established for a square symmetric matrix to be an impedance or an admittance matrix. The condition is that the quadratic form associated with the given matrix is a 'positive real function' in the sense in which Brune uses the term. This result generalizes the theorem established by Brune for the impedance matrices of 2-pole networks (1932 Abstracts, p. 280) and by Gewertz for those of quadripoles (1934 Abstracts, p. 514). The greater part of the mathematical treatment included in the original paper presented at a meeting of the Société française des Électriciens is here omitted.

621.396.611.1 **63**

Energy Fluctuations in a van der Pol Oscillator.—N. Minorsky. (*J. Franklin Inst.*, Sept. 1949, Vol. 248, No. 3, pp. 205–223.) The behaviour of the van der Pol oscillator, whose differential equation is

$$\ddot{x} - \epsilon(1 - x^2)\dot{x} + x = 0,$$

resembles that of the harmonic oscillator when ϵ is small; the very different behaviour when ϵ is large is examined with the aid of data obtained by the method of isoclines.

The van der Pol oscillator has a prescribed energy content which does not depend on the initial conditions, whereas the harmonic oscillator can have any energy content. The van der Pol oscillator is nevertheless the best means available for physical realization of simple harmonic oscillation if ϵ is small. The perturbation method is used to determine the fluctuations of energy with time and azimuth for $\epsilon \ll 1$. For $\epsilon \gg 1$, the energy fluctuations of the van der Pol oscillator are quasi-discontinuous, and somewhat analogous to those of a pneumatic hammer. See also 1930 Abstracts, p. 503 (van der Pol).

621.396.611.1 : 621.3.015.33 **64**

Response of RC Circuits to Multiple Pulses.—D. Levine. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1207–1208.) The voltage across the capacitor due to the application of several pulses in succession is determined by a generalized step-by-step process for any number of pulses. Only the well-known charge/discharge functions for a d.c. circuit are required. The voltage across the resistor can then be directly determined.

621.396.611.1.029.63 **65**

Tank Circuits as Resonators in Decimetre-Wave Technique.—G. Megla. (*Elektrotechnik, Berlin*, Nov. 1948, Vol. 2, No. 11, pp. 305–312.) Detailed treatment of the properties of tank circuits, with illustrations of many different types and derivation of suitable formulae for the resonance frequency and resistance. Below a wavelength of about 10 cm the Q of tank circuits decreases, so that cavity resonators are preferable.

621.396.615 : 621-12 **66**

The Reciprocator.—W. C. White & H. W. Lord. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 70–71.) A ring oscillator, comprising 2 one-shot multivibrators whose on and off periods can be varied independently between 0.2 and 1.5 sec, energizes linear or rotary solenoids which generate reciprocating motion in which the distance/time relationship during the whole stroke can be controlled.

621.396.615.141.1/.2 **67**

On the Theory of Magnetron Barkhausen Oscillations.—H. G. Möller. (*Elektrotechnik, Berlin*, May 1949, Vol. 3, No. 5, pp. 129–133.) The mechanism of the production of Barkhausen oscillations in whole-anode magnetrons is similar to that for triodes. For magnetrons the period of the pendular electrons is shorter than that of the retarded electrons, the reverse being the case for triodes. In consequence of the different frequencies, phase focusing occurs. An explanation of the oscillation mechanism is put into a mathematical form and the approximate path of the electrons, the dependence of the pendular frequency on the amplitude, the a.c. contribution to the space charge, and the excitation factor, are calculated. An upper limit for the efficiency can be found if it is assumed that the total pendular energy can be converted to oscillation energy.

621.396.615.17 : 621.317.755 **68**

Panoramic Sweep Circuits.—C. B. Clark & F. J. Kamphoefner. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 111–114.) Brief details, with block diagrams, of 12 methods of obtaining sweep voltages for panoramic receivers, f.m. signal generators and r.f. spectrum analysers.

621.396.619.23 : 621.396.615.17 **69**

A Modulator Producing Pulses of 10^{-7} Second Duration at a 1-Mc/s Recurrence Frequency.—M. G. Morgan. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, p. 1178.) Correction to 2185 of 1949.

621.396.645 **70**

Musician's Amplifier.—D. Sarser & M. C. Sprinkle. (*Audio Engng, N. Y.*, Nov. 1949, Vol. 33, No. 11, pp. 11–13..55.) An adaptation of the Williamson circuit (2715 of 1947 and 3101 of 1949). Williamson's output-transformer performance specifications are satisfactorily met by the Peerless transformer Type S-265Q. Construction and performance details are discussed and shown graphically. Quality is outstanding.

621.396.645 **71**

Amplification by Direct Electronic Interaction in Valves without Circuits.—P. Guénard, R. Berterottière & O. Doehler. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 543–549.) See 2977 of 1949.

621.396.645 **72**

Simplified Preamplifier Design.—H. T. Sterling. (*Audio Engng, N. Y.*, Nov. 1949, Vol. 33, No. 11, pp. 16–17..45.) Unnecessary complications may be avoided by making practical compromises in performance requirements. A modified Pickering circuit is recommended. See also 1608 of 1948 (Burwen).

621.396.645 : 539.17 **73**

Fast Pulse-Amplifiers for Nuclear Research.—W. C. Elmore. (*Nucleonics*, Sept. 1949, Vol. 5, No. 3, pp. 48–55.) Discussion of the limitations affecting the speed of response of amplifiers without feedback, and of the design of amplifiers whose speed of response approaches the theoretical limit. In each stage of the amplifier, the output signal is assumed to rise monotonically to its final steady value for a step-voltage input. The relations between the overall rise time of an amplifier and the rise times of individual stages are considered. Characteristics of 11 valves useful for pulse amplifiers are tabulated and discussed.

621.396.645 : 578.088.7 **74**

The Design and Construction of an Amplifier for Bio-Electric Recording.—R. T. Jamieson. (*Trans. S. Afr. Inst. elect. Engrs*, Sept. 1949, Vol. 40, Part 9, pp. 204–212. Discussion, p. 212.) Requirements of such amplifiers are discussed. An a.c. mains-operated amplifier is described. The pre-amplifier has a gain of 74 db and consists of two coupled-cathode stages followed by a cathode follower with gas-valve coupling to the input of the high-level amplifier, which is a 3-stage resistance-coupled amplifier with cathode-follower output and a gain of 66 db. Full-scale deflection on the c.r.o. is obtained for a 10-μV input signal. The two amplifiers should be isolated in places reasonably free from electrical noise.

621.396.645 : 621.385 **75**

Operation of Output Valves in High-Power Public-Address Amplifiers.—N. L. Bezladnov. (*Radiotekhnika, Moscow*, July/Aug. 1949, Vol. 4, No. 4, pp. 8–17. In Russian.) Continuation of 2662 of 1949. The efficiency of the final stage of such amplifiers can be improved by (*a*) anode loading, (*b*) use of a limiting device. In case (*a*), the average anode dissipation under dynamic operating conditions, not the maximum dissipation, should be regarded as determining maximum permissible anode loading. In case (*b*), the transmission power can be increased without increasing nonlinear distortion. The theory of both methods is discussed and experimental curves are shown.

621.396.645.37 : 518.4 **76**

Calculator and Chart for Feedback Problems.—J. H. Felker. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1204–1206.)

621.396.645.37.001.4 : 621.3.016.352 : 621.3.015.3 **77**

Examination of Amplifier Stability by applying a Sudden D.C. Test Voltage.—B. Carniol. (*Tesla tech. Rep., Prague*, March 1949, pp. 11–20.) Nyquist's theorem and the corresponding characteristic curve for feedback amplifiers are discussed and practical methods for determining the characteristic for any particular amplifier are described in detail. The computation accuracy depends on the exactness with which the phase characteristic can be represented by a series of straight lines. The advantages of the method of testing amplifier stability by studying the response to a transient voltage or square wave are considered. The effect of circuit variations in enhancing or reducing transient oscillations in the output of various amplifiers is illustrated by a series of oscillograms. A Nyquist characteristic for one of the amplifiers shows the existence of a critical frequency near which a definite tendency to instability exists. See also 218 below.

621.396.645.371 : 621.3.015.3 **78**

Transient Phenomena in Wide-Band Feedback Amplifiers.—O. B. Lur'e. (*Zh. tekh. Fiz.*, Aug. 1949, Vol. 19, No. 8, pp. 952–972. In Russian.) Negative-feedback amplifiers should be widely used in video circuits although they give somewhat lower gain than that obtained with the usual distortion-correcting circuits. Formulae are derived for determining circuit parameters when given (*a*) the time for reaching the steady state, (*b*) the maximum permissible overshoot.

621.396.662 : 621.396.61 **79**

A New Type of V.H.F. Tank Design.—B. E. Parker. (*FM-TV*, Oct. 1949, Vol. 9, No. 10, pp. 14–15.) A balanced 2-wire section of transmission line is tuned by varying its distance from a flat conductor. This affects the series inductance and the shunt capacitance, and hence the surge impedance. This arrangement has advantages in a push-pull output circuit, including the fact that the tuning element is at earth potential.

621.396.662 : 621.396.61 : 513.76 **80**

Bilinear Transformations applied to the Tuning of the Output Network of a Transmitter.—K. S. Kunz. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1211–1217.) The theory of bilinear transformations in a complex plane, by which circles are transformed into circles, is used to determine the actual value C of the secondary capacitance for (*a*) resonance of the secondary circuit, (*b*) a maximum or minimum of the average anode current, (*c*) maximum coupled-circuit efficiency. (*b*) and (*c*) require values of C differing widely from that required for (*a*), except for the case of a series load in the secondary circuit. Although the values of C required for (*b*) and (*c*) may differ considerably, the difference is small if the Q of the primary coil is large and the coupling coefficient very small.

621.396.662.2 **81**

A New Decade Inductor.—H. W. Lamson. (*Gen. Radio Exp.*, July 1949, Vol. 24, No. 2, pp. 1–8.) For the range 1 mH–10 H; intended for use at audio and the lower ultrasonic frequencies. Each decade unit consists of four inductors whose inductances are in the ratio 1 : 2 : 2 : 5, with an overall e.s. shield and a special switch for connecting the inductors in series as required. Multi-layer uniformly wound toroidal coils are used. These have a banked winding to minimize distributed capacitance and can be stacked in a compact unit with negligible mutual inductance. The stabilized Mo-permalloy dust cores have low eddy-current and hysteresis losses. Construction details and electrical properties are discussed.

GENERAL PHYSICS

530.12 : 531.18 **82**

The Special Relativity Theory.—E. Kübler. (*Elektrotechnik, Berlin*, Nov. 1948, Vol. 2, No. 11, pp. 323–327.) A simple explanation, by an electrician for electricians, of the electrodynamic consequences of this theory.

534.26 + 535.42 **83**

On the Theory of Diffraction by an Aperture in an Infinite Plane Screen : Part 1.—H. Levine & J. Schwinger. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 958–974.) The case of a scalar plane wave is considered. The wave function at an arbitrary point in space is expressed in terms of its values in the aperture, and constructed so as to vanish on the screen, in accordance with the assumed boundary condition. An integral equation is obtained, by means of which the amplitude of the diffracted spherical wave at large distances from the aperture can be expressed in a form which is stationary with respect to small variations of the aperture fields arising from a pair of incident waves. This expression is independent of the scale of the aperture fields. The transmission cross-section of the aperture for a plane wave is simply related to the diffracted amplitude observed in the direction of incidence. The method is applied to the case of a wave incident normally on a circular aperture, for which exact results are available; by using suitable trial aperture fields in the variational method, approximate but sufficiently accurate results are obtained for the diffracted amplitude and transmission cross-section over a wide range of frequencies. See also 3294 of 1948 (Spence).

534.26 + 535.42 **84**

On the Transmission Coefficient of a Circular Aperture.—C. J. Bouwkamp : H. Levine & J. Schwinger. (*Phys. Rev.*, 15th May 1949, Vol. 75, No. 10, pp. 1608–1609.) Comment on 83 above and the authors' reply.

535.42 : 538.566 **85**

New Solution of the Problem of the Diffraction of Electromagnetic Waves by a Plane Perfectly Conducting Screen.—J. P. Vasseur. (*C. R. Acad. Sci., Paris*, 19th Sept. 1949, Vol. 229, No. 12, pp. 586–587.) Using the same notation as in a previous note (3124 of 1949), a rigorous expression of Babinet's principle is derived by the help of integral equations, the integration extending over the surface of the screen. This expression of Babinet's principle has been given by H. G. Booker in an unpublished paper. See also 1335 of 1947 (Booker).

537.311.62 **86**

Skin Effect.—C. Vazaca. (*Radio tech. Dig., Édn franç.*, June–Oct. 1949, Vol. 3, Nos. 3–5, pp. 175–184, 223–233 & 307–316.) Reprint of article in *Bull. nat. Recherches technol. Roumanie*, 1948, Vol. 3, Nos. 3/4. The concentration of the current in the surface layers of a conductor carrying a.c. is quite analogous to the concentration of magnetic field in the surface layers under the action of a longitudinal alternating magnetic field, owing to eddy-current effects. Starting from Maxwell's equations, formulae are developed for the case of a long cylindrical conductor, giving the law of current density distribution within the conductor of the current density and total current, and also of the magnetic field and total magnetic flux. Formulae are also derived for the impedance and the complex reluctance, the effective depth of penetration of the current and of the magnetic field, and the energy dissipated per unit length or volume of the conductor.

537.521.7 **87**

The Positive Streamer Mechanism of Spark Breakdown.—W. Hopwood. (*Proc. phys. Soc.*, 1st Oct. 1949, Vol. 62, No. 358B, pp. 657–664.)

537.525 : 538.551.25 **88**

Theory of Plasma Oscillations. A. Origin of Medium-Like Behavior.—D. Bohm & E. P. Gross. (*Phys. Rev.*, 15th June 1949, Vol. 75, No. 12, pp. 1851–1864.) A theory of electron oscillations of an unbounded plasma of uniform ion density is developed, taking into account the effects of random thermal motions, but neglecting collisions. The frequencies are determined at which a plasma can undergo organized steady-state small oscillations to which a linear approximation applies. Organized oscillations of wavelength smaller than the Debye length for the electron gas are not possible. For a given wavelength, a plasma can oscillate with arbitrary frequency, but the frequencies not satisfying a 'steady-state dispersion relation' describe motions in which, after some time, there is no contribution to large-scale averages. The treatment is extended to the case of large steady-state oscillations for which the equations are nonlinear, and the general nature of solutions for this case is discussed. See also 89 below.

537.525 : 538.551.25 : 621.396.822 **89**

Theory of Plasma Oscillations. B. Excitation and Damping of Oscillations.—D. Bohm & E. P. Gross. (*Phys. Rev.*, 15th June 1949, Vol. 75, No. 12, pp. 1864–1876.) The theory discussed in 88 above is extended to include the effects of collisions and of special groups of particles having well-defined ranges of velocities. A wave tends to be damped by collisions in a time of the order of the mean time between collisions. Groups of particles having speeds far above the mean thermal speed may cause instability only limited by effects neglected in the linear approximation. In the absence of plasma oscillations, any beam of well-defined velocity is scattered by the individual plasma electrons acting at random, but the scattering is much greater when all the particles oscillate in unison. The beams are thus scattered by the oscillations they produce. This type of instability may be responsible for solar and cosmic r.f. noise.

538.12 **90**

Production of Intense Magnetic Fields by means of Pulses.—G. Raoult. (*Ann. Phys., Paris*, July/Aug. 1949, Vol. 4, pp. 369–421.) By means of recurrent voltage pulses, a suitable commutator and a grid-controlled Hg rectifier, a capacitor is charged and then discharged through a coil about 100 times per sec. In this way magnetic field pulses of roughly sinusoidal shape and of duration about 15 μs have been produced with a peak power of the order of 90 MW and a mean power of 850 W. The maximum field strength was 52 000 gauss in a useful volume of about 3 cm^3. Applications to phenomena of polarization rotation and magnetic double refraction in CS_2 are described.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523 : 621.396.9 **91**

Radio Astronomy.—J. S. Hey. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 2, pp. 179–211. Bibliography, pp. 211–214.) General survey of (*a*) radio detection of meteors and reflections from the moon, (*b*) solar radiation, and (*c*) galactic radiation.

523.746.5 **92**

The Probable Behavior of the Next Sunspot Cycle.—W. Gleissberg. (*Astrophys. J.*, July 1949, Vol. 110, No. 1, pp. 90–92.) The probability laws of sunspot variations, which have yielded successful predictions for the present sunspot cycle, suggest that a steep ascent to a very high maximum is highly probable in the next cycle, and that the period of low activity preceding the next cycle will be extremely short.

550.385"1949.01.24/.26" **93**

Recurrence Features of the Magnetic Storm of 1949 January 24-26.—(*Observatory*, Oct. 1949, Vol. 69, No. 852, pp. 195–196.) Great magnetic storms, beginning with a 'sudden commencement' and associated with solar flares, do not usually show any recurrence connected with the solar rotation. This particular storm, however, recurred with sudden commencements on 21st Feb. 1949 and 21st March 1949. No positive evidence of flares associated with the last two storms is available. These storms were of the polar type, and were associated with aurorae. Magnetograms are reproduced and compared.

551.51 **94**

The Earth's Upper Atmosphere.—D. R. Bates. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 2, pp. 215–242. Bibliography, pp. 242–245.) Known facts about the constitution, density and temperature at various levels are summarized, and methods of exploring the upper atmosphere are surveyed. The ionized layers and aurorae are also discussed.

551.510.535 **95**

Ionization in the Earth's Upper Atmosphere.—(*Observatory*, Oct. 1949, Vol. 69, No. 852, pp. 185–191.) Report of a discussion held at Manchester University on 2nd July 1949.

551.557 : 621.396.9 **96**

A Radio Method of Measuring Winds in the Ionosphere.—S. N. Mitra. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 441–446.) A pulse transmitter operating at a frequency of about 4 Mc/s is used in conjunction with 3 receivers at the corners of a right-angled triangle with sides of the order of 100 m. A single magneto-ionic component received at one point will show fading only if the ionosphere changes either by random motion of irregularities or by steady motion of the ionosphere as a whole. A uniform drift of the ionosphere would cause the diffraction pattern to move past a receiver with twice the velocity of the drift. Wind velocities can thus be deduced when the records at the 3 receivers are similar but displaced in time. Results thus obtained are compared with those of previous measurements by other methods.

551.594.6 **97**

Large-Scale Variation of the Level of Atmospherics during the Antarctic Cruise of the *Commandant Charcot*.—R. Bureau & M. Barré. (*C. R. Acad. Sci., Paris*, 26th Sept. 1949, Vol. 229, No. 13, pp. 626–627.) The recorder used on board the *Commandant Charcot* has been calibrated by Carbenay's method (2902 of 1948). A map is given showing, for the various sections of the whole course, the operational threshold in maxwells per metre. Longitude and latitude effects are clearly indicated and the difference between the threshold sensitivities for January and March in Australian waters indicates also a seasonal effect. See also 3429 of 1949.

551.594 **98**

Atmospheric Electricity. [Book Review]—J. A. Chalmers. Publishers: Oxford University Press, Oxford, 1949, 175 pp., 15s. (*Proc. phys. Soc.*, 1st Oct. 1949, Vol. 62, No. 358B, pp. 665–666.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 **99**

Radar.—(*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, p. 532.) In Quillet's encyclopaedia the following entries may be found:—

Radar.—En Perse: Membre d'une milice créée pour protéger les voyageurs.

[In Persia: Member of a militia established for the protection of travellers.]

Radarie.—Droit persan payé par les marchandises sous la protection des radars.

[Persian toll paid on merchandise under the protection of radars.]

621.396.9 : 061.4 **100**

Radar Research and Development Establishment [Malvern].—(*Engineer, Lond.*, 30th Sept. 1949, Vol. 188, No. 4888, p. 373.) A brief survey of work in progress at this establishment, based on a visit made on a recent open day. See also *Nature, Lond.*, 29th Oct. 1949, Vol. 164, No. 4174, pp. 740–741.

621.396.9 : 621.385.832 : 535.371.07 **101**

Radar Screens.—de la Pinsonie. (*See* 267.)

621.396.933 : 526.92 **102**

Distance-Measuring Equipment for Aircraft Navigation.—V. D. Burgmann. (*Proc. Instn elect. Engrs*, Part III, Sept 1949, Vol. 96, No. 43, pp. 395–402.) An airborne light-weight radar set works in conjunction with a responder beacon on the ground. The radar transmitter sends out a stream of pulses which are returned by the beacon at a slightly different frequency. The time interval between the outgoing and corresponding return pulse is measured automatically and shown on a meter calibrated in miles. The design of the airborne set and results obtained in trials on an air route are discussed. Well-established techniques are used.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **103**

Review of the Interpretations of Luminescence Phenomena.—F. E. Williams. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 648–654.)

535.37 **104**

A Survey of Present Methods used to Determine the Optical Properties of Phosphors.—W. B. Nottingham. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 641–647.)

535.37 **105**

The Intensity Dependence of the Efficiency of Fluorescence of Willemite Phosphors.—W. Hoogenstraaten & F. A. Kröger. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 541–556. In English.)

535.37 **106**

Temperature Quenching and Decay of Fluorescence in Zinc and Zinc-Beryllium Silicates activated with Manganese.—F. A. Kröger & W. Hoogenstraaten. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 557–568. In English.) Continuation of 3156 of 1949 and 105 above.

535.37 : 546.412.84 **107**

Optical Properties of Calcium Silicate Phosphors.—F. J. Studer & G. R. Fonda. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 655–660.)

535.37 : 546.471.61 **108**

A Correlation between Cathodoluminescence Efficiency and Decay [of Mn-activated ZnF_2] **as a Function of Temperature.**—R. H. Bube. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 681–684.)

535.37 : 546.472.21 **109**

Sodium and Lithium as Activators of Fluorescence in Zinc Sulfide.—F. A. Kröger. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 670–672.)

535.37 : 546.472.21 **110**

The Luminescence of Zinc Sulfide Activated by Lead.—N. W. Smit & F. A. Kröger. (*J. opt. Soc. Amer.*, Aug. 1949, Vol. 39, No. 8, pp. 661–663.)

537.311.31 + 536.212.2] : 546.78 **111**

Thermal and Electrical Resistance of a Tungsten Single Crystal at Low Temperatures and in High Magnetic Fields.—J. de Nobel. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 532–540. In English.)

537.312.62 : 621.396.622 **112**

Detection at Radio Frequencies by Superconductivity.—Lebacqz, Clark, Williams & Andrews. (*See* 223.)

538.221 **113**

Magnetic Materials for Electrical Power Plant.—F. Brailsford. (*Engineering, Lond.*, 16th Sept. 1949, Vol. 168, No. 4364, pp. 293–296.) Long summary of paper read before the British Association. The progress in steel- and sheet-making processes is reviewed. Different steels are compared; the need for improving magnetic quality is stressed. Methods outlined include directional cold-rolling technique and a laboratory method for preferred orientation in silicon-iron crystals. For other summaries see 3442 of 1949 and *Electrician*, 2nd Sept. 1949, Vol. 143, No. 3716, pp. 737–738. For discussion, see *Electrician*, 16th Sept. 1949, Vol. 143, No. 3718, pp. 893–894.

549.514.51 **114**

The Quartz Crystal as Raw Material for High-Frequency Technics.—H. Neels. (*Elektrotechnik, Berlin*, Oct. 1949, Vol. 3, No. 10, pp. 318–322.) Discussion of the various forms of natural quartz, methods of selection by visual inspection, and optical and electrical tests for twinning.

549.514.51 **115**

A New Crystal Cut for Quartz with Zero Temperature Coefficient.—E. J. Post. (*Tijdschr. ned. Radiogenoot.*, Sept. 1949, Vol. 14, No. 5, pp. 147–157.) A rotated *y*-cut making an angle of about +36° with the *z*-axis. It is suitable for the frequency range 400–1 000 kc/s and the term HT-cut is proposed. Resonators can be mounted by soldering springs at the nodal points. Spurious responses are absent in the range within 10% above or below the main resonance frequency.

549.514.51 : 621.392.52 **116**

Crystals for Electrical Filters.—R. Taylor, R. Bechmann & A. C. Lynch. (*Research, Lond.*, Sept. 1949, Vol. 2, No. 9, pp. 414–417.) The equivalent circuit of a quartz crystal is discussed, and factors that must govern the choice of suitable crystals for practical applications are considered. A crystal may have as many as 18 piezoelectric constants, 6 permittivities and 21 elastic constants, all of which may have different temperature coefficients. The highest piezoelectric constants for various classes of piezoelectric crystal are tabulated. Temperature coefficients, ferroelectric properties, methods of growing crystals, etc., are briefly discussed. The ideal piezoelectric material has yet to be found.

621.315.59 + 621.314.6 **117**

Semiconductor Rectifiers.—(*See* 240.)

621.315.59 + 621.314.63 **118**

Semi-Conductors and Rectifiers.—N. F. Mott. (*Proc. Instn elect. Engrs*, Part I, Sept. 1949, Vol. 96, No. 101, pp. 253–260.) Full paper: summary noted in 2814 of 1949.

621.315.59 + 621.315.61 **119**

New Dielectric Materials : Semi-Conductors, Plastics and Silicones.—(*Electrician*, 2nd Sept. 1949, Vol. 143, No. 3716, pp. 735–736. Discussion, *ibid.*, 16th Sept. 1949, Vol. 143, No. 3718, pp. 893–894.) Summary of paper presented before the British Association by R. W. Sillars, entitled "Insulating and Semi-Conducting Materials". Another summary noted in 3442 of 1949. See also 3168 of 1949 (Jones, Scott & Sillars).

621.315.612 **120**

Titanates with High Dielectric Constant.—H. Sachse. (*Z. angew. Phys.*, Aug. 1949, Vol. 1, No. 10, pp. 473–484.) A comprehensive review of the results of measurements, made in various countries, of the properties of a wide range of titanate materials. 57 references are given.

621.315.612 : 621.317.37.029.6 **121**

The Measurement of the Dielectric Properties of High-Permittivity Materials at Centimetre Wavelengths.—J. G. Powles & W. Jackson. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 383–389.) Results of room-temperature measurements on ceramic specimens of the titanates of Mg, Ca, Sr and Ba at 1.5 Mc/s and at 9 450 Mc/s, and on $BaTiO_3$ at 24 000 Mc/s are discussed. $BaTiO_3$ is unique among these materials, because a considerable fall in permittivity and a large increase in tan δ occur at the higher frequencies. Variable-temperature measurements on $BaTiO_3$ show that the crystallographic change associated with the Curie point at 120°C affects the permittivity at 9 450 Mc/s and at 1.5 Mc/s in an analogous manner. Measurements at the same frequencies on (Ba,Sr) titanate compositions are also described; the composition 56% $BaTiO_3$: 44% $SrTiO_3$ has a permittivity of 760 and tan $\delta = 0.02$ at 9 450 Mc/s and 20°C. The three methods of measuring high permittivities at cm λ developed in the course of this work are described.

621.315.614 : 621.317.372 **122**

Electrical Testing of Capacitor Paper.—Endicott. (*See* 144.)

621.315.614.62/.63 : 621.319.4 **123**

Metallizing Paper for Capacitors.—H. G. Wehe. (*Bell Lab. Rec.*, Sept. 1949, Vol. 27, No. 9, pp. 317–321.) A German wartime metal-vapour spraying process, developed by the Bell Telephone Laboratories. For a given capacitance the metallized-paper capacitor is much smaller than the corresponding metal-foil capacitor, and has the advantage of self-healing of punctures through the insulation.

621.315.615.011.5 : 537.226.2 **124**

A Contribution to the Theory of the Dielectric Constant of Polar Liquids.—T. G. Scholte. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 437–449. In English.)

621.315.615.2.011.5 : 537.226.2 **125**

The Absolute Dielectric Constant of Benzene.—F. van der Maesen. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 481–483.) The dielectric constant is appreciably reduced by prolonged drying over Na. This confirms the conclusion of Hartshorn & Oliver (*Proc. roy. Soc. A*, 1929, Vol. 123, pp. 664–685) that moisture is the only impurity of importance in dielectric-constant measurements. Values obtained differ by less than 0.1% from the generally accepted standard values. The method of purification is discussed.

621.315.616 **126**

Ethoxylines.—E. Preiswerk & C. Meyerhans. (*Elect. Mfg, N.Y.*, July 1949, Vol. 44, No. 1, pp. 78–81 . . 166.) Properties and applications are discussed. The first resins of this type were supplied under the trade name Araldite; for another account see 3450 of 1949 (Moss).

621.315.616 : 546.287 **127**

Recent Progress made in Silicone Rubber Materials.—C. E. Arntzen & R. D. Rowley. (*Materials & Methods*, Oct. 1949, Vol. 30, No. 4, pp. 73–76.) The chemical nature of silicones, mechanical and physical properties of various silastic rubbers, and applications, are discussed. Silicone rubbers are much less affected by temperatures of the order of 300°F than natural rubbers.

621.315.618.011.5 : 537.226.2 **128**

The Absolute Dielectric Constant of Gases at Pressures of 0-80 Atm. at 25°C.—J. Clay & F. van der Maesen. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 467–480. In English.) Experimental values for air, He, Ar and CO_2 are tabulated and discussed. A heterodyne beat method is used for determining the absolute values of small differences of capacitance by means of Clay's cylindrical measuring capacitor (141 below).

621.318.2 : 538.652 **129**

The Magnetostriction of Anisotropic Permanent Magnet Alloys.—M. McCaig. (*Proc. phys. Soc.*, 1st Oct. 1949, Vol. 62, No. 358B, pp. 652–656.) Blocks of permanent magnet alloys of the system FeNiAlCoCu were prepared with columnar crystals. The magnetostriction was measured in various directions before and after heat treatment in a magnetic field. The results agree well with those predicted theoretically, and so confirm the postulated crystal structure.

621.775.7 **130**

Sintering of Iron Powders.—H. Bernstorff. (*Metal Treatm.*, Summer 1948, Vol. 15, No. 54, pp. 85–89.) Tabulated results of experimental studies in the Degussa laboratories on the sintering of DPG Schleuder iron powder are used to derive curves showing tensile strength and elongation as a function of sintering time. For the higher sintering temperatures the curves approach constant values. At lower temperatures distinct minima are found for both strength and elongation.

666.1.037.5 **131**

Glass-to-Metal Seals.—(*Metal Ind., Lond.*, 30th Sept. & 7th Oct. 1949, Vol. 75, Nos. 14 & 15, pp. 263–266 & 292–293.) The relative merits of various metals and glasses used for sealing and various types of seal are discussed; characteristics of certain glasses are tabulated. For many purposes, B.T.H. C40 borosilicate glass sealed to Nilo-K, an alloy consisting of 54% Fe, 31% Ni and 15% Co, is the best combination now available. No great skill is required in preparing or manufacturing the seal; pre-beading is unnecessary. Seals with diameters up to at least 5 in. have been successfully made with these materials. The nature of stresses in seals is briefly discussed.

MATHEMATICS

512.974 : 621.3 **132**

Vectorial Space. Region of Representation for Electrotechnics.—G. Nasse. (*Bull. Soc. franç. Élect.*, Sept. 1949, Vol. 9, No. 96, pp. 459–474.) The concept of the region of representation, limited in classical teaching to the Fresnel plane, is shown to be capable of a natural extension leading to the vectorial space of geometers, a metric space capable of representing under one and the same structure the properties of monophase and polyphase systems, and even those of their transitory states.

681.142 **133**

The University of Manchester Universal High-Speed Digital Computing Machine.—T. Kilburn. (*Nature, Lond.*, 22nd Oct. 1949, Vol. 164, No. 4173, pp. 684–687.) The binary system is used, and numbers up to 2^{40} can be accommodated. Operations which the machine can perform and 'addresses' where numbers can be stored also have numbers. 'Instructions' take the form of numbers which specify that a certain operation is to be performed on the contents of a certain address. An electronic storage unit with a capacity of 5 120 digits is included; this type of storage was discussed in 2258 of 1949 (Williams & Kilburn). A magnetic storage unit is also available in which the numbers stored are less accessible but which has a capacity of 40 960 digits; a similar storage system was described by Booth (3179 of 1949). Special circuits are provided to perform addition, subtraction, multiplication and certain logical operations, but a 'sub-programme' is used for other operations, including division, which occur less frequently. The component elements of the computing circuits used are similar to those used in video pulse circuits in radar (see 1874 of 1948). One type of adding circuit is considered in detail. The 'control' is an electronic storage tube, holding two numbers; its operation is described. Arrangements are made to enable the machine to perform or omit an instruction according to the nature of the result obtained at a particular stage of the calculation.

681.142 : 621.385.032.212 **134**

Polycathode Glow Tube for Counters and Calculators.—Lamb & Brustman. (*See* 266.)

MEASUREMENTS AND TEST GEAR

531.764.5 **135**

The Development of the Quartz Clock.—W. A. Marrison. (*Elektrotechnik, Berlin*, Oct. 1949, Vol. 3, No. 10, pp. 311–316.) Condensed version of the paper noted in 762 of 1949.

621.317.2 **136**

New High-Voltage Engineering Laboratory.—J. H. Hagenguth. (*Gen. elect. Rev.*, Sept. 1949, Vol. 52, No. 9, pp. 9–14.) The laboratory was built for development and research work on apparatus used for power transmission and distribution. Test power for a.c. h.v. tests is supplied by one 1 000-kVA generator and two 500-kVA generators. Two 500-kW 500-V d.c. generators are also available. For studying transient voltages, such as those due to lightning, under controlled conditions, two 5 100-kV impulse generators are provided. These can produce a peak voltage of 7 500 kV to ground at a current of 33 kA when operated individually, or 66 kA when connected in parallel. Five 350-kV 1 000-kVA test transformers can be connected in cascade to deliver 1 750 kV (r.m.s.) to ground. A surge current generator is also available, capable of producing 260 kA at 50, 100 or 150 kV.

621.317.3.011.5 : 621.365.55† **137**

Dielectric Loss with Changing Temperature.—J. B. Whitehead & W. Rueggeberg. (*Elect. Engng, N.Y.*, Oct. 1949, Vol. 68, No. 10, p. 874.) Summary only. A method of measuring the properties of a dielectric while its temperature is changing has been developed and applied to certain thermosetting materials subjected to h.f. heating. The presence of absorbed moisture in small amounts has a pronounced effect on the dielectric properties of such materials. The two important phenomena are dielectric absorption and some form of molecular polarization; their relative importance depends on the type of heating cycle.

621.317.3.029.3 **138**

Audio-Frequency Measurements.—W. L. Black & H. H. Scott. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1108–1115.) Discussion of the theory involved in making measurements of gain, frequency response, distortion and noise, with particular reference to high-gain systems. Techniques of measurement and factors affecting accuracy are also discussed. See also 147 and 148 below.

621.317.32 **139**

Problems Related to Measuring the Field Strength of High-Frequency Electromagnetic Fields.—R. Truell. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1144–1147.) Continuation of 429 of 1949, with more detailed treatment of the parallel-plate field and extension to the field in a rectangular cavity. In both cases the field amplitude can be expressed quite simply in terms of easily measurable parameters, if certain velocity conditions are satisfied by the electron beam, and the cyclotron frequency $|e|H/mc$ is equal to the frequency of the e.m. field.

621.317.32 : 551.594 **140**

A New Method of Measuring the Vertical Electric Field in the Atmosphere.—J. A. Chalmers. (*J. sci. Instrum.*, Sept. 1949, Vol. 26, No. 9, pp. 300–301.) A metal ball rolls down an inclined earthed gutter and drops into an insulated collector, which thus acquires a potential proportional to the atmospheric electric field. This potential is amplified and measured by a galvanometer.

621.317.335.2† : 621.319.4 **141**

Accurate Determination of the Absolute Capacity of Condensers : Part 2.—J. Clay. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 484–488. In English.) Results are given of new precision measurements of the dimensions of three variable steel capacitors, from which their capacitances are deduced. Values obtained agree to within 1 part in 3 000 with those found by e.s. and oscillation methods, and the absolute value is believed to be accurate within 0.01%. For part 1 see 4175 of 1936. These capacitors were used for the measurements of dielectric constant discussed in 125 and 128 above.

621.317.37.029.6 : 621.315.612 **142**

The Measurement of the Dielectric Properties of High-Permittivity Materials at Centimetre Wavelengths.—Powles & Jackson. (*See* 121.)

621.317.372 + 621.317.334 **143**

Q and L Measurements.—W. T. Cocking. (*Wireless World*, Nov. 1949, Vol. 55, No. 11, pp. 449–453.) When a Q meter is not available, the frequency or capacitance detuning methods here described form convenient ways of determining Q and also the inductance and self-capacitance of coils; Q is obtained by calculations involving measured values of frequency or capacitance. Factors limiting accuracy are discussed.

621.317.372 : 621.315.614 **144**

Electrical Testing of Capacitor Paper.—H. S. Endicott. (*Gen. elect. Rev.*, Sept. 1949, Vol. 52, No. 9, pp. 28–35.) Equipment is described for measuring the dielectric constant and power factor of dry, unimpregnated capacitor paper. The sample is not removed from the drying chamber. The relation between the power-factor/temperature curves of dry and impregnated paper is discussed. The time necessary for a test has been reduced from 3 weeks to 2 days.

621.317.7 + 621.38 + 621.396.69] : 061.4 **145**

Radiolympia Review.—(*Wireless World*, Nov. 1949, Vol. 55, No. 11, pp. 428–444.) An illustrated review of various exhibits, namely (*a*) television equipment, (*b*) broadcast receivers, (*c*) sound-reproducing equipment, (*d*) components and accessories, (*e*) communication equipment, (*f*) testing and measuring gear, (*g*) scientific, industrial and medical apparatus. See also 3472 of 1949.

621.317.7.001.4 **146**

Operation and Care of Circular-Scale Instruments: Parts 1 & 2.—J. Spencer. (*Instruments*, July & Aug. 1948, Vol. 21, Nos. 7 & 8, pp. 620–632 & 715–724.) A fully-illustrated discussion of the mechanism of such instruments, and dismantling and reassembling procedure for repair, showing the principles of operation of Westinghouse and General Electric moving-coil d.c. meters Types KX24 and DB-12, and moving-iron a.c. meters Types KA24 and AB-12. Calibration adjustments, maintenance, and repair of various defects, from simple frictional defect to component failure, are also considered.

621.317.7.029.3 **147**

Audio Frequency Measurements: Part 1.—W. L. Black & H. H. Scott. (*Audio Engng, N.Y.*, Oct. 1949, Vol. 33, No. 10, pp. 13–16 . . 43.) Paper presented at a joint I.R.E./R.M.A. meeting at Syracuse, N.Y. Definitions and minimum standards for the audio facilities of a broadcasting system are specified in R.M.A. Standard TR-105A, published in May 1948. The technical background which is the basis for this specification is here surveyed and measurement methods are discussed thoroughly. A test circuit for gain measurements is described. The use of calibrated adjustable attenuators is recommended. Sources of error include mismatch and variation in the degree of earthing. The measurement of bridging gain is considered. Part 2: 148 below.

621.317.7.029.3 **148**

Audio Frequency Measurements: Part 2.—W. L. Black & H. H. Scott. (*Audio Engng, N.Y.*, Nov. 1949, Vol. 33, No. 11, pp. 18–19 . . 50.) Continuation of 147 above. Determination of harmonic distortion at the output, and intermodulation and noise measurements are discussed. See also 138 above.

621.317.7.088.22 **149**

The Ratio of Electrical to Friction Torques in Indicating Instruments.—G. Szabó. (*J. sci. Instrum.*, Sept. 1949, Vol. 26, No. 9, pp. 301–304.) Factors affecting this ratio at its most favourable value are discussed. The shock-acceleration and shock-velocity are computed for the range of deformations where pivots and jewels are not damaged.

621.317.71 : 621.385.5 **150**

The Use of Multigrid Tubes as Electrometers.—J. R. Prescott. (*Rev. sci. Instrum.*, Aug. 1949, Vol. 20, No. 8, pp. 553–557.)

621.317.715 **151**

The Galvanometer as a Built-In Component.—G. Spiegel. (*Elect. Mfg, N.Y.*, July 1948, Vol. 42, No. 1, pp. 80–83.) Both the jewelled and the taut-suspension types of galvanometer are considered. The latter have much greater sensitivities and longer periods.

621.317.72 **152**

Compensator — A Device for Measurement of Alternating Currents within a Broad Frequency Range.—V. Hlavsa. (*Tesla tech. Rep., Prague*, March 1949, pp. 4–10.) For measurements at frequencies between 20 c/s and 20 kc/s. One of two synchronous generators supplies current to the object under test and the voltage developed across it is balanced by the output of the other generator. The magnitude and phase of this output voltage are controlled by means of a potentiometer and a phase shifter, both of which are calibrated. Design details and applications of the equipment are discussed.

621.317.726 : 621.396.615.17 **153**

Measurement of the Time Constants of Peak Voltmeters intended for the Study of Transient Phenomena.—F. de Clerck. (*HF, Brussels*, 1949, No. 3, pp. 81–87.) For measuring the time constant of the indicating instrument, a rectangular pulse is used of duration variable and of the order of the time to be measured. For the time of charge of the electrical circuit a sine-wave pulse, symmetrical with respect to zero and with a rectangular envelope, is used; the pulse duration is again variable. The discharge time requires the sudden interruption, for a controlled time, of a sine wave. A generator for producing these three types of pulse is described and also a method of using it to enable the times to be measured on the screen of a c.r.o. Other applications of the equipment are mentioned.

621.317.729 : 532.517.2 **154**

Fields from Fluid Flow Mappers.—A. D. Moore. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 790–804.) Fluid flow within the streamline range, made visible by means of potassium permanganate crystals, can be used to simulate e.s., e.m. and other fields. Flow takes place between a flat slab of plaster-of-Paris, provided with suitable sources and sinks, and a parallel sheet of plate glass. Setting-up techniques for particular problems are described. Two-dimensional fields can in general be set up easily; some symmetrical three-dimensional fields can also be simulated. Photographs of results obtained are included and discussed.

621.317.73 **155**

Impedance Measurements with Directional Couplers and Supplementary Voltage Probe.—B. Parzen. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1208–1211.) The impedometer consists of two oppositely connected directional couplers and a voltage probe in a short transmission line. An experimental model for frequencies between 50 and 500 Mc/s is described.

621.317.733 **156**

The Design and Construction of a Comparison Impedance Bridge for Frequencies of 40-270 Mc/s.—W. C. Weatherley. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 429–432.) Two types of bridge are described, one for measuring 'balanced' and the other for 'unbalanced' impedances to earth. The frequency range is about ± 20% of the working mid-frequency. Measurements can be obtained without placing bulky apparatus near the impedance being measured. Changes in impedance over a definite frequency band are measured, rather than absolute impedance. Circuit details, suitable components and calibration procedure are described. Accuracy is within ±2% for resistance comparison and within ±5% for capacitance comparison.

621.317.74 : 621.395.44 **157**

Transmission-Measuring Set for Low-Frequency Carrier Systems.—J. Brundage & J. Zyda. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 204–208.) Description of the Type 902-A set, which includes a stabilized RC oscillator covering the frequency range 300–40 000 c/s. A 4-position rotary switch provides for sending, receiving, measuring and calibration. Transmission power may be varied from −40 to +20 db relative to 1 mW, and receiver sensitivity is adequate. Self-calibration is arranged. The unit may be either of portable form or rack-mounted.

621.317.75 **158**

Harmonic Analyzer and Synthesizer.—J. Lehmann. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 106–110.) Any waveform which can be represented by a Fourier sine or cosine series having up to 20 terms can be analysed by this electromechanical instrument. Two dials are provided on which the amplitude and phase of each term can be set. For synthesis, the amplitudes and phases of the first 20 odd harmonics are set on the dials, and the response is plotted on a dynamometer-type recorder. For analysis, the amplitudes of the steps of a stepped-wave approximation to the waveform under investigation are set on the amplitude dials, and the frequency response is obtained as two plotted curves from twin recorders, in rectangular or polar coordinates. Circuit arrangements are discussed, and examples illustrating the operation of the instrument are included

621.317.755 : 621.385.029.63/.64 **159**

Traveling-Wave Oscilloscope.—Pierce. (*See* 264.)

621.317.761 **160**

Electronic Frequency Meter.—(*J. sci. Instrum.*, Sept. 1949, Vol. 26, No. 9, p. 310.) Made by Airmec Laboratories Ltd, High Wycombe. Designed to measure frequencies 0–200 c/s, 0–2 kc/s and 0–20 kc/s. Input signal can be between 0.1 and 20 V; the wave may be of any shape having not more than 2 zeros per cycle. A circuit diagram is given showing the waveform at various stages. Pulses of recurrence frequency corresponding to the signal frequency are derived. The meter indicates the number of pulses received per second. Accuracy within 1% is unaffected by mains voltage fluctuations not exceeding 10%.

621.317.761 **161**

A New Frequency-Meter and its Application.—H. Hochrainer. (*Elektrotech. u. Maschinenb.*, Oct. 1949, Vol. 66, No. 10, pp. 288–291.) The current whose frequency is to be determined passes through a barretter and thence through a capacitor and a resistor respectively to opposite corners of a rectifier bridge. If the currents through the capacitor and resistor are equal, a moving-coil ammeter connected across the other diagonal will show no deflection. If, however, the frequency alters, the capacitive current will change and a deflection will be obtained on one side or the other of the instrument's centre zero. Applications to frequency recording for power systems and to frequency control are considered.

621.317.763 : 621.392.26† **162**

Wave-Guide Interferometers as Differential Wave-Meters.—A. B. Pippard. (*J. sci. Instrum.*, Sept. 1949, Vol. 26, No. 9, pp. 296–298.) The advantages of non-resonant waveguide interferometers over resonant cavities as absolute differential wavemeters are discussed, and two simple interferometers are considered in detail. An interferometer using a hybrid junction, and operating similarly to Michelson's interferometer, can have extremely high sensitivity in detecting small changes of frequency; experimental results are discussed.

621.317.772 **163**

On a Valve-Type Phase Meter.—J. Gilbert. (*Helv. phys. Acta*, 15th Aug. 1949, Vol. 22, No. 4, pp. 409–411. In French.) Description, with circuit diagram giving no component details, of a meter for reading directly the phase difference between two l.f. voltages of any waveform, and any amplitude between 20 V and 250 V. For frequencies in the range 20–500 c/s the accuracy is of the order of ±2°. A phase meter based on similar principles has been described by Florman & Tait (1726 of 1949). See also 3483 of 1949 (Kretzmer).

621.317.79 : 621.396.615 **164**

Citizens' Band Signal Generator.—W. C. Hollis. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 77–79.) Construction details of a unit which contains a tunable concentric-line resonator in a Colpitts oscillator circuit using a subminiature valve. For earlier articles on Citizens' Radio see 3482 of 1949 (Lurie) and back references.

621.317.79 : 621.396.822 **165**

A Video-Frequency Noise-Spectrum Analyzer.—P. S. Jastram & G. P. McCouch. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1127–1133.) Requirements for noise-analyser design are discussed. The heterodyne method of analysis is preferred to the tuned-circuit method because wide frequency coverage can be obtained with constant sensitivity and simple tuning arrangements. Design procedures can be worked out for obtaining adequate dynamic operating range and for suppression of errors. All circuits after the first modulator operate over fixed narrow frequency bands. A practical instrument for a frequency range of 50 kc/s to 10 Mc/s is described. The width of the analysing pass band is 33 kc/s.

621.317.79 : 621.396.933 **166**

Distant Monitoring of Radio Transmissions for Naval and Aviation Services.—J. Marique. (*HF, Brussels*, 1949, No. 3, pp. 71–80.) The subject is considered as affecting ship or aircraft security, navigation and communications. Examples illustrate the results of measurements carried out at the special monitoring centre established in Brussels since 1946. An outline is given of the methods adopted there for the measurement of frequency, the recording of signals in a given frequency band and analysis of the records.

621.317.794 **167**

A Ten Centimeter Broadband Bolometer Cavity.—T. Miller. (*Tele-Tech*, Sept. 1949, Vol. 8, No. 9, pp. 28–31, 74.) A 10-mA fuse is used as the bolometer element of a cavity resonator for measuring powers from 100 μW up to several milliwatts. Power reflection is $<1\%$ for wavelengths between 9 and 10.5 cm. The cavity bridge circuit and methods of increasing bandwidth by means of a resonant diaphragm soldered into the waveguide are described.

621.319.4.089.6 **168**

The Calibration Curves for Kohlrausch Capacitors.—G. Zickner. (*Elektrotechnik, Berlin*, Nov. 1948, Vol. 2, No. 11, pp. 317–320.) Description of a parallel-plate capacitor with variable plate distance, and discussion of the representation of its calibration curve in cartesian, double-logarithmic or hyperbolic coordinates, and also of the best means for determining the error curve showing the departure from the exact hyperbolic law.

621.385.001.4 : 621.3.015.3 **169**

Surge Testing of High Vacuum Tubes.—H. J. Dailey. (*Tele-Tech*, Oct. 1949, Vol. 8, No. 10, pp. 26–29..60.) An experimental investigation with artificially generated flash-arcs. Results indicate that (*a*) adding series resistors in the anode circuit does not materially affect valve damage per flash-arc for low gas pressures, but does reduce the tendency towards arcing, (*b*) shielding the filament supports from the anode causes prompt failure, (*c*) internal sources of gas must be minimized, (*d*) initial gas pressure should be of the order 10^{-6} mm Hg to minimize flash-arc damage, (*e*) the filament exposed to flash-arc should be at maximum operating temperature, (*f*) the addition of a series resistor may increase flash-arc damage if the valves are soft and remain soft.

621.396.621.001.4 : 621.3.015.3 **170**

Transient Phenomena in Radio Receivers.—Carniol. (*See* 218.)

621.396.645.37.001.4 : 621.3.016.352 : 621.3.015.3 **171**

Examination of Amplifier Stability by applying a Sudden D.C. Test Voltage.—Carniol. (*See* 77.)

621.397.62.001.4 : 621.396.619 **172**

Measuring Modulation Depths of TV Signals.—R. P. Burr. (*Tele-Tech*, Sept. 1949, Vol. 8, No. 9, pp. 32–35, 77.) Description of methods used and equipment required, especially for cases where only a small test signal is available. See also 3593 of 1947 (Buzalski).

621.317 **173**

Hochfrequenzmesstechnik. [Book Review]—O. Zinke. Publishers: S. Hirzel, Leipzig, 2nd edn 1947, 253 pp. (*Elektrotechnik, Berlin*, Nov. 1948, Vol. 2, No. 11, p. x.) There are twelve main sections dealing with current, voltage, field-strength and power measurements and with practically every type of measurement required in radio technique. "...an extraordinarily valuable help for every h.f. technician."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.718.4 : 621.396.619.13 **174**

Measurement and Amplification of Small Displacements by means of F.M.—P. Bricout & M. Boisvert. (*Rev. gén. Élect.*, Oct. 1949, Vol. 58, No. 10, pp. 402–404.) An instrument is described in which small displacements of the plate of a specially-contructed capacitor in an oscillatory circuit produce frequency variations at the mixer grid of a heptode in a Hartley circuit. This discriminator is due to Bradley (227 of 1947) and is relatively insensitive to amplitude variations; it operates linearly over a large part of the scale. Sensitivity is adjustable within wide limits; amplification is above 1 000 and relative error below 1%. Applications of the instrument in various pressure measurements are noted.

534.321.9.001.8 : 539.61.08 **175**

Evaluation of Adhesion by Ultrasonic Vibrations.—S. Moses & R. K. Witt. (*Industr. Engng Chem.*, Oct. 1949, Vol. 41, No. 10, pp. 2334–2338.) A direct, quantitative method for measuring the adhesion of organic coatings to both metallic and non-metallic surfaces is described. Longitudinal ultrasonic vibrations are induced by an electrodynamic system in a metal cylinder, one end of which is threaded for attachment of the sample to be coated. The coating separates from the face of the sample when the force required to accelerate it exceeds the adhesion force at the interface. The accelerating force is determined by the frequency and amplitude of the vibration, and the mass and dimensions of the film.

535.247.4 **176**

Darkroom Light Meter.—S. Becker. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 90–91.) A sensitive photocell unit samples the light falling upon an enlarging easel and gives the optimum exposure time directly in seconds. Complete construction details are included.

535.61-15 : 621.385.832 **177**

Cathode-Ray Presentation for Infrared Spectrometer.—J. H. Jupe. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 189..193.) Description of an instrument capable of scanning a band of width 3 μ anywhere in the range 2–16 μ, in a total time of about 15 sec.

539.16.08 **178**

Electron Mobilities in Geiger-Müller Counters.—H. den Hartog, F. A. Muller & C. S. W. van Rooden. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 581–587. In English.)

539.16.08 **179**

Geiger Tube Quenching Circuit for a Negative High Voltage Supply.—R. J. Watts. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, p. 699.) A modified Neher-Harper circuit. The Type CK569AX valve was selected for a portable design; other heater types of valve can be used.

539.16.08 **180**

Speed of Operation of Geiger-Müller Counters.—H. den Hartog. (*Nucleonics*, Sept. 1949, Vol. 5, No. 3, pp. 33–47. Bibliography, p. 47.) Discussion of the delays caused by electron transit time, discharge development, discharge quenching and dead-time. The work of various authors who have attempted to explain or measure some of the complex phenomena involved is reviewed. The resolution of G-M counters is compared with that of other counters.

539.16.08 : 621.386 **181**

Dead-Time and Non-Linearity Characteristics of the Geiger-Counter X-Ray Spectrometer.—L. Alexander, E. Kummer & H. P. Klug. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 735–740.)

621.316.7.076.7 : 543.712 : 676/677 **182**

Automatic Control of Moisture.—R. V. Coles. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 82–86.) Electronic equipment makes corrections proportional to the difference from the desired moisture content as material passes through a capacitive measuring element. This type of control is specially useful in the textile and paper industries.

621.317.083.7 **183**

Electrical Telemetering.—N. A. Abbott. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Oct. 1949, Vol. 13, No. 4, pp. 3–6..29.) Discussion of primary detectors for the actual measurements, intermediate links for transmitting the information, and indicating or recording units. A block diagram of a typical complete telemetering system is included.

621.317.39 : 531.775 **184**

A Tachometer.—A. E. Benfield. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, pp. 663–667.) Theory and operation of a simple instrument in which a d.c. e.m.f. is generated by means of a magnet attached to the rotating member. A formula for the e.m.f. is given, and the effect of varying the position and orientation of the magnet is considered. The e.m.f. is directly proportional to the speed of rotation, but is rather small; possible ways of increasing it are briefly discussed.

621.317.39 : [620.178.3 + 531.768 **185**

Modern Vibration Meters with Electrical Indication.—H. Köhler. (*Elektrotechnik, Berlin*, Oct. 1949, Vol. 3, No. 10, pp. 301–310.) The physical principles of vibration and acceleration meters are considered and short descriptions are given of a wide variety of instruments, including capacitive, electrodynamic and piezoelectric types. These fall into two groups: (*a*) with relatively low sensitivity for investigations dealing with machinery; (*b*) with high sensitivity for use in seismology and in building and mining research. A fuller account is given of a piezoelectric acceleration meter with very high sensitivity; this has a longitudinally stressed Rochelle-salt crystal as indicating element. Results obtained with this meter are described.

621.365.5 **186**

Coupling Circuits for H.F. Heating.—R. A. Whiteman. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Oct. 1949, Vol. 13, No. 4, pp. 8–11..27.) Design of such circuits for optimum power transfer and optimum loading of the power stage.

621.365.54† **187**

[Vacuum] Induction Furnace for High-Temperature Ceramic Research.—P. D. Johnson. (*J. Amer. ceram. Soc.*, Oct. 1949, Vol. 32, No. 10, pp. 316–319.) An illustrated description. Power is supplied by a 9 600-c/s generator driven by a 90-h.p. 3-phase motor. Temperatures up to 2 300°C can be obtained by using Mo for the susceptor and the radiation shields.

621.365.54† : 621.785.6 **188**

Multi-Purpose Inductance Hardening Units.—(*Machinery, Lond.*, 22nd Sept. 1949, Vol. 75, No. 1926, pp. 413–415.)

621.365.55† **189**

Temperature Behaviour in Electrically Heated Non-homogeneous Bodies.—W. F. Kussy. (*Elektrotechnik, Berlin*, Oct. 1949, Vol. 3, No. 10, pp. 323–326.) Calculations with particular application to porcelain coil-formers, for both short-period and continuous loading.

621.365.55† : 621.317.3.011.5 **190**

Dielectric Loss with Changing Temperature.—Whitehead & Rueggeberg. (*See* 137.)

621.38.001.8 **191**

Electronics in War and Peace.—A. L. Whiteley. (*Engineering, Lond.*, 30th Sept. 1949, Vol. 168, No. 4366, pp. 350–352.) Long summary of paper read before the British Association. The advantages of electronics for war purposes are high sensitivity and high speed of response. Industrial applications to welding and printing are discussed. The development of electronics in industry has been slower than expected because the installation of electronic devices often requires the re-design of machinery and the training of operating and maintenance staffs. The accuracy of electronic devices is often far greater than that required. Valve life must be lengthened. Electronic engineers must have a closer understanding of the processes they hope to improve.

621.38.001.8 : 629.13.052 **192**

An Electronic Pressure-Sensitive Transducer.—G. Day. (*J. sci. Instrum.*, Oct. 1949, Vol. 26, No. 10, pp. 327–329.) The applied pressure varies the interelectrode spacing of a double-diode valve working under space-charge-limited conditions. The resultant changes in the two anode currents produce an out-of-balance voltage in a bridge circuit of which the diodes form two of the arms. The device is primarily designed for use as an aircraft altimeter.

621.383.001.8 : 535.61-15 **193**

Applying the Infrared Image Converter Tube.—R. D. Washburne. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 150..164.) Description of a British tube, Type CRI-143, in which conversion is achieved by means of a uniform field between the anode and the cathode. The image is not inverted, and the tube is much simpler than its American counterpart. For another account see 1710 of 1948 (Pratt).

621.383.001.8 : 536.587 **194**

Light-Sensitive Cells.—(*Overseas Engr*, Nov. 1949, Vol. 23, No. 265, pp. 128–129.) Applications in industry are discussed, with particular reference to automatic temperature control during welding and pre-heating operations.

621.384.611† **195**

Betatron Injection into Synchrotrons.—F. K. Goward. (*Proc. phys. Soc.*, 1st Oct. 1949, Vol. 62, No. 358A, pp. 617–631.) Factors influencing the proportion of electrons which may be trapped and accelerated in a transition from betatron to synchrotron operation are discussed; this transition is important in synchrotron design. Machines of various energies are studied; satisfactory agreement between theory and experimental results is obtained.

621.384.611.2† **196**

A 30-Million Volt Synchrotron for Medical Use.—(*Nature, Lond.*, 29th Oct. 1949, Vol. 164, No. 4174, pp. 726–728.) A fuller description of the equipment noted in 3223 of 1949 (Martin).

621.384.611.2† **197**

The Dynamics of a Synchrotron with Straight Sections.—N. M. Blachman & E. D. Courant. (*Rev. sci. Instrum.*, Aug. 1949, Vol. 20, No. 8, pp. 596–601.)

621.384.612.1† **198**

The Electron Cyclotron.—W. J. Henderson & P. A. Redhead. (*Nucleonics*, Oct. 1949, Vol. 5, No. 4, pp. 60–67.) An experimental model, built by the National Research Council of Canada, is described. Magnetic field and applied r.f. are constant; the electron time lag per revolution due to the relativistic increase in mass is made equal to an integral number of periods of the r.f. field. This type of accelerator may have distinct advantages over other types in the energy region of 10^7–10^8 eV.

621.385.833 **199**

Electron-Optical Shadow Method.—(*Tech. Bull. nat. Bur. Stand.*, Sept. 1949, Vol. 33, No. 9, pp. 106–108.) A technique based on extensive theoretical analysis and developed at the National Bureau of Standards by L. L. Marton; theoretical formulae have been derived by S. H. Lachenbruch. An electron lens system is used to produce a shadow image of a fine wire mesh placed in the path of an electron beam. From the distortion in the shadow pattern caused by deflection of the electrons as they pass through the field under investigation, accurate values of field strength can be computed. The method can be applied to fields of very small dimensions, such as the fringe fields from the small domains of spontaneous magnetization in ferromagnetic materials. The method is somewhat similar to the electron-optical schlieren method, but is much better adapted to precise determination of field intensity.

621.385.833 **200**

A New Type of Focusing in a Magnetic Lens Field.—H. Slätis & K. Siegbahn. (*Phys. Rev.*, 15th June 1949, Vol. 75, No. 12, p. 1955.)

621.396.615 : 621-12 **201**

The Reciprocator.—White & Lord. (*See* 66.)

PROPAGATION OF WAVES

535.42 : 538.56 **202**

On the Diffraction of an Electromagnetic Wave through a Plane Screen.—J. W. Miles. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 760–771.) The screen is assumed infinitely thin and perfectly conducting. The diffraction problem is formulated, using generalized cylindrical coordinates, in terms of the generalized Fourier transform of the tangential electric field in the aperture. An integral equation for this transform is obtained. The power transferred through the aperture is calculated and expressed in a variational form of the Schwinger type. The significance and behaviour of the aperture impedance is considered. Other formulations of the problem, including one involving Babinet's principle (1335 of 1947), are discussed. The variational formulation appears to provide a convenient link between the results for large wavelengths for which Rayleigh's static methods are valid, and those for small wavelengths where geometrical optics can be used. It appears to be superior to the Kirchhoff theory for any assumed aperture field. See also 1845 of 1948 (Levine & Schwinger).

535.42 : 621.396.81.029.6 **203**

Diffraction of High-Frequency Radio Waves around the Earth.—M. D. Rocco & J. B. Smyth. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1195–1203.) The results of height-gain measurements at 7 frequencies in the range 25–9 375 Mc/s for a nonoptical path in the Gila valley, Arizona, can be adequately explained by diffraction theory alone for the lower frequencies. Fields observed at the higher frequencies for low terminal heights were considerably stronger than those predicted by standard diffraction theory, even under meteorological conditions which were subnormal near the ground. These strong fields had rapid variations with time but no variation with height. The frequency distribution of the signal fluctuations agrees with a Rayleigh distribution. Interpretation of the data according to the waveguide theory of atmospheric propagation (507 and 2892 of 1947) is being investigated.

538.566 **204**

Transmission of Electric Waves through Wire Grids.—W. Franz. (*Z. angew. Phys.*, June 1949, Vol. 1, No. 9, pp. 416–423.) The transmission of plane e.m. waves through a system of parallel grids of identical grid-constant is calculated, assuming that the radius of the wires is small with respect to the wavelength and to the wire spacing. The radiation resistances occur as coefficients in a system of linear equations from which the excitation of the individual grids and also the transmission properties of the whole system can be determined. Comparison with the measurements of Esau, Ahrens & Kebbel (2631 of 1939) shows satisfactory agreement.

538.566.2 : 535.13 **205**

The Propagation of Electromagnetic Waves through a Stratified Medium and its WKB Approximation for Oblique Incidence.—H. Bremmer. (*Physica*, *'s Grav.*, Aug. 1949, Vol. 15, No. 7, pp. 593–608.) The plane-wave solution of Maxwell's equations for a stratified medium is split into a series of terms, which have a simple physical meaning; the first of these terms constitutes the WKB approximation. By the introduction of a convenient Hertzian vector, the original vector problem is made scalar. The application of the saddle-point method to the individual terms of the series leads to simple geometric-optical approximations.

621.396.11 **206**

Velocity of Electromagnetic Waves.—C. I. Aslakson. (*Nature, Lond.*, 22nd Oct. 1949, Vol. 164, No. 4173, pp. 711–712.) The U.S. Air Forces used shoran extensively for measuring geodetic distances of from 67 to 367 miles. The results appeared to indicate that the velocity of e.m. waves was 299 792 km/sec. The method of observation was to determine the minimum of the sum of the distances between an aircraft and two ground stations as the aircraft flew across the line between the stations. The distances were corrected for the velocity of radio waves by a numerical integration along the ray path based on nearly simultaneous psychometric observations. See also 3488 of 1948 (Essen & Gordon-Smith) and 208 below.

621.396.11 : 551.510.535 **207**

Some Important Results of the Geometrical-Optical Properties of the Ionosphere.—K. Rawer. (*Rev. sci., Paris*, May/June 1948, Vol. 86, No. 3296, pp. 481–485.) The results are presented of calculations of the paths of rays reflected from an ionosphere layer with a parabolic ionization distribution, the angle of projection of the rays having any value up to 90°. Curves are also given for the field strength and the m.u.f. factor as a function of distance from the transmitter. Values calculated for the radius of the zone of silence for different angles of projection are in good agreement with the values found from formula (12) of Appleton & Beynon's paper noted in 3290 of 1940.

621.396.11.029.64 **208**

The Measurement of the Velocity of Propagation of Centimetre Radio Waves as a Function of Height above the Earth: Part 2 — The Measurement of the Velocity of Propagation over a Path between Ground and Aircraft at 10 000, 20 000 and 30 000 ft.—F. E. Jones & E. C. Cornford. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 447–452.) Continuation of 1441 of 1948 (Jones). Results of observations at two Oboe ground stations are given. The most probable values for the mean velocity of propagation between ground and aircraft are 299 713 km/s, 299 733 km/s and 299 750 km/s for aircraft heights of 10 000 ft, 20 000 ft and 30 000 ft respectively.

621.396.11.029.66† **209**

Propagation Characteristics of Tenth-Millimetre Waves.—R. Franz. (*Radio Tech., Vienna*, Aug. & Oct. 1949, Vol. 25, Nos. 8 & 10, pp. 461–464 & 581–583.) Absorption, transmission and selective-reflection properties of various solids for these waves are reviewed and the quartz-lens and residual-ray methods of isolating them are outlined. Absorption and reflection properties of gases and dipolar substances, and resonance phenomena in rock salt and other materials are considered.

621.396.81 : 621.397.5 **210**

WDTV Field-Strength Report.—Goldsmith. (*See* 250.)

621.396.812 + 538.566.3 **211**

A Survey of Ionospheric Cross-Modulation (Wave-Interaction or Luxembourg Effect).—L. G. H. Huxley & J. A. Ratcliffe. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 433–440.) Existing theoretical and experimental knowledge is surveyed. The pioneer theory of Bailey & Martyn (1934 Abstracts, p. 109 and p. 606) is restated in a form which relates it more closely to standard ionosphere theory. The experimental results are summarized in a form which enables the magnitude of the effect to be deduced approximately for any pair of stations. The way in which observations of cross-modulation can be used in ionosphere research is outlined. See also 1767 of 1949 (Cutolo & Ferrero).

621.396.812.029.62 **212**

Painless Prediction of Two-Meter Band Openings.—W. F. Hoisington. (*QST*, Oct. 1949, Vol. 33, No. 10, pp. 22–25.) Several examples of long ranges for amateur communication are correlated with the corresponding weather maps. Long ranges are associated with areas of high barometric pressure. The trailing edges of such high-pressure areas are particularly important.

621.396.812.3.029.56 **213**

Tropospheric Effects in Short and Medium Radio Wave Propagation.—W. J. G. Beynon. (*Nature, Lond.*, 22nd Oct. 1949, Vol. 164, No. 4173, p. 711.) The results obtained by Heightman (2308 of 1949) are confirmed by measurements made in July 1945 at Loth, Sutherland, on wavelengths between 60 and 300 m. Echo signals of appreciable amplitude appeared at ranges of 45 km and 65 km. They could be identified as reflections from mountains and were observed at all frequencies between 1 Mc/s and 5 Mc/s. Amplitude was often constant for several minutes or even hours, but sometimes varied by a factor of 4 or 5 to 1 in a few seconds. No well-defined variation in mean amplitude was found.

RECEPTION

621.396.621 + 621.397.62 **214**

Mass Production of Radio and Television Receivers.—M. Alixant. (*Radio tech. Dig., Édn franç.*, Aug. 1949, Vol. 3, No. 4, pp. 197–213.) Discussion of modern methods, from the prototype to the finished and tested article.

621.396.621 **215**

Features of French Broadcasting Receivers for the Season 1949-1950.—J. Rousseau. (*T.S.F. pour Tous*, Oct. 1949, Vol. 25, No. 252, pp. 325–328.) A list is given, with details of valves fitted in each receiver, type of circuit and number of stages. Only a few models have a h.f. stage preceding the frequency changer.

621.396.621 **216**

A 400-Mc/s Receiver Front End employing Sub-miniature Tubes and New Miniature Tuned Circuits.—V. H. Aske. (*Sylvania Technologist*, Oct. 1949, Vol. 2, No. 4, pp. 2–5.) A new type of matched single-tuned input circuit is used, with plunger-type tuning. This is followed by a double-tuned r.f. stage and a pentode-type mixer working into a 30-Mc/s i.f. stage. The i.f. circuit is loaded with an impedance which simulates the input loading of the i.f. valve. Design considerations and circuit and performance details are discussed. Gain could be increased by reducing the bandwidth of the r.f. valves. Results show that valves are available which can be used satisfactorily for the awkward frequencies between 400 and 1 000 Mc/s.

621.396.621 : 621.317.35 **217**

On the Energy-Spectrum of an Almost Periodic Succession of Pulses.—G. G. Macfarlane. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1139–1143.) The energy/frequency spectrum is discussed for (*a*) regularly spaced pulses whose amplitudes have random oscillations about a mean value, (*b*) identical pulses whose recurrence rate varies in a random manner about a mean value. Both spectra have two components, a line spectrum and a continuous spectrum. In case (*a*), the envelope of each component is proportional to the envelope of the spectrum of a single pulse and the spacing of the lines in the line spectrum equals the repetition frequency. In case (*b*), the envelopes of the two spectra are not the same as that of a single pulse, and the spacing of the lines equals the mean repetition frequency. Extension of the method of calculation to other cases is briefly discussed.

621.396.621.001.4 : 621.3.015.3 **218**

Transient Phenomena in Radio Receivers.—B. Carniol. (*Tesla tech. Rep., Prague*, March 1949, pp. 21–34.) For testing the a.f. part of a receiver, square-wave oscillations with a relatively low fundamental frequency are used, so that any transients will terminate within less than half a period. Unstable frequencies well outside the a.f. range usefully transmitted may affect receiver performance considerably. For the h.f. stages, a rectangularly modulated h.f. signal is used. Relations between frequency characteristics, phase characteristics and transients are discussed. Transient phenomena occurring in tuned circuits and band-pass filters on the sudden application of a d.c. or h.f. voltage are considered in some detail and illustrated by oscillograms and phase characteristics. See also 77 above.

621.396.621.53 **219**

High Gain V.H.F. Converter.—H. O'Heffernan. (*Short Wave Mag.*, Feb. 1948, Vol. 5, No. 12, pp. 720–724.) Design, construction and component details for a 50–58-Mc/s unit of exceptional performance. The unit is arranged to have extremely short r.f. wiring. Each stage can be easily adjusted. Aerial coupling can be varied from the front panel. There is similar front-panel control of the first r.f. stage trimmer. Transformer or capacitive coupling is available between stages, and coils are easily accessible. The converter is designed to work into the common 1.6-Mc/s i.f. channel of the main receiver, and to be switched in when required.

621.396.621.54 **220**

New Reception Principle for Superheterodynes.—F. Tomek. (*Radio Tech., Vienna*, Oct. 1949, Vol. 25, No. 10, pp. 584–586.) Description of a patented circuit termed the 'summadyne'. Instead of selecting the difference between the signal frequency and that of the local oscillator as the receiver i.f., the sum of the two frequencies is chosen. In order, therefore, to keep the i.f. constant, the tuning of the local oscillator must be lowered as that of the input circuit is raised. This is effected by using identical components for the two circuits, with variable capacitors ganged in opposition. The advantages of such an arrangement are enumerated. A differential capacitor is used for tuning in two examples of receiver circuits, which both use double heterodyning and one of which has an amplifier stage for the first i.f. Intermediate frequencies of about 2 000 kc/s and 100 kc/s are used.

621.396.622 **221**

Signal-to-Noise Ratios of Linear Detectors.—R. H. DeLano. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1120–1126.) A practical approach to the problem of obtaining the signal and noise spectra of the output of a linear detector, given the input signal and the input noise power spectrum. Graphical Fourier analyses are performed since the corresponding analytical expressions are cumbersome. The ratio of the input bandwidth to the centre frequency is assumed small. Certain restrictions are assumed for the input signal: an a.m. signal, for example, is regarded as the product of a slowly varying envelope and a carrier-frequency sine wave. A comparison is made with square-law detection for a few useful cases. The linear detector gives a higher output signal/noise ratio than the square-law detector for some types of signal.

621.396.622 **222**

An Improved Synchronous Detector.—W. C. Michels & E. D. Redding. (*Rev. sci. Instrum.*, Aug. 1949, Vol. 20, No. 8, pp. 566–568.) The synchronous amplifier design of Michels & Curtis (43 of 1942) has been modified to minimize feedback and hence to allow pre-amplification and a sensitivity of 2×10^5 mm/V. The instrument has an inductive input impedance of 2 MΩ and a bandwidth of 0.25 c/s at 800 c/s. Its merits are discussed.

621.396.622 : 537.312.62 **223**

Detection at Radio Frequencies by Superconductivity.—J. V. Lebacqz, C. W. Clark, M. C. Williams & D. H. Andrews. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1147–1152.) Detection by superconducting CbN was studied as a function of r.f. current, bias current and temperature. A nonlinear resistance effect occurs in the transition region, with specially high values of dR/dI for currents $<$ 1 mA. This is believed to be due to the effect of the magnetic field of the current superconductivity (Silsbee hypothesis). The observed values of dR/dI explain to a certain extent the observed rectified potentials at 1 Mc/s, but the increasing rectification observed at higher frequencies is not yet explained. See also 2531 of 1949 (Lebacqz & Andrews).

621.396.622 : 621.396.619.13 **224**

Experimental Tube for F.M. Detection.—L. J. Giacoletto. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 87–89.) A single-valve locked-in oscillator was used for f.m. detection by Bradley (227 of 1947) with a grid-controlled multigrid valve such as Type 6SA7. For optimum performance of this circuit, the current flowing beyond the second grid of the valve should not affect the oscillator circuit except through the feedback loop. In conventional multigrid valves, the oscillator grid and the input-signal grid are not sufficiently isolated to permit the use of a high-impedance input circuit. To overcome this difficulty a valve combining beam deflection and grid control was developed. Audio output on an early model was low, but proposed design changes may increase the average output current at least fivefold. Performance characteristics of various f.m. detectors are compared.

621.396.622.7 **225**

Limiter Discriminator versus Ratio Detector.—H. K. Milward & R. W. Hallows. (*Radio-Electronics*, Nov. 1949, Vol. 21, No. 2, pp. 20–22.) Results of tests carried out in England indicate that (*a*) although the difference in noise rejection is not great, the discriminator with a single limiter has slightly better performance than the ratio detector, (*b*) the discriminator with 2 limiters is decidedly superior to the ratio detector, particularly when the noise level is high. Test apparatus and procedure are discussed. See also 2345 of 1948 (Maurice & Slaughter).

621.397.82 **226**

The Influence of U.H.F. Allocations on Receiver Design.—Reid. (*See* 258.)

STATIONS AND COMMUNICATION SYSTEMS

621.391.5 : 621.395.623.66 : 791.44 **227**

Inductive Prompting System.—B. H. Denney & R. J. Carr. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 66–69.) A system which allows the producer to communicate with actors in a film studio, and which does not interfere with the film sound system. A modulated magnetic field is detected and demodulated in receivers of the hearing-aid type. Receiver leads can be made photographically invisible or concealed under the actor's clothing. The receivers have neither valves nor batteries; crystal detectors are used. Each actor wears a coil of wire in which a secondary current flows; the 100-kc/s transmitter, of which circuit details are given, is connected to a single-turn loop which surrounds the set area and induces a strong r.f. field at all points within the area.

621.396.1 : 621.396.931 **228**

Radio Communications Services : Parts 2-4.—(*FM-TV*, July, Sept. & Oct. 1949. Vol. 9, Nos. 7, 9 & 10, pp. 18–21, 45, 21–24, 30, & 21–23.) Part 1: 2907 of 1949.

621.396.619 **229**

Neglected Outphasing System of Modulation.—W. H. Hartman. (*CQ*, Oct. 1949, Vol. 5, No. 10, pp. 18–26..68.) Theory, design and constructional details of a practical transmitter using this form of modulation, which combines all the advantages of high-level modulation of a class-C amplifier with the economies of low-level systems. See also 85 of 1936 (Chireix).

621.396.619.16 **230**

A Method of Asymmetrical Pulse Duration Modulation.—R. J. Watts. (*Rev. sci. Instrum.*, Aug. 1949, Vol. 20, No. 8, pp. 622–623.)

621.396.65 + 621.396.931/.932 **231**

Review of the Applications of V.H.F. Radio Communications.—E. W. Northrop. (*G.E.C. J.*, Oct. 1949, Vol. 16, No. 4, pp. 184–196.) Discussion of typical equipment both for mobile and for point-to-point communication, choice of headquarters site, aerial height, optimum power and frequency, etc.

621.396.712 **232**

The "New Look" at KTBS.—(*Broadcast News*, Sept. 1949, No. 56, pp. 40–45.) General description of facilities available, with photographs of studios, control room etc.

621.396.931 **233**

The Planning of 'Business-Radio' Services at Very High Frequencies.—(*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 381–382.) Report on I.E.E. Radio Section discussion meeting. Two main types of service are considered: (*a*) an extension of the ordinary telephone service to mobile units, (*b*) an exclusive service for the various mobile units within one organization, such as a taxi company.

621.396.97 **234**

25 Years Broadcasting in Austria.—W. Füchsel. (*Radio Tech., Vienna*, Oct. 1949, Vol. 25, No. 10, pp. 576–580.) A review of developments at the R.A.V.A.G. station, Vienna. The 120-kW transmitter installed in 1932 on the Bisamberg, the 100-kW Graz-Dohl transmitter and low-power transmitters in Kärnten and Steiermark are mentioned. Subscribers now number over 1 200 000.

SUBSIDIARY APPARATUS

621-526 **235**

Servomechanisms and Modern Physics.—R. Moch. (*Radio tech. Dig., Édn franç.*, June & Aug. 1949, Vol. 3, Nos. 3 & 4, pp. 133–145 & 235–240..252.) The construction and operation of servomechanisms is studied and also the electronic or electromechanical calculating elements which can be incorporated in such devices, including differentiators, integrators and apparatus for other types of mathematical operations. Various examples of the application of servomechanisms are briefly described; these include process control, stabilization (as in the 'atomic clock' of the National Bureau of Standards) and calculating machines.

621-526 **236**

Design Equations for Servomechanisms.—B. Parzen. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 249–256.) Reprinted from the book noted in 268 below. Fundamental quantities, and relations between them, are derived for linear lumped-constant servomechanisms; positioning systems using electronic and electromechanical devices are considered in more detail. General theory and its application to typical positioning systems are discussed. Performance and stability criteria are briefly mentioned. See also 232 of 1949 (James, Nichols & Phillips).

621-526 **237**

Magnetic Fluid Clutch in Servo Applications.—G. R. Nelson. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 100–103.) Report on experience obtained with various iron-disk rotor designs running in a mixture of oil and powdered iron which solidifies when a magnetic field is applied. Such clutch units are useful in servomechanisms at natural frequencies below 30 c/s.

621.3.076.7 : 621.3.016.1 **238**

Torque and Speed Regulation with the Electronic Amplidyne.—J. L. Dutcher. (*Elect. Mfg, N.Y.*, July 1948, Vol. 42, No. 1, pp. 84–89..158.) Principles of the amplidyne, which differs from a conventional generator only in having an extra pair of short-circuited brushes, are discussed. Circuit diagrams showing its use for various applications are included.

621.3.077.2/.3 **239**

The Amplidyne Generator — Its Performance and Design.—M. S. Hoffenberg. (*Trans. S. Afr. Inst. elect. Engrs*, Aug. 1949, Vol. 40, Part 8, pp. 175–188. Discussion, pp. 188–191.) Discussion of: (*a*) the desirability of high amplification and low time constant in control apparatus, (*b*) the cross-field principle of operation of the amplidyne, its steady-state operation on d.c., and the effect of varying the compensation of the output stage, (*c*) the transient and steady-state response to a.c. signals of both perfectly and imperfectly compensated machines, (*d*) the effects of rocking the brushes and chording the armature windings, (*e*) two types of stator construction, (*f*) the use of an output coefficient as an aid to design, (*g*) the effect of field form factor on the average flux density, and of quadrature current on specific electric loading, (*h*) variation of power-amplification ratio with number of cycles, (*i*) the magnetic circuit and commutation, (*j*) the calculation of leakage fluxes and stage inductances.

621.314.6 : 621.315.59 **240**

Semiconductor Rectifiers.—(*Elect. Engng, N.Y.*, Oct. 1949, Vol. 68, No. 10, pp. 865–872.) Long summary, compiled by S. J. Angello, of 4 papers read at an A.I.E.E. symposium on 'Electrical Properties of Semiconductors and the Transistor', namely:—Theory of Rectification, by F. Seitz. Boundary Layers in Rectifiers, by H. Y. Fan. Noise in Semiconducting Contacts, by P. H. Miller, Jr.

A Comparison between the Schottky Rectifier Theory and Measurements upon Cuprous Oxide Cells, by S. J. Angello.

621.314.63 **241**

High Inverse Voltage Germanium Rectifiers.—S. Benzer. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 804–815.) Current/voltage characteristics were determined for various point-contact Ge rectifiers. Inverse voltages of several hundred volts were observed; a reproducible negative differential-resistance region occurs in the inverse characteristic. The metal used for the point contact has little effect; the effects of impurities, surface treatment, temperature and contact pressure are discussed. Contact between two Ge crystals is also considered.

621.314.63 **242**

The Characteristics and Applications of Metal Rectifiers.—P. A. Goodyer. (*Trans. S. Afr. Inst. elect. Engrs*, July 1949, Vol. 40, Part 7, pp. 147–172.) The characteristics of Se rectifiers are briefly described, and applications are considered fully. The relative merits of Se and Cu_2O rectifiers are discussed.

621.314.67 **243**

Thoriated Tungsten Filaments in Rectifiers.—Z. J. Atlee. (*Elect. Engng, N.Y.*, Oct. 1949, Vol. 68, No. 10, p. 863.) Summary only. A thoriated tungsten filament can have an emission efficiency of 30–40 mA/W at an operating temperature of 1 800–2 200°K with a life of 2 000 hr; it is thus superior to a pure tungsten filament. An account is given of the development of a very small 25-W rectifier for use in an X-ray application requiring a maximum of 110 kV and 250 mA from a full-wave bridge rectifier with 4 rectifier valves. Loss of emission by positive-ion bombardment is prevented by a new method of applying adequate getter. A new seasoning process prevents the deposit of thorium on the anode and glass.

621.316.722.1 **244**

Operation of Voltage-Stabilizing Elements with Current-Stabilized Supplies.—J. J. Gilvarry & D. F. Rutland. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, pp. 633–637.) The performance parameters are determined. The range-regulation factor Q is defined and suggested as a figure of merit. Advantages of a current-stabilized power supply for voltage stabilization under varying load conditions are emphasized. Stability criteria for the case when the stabilizing element has a negative-resistance characteristic are given, and also a graphical analysis for the case of nonlinear elements. The special case of voltage-reference tubes is discussed, with experimental results.

621.396.68 **245**

Variable Frequency Power Supply.—E. B. Steinberg. (*Elect. Mfg, N.Y.*, May 1949, Vol. 43, No. 5, pp. 100–102.) Design details of a single-phase parallel inverter, using hydrogen thyratrons Type 5C22, which has an output of several kilowatts. The output frequency can be adjusted between 60 and 5 000 c/s. Performance data are discussed.

621.316.7.004.5 : 621.38 **246**

Maintenance Manual of Electronic Control. [Book Review]—R. E. Miller (Ed.). Publishers: McGraw-Hill, New York, 1949, 304 pp., $4.50. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 235–236.) Based on a series of articles published in *Electrical Construction and Maintenance* on the installation and service of electronic equipment. "The book should be a valuable aid to any engineer, maintenance man or technician who is involved in any way with timing relays, time-delay relays, photoelectric relays, electronic motor control, welding control, furnace temperature control and mercury-arc rectifiers."

TELEVISION AND PHOTOTELEGRAPHY

621.397.331.2 **247**

The Image Isocon — An Experimental Television Pickup Tube based on the Scattering of Low Velocity Electrons.—P. K. Weimer. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 366–386.) A description of a new method of generating the video signal by introducing additional helical motion into the primary beam and collecting the electrons not reflected specularly to give an output signal of polarity opposite to that of the maximum current in the light. This results in (*a*) an improved signal/noise ratio in the darker parts of the picture, (*b*) freedom from spurious signals caused by multiplier dynode spots, an advantage which offsets the slightly superior resolution of the image orthicon. Closer tolerances in component design are required. The task of the operating crew is more exacting and the time lag is more objectionable than in the case of the image orthicon. Applications of the techniques used in the isocon are suggested for colour television and for image-storage tubes.

621.397.5 **248**

How RCA's Color TV Works.—E. W. Engstrom. (*FM-TV*, Oct. 1949, Vol. 9, No. 10, pp. 11–13..30.) The principles of the system were discussed in 3297 of 1947 and 572 of 1948. Improvements have been added which make possible the transmission of a high-definition colour picture in a 6-Mc/s channel. Present receivers need no modification to receive these colour transmissions in monochrome. A block diagram of the broadcasting station is included and discussed. See also *Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 122..189.

621.397.5 : 535.88 : 791.45 **249**

Theater Television Today.—J. E. McCoy & H. P. Warner. (*J. Soc. Mot. Pict. Engrs*, Oct. 1949, Vol. 53, No. 4, pp. 321–350.)

621.397.5 : 621.396.81 **250**

WDTV Field-Strength Report.—T. T. Goldsmith, Jr. (*FM-TV*, Sept. 1949, Vol. 9, No. 9, pp. 15–18, 30.) Field-strength measurements for a hilly path radiating from Pittsburgh are tabulated, shown graphically, and compared with those expected from the results given in the Ad Hoc Committee's report (3524 of 1949).

621.397.5(437) **251**

Television in Czechoslovakia.—J. Havelka. (*Tesla tech. Rep., Prague*, March 1949, pp. 2–3.) Post-war work has hitherto only been possible in laboratories. Only locally-produced equipment is used; this includes a kinescope with a flat square front. 625 lines, 25 frames/sec and negative modulation are used; picture and sound transmission are separate.

621.397.62 + 621.396.621 **252**

Mass Production of Radio and Television Receivers.—Alixant. (*See* 214.)

621.397.62 **253**

New Television Receiver without Transformers. Design with Interchangeable Units.—R. Aschen. (*T.S.F. pour Tous*, Oct. 1949, Vol. 25, No. 252, pp. 329–330.) Continuation of 2658 of 1949. Full details are given of the sound receiver, which uses two Type-UF41 pentodes as h.f. amplifier and grid detector respectively, and a Type-UL41 pentode for the output stage. Sensitivity is of the order of 200–300 μV for 50 mW in the loudspeaker.

621.397.62 : 621.385 **254**

Radio-Frequency Performance of some Receiving Valves in Television Circuits.—R. M. Cohen. (*Radiotronics*, July/Aug. 1949, No. 138, pp. 58–63.) Reprint. See 2971 of 1948.

621.397.645 **255**
Stagger-Tuned Television Amplifiers.—A. Easton. (*Radio tech. Dig., Édn franç.*, June 1949, Vol. 3, No. 3, pp. 147–152.) French version of 1344 of 1949.

621.397.7 **256**
WBAL-TV Channel 11, Baltimore.—W. C. Bareham. (*Broadcast News*, Sept. 1949, No. 56, pp. 72–80.) General description of facilities available, with photographs of studios, control room, etc., and map showing coverage.

621.397.8 **257**
TV Reception below Line of Sight.—R. B. McGregor. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 72–76.) Signals were received at a point 92 miles from the transmitter and 2 000 ft below the line of sight, with the aid of an 18-element aerial array, a cascode pre-amplifier (3061 of 1948) at the aerial and special i.f. amplifier stages and sweep circuits. Signals were received whenever the transmitter was operating. About 50% of the time, the picture was satisfactory. Sometimes it remained consistently good all the evening. Sometimes it was good by day and poor by night, more often vice versa. Some frequency-selective reception was noted. No correlation between reception and weather could be found.

621.397.82 **258**
The Influence of U.H.F. Allocations on Receiver Design.—J. D. Reid. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1179–1181.) Added protection of receivers from local oscillator radiation can be obtained by alternate channel assignments and receiver i.f. standardization. Additional protection from image interference can be given by having the picture-signal station separated by $\sqrt{2}$ times the distance between stations on adjacent channels, and co-channel stations separated by double this distance. 41.25 Mc/s is suggested as the optimum i.f. for joint v.h.f./u.h.f. usage.

TRANSMISSION

621.396.61 : 621.396.662 **259**
A New Type of V.H.F. Tank Design.—Parker. (*See* 79.)

621.396.619.23 **260**
Rectifier Modulators with Frequency-Selective Terminations.—D. G. Tucker. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 422–428.) A simple method is given for determining the performance of such a modulator provided that the terminating impedance is resistive, zero or infinite at all significant frequencies. Cases likely to be useful or unavoidable in practice are worked out for the ring, Cowan (shunt-type) and series modulators. Optimum terminating resistances and minimum insertion losses are tabulated in terms of the rectifier ratio and geometric-mean resistance.

VALVES AND THERMIONICS

621.385 : 621.396.645 **261**
Operation of Output Valves in High-Power Public-Address Amplifiers.—Bezladnov. (*See* 75.)

621.385 : 621.397.62 **262**
Radio-Frequency Performance of some Receiving Valves in Television Circuits.—R. M. Cohen. (*Radiotronics*, July/Aug. 1949, No. 138, pp. 58–63.) Reprint. See 2971 of 1948.

621.385.001.4 : 621.3.015.3 **263**
Surge Testing of High Vacuum Tubes.—Dailey. (*See* 169.)

621.385.029.63/64 : 621.317.755 **264**
Traveling-Wave Oscilloscope.—J. R. Pierce. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 97–99.) The 1 000-V oscilloscope here described was developed specially for laboratory examination of short recurrent pulses. Response is almost flat from 0 to 500 Mc/s. Input impedance is 75Ω. A peak-to-peak signal of 0.37 V gives a pattern 10 trace-widths high, which is viewed through a microscope. Good vertical deflection sensitivity is obtained by means of a travelling-wave deflection system, without transit-time bandwidth limitations. The essentials of the oscilloscope are illustrated and discussed.

621.385.032.21 : 621.317.39 : 536.5 **265**
On a New Method of Measuring the Temperature of a Thermionic Cathode.—P. Gandin & R. Champeix. (*C. R. Acad. Sci., Paris*, 12th Sept. 1949, Vol. 229, No. 11, pp. 545–547.) By differentiation of the expression for the anode current I in terms of the saturation current, negative voltage of the anode, and cathode temperature T, the following formula is derived: $T = 11\,600\rho I$, where ρ is the differential resistance of the cathode/anode space in ohms, I is in amperes and T in absolute degrees. A simple measurement circuit is described; this makes use of a transformer whose secondary provides two equal voltages of opposite phase. These voltages should be less than 0.01 V. One voltage is applied to cathode and anode, a variable d.c. voltage and a galvanometer being included in the cathode lead; the other voltage feeds a standard resistor, one terminal of which is connected to the anode. A null indicator is connected in the lead common to the two branches. Errors in determining T should not exceed 2%. Results obtained by this method will be given in a later paper.

621.385.032.212 : 681.142 **266**
Polycathode Glow Tube for Counters and Calculators.—J. J. Lamb & J. A. Brustman. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 92–96.) A cold-cathode neon-filled discharge tube whose basket-shaped anode has 30 narrow slots. Cathode fingers, in staggered sets of 10, are located so as to line up with the anode segments, the gap being 0.020 in. The 10th finger of one set is separate from the remainder and is used for numerical carrying. The initial potential difference between anode and cathodes is such that a discharge takes place between only one of the cathode fingers and the anode when a potential exceeding the breakdown voltage is applied. The residual ionization around this finger favours the formation of the next discharge at the adjacent finger of another cathode ring when that ring is energized. The tube is capable of operation at rates up to 10^5 per sec and can be adapted to decade counting circuits with rates exceeding 16 000 per sec.

621.385.832 : 535.371.07 : 621.396.9 **267**
Radar Screens.—B. de la Pinsonie. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 532–542.) The mechanism of fluorescence and phosphorescence is discussed, the characteristics of screens specially adapted for radar presentation are considered and suitable methods for measuring the various characteristics are described, with experimental results, both for ordinary radar screens and for the skiatron type.

MISCELLANEOUS

621.396 **268**
Reference Data for Radio Engineers. [Book Review]—Publishers: Federal Telephone and Radio Corporation, New York, 3rd edn 1949, 672 pp., $3.75. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, p. 242.) Material in the second edition (see 1301 of 1947) has been expanded and new material added, doubling the size. See also 236 above.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

534.321.9 **269**

Ultrasonics: A Brief Survey.—J. H. Jupe. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, pp. 422–423. Bibliography, pp. 423–424.)

534.78 **270**

Speech Communication under Conditions of Deafness or Loud Noise.—W. G. Radley. (*Proc. Instn elect. Engrs*, Part I, Nov. 1949, Vol. 96, No. 102, pp. 312–313.) Discussion on 2690 of 1948.

534.78 **271**

The Sonograph: Elements and Principles.—J. Dreyfus-Graf. (*Schweiz. Arch. angew. Wiss. Tech.*, Dec. 1948, Vol. 14, No. 12, pp. 353–362. In French.) Description of an instrument which transforms each sound into a group of electrical pulses and then into mechanical motions characterizing certain elements of the sound. It can transform speech into writing and may have wide application in linguistic investigations.

534.851 : 621.395.813 **272**

Measuring Turntable Speed Fluctuations.—E. W. Berth-Jones. (*Wireless World*, Dec. 1949, Vol. 55, No. 12, pp. 471–474.) Fluctuations of the order of 0.01% must be detected. An a.f. oscillator is used which generates a tone of known frequency, constant within less than 0.01%. This tone is fed through the recording channel to the cutter head, which is mounted in position on the recording lathe to be tested. A pickup is mounted so that it will track the groove cut by the recording head, at a distance of a few inches behind it. The output of the pickup is amplified and matched in level with a second output obtained from the recording channel. If these outputs are adjusted to be in phase initially, they can be combined to have zero resultant at constant turntable speed; small variations in this speed cause the resultant to have an amplitude dependent on the change in speed. The method can be adapted to magnetic as well as disk recording. Sensitivity can be adjusted by varying the oscillator frequency.

621.395.625 **273**

The Development of Mobile Recording Technique.—M. J. L. Pulling. (*B.B.C. Quart.*, Oct. 1949, Vol. 4, No. 3, pp. 179–192.) Description of various types of apparatus used by the British Broadcasting Corporation since 1936, notably the Type-C equipment which operated from two 6-V accumulators in series and could be carried in a private car, and the Midget Disk Recorder which weighs 35 lb complete. Magnetic recorders have not so far been used much; they have marked advantages for recording sporting events where important incidents occur infrequently and unexpectedly. Problems of organization and possible future improvements are discussed. See also 11 of 1949.

621.395.625.2 : 621.396.97 **274**

Reproduction from Disks and Records for Broadcasting.—J. W. Godfrey. (*B.B.C. Quart.*, Oct. 1949, Vol. 4, No. 3, pp. 170–175.) Variations in recording standards and in reproducing devices, particularly playback needles, make it difficult to obtain consistency in quality and signal/noise ratio. A reasonable compromise is possible if light-weight pickups and a standardized sapphire-tipped reproducing stylus are used, and if selective equalization is used in reproducing circuits. The effects of variations in playback time, in the linear speed of the groove, in recording characteristic, and in needle and groove radius are considered separately.

681.85 : 621.317.616† **275**

The Variable-Disk-Speed Method of Measuring the Frequency Characteristics of Pick-Ups.—P. R. Terry. (*B.B.C. Quart.*, Oct. 1949, Vol. 4, No. 3, pp. 176–178.) A test disk has a single band of recorded tone, and its speed of rotation is varied in a 4 : 1 range. A portion of the pickup frequency-response curve is thus obtained, which can easily be joined to similar portions at other frequencies. Although the response of a pickup cannot be fully defined in a simple manner, this method gives adequate information for practical purposes without requiring calibrated test disks.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.397.5 **276**

London-Birmingham Television Cable.—H. Stanesby & W. K. Weston. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 186–200.) Reprint. See 1279 and 1857 of 1949.

621.315.65 **277**

Notes on a Coaxial Line Bead.—D. W. Peterson. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1294.) Comment on 1582 of 1949 (Cornes).

621.392.26† 278

Electromagnetic Waves in Metal Tubes.—R. Honerjäger. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 31–44. In German.) A concise treatment of the propagation of E-, H-, and Lecher-type waves, which are grouped under the term 'line waves' (Leitungswellen). The principal formulae for the propagation constants for waveguides of rectangular or circular cross-section and for concentric cables are summarized. The excitation of line waves by electric or magnetic dipoles, and their reflection, refraction and diffraction, are also considered. References to over 30 articles and reviews published in Germany are given.

621.392.26† : 621.3.09 279

The Propagation of Electromagnetic Waves in a [cylindrical] Tube containing a Coaxial D.C. Discharge.—P. Rosen. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 868–877.) The boundary-value problem is solved. Ohm's law is assumed to hold for the a.c.: this has been verified theoretically for the case where the a.c. field is small compared with the d.c. field. "Curves which give the relationship between the complex propagation constant, γ, and the complex dielectric coefficient, K_c', have been computed for the solution in which the TEM mode of the coaxial line is approached as K_c' becomes infinite."

621.392.26† : 621.396.662 280

Corrections to the Attenuation Constants of Piston Attenuators.—J. Brown. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 491–495.) The modes existing in a circular waveguide with walls of finite conductivity are investigated and the effect of an oxide layer on the inner surface of the attenuator is considered. Expressions are derived for the corrections to the attenuation constant, which are of importance in the case of H modes when an accuracy within 1 part in 10^4 is desired.

621.396.67 + 621.315.14 281

Antennas and Open-Wire Lines: Part 1 — Theory and Summary of Measurements.—R. King. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 832–850.) The apparent impedance of an aerial as a load on an open-wire transmission line may be determined from the theoretical impedance of the isolated aerial if the transmission line end-effects and the coupling between the line and the aerial are represented by an inductance in series and a capacitance in parallel with the aerial. The inductive effects are small, while the capacitive effects may be large, so that the general variation of the apparent aerial impedance, with various types of transmission line and methods of connection, may be derived by determining the effect of a lumped positive or negative capacitance in parallel with the isolated aerial. Curves are given showing the good agreement obtained between the experimental and theoretical results. Part 2, 399 below.

621.396.67 282

Aerials.—K. Fränz. (*FIAT Review of German Science 1939–1946: Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 65–89. In German.) Discussion of the properties of dipole, long-wire, and parabolic aerials, slot and dielectric radiators, and of various measurement methods, with references to 26 relevant papers.

621.396.67 283

The Influence of Conductor Size on the Properties of Helical Beam Antennas.—T. E. Tice & J. D. Kraus. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1296.) Results of measurements on three helices of identical construction, except for conductor diameter, indicate that the frequency range of the beam mode is only slightly affected by conductor diameter. See also 306 and 1860 of 1949 (Kraus).

621.396.67 : 538.566.2 284

The Magnetic Dipole in a Stratified Atmosphere.—G. Eckart. (*Onde élect.*, Oct. 1949, Vol. 29, No. 271, pp. 378–381.) The e.m. field is determined for a dipole in a free atmosphere whose dielectric constant is a linear function of the z coordinate. The case of such an atmosphere above a plane earth is also considered. The physical interpretation of the results is discussed.

621.396.67 : 551.510.535 285

Impedance Characteristics of Some Experimental Broad-Band Antennas for Vertical Incidence Ionosphere Sounding.—H. N. Cones. (*Bur. Stand. J. Res.*, July 1949, Vol. 43, No. 1, pp. 71–78.) Results of measurements of the modulus of input impedance of a number of non-resonant aerials over a continuous frequency range from 1 to 25 Mc/s are shown graphically and discussed. The aerials are compared with each other from the standpoint of uniformity of impedance over the frequency range. The use of multiple-wire construction to lower the average input impedance, to minimize impedance variations, and to increase radiation efficiency is considered.

621.396.67 : 629.135 286

Suppressed Aircraft Aerials.—G. E. Beck. (*Wireless World*, Dec. 1949, Vol. 55, No. 12, pp. 468–470.) Drag is reduced by using (*a*) the whole aircraft as an aerial, excitation being provided by a small coil in the root of the wing, (*b*) rod or loop aerials buried in a portion of the wing or fuselage, any drag-producing cavities being filled in with a woven-glass type of dielectric, (*c*) slot aerials. Each of these methods is briefly discussed. See also 1335 of 1947 (Booker) and 2457 of 1948 (Johnson).

621.396.671 287

Gain of Aerial Systems.—J. Brown. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 409–410.) When an aperture of given size is used as an end-fire radiator instead of as a broad-side radiator, only the normal increase in gain is realized which occurs when a radiator is situated at the surface of a perfect reflector. This increase is less than that predicted by Bell (3057 of 1949), because the field strength near the plane of the aperture is not zero, at any rate in the direction of the beam.

621.396.671 288

Input Impedance of Wide-Angle Conical Antennas Fed by a Coaxial Line.—C. H. Papas & R. King. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1269–1271.) Such impedances have been computed for several flare angles; certain auxiliary functions are shown graphically.

621.396.671 : 621.317.336 289

Antennas and Open-Wire Lines: Part 2 — Measurements on Two-Wire Lines.—Tomiyasu. (*See* 399.)

621.396.677 290

Analysis of the Metal-Strip Delay Structure for Microwave Lenses.—S. B. Cohn. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, p. 1011.) Addendum to 2147 of 1949.

621.396.679.4 291

Open-Wire Line for F.M.—J. W. Ecklin. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 80–81.) Two 0-gauge wires, spaced 6-in. apart, were used for connecting a 10-kW transmitter to a high-gain aerial at the top of a 240-ft tower. Matching was effected at each end of the line by means of a bazooka, which is essentially a 1 : 1 transformer for taking care of the balanced-to-unbalanced to ground conditions, together with a $\lambda/4$ coaxial impedance-matching section. This arrangement is cheaper and more efficient than a comparable coaxial feeder and is substantially unaffected by the weather. Construction and installation details are discussed.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.3 **292**

"G" Curves in Tube Circuit Design.—K. A. Pullen. (*Tele-Tech*, July & Aug. 1949, Vol. 8, Nos. 7 & 8, pp. 34–36 & 33–35, 59.) Curves and abacs for the determination of dynamic operating characteristics of valve circuits directly and for evaluation of distortion. Applications to various amplifier and oscillator circuits are discussed.

621.3.016.352 **293**

A Generalization of Nyquist's Stability Criteria.—A. Vazsonyi. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 863–867.) A new type of diagram is developed, from which the lower limits of the 'damping ratios' can be determined, and hence the degree of stability of systems characterized by ordinary linear differential equations. See also 294 below.

621.3.016.352 **294**

A Generalization of Nyquist's Stability Criteria.—S. J. Mason. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, p. 867.) Comment on 293 above. An alternative method of Q-determination is described in which the ordinary Nyquist diagram is used.

621.3.018.83† **295**

R-Q Factor.—W. W. Harman. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1295.) The relation between the Q of an electrical resonator and its resonance or shunt resistance R can be written in the form $R = \zeta Q/\omega_0 C$, where $0 < \zeta < 1$. The R/Q factor ζ is a measure of how effectively the electric field in the resonator is concentrated in the capacitance.

621.314.2.045 : 621.3.011.4 **296**

Winding Capacitance.—N. H. Crowhurst. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, pp. 417–421, 431.) Discussion of winding capacitance for interleaved or random-wound multilayer a.f. transformers, chokes etc. Charts are given for determining distributed, interwinding or winding-to-screen capacitance. Practical examples are considered.

621.314.26 : 621.396.645.371 **297**

Frequency Changers and Amplifiers with Constant Gain.—D. G. Tucker. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1324–1327.) A method of applying negative feedback to a frequency changer by using a similar frequency changer in the feedback path is described. If the reduction of conversion gain due to the feedback is adjusted to 6 db, equal changes of ± 2 db in each frequency changer only alter the overall conversion gain by ± 0.1 db. A typical pentode circuit is described. Nonlinear distortion is reduced by the feedback. The application of the principle to stable-gain linear amplifiers is discussed; constancy of gain compares favourably with that of conventional feedback systems, but the conditions for linearity are more difficult to realize.

621.314.3† **298**

Barkhausen Noise and Magnetic Amplifiers: Part 2 — Analysis of the Noise.—J. A. Krumhansl & R. T. Beyer. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 582–586.) The Barkhausen noise is calculated for ferromagnetic cores by a method similar to that used for analysing the shot effect. The signal/noise ratio of a typical amplifier circuit is calculated and compared with the measured value. Part 1 : 2730 of 1949.

621.314.3† **299**

On the No-Load Characteristics of a Transductor.—K. Kühnert & M. Delattre. (*C. R. Acad. Sci., Paris*, 17th Oct. 1949, Vol. 229, No. 16, pp. 751–753.)

621.316.8 **300**

Fixed Resistors for use in Communication Equipment.—P. R. Coursey. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, p. 482.) Discussion on 2735 of 1949.

621.316.8 **301**

Resistors for Deposited-Circuit Techniques.—W. R. Conway. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, pp. 403–408.) Charts are given from which the dimensions of a rectangular film resistor of given wattage can be determined in terms of the aspect ratio. The case of fractional electrodes is also considered.

621.316.86 **302**

Investigations on Carbon-Layer Resistors.—A. Schulze & D. Bender. (*Elektrotechnik, Berlin*, Oct. 1947, Vol. 1, No. 4, pp. 97–105.) A short general discussion of methods of production, properties, and methods of measurement, with experimental curves showing the dependence of the resistance on age, temperature, humidity, and loading.

621.316.86 **303**

Negative Temperature Coefficient Resistors.—(*Philips tech. Commun., Aust.*, 1949, Nos. 2/3, pp. 35–39.) The resistors consist of mixed crystals of Fe_3O_4 and other spinels, such as $MgAl_2O_4$ and Zn_2TiO_4. Properties and applications are discussed.

621.318.572 : 621.396.1 **304**

Electronic Diversity Switching.—H. V. Griffiths & R. W. Bayliff. (*Wireless World*, Nov. & Dec. 1949, Vol. 55, Nos. 11 & 12, pp. 414–418 & 486–488.) The previous diversity switching system (1878 of 1949) required Type EF8 valves. Since these valves are no longer in production and no other type is available with a similar low ratio of screen to anode current, a modified dual-diversity switch using perferred types of valve was designed. This makes some simplification of the prototype triple-diversity system possible. Advantages over combined diversity systems are discussed.

621.392 **305**

Network Theorem.—E. R. Wigan. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, p. 409.) The theorem enunciated is derived very simply from the basic equations which define the properties of a quadripole. It states that the ratio between the output open-circuit voltage and the input voltage is identically equal to the ratio of the output short-circuit current to the input current, the direction of transmission of power through the network being reversed in the second case. An example of the application of the theorem is given.

621.392 **306**

A Note on Thévenin's Theorem.—(*Electrician*, 4th Nov. 1949, Vol. 143, No. 3725, pp. 1473–1474.) A simple proof, based on Kirchhoff's laws.

621.392 : 517.512.2 **307**

Application of Fourier Transforms to Variable-Frequency Circuit Analysis.—A. G. Clavier. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1287–1290.) The behaviour of passive circuits is studied for the case where f.m. is applied to the driving force. The output current or voltage is expressed in the form of a convolution integral, which can lead either to the expansion of Carson & Fry (464 of 1938) or preferably to that of van der Pol (2310 of 1946); the latter is expressed in terms of the values of the transfer impedance or admittance for the instantaneous frequency, and its derivatives. Convergence conditions are discussed. The particular case of broad-band f.m. line discriminators, for which the convolution integral can be expressed in terms of known functions, is considered. See also 1860 of 1943.

621.392 : 621.385.3 **308**

The Application of Power Series to the Solution of Non-Linear Circuit Problems.—A. W. Gillies. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 453–475.) Discussion of circuit problems in which a triode is associated with any kind of linear network; Carson's power series solution for a triode circuit can be extended to cover such cases. See also 3825 of 1945 (Tucker) and 2740 of 1948 (Cartwright).

Part 1: Triode Circuit with Negative Feedback. The reduction of nonlinear distortion in an amplifier by means of negative feedback is discussed. Conditions of stability are derived. The power-series solution remains convergent even when the circuit is regenerative, failing completely only at the point of critical regeneration. When the circuit is unstable and an e.m.f. of nearly the natural frequency is applied, the solution represents an unstable oscillation, but when the frequency of the applied e.m.f. is not near the resonance frequency, the solution represents a stable forced oscillation if the amplitude is sufficiently large.

Part 2: The Free Oscillations of a Regenerative Triode Circuit. A single complex equation determines the frequency of oscillation and the amplitude of the fundamental; the complex amplitudes of the harmonics are expressed by power series. A particular circuit is considered in detail.

Part 3: The Forced Oscillations of a Regenerative Triode Circuit. The conditions for synchronization and for the suppression of the free oscillation are discussed, and also the asymmetry of the resonance curves. The analysis is extended to harmonic and subharmonic resonance, and the mechanism by which the various effects are produced is explained.

621.392 : 621.396.619.13 **309**

The Solution of Steady-State Problems in F.M.—B. Gold. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1264–1269.) A method is described for deriving a polynomial approximation to the admittance of a given network. The degree of the polynomial depends on the ratio of the width of the sideband spectrum to the bandwidth of the network. This polynomial approximation can be used with advantage when the sideband method is impracticable and the quasi-steady-state method invalid; it enables the output wave to be expressed in terms of the derivatives of the input wave.

If the range of approximation coincides with the part of the spectrum of the input wave that is not negligible, and if the approximating function is derived from a set of orthogonal polynomials, a practical method for solving steady-state f.m. problems can be established. The validity of this method is investigated and examples are included.

621.392.5 **310**

Delay Networks having Maximally Flat Frequency Characteristics.—W. E. Thomson. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 487–490.) "A lumped-constant equivalent of a transmission line can be obtained in general in the form of a symmetrical lattice, in which the series and lattice arms are inverse and approximate respectively to the short-circuit and open-circuit impedances of half the line. One such set of approximations can be derived from the infinite ladder networks (Cauer's canonical form) equivalent to these impedances.

"These approximations produce all-pass constant impedance networks (dissipation being neglected) in which the delay is maximally flat in the sense that the first $2m-1$ derivatives of the delay with respect to frequency are zero at the origin; m is an integer expressing the order of the approximation."

621.392.52 **311**

A Generalized Formula for Recurrent Filters.—M. C. Pease. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1293.) A generalization of the formula given by Fano & Lawson (695 of 1948).

621.392.52 **312**

Impedance Transformations in Four-Element Band-Pass Filters.—R. O. Rowlands. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1337–1340.) By using a different type of basic section for constructing the filter, a similar transformation to that described by Belevitch (3818 of 1947) can be achieved with slightly greater economy, both in particular cases and in the general case.

621.392.6 **313**

Theory of 2*n*-Pole Networks.—R. Feldtkeller. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 91–102. In German.) General review, with references to 56 relevant German papers. A note is added by N. T. Ming with reference to unpublished work, from papers left by W. Cauer, on (*a*) the practical calculation of reactance, bridge, and recurrent quadripoles for given characteristics, (*b*) the design of filters with prescribed minimum damping curve in the blocking region, (*c*) the design of amplifiers with oscillatory-circuit coupling and with prescribed amplitude characteristics, (*d*) the calculation of h.f. amplifiers with relatively narrow pass-band.

621.395.645.37 : 621.395.44 **314**

Transmitting Amplifier for the K2 Carrier System.—H. C. Fleming. (*Bell Lab. Rec.*, Nov. 1949, Vol. 27, No. 11, pp. 391–393.) The line amplifiers for this system have thermistor control that keeps their output approximately constant. The amplifier at the transmitting terminal must therefore have a constant output, however many channels are in use. This is achieved by using the amplifier also as a 60-kc/s oscillator; its 60-kc/s output is varied so that the combined output, consisting of voice sidebands plus 60-c/s signal, remains nearly constant. The method is explained with the aid of circuit diagrams.

621.396.029.65† **315**

Millimetre Waves: A General Survey.—A. W. Lines. (*T.R.E. J.*, July 1949, pp. 1–20.) Discussion of: (*a*) the behaviour of the klystron and the rising-sun magnetron at mm λ, (*b*) other possible types of mm-wave generator, (*c*) atmospheric absorption, (*d*) the hobbing technique for anode construction, (*e*) possible methods of increasing resonator size or resonator separation, (*f*) tunable reflex klystrons for λ 8–9 mm, (*g*) frequency instability, (*h*) techniques for constructing small waveguides, (*i*) techniques for propagation in larger waveguides, (*j*) optical methods of transmission, (*k*) reception technique, for which the crystal valve and reflex klystron local oscillator, with a balanced mixer, are essential, (*l*) methods of measurement.

621.396.611.1 + 621.392.52 **316**

Resonance Curves from Tables of Functions, and Some Simplifications in the Theory of Electrical Filters.—H. Nitz. (*Frequenz*, Aug. 1949, Vol. 3, No. 8, pp. 237–244.) Simple series and parallel oscillatory circuits are considered and expressions are derived for their apparent impedance. By suitable transformations these expressions are put into a form which enables both branches of the resonance curve to be determined directly from tables of functions. Essential simplification of known formulae for filter characteristics results from similar transformations, including the transformation of hyperbolic functions into a form scarcely used hitherto. These transformations give an appreciably better insight into the functional behaviour of many characteristics and in conjunction with Hayashi's tables of functions reduce the time required for numerical computations. The methods are applied to T and Π filters of general form and to the simplification of certain quadripole formulae. The functions used are tabulated.

621.396.611.1 **317**

Frequency Contours for Microwave Oscillator with Resonant Load.—M. S. Wheeler. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1332–1336.) Discussion of a method of representing frequency and power relations in an oscillator coupled through a transmission line to a frequency-sensitive load. The method is applied to the case of a reactance valve coupled to a magnetron, and a solution is obtained, making certain simplifying assumptions. A more general method, not requiring these assumptions, is then developed and used to determine the limiting conditions for the appearance of frequency discontinuities in the characteristics.

621.396.611.3 **318**

Theory of Systems with Transmission-Line Coupling.—A. Weissfloch. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 103–119. In German.) Discussion with special reference to 4-pole and 6-pole devices for decimetre and centimetre waves. 35 relevant German papers are noted.

621.396.611.4 **319**

Cavity Resonators.—R. Müller. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 44–48. In German.) A short review, with references to 28 relevant German papers.

621.396.611.4 **320**

Theory of Cavity-Resonator Systems.—G. Goubau. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 120–126. In German.) Short discussion of the coupling theory developed by Dahlke, the cavity resonator being regarded as a quasi-stationary oscillatory circuit, and an outline of the $2n$-pole theory developed by Goubau.

621.396.611.4 **321**

On the Experimental Determination of the Resonance Resistance of E.M. Cavities.—F. Borgnis. (*Helv. phys. Acta*, 15th Oct. 1949, Vol. 22, No. 5, pp. 555–578. In German.) Various general methods available for the determination of resonance resistance, using microwave technique, are discussed and applied to cavity resonators, for which the e.m. field in certain regions, to which the resonance resistance is related, can be regarded as either homogeneous or rotationally symmetrical. The necessary theoretical relationships are derived; experimental investigations for λ 14 cm on resonators of different shapes confirm the suitability and the accuracy of the methods considered.

621.396.611.4 : 621.384.611.2† **322**

Quarter-Wavelength Coaxial-Line Resonators for Betatron-Started Synchrotrons.—Goward, Wilkins, Holmes & Watson. (*See* 430.)

621.396.615 **323**

Design of Nonlinear Sine-Wave Oscillators by the Moving-Axis Method.—J. Abelé. (*Ann. Phys., Paris*, Nov./Dec. 1948, Vol. 3, pp. 655–679.) The amplitude of an oscillation represented by a differential equation of the second or higher order is defined as the locus of the maxima of a family of oscillations. This definition is applied to a linear oscillator, and a geometrical construction for determining the amplitude is described. This is extended to a certain class of nonlinear oscillators which are capable of steady-state oscillations that are rigorously sinusoidal; such oscillators include those with amplitude control. See also 2525 of 1946.

621.396.615 **324**

Phase-Shift Oscillator.—W. C. Vaughan. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 391–399.) An examination of the mechanism of three- and four-mesh phase-shifting networks. The condition considered is that of steady oscillation, assuming that (*a*) oscillations can be initiated, (*b*) the waveform is sinusoidal, (*c*) the load resistance is substantially less than the input impedance of the network. From simple derivations of the values of voltage and current for each component in the network, three tables are compiled: (*a*) formulae for the frequency at which 180° phase reversal occurs, and the corresponding relations which define the voltage loss in a four-mesh network as each shunt and series impedance is varied in turn, (*b*) corresponding formulae for a three-mesh network, (*c*) the voltage and current formulae for a uniform three-mesh phase-advancing network. See also 1298 of 1948 (Dawe).

621.396.615 **325**

A Variable Phase-Shift Frequency-Modulated Oscillator.—O. E. De Lange. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1328–1330.) The theory of operation is discussed for an oscillator consisting of a broad-band amplifier whose output is fed back to the input through a phase-shifting circuit. The instantaneous frequency is controlled by the phase shift. The frequency deviation is directly proportional to the instantaneous amplitude of the modulating signal and substantially independent of the modulation frequency. A practical 65-Mc/s circuit is described.

621.396.615 **326**

The Reactance-Tube Oscillator.—H. Chang & V. C. Rideout. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1330–1331.) A single-valve combination of a capacitive or inductive reactance-valve circuit and an oscillator circuit. The capacitive type is similar to the Hartley oscillator and the inductive to the Colpitts oscillator. A linear frequency/grid-voltage relation and constant output amplitude can be obtained over a range of more than 5% around centre frequencies in the range 1–4 Mc/s.

621.396.615.17 **327**

The Blocking Oscillator as a Variable-Frequency Source.—L. Fleming. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1293.) A blocking oscillator can be used instead of the positive-bias multivibrator described by Bertram (1884 of 1948) to transform variations of a d.c. voltage into variations in the frequency of a sub-carrier.

621.396.615.17 : 621.317.755 **328**

The Integration Method of Linearizing Exponential Waveforms.—A. W. Keen. (*J. Brit. Instn Radio Engrs*, Nov. 1949, Vol. 9, No. 11, pp. 414–423.) The exponential response of the simple CR integrator to a step voltage differs from linearity by an error voltage proportional to the integral of the exponential output. Three methods of nearly cancelling this error voltage by means of an additional CR integrating circuit are given. Each corrected network has an LR equivalent and may be arranged for voltage or current excitation. Practical arrangements are discussed for (*a*) linear sawtooth voltage generation, (*b*) waveform linearization in time-base voltage amplifiers, (*c*) linear sawtooth current generation, as in television reception timebases. In case (*c*), split deflecting coils are used.

621.396.645 **329**
Valve Amplifiers for Decimetre Waves.—W. Bürck. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 1–11. In German.) The special valve and circuit problems for dm-λ apparatus are discussed and an illustrated description is given of a 3-stage amplifier for λ 59 cm. This uses disk valves. Type LD12, and tubular tank circuits, and has a power amplification of about 10 per stage. Another amplifier, using two push-pull Type-LV4 pentodes and with a power amplification of 3–4 per stage and a bandwidth of about 8 Mc/s, is mentioned. Development of valves of the ceramic-disk type enabled amplifiers to be constructed with a tuning range of 48–53 cm, a bandwidth of about 1 Mc/s and overall power amplification of about 400 for 2 stages.

621.396.645 **330**
Various Types of Amplifier.—K. Schönhammer. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 12–19. In German.) Brief discussion, with references to 64 papers published in Germany, of investigations on d.c. amplification, broad-band amplification, gain limits, linearity, feedback, and on amplifiers for voice-frequency and carrier-frequency telephony, for the transmission of speech and music, and for measurement purposes.

621.396.645 **331**
A New Wide-Band Amplifier Circuit.—R. Aschen. (*T.S.F. pour Tous*, Nov. 1949, Vol. 25, No. 253, pp. 349–352.) The principles and construction are described of an aperiodic amplifier with a remarkably linear gain curve from 25 c/s to above 10 Mc/s. The two valves used are Types EF42 and EL41, which give a gain of 20. The valves have a common load resistor and strong negative feedback from one anode to the other. Followed by a sensitive detector using a double triode, Type ECC40, and giving full-scale deflection on a 100-μA meter for an applied voltage of 250 mV, the amplifier constitutes an aperiodic monitor with many practical applications.

621.396.645 **332**
Distributed Amplification.—T. Sárkány. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1294.) Comment on 3375 of 1948 (Ginzton et al.).

621.396.645 **333**
Amplification of E.M. Waves by Interaction between Electron Beams under the Influence of Crossed Electric and Magnetic Fields.—R. Warnecke, O. Doehler & W. Kleen. (*C. R. Acad. Sci., Paris*, 10th Oct. 1949, Vol. 229, No. 15, pp. 709–710.) Increased amplification can be obtained by an arrangement such that the electrons move in a direction normal to the directions of the crossed fields. A plane structure is here considered in which there are two narrow parallel beams between parallel electrodes; a formula is derived for the complex propagation constant. The expression for the imaginary part of this constant may explain certain phenomena associated with magnetrons.

621.396.645 : 537.311.33 : 621.315.59 **334**
Some Circuit Aspects of the Transistor.—R. M. Ryder & R. J. Kircher. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 367–400.) An analysis of the type-A transistor as an active quadripole is given and the equivalent circuits for single-stage and cascade amplifiers are discussed in relation to gain, stability and termination. Gains of 15–20 db per stage can be realized and examination of the dependence of the frequency response on collector voltage and point spacing shows that useful gain is possible at frequencies up to 10 Mc/s. Large-signal operation is discussed with reference to the power output and the distortion in amplifiers and oscillators; power transistors giving outputs of 200–600 mW are described.

Over the frequency range 20–20 000 c/s the noise power per unit bandwidth is proportional to (frequency)$^{-1.1}$ and appears to be a mixture of smooth and impulse noise. The noise factor at 1 000 c/s is about 60 db.

621.396.645.029.3 **335**
High-Quality Amplifier: New Version: Parts 2-4.—D. T. N. Williamson. (*Wireless World*, Oct.–Dec. 1949, Vol. 55, Nos. 10–12, pp. 365–369, 423–427 & 477–479.) Design details of tone controls, auxiliary gramophone circuits, and a complete tone-compensation and filter unit, with the circuit of a receiver for use in districts where the spacing between the carrier frequencies of the principal local transmitters is of the order of 200 kc/s. Part 1: 3101 of 1949. See also 70 of January (Sarser & Sprinkle).

621.396.645.36 : 621.385 **336**
Secondary Emission Tubes in Wideband Amplifiers.—N. F. Moody & G. J. R. McLusky. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 410–411.) Push-pull output can be obtained from a single valve, by fitting appropriate loads in series with both dynode and anode. The application of this principle to the Type-EFP60 valves of an amplifier with distributed amplification is briefly considered. See also 3375 of 1948 (Ginzton et al.).

621.396.662 : 621.392.26† **337**
Magnetically Controlled Wave-Guide Attenuators.—T. Miller. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 878–883.) Discussion of experiments on the power loss in a waveguide filled with various iron powders, and the variations due to an external magnetic field applied either parallel or perpendicular to the magnetic component of the e.m. wave in the guide. Effects are observed which may be due to ferromagnetic resonance. A theoretical formula for the power loss of low-conductivity powders is developed and compared with experimental results.

621.396.69 **338**
Circuit Components for V.H.F.—H. Meinke. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 48–64. In German.) Reflection-free elements of uniform transmission lines and waveguides, transformers, connections between conductors of different types (such as balanced and unbalanced lines or concentric and parallel twin conductors), reflection-free terminating impedors, voltage dividers, chokes and resonance circuits are considered. References are given to 68 German publications.

621.397.645 **339**
Cathode Neutralization of Video Amplifiers.—J. M. Miller, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1345.) Addendum to 3393 of 1949.

621.318.2 **340**
Permanent Magnets. [Book Review]—F. G. Spreadbury. Publishers: Pitman & Sons, Ltd, London, 280 pp., 35s. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, p. 411.) A well-written, up-to-date and comprehensive work covering fundamental theory, materials, circuit design,

applications, measurements etc. The treatment of the subjects is concise and appropriately mathematical or descriptive.

621.318.4 + 621.314.2 **341**

Einführung in die Theorie der Spulen und Übertrager mit Eisenblechkernen (Introduction to the Theory of Coils and Transformers with Laminated-Iron Cores). [Book Review]—R. Feldtkeller. Publishers: S. Hirzel Verlag, Stuttgart, 2nd edn. Part 1, 190 pp., 10.50 DM. Part 2, 130 pp., 8 DM. Part 3, 65 pp., 4 DM. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 411–412.) The second edition, revised and extended, of one of a series of monographs dealing with telegraphy and telephony. It treats the subject both mathematically and from the practical point of view for the telecommunications engineer. The three parts deal with (*a*) coils, (*b*) transformers, (*c*) design data. "The book is . . . a valuable addition to the available information on this subject."

621.392 : 51 **342**

The Mathematics of Circuit Analysis. [Book Review]—Guillemin. (*See* 389.)

GENERAL PHYSICS

530.12 : 531.18 : 537.122 **343**

Special Relativity and the Electron.—W. W. Harman. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1308–1314.) An elementary paper, intended to introduce the subject "in a manner attractive to the engineer". See also 82 of January (Kübler.)

535.412 **344**

Study of Interference Fringes in the Neighbourhood of Caustics.—É. Durand. (*Ann. Phys., Paris*, Nov./Dec. 1948, Vol. 3, pp. 621–636.) The interference fringes near the caustic of a concave spherical mirror inclined at 45° to an incident beam of parallel rays is considered. The intensities in the system of fringes are calculated by geometrical optics and the interferences by Huyghens' principle; results are verified experimentally.

535.42 **345**

On the General Laws of Diffraction. Critical Review.—G. Toraldo di Francia. (*Rev. d'Optique*, Nov. 1949, Vol. 28, No. 11, pp. 597–611.) Difficulties encountered in the practical application of various classic theories are discussed. Different expressions for Huyghens' principle are considered; that of Luneberg appears to be most suitable for present-day applications. Luneberg has chosen a single-layer and double-layer distribution on the surface of integration which differs from that of Helmholtz and Kirchhoff. The principle of inverse interference, which is related to Huyghens' principle, is used to explain (*a*) the existence of evanescent waves, (*b*) transmission and total reflection phenomena, (*c*) diffraction of non-planar incident waves by grids, (*d*) a thermodynamic conception of diffraction.

535.8 **346**

On the Corrector Plates of Schmidt Cameras.—E. H. Linfoot & E. Wolf. (*J. opt. Soc. Amer.*, Sept. 1949, Vol. 39, No. 9, pp. 752–756.) Discussion of the design of the aspherical surface of a Schmidt corrector so as to obtain optimum performance, in an agreed sense, over the field taken as a whole.

535.8 **347**

On the Optics of the Schmidt Camera.—E. H. Linfoot. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 3, pp. 279–297.) "A fifth-order aberration function is derived for the ordinary Schmidt camera. Colour correction is also considered and a proof is given of J. G. Baker's formulae for the first three coefficients in the aspheric plate profile of a system with minimized axial colour-spreads (*Proc. Amer. phil. Soc.*, 1940, Vol. 82, pp. 323–338). Aberration functions are used to design a modified system in which the monochromatic aberrations are balanced over a finite field, and the performance of this system is compared with that of the ordinary Schmidt camera by means of spot diagrams."

537.213 : 517.564.4 **348**

The Application of Non-Integral Legendre Functions to Potential Problems.—Hall. (*See* 384.)

537.311.4 : 621.315.59 **349**

On the Theory of the A.C. Impedance of a Contact Rectifier.—J. Bardeen. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 428–434.) An extension of Dilworth's d.c. analysis (2769 of 1948) to the a.c. case, leading to the usual equivalent circuit (R and C in parallel, with R_s in series) which was discussed by Spenke in an earlier comprehensive analysis (532 of 1942). R and C may depend upon the d.c. flowing and also on frequency, because of the effect of ionic drift.

537.311.5 + 537.312.6 **350**

Distribution of Temperature and Current in Cylindrical Bodies.—C. F. Muckenhoupt. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 939–942.) These distributions depend not only on skin effect but also on the variation of resistivity with temperature. Since the resistivity change is 3–4% for every 10 C rise in temperature for metals, and greater for insulators, its effect can be appreciable. A complete solution for the steady state is given.

537.525 : 621.396.61 **351**

Relaxation Oscillations in Discharge Tubes: Application to the Study of [discharge] Ignition.—J. Moussiegt. (*Ann. Phys., Paris*, Sept./Oct. 1949, Vol. 4, pp. 593–670.) A detailed investigation is described of the phenomena associated with intermittent discharges in a commercial neon tube with twisted stranded electrodes lying along the axis, their free ends being about 3 mm apart. The critical capacitance value for the production of relaxation oscillations and the conditions during the relaxation cycle are particularly considered. Previous theories of the intermittent discharge are discussed and a theory is developed which involves a time constant for the ignition period, assuming an exponential law. This theory is confirmed for the discharge tube with axial electrodes. For other types, with different electrode structures, the theory certainly holds good in some cases. Values of the ignition time constant, determined from measurements of current maxima, are given.

538.5 **352**

The Induction of Electric Current in Non-Uniform Thin Sheets and Shells.—A. T. Price. (*Quart. J. Mech. appl. Math.*, Sept. 1949, Vol. 2, Part 3, pp. 283–310.) General equations are obtained for the induction of electric currents, in any thin-sheet distribution of conducting material, by periodic or aperiodic fields. Methods of solving these equations are considered, with special reference to plane sheets and spherical shells.

538.541 **353**

On the Theory of the Eddy-Current Anomaly.—R. Feldtkeller. (*Frequenz*, Aug. 1949, Vol. 3, No. 8, pp. 229–237.) Any explanation of this anomaly for ordinary transformer sheet must take account of the effect of variation of the initial permeability and of the doubling of the field strength from the surface to the middle of the material.

538.56.029.64 : 531.61 **354**

Torque and Angular Momentum of Centimetre Electromagnetic Waves.—N. Carrara. (*Nature, Lond.*, 19th Nov. 1949, Vol. 164, No. 4177, pp. 882–884.) When a plane circularly polarized e.m. wave is absorbed by a screen at right angles to the direction of propagation, it exerts a mechanical torque S/ω per unit surface, where

S is the Poynting vector and $\omega/2\pi$ is the frequency. Beth (2451 of 1936) measured this torque for light waves; a method of measuring it for centimetre waves is here discussed. Results are in qualitative agreement with theory; the fact that circularly polarized waves possess angular momentum is established.

538.3 **355**

The Fundamentals of Electromagnetism. [Book Review]—E. G. Cullwick. Publishers: Cambridge University Press, 2nd edn, 327 pp., 18s. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 383–384.) For comment on first edition see 4764 of 1939 and 1260 of 1940.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72 + 523.854 + 523.53] : 621.396.822 **356**

Radio Astronomy.—J. S. Hey. (*Nature, Lond.*, 12th Nov. 1949, Vol. 164, No. 4176, pp. 815–817.) Report on a British Association meeting at which recent progress was reviewed. Summaries are included of: (*a*) a paper by J. S. Hey describing investigations undertaken by the Army Operational Research Group on r.f. emission from sunspots and solar flares, (*b*) a paper by F. G. Smith on recent investigations at the Cavendish Laboratory, Cambridge, on galactic r.f. radiation, (*c*) a paper by A. C. B. Lovell on recent research in meteor astronomy at the University of Manchester by means of radio reflection or radar methods.

523.75 **357**

The Emission of Radiation from Flares.—R. G. Giovanelli. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 3, pp. 337–342.) "An extension of recent theories of the emission and absorption of radiation indicates that the temperature in a typical flare is $< 2 \times 10^5$ deg. K and the electron concentration is $< 10^{13}$ per cc."

551.510.535 : 621.3.087.4 **358**

A Single-Band 0 – 20-Mc/s Ionosphere Recorder embodying some New Techniques.—Wadley. (*See* 392.)

551.510.535 : 621.396.11 **359**

Thermal Expansion of Ionospheric Layer and Temporary Morning Disappearance of Radio Signals.—Banerjee & Singh. (*See* 440.)

551.576 : 621.396.9 **360**

Application of Radar Equipment to Storm Location in South East Asia.—Lutkin & Chisholm. (*See* 362.)

551.594.6 : 621.396.821 **361**

Atmospherics.—H. Siedentopf. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 167–171. In German.) Short discussion of different types, their relation to weather conditions, and their seasonal variations.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 551.576 **362**

Application of Radar Equipment to Storm Location in South East Asia.—F. E. Lutkin & J. Chisholm. (*J. R.E. J.*, July 1949, pp. 21–30.) The American 40-kW 3-cm radar Type AN/APS-15 was fitted in a vehicle, with a 30-in. scanner mounted on the roof, at each of 7 Royal Air Force meteorological stations. Plan presentation of clouds within 50 miles was obtained, though response was reduced at extreme range when there was rain near the observing station. On Singapore Island, an A.M.E.S. Type 13 radar was installed; this 500-kW 10-cm set has a narrow beam in the vertical plane which sweeps over 25° in elevation. Maximum range was 150 miles; cloud responses and permanent echoes could be distinguished. The general nature of storm clouds in this region and of their radar responses is discussed. There was good correlation between cloud reports by pilots or from local meteorological stations and those given by the equipments; the radar information both increased the forecaster's knowledge of atmospheric processes and was of immediate practical value for short-term forecasts for aviation.

621.396.93 **363**

Direction Finding.—P. v. Handel. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 173–183. In German.) The term 'direction finding' is used in the wider sense to include bearing and distance measurements with h.f. waves. Small-base arrangements, in which the base length is small compared with λ, are first considered, then large-base systems and finally methods of distance measurement. References are given to 35 relevant German publications.

621.396.93 **364**

Some Relations between Speed of Indication, Bandwidth, and Signal-to-Random-Noise Ratio in Radio Navigation and Direction Finding.—H. Busignies & M. Dishal. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 228–242.) Reprint. See 2232 of 1949.

621.396.933 : 621.396.619.16 **365**

Pulse-Multiplex System for Distance-Measuring Equipment (DME).—C. J. Hirsch. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1236–1242.) Distance from a ground transponder beacon is determined by measuring the time interval between sending an interrogator pulse and receiving the reply. Traffic among several beacons with overlapping service areas can be handled by frequency and pulse-pair coding arrangements so that each signal consists of a pulse pair of distinctive spacing, of the order of 10–25 μs. Circuits are described which recognize signals having only one such spacing. The equipment described is for 52 channels, but the same method could be used for 100 channels. See also 102 of January (Burgmann).

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **366**

McLeod-Type Alloy-Filled Vacuum Gauge.—J. Groszkowski. (*Nature, Lond.*, 19th Nov. 1949, Vol. 164, No. 4177, pp. 886–887.) Certain disadvantages associated with the Hg-filled McLeod gauge can be avoided if Hg is replaced by an easily fused alloy, such as that comprising 27% Pb, 13% Sn, 50% Bi and 10% Cd; the effects of this change on gauge design are discussed.

535.37 **367**

Dielectric Changes in Phosphors containing more than One Activator.—G. F. J. Garlick & A. F. Gibson. (*Proc. phys. Soc.*, 1st Nov. 1949, Vol. 62, No. 359A, pp. 731–736.) Measurements of these dielectric changes are discussed. Assuming that the changes are due to electron trapping, information regarding the nature of the traps and their apparent association with luminescence centres is derived.

535.37 : 535.61-15 **368**

The Rise in Brightness of Infra-Red-Sensitive Phosphors.—R. C. Herman & C. F. Meyer. (*J. opt. Soc. Amer.*, Sept. 1949, Vol. 39, No. 9, pp. 729–731.) "A phenomenological theory of infra-red-sensitive phosphors is given which assumes the existence of two types of luminescent centers in order to account for the so-called 'inertia' effects in the rise of brightness. The equations describing the electron transfer processes have been integrated and show under certain conditions a very rapid initial rise in brightness followed by a relatively slow attainment of the maximum. The effect of varying the intensity of the stimulating infra-red radiation is discussed."

535.61-15 : 535.215 **369**

The Temperature Variation of the Long-Wave Limit of Infra-Red Photoconductivity in Lead Sulphide and Similar Substances.—T. S. Moss. (*Proc. phys. Soc.*, 1st Nov. 1949, Vol. 62, No. 359B, pp. 741–748.)

538.221 **370**

Ferro-Magnetism.—(*Elect. Times*, 17th Nov. 1949, Vol. 116, No. 3028, pp. 687–688.) Discussions at an I.E.E. symposium.

538.221 **371**

Ferroxcube.—(*Philips tech. Commun., Aust.*, 1949, Nos. 2/3, pp. 28–34.) Manufacture, properties and applications of two varieties of low-loss ferrites.

538.221 **372**

Magnetic Characteristics of an Oriented 50-Percent Nickel-Iron Alloy.—J. H. Crede & J. P. Martin. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 966–971.) Single-crystal magnetic properties have been closely approached in a polycrystalline 50%-Ni 50%-Fe alloy by the development of a favourable grain orientation. Elimination of the first and third steps of the normal magnetization process produced a hysteresis loop of nearly rectangular shape.

538.221 **373**

Magnetic Viscosity in Mn-Zn Ferrite.—R. Street & J. C. Woolley. (*Proc. phys. Soc.*, 1st Nov. 1949, Vol. 62, No. 359A, pp. 743–745.)

546.431.82 : 536.48 **374**

Symmetry Changes in Barium Titanate at Low Temperatures and their Relation to its Ferroelectric Properties.—H. F. Kay & P. Vousden. (*Phil. Mag.*, Oct. 1949, Vol. 40, No. 309, pp. 1019–1040.) The optical changes in $BaTiO_3$ are described; they can be completely explained if the crystal symmetry changes from tetragonal to orthorhombic at −5°C, and then to rhombohedral at −90°C. These changes have been confirmed by X-ray investigations: they are due to successive spontaneous polarizations along the [100], [110] and [111] cube directions. The relation of polarization to the cell structure is discussed; the simple Lorentz equation does not apply if the Ti/O interaction energy is large. The three transitions are explained on the basis of this interaction; difficulties of electrical dipole co-operative effects in $BaTiO_3$ are considered.

549.514.51 **375**

Increase in Q-Value and Reduction of Aging of Quartz Crystal Blanks.—A. C. Prichard, M. A. A. Druesne & D. G. McCaa. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, p. 1011.) The quartz blank is annealed by heating it almost to the inversion temperature of quartz, or 500°C, and cooling it down extremely slowly. Values of *Q* thus obtained are at least double those of untreated quartz blanks, and variations in frequency and *Q* are minute. These improvements appear to be permanent. A more detailed report is being prepared.

549.514.51 **376**

Salvaging Electrically Twinned Quartz.—J. L. Rycroft & L. A. Thomas. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, pp. 410–415. Correction, *ibid.*, Dec. 1949, Vol. 21, No. 262, p. 477.) For another account see 112 of 1949 (Wooster, Wooster, Rycroft & Thomas).

621.315.59 **377**

Editorial Note regarding Semiconductors.—(*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 335–343.) Surveys briefly the atomic physics of impurity semiconductors, with special reference to Si and Ge and the phenomena of rectification and amplification in semiconducting devices.

621.315.59 **378**

Theory of Transient Phenomena in the Transport of Holes in an Excess Semiconductor.—C. Herring. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 401–427.) "An analysis is given of the transient behaviour of the density of holes n_h in an excess semiconductor as a function of time t and of position x with respect to the electrode from which they are being injected. When the geometry is one-dimensional, an exact solution for the function $n_h(x,t)$ can be constructed, provided certain simplifying assumptions are fulfilled, of which the most important are that there be no appreciable trapping of holes or electrons and that diffusion be negligible. An attempt is made to estimate the range of conditions over which the neglect of diffusion will be justified. A few applications of the theory to possible experiments are discussed."

621.315.59 : 537.311.33 : 621.396.645 **379**

The Theory of *p-n* Junctions in Semiconductors and *p-n* Junction Transistors.—W. Shockley. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3 pp. 435–489.) "In a single crystal of semiconductor the impurity concentration may vary from *p*-type to *n*-type producing a mechanically continuous rectifying junction. The theory of potential distribution and rectification for *p-n* junctions is developed with emphasis on germanium. The currents across the junction are carried by the diffusion of holes in *n*-type material and electrons in *p*-type material, resulting in an admittance for a simple case varying as $(1 + i\omega\tau_p)^{\frac{1}{2}}$ where τ_p is the lifetime of a hole in the *n*-region. Contact potentials across *p-n* junctions, involving no current, may develop when hole or electron injection occurs. The principles and theory of a *p-n-p* transistor are described."

621.315.59 : 537.311.33 : 621.396.645 **380**

Hole Injection in Germanium — Quantitative Studies and Filamentary Transistors.—W. Shockley, G. L. Pearson & J. R. Haynes. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 344–366.) Holes injected by an emitter point into thin single-crystal filaments of germanium can be detected by collector points. From studies of transient phenomena the drift velocity and lifetimes (as long as 140 μs) can be directly observed and the mobility measured. Hole concentrations and hole currents are measured in terms of the modulation of the conductivity produced by their presence. Filamentary transistors utilizing this modulation of conductivity are described.

621.315.611.011.5 : 548.0 **381**

Polarizability and Dielectric Constant of Ionic Crystals.—B. Szigeti. (*Trans. Faraday Soc.*, Feb. 1949, Vol. 45, No. 314, pp. 155–166.) The polarizability α of a crystal is connected with its natural frequencies. In static fields or for very long external waves it depends on the shape of the material, but for short waves it depends only upon whether the wave is longitudinal or transverse. The Clausius-Mosotti formula connecting α with the dielectric constant χ is $(\epsilon-1)/(\epsilon+2) = 4\pi\alpha/3$; it holds for a sphere in very long waves. The Drude formula $\epsilon - 1 = 4\pi\chi$ is valid for short transverse waves. For short longitudinal waves, $4\pi\chi = (\epsilon-1)/\epsilon\pi$.

669.177 **382**

Electrolytic Iron.—C. Tschäppät. (*Schweiz. Arch. angew. Wiss. Tech.*, Aug. 1949, Vol. 15, No. 8, pp. 225–242. In French.) The production of thin sheets of electrolytic iron has hitherto been a matter of great difficulty. An account is given of investigations, extending over the last 20 years, with the object of producing thin sheets directly by electrolysis, thus eliminating melting and rolling processes. The principles of the process evolved are explained and the mechanical and electrical properties of the sheets produced are described. Such sheets of thickness 0.05–0.3 mm appear to be ideal for many electrotechnical applications as well as for the production of small mechanical parts.

621.775.7 **383**

Treatise on Powder Metallurgy: Vol. 1 — Technology of Metal Powders and their Products. [Book Review]—C. G. Goetzel. Publishers: Interscience Publishers, London, 778 pp., £6. (*Metal Ind., Lond.*, 9th Dec. 1949, Vol. 75, No. 24, pp. 495–496.) The first of 3 volumes planned " to organize the mass of present-day knowledge on powder metallurgy in a standard manner". A short introductory chapter maps out the whole field; succeeding chapters fill in the details. ". . . this work can be unreservedly recommended to all who have any interest in powder metallurgy."

MATHEMATICS

517.564.4 : 537.213 **384**

The Application of Non-Integral Legendre Functions to Potential Problems.—R. N. Hall. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 925–931.) The numerical evaluation of various potentials requires knowledge of zero-order Legendre functions of real but non-integral degree. Tables and curves are given for the zeros of these functions and for certain integrals, together with a number of associated approximate formulae. Illustrative examples involving conducting cones, spheres and rings are included.

517.942 : 538.566 **385**

On Weber's Function.—C. G. Darwin. (*Quart. J. Mech. appl. Math.*, Sept. 1949, Vol. 2, Part 3, pp. 311–320.) Discussion of the behaviour of real solutions of the differential equation

$$(d^2u/dx^2) + (\tfrac{1}{4}x^2 - a)u = 0$$

which occurs in connection with e.m. wave propagation in the ionosphere and in vibration problems. Convergent power series are given for the two solutions, and also associated asymptotic series for large values of x and for large values of a. Tables of the real solutions are being prepared.

681.142 **386**

An Electronic Differential Analyzer.—A. B. Macnee. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1315–1324.) The analyser described can be used to solve ordinary differential equations, both linear and nonlinear, of orders up to and including the sixth. The coefficients may be constant or variable. The analyser has a high speed of operation and is extremely flexible. Questions of periodicity and stability and of the continuity of solutions can be investigated, as well as problems in which final rather than initial values are specified. New types of electronic function generator and of electronic multiplier are used. Accuracy is within 1–5%; solutions can be repeated within 0.002–0.1%. Sources of error are analysed.

681.142 **387**

The Bell Relay Computer.—F. L. Alt. (*Instruments*, Oct. 1948, Vol. 21, No. 10, pp. 912–913.) A brief illustrated discussion. This computer is a great deal slower than the ENIAC, but much more flexible; it can be instructed to choose between alternative courses of action. See also I.R.E. paper by G. R. Stibitz entitled "Counting Computers", of which a summary was noted in 1703 of 1949.

51 : 621.39 **388**

Compléments de Mathématiques à l'Usage des Ingénieurs de l'Électrotechnique et des Télécommunications (Mathematics for Electrical and Telecommunications Engineers.) [Book Review].—A. Angot. Publishers: Éditions de la Revue d'Optique, Paris, 1949. 660 pp. (*Nature, Lond.*, 12th Nov. 1949, Vol. 164, No. 4176, pp. 809–810.) In the reviewer's opinion the book provides " a common language " for the pure mathematician and the practical man. It shows both the relevant applications of theory and the theoretical basis of familiar practical results. Many subjects are covered. Fundamental groundwork is included for each, with full discussion of appropriate numerical examples. A sufficient basis for the reader's further progress by himself is thus provided. The book is " recommended both as a textbook and especially as a reference book".

51 : 621.392 **389**

The Mathematics of Circuit Analysis. [Book Review]—E. A. Guillemin. Publishers : J. Wiley & Sons, New York, 1949, 575 pp., $7.50. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1304 : *J. Franklin Inst.*, Oct. 1949, Vol. 248, No. 4, pp. 356–357.) " It is not a mathematical textbook on the principles of circuit analysis, but rather . . . a presentation, within the compass of a single volume, of material appropriate to provide for the student fundamental mathematical equipment for the understanding of the theory underlying advances in the subject of circuit analysis. Applications of the theory are reserved for later publications . . . Each chapter furnishes a well-rounded treatment of its subject."

517.948 **390**

Integralgleichungen (Integral Equations). [Book Review]—G. Hamel. Publishers : Springer-Verlag, Berlin-Göttingen-Heidelberg, 2nd edn 1949, 166 pp., 15.60 DM. (*Phys. Blätter*, 1949, Vol. 5, No. 10, pp. 481–482.) Theory and applications. Based on a course of external lectures at the Technical College, Berlin.

MEASUREMENTS AND TEST GEAR

531.761 **391**

Direct Reading Timer and Clock.—A. E. Wolfe, Jr, & F. G. Steele. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Nov. 1949, Vol. 13, No. 5, pp. 3–5, 28.) Design and construction details of an electronic clock for measuring intervals from 0.01 sec to 24 hr. For another account see *Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 75–77.

621.3.087.4 : 551.510.535 **392**

A Single-Band 0-20-Mc/s Ionosphere Recorder embodying some New Techniques.—T. L. Wadley. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 483–486.) Description of a recorder developed in South Africa. See also 229 of 1948 (F. J. Hewitt, J. Hewitt & J. Wadley).

621.317.3 **393**

Measurement of [electrical] Constants of Materials.—C. Schmelzer. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 268–278. In German.) A review of various methods for measurement of dielectric constant, loss factor, h.f. resistance etc., including methods suitable for u.h.f. References to 32 relevant German publications are given.

621.317.3 : 621.396.11 **394**

Wave-Propagation Measurements.—Beckmann. (*See* 441.)

621.317.324† **395**

Measurement of Field Distribution.—A. Stenzel. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 264–268. In German.) A short account of the 'test-body' method used first by Müller for loss-free cavity resonators (1379 of 1940) and extended by Goubau to the general linear 2-pole (1870 of 1944).

621.317.335.3† : 621.315.615 **396**

The Measurement of Dielectric Constants of Liquids by a Frequency Deviation Method.—W. L. G. Gent. (*Trans. Faraday Soc.*, Aug. 1949, Vol. 45, No. 320, pp. 758–

759.) A method which allows a continuous check to be made on the standard capacitance by calibration against a crystal oscillator.

621.317.335.3† + 621.317.374† : 621.396.611.4 **397**

Measurement of the Dielectric Constant and Loss of Solids and Liquids by a Cavity Perturbation Method.—G. Birnbaum & J. Franeau. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 817–818.) The changes Δf, ΔQ in the resonance frequency and Q of a cavity resonator when a small cylindrical sample of a solid is inserted are measured by a method in which the resonance curve, together with a pair of calibrated variable frequency markers, are displayed on a c.r.o. screen. Formulae due to Bethe & Schwinger relate Δf and ΔQ to the complex dielectric constant of the solid. A block diagram of the equipment is given. Typical results are tabulated and compared with those of Bleaney, Loubser & Penrose (3187 of 1947). The method described extends the usefulness of Sproull & Linder's method (2240 of 1946) by its sensitive technique for measuring small frequency differences.

621.317.336 **398**

Impedance Measurements.—A. Weissfloch. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 234–241. In German.) A general description of methods suitable for use in the dm-λ and cm-λ regions. The methods mainly use resonance effects or the properties of transmission lines. References to 14 relevant German papers are given.

621.317.336 : 621.396.671 **399**

Antennas and Open-Wire Lines: Part 2 — Measurements on Two-Wire Lines.—K. Tomiyasu. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 892–896.) Difficulties involved in such measurements are discussed. These include the problem of balance. The impedance of aerials is shown to depend on the nature of the driving structures. Measured impedances agree well with theoretical values. Part 1: 281 above.

621.317.372 **400**

Microwave Q Measurements in the presence of Series Losses.—L. Malter & G. R. Brewer. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 918–925.) Appreciable errors can result from neglecting the losses in coupling devices, which appear in equivalent circuits in the form of series resistance. Formulae are derived and curves are plotted for determining Q and the circuit efficiency, given the s.w.r. at resonance and far from resonance, and knowing whether the resonant system is undermatched or overmatched to the external load.

621.317.616† : 681.85 **401**

The Variable-Disk-Speed Method of Measuring the Frequency Characteristics of Pick-Ups.—Terry. (*See* 275.)

621.317.7.001.4 **402**

Operation and Care of Circular-Scale Instruments: Part 3 — Electrodynamic Type Instruments.—J. Spencer. (*Instruments*, Sept. 1948, Vol. 21, No. 9, pp. 836–839 .. 852.) Discussion of single-phase and polyphase wattmeters and frequency meters, with special reference to the Westinghouse Type KF-24 and the General Electric Type AB-12. Parts 1 & 2: 146 of January.

621.317.7.029.64 : 621.392.26† **403**

A Michelson-Type Interferometer for Microwave Measurements.—B. A. Lengyel. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1242–1244.) 1949 I.R.E. National Convention paper noted in 1713 of 1949 [No. 14]. The optical Michelson interferometer is modified by replacing one of its branches by a directional coupler and a waveguide. Various applications are discussed. An instrument for λ 3.2 cm is described. For a similar instrument, see 162 of January (Pippard).

621.317.74 : 621.396.9 **404**

A Radar Test Set for the Super-High-Frequency Band of 9 000–9 700 Mc/s.—W. Rosenberg, J. S. Fleming & E. D. Hart. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 476–482.) The quantities such a test set must be able to measure are: (*a*) mean power output of transmitter, (*b*) mean transmitter frequency, (*c*) s.w.r. in the aerial feeder, (*d*) width of the transmitter spectrum, (*e*) recovery time of the t.r. switch, (*f*) receiver sensitivity, (*g*) the i.f. response curve. Facilities must also be provided for checking receiver a.f.c. and for tuning. The waveguide system and circuits of a set meeting these requirements are described, and the methods of making the various measurements are outlined.

621.317.755 **405**

High-Frequency Oscillography.—R. Theile. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 241–264. In German.) The development of high-power sealed c.r. tubes is described and some details of the A.E.G. tube (noted in 1946 of 1943) are given. Hollmann's microwave oscillograph (1977 of 1940) and transit-time oscillography using dynamic Lissajous figures (544 of 1940) are discussed and also single-sweep methods (2198 of 1941). References to 33 relevant German papers are given.

621.317.755 : 621.317.761 **406**

Frequency Spectrometer.—W. Kroebel. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 227–233. In German.) A method is described for analysing the signals from a transmitter and displaying the frequency spectrum on a c.r.o. The method can be used throughout the range from the longest waves to cm waves.

621.317.755.087.4 **407**

A Miniature Portable Cathode-Ray Oscillograph Recorder.—C. F. Johnson. (*Instruments*, Sept. 1949, Vol. 22, No. 9, pp. 800–801.) A 1-in. c.r.o. Type RCA-913 is fixed inside a 3-in. brass tube which is silver-soldered to the top of a light-tight sheet-metal box of dimensions 2 × 2.5 × 5 in., containing the readily removable paper-drive mechanism. A tape mask forming a 1/64-in. slit is placed over the face of the c.r.o., and the intensity and size of the spot are adjusted to give the correct exposure. For a given spot intensity, the width of the trace is inversely proportional to the speed of the spot. A dry battery supplies power to the c.r.o. and to an associated high-gain a.f. amplifier.

621.317.761 **408**

Absolute Frequency Measurement.—A. Scheibe. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 216–226. In German.) An account of the quartz clocks, frequency and wavelength standards, oscillation generators and associated magnetron valves, and indicators for measurements with cm and mm waves, of the Physikalisch-Technische Reichsanstalt in the years 1936 to 1945.

621.317.78 **409**

Power Meter for Communication Frequencies.—R. L. Linton, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1245–1246.) A portable, rugged instrument which is easy to use, for measuring the power delivered to an aerial in the frequency range 2–20 Mc/s and power range 1–200 W. Accuracy is within ± 50%. A directional coupler loop of the type described by Early (1007 of 1947) is used.

621.317.79 : 621.396.61 **410**

Signal Generators.—C. Schmelzer. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 211–216. In German.) Sources are considered which will provide oscillations approximating closely to sine waves over a wide range of both frequency and amplitude. References to 27 relevant German papers are given.

621.385.001.4 **411**

A Universal Visual Valve Tester.—F. L. Hill & C. W. Brown. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, pp. 425–430.) The valve tester described incorporates a c.r. tube on which is displayed a complete family of V_a/I_a curves for ten different grid voltages. Sockets are provided to accommodate all modern types of valve, and a universal connection board enables any electrode to be connected to any supply. The 12-phase generator used is operated from 3-phase or single-phase mains.

621.392.26† : 621.396.662 **412**

Corrections to the Attenuation Constants of Piston Attenuators.—Brown. (*See* 280.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.768 : 549.514.51 **413**

A Piezoelectric Device for Measuring Momentary Accelerations.—E. Völcker. (*Frequenz*, Aug. 1949, Vol. 3, No. 8, pp. 244–249.) Details of the construction and calibration of apparatus in which the acceleration to be measured is applied to a small cylinder whose slight motion compresses a quartz rod. The resulting potential developed on the side of the rod is amplified and applied to one pair of deflection plates of a c.r.o.

534.321.9 **414**

Ultrasonics: A Brief Survey.—Jupe. (*See* 269.)

534.321.9.001.8 : 534.88 **415**

Obstacle Detection using Ultrasonic Waves in Air.—G. Bradfield. (*Electronic Engng*, Dec. 1949, Vol. 21, No. 262, pp. 464–468.) Discussion of experimental results obtained with a spark transmitter using a standard 14-mm spark plug with the 1-mm gap at the focus of a 7½-in. paraboloid; the microphone included a hollow double bimorph Rochelle-salt crystal of dimensions 9.5 × 9.5 × 3 mm, resonant at about 19 kc/s, and was used with a Type-CV138 head amplifier. Frequencies of 52 and 110 kc/s were used. Signal strengths obtained from various objects at different distances are tabulated. The directivity of the apparatus was very high, giving good resolution of objects which are side by side; poor scattering surfaces such as walls gave feeble returns, especially at oblique incidence. At this stage of development, ultimate success with equipment of this type as an obstacle detector for use by the blind, or as a fog safety device, cannot be confidently predicted.

620.91 : 537.56 **416**

Comparative Survey of Ion Guns: Parts 1-3.—M. Hoyaux & I. Dujardin. (*Nucleonics*, May–July 1949, Vol. 4, Nos. 5 & 6, pp. 7–9, 12–29 & Vol. 5, No. 1, pp. 67–71.) Part 1: General properties and specific characteristics of typical guns. Part 2: Properties and relative merits of representative ion sources, with bibliography of 86 references. Part 3: Necessary refinements of ion gun design.

621.317.39 : 531.77 **417**

Precision Speed Measurement of Rotating Equipment.—M. W. Hellar, Jr. (*Gen. elect. Rev.*, Oct. 1949, Vol. 52, No. 10, pp. 22–26.) An instrument is described which will measure instantaneous values of speed of rotation with accuracies of ± 0.025% and ± 0.125% over the ranges 1 710–1 780 r.p.m. and 1 350–1 700 r.p.m. respectively. A signal-frequency voltage is derived from the machine under test by a generator loading device or by a photocell method, and mixed with a standard-frequency voltage generated by a synchronous motor driving a small induction alternator. The difference frequency is selected and measured to give slip speed in r.p.m., from which running speed is at once determined.

621.317.39 : 620.172.222 **418**

The Measurement of Changes in Length with the aid of Strain Gauges.—A. L. Biermasz & H. Hoekstra. (*Philips tech. Rev.*, July 1949, Vol. 11, No. 1, pp. 23–31.) Description of strain gauges Types GM4472 and GM4473 manufactured by Philips, and associated bridges. Various applications are considered.

621.365.54† **419**

Radio-Frequency Induction Furnaces.—(*Metallurgia, Manchr*, Oct. 1949, Vol. 40, No. 240, p. 336.) Brief illustrated description of a Metropolitan-Vickers 25-kW 600-kc/s unit which can be used to melt 20 lb of ferrous metal in about 30 min, using 380–460-V 50-c/s 3-phase power supply. Similar 5-kW and 10-kW units are also mentioned.

621.365.54† **420**

High-Frequency Induction Heating.—(*Metallurgia, Manchr*, Oct. 1949, Vol. 40, No. 240, pp. 332–334.) Description of a new forging shop at John Garrington & Sons, Bromsgrove. Three 10-kc/s generators are installed, each consisting of two 150-kW units driven by a common motor and feeding separate induction heaters for small billets. There are also three 3-kc/s generators, each with two 250-kW units which can be run independently or in parallel, for heating larger billets. Power consumption varies from 400 to 500 kWh per ton according to the size of billet. By using induction heating, high rates of production can be maintained in clean and airy buildings. Forging can be begun within a few minutes of starting up.

621.365.54† **421**

Induction Heating.—(*Metal Ind., Lond.*, 9th Dec. 1949, Vol. 75, No. 24, pp. 498–501.) Illustrated description of various applications in the non-ferrous metal industry.

621.365.54† : 621.785.6 **422**

Multi-Purpose Induction Hardening Units.—Please alter title of 188 of January to read as above.

621.365.55† **423**

Dielectric Heating : Applications in the Foundry.—J. Pound. (*Metal Ind., Lond.*, 21st Oct.–4th Nov. 1949, Vol. 75, Nos. 17–19, pp. 351–353, 379–381 & 399–400.) The use of dielectric heating for the baking of resin-bonded sand cores is considered.

621.38.001.8 **424**

Industrial Applications of Electronic Techniques.—H. A. Thomas. (*Proc. Instn elect. Engrs*, Part I, Nov. 1949, Vol. 96, No. 102, pp. 323–324.) Discussion on 3992 of 1947.

621.38.001.8 : 578.088.7 **425**

Biological Properties of Microwaves.—L. de Seguin. (*Onde élect.*, Oct. 1949, Vol. 29, No. 271, pp. 368–377 : *Ann. Radioélect.* Oct. 1949, Vol. 4, No. 18, pp. 331–343.) Experiments were conducted to determine the effect of microwaves on bacteria, tissue growth and capillary circulation, and their penetration of dead and living tissue. Microwaves have much greater penetration than infra-red rays and are preferable to the longer e.m. waves for therapeutic heat treatment.

621.38.001.8 : 786.6 **426**

The Hammond Spinet.—A. Douglas. (*Electronic Engng*, Dec. 1949, Vol. 21, No. 262, pp. 461–463.) General description and circuit details of a simplified type of instrument for home use, similar to the organ noted in 470 of 1949 (Wells) and back references.

621.383 : 551.576 **427**

Telemetry of Clouds by means of Light Pulses.—A. Baude. (*Radio franç.*, Oct. 1949, No. 10, pp. 3–17.) A very short pulse of light is sent vertically upwards from a source at the focus of a parabolic mirror; the light scattered from the base of a cloud towards a receiving photocell near the transmitter is concentrated by a second parabolic mirror. Electronic methods are used to measure the time interval t between the transmitted and received pulses; the cloud height is at once given by $h = 150t$, where t is in μs. Measurement accuracy to a fraction of 1 μs is necessary. Equipment details of two French sets, with typical records, are given. See also 1943 of 1946 (Moles) and 2657 of 1946.

621.384.6 : [615.849 + 53 **428**

The Development of Linear Accelerators and Synchrotrons for Radiotherapy and for Research in Physics.—J. Cockcroft. (*Proc. Instn elect. Engrs*, Part I, Nov. 1949, Vol. 96, No. 102, pp. 296–303.) A general survey, with brief reference to early types, the travelling-wave accelerator, the Atomic Energy Research Establishment accelerator, the 10-MeV accelerator developed by Metropolitan-Vickers for the Medical Research Council, and a 30-MeV betatron-started synchrotron. Applications to radiotherapy and physical research are considered. See also 175–177, 1148 and 2595 of 1949.

621.384.611.1† **429**

Electronics applied to the Betatron.—T. W. Dietze & T. M. Dickinson. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1171–1178.) Discussion of circuits for electron injection and ejection, and X-ray monitoring.

621.384.611.2† : 621.396.611.4 **430**

Quarter-Wavelength Coaxial-Line Resonators for Betatron-Started Synchrotrons.—F. K. Goward, J. J. Wilkins, L. S. Holmes & H. H. H. Watson. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 508–516.) Description of air-spaced and silvered-dielectric resonators for use in synchrotrons giving energies < 400 MeV. Methods of feeding, monitoring and tuning, modes of resonance, power requirements, and measurements on resonators which have been incorporated in 8-MeV and 30-MeV synchrotrons are considered.

621.385.833 **431**

The Design and Construction of a New Electron Microscope.—M. E. Haine. (*Proc. Instn elect. Engrs*, Part I, Nov. 1949, Vol. 96, No. 102, pp. 303–304.) Discussion on 2041 of 1948.

621.385.833 : 016 **432**

Metallurgical Achievements of the Electron Microscope.—G. A. Geach. (*Metallurgia, Manchr*, Oct. 1949, Vol. 40, No. 240, pp. 319–324. Bibliography, pp. 324–326.) A review of the literature to the end of 1948.

621.385.833 : 669.017 **433**

Electron Microscope and Diffraction Study of Metal Crystal Textures by means of Thin Sections.—R. D. Heidenreich. (*J. appl. Phys.*, Oct. 1949, Vol. 20, No. 10, pp. 993–1010.)

621.365.5 **434**

Radio-Frequency Heating Equipment. [Book Review]—L. L. Langton. Publishers: Pitman & Sons, London, 196 pp., 17s. 6d. (*Metal Ind., Lond.*, 9th Dec. 1949, Vol. 75, No. 24, p. 496.) ". . . the time is suitable for such a book on the theory and practice of the generator. This book covers the subject in detail and is one that should be on the list of all engineers interested in this field of electronics."

621.38.001.8 **435**

Electronics in the Factory. [Book Review]—H. F. Trewman (Ed.). Publishers: Pitman & Sons, London, 183 pp., 20s. (*Electronic Engng*, Dec. 1949, Vol. 21, No. 262, pp. 475–476.) "Compiled by members of the staff of Electrical and Musical Industries, Ltd . . . but the contents are well representative of all branches and manufacturers . . . The writing is clear and not too tedious to be read by the directors, general managers and production engineers to whom the book is addressed." Subjects covered include timing circuits, counting, motor control, regulation, heating, servomechanisms, photocell applications and strain gauges.

PROPAGATION OF WAVES

538.566 **436**

On the Boundary Conditions in the case of Two Absorbent Media in Contact.—H. Arzeliès. (*Ann. Phys., Paris*, Nov./Dec. 1948, Vol. 3, pp. 637–654.) The general boundary conditions for such media are derived from Maxwell's equations. The results can be used to express the theory of reflection in a very simple form. See also 3250 of 1947 (Booker).

538.566.2 : 621.396.67 **437**

The Magnetic Dipole in a Stratified Atmosphere.—Eckart. (*See* 284.)

621.396.11 **438**

Theory of Wave Propagation over the Earth, including the Influence of the Troposphere.—W. Pfister. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 127–133. In German.) The results of investigations on wave propagation carried out before the war are mostly to be found in three books: (*a*) Lehrbuch der drahtlosen Nachrichtentechnik, Band 2: Ausstrahlung, Ausbreitung und Aufnahme elektromagnetischer Wellen, by H. Lassen (Springer, 1940). (*b*) Die Ausbreitung der elektromagnetischen Wellen, by B. Beckmann (Akad. Verl. Ges., 1940). (*c*) Vol. 1 of Fortschritte der Hochfrequenztechnik (Akad. Verl. Ges., 1941), which includes contributions by H. Lassen, J. Grosskopf and B. Beckmann. References to 15 later papers are given.

621.396.11 : 551.510.535 **439**

Theory of Wave Propagation in the Ionosphere.—W. Becker. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 134–142. In German.) Discussion of investigations on (*a*) partial reflection by ionosphere layers, (*b*) the validity of the ray theory, (*c*) the perpendicular incidence of plane e.m. waves on a plane layered ionized medium under the influence of a magnetic field, (*d*) the propagation of e.m. waves in a layered ionized medium under the influence of a magnetic field, for oblique incidence, (*e*) indirect signals and transmission of s.w. signals round the earth. References to 13 relevant papers are given.

621.396.11 : 551.510.535 **440**

Thermal Expansion of Ionospheric Layer and Temporary Morning Disappearance of Radio Signals.—S. S. Banerjee & R. N. Singh. (*Nature, Lond.*, 26th Nov. 1949, Vol. 164, No. 4178, p. 925.) The reception in India of signals via the ionosphere, at wavelengths of the order of 20 m, often ceases for an hour or more after sunrise.

It is suggested that this is due to a thermal expansion of the F_2 layer which is more than sufficient to counterbalance the increase in ionization as the sun's altitude increases.

621.396.11 : 621.317.3 **441**

Wave-Propagation Measurements.—B. Beckmann. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena,* Part 2, 1948, pp. 143–167. In German.) Review of investigations concerning ground waves, propagation mechanism, angle of incidence, polarization, scattering, attenuation, and of u.s.w. measurements of tropospheric propagation, with references to 54 relevant German papers.

621.396.812.3 : 551.510.535 **442**

Statistical Analysis of Fading of a Single Downcoming Wave from the Ionosphere.—S. N. Mitra. (*Proc. Instn elect. Engrs,* Part III, Nov. 1949, Vol. 96, No. 44, pp. 505–507.) The fading of a single magneto-ionic component of a radio wave of frequency 2–6 Mc/s, incident vertically on the ionosphere and reflected downwards, was recorded at two points 100 m apart. The records which indicate that the fading was not due to a regular ionospheric drift are analysed. The results agree, to the first order, with the assumption that in the reflecting region there are irregularities moving with velocities in the line of sight having a Gaussian distribution with r.m.s. value about 2–3 m/sec. Possible ionospheric causes for a significant discrepancy between the records and the simple theory are discussed. There is some experimental evidence to suggest that the irregularities responsible for the fading are situated below the E-region reflection point for 4-Mc/s waves. See also 96 of January and 443 below.

621.396.812.3 : 551.510.535 **443**

The Fading of [downcoming] **Radio Waves of Medium and High Frequencies.**—R. W. E. McNicol. (*Proc. Instn elect. Engrs,* Part III, Nov. 1949, Vol. 96, No. 44, pp. 517–524.) The production of fading is considered in terms of an ionosphere with irregularities varying horizontally. The theoretical nature of the fading curve, with regard to both the distribution of amplitude and the variation with time, is indicated and compared with experimental results. The relative magnitudes of the steady and random components of a wave exhibiting fading were determined for different conditions; the results are summarized. From the rate of change of amplitude it is possible to calculate the effective velocity of the irregularities in the ionosphere, assuming that the fading is caused either by turbulent motion of the irregularities, or by a steady drift of the irregular ionosphere as a whole. The effective velocities deduced from 122 records made for vertical incidence and 55 for oblique incidence, lie between 0.3 and 8.0 m/sec, with an average value of 1.9 m/sec. See also 442 above.

621.396.11 : 621.396.813 **444**

An Analysis of Distortion Resulting from Two-Path Propagation.—Gerks. (*See* 451.)

RECEPTION

621.396.621 **445**

Ekco Model CR61.—(*Wireless World,* Dec. 1949, Vol. 55, No. 12, pp. 480–482.) Test report on an all-wave car receiver with permeability tuning.

621.396.621 : 621.396.619.11/.13 **446**

A Simple Frequency Discriminator for A.M.-F.M. Receivers.—E. G. B. (*Philips tech. Commun., Aust.,* 1949, Nos. 2/3, pp. 17–22, 27.)

621.396.621 : 621.396.619.11/.13 : 621.396.615 **447**

Signal Frequency and Oscillator Circuits for A.M.-F.M. Receivers.—E. G. Beard. (*Philips tech. Commun., Aust.,* 1949, Nos. 2/3, pp. 23–27.) The input and oscillator circuits of a medium-wave receiver can be modified at small cost for f.m. reception. Small inductors inserted in the signal-grid and oscillator-grid leads are 'series-tuned' by the normal medium-wave 350-pF tuning capacitors. A cathode choke is inserted and switching is effected by short-circuiting the medium-frequency coils. Tests show that the modification is effective while only one or two stations are operating on the m.f. band. Details of modifications of the remaining a.m. receiver circuits will be given later.

621.396.621 : 621.396.619.13 **448**

The Demodulation of a Frequency-Modulated Carrier and Random Noise by a Discriminator.—N. M. Blachman. (*J. appl. Phys.,* Oct. 1949, Vol. 20, No. 10, pp. 976–983.) The discriminator is regarded as consisting of two selective circuits, both fed by the output of the i.f. amplifier but peaked at different frequencies, feeding rectifiers whose outputs are subtracted. The effect of passing random noise through each of these circuits is considered by Rice's method (440, 2168 and 2169 of 1945) with due regard to the correlation between the noise voltages fed to the two rectifiers. Quadratic and linear rectification are considered. The results are applied to the case of a rectangular i.f. noise spectrum, and the signal/noise ratio is determined for the cases of narrow-band and wide-band f.m. The results are very much like those for Middleton's idealized representation of the discriminator (2619 and 3532 of 1949), and are tabulated with corresponding a.m. results. The optimum signal/noise ratio for narrow-band f.m. without a limiter occurs when the discriminator is designed for the least possible bandwidth; this optimum ratio differs very little from that for a.m.

621.396.621 : 621.396.645.371 **449**

Some Dangers in the Use of Negative Feedback in Radio Receivers.—E. G. Beard. (*Philips tech. Commun., Aust.,* 1949, Nos. 2/3, pp. 3–13.) A non-mathematical discussion of the principles of negative feedback, with criticism of some popular feedback circuits in audio amplifiers. Wrong positioning of the feedback resistor or volume control in the circuit can increase hum or lead to anomalies in amplifier gain. Recommended general-purpose feedback circuits are shown. Positive envelope feedback can occur by accident in a negative-feedback circuit; a circuit is described in which this is avoided. Distortion in a reflex receiver circuit due to an unwanted envelope feedback effect, and methods of circumventing this, are discussed from a practical point of view.

621.396.622.7 : 621.385.5 : 621.396.619.13 **450**

The 'ϕ Detector', A Detector Valve for Frequency Modulation.—Jonker & van Overbeek. (*See* 505.)

621.396.813 : 621.396.11 **451**

An Analysis of Distortion Resulting from Two-Path Propagation.—I. H. Gerks. (*Proc. Inst. Radio Engrs, W. & E.,* Nov. 1949, Vol. 37, No. 11, pp. 1272–1277.) For a.m., nonlinear distortion caused by two-path propagation is a result of over modulation in the resultant signal. This distortion becomes severe only when the time delay on the secondary path is large and the amplitudes are nearly equal. For f.m., the instantaneous frequency of the resultant signal has spike-shaped variations which reach large amplitude when the signals are nearly equal. When the discriminator is designed to respond linearly to a very wide frequency deviation, an averaging process takes place in the receiver which tends to minimize distortion; a discriminator range of several megacycles per second may be necessary for optimum reduction of distortion.

621.396.821 : 551.594.6 **452**

Atmospherics.—Siedentopf. (*See* 361.)

621.396.828 **453**

Suppressing Impulse Noise.—D. C. Rogers. (*Wireless World*, Dec. 1949, Vol. 55, No. 12, pp. 489–492.) The duration of impulse noise is nearly always substantially less than 1 μs, and the impulses seldom overlap. A circuit is described in which this short duration is used to distinguish noise from signal, whatever their relative amplitudes. The output from the receiver detector is divided into two parts, one passing through a phase inverter and an attenuator, the other through a high-pass filter and a pulse shaper; these parts are then re-combined to form a noise-free resultant. The principal use of the circuit is for frequencies above 30 Mc/s and it is restricted to cases where selectivity is unimportant; it can thus be used for suppressing ignition interference in the sound section of a television receiver, but not with broadcast or communication receivers.

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 : 621.396.4 : 621.396.619 **454**

Band Width and Transmission Performance.—C. B. Feldman & W. R. Bennett. (*Bell Syst. tech. J.*, July 1949, Vol. 28, No. 3, pp. 490–595.) A general and very comprehensive discussion is given of the relation between transmission bandwidth, power, noise, interference and overall performance for various multiplex systems, with due attention to all the relevant practical factors. Frequency division and time division are considered in combination with either a.m. or f.m. of a carrier by pulse-position, pulse-amplitude or pulse-code signals. The advantages and disadvantages of trading bandwidth for improved transmission are discussed in detail. The superiority of p.c.m. arising from the facility of signal regeneration, coding and power reduction is stressed, and the advantages of p.c.m./a.m. over f.m. for long television relay routes are noted.

621.395 : 061.3 **455**

C.C.I.F. Meetings, May and July, 1949.—(*P. O. elect. Engrs' J.*, Oct. 1949, Vol. 42, Part 3, pp. 168–171.) Brief summaries are given of work done by committees on protection, corrosion, long-distance transmission, local transmission, signalling, switching and symbols.

621.395.44 : 621.395.645.37 **456**

Transmitting Amplifier for the K2 Carrier System.—Fleming. (*See* 314.)

621.395.47 **457**

Analysis-Synthesis Telephony, with special reference to the Vocoder.—R. J. Halsey & J. Swaffield. (*Proc. Instn elect. Engrs*, Part III, Nov. 1949, Vol. 96, No. 44, pp. 497–504.) Discussion on 513 of 1949.

621.396.1 : 061.3 **458**

The High Frequency Broadcasting Conference, Mexico City, October 1948-April 1949.—(*P.O. elect. Engrs' J.*, Oct. 1949, Vol. 42, Part 3, pp. 166–168.) The detailed allocation of frequencies within the bands scheduled at the Atlantic City conference was discussed.

621.396.619.16 **459**

Pulse Modulation.—E. M. Deloraine. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 222–227.) Reprint. See 2636 of 1949.

621.396.619.16 **460**

Signal-to-Noise Ratio Improvement in a Pulse-Count-Modulation System.—A. G. Clavier, P. F. Panter & W. Dite. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 257–262.) Reprint. See 2325 of 1949.

621.396.619.16 **461**

Theoretical Study of Pulse-Frequency Modulation.—A. E. Ross. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1277–1286.) The accuracy in reconstruction of the signal depends not only on the number of sampling points per period but also on their distribution. Assuming a fixed average pulse frequency (sampling rate), the maximum range of the signal frequency for which the corresponding periodic signal may be transmitted with acceptable accuracy is determined. P.f.m. is as far as possible considered independently of the circuit used to realize it. The sampling for certain ranges of the ratio of signal frequency to pulse frequency is considered specially. The behaviour of the general periodic signal cannot be deduced from that of its sinusoidal components; the methods here developed must be applied directly to the particular waveform considered. An example is given.

621.396.619.16 : 621.396.41 **462**

A Technique for the Design of Pulse Time Multichannel Radio Systems.—M. M. Levy. (*J. Brit. Instn Radio Engrs*, Nov. 1949, Vol. 9, No. 11, pp. 386–411.) The transmitter uses a delay line in a special feedback circuit, and a square wave. Each channel is selected by a correct tapping on the delay line, and the channel boundaries are accurately timed by the square wave. The whole system is automatic. Special 3-valve 'power multivibrators' are used as generators which produce pulses of high peak power in impedors of low value; a shock-excited tuned circuit is used to define the length of the pulse. Trapezoidal pulses trigger these generators. When a signal pulse is added, the instant of triggering is modulated in time. The use of trapezoidal pulses ensures that the pulse time modulation never crosses the boundaries of the channel.

The demodulation process consists of transforming the time modulation into pulse length modulation by means of another type of multivibrator which is sensitive only during the time allocated to the corresponding channel, and which triggers only when the corresponding channel pulse appears. The demodulated signal is filtered with a low pass filter. A single circuit is used for several channels; this reduces the number of valves required to about 3 per 2 channels, including mixing valves. The mixer circuit comprises cathode followers with cathodes connected together. Crosstalk is negligible if 'power multivibrators' are used. The optimum number of channels seems to be 20–40, and the maximum number 100. Block and simplified circuit diagrams are given for a 24-channel system, and an experimental 20-channel system built in 1943 is described which was satisfactorily tested for distances up to about 36 miles in mobile vans. See also 3054 of 1947 and 2620 of 1948.

621.396.65 : 621.397.5 **463**

Television Radio Relay: London-Birmingham Link.—(*See* 471.)

621.396.931 **464**

V.H.F. Radio Equipment for Railways and Heavy Industries.—(*Engineer, Lond.*, 28th Oct. 1949, Vol. 188, No. 4892, p. 502.) A brief description of a specially designed 15–20-W f.m. transmitter and receiver. The whole is mounted in a light-alloy dustproof and weatherproof case and can be installed in any position. A built-in selective-calling device using uniselectors makes constant monitoring of the mobile units unnecessary, and is applicable to simplex, two-frequency simplex or duplex working. A 3-digit system will cover 500 substations. The control unit is in the form of a telephone handset. Provision is made for mains or battery operation and for the substitution of a.m. units if desired.

SUBSIDIARY APPARATUS

621.314.63 **465**

Image Force in Rectifiers.—P. T. Landsberg. (*Nature, Lond.*, 3rd Dec. 1949, Vol. 164, No. 4179, pp. 967–968.) A theoretical characteristic which allows for the effect of image force was given by Mott (4136 of 1939). A general method of allowing for this force is given, and applied to the Cu_2O rectifier.

621.315.59 : 537.311.4 **466**

On the Theory of the A.C. Impedance of a Contact Rectifier.—Bardeen. (*See* 349.)

621.316.721 **467**

A Stabilized 100-A Power Supply.—D. E. Caro & J. K. Parry. (*J. sci. Instrum.*, Nov. 1949, Vol. 26, No. 11, pp. 374–377.) "A system is described for maintaining constant currents of up to 100 A through highly inductive loads. The system stabilizes against changes in mains voltage and generator characteristics, reducing the short-period current variations to less than 1 part in 2 000. Current changes due to load-impedance variations are reduced by a factor of approximately 20. The main interest in the system is the electromagnetic method of comparing the load current with a standard current."

621.396.682 : 621.316.722 **468**

Heater Compensation improves Stabilized Power Supplies.—(*Tech. Bull. nat. Bur. Stand.*, Oct. 1949, Vol. 33, No. 10, pp. 115–116.) A method developed by R. C. Ellenwood & H. E. Sorrows. Heater-voltage fluctuations are used to compensate for line-voltage fluctuations. The method can be applied to power supplies using degenerative voltage stabilizers in which the output voltage is compared with a fixed reference voltage, the difference voltage being used to alter the resistance of a control valve. Circuit and component details are given. For another account see *Radio & Televis. News, Radio-Electronic Engng Supplement*, Nov. 1949, Vol. 13, No. 5. pp. 8, 30.

621.396.682 : 621.319.3 **469**

Stabilized High Voltage Power Supply for Electrostatic Analyzer.—R. L. Henkel & B. Petree. (*Rev. sci. Instrum.*, Oct. 1949, Vol. 20, No. 10, pp. 729–732.) A description of an a.c. operated power supply which provides a voltage continuously variable from 5 to 50 kV with stability and accuracy of measurement within ± 0.01%. The stabilizer is of the usual degenerative type, but the error signal is amplified by a photocell galvanometer, d.c. amplifier and applied to a series impedance in the h.v. transformer primary circuit. The generator beam energy automatically follows adjustments of a l.v. potentiometer used for voltage measurements in this supply.

771.3 : 621.3.087.5 : 551.510.535 **470**

Continuous [-recording] **Oscillograph Camera for Ionosphere Measurements.**—J. E. Hacke, Jr. (*Instruments*, Oct. 1948, Vol. 21, No. 10, pp. 914–915.) Illustrated description, with special reference to the mechanism for moving the photographic paper.

TELEVISION AND PHOTOTELEGRAPHY

621.396.65 : 621.397.5 **471**

Television Radio Relay: London-Birmingham Link.—(*Wireless World*, Dec. 1949, Vol. 55, No. 12, pp. 474–476.) The link has four unattended relay stations. It provides a single vision channel which can be used in either direction. The installation is permanent and designed for reliability; all apparatus is duplicated. Transmission frequencies of 870 Mc/s and 890 Mc/s are used. At the terminal station the video-frequency signal is used for f.m. of a 34-Mc/s carrier; this modulated carrier modulates a 904-Mc/s carrier and the sideband in the range 868.5–871.5 Mc/s is fed to the aerial. Relay-station transmitter output is about 10 W and the gain is about 70 db. Dipole aerials with reflectors are used; their gain is about 28 db. A special filter provides 70-db discrimination between wanted and unwanted frequencies in the a.m. process; it uses coaxial resonant circuits in which the conductors are separated by alternate short sections of air and polythene, so that the total length of the filter is reduced from 10 ft to 18 in. A r.f. switch is used for the coaxial circuits of the transmitters and receivers and for bringing in duplicate equipment when a fault occurs. It has no contacts and operates by moving plungers into coaxial stubs, so that in either extreme position an infinite impedance is presented on one side and a zero impedance on the other. The quality of the picture originating in London and seen in Birmingham is as good as that usually obtained near London. See also 297 of 1948, 1279 and 1857 of 1949 (Stanesby & Weston), and *Electronic Engng*, Dec. 1949, Vol. 21, No. 262, pp. 457–460.

621.397.5 **472**

Television (including Scanning).—F. Schröter. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 185–210. In German.) The principal developments in fundamental investigations in Germany during the war years were concerned with improvement of c.r. tube spot sharpness, reduction of errors in the deflection system, sensitive photoelectric layers and secondary-emission layers with a high multiplication factor, with applications to picture-scanning tubes, projection apparatus and colour television. These questions are reviewed and also improvements in technique and in transmitting and receiving equipment. References to 53 relevant German publications are included.

621.397.5 : 621.315.212 **473**

London-Birmingham Television Cable.—H. Stanesby & W. K. Weston. (*Elect. Commun.*, Sept. 1949, Vol. 26, No. 3, pp. 186–200.) See 1279 and 1857 of 1949.

TRANSMISSION

621.396.61 **474**

Power Tubes in Parallel at U.H.F.—J. R. Day. (*Electronics*, Nov. 1949, Vol. 22, No. 11, pp. 166..170.) An arrangement in which the power output is proportional to the number of valves in parallel and the upper frequency limit is the same as for each individual valve used alone. The active input and output circuits comprise 3 coaxial cylinders and 4 shorting rings. The valves, which must be either of the planar type or have an external disk connection to the separation electrode, are arranged with their axes lying in a plane normal to the cylinders and meeting the cylinder axis. The plane of the valves is about half way between the shorting rings, so that they are, in effect, at or near the voltage loop of a resonant half-wave coaxial circuit. Spurious modes presented no difficulty. An alternative rectangular arrangement with valves on opposite sides is briefly considered.

621.396.61 **475**

Miniature Tubes in a Band-Switching Exciter.—W. Mayer. (*QST*, Dec. 1949, Vol. 33, No. 12, pp. 11–15.) Description of a 75-W variable-frequency driver unit, built for eliminating television interference, contained in one compact shielded unit, with complete band-switching for amateur frequencies.

621.396.61 **476**

TVI on 160 Meters?—P. S. Rand. (*CQ*, Dec. 1949, Vol. 5, No. 12, pp. 11–14..62.) Circuit diagram and component details for an amateur transmitter free from television interference. Part of the circuit was also used for the 10-m transmitter discussed in 1530 of 1949.

621.396.61 : 621.396.712 **477**

KTBS' New Transmitter.—W. M. Witty. (*Broadcast News*, Sept. 1949, No. 56, pp. 46–53.) A general illustrated description. A 6-element directional aerial array is used. Special precautions against possible flooding, lightning etc. are discussed. The power is 10 kW during the day and 5 kW at night, with a frequency of 710 kc/s.

621.396.619.22 **478**

Non-Linear Inductance and Capacitance as Modulators for Amplitude-Modulation Systems.—D. G. Tucker. (*P.O. elect. Engrs' J.*, Oct. 1949, Vol. 42, Part 3, pp. 156–159.) The performance of modulators using the nonlinear characteristics of suitable inductors and capacitors is discussed theoretically. The output of any sideband depends upon its frequency, and low-frequency products have a small amplitude. Practical circuits and measurement results are given for a magnetic modulator using a nonlinear inductor.

621.396.619.23 **479**

New Modulator Circuit utilizes 807's in Class B with Zero Bias.—A. M. Seybold. (*Radiotronics*, July/Aug. 1949, No. 138, pp. 64–65.) A 20 000-Ω 1-W resistor connects the control grid to the screen grid of each of the Type-807 valves, the cathodes are earthed and the secondary of the driver output transformer is connected to the two screen grids, the centre tap being also earthed. With a supply voltage of 750 V and peak grid-to-grid input of 555 V, audio output into a 6600-Ω load is 120 W. Type-2A3 valves are recommended for the driver. A circuit diagram, with component details, and functional curves for the Type-807 valves for various signal voltages, are given.

621.396.619.231 **480**

Modulators for High Power Transmitters.—H. A. Teunissen. (*Commun. News*, June 1949, Vol. 10, No. 2, pp. 41–51.) Anode modulation with a class-B modulator is generally used for medium- and short-wave transmitters; it is more efficient than other possible systems mentioned. Efficiency has recently been improved by using feedback and a cathode-follower driver stage. Damping resistors are not then needed in the grid circuit, and no transformer is necessary in the chain of amplifier stages over which feedback is acting; it is difficult to build a.f. transformers without introducing a considerable phase shift which might endanger stability. The feedback factor should be as large as possible; the best solution is to feed from the primary of the modulation transformer back to the cathode of the first stage, so that a very low output impedance is obtained. A coupling arrangement in which the anode of the modulated amplifier is shunt-fed is advantageous. The application of these principles to the design of the modulator of a 100-kW transmitter is discussed, and experimental results obtained during the testing of the modulator of a 40-kW transmitter are considered.

VALVES AND THERMIONICS

537.291 + 538.691 **481**

On the Theory of Axially Symmetric Electron Beams in an Axial Magnetic Field.—A. L. Samuel. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1252–1258.) A type of electron beam is proposed in which the space-charge repulsive forces are balanced by magnetic focusing forces, so that the beam may be made as long as required without any change in its cross-section. The equations governing the existence of such beams are derived.

621.385 **482**

A Survey of Modern Radio Valves: Part 1 — Introduction.—H. Stanesby. (*P.O. elect. Engrs' J.*, Oct. 1949, Vol. 42, Part 3, pp. 117–118.) Introduction to a series of articles on basic principles common to most valves, and on valves for use in various frequency ranges up to 30 kMc/s. See also 483 below.

621.385 **483**

A Survey of Modern Radio Valves: Part 2 — The Physical Principles of Thermionic Valve Operation.—K. D. Bomford. (*P.O. elect. Engrs' J.*, Oct. 1949, Vol. 42, Part 3, pp. 118–123.) Phenomena common to most valves are surveyed. Primary and secondary emission, space charge, transit time, and the functions of various electrodes in conventional valves are discussed. See also 482 above.

621.385 **484**

Low-Distortion Power Valves.—G. Diemer & J. L. H. Jonker. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 385–390.) A survey is given of various low-distortion valve constructions. Two new constructions for pentodes are described which involve (*a*) alignment of the first and second grids, (*b*) introduction of additional focusing rods into the electrode system. By either means the second harmonic of a single-stage class-A pentode amplifier can be considerably reduced. The total distortion can be halved for an output up to about 25% of the static anode dissipation. The new valves have I_a/V_g characteristics that are practically linear in the neighbourhood of the normal operating point. See also 4110 of 1937 (Kleen).

621.385 : 538.691 **485**

Study of the Magnetic Focusing of Cylindrical [electron] **Beams.**—G. Convert. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 550–558.) General equations are developed for the electron motion in a system with axial symmetry, consisting of an electron gun sending a beam along a drift tube maintained at a constant potential, with a uniform axial magnetic field. Cylindrical beams are considered for the two cases in which the rotational moment has or has not the same value for all the electrons. Undulations of the beam within the drift tube are discussed and the importance is stressed of proper adjustment of the magnetic field at the entrance of the tube by fitting suitable screens.

621.385.001.4 : 533.59 **486**

An Improved Method of Testing for Residual Gas in Electron Tubes and Vacuum Systems.—E. W. Herold. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 430–439.) An ionization-gauge method in which the ion current due to the residual gas is converted into a.c. by modulation of the ionizing electron stream, while stray currents are left relatively unmodulated. The sensitivity limit of 10^{-11} A, or 10^{-9} A without neutralization of undesired quadrature components, compares favourably with the sensitivity limit of 10^{-7} A for conventional d.c. ionization gauges. Some applications of the method are shown.

621.385.012 : 517.54 **487**

Potential Functions for a Thermionic Vacuum Tube.—E. C. Okress. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 850–856.) Potential functions are derived, by application of conformal transformations, for a system comprising two parallel metal plates at the same potential, with three flat parallel-wire grids evenly spaced between them. The wires in the central grid are orthogonal to those in the other two grids. The results are applied to the Western Electric Type 104D valve, the construction of which approximates to the theoretical system considered.

621.385.032.2 : 777.1 **488**

Electrodes for Vacuum Tubes by Photogravure.—M. P. Wilder. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, pp. 1182–1184.) An improved method which enables complicated designs to be cut with little effort; its chief utility is in the manufacture of precision parts for experimental valves.

621.385.032.212 489

Circuits for Cold Cathode Glow Tubes.—W. A. Depp & W. H. T. Holden. (*Elect. Mfg, N.Y.*, July 1949, Vol. 44, No. 1, pp. 92–97.) Discussion of fundamental operating characteristics, and typical circuits using these tubes for relays, impulse generators, pulse counting, and interlocking.

621.385.032.216 490

Some Properties of the Ba_2SiO_4 Oxide-Cathode Interface.—A. Eisenstein. (*J. appl. Phys.*, Aug. 1949, Vol. 20, No. 8, pp. 776–790.) The thickness of the interface, its effective specific electrical conductivity, and the interface voltage developed by the flow of emission current are considered. Methods of measuring these quantities and results obtained are discussed.

621.385.032.216 491

Electron Emission and Conduction Mechanism of Oxide-Coated Cathodes.—R. Loosjes & H. J. Vink. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, p. 884.) Experiments with oxide cathodes, showing that the curve of log σ against $1/T$ has a bend at 750°K, suggest that there are two conduction mechanisms operating in parallel in the coating, one with a low activation energy which predominates below 750°K and one with a high activation energy which predominates above that temperature. This theory gives a simple explanation of Mahlman's results (2094 of 1949). A fuller account of these investigations will appear in *Philips Res. Rep.*

621.385.032.216 492

Microanalysis of Gas in Cathode Coating Assemblies.—H. Jacobs & B. Wolk. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1247–1251.) Gases evolved during degassing and activation of oxide cathodes are considered.

621.385.032.216 : 536.7 493

Application of Thermodynamics to Chemical Problems involving the Oxide Cathode.—A. H. White. (*J. appl. Phys.*, Sept. 1949, Vol. 20, No. 9, pp. 856–860.)

621.385.15 494

A Microwave Secondary Electron Multiplier.—M. H. Greenblatt. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, pp. 646–650.) The multipactor, a dynamic electron multiplier, consists of two parallel secondary-emission plates with an a.c. voltage across them which is adjusted so that the transit time across the gap, for electrons starting with zero velocity from one of the plates when the field is passing through zero, is half the period of the a.c. voltage. Primary and secondary electrons are thus made to oscillate between the plates and multiplication takes place. Phase relations between the electrons and the field are discussed. When the multipactor was used as a γ-ray detector and the a.c. voltage was obtained from 10-cm power, the rise time of the pulse obtained was calculated as 5×10^{-10} sec and measured to be $< 10^{-7}$ sec. The dead-time was about 5 μs.

621.385.18.032.213 : 621.396.615.12 495

The Generation of High-Frequency Oscillations by Hot-Cathode Discharge Tubes containing Gas at Low Pressure.—E. B. Armstrong & K. G. Emeleus. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 390–394.) Discussion of experimental results concerning the generation of plasma electron oscillations by the discharge from a hot filament through ionized Hg vapour, Ar and other gases. Oscillations are produced both with bare metal cathodes and with oxide cathodes. The vacuum wavelengths of the e.m. waves produced range from 5 cm to 2 m. Under favourable conditions 1% of the anode power can be converted into energy of oscillation in a coupled external circuit. Restricted regions of oscillating plasma appear to exist primary electron beams traversing these regions undergo v.m.

621.385.2 496

The High-Frequency Response of Cylindrical Diodes.—E. H. Gamble. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1949, Vol. 37, No. 10, p. 1206.) Summary only. The investigation includes the case of large signals which have components varying with time through an amplitude comparable with that of the constant polarizing voltage. The problem is regarded as quasi-stationary; the solution is based on Poisson's equation, Newton's equation and the continuity equation. The method of integral equations is used. A method of successive approximations is devised for each specific form of applied voltage. Though the solutions are approximate they throw light on the inner mechanism of the cylindrical diode. The simplifying assumptions applicable to the cases of space-charge-limited and temperature-limited operation are mentioned. A first approximation to numerical solutions was obtained by means of an analogue computer; the solutions are shown graphically and satisfy the integral equations to an accuracy within 2%. For large signals, considerable modulation of the electric field and of the velocity and trajectory of the electrons occurs. In some cases, electrons are returned to the cathode or oscillate radially in the interelectrode space. For large electrode radii, the solutions reduce to those applicable to the planar diode.

621.385.2 497

Extension of the Planar Diode Transit-Time Solution.—N. A. Begovich. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1340–1344.) Llewellyn's small-signal theory for the plane parallel diode (552 of 1936 and 1669 of 1941) has been extended to include a closed-form second-order and third-order solution for complete space-charge operation. This solution includes terms not given by Benham's conservation-of-charge method (148 of 1939).

621.385.2 : 621.3.011 498

The Unit of Perveance.—G. D. O'Neill. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, p. 1295.) Perveance is defined as the constant G in the current/voltage relation $I = GV^{\frac{3}{2}}$ applicable to a space-charge-limited diode. It is suggested that the unit for G should be associated with the name of Langmuir.

621.385.2 : 621.396.822 499

Transit Time Correction Factor for Cylindrical Noise Diodes.—H. Ashcroft & C. Hurst. (*Proc. phys. Soc.*, 1st Oct. 1949, Vol. 62, No. 358B, pp. 639–646.) The noise generated by a diode is always less than it would be if the transit of the electrons were instantaneous. The factor by which it is reduced is tabulated for transit angles θ up to $12\frac{1}{2}$ radians and for ratios r of anode to cathode radius up to 20. The reduction is zero when $\theta = 7.498$ radians and $\log_e r = 1.246$.

621.385.2 : 621.396.822 500

Temperature-Limited Noise Diode Design.—R. W. Slinkman. (*Sylvania Technologist*, Oct. 1949, Vol. 2, No. 4, pp. 6–8.) A general discussion of design problems and of the more important characteristics of such diodes. Design and construction details are given for a diode with approximately 8 W total dissipation and maximum operating frequency 500 Mc/s. A 50-W tube is in the experimental stage.

621.385.3 501

Pencil-Type U.H.F. Triodes.—G. M. Rose, D. W. Power & W. A. Harris. (*RCA Rev.*, Sept. 1949, Vol. 10, No. 3, pp. 321–338.) 1949 I.R.E. National Convention paper noted in 1824 of 1949 [No. 141]. A new type of triode is described which satisfies basic requirements of minimum transit time, lead inductance and internal capacitance. It is small, has good thermal stability and low heater wattage, and is suitable for mass production. A double-ended construction is used, with the rod-type anode and cathode connections extending outwards from the two sides of a control-grid disk. The internal elements are cylindrical and coaxial. Characteristics and performance data are included for 4 different valves of this type, designed for use as amplifiers and low-power oscillators. Typical applications are described.

621.385.38 **502**

Hydrogen Thyratrons.—J. Grolleau. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 522–524.) The advantages and disadvantages of hydrogen thyratrons are enumerated and a thyratron capable of handling high peak power is described. This valve, developed by the Compagnie Générale de Télégraphie sans Fil (C.S.F.), has an indirectly heated cathode in the form of a cylinder covered with fine-meshed Ni gauze to avoid flaking of the coating which usually occurs with large metal surfaces. Two thermal screens are arranged on either side of the cathode in order to maintain the cathode at its correct operating temperature of 820°C with the minimum heating current. The grid completely surrounds the anode/cathode space and the part which controls the damping of the arc consists of three baffles. Deionization is aided by keeping the anode/grid space reasonably small. The heater current is 11.5 A at 6.3 V, maximum peak voltage 16 kV, maximum peak current 160 A and mean current 100 mA. Pulses of duration up to 6 μs, with a recurrence frequency of 4 000 per sec, can be handled. Valve life is of the order of 500 hours. For peak powers higher than 1–2 MW, the thyratrons can be connected either in series or in parallel.

621.385.38 **503**

Extending Range D.C. Bias Control of Thyratron Plate Current.—L. Reiffel. (*Rev. sci. Instrum.*, Sept. 1949, Vol. 20, No. 9, pp. 699–702.) Advantages and disadvantages of three existing methods of controlling the average current in a thyratron with alternating anode voltage are discussed. In a new method, an alternating voltage is applied to the anode of the thyratron and another alternating voltage to the screen grid. The phase of the screen-grid voltage is shifted about 90° behind that of the anode voltage by a fixed phase-shifting network. An asymmetry is thus introduced into the critical grid bias control curve of the thyratron, and the minimum of this curve is shifted towards the 180° point of the anode voltage. Modifications of this simple system are discussed.

621.385.38 **504**

Hot-Cathode Thyratrons: Practical Studies of Characteristics.—H. de B. Knight. (*Proc. Instn elect. Engrs*, Part III, Sept. 1949, Vol. 96, No. 43, pp. 361–378. Discussion, pp. 379–381.) A survey of the main factors affecting the characteristics and life of thyratrons, based on experimental results. Such factors include electron emission from the cathode, ionization and current build-up, grid control, current-carrying capacity, the decay of ionization at the end of conduction, and the provision of suitable operating conditions. Other factors, such as positive-ion bombardment, may affect valve life but not electrical performance. The control characteristics of different types of grid are discussed, with special reference to the pentode design, which enables heavy currents to be controlled from high-impedance grid circuits. The arc voltage drop varies considerably with filling pressure and current. If the current-carrying capacity of the arc path is exceeded, the arc may suddenly go out, and undesirable h.v. surges may result. A method of measuring deionization time is described. Results are given showing how this time varies according to the nature of the filling gas and its pressure. See also 3168 of 1949 (Jones et al.).

621.385.5 : 621.396.622.7 : 621.396.619.13 **505**

The 'ϕ-Detector', A Detector Valve for Frequency Modulation.—J. L. H. Jonker & A. J. W. M. van Overbeek. (*Philips tech. Rev.*, July 1949, Vol. 11, No. 1, pp. 1–11.) Description of a new valve with 7 grids, which can replace several circuits and valves needed in other detection systems. The second, fourth and sixth grids are screen grids and the seventh is a suppressor grid. The third and fifth grids are control grids, to each of which an output voltage is applied from an i.f. transformer. The r.m.s. value of these voltages must be at least 8 V. The mean value of the anode current is a function of the phase shift ϕ between the two control voltages. ϕ is a function of the frequency deviation. Both these functions are approximately linear when ϕ has a sweep between 60 and 120°. The amplitude of the anode current is independent of the magnitude of the control voltages, provided these exceed 8 V. The valve thus acts as a limiter; this renders certain sources of noise and of distortion harmless. No inertia other than electron inertia is involved, so that short impulsive interference bursts are also limited. The 'ϕ-detector' has an a.f. output voltage of 20–25 V. No i.f. transformer is needed. The first grid can be used for blocking the cathode current if the control voltages are not large enough, thus suppressing interchannel noise. Type EQ80 is made in the same way as Rimlock valves but has a 'Noval' base with 9 pins. The mean anode current is 0.25 mA.

621.385.832 **506**

Cathode-Ray Tubes for the Study of Rapid Phenomena.—P. Patriarche & P. Bonvalot. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 525–531.) Improvement of the performance of c.r. tubes by better design of electron guns, by reduction of distortion and aberration of the electron-optical systems, and particularly by the use of post-deflection acceleration, is discussed and optimum conditions for the observation of transient effects are considered.

621.396.615.141.2 **507**

Methods of Measurement used in the Study of Magnetrons. Results obtained on New Types of Magnetron.—J. Legros & C. Azéma. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 568–576.) Measurements necessary prior to evacuation, such as the determination of the resonance frequencies of the anode block, and measurements of various parameters for completed magnetrons under pulse or c.w. conditions, are outlined. Operating characteristics are given for the following new valves: (*a*) Type MV.201, a miniature valve with glass envelope and overlapping segments giving a mean power of 6 W on wavelengths from 19 to 28 cm, with frequency variation by means of an external circuit. (*b*) Type MCV.81, for c.w. operation with a power of 80 W in the range 8.2–8.8 cm, with mechanical regulation. (*c*) Type MC.1011, for high-power radar pulse operation; the anode block has double strapping on both faces; air-jet cooling is used and the useful power with 1-μs pulses at 500 per sec can reach 1 MW. (*d*) Type MC.231, for c.w. operation on a wavelength of about 23 cm, with a useful power of 1 kW; the anode is water-cooled, but air-cooling will be used on later models.

621.396.615.141.2 **508**

The Modes of Oscillation for Magnetron Anodes.—C. Azéma. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 559–567.) Two methods are available for determining the resonance frequency for cavity magnetrons, one based on calculations of e.m. fields by the methods of mathematical physics, the other based on the concept of equivalent circuits, to which ordinary circuit technique can be applied. Both methods are used to obtain information as to the characteristics of the frequency spectrum for magnetrons with different types of strapping, and for rising-sun magnetrons. Three methods of mode isolation that have been tried by the Compagnie générale de T.S.F., involving the use of rounded fins, decoupled cavities or unequal cavities, are briefly mentioned.

621.396.615.141.2 **509**

Modes in Interdigital Magnetrons.—J. F. Hull & L. W. Greenwald. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1258–1263.) A set of design equations is derived, by means of which the resonance wavelength and external Q can be calculated for each mode of these magnetrons. Results thus obtained are compared with experimental results. See also 908 of 1949 (Hull & Randals).

621.396.615.142 : 621.385.029.63/.64 **510**

Electron Bunching in a Velocity-Modulation Valve by means of a Travelling-Wave Device.—R. Warnecke, W. Kleen, O. Doehler & H. Huber. (*C. R. Acad. Sci., Paris*, 3rd Oct. 1949, Vol. 229, No. 14, pp. 648–649.) The gain of travelling-wave amplifiers of the Kompfner-Pierce type is of the order of magnitude of the ratio of the real part to the imaginary part of the propagation constant of the amplified wave; only the energy corresponding to a small excess of the electron velocity over the travelling-wave velocity can be converted to h.f. e.m. energy. The efficiency of the energy exchange can be improved by means of a system in which the electron beam, modulated in density and velocity by means of a wave applied at the input of a retarding system, is injected into a cavity resonator in the field of which the electron packets give up a large part of their kinetic energy. The h.f. energy transported by the travelling wave to the output end of the retarding system is either absorbed by a matched attenuating element or added, by means of a phase transformer, to that which appears in the resonator. This arrangement can thus be considered as an improvement of the ordinary travelling-wave valve, or of the v.m. valve with two interacting fields. Theory of this method of amplification is summarized. Electron bunching and energy conversion factors as high as those for v.m. valves can be obtained. The method has the advantage of requiring no tuned device, with the properties of an oscillatory circuit, at the input. This results in an essential simplification of the adjustments and avoids the limitation of the pass band which, in klystron amplifiers, involves the high Q of the tuned device. With the new amplifier, in fact, the pass band is that of the output cavity resonator and this band is widened by the operational load.

621.396.645 **511**

Amplification by Direct Electronic Interaction in Valves without Circuits.—P. Guénard, R. Berterottière & O. Doehler. (*Bull. Soc. franç. Élect.*, Oct. 1949, Vol. 9, No. 97, pp. 543–549.) See 2977 of 1949.

621.396.645 : 537.311.33 : 621.315.59 **512**

The Theory of *p-n* Junctions in Semiconductors and *p-n* Junction Transistors.—Shockley. (*See* 379.)

621.396.645 : 537.311.33 : 621.315.59 **513**

Hole Injection in Germanium — Quantitative Studies and Filamentary Transistors.—Shockley, Pearson & Haynes. (*See* 380.)

621.396.645 : 537.311.33 : 621.315.59 **514**

Some Circuit Aspects of the Transistor.—Ryder & Kircher. (*See* 334.)

621.396.822 **515**

On the Theory of the Shot Effect.—L. A. Weinstein. (*Zh. tekh. Fiz.*, Sept. 1947, Vol. 17, No. 9, pp. 1045–1050. In Russian.) A mathematical discussion of the shot effect in a cylindrical diode when the current is limited by space charge, taking into account the transit time of electrons. When space charge is present the velocity distribution of emitted electrons must be considered. Further investigations are required to determine the relation between the fluctuations of the velocity distribution and those of the anode current.

621.396.822 **516**

Suppression of Shot Effect Noise in Triodes and Pentodes.—K. S. Knol & A. Versnel. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 462–464. In English.) Strutt & van der Ziel (3358 of 1948) suggested that spontaneous fluctuations arising from the shot effect could be suppressed by using induced grid noise and capacitive detuning of the input circuit. The connection of a capacitor between the control grid and the anode results in a much larger suppression of noise by detuning than is possible without the capacitor. Noise measurements at frequencies of 43 and 120 Mc/s on a Type-EF50 valve used first as a triode and then as a pentode are discussed. The method of measurement was analogous to that of van der Ziel & Versnel (249 of 1949).

621.396.822 **517**

Measurements on Total-Emission Conductance at 35 cm and 15 cm Wavelength.—G. Diemer & K. S. Knol. (*Physica, 's Grav.*, July 1949, Vol. 15, Nos. 5/6, pp. 459–462. In English.) An experimental disk-seal diode was used, the cathode/grid spacing being 15 μ at a saturation current of 35 mA and 20 μ at a saturation current of 0.1 mA. The active area was 0.75 mm^2. Measurements were made at cathode temperatures between 1 100°K and 1350°K. The valve was studied in a coaxial circuit loosely coupled to a modulated standard signal generator and also to a crystal detector and l.f. amplifier; the valve conductance was calculated from Q measurements on this circuit for various saturation currents and anode voltages. Results are shown graphically and discussed; they do not support the 'linear field theory'. See also 3310–3313 of 1949.

621.396.822 : 621.385 **518**

Shot Effect in Valves and the Limits of Amplification.—K. Fränz. (*FIAT Review of German Science, 1939–1946; Electronics, incl. Fundamental Emission Phenomena*, Part 2, 1948, pp. 21–29. In German.) A general review, with references to 19 German publications. Input-circuit design is considered.

621.385 **519**

Fundamentals of Radio-Valve Technique. [Book Review]—J. Deketh. Publishers: Cleaver-Hume Press, London, 535 pp., 35s. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, p. 413.) A translation of the first of a series of books on valves originated by Philips, Eindhoven. A fairly elementary treatment suited to the student and with useful references for the engineer.

MISCELLANEOUS

5 + 6](43) **520**

FIAT Review of German Science, 1939-1946: Electronics, incl. Fundamental Emission Phenomena: Part 2. [Book Notice]—G. Goubau & J. Zenneck (Senior Authors). Publishers: Office of Military Government for Germany, Field Information Agencies Technical, British, French, U.S., 1948, 288 pp. In German. Part 1 was noted in 2414 of 1949. For abstracts of papers see various sections.

ABSTRACTS and REFERENCES

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **521**
References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 639–646.) Continuation of 1 of January.

534.121.1 **522**
Vibration of a Metal Plate in a Sound Field.—T. Vogel. (*J. Phys. Radium*, July 1946, Vol. 7, No. 7, pp. 193–201.) The theory of acoustic transparency is discussed and an approximate expression is derived for the transparency of a plate for excitation frequencies considerably different from its fundamental resonance frequency. A method is described for the measurement of transparency. Results obtained for four Al plates, of thickness 1 mm and of sizes from 2 m × 1 m to 33 cm × 25 cm, confirm the theory given but are not in agreement with the theory of Davis (1933 Abstracts, p.210), especially for the smaller plates.

534.21 **523**
General Expression for Huyghens' Principle for Attenuated Propagation of Longitudinal Waves.—J. Brodin. (*C. R. Acad. Sci., Paris*, 14th Nov. 1949, Vol. 229, No. 20, pp. 983–991.) It is required to determine a surface distribution of sources on a closed surface S which produces the same wave outside S as a given distribution of sources inside S. If the medium is imperfectly transparent, the solution is not unique: the general solution involves a single-layer distribution and a double-layer distribution over S, one of these layers being arbitrary. Among these solutions, however, only one gives no wave inside S. See also 712 below.

534.213 **524**
The Acoustic Characteristics of Conical Pipes.—M. Mokhtar & G. A. Messih. (*Proc. phys. Soc.*, 1st Dec. 1949, Vol. 62, No. 360B, pp. 793–799.) Experimental investigation of slightly tapered pipes to determine end corrections and the variation of velocity and pressure along the pipe. The resonance frequencies are in fair agreement with the theoretical formula $kr = -\tan kl$ (r = throat radius, l = slant length and $k = \omega/c$, where c is the velocity of sound). The nodes are not equidistant and pressure at the nodes is not zero. The end correction is given approximately by the empirical expression $0.6r + (0.6l - 2\,100\,n)\sin\theta$, where n is the resonance frequency and θ the semi-apical angle of the cone.

534.231 : 534.121.1 **525**
Pressure Distribution in the Acoustical Field Excited by a Vibrating Plate.—J. Pachner. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 617–625.) The computed distribution is based on an exact expression for the form of the vibrations in the circular plate, and is valid at distances from the centre of the plate greater than 10–20 times its radius. A short survey of the theory of forced vibrations is included.

534.321.7 : 621.396.615.11 **526**
Tone Source for Tuning Musical Instruments.—E. L. Kent. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 164, 166.) A Hartley oscillator produces two alternative timbres for the notes A and B♭, the semitone relation being retained irrespective of the setting of a control for the frequency of A in the range 435–445 c/s.

534.321.7.08 **527**
International Standard Musical Pitch.—L. S. Lloyd. (*J. R. Soc. Arts*, 16th Dec. 1949, Vol. 98, No. 4810, pp. 74–85. Discussion, pp. 86–89.) A verbatim report of a paper read before the Society on 10th Nov. 1949. The history of the adoption of standard pitch is traced from the French decree of 1858 to the British Standards publication B.S.880/49 of July 1949, which defines the international standard of concert pitch to be based on a frequency of 440 c/s for the note A in the treble clef.

534.321.9 **528**
Measurements on the Absorption of Ultrasonics in Water.—A. van Itterbeek & P. Slootmakers. (*Physica, 's Grav.*, Oct. 1949, Vol. 15, No. 10, pp. 897–905. In English.) A balance method was used, at a frequency of 1 500 kc/s. If α is the absorption coefficient and ν the frequency, $\alpha/\nu^2 = 55 \times 10^{-17}$ sec²/cm at 22 C, which agrees well with the value obtained for frequencies over 10 Mc/s. Absorption in a NaCl solution was also measured as a function of concentration.

534.321.9 **529**
Scattering of an Underwater Ultrasonic Beam from Liquid Cylindrical Obstacles.—P. Tamarkin. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 612–616.) Long summary of part of a thesis.

534.42 + 538.561 **530**

Production and Observation of High Frequencies due to Combination of Several Low Frequencies.—Dolinski. (*See* 560.)

534.612.4 **531**

The Plane Wave Reciprocity Parameter and its Application to the Calibration of Electroacoustic Transducers at Close Distances.—B. D. Simmons & R. J. Urick. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 633–635.) "The reciprocity parameter for a plane wave sound field is shown to be equal to $2A/\rho c$, where A is the area of the plane piston source and ρc the characteristic acoustic resistance of the medium. It is shown experimentally that the sound field in front of a plane piston source is effectively plane over a distance approximately equal to A/λ, and that in such a region the plane wave parameter may be used to obtain a free-field calibration of the transducer by the reciprocity method."

534.78 **532**

Theory of Speech Masking by Reverberation.—R. H. Bolt & A. D. MacDonald. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 577–580.) A general statistical theory, in which speech is regarded as a series of discrete pulses distributed over a 30-db range in sound-pressure level in a given frequency band.

534.843 **533**

Acoustics of Rooms.—M. A. S. Ross. (*Nature, Lond.*, 24th Dec. 1949, Vol. 164, No. 4182, pp. 1080–1081.) Summary of a course of 6 lectures by R. H. Bolt, which included reviews of accepted theory, recent progress, and problems requiring further investigation.

534.844.4 **534**

Problems of Sound in Large Halls with Strong Reverberation.—T. S. Korn. (*HF, Brussels*, 1949, No. 4, pp. 103–108. In French, with English summary.) Reasons for reduced intelligibility in certain halls are discussed. The simplifications generally accepted for the acoustic study of halls do not apply when the reverberation time is large. Methods for reducing the reverberation effect are discussed and an 'apparent reverberation time' is introduced, in which account is taken of the duration of the exciting sound. The most effective procedure for reducing reverberation is to increase as far as possible the intensity of the direct wave relative to that of the reflected wave.

534.86 : 621.396.619.13 : 621.396.712 **535**

A Demonstration of Experimental F.M. Broadcast Transmitting and Receiving Equipment.—W. W. Honnor. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1949, Vol. 10, No. 2, pp. 35–41.) 1948 Australian I.R.E. Convention paper. The equipment is described and an analysis of a listening test is given. The results indicate that f.m. broadcasting transmissions, if reproduced by high-quality receivers, will be more acceptable to the majority of listeners than the service provided by the existing a.m. m.f. system, if conventional superheterodyne receivers are used.

621.395.61/.62 **536**

A Low-Q Directional Magnetostrictive Electroacoustic Transducer.—L. Camp & F. D. Wertz. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, p. 636.) Correction to 3022 of 1949.

621.395.61/.62 **537**

Theory of Passive Linear Electroacoustic Transducers with Fixed Velocity Distribution.—L. L. Foldy. (*J. acoust. Soc. Amer.*, Nov. 1949, Vol. 21, No. 6, pp. 595–604.) In previous papers (3559 of 1945 and 1990 of 1947) a general theory of transducers was developed. The special case of a fixed velocity distribution is now analysed in simpler mathematical terms but in greater detail. The impedances, transmitting and receiving responses, directional properties, and efficiency are considered, and the 'reciprocity' and 'available acoustic power' theorems are proved. Summary noted in 939 of 1949.

621.395.61 **538**

Sensitivity and Fidelity of Microphones.—J. Henry. (*Radio franç.*, Nov. 1949, No. 11, pp. 17–20.) Two applications of the principle of reaction are first outlined and two microphone circuits then described. The first circuit comprises a microphone of any type that may act as a variable impedance element in an oscillatory circuit, a h.f. oscillator, a special type of quartz discriminator, and a frequency stabilizer. Using a capacitor microphone the l.f. output available is of the order of 1 V, compared with the normal 10–100 mV. The second arrangement is a reaction system using a carbon microphone coupled mechanically to a telephone earpiece. This can give either a considerable increase in sensitivity or in fidelity.

621.395.625 + 534.862.3/.4 **539**

Some Factors governing the Choice of a High-Quality Recording and Reproducing System.—G. F. Dutton. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1949, Vol. 10, No. 10, pp. 269–275.) A general discussion of the advantages and limitations of film recording, the Philips-Miller system (mechanically engraved variable-area film), disk systems and magnetic-tape systems.

621.395.625.2 **540**

Modern Practice in Disc Recording.—R. V. Southey. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1948, Vol. 9, No. 11, pp. 16–20.) A general survey, with special reference to needle-tip and groove dimensions, cross-over frequency and frequency correction. Recommended tip and groove dimensions for standardization are noted.

621.395.625.2 : 534.86 **541**

Some Problems of Disc Recording for Broadcasting Purposes.—F. O. Viol. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1949, Vol. 10, No. 2, pp. 42–47.) The advantages of disk recording are outlined and the best compromise for groove spacing and velocity and direction of cut for 16-in. disks is discussed. A recommended recording characteristic for general use is given. Recording heads and pickups suitable for cellulose-nitrate disks are also considered.

621.396.619.23 : 621.396.615.11 **542**

Warbler for Beat-Frequency Oscillator.—Flanagan. (*See* 590.)

621.396.645 **543**

Description and Analysis of a New 50-Watt Amplifier Circuit.—McIntosh & Gow. (*See* 592.)

621.396.645.37 **544**

The Cathode Follower as Audio Power Amplifier.—Sterling. (*See* 599.)

681.84 **545**

Designing a Portable Sound Projector.—G. A. del Valle. (*Elect. Mfg, N.Y.*, Aug. 1949, Vol. 44, No. 2, pp. 74–79 . . 188.) The R.C.A.400 Junior model, for use with 16-mm sound film, weighs only 46 lb with its loudspeaker. The sound amplifier has four stages, with inverse feedback, and gives up to 10 W sound output with $<2\%$ distortion, while frequency response varies by less than 5 db over the range 50–5 000 c/s. An intensity of 150 lumens is obtained on the screen, using a standard 1 000-W lamp with forced-air cooling. The apparatus gives a class-room performance comparable with professional cinema standards and it does not require a skilled operator.

681.85 **546**

Some Aspects of Phonograph Pickup Design.—W. R. Nicholas. (*Proc. Instn Radio Engrs, Aust.*, March 1949, Vol. 10, No. 3, pp. 63–73. Correction, Vol. 10, No. 4, p. 113.) A brief review is given of the properties of lateral disk records. The electrical and mechanical requirements to be met by a pickup are stated and a general treatment of the design of a typical magnetic pickup is given. The forces likely to be encountered at the stylus point are discussed and calculations are made for a particular type of magnetic pickup. Improved types are briefly described and their principal characteristics noted.

AERIALS AND TRANSMISSION LINES

621.315.212 : [621.395 + 621.397 **547**

Progress in Coaxial Telephone and Television Systems.—Abraham. (*See* 739.)

621.392.22 + 621.392.26† **548**

A General Method of Solution for Non-Uniform Cylindrically Symmetrical Wave Fields.—H. H. Meinke. (*Z. angew. Phys.*, Oct. 1949, Vol. 1, No. 11, pp. 509–516.) Continuation of 1645 of 1948. The frequency dependence of the permeability μ of the dielectric in the transformed system is determined by the Fourier coefficients in the expression for μ. To a first approximation the permeability increases as the square of the frequency. The wave field of a cylindrically symmetrical non-uniformity can be determined as soon as the e.s. field distribution for the transformed system and its equipotential lines are known.

621.392.22 : 621.3.09 **549**

Contribution to the Study of Propagation on a Heterogeneous Line.—F. H. Raymond. (*J. Phys. Radium*, June 1946, Vol. 7, No. 6, pp. 171–177.) Methods of solving the equations of propagation, due to Parodi (2149 of 1944) and to Raymond (2472 of 1946), are discussed. The coefficients of reflection and transmission are defined for the general case, and a solution is obtained by means of series. Steady-state conditions are considered; Laplace transformations can be used to apply the results obtained to transient conditions. The method of treatment is applicable to coaxial cables with irregularities which may give rise to echo signals, and to propagation in heterogeneous media.

621.392.26† **550**

The Field in Non-Uniform Rectangular Waveguides with H_{10}-Wave Excitation.—R. Piloty, Jr. (*Z. angew. Phys.*, Oct. 1949, Vol. 1, No. 11, pp. 490–502.) Continuation of 31 of January. An approximation method of solution of the general equation is developed. See also 548 above.

621.392.26† **551**

On the Input Impedance of a Waveguide beyond its Cut-Off Frequency.—A. Briot. (*C. R. Acad. Sci., Paris*, 21st Nov. 1949, Vol. 229, No. 21, pp. 1066–1068.) Bromwich's differential equation for the e.m. field can be simplified in the case of a piston attenuator, the excitation being longitudinal and periodic. Formulae are obtained for the impedance for both electric and magnetic modes. The input impedance of a piston attenuator is imaginary, whatever the mode considered. It is capacitive for electric modes and inductive for magnetic modes. Since the characteristic impedance of a waveguide is a real quantity, a dissipative element should be placed in front of the attenuator to absorb reflected energy.

621.392.26† : 621.392.43 : 621.396.615.141.2 **552**

Determination of the Characteristics of Matching Circuits for a Magnetron Modulator.—J. Ortusi & P. Fechner. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 295–314.) The characteristic impedances of waveguides are calculated for different types of wave, and the conditions for suppression of the stationary waves caused by the insertion of an active obstacle in the waveguide are considered in detail. A method is described for measurement of the reflection, transmission and loss characteristics of an active obstacle in a waveguide and, for the case of a magnetron modulator, the conditions are determined which are necessary for the greatest possible variation of the impedance thrown back by the magnetron into the waveguide. See also 894 of 1949 (Gutton & Ortusi) and 2140 of 1949.

621.396.67 **553**

Fundamental Limitations of Small Antennas.—H. A. Wheeler. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1949, Vol. 10, No. 2, pp. 47–52.) Reprint. See 1261 of 1948.

621.396.67 **554**

Radiation Patterns and Gain of a Four-Antenna Array located at the Corners of a Square around a Central Parasitic Antenna.—G. Boudouris. (*J. Brit. Instn Radio Engrs*, Dec. 1949, Vol. 9, No. 12, pp. 427–439.) Analysis assuming all are $\lambda/4$ aerials grounded to a perfectly conducting plane. The impedance at the base of each aerial is calculated as a function of the length of the diagonal, and the horizontal and vertical radiation patterns are determined. These may have directional characteristics. By comparing the field produced by the array to the field produced by a single aerial for the same power input, the average increase in field is found as a function of the diagonal spacing. The maximum average increase is 20% and the maximum peak increase in certain directions 60%. The effect of limited ground conductivity and the use of radiators shorter than $\lambda/4$ are discussed.

621.396.67 **555**

Helical Beam Antenna Design Techniques.—J. D. Kraus. (*Communications*, Sept. 1949, Vol. 29, No. 9, pp. 6–9 . . 35.) Approximate formulae are derived for beam width, power gain, axial ratio and terminal resistance of a helix radiating in the axial mode with angle of pitch between 12° and 15°. The smaller angle gives a sharper main lobe for given axial length, while the larger angle gives a slightly smaller resistance variation throughout the frequency band.

621.396.67 : 621.392.43 **556**

Impedance Transformation in Folded Dipoles.—R. Guertler. (*Proc. Instn Radio Engrs, Aust.*, April 1949, Vol. 10, No. 4, pp. 95–100.) The impedance of a folded dipole, relative to that of a simple dipole, may be adjusted by the use of conductors of different diameters for the separate elements. Increased impedance ratios can be obtained by the use of additional elements. Approximate formulae are developed for calculating the impedance ratio when the current ratio is known. Measurements confirm the practical applicability of the formulae.

621.396.67 : 621.397.62 **557**

Quadrature Phased TV Receiving Antenna.—(*Tele-Tech*, Nov. 1949, Vol. 8, No. 11, pp. 36–37.) A capacitive phase shifter, with combined resistive and inductive detuning compensation, is used with two crossed horizontal dipoles to provide variable directivity without rotation of the aerial system. Orientation of one dipole can be used to minimize ghost effects. An outdoor and a built-in system are described. The whole U.S. television band is covered without switching.

621.396.671 **558**

The Predetermination of Antenna Characteristics by Means of Models.—R. D. Boadle. (*Proc. Instn Radio*

Engrs, Aust., June 1949, Vol. 10, No. 6, pp. 155–159.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. Description of equipment and technique, with results for a high-gain vertically polarized v.h.f. aerial.

621.396.67 : 621.396.9 **559**
Radar Scanners and Radomes. [Book Review]—Cady, Karelitz & Turner. (*See* 651.)

CIRCUITS AND CIRCUIT ELEMENTS

534.42 + 538.561 **560**
Production and Observation of High Frequencies due to Combination of Several Low Frequencies.—S. Dolinski. (*C. R. Acad. Sci., Paris*, 24th Oct. 1949, Vol. 229, No. 17, pp. 812–814.) Suitable methods are described for audio and radio frequencies.

621.3.015.33 : 621.392 **561**
Response of Circuits to Steady-State Pulses.—D. L. Waidelich. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1396–1401.) "A method of calculating the steady-state response of circuits to repeated pulses is given using the method of the steady-state operational calculus. A short table of transforms which have been found useful in these calculations is also presented. The response of several basic circuits to these pulses is obtained and shown as calculated curves, and the calculated curves are then compared with curves obtained experimentally. These curves have been found to be very useful in adjusting circuits to be used with pulses. Several other possible applications are discussed."

621.314.2 : 621.396.611.33/.34 **562**
A Design for Double-Tuned Transformers.—J. B. Rudd. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1949, Vol. 10, No. 1, pp. 3–9.) 1948 Australian I.R.E. Convention paper. See 3063 of 1949.

621.314.3† **563**
An Experimental Study of the Magnetic Amplifier and the Effects of Supply Frequency on Performance.—E. H. Frost-Smith. (*J. Brit. Instn Radio Engrs*, Dec. 1949, Vol. 9, No. 12, pp. 440–443.) Discussion on 44 of January.

621.314.3† **564**
On the Dynamics of the Self-Excited Series Transductor.—M. Delattre & K. Kühnert. (*C. R. Acad. Sci., Paris*, 24th Oct. 1949, Vol. 229, No. 17, pp. 819–821.) Discussion for the period of transition from one steady state to a different one when the control current is changed. The response time depends on the absolute value of the input signal and on various other factors; it approaches zero under ideal conditions.

621.314.3† **565**
Self-Saturation in Magnetic Amplifiers.—W. J. Dornhoefer. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, p. 988.) Summary of A.I.E.E. paper. A high voltage can be induced in the control winding if one a.c. coil becomes inoperative and the effective inductance and time delay of the control circuit are substantial, but these factors can be reduced either by external feedback or by self-saturation. The latter method makes use of a rectifier valve in series with each a.c. (anode) winding; its advantages are discussed: it has been applied for both a.c. and d.c. output and for single and polyphase supplies. Rectifiers with high backward/forward resistance ratio are required.

621.317.772 **566**
Diode Phase-Discriminators.—R. H. Dishington. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1401–1404.) "Two sinusoidal phase-discriminators are analyzed and it is found that universal curves of their general phase characteristics can be plotted as a function of two parameters. From these curves it is concluded that the resistances in series with the tubes and also the tube resistances themselves are the most important factors in determining optimum performance."

621.318.4 : 621.397.62 **567**
Coils for Television Receivers.—F. Juster. (*Télévis. franç.*, Nov. 1949, No. 53, pp. 15–18, 24.) Graphical methods for designing h.f., i.f. and video-frequency coils with maximum Q.

621.318.42 **568**
On the Calculation of Effective Core Permeability of Premagnetized Choke Coils.—J. Kammerloher. (*Funk u. Ton*, 1949, Vol. 3, Nos. 9/10, pp. 491–496.) Continuation of 29 of 1949. Values obtained when differential permeability is replaced by reversible permeability are in good agreement with those of Feldtkeller.

621.318.7 **569**
The Theory of Electric Filters and the Polynomials of Tchebycheff.—A. Colombani. (*J. Phys. Radium*, Aug. 1946, Vol. 7, No. 8, pp. 231–243.) Full paper; for abstract of shorter version see 652 of 1947.

621.392 **570**
Quarter Wave Networks.—E. Green. (*Marconi Rev.*, Oct./Dec. 1949, Vol. 12, No. 95, pp. 157–171.) The properties of a normal $\lambda/4$ line are derived by means of vector diagrams and the following basic equations used to express any form of $\lambda/4$ or inverting network:

$$I_1 = jV_2/R_0; \quad V_1 = jR_0I_2.$$

I_1, V_1 and I_2, V_2 are respectively the input and output current and voltage and R_0 is the surge impedance of the $\lambda/4$ line. It is proved that certain types of lumped network are identical as regards external relations. The component values and characteristic impedances of various balanced and unbalanced networks are tabulated. An appendix deals with the derivation of different forms of a bridge network devised by A. T. Starr for operation between balanced and unbalanced lines. This derivation is based on that given by Starr in an unpublished memorandum.

621.392.43 : 621.396.67 **571**
Design Procedures for Pi-Network Antenna Couplers.—L. Storch. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1427–1432.) "The design of reactive pi-networks for transforming a wide range of complex load impedance into a fixed resistance shunted by a tuned circuit is subjected to a thorough investigation. A very significant result is the complete analogy which is established between the analysis and design of the pi-network and the equivalent manipulation of a group of simple geometrical figures."

621.392.5 **572**
Realization of Linear Quadripoles with Prescribed Frequency Dependence, taking account of Equal Coil and Capacitor Losses.—Nai-Ta Ming. (*Arch. Elektrotech.*, 1949, Vol. 39, No. 8, pp. 496–507.) See also 3367 of 1949.

621.392.5 **573**
Resistance Quadripoles as Attenuator Elements.—W. Taeger. (*Funk u. Ton*, 1949, Vol. 3, Nos. 9/10, pp. 475–487.) Calculations of various impedance ratios in T, L, π and bridged-T networks. Attenuation in nepers is tabulated and plotted for different values of R/Z.

621.392.5 **574**
On the Synthesis of the Most General Passive Quadripoles.—V. Belevitch: R. Leroy. (*Câbles & Transmission, Paris*, Oct. 1949, Vol. 3, No. 4, pp. 340–341.) Comment on 1886 of 1949 and author's reply.

621.392.52 575

General Forms of Ladder-Filter Half-Sections Classed according to the Value of the Image-Impedance Transfer Index.—J. E. Colin. (*Câbles & Transmission, Paris,* Oct. 1949, Vol. 3, No. 4, pp. 281–293.) Continuation of 2748 of 1949. Different simple and compound types of ladder-filter network with one or two cut-off frequencies are reduced to eight basic forms, whose principal characteristics are discussed. Formulae for impedance ratio, component values and image-impedance are tabulated, and three general laws of form are enunciated.

621.392.52 576

Transference Nomographs for Low-Pass Iterative Filters.—E. W. Tschudi. (*Electronics,* Dec. 1949, Vol. 22, No. 12, pp. 112, 114.) For determining time constant and phase lag, given input frequency, attenuation and number of stages up to 6.

621.392.52 577

Using the Reactance Chart for Filter Design Problems.—H. B. Davis. (*Audio Engng, N.Y.,* Dec. 1949, Vol. 33, No. 12, pp. 12–13, 40.) Methods are outlined for determining the values of components of various filter and equalizer circuits.

621.392.52 578

Filters: Part 1 — The Importance of Z_0, the Characteristic Impedance.—"Cathode Ray". (*Wireless World,* Jan. 1950, Vol. 56, No. 1, pp. 25–29.)

621.392.52 : 621.395.44 : 621.316.1 579

Wave Filters protect Carrier Signals from Shunting Effect of Capacitors.—W. A. Ringger, Jr. (*Elect. World, N.Y.,* 19th Nov. 1949, Vol. 132, No. 21, pp. 106–108.) High-voltage wave filters using various parallel and series resonant-circuit combinations preserve carrier voltages and suppress spurious voltages associated with carrier operation on distribution systems.

621.395.667 580

Equalizer Charts.—(*Bell Syst. tech. Publ. Monogr.* B-1643, 15 pp.) Loss and phase of series, shunt and bridged-T equalizers are given in decibels and degrees.

621.396.611 581

Contribution to the Theory of the Mathematical Treatment of Nonlinear Phenomena.—H. Rosenhamer. (*Bull. schweiz. elektrotech. Ver.,* 8th Jan. 1949, Vol. 40, No. 1, pp. 5–18. In German.) A method is given for the solution of the general equation of order n applicable to nonlinear electrical phenomena. The equation is reduced to the sum of products of linear differential quotients with functional coefficients, which are then replaced successively by suitably chosen constants and the integration carried out by normal methods. The solution thus obtained only satisfies the original equation approximately, but can be used to determine fresh values of the functional coefficients giving a better solution. The method is applied to the study of an LCR circuit to which a sinusoidal voltage is applied.

621.396.611.1 582

Some Theoretical Considerations and Experiments on Oscillation Phenomena in Circuits with Nonlinear Elements.—G. J. Elias & S. Duinker. (*Tijdschr. ned. Radiogenoot.* Nov. 1949, Vol. 14, No. 6, pp. 163–191. In Dutch, with English summary.) The solutions of the equation

$$\ddot{y} + y + \upsilon y^3 = \alpha \cos (px + \phi)$$

are discussed. They include periodic solutions giving a fundamental frequency which is a submultiple of the generator frequency.

For free vibrations, the period can be expressed as an elliptic integral; for forced vibrations, an extension of this expression is given and the stability of the solution is discussed. If the e.m.f. is varied continuously, several discontinuities must occur if a periodic forced vibration, of the fundamental or a subharmonic frequency, is to be sustained. The effect of adding any number of odd powers of y to the left hand side of the differential equation is also considered; the expression for the period then becomes a hyperelliptic function. Experiments which confirm the theory are described; oscillograms of subharmonic vibrations are shown.

621.396.611.1 583

Resonant Circuits with Time-Varying Parameters.—R. H. Kingston. (*Proc. Inst. Radio Engrs, W. & E.,* Dec. 1949, Vol. 37, No. 12, pp. 1478–1481.) An approximate solution of the differential equation, with an error criterion giving the limits of accuracy of the solution.

621.396.611.4 584

Analogue Studies of Losses in Reflex Oscillator Cavities.—F. W. Schott & K. R. Spangenberg. (*Proc. Inst. Radio Engrs, W. & E.,* Dec. 1949, Vol. 37, No. 12, pp. 1409–1418.) "An analysis is made which shows the method of applying the network analogue to investigation of the effect of dielectric and wall losses on cavity-resonator behavior.

"The Q and shunt resistance of re-entrant cavities operating in the first- and second-order TM_0 type modes are investigated. The condition for a zero of shunt resistance is determined. Experimental results are discussed."

621.396.615 585

The Breadth of the Pulling-In Range of a Self-Excited Valve Generator controlled by an Integral Multiple of its Natural Frequency.—H. Kanberg. (*Funk u. Ton,* 1949, Vol. 3, Nos. 9/10, pp. 497–505.) Analysis showing how the frequency range may be determined from the Lissajous figure displayed on a c.r.o.

621.396.615 586

The Transitron Effect and its Applications.—J. Moline. (*Radio franç.,* Nov. 1949, No. 11, pp. 21–24.) Distinction is made between the dynatron effect in a tetrode and the transitron effect in a pentode, and a simple explanation of transitron operation is given. The characteristics of some typical valves operating as transitrons are noted, and applications of the transitron effect to the maintenance of sinusoidal or of relaxation oscillations are considered.

621.396.615 : 621.396.611.32 587

Phase-Shift Oscillators with Very Tight Coupling.—M. Soldi. (*Radio tech. Dig., Édn franç.,* Dec. 1949, Vol. 3, No. 6, pp. 353–363.) French version of 2757 of 1949, with the addition of a comprehensive bibliography.

621.396.615.17/.18 588

High-Ratio Multivibrator Frequency Divider.—M. Silver & A. Shadowitz. (*Proc. Instn Radio Engrs, Aust.,* Sept. 1949, Vol. 10, No. 9, pp. 256–258.) Reprint. See 52 of 1949.

621.396.615.17 : 621.317.755 589

A Slow-Sweep Time-Base.—V. H. Attree. (*J. sci. Instrum.,* Aug. 1949, Vol. 26, No. 8, pp. 257–262.) The requirements of timebases suitable for sweep durations of the order 100 sec–10 ms are discussed with special reference to the use of triggered multiple sweeps. Flyback time can be made as little as one thousandth of the scan time. The circuit described is direct-coupled throughout, and linear traces of identical velocity and duration are generated irrespective of the nature of the triggering wave. The timebase is unaffected by any trigger pulses which may occur during sweeping.

621.396.619.23 : 621.396.615.11 590

Warbler for Beat-Frequency Oscillator.—J. L. Flanagan. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 93–95.) A new reactance valve circuit giving f.m. of about ± 10% without accompanying a.m., for use with a standard beat-frequency audio oscillator. Instead of using a capacitor to couple anode and grid, the grid is earthed and the capacitor is connected between anode and cathode, a degenerative resistance being introduced between cathode and earth. The theoretical expression for the input impedance shows that its resistive component is independent of g_m.

621.396.645 591

A Contact-Modulated Amplifier and Some of Its Laboratory Uses.—J. F. Lash. (*Science*, 7th Oct. 1949, Vol. 110, No. 2858, pp. 374–375.) A d.c. signal, converted to 80-c/s a.c. by a mechanical interrupter, is stepped up in voltage by a transformer followed by several valve-amplifier stages and finally rectified by a second interrupter synchronized with the first. This system enables d.c. signals of a few hundredths of a microvolt to be measured.

621.396.645 592

Description and Analysis of a New 50-Watt Amplifier Circuit.—F. H. McIntosh & G. J. Gow. (*Audio Engng, N.Y.*, Dec. 1949, Vol. 33, No. 12, pp. 9–11 . . 40.) A circuit is described which eliminates the distortion present in conventional push-pull amplifiers operating between class A and class B, due to leakage reactance between the primary windings. A high ratio (> 200 000 to 1) of primary inductance to leakage reactance is obtained by winding the two primaries together in a bifilar manner. Circuit details and performance characteristics are given. A 50-W output is obtained at frequencies from 20 c/s to 20 kc/s with less than 1% harmonic or intermodulation distortion.

621.396.645 593

Grounded-Grid Power Amplifiers.—P. A. T. Bevan. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, pp. 323–339.) French version of 2763 of 1949, with the addition of a comprehensive bibliography.

621.396.645 594

Wide-Band Chain Amplifier.—F. Kennedy & G. Rudenberg. (*Elect. Mfg, N.Y.*, Nov. 1949, Vol. 44, No. 5, pp. 56–59 . . 168.) The amplifier operates on the travelling-wave principle; a series of valves have their grids connected to one delay line and their anodes to another. The forward waves produced in the lines augment each other and the backward waves are absorbed by the anode resistors. Six valves are used in an amplifier with a constant gain of 20 db over the range 200 kc/s–200 Mc/s. Undistorted output is obtained up to 4 V and the s.w.r. is < 1.5 db. Design and construction details are given; the importance of careful layout to avoid stray capacitance and inductance is stressed.

621.396.645 : 621.385.029.63/.64 595

200-Mc/s Traveling-Wave Chain Amplifier.—H. G. Rudenberg & F. Kennedy. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 106–109.) A brief descriptive account of a wide-band amplifier consisting of several valves whose grids are fed from taps on a terminated artificial line consisting of a series of inductors connected between the grid shunt capacitors. The output is taken from the end of a similar line joining the anodes. Particular examples and some refinements are discussed. The optimum gain per chain is 2.718. Any further gain should be obtained by connecting such chains in series. Such a design is most economical in valves.

621.396.645.029.42/.52 : 621.396.822 596

Selective Amplification at Low Frequencies.—L. de Queiroz Orsini. (*Onde élect.*, Nov. & Dec. 1949, Vol. 29, Nos. 272 & 273, pp. 408–413 & 449–456.) Discussion of voltage amplifiers with narrow pass-band, for frequencies between 2 c/s and 50 kc/s. Feedback circuits are described for frequencies near 500 c/s, and parallel-T circuits for very low frequencies. Flicker effect and other valve and circuit noise, and methods of reducing it, are also considered.

621.396.645.211 597

Theory of Resistance-Amplifier Stage.—W. Druey. (*Bull. schweiz. elektrotech. Ver.*, 22nd Jan. 1949, Vol. 40, No. 2, pp. 49–51. In German.) A derivation of the gain formula from a consideration of equivalent circuits.

621.396.645.35 598

Stabilizing a Wide-Band D.C. Amplifier.—A. J. Williams, Jr, W. G. Amey & W. McAdam. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, p. 934.) Summary of A.I.E.E. paper. The problem of zero stabilization in d.c. amplifiers with negative feedback is discussed. A comparison of input with output divided by gain can be used to indicate zero disturbance, whether a signal is present or not. The comparison voltage is applied to a correcting circuit using a contact-modulated d.c. amplifier and integrator. Zero correction to within a fraction of a microvolt is thus obtained in less than 0.005 sec.

621.396.645.37 599

The Cathode Follower as Audio Power Amplifier.—H. T. Sterling. (*Audio Engng, N.Y.*, Dec. 1949, Vol. 33, No. 12, pp. 14–15 . . 29.) As an output stage, the cathode follower is a feedback amplifier with special characteristics which can be provided equally well by conventional amplifier circuits.

621.396.662.029.64 : 621.392.26† 600

Microwave Attenuators.—R. Malvano. (*Elettronica & Televisione, Turin*, Sept. 1949, Vol. 4, No. 6, pp. 221–226; French version in *Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, pp. 369–374.) A general discussion with particular reference to waveguide attenuators. A description of an experimental attenuator made at the Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin, is included.

GENERAL PHYSICS

535.3 601

On the Attenuation of Plane Waves by Obstacles of Arbitrary Size and Form.—H. C. van de Hulst. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, Nos. 8/9, pp. 740–746. In English.) The extinction cross-section of any obstacle is -2λ times the imaginary part of the amplitude function for forward scattered light. This relation holds for any size, shape or composition of the obstacle, and may be applied to light, sound and electron scattering. It may be generalized to include polarization effects. Examples are discussed.

537.311.62 : 621.318.4 602

Study of the H.F. Resistance of a Stranded-Wire Coil.—A. Colombani. (*J. Phys. Radium*, Oct. 1949, Vol. 10, No. 10, pp. 285–294.) Starting from Maxwell's equations and assuming the radius of the strand to be less than the depth of penetration of the current, a simple formula is derived for h.f. resistance. The formula is in agreement with the calculations of Sommerfeld and with measured values. Its application to different problems is illustrated and shows that there is an optimum resistance and form of coil in each case. For frequencies above 3 Mc/s, solid wire is preferable to stranded wire, for which the losses in the enamel insulation of the strands become important.

537.533 : 538.569 : 621.396.822 **603**

Fluctuation Phenomena arising in the Quantum Interaction of Electrons with High-Frequency Fields.—D. K. C. MacDonald & R. Kompfner. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1424–1426.) Quantum-mechanical analysis of the interaction of an electron beam with an oscillating resonant cavity is applied to determine the fluctuations in energy flow in the beam. Comparison of the expressions for the classical and quantal cases indicates that, under extreme limiting conditions of operation, a difference might just be perceptible.

537.581 : 621.385.032.213 **604**

Thermionic Electron Emission from Carbon.—H. F. Ivey. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, p. 567.) Values of the electronic work function ϕ, the Richardson constant A, and the emission current density are given for a carbon filament after heating to 2 500°K. ϕ = 4.60 eV and A = 46 A/cm² degree². The values of current density at 1 500°K and 2 000°K are 0.039 μA/cm² and 0.50 mA/cm² respectively, which are lower than the values found by other investigators.

538.3 **605**

The Application of Maxwell's Second Law.—H. Kafka. (*Elektrotechnik, Berlin*, Nov. 1949, Vol. 3, No. 11, pp. 353–358.) A distinction between the mathematical expression and the physical interpretation of the laws of induction.

538.51 **606**

Electromagnetic Induction in a Rotating Sphere.—E. C. Bullard. (*Proc. roy. Soc. A*, 7th Dec. 1949, Vol. 199, No. 1059, pp. 413–443.) An account is given of the induction of electric currents in a rotating, conducting sphere surrounded by and in contact with a concentric, stationary, conducting shell of any thickness. The currents and associated mechanical couples induced by various constant fields are discussed, and the freely decaying modes are studied. The modes involving toroidal magnetic fields are of most interest and may be important in terrestrial magnetism. Induction in an oscillating sphere is briefly discussed.

538.56 : 537.71 **607**

On the Resistance of Electromagnetic Waves.—C. Budeanu. (*Rev. gén. Élect.*, Nov. 1949, Vol. 58, No. 11, pp. 481–484.) This resistance could be given different values according as the classical or the rationalized system of units is used. The precautions necessary in expressing this quantity and the value it should be given are considered.

538.566 : [537.562 + 537.525.92 **608**

Wave Amplification by Interaction with a Stream of Electrons.—J. A. Roberts. (*Phys. Rev.*, 1st Aug. 1949, Vol. 76, No. 3, pp. 340–344.) Discussion of the propagation of plane e.m. waves in a uniform ionized medium in which the electrons have a mean drift velocity. The treatment is based on Bailey's general theory (2785 and 3406 of 1949). For frequencies below a critical frequency of the same order as the electron plasma frequency, one of the eight waves possible in general grows in amplitude as it progresses through the medium. The relation of this result to theories of solar noise and of the travelling-wave amplifier is discussed.

538.569.4 **609**

Absorption of Ultra High-Frequency Radio Waves in Organic Liquids.—S. C. Sirkar & S. N. Sen. (*Nature, Lond.*, 17th Dec. 1949, Vol. 164, No. 4181, pp. 1048–1049.) Acetone shows an absorption peak at about 400 Mc/s and glycerine at about 500 Mc/s for a temperature of 31°C. Absorption curves for these and other liquids are given and discussed.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

016 : 550.3 **610**

List of Recent Publications.—H. D. Harradon. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 308–314.) Subjects covered include terrestrial magnetism and electricity, cosmic rays, upper-air research, and the earth's crust and interior.

061.3 : 551.510.535 : 538.566 **611**

The Conference on Ionospheric Research.—(*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 281–294.) Summaries of symposia and abstracts of papers presented at the conference held at Pennsylvania State College under joint sponsorship of that College and of the Geophysical Research Directorate, U.S.A.F., 27th–29th June 1949. Selected papers are noted below, in this section or in the 'Propagation of Waves' section.

523.32 : 621.396.822 **612**

Microwave Thermal Radiation from the Moon.—J. H. Piddington & H. C. Minnett. (*Aust. J. sci. Res., Ser. A*, March 1949, Vol. 2, No. 1, pp. 63–77.) Measurements have been made in a 15-Mc/s band centred at 24 kMc/s. The average temperature over the lunar disk varies sinusoidally between 198.7°K and 279.3°K, with a phase lag behind the lunar phase angle of about 45°. The discrepancy with previous measurements at long infra-red wavelengths is explained in terms of radiation from subsurface layers which are partially transparent to 24-kMc/s waves. Results are consistent with the existence of a thin layer of dust covering a solid lunar surface. The temperature of the disk of the new moon is estimated at 156°K, and that of the deep interior at 241°K.

523.53 : 621.396.9 **613**

A Study of Radio Reflections from Meteor Trails in Research on the Upper Atmosphere.—A. G. McNish. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 285.) Summary of Pennsylvania State College Conference paper. Discussion of radio research on meteors in progress at C.R.P.L., with special reference to the investigation of ionic processes in the upper atmosphere. Experimental equipment consists of two 10-kW pulse transmitters operating continuously on 27.2 and 40.4 Mc/s. Signals reflected from the ionized trail left by the meteor are recorded on pen-and-ink tape and on photographic film. Results already obtained indicate clearly that meteors are not responsible for most of the E_s reflections ordinarily obtained by vertical-incidence recorders. Two possible mechanisms of reflection are considered and an experimental method for discriminating between them is suggested.

523.72 + 523.854] : 621.396.822 **614**

Solar and Galactic R.F. Radiation.—M. Laffineur. (*Onde élect.*, Nov. 1949, Vol. 29, No. 272, pp. 402–407.) A general survey of recent work; results obtained by various authors are compared graphically. A solar disturbance observed at Meudon on 26th March 1949 is discussed. Other such disturbances were noted in 698 and 3129 of 1949. See also 2777 of 1948 (Lehmann).

523.72 : 621.396.11 **615**

Observations of the Propagation of Broadcasting Waves, λ = 1250 m, during the Occurrence of Mögel-Dellinger Effects.—Lauter. (*See* 716.)

523.72 : 621.396.822 **616**

Solar Radiation at 1 200 Mc/s, 600 Mc/s and 200 Mc/s.—F. J. Lehany & D. E. Yabsley. (*Aust. J. sci. Res., Ser. A*, March 1949, Vol. 2, No. 1, pp. 48–62.) Daily observations made between 18th Aug. and 30th Nov. 1947 are described. The characteristics of the radiation at 200 Mc/s were in general agreement with other observations. At 600 and 1 200 Mc/s the received intensity showed long-term variations over a range of about 2 : 1. "The radiation received when the sun was almost free of sunspots corresponded to an effective black-body temperature of 0.5 million °K at 600 Mc/s and 0.1 million °K at 1 200 Mc/s. As sunspots appeared, the temperature rose and showed marked correlation with sunspot area. It is considered that radiation at these frequencies is entirely thermal in origin and that the long-period variations are at least partly due to the influence of the magnetic field of sunspots on the mechanism of thermal emission from a magneto-ionic medium. On a few occasions, isolated disturbances were observed on 600 Mc/s and 1 200 Mc/s, some of which were associated with chromospheric flares and radio fade-outs. The difficulties arising in the calibration of the apparatus and the steps taken to overcome them are discussed in detail."

523.746 : 523.752 **617**

Hall Currents and the Ejection of Prominences by Sunspots.—R. G. Giovanelli. (*Aust. J. sci. Res., Ser. A*, March 1949, Vol. 2, No. 1, pp. 39–47.) A theoretical explanation of the occurrence of eruptive prominences in the neighbourhood of a chromospheric flare. Localized regions of large space charge occur because of the relatively low conductivity perpendicular to lines of magnetic force. Large electric fields are thus set up normal to the magnetic field, and both positive and negative charges drift in the same sense in a direction at right angles to the crossed fields, giving rise to a general movement of the gas. The drift velocities appear to be comparable with those found in prominences. See also 78 and 376 of 1949 and 357 of February.

523.746"1949.04/.06" **618**

Provisional Sunspot-Numbers for April to June 1949.—M. Waldmeier. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 300.)

523.75 : 551.510.535 **619**

Ionospheric Effects of Solar Flares, 1948.—O. E. H. Rydbeck & D. Stranz. (*Chalmers tekn. Högsk. Handl.*, 1949, No. 83, 16 pp. In English.) Regular recordings of such effects with different kinds of apparatus were started at the Chalmers University Geophysical Observatory early in 1948. The results of the first half-year are discussed in this preliminary report. The statistical distribution across the solar disk of radiation sources giving rise to a greater or less degree of fading of radio signals is shown. The magnitude and probability of the absorption of the ultraviolet fade-out radiation in the solar corpuscular beam is discussed.

550.38"1949.01/.03" **620**

International Data on Magnetic Disturbances, First Quarter, 1949.—(*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 295–299.) Continuation of 3418 of 1949 in revised form, with explanation of new symbols and abbreviations. The original *K*-index is replaced by a planetary 3-hour range index K_p. Additional preliminary data on sudden commencements and solar flare effects (crochets) are included.

550.38"1949.04/.06" **621**

Cheltenham [Maryland] **Three-Hour-Range Indices *K* for April to June, 1949.**—P. G. Ledig. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 300.)

550.384 **622**

The *K*-Index of Geomagnetic Activity at Eskdalemuir, 1940–47.—J. Crichton. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 275–276.) Discussion of the relative importance of horizontal intensity H, declination D, and vertical intensity V as the determining factor in the assignment of *K*-indices, and of the diurnal and seasonal incidence, and recurrence tendencies, of occasions when D or V was the determining factor.

550.385"1949.01/.06" **623**

Principal Magnetic Storms [Jan.–June 1949].—(*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 301–302.)

551.510.5 : 551.524.7 **624**

Tropopause Fluctuations due to High-Reaching Influxes of Cold Air.—W. Hesse. (*Z. Met.*, May/June 1949, Vol. 3, Nos. 5/6, pp. 129–135.) Discussion of the connection between variations of the temperature at the tropopause and in the upper troposphere and lower stratosphere.

551.510.52 : 546.214 : 551.524.7 **625**

Total Ozone Related to Troposphere Temperatures.—(*Tech. Bull. nat. Bur. Stand.*, Nov. 1949, Vol. 33, No. 11, pp. 128–129.) Long-term measurements of the ultraviolet radiation reaching the earth from the sun reveal a correlation between the temperature of the air at an altitude of about 5 miles and the total amount of O_3 in the atmosphere.

551.510.535 **626**

Ionization of the Stratosphere over High- and Low-Pressure Regions of the Troposphere.—G. Falckenberg & E. Lauter. (*Z. Met.*, May/June 1949, Vol. 3, Nos. 5/6, pp. 136–140.) A statistical analysis of the results of 650 observations of the reflection of 1 250-m waves from the E layer.

551.510.535 **627**

Calculation of the Absorption Decrement for a Parabolic Ionospheric Layer for the case of Vertical Incidence.—É. Argence & K. Rawer. (*C. R. Acad. Sci., Paris*, 14th Nov. 1949, Vol. 229, No. 20, pp. 996–997.) The total absorption is the sum of three parts, the first (δ_1) being the attenuation which depends on the path length, the second (δ_2) the loss of energy due to collisions in the layer, and the third (δ_3) due to partial reflection by the sporadic-E layer. Formulae are obtained for δ_2 for the case of total reflection and for that of layer penetration; the influence of the earth's magnetic field is neglected. These formulae are of importance in the study of E-layer absorption, which cannot be neglected when working near the critical frequency. See also 3035 and 3879 of 1939.

551.510.535 **628**

Electron Production in the Ionosphere.—R. Seeliger. (*Naturwissenschaften*, Nov. 1949, Vol. 36, No. 11, pp. 321–327. Bibliography, p. 327.) A study of conditions in the E layer.

551.510.535 **629**

True Heights of the F_2 Layer.—G. R. White & I. S. Wachtel. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 239–242.) "The true heights of electron density for Washington were computed, using the parabolic method, for winter, summer, and equinox of 1945 at noon and at midnight. Representative curves were formed by combining the data from a large number of days." The distributions obtained show that the maximum electron-density of the F_2 region occurs at a lower height at midday than at midnight. The curves are compared with similar curves for Huancayo, where the height of maximum electron density is greater at midday than at midnight.

551.510.535 **630**

Ionospheric Research in the U.S. Air Force.—N. C. Gerson. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 286–287.) Summary of Pennsylvania State College Conference paper. Various experimental undertakings planned or in progress are briefly mentioned.

551.510.535 **631**

Ionospheric Research at the Pennsylvania State College.—B. B. Underhill. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 287–288.) Summary of Pennsylvania State College Conference paper. An account of the history, organization, and research in progress at the Radio Propagation Laboratory.

551.510.535 **632**

Summary of a Meeting on Mathematical Problems in Ionospheric Research.—N. C. Gerson. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 289–290.) Discussion following the Pennsylvania State College Conference. Ten of the major problems suggested for investigation are noted.

551.510.535 **633**

Sunrise Effects in F Region from High Speed Ionospheric Recordings.—H. W. Wells. (*J. geophys. Res.*, Sept. 1949, Vol. 54. No. 3, pp. 277–280.)

551.510.535 : 525.624 **634**

Tidal Effects in the F Layer.—M. W. Jones & J. G. Jones. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, p. 581.) A periodic variation of the thickness of the F layer, noted at College, Alaska, was submitted to harmonic analysis. In addition to the diurnal change due to the sun's ionizing radiation, variations resulting from the contractions and expansions of the layer due to solar and lunar gravitational forces were noted. The lunar diurnal wave, whose amplitude varied from 0.1 to 1.6 times that of the solar semidiurnal tide during the winter of 1948–1949, can be explained by simple tidal theory.

551.510.535 : 525.624 **635**

Lunar Ionospheric Variations at Low-Latitude Stations.—A. G. McNish & T. N. Gautier. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 303–304.) Amplitudes and phase angles for variation in F_2-layer critical frequency at noon and 4 p.m. are tabulated for Huancayo, Christmas Island and Leyte (near the geomagnetic equator) and Trinidad and Maui (about 20° from the geomagnetic equator). Results are given for solstices and equinoxes; the age of the moon is included. The phase reversal in the noon values at 20° with respect to 0° geomagnetic latitude may be associated with the equatorial trough in the latitude distribution of F_2-layer critical frequencies.

551.510.535 : 525.624 **636**

On the Practical Determination of Lunar and Luni-Solar Daily Variations in Certain Geophysical Data.—K. K. Tschu. (*Aust. J. sci. Res., Ser. A*, March 1949, Vol. 2, No. 1, pp. 1–24.)

551.510.535 : 621.396.11 **637**

Summary of Symposia [at the Pennsylvania State College Conference].—A. H. Waynick. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 290–294.) The symposia covered (*a*) long-wave propagation, (*b*) the physical bases for the Appleton-Hartree dispersion equation, (*c*) studies of the auroral region, (*d*) ionospheric absorption, theory and measurement, (*e*) tidal oscillations in the upper atmosphere.

551.510.535 : 621.396.11 **638**

The Effect of the Lorentz Polarization Term on the Vertical Incidence Absorption in a Deviating Ionosphere Layer.—J. M. Kelso. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 284.) Summary of Pennsylvania State College Conference paper. Appropriate assumptions and approximations are used to derive expressions for absorption and for group height by means of the Lorentz theory. The results are compared with those obtained by Hacke from the Sellmeyer theory. The determination of the value of the collisional frequency at the level of maximum ionization is discussed for both theories. See also 1050 of 1949 (Hacke & Kelso).

551.510.535 : 621.396.11 **639**

Sporadic Ionization at High Latitudes.—Meek. (*See* 725.)

551.524 + 551.54 **640**

Atmospheric Pressure and Temperature Gradients over Central Europe.—R. Höhn. (*Z. Met.*, May/June 1949, Vol. 3, Nos. 5/6, pp. 148–153.)

551.594.5 : 621.396.11 **641**

Sky-Wave Observations (λ = 1250 m) during Displays of the Northern Lights in 1947.—Lauter & Sprenger. (*See* 728.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 **642**

The Use of Radar in the Ice-Breaker Service.—H. Larsson. (*J. Inst. Nav.*, Oct. 1949, Vol. 2, No. 4, pp. 315–323.) A R.C.A. Type CR-101 radar set was used for the 3-cm band and a Raytheon Mariners' Path-finder for the 10-cm band. The type of echo received from various types of ice is described. Radar can be used to determine the ice-breaker's position from bearings on landmarks, to detect open-water channels in conditions of bad visibility, or to locate a ship whose position is only approximately known in the ice-breaker. The relative merits of the two wavelengths are discussed.

621.396.9 : 523.53 **643**

A Study of Radio Reflections from Meteor Trails in Research on the Upper Atmosphere.—McNish. (*See* 613.)

621.396.9 : 551.515.2 **644**

Industrial Radar for Hurricane Tracking.—W. F. Gerdes & R. C. Jorgensen. (*Science*, 7th Oct, 1949, Vol. 110, No. 2858, pp. 357–360.) Hurricanes present a distinctive picture on a radar set because of the accompanying heavy rain. Modifications to a 10-cm radar set Type SCR-784, for hurricane observation near Freeport, Texas, are discussed.

621.396.933 **645**

High-Stability Radio Distance-Measuring Equipment for Aerial Navigation.—H. Busignies. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1948, Vol. 9, No. 11, pp. 5–10.) Paper presented at the 1948 Australian I.R.E. conference, Sydney, and describing equipment noted in 1402 and 1944 of 1949.

621.396.933 **646**

Improved Radio Systems for Modern Aircraft.—(*Tele-Tech*, Nov. 1949, Vol. 8, No. 11, pp. 31–33, 59.) Discussion of recent developments incorporating many P.I.C.A.O. recommendations (see 2436 and 3532 of 1947) and of distance measuring equipment, full use of which may be expected by 1953. See also 102 of January (Burgmann).

621.396.933 **647**

The Oboe System.—P. Besson. (*Onde élect.*, Oct. & Nov. 1949, Vol. 29, Nos. 271 & 272, pp. 351–367 & 414–426.) A comprehensive description. See also 1790 of 1947 (Jones).

621.396.933 **648**

Pulse Navigation Systems.—W. L. Barrow. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1949, Vol. 10, No. 10, pp. 276–282.) Paper presented at the International Meeting on Marine Radio Aids to Navigation, New York, 1947. Brief review of short-, medium- and long-distance systems available at present, with discussion of the factors affecting their suitability for particular services.

621.396.933 **649**

Rotating-Field Radio Beacons for Navigation.—S. Ostrovidow. (*Rev. gén. Élect.*, Nov. 1949, Vol. 58, No. 11, pp. 469–473.) The general theory for this type of beacon is outlined and an installation near Marseilles is described. This operates on 3.965 Mc/s with modulation frequency of 1 kc/s. Aerial power is about 2 kW and the effective range above 500 km. Sources of error, in particular those due to the site, are discussed. Performance is considered to be comparable with that of the Decca and Gee systems.

621.396.933(083.71) **650**

Standards on Radio Aids to Navigation: Definitions of Terms, 1949.—(*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1364–1371.) Prepared by an I.R.E. committee.

621.396.9 : 621.396.67 **651**

Radar Scanners and Radomes. [Book Review]—W. M. Cady, M. B. Karelitz & L. A. Turner (Eds). Publishers: McGraw-Hill, New York and London, 1949, 491 pp., 42s. (*Nature, Lond.*, 24th Dec. 1949, Vol. 164, No. 4182, pp. 1064–1065.) No. 26 of the M.I.T. Radiation Laboratory series. The book "deals mainly with the engineering aspects of the design of scanners and their housings. . . . There is almost no reference to equipment operating at wavelengths greater than 10 cm, and there is little discussion of scanners not developed at the Radiation Laboratory."

MATERIALS AND SUBSIDIARY TECHNIQUES

533.56 **652**

A New Type of Diffusion Pump.—E. L. Harrington. (*Rev. sci. Instrum.*, Nov. 1949, Vol. 20, No. 11, pp. 761–762.) Improvements to the Kerth Hg diffusion pump, reducing noise, operating expenses and operating temperature, and providing a qualitative measure of the degree of vacuum. The introduction of a Hg seal between the high- and low-vacuum sections makes interrupted operation possible.

535.37 **653**

Luminescence of Barium-Strontium Oxide.—R. E. Aitchison. (*Nature, Lond.*, 24th Dec. 1949, Vol. 164, No. 4182, p. 1088.) Well-activated (Ba,Sr)O cathodes gave a pale blue fluorescence under electron bombardment, the total emission spectrum extending from 4 600 Å to 5 400 Å. The intensity of the emitted radiation decreases with increasing oxide temperature and falls rapidly above 700° K. Afterglow is negligible.

535.37 **654**

The Luminescence Characteristics of Tin-Activated Zinc Sulphide Phosphors.—G. F. J. Garlick & D. E. Mason. (*Proc. phys. Soc.*, 1st Dec. 1949, Vol. 62, No. 360A, pp. 817–822.) "It has been found that the inclusion of stannous compounds in relatively large concentrations in the preparation of zinc sulphide phosphors results in an intense red luminescence when excitation is by ultra-violet light of long wavelength (3 650–4 000 Å). Such characteristics as the luminescence spectra, excitation spectra, phosphorescence and thermoluminescence and the variation of luminescence with temperature have been studied. The hexagonal crystal form of zinc sulphide is essential to the production of efficient phosphors with tin as the activating impurity."

537.228.1 : 548.0](083.7) **655**

Standards on Piezoelectric Crystals, 1949.—(*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1378–1395.) Prepared by an I.R.E. committee. Includes (*a*) definitions of axes for the various crystal systems, (*b*) specification of crystal-plate orientation, (*c*) basic equations, symbols and units of piezoelectric theory.

538.221 **656**

On the Conditions for the Occurrence of Ferromagnetism in Metal Compounds.—J. H. Gisolf. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, Nos. 8/9, pp. 677–678. In English.) It is necessary, though not sufficient, that the lines of communication between the metal atoms which are in exchange interaction form a 3-dimensional network. The ferrites with spinel structure are considered; it appears that only the metal ions in tetrahedron holes can contribute to the ferromagnetism.

538.221 **657**

Relation between the Thermal Expansion, the Curie Temperature and the Lattice Spacing of Homogeneous Ternary Nickel-Iron Alloys.—J. J. Went. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, Nos. 8/9, pp. 703–710. In English.) These quantities were measured for 15 different alloys, all having about 50% Ni and 50% Fe. The change in the expansion anomaly is closely related to the change in Curie temperature. The value of the latter change depends upon the relative positions of Ni and the third alloying element in the periodic system of elements. There is no direct relation between the change in Curie temperature and the lattice spacing.

538.221 **658**

Ferromagnetic Alloys in the Systems Cu-Mn-In and Cu-Mn-Ga.—F. A. Hames & D. S. Eppelsheimer. (*J. Metals*, formerly *Metals Technol.*, Aug. 1949, Vol. 1, No. 8, pp. 495–499.) An investigation to determine whether ferromagnetic β-phases exist in these systems analogous to such phases in the systems Cu-Mn-Al and Cu-Mn-Sn. A Cu-Mn-In alloy having an ordered body-centred cubic structure analogous to that of the Heusler alloys is discussed. An alloy $Cu_{1.97}Mn_{1.0}Ga_{1.05}$ variously heat treated is feebly magnetic and has a 2-phase structure. With higher Cu contents, quenched Cu-Mn-Ga alloys are strongly magnetic.

538.221 **659**

Magnetic Ferrites.—C. L. Snyder, E. Albers-Schoenberg & H. A. Goldsmith. (*Elect. Mfg, N.Y.*, Dec. 1949, Vol. 44, No. 6, pp. 86–91.) 'Ferramics' consist only of metallic oxides, and have high resistivity and high permeability, but low losses. They can thus be used to reduce the size and weight of h.f. magnetic apparatus. Properties of typical ferramics are tabulated or shown graphically. See also 3447 of 1948 (Snoek).

538.221 **660**

Magnetic Ferrites for High-Frequency Uses.—F. G. Brockman. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, pp. 1077–1080.) Discussion of (*a*) the historical background of research on such materials by the Philips Co. at Eindhoven, Holland, and Irvington-on-Hudson, N.Y., U.S.A., with special attention to the crystallography of the ferrites, (*b*) characteristics of the materials, (*c*) applications, (*d*) the existence of displacement currents as well as ohmic currents in a core of ferroxcube III. See also 2265 of 1948 (Verwey, Haayman & Romeyn) and 2387 of 1948 (Rinia et al.).

538.221 : 621.775.7 **661**

The Coercive Field of Ferromagnetic Powders.—C. Guillaud. (*C. R. Acad. Sci., Paris*, 24th Oct. 1949, Vol. 229, No. 17, pp. 818–819.) The variation of coercive field with temperature for a powder consisting of single crystals of Mn_2Sb is discussed.

538.23 : 621.318.323.2 **662**

Unsymmetrical Hysteresis Loops in a Nickel-Iron Alloy.—J. L. Rothery & An Wang. (*Nature, Lond.*, 10th Dec. 1949, Vol. 164, No. 4180, pp. 1004–1005.) A very pronounced asymmetry of the hysteresis loop has been observed in one particular sample of grain-oriented Ni-Fe alloy core when a large d.c. magnetizing pulse was applied to the core and followed by smaller a.c. excitation. If the a.c. excitation is gradually increased until saturation is reached and then reduced, the asymmetry persists except during saturation. Reversal of the magnetizing pulse reverses the loop. The phenomenon persists even if the core is completely disconnected for several days or weeks; the core can therefore be used to store information about the polarity of the last transient magnetizing pulse.

546.431.82 **663**

Theory of Barium Titanate: Part 1.—A. F. Devonshire. (*Phil. Mag.*, Oct. 1949, Vol. 40, No. 309, pp. 1040–1063.) Dielectric and crystallographic properties are considered. By expanding the free energy as a function of polarization and strain, and making reasonable assumptions about the coefficients, the various crystal transitions can be explained. The dielectric constants, crystal strains, internal energy and self polarization are calculated as functions of temperature. Relations are obtained between the coefficients in the free energy and the ionic force constants. These are used to estimate some of the coefficients which are not completely determined by experimental data.

620.197.7 **664**

Preventing Fungus Damage.—E. F. Little. (*Elect. Mfg, N.Y.*, Nov. 1949, Vol. 44, No. 5, pp. 89–91, 170.) Fungus attack is to be expected in most climates, but particularly under hot, moist conditions. Materials most liable to attack are those containing organic compounds. Protection is secured by the addition of fungicides harmless to animal life, notably copper-8-quinolinolate and copper naphthanate.

621.315.5/.6 **665**

Plastics can be Electrical Conductors.—(*Elect. Mfg, N.Y.*, Nov. 1949, Vol. 44, No. 5, pp. 60–63 . . 180.) Discussion of Markite materials. For another account see 3443 of 1949.

621.315.59 **666**

Conductivity in Semiconductors.—K. Lark-Horovitz. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, pp. 1047–1056.) A survey of papers presented at the A.I.E.E. summer general meeting.

621.315.59 **667**

On the Spontaneous Current Fluctuations in Semi-conductors.—J. H. Gisolf. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, Nos. 8/9, pp. 825–832. In English.) Formulae are derived which indicate that (*a*) the effective current strength of the fluctuations is proportional to the field strength, (*b*) at l.f. the fluctuations are independent of frequency, (*c*) at h.f. the effective current strength decreases with increasing frequency, (*d*) for alternating fields, the fluctuations depend on the difference between the observation frequency and that of the alternating field, (*e*) effective current strength is proportional to the square root of the mean life time of the free electrons in the semiconductor.

621.315.59 : 535.215.1 **668**

Photoeffects in Semiconductors.—(*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, pp. 937–942.) Long summary, compiled by J. A. Becker, of 3 papers read at an A.I.E.E. symposium on 'Electrical Properties of Semiconductors and the Transistor', namely:—General Features of Photoconductivity and Photoemission in Semiconductors, by L. Smith. External Photoelectric Effects in Semi-conductors, by L. Apker. Internal Photoeffects in Germanium, by J. N. Shive. For summaries of other papers at this symposium, see 240 of January.

621.318.22 **669**

Magnetic Saturation Intensities and Curie Temperatures for Some Industrial Permanent Magnet Materials.—L. Ward. (*Metallurgia, Manchr*, Nov. 1949, Vol. 41, No. 241, pp. 3–7.) Magnetic analysis of various steels and alloys indicates that in alloys of the Alnico type there is a reversible phase up to the Curie point, and that cobalt steels, as industrially heat treated, contain mixtures of austenitic and magnetic-α phases. The apparatus used and the experimental procedure are described.

621.318.22 **670**

Mechanism of the Coercive Field and of the Remanent Magnetism of Powdered MnBi. Generalization.—C. Guillaud. (*C. R. Acad. Sci., Paris*, 14th Nov. 1949, Vol. 229, No. 20, pp. 992–993.) The coercive field of ordinary permanent magnets is due to internal strains. Fields obtained with powdered MnBi are of a much higher order of magnitude. It is supposed that in the absence of an inductive field, the elementary magnetic vectors are all parallel, but half of one sense and half of the opposite sense. A sufficient inductive field causes one set of these vectors to rotate so that all are thereafter of the same sense. The effect is more pronounced the smaller the grain size; the cases where one grain includes (*a*) several elementary Weiss domains, (*b*) at most one domain, are considered. This mechanism also exists in certain ferromagnetic substances which belong to the hexagonal system, and also for substances belonging to the cubic system. To obtain the best characteristics in magnets produced from powdered materials, each grain should contain only a single elementary domain and the axes of easy magnetization should be parallel.

669.157.82 : 621.775.7 : 537.311.3 **671**

Electrical Resistivity Measurements on Iron-Silicon Compacts prepared by the Powder Metallurgy Procedure.—F. W. Glaser. (*J. Metals*, formerly *Metals Technol.*, Aug. 1949, Vol. 1, No. 8, pp. 475–480.) A study, by means of electrical resistivity measurements, of the progress of diffusion in Fe-Si alloys.

MATHEMATICS

681.142 **672**

The Binary Quantizer.—K. H. Barney. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, pp. 962–967.) A detailed description is given of apparatus for the continuous conversion of input currents or voltages, varying with time, into discrete binary numbers. When a difference exists between the input voltage and the feedback voltage from the counter circuit, the direction of operation of the counter is controlled by the sign of this difference or error voltage.

681.142 **673**

An Analogue Computer for the Solution of Linear Simultaneous Equations.—R. M. Walker. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1467–1473.)

681.142 : 517.512.2 **674**

Fourier Coefficient Harmonic Analyzer.—S. Charp. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, p. 1057.) Summary only. A ball-and-roller type of mechanical integrator, specially adapted for determining Fourier coefficients directly. The curve to be analysed is drawn on graph paper, which is wrapped round a cylinder and inserted into the machine. The curve is tracked manually; counters then give the required coefficients. Each time the curve is scanned another set of coefficients is determined. A range of 100 harmonics can be investigated. The time required for each harmonic is 2–7 minutes, depending on the curve.

681.142 : 621.318.572 **675**

Gate-Type Shifting Register.—J. H. Knapton & L. D. Stevens. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 186 . . 192.) Double-triode trigger circuits are used to store the numbers 1 or 0 of the binary system, and each stage passes its number to a following stage on receipt of a shift pulse. The register operates reliably with 1-μs pulses at 250 kc/s and numbers have been circulated through six stages at 600 kc/s.

MEASUREMENTS AND TEST GEAR

621.317.2 : 620.193 **676**

A Laboratory for the Study of the Resistance of Materials under Tropical Conditions.—A. Nizery & S. Crespi. (*Rev. gén. Élect.*, Nov. 1949, Vol. 58, No. 11, pp. 455–468.) A full description of the laboratory equipment at Saint-Cyr is preceded by a study of the actual conditions to be reproduced.

621.317.3 : 621.396.822 **677**

The Application of I.F. Noise Sources to the Measurement of Over-All Noise Figure and Conversion Loss in Microwave Receivers.—L. A. Moxon. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1433–1437.) A method is described of extending noise-diode technique to microwaves, using a frequency changer to produce the required r.f. test signal from an i.f. noise source. An experimental procedure has been developed which enables the signal level to be accurately evaluated, subject to such limitations as those of Dicke's reciprocity theorem, which are of little practical significance for the applications so far considered. As in the low-frequency case, measurements are in general independent of receiver bandwidth, there is no stray radiation problem, and the receiver output indicating device may follow any law within wide limits. The necessary components are easy to construct and can be calibrated without the use of additional apparatus. The system is particularly well suited to mixer crystal measurements, since both conversion loss and over-all noise figure can be measured with equal facility, and the latter is readily analysed in terms of conversion loss and noise ratio. See also 1196 of 1947.

621.317.3(083.74) : 621.396.931 **678**

Standards on Railroad and Vehicular Communications: Methods of Testing, 1949.—(*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1372–1375.) Prepared by an I.R.E. committee.

621.317.324† : 621.396.11 **679**

The Fresnel Reflection Formula in the Region of Long Waves.—E. Roeschen. (*Funk u. Ton*, 1949, Vol. 3, Nos. 9/10, pp. 525–528.) A short description of a method of verification by determining the field distribution beneath a vertical radiator. A 30-m Al mast was mounted on a platform floating on a lake and an earth plate of area 4 m² was arranged symmetrically below the mast. The field distribution at different levels above and below the plate was measured for wavelengths of 217, 437 and 1 450 m. The results are shown graphically.

621.317.335.2† : 621.319.4(083.74) **680**

Standard Test Capacitors.—(*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 168..174.) A T-network of ordinary mica capacitors can provide a very small capacitance (e.g. 0.001 pF) between the extremities of the series elements when the shunt arm is grounded, if the capacitors in the series arms are of only a few picofarads each and the capacitance in the shunt arm is several thousand picofarads Such networks can be used as low capacitance standards in the measurement of interelectrode capacitances.

621.317.35 : 621.3.015.33 **681**

Analysis of Pulse Shape.—G. F. Drafin. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1948, Vol. 9, No. 11, pp. 10–15.) A simple graphical method is described for determining the amplitudes of the various harmonics present in a pulse of any waveform. The method is particularly useful for the rapid study of such problems as the effect on pulse shape of frequency-dependent amplification or attenuation.

621.317.373.029.64 **682**

The Experimental Determination of Phase Characteristics of Circuits for Centimetre Waves.—M. Denis & P. Palluel. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 315–330.) A critical review of the principles, methods and apparatus used for quantitative measurements of (*a*) phase displacement between input and output at a fixed frequency; (*b*) phase variations with frequency, and phase distortion; (*c*) phase velocity in transmission lines; (*d*) phase variation of active quadripoles as a function of certain parameters. The relative advantages and disadvantages of dynamic, reflection, resonance and transmission methods of measurement are discussed. Illustrations and some details are given of suitable wavemeters and slotted lines.

621.317.43 : 669.14-41 **683**

Core-Loss Test for Narrow Silicon-Steel Strip.—J. A. Ashworth. (*Bell Syst. tech. Publ. Monogr.*, B-1667, 8 pp.) Description of a method for measuring the across-grain core loss in silicon-steel strip when the standard A.S.T.M. method cannot be applied. The Epstein method is modified by decreasing the lengths of the test windings and test pieces.

621.317.66 **684**

Measurement of Microwave-Transmission Efficiency.—A. L. Cullen. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, pp. 345–348.) French version of 3196 of 1949.

621.317.7 **685**

A New Type of Electrical Instrument.—K. A. Pullen. (*Instruments*, Nov. 1948, Vol. 21, No. 11, pp. 1008–1011.) A double-moving-coil arrangement is used. to overcome difficulties caused by vibration, shock etc. The coils are mounted on opposite ends of the support frames, which carry the pivots at the centre. The pointer is an extension of the upper frame. Theory and mechanical details of such instruments are fully discussed. Advantages include high torque/weight ratio, high sensitivity, low power consumption and extreme robustness.

621.317.7.089.6 **686**

Equipment for Instrument Calibration.—E. A. Gilbert. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, pp. 1065–1069.) Description of three self-contained units for the calibration of all types of a.c. and d.c. measuring instrument now used, and designed to anticipate future requirements. A power supply at 110–120 V with frequency between 50 and 1 600 c/s is required.

621.317.725 **687**

A New Expanded-Scale A.C. Voltmeter.—N. P. Millar. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, p. 1044.) Summary only. An iron-core saturable reactor is used to energize the moving coil of a standard electrodynamic wattmeter. Accuracy is within about ½% of full-scale rating.

621.317.73.029.63 **688**

Circular Standing-Wave Detector.—(*Radio & Televis. News, Radio-Electronic Engng Supplement*, Dec. 1949, Vol. 13, No. 6, pp. 12–13.) A brief general description of the apparatus. For another account see 3198 and 3203 of 1949 (Meinke).

621.317.733 **689**

Self-Balancing Resistance Bridge.—H. F. Rondeau. (*Gen. elect. Rev.*, Oct. 1949, Vol. 52, No. 10, pp. 45–46.) A servo system, consisting of an electronic converter and amplifier unit feeding a reversible induction motor, balances the bridge rapidly and automatically. The equipment, which can be switched for manual operation, is recommended for production tests requiring an accuracy of about 1% over the resistance range of 0.01Ω to above 30 kΩ.

621.317.74 : 621.315.212 690

Maintenance Equipment for Coaxial-Cable Circuits.—J. Selz. (*Câbles & Transmission, Paris*, Oct. 1949, Vol. 3, No. 4, pp. 306–325.) Specifications and description of apparatus constructed in France for making comprehensive line measurements in the range 30 kc/s–4 Mc/s.

621.317.762 691

Loading and Coupling Effects of Standing-Wave Detectors.—K. Tomiyasu. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1405–1409.) "When measuring impedances on transmission lines, insensitive standing-wave detectors have the effect of yielding lower standing-wave ratios than the true values. Double-hump distribution curves are shown to be the result of very tight coupling of the detector. Detectors that can be represented by a susceptance component may indicate unsymmetrical distribution curves. Sensitive detectors used on transmission lines having low power levels can introduce tight-coupling effects. Conditions are given for a loosely coupled detector.

621.317.79 : 621.396.615.12 692

Low Frequency Generators.—R. A. Raffin-Roanne. (*Radio prof., Paris*, Nov. 1949, Vol. 18, No. 178, pp. 16–20.) Description of two signal generators for testing l.f. amplifier fidelity. The first provides a sinusoidal output of 500 mW maximum with <3% harmonic distortion, covering 15 to 16 000 c/s. The second is an adapter for use with the first to provide a rectangular-wave output. Complete circuit diagrams are given and some aspects of amplifier fidelity are considered.

621.396.933.001.4 693

The Servicing of Airborne Equipment.—T. R. W. Bushby. (*Proc. Instn Radio Engrs, Aust.*, July 1949, Vol. 10, No. 7, pp. 190–195.) 1948 Australian I.R.E. Convention paper. An outline of the organization of servicing procedure in Australia is given. Servicing requirements and test apparatus are discussed. Instruments for checking transmitter radiation and ignition noise and for the overhaul of relays, microphones and headphones are described.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

526.9 : 621.396.9 694

Geodetic Measurements by Radar.—D. J. Halliday. (*Nature, Lond.*, 10th Dec. 1949, Vol. 164, No. 4180, pp. 1005–1006.) An aircraft flies in a circular arc at the centre of which is a ground radar beacon. The distance of the aircraft from a second beacon is recorded at regular intervals. The geodetic distance between the beacons is calculated from the radius of the arc and the minimum recorded distance from the second beacon, corrections being made for altitude and atmospheric refraction.

531.78 : 621.3.083.7 695

The Differential Transformer as Applied to Instrumentation.—W. D. Macgeorge. (*Science*, 7th Oct. 1949, Vol. 110, No. 2858, pp. 365–368.) Basic design of differential transformers is discussed and illustrated by a description and performance details of the 'Atcotran' type made by the Automatic Temperature Control Co. Suitable circuits for using these transformers in the measurement of variables such as pressure, flow and force are also considered, the null-balance type of circuit being especially noted. Practical wiring procedures are given for systems in which the indicating instrument is a considerable distance from the equipment on which measurements are to be made.

535.61-15 696

Some Experimental Demonstrations with Infra-Red Rays.—T. Gast. (*Funk u. Ton*, 1949, Vol. 3, Nos. 9/10, pp. 529–533.)

538.71 697

Airborne Magnetometer for Measuring the Earth's Magnetic Vector.—E. O. Schonstedt & H. R. Irons. (*Science*, 7th Oct. 1949, Vol. 110, No. 2858, pp. 377–378.) The airborne total field magnetometer, developed during World War II by the Naval Ordnance Laboratory and Bell Telephone Laboratories, has been modified so that the total magnetic field vector is measured instead of the intensity only.

539.16.08 698

Equipment for the Counting of Particles by the Geiger-Müller Method.—A. Berthelot. (*J. Phys. Radium*, July 1946, Vol. 7, No. 7, pp. 185–192.) Description of apparatus for laboratory measurements, including scaler circuits, a stabilized h.v. supply, pulse generator, and a complete unit comprising preamplifier, decade scaler circuit, power stage, counter, power supply and voltmeter.

539.16.08 699

Glass-Walled Counters with External Cathode.—R. Maze. (*J. Phys. Radium*, June 1946, Vol. 7, No. 6, pp. 164–166.) Colloidal graphite is deposited on the outside of a thin-walled tube of ordinary glass with axial wire anode and hydrogen filling. In use as a counter, the inside of the glass becomes charged as uniformly as if it had a conducting surface layer. The arrangement is thus equivalent to the usual type of counter with the cathode earthed through a high resistance in parallel with a capacitance. Owing to the weak secondary effects of glass a production efficiency of 100% can easily be obtained.

539.16.08 700

Ion Mobilities in Geiger-Müller Counters.—H. den Hartog & F. A. Muller. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, Nos. 8/9, pp. 789–800. In English.) Formulae and measuring instruments are described for a detailed study of the deionization current in a self-quenching counter. Ion mobility in alcohol is 2.6 cm/sec per V/cm, in argon 7.1 cm/sec per V/cm, both at 100 mm Hg pressure. These results supersede earlier measurements by van Gemert and the authors, noted in 1139 of 1949.

539.16.08 701

Spurious Counts in Geiger Counters and the Pretreatment of the Electrodes.—J. D. Louw & S. M. Naudé. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, pp. 571–572.)

539.16.08 702

On the Temperature Dependence of Counter Characteristics in Self-Quenching G-M Counters.—O. Parkash. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, pp. 568–569.)

551.508.1 : 621.317.083.7 703

Range-Adjusting Radiosonde Recorder.—G. E. Beggs, Jr. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, p. 990.) Summary of A.I.E.E. paper. Range-adjustment and calibration are performed automatically. A block diagram of the complete system is included.

621.316.718 704

Basic Control Requirements of D.C. Adjustable-Voltage Drives.—E. E. Moyer & M. E. Cummings. (*Elect. Mfg, N.Y.*, Nov. 1949, Vol. 44, No. 5, pp. 64–70.) Discussion of the field control sequences for starting, accelerating, running, retarding, reversing and stopping the motor unit of a d.c. adjustable-voltage drive of the Ward-Leonard type. The necessary design information is given mainly in a comprehensive series of scaled diagrams, with brief notes.

621.316.726 : [621.365.55† + 615.84 705

Industrial Oscillator Frequency Control.—J. W. Lower. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 84–86.) Describes an a.f.c. system for diathermy or dielectric-heating power oscillators. The oscillator frequency is sampled 200 times per sec and compared with a crystal-controlled reference frequency. The resulting error signal is applied to a servo system operating a 2-phase induction motor which adjusts the reactive tuning element of the oscillator, whose frequency is thus kept within 0.01% of the 27-Mc/s standard.

621.317.39 : 534.08 **706**

A New Method of Vibration Measurement for the Frequency Range 20 to 20 000 c/s.—F. Massa. (*Instruments*, Nov. 1948, Vol. 21, No. 11, pp. 1012–1014.) An accelerometer unit is designed so that its electromechanical system has a single degree of freedom and its resonance frequency is above 20 kc/s. The unit consists of a system of ADP crystal plates mounted within a cylindrical stainless steel housing 1 in. in diameter and 2 in. long. A stress is imparted along the piezoelectric axis of the plates in proportion to the component of mechanical vibration in the direction of the cylinder axis. Typical response curves are shown and discussed.

621.365.54† **707**

Production Economies realized by Proper Use of Induction Heating.—J. A. Evans. (*Materials & Methods*, Nov. 1949, Vol. 30, No. 5, pp. 57–60.)

621.38.001.8 **708**

Electronics Symposium, 1949.—(*Engineer, Lond.*, 4th Nov. 1949, Vol. 188, No. 4893, p. 525.) Brief notice of the papers presented and the apparatus exhibited at a symposium on instruments in research and industry, held in London 2nd–4th Nov. 1949.

621.38.001.8 **709**

Electronic Aids to Industry.—(*J. Brit. Instn Radio Engrs*, Dec. 1949, Vol. 9, No. 12, pp. 446–464.) A survey prepared by the Technical Committee of the British I.R.E. Applications are grouped in 33 sections, each with a bibliography which, though not exhaustive, may serve as a guide to more detailed technical information.

621.38.001.8 : 543/545 **710**

Electronic Instrumentation for Chemical Laboratories.—F. Gutmann. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1949, Vol. 10, No. 9, pp. 241–254. Bibliography, pp. 254–256.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. A comprehensive survey, with many diagrams of the principles of various analysing instruments, including pH meters and the associated current amplifiers, colorimeters using photoelectric cells, polarographs for the analysis of electrolytes by measurement of the current/voltage curve, gas analysers, titration potentiometers, electrolytic conductance bridges, dielectric-constant and dielectric-loss measuring equipment for radio frequencies, moisture meters, supersonic equipment, an ionization gauge and an electronic balance.

PROPAGATION OF WAVES

061.3 : 551.510.535 : 538.566 **711**

The Conference on Ionospheric Research.—(*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 281–294.) Summaries of symposia and abstracts of papers presented at the conference held at Pennsylvania State College under joint sponsorship of that College and of the Geophysical Research Directorate, U.S.A.F., 27th–29th June 1949. Selected papers are noted below in this section, or in the 'Geophysical and Extraterrestrial Phenomena' section.

538.56 **712**

General Expression of Huyghens' Principle for Electromagnetic Waves in an Imperfectly Transparent Medium.—J. Brodin. (*C. R. Acad. Sci., Paris*, 21st Nov. 1949, Vol. 229, No. 21, pp. 1064–1066.) Extension of 523 above to the case of e.m. waves. The layers involved in this case consist respectively of electric and magnetic dipoles.

538.566 **713**

On the Electromagnetic Surface Wave of Sommerfeld.—T. Kahan & G. Eckart. (*Phys. Rev.*, 1st Aug. 1949, Vol. 76, No. 3, pp. 406–410.) See 2892 of 1949.

538.566.3 : 551.510.535 **714**

Application of the Magneto-Ionic Theory to Radio Waves Incident Obliquely upon a Horizontally-Stratified Ionosphere.—H. G. Booker. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 243–274.) Pennsylvania State College Conference paper. "A study is made of the propagation of wave-packets incident obliquely upon a slowly varying plane-stratified ionosphere, allowing for the full effect of the earth's magnetic field. Propagation of a magneto-ionic component is described in terms of the vertical component q of the phase-propagation vector, so as to avoid using a refractive index which depends in a complicated way on an unknown angle of refraction. The fundamental formula of the theory is an algebraic quartic equation for q, the coefficients in which depend on electron-density N, wave-frequency, direction of earth's magnetic field, the direction of incidence upon the ionosphere. The four roots of the quartic for q correspond to the upgoing/downcoming ordinary/extraordinary magneto-ionic components.

"It is shown that, to plot the four roots of q as a function of N for fixed values of the other parameters, it is easier to restate the fundamental formula as a cubic equation for N as a function of q. Using this cubic equation, simple limiting curves between which the actual curves necessarily lie are deduced, thereby facilitating plotting in a particular case. Methods for mass-production of such propagation-curves are devised but not applied on a large scale.

"Formulas for attenuation, lateral deviation, horizontal range, and equivalent paths of magneto-ionically split wave-packets are derived and illustrated graphically. The amount to which a wave-packet can be permanently deviated out of its plane of incidence by the earth's magnetic field can be extremely large, but probably not in cases of practical importance in commercial radio communication."

621.396.11 **715**

The Reflection Coefficient of a Linearly Graded Layer.—G. Millington. (*Marconi Rev.*, Oct./Dec. 1949, Vol. 12, No. 95, pp. 140–151.) A study of the reflection of a horizontally polarized plane wave incident obliquely on a layer in which there is a linear variation of dielectric constant from a constant value on one side of the layer to another constant value on the other side of the layer. The curves given have particular application to the propagation of u.h.f. radio waves in the troposphere, and should be a useful contribution to the understanding of u.h.f. long-distance transmission.

The curves refer only to horizontal polarization, but when the change in refractive index is very small and the wave is at nearly grazing incidence, the reflection coefficients for vertical and for horizontal polarization are approximately equal numerically, though their analytical forms are different. Under these strictly limited conditions, the curves may also give the numerical value of the reflection coefficient for vertical polarization.

621.396.11 : 523.72 **716**

Observations of the Propagation of Broadcasting Waves, $\lambda = 1\,250$ m, during the Occurrence of Mögel-Dellinger Effects.—E. A. Lauter. (*Z. Met.*, July 1949, Vol. 3, No. 7, pp. 204–206.) D-layer reflection effects, scattering, and absorption effects for 1 250-m waves are discussed in relation to the occurrence of outbursts of ultraviolet emission from the sun and consequent fading of broadcasting signals. The Mögel-Dellinger effect does not appear to have been observed hitherto for such long waves. Its occurrence may give new insight into the ionization of the middle stratosphere.

621.396.11 : 535.31 : 551.510.535 **717**

Geometrical Optics of the Ionosphere.—K. Rawer. (*Rev. sci., Paris*, Sept./Oct. 1948, Vol. 86, No. 3298, pp. 585–600.) The dependence of field strength upon path length is considered, and a solution is obtained involving the diameter of the ray in the vertical plane containing its path. Calculations are made for the cases of flat and curved earth, and thin and thick ionospheric layers. Diameter/distance curves are plotted. Results obtained for single and multiple reflections show three focal points, (*a*) at the edge of the silent zone, (*b*) for the horizontal ray, (*c*) for the antipodal point. Approximations for the case of a parabolic layer are considered and discrepancies between these and the results of Försterling & Lassen (1932 Abstracts, pp. 87 & 217) and of Appleton & Beynon (3290 of 1940) are noted. The application of the curves finally obtained to propagation problems is briefly considered.

621.396.11 : 551.510.535 **718**

Ray Paths of Radio Waves in the Ionosphere.—H. Poeverlein. (*Z. angew. Phys.*, Oct. 1949, Vol. 1, No. 11, pp. 517–525.) Detailed discussion of the theoretical bases for the graphical construction of ray paths. Several graphical representations of the dependence of the refractive index on the direction of the wave normal are given and discussed.

621.396.11 : 551.510.535 **719**

Some Problems of Wave-Diffraction in the Ionosphere.—J. A. Ratcliffe. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 288.) Summary of Pennsylvania State College Conference paper. "Simultaneous observations of radio 'fading' at two points force us to the conclusion that radio waves are returned from the ionosphere by a process of diffractive reflection as if from a rough surface. The diffraction effects produced by a simple model of this kind are considered and are related to well-known phenomena of optical diffraction. It is shown that the methods of calculation are similar to those employed in the analysis of random fluctuations such as occur with radio 'noise'. The fading is shown to be produced by movements of the random irregularities in the ionosphere and is related to their turbulent or regular motions. It is shown how winds in the ionosphere can be measured. Analogies are made with some well known optical phenomena."

621.396.11 : 551.510.535 **720**

Oblique Incidence Propagation Work of the Central Radio Propagation Laboratory.—R. Silberstein. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 288.) Summary of Pennsylvania State College Conference paper. Discussion of experiments, begun in 1947, using a 13.7-Mc/s transmitter capable of an output of several hundred kilowatts. Three methods were used to determine the source of back-scatter; the results indicated that ground-scatter usually predominated over scatter from the E layer. An examination of A-scope photographs confirmed the existence of many of the predicted modes of propagation.

621.396.11 : 551.510.535 **721**

The Interpretation of Long Scatter Echo Patterns.—A. M. Peterson. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 284.) Summary of Pennsylvania State College Conference paper. The mechanism of ground scatter is analysed. It is shown that angle focusing and time-delay focusing produce characteristic patterns on pulse-echo equipment. It is deduced that E-region ionization contributes relatively little to long scatter.

621.396.11 : 551.510.535 **722**

Pulse Transmission over Long Distances.—J. A. Pierce. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 282–283.) Summary of Pennsylvania State College Conference paper. The two methods used for recording fixed-frequency pulse signals received from a distant transmitter are discussed. These are (*a*) the use of stable oscillators to control the recurrence period; (*b*) the use of a servomechanism to synchronize the controlling oscillator with the received signal. Examples are shown of the records obtained with the synchronizer at frequencies of 9.1 and 12.9 Mc/s, chosen to exhibit the effects of the Pedersen ray. The effects of seasonal changes between July 1948 and June 1949 on the propagation of a 17-Mc/s signal over a 6 000-km transatlantic path are studied, and comparisons made with C.R.P.L. predictions.

621.395.11 : 551.510.535 **723**

Effect of the D Ionospheric Layer on Very Low Frequency Radio Waves.—W. Pfister. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, p. 286.) Summary of Pennsylvania State College Conference paper. The D layer considered is a normal Chapman layer at a height of about 60 km. In long-distance propagation, maximum absorption is observed at 45 kc/s, and the calculated ion concentration is of the order of 100/cm³sec. Reflection coefficients, transmission values and virtual heights are also calculated. Different conceivable forms of ion distribution are considered.

621.396.11 : 551.510.535 **724**

The Propagation of Long and Very-Long Waves.—J. A. Ratcliffe. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 281–282.) Summary of Pennsylvania State College Conference paper. An account of the measurements which have been made in England since the war, to investigate reflection from the ionosphere at steep incidence. Results are described of investigations at frequencies between 16 kc/s, for which the daytime downcoming wave is strong, and 100 kc/s, for which the reflected wave is weak.

The variations in the phase of the reflected wave are recorded for transmissions over different distances; the results provide information about changes in the equivalent height of reflection. An account is given of deductions made from the normal diurnal and annual variations.

A sudden phase anomaly often accompanies a sudden ionospheric disturbance and is observable throughout the disturbance because the amplitude of the very long wave is not seriously diminished by the disturbance. The importance of these anomalies for solar and ionospheric theories is discussed.

Attempts are being made to relate propagation at oblique incidence to propagation at more vertical incidence, both by plotting the ground interference pattern in an aircraft and by making detailed measurements at a point distant 500 km from the transmitter.

621.396.11 : 551.510.535 **725**

Sporadic Ionization at High Latitudes.—J. H. Meek. (*J. geophys. Res.*, Sept. 1949, Vol. 54, No. 3, pp. 284–285.) Summary of Pennsylvania State College Conference paper. Discussion of the variations in the (h', f) trace produced by different types of sporadic ionization recorded in northern Canada. Estimates of the speed of motion of sporadic ionized clouds range from 400 km/hr to 1 200 km/hr for virtual heights from 100 km to 300 km.

621.396.11 : 551.510.535 **726**

Summary of Symposia [at the Pennsylvania State College Conference].—Waynick. (*See* 637.)

621.396.11 : 621.317.324† **727**

The Fresnel Reflection Formula in the Region of Long Waves.—Roeschen. (*See* 679.)

621.396.11 : 551.594.5 **728**

Sky-Wave Observations (λ = 1 250 m) during Displays of the Northern Lights in 1947.—E. Lauter & K. Sprenger. (*Z. Met.*, July 1949, Vol. 3, No. 7, pp. 193–198.) Numerous northern-light observations at German stations on 40 nights during 1947 are correlated with observations at Warnemunde of 1 250-m waves reflected from the E layer. The relation of sky-wave absorption to sunspot relative numbers and to geomagnetic quantities is considered both for evenings with northern-light displays and for those with abnormal E-layer effects.

621.396.11.029.6 **729**

V.H.F. and U.H.F. Propagation within the Optical Range.—M. W. Gough. (*Marconi Rev.*, Oct./Dec. 1949, Vol. 12, No. 95, pp. 121–139.) The mechanism of v.h.f. and u.h.f. propagation can be explained in terms of five major factors, namely (*a*) atmospheric refraction, (*b*) ionospheric reflection, (*c*) tropospheric reflection, (*d*) diffraction, (*e*) ground reflection. (*e*) is the dominant factor in propagation within the optical range, and it is with this aspect of the problem that this article is concerned.

From the ray concept of propagation, a technique has been evolved using simple microwave field strength measurements to forecast the behaviour of v.h.f. and u.h.f. transmissions over a specific optical path. In particular the method predicts, without further measurement, the best height for the receiving aerial on any frequency in the v.h.f. or u.h.f. band.

The process is based on the assumption that ground reflection is confined to a point. This assumption becomes increasingly invalid with increasing wavelength and may lead to errors. However, these can be corrected to a large extent by invoking Fresnel's zone theory, which defines what region of the path is involved in reflection. Furthermore, by examining the ground irregularities in this region the reflecting power of the ground can be assessed.

This article develops the theory of the microwave survey technique and describes and interprets a survey made over a test path, from which the behaviour of specific longer waves is predicted. It concludes with a description of confirmatory experiments made over the same path which verify the predictions.

The 'calibration' of optical paths by the use of microwaves eliminates the necessity for tests on operational wavelengths, and coupled with the lightness and compactness of microwave equipment, saves experimental labour, particularly if the path is to carry transmissions on more than one wavelength.

621.396.81 : 523.78 **730**

Field-Strength Observations made during the Total Eclipse of the Sun.—J. Gross. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, p. 1447.) Curves are given showing the estimated signal strength and readability of WWV s.w. signals received at Eastleigh aerodrome, Nairobi, on 1st Nov. 1948. The transmission path was approximately the same as that of the eclipse. Signals disappeared completely during the totality period and returned to normal by the time the sun was completely unobscured. Signals were of normal strength both on the day before and the day after the eclipse.

621.396.81 : 621.396.67.029.64 **731**

The Effect of Antenna Size and Height above Ground on Pointing for Maximum Signal.—A. H. LaGrone & A. W. Straiton. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1438–1442.) An account of investigations of 3.2-cm transmissions over a 27-mile desert path in Arizona. The effect of aerial size and height above ground on the angle of arrival, as indicated by pointing the aerial for maximum signal, is shown in tables and curves for three measured fields. A comparison is also made of the response of the aerials for various angles of tilt in these fields, and their response in an assumed field made up of two plane-wave components.

621.396.812 **732**

Ground-Wave Field-Strength Calculation.—H. L. Kirke. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, p. 1446.) Comment by G. Millington on 2304 of 1949 and author's reply.

RECEPTION

621.396.621 **733**

Reflex Receiver with Feedback and A.V.C.—E. G. Beard. (*Philips tech. Commun., Aust.*, 1949, No. 4, pp. 9–14.)

621.396.621 : 621.396.619.13 **734**

Sky-Wave F.M. Receiver.—L. B. Arguimbau & J. Granlund. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 101–103.) Early experiments showed that reception in the presence of multi-path signals was much inferior for f.m. than for a.m. When signal and interference (multi-path or other) are of nearly equal amplitude, the limiter must have a uniform response over a very wide band. Thus when two signals differ in amplitude by 5% and in frequency by 150 kc/s, the resultant will sweep through 6 Mc/s, and the limiter must pass all these frequencies equally so as not to introduce a.m. A brief description of circuits and laboratory tests of a receiver is given and it is suggested that a transatlantic f.m. high-fidelity link should be possible if a channel of width 150 kc/s could be spared in the s.w. band.

621.396.623 **735**

A De Luxe Receiver with Very High Musical Fidelity: Le Jubilé.—J. Rousseau. (*T.S.F. pour Tous*, Dec. 1949, Vol. 25, No. 254, pp. 398–404.) An illustrated description of the circuit features of a 33-valve broadcast receiver built by M. Laugier and incorporating various design recommendations which have appeared in the journal in recent years. References to these articles are made on a complete circuit diagram. The receiver has six wavebands and uses three separate amplifier stages for high, medium, and low audio frequencies, and an expansion circuit for contrasts.

621.396.822 **736**

Note on Transit-Time Deterioration.—A. van der Ziel. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, p. 1447.) A simple derivation of some formulae recently published by MacDonald (2408 of 1949). See also 1890 of 1948 (Strutt & van der Ziel).

621.396.822 : 621.317.3 **737**

The Application of I.F. Noise Sources to the Measurement of Over-All Noise Figure and Conversion Loss in Microwave Receivers.—Moxon. (*See* 677.)

621.396.621 **738**

Les Récepteurs de Radiodiffusion (Broadcasting Receivers). [Book Review]—Y. Angel. Publishers: Eyrolles, 244 pp. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, p. 375.)

STATIONS AND COMMUNICATION SYSTEMS

[621.395 + 621.397] : 621.315.212 **739**

Progress in Coaxial Telephone and Television Systems.—L. G. Abraham. (*Bell Syst. tech. Publ. Monogr.* B-1630, 8 pp.; *Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, pp. 1520–1527.) A general description of the Bell Telephone L1 system, which provides either 600 telephone circuits or a 2-way television circuit with a bandwidth of 2.8 Mc/s, with details of the coaxial cables used and their associated equipment.

621.395.635 : 621.395.44 : 621.396.931 **740**

Vibrating Reed Selective Signaling System for Mobile Telephone Use.—H. M. Pruden & D. F. Hoth. (*Bell Syst. tech. Publ. Monogr.*, B-1663, 5 pp.; *Trans. Amer. Inst. elect. Engrs*, 1949, Vol. 68, pp. 387–391. Summary in *Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, p. 927.) A means of calling a particular car in a group tuned to a common carrier frequency. The transmitter at the fixed station can transmit any combination of four a.f. tones from the 32 available, 10 000 combinations being possible. Each car is equipped with a set of four vibrating-reed selectors (756 below) tuned to selected tones, the combination being different for each car. The operation and advantages of the system are discussed.

621.396.1 : 621.396.931 **741**

Radio Communications Services: Part 2.—(*FM-TV*, July 1949, Vol. 9, No. 7, pp. 18–21, 45.) Continuation of 2907 of 1949.

621.396.1 : 621.396.931 **742**

New Frequency Assignments for Mobile-Radio Systems.—G. H. Underhill. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, pp. 951–955.) Description of the method by which a new operating frequency will be selected for each of 500 mobile-radio systems.

621.396.619.13 **743**

On the Question of the Applicability of Single-Sideband Methods for Frequency-Modulation Transmissions.—A. Lutsch. (*Fernmeldetech. Z.*, Nov. 1949, Vol. 2, No. 11, pp. 347–351.) A theoretical treatment of the subject shows that no simple demodulation process can be applied. Investigation of the a.m. which occurs in s.s.b. systems indicates that the phase swing is limited to < 1.7 radians, so that only narrow-band modulation is possible. Formulae are given for determining the behaviour of the demodulated l.f. curves, and distortion is discussed. From these considerations, s.s.b. f.m. appears to be impracticable for communication purposes.

621.396.619.13 : 621.396.712 : 534.86 **744**

A Demonstration of Experimental Broadcast Transmitting and Receiving Equipment.—Honnor. (See 535.)

621.396.65.029.63 **745**

A Wide-Band V.H.F. Radio-Relay System.—W. S. McGuire. (*Proc. Instn Radio Engrs, Aust.*, June 1949, Vol. 10, No. 6, pp. 160–165.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. The link operates in the frequency range 152–165 Mc/s, the frequency deviation being ± 30 kc/s. Frequency response is constant to within ± 1 db from 50 c/s to 17 kc/s. Terminal and repeater equipment are described, with performance figures for an experimental 22-mile link.

621.396.712+621.396.97 **746**

High-Frequency Broadcasting in Australia.—N. S. Smith. (*Proc. Instn Radio Engrs, Aust.*, Oct. 1948, Vol. 9, No. 10, pp. 4–20.) Paper presented at the Australian I.R.E. Convention, Nov. 1948, and giving a historical outline of the development of broadcasting in the frequency band 3–30 Mc/s. The transmission characteristics of the ionosphere, as they affect this band, are summarized. 'Internal' and 'external' services are dealt with in two main sections and brief technical summaries are included of the transmitters, the power output of which ranges from 1 to 100 kW. Descriptions are given of aerial arrays and switching arrangements.

621.396.72 : 621.3.018.4(083.74) **747**

Experimental Standard-Frequency [3-kW] Transmitting Station, WWVH.—G. H. Lester. (*Communications*, Sept. 1949, Vol. 29, No. 9, pp. 20–23..33.) See also 1982 of 1949.

621.396.931 : 621.317.3(083.74) **748**

Standards on Railroad and Vehicular Communications: Methods of Testing, 1949.—(*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1372–1375.) Prepared by an I.R.E. committee.

621.396.931 : 621.396.619.13 **749**

South Australian Police F.M. Network.—R. W. Goss. (*Communications*, Sept. 1949, Vol. 29, No. 9, pp. 14–16.) General description of the 72.5-Mc/s system, which comprises a 250-W transmitter located in Adelaide, a 25-W remote station 1 250 ft above sea level, and 10-W mobile units. Points within 25–30 miles of the 250-W transmitter are covered.

621.396.931 : 621.396.619.13 **750**

Mobile F.M. Communications Equipment for Australian Conditions.—R. A. Ratcliffe & R. S. Zucker. (*Proc. Instn Radio Engrs, Aust.*, April 1949, Vol. 10, No. 4, pp. 101–113. Correction, June 1949, Vol. 10, No. 6, p. 159.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. Examples of performance specifications for mobile f.m. v.h.f. equipment, issued by various public bodies in Australia, and also for typical American installations are tabulated and discussed. A standard performance specification for Australian equipment is proposed. A description is given, with photographs and circuit diagrams, of mobile transmitter and receiver units designed to meet the requirements of the proposed specification.

621.396.931 : 621.396.619.13 **751**

V.H.F. Mobile Communication Systems.—A. J. Campbell. (*Proc. Instn Radio Engrs, Aust.*, March 1949, Vol. 10, No. 3, pp. 73–82.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. The main factors which have encouraged the development of such systems are reviewed. A detailed description is given of a standardized range of f.m. equipment designed to provide reliable service over an area of at least 20-miles radius around a central station. Carrier frequencies in the bands 70–80 Mc/s and 152–166 Mc/s are used, with crystal control of the transmitter frequency. The double-superheterodyne receivers derive both local-oscillator frequencies from appropriate points in a crystal-driven multivibrator chain, the crystals vibrating in the third harmonic mode and thus providing initial high frequencies which greatly simplify design. Various types of aerial are available. Two selective-calling systems are mentioned: (*a*) a 2-tone system for a maximum of 33 mobile units, in which mechanically resonant reed selectors are fitted; (*b*) a digit system similar in principle to that of the automatic telephone. This has a much greater capacity than the 2-tone system. With a 2-digit code, about 80 mobile units can be called.

621.396.933 **752**

The Modern Civil Aircraft Radio Station.—S. C. Wallace. (*Marconi Rev.*, Oct./Dec. 1949, Vol. 12, No. 95, pp. 152–156.) The methods of installing radio instruments in aircraft are reviewed. The general trend towards standardization has now developed into the 'standard racking scheme'. This is described and its use illustrated.

SUBSIDIARY APPARATUS

621-526 : 623.451 **753**

German Missile Accelerometers.—T. M. Moore. (*Elect. Engng, N.Y.*, Nov. 1949, Vol. 68, No. 11, pp. 996–999.) Control of steering and fuel cut-off in German rocket missiles was effected by various methods based on the measurement and integration of acceleration. Single integration systems used gyroscope precession and electro-deposition. A circuit for double integration by electro-deposition methods is described. A system for lateral control, using an electrically-maintained moving-coil vibrator, is also described; by triple integration of lateral acceleration the missile was made to return to its course in spite of side winds.

621.314.5 : 621-526 754
An Electronic D.C. to A.C. Converter for Use in Servo Systems.—E. E. St. John. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1474–1478.)

621.314.632 755
The Easy-Flow Characteristics of Copper Oxide Rectifiers.—F. Rose & E. Spenke. (*Z. Phys.*, 30th Aug. 1949, Vol. 126, Nos. 7/9, pp. 632–641.) The present diffusion theory of dry rectifiers gives the d.c. characteristics only qualitatively. An improvement in measurement technique and a more exact interpretation of the theory shows that, for Cu_2O rectifiers, large portions of the easy-flow characteristic are given quantitatively by the theory. The existence of the chemical barrier layer is confirmed. See also 826 of 1942 (Schmidt).

621.395.635 756
Vibrating Reed Selectors for Mobile Radio Systems.—A. C. Keller & L. G. Bostwick. (*Bell Syst. tech. Publ. Monogr.*, B-1662, 4 pp.; *Trans. Amer. Inst. elect. Engrs*, 1949, Vol. 68, pp. 383–386.) The vibrating reeds are attached to a metal block to form a small tuning fork. A pole-piece attached to a small magnet is arranged centrally between the tines and an actuating coil surrounds both tines and pole-piece. When the coil is energized with the correct frequency and voltage, the tines vibrate, thus causing a contact to close during a fraction of each cycle of vibration. Another type, without contacts, can be used to provide sharply selective filters. Performance data, graphs, and photographs are included.

621.396.622 757
Theoretical and Experimental Study of Detection by Silicon Crystals.—Lapostolle. (*See* 788.)

621.396.68 : 621.397.62 758
Power Supplies for Home Television Receivers.—V. Wouk. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, pp. 1061–1065.) Discussion, with circuit diagrams, of various methods of supplying (*a*) l.v. B+ and bias power, (*b*) h.v. power for the c.r. tube.

778.3 : 621.317.755 759
Techniques in High-Speed Cathode-Ray Oscillography.—C. Berkley & H. P. Mansberg. (*J. Soc. Mot. Pict. Engrs*, Nov. 1949, Vol. 53, No. 5, pp. 549–578.) Photographic technique for recording c.r.o. traces of (*a*) recurrent, (*b*) transient, (*c*) drifting phenomena is discussed.

TELEVISION AND PHOTOTELEGRAPHY

621.397.335 760
A Television Synchronising-Signal Generator.—J. E. Benson, H. J. Oyston & B. R. Johnson. (*Proc. Instn Radio Engrs, Aust.*, May 1949, Vol. 10, No. 5, pp. 128–139.) Paper presented at the Australian I.R.E. convention, Sydney, 1948. The synchronizing signal waveforms of the British and American television systems are described, and the technical requirements of the generating equipment are indicated. An outline is given of some typical circuit techniques used in synchronizing generators, and an experimental 525-line 25-frame synchronizing-signal generator unit is described which uses equalizing pulses and is suitable for negative modulation.

621.397.5 761
Distant Electric Vision.—J. D. McGee. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1949, Vol. 10, No. 8, pp. 211–223.) 1948 Australian I.R.E. Convention lecture. A historical review of television, with special reference to the development of the emitron, super-emitron and C.P.S. emitron, and discussion of their relative merits. (*Note.* This lecture was recorded in England on magnetic tape and reproduced, with slides, in Sydney. The tape, slides and original manuscript were sent from England by air mail.)

621.397.5 762
Dr. Lee de Forest's Color Television System.—(*Tele-Tech*, Nov. 1949, Vol. 8, No. 11, pp. 41–42.) Tricolour filters, made up of hexagonal elements of the three primary colours are made to oscillate synchronously before the camera and the reproducing c.r. tube, so that every element of the transmitted picture is scanned by each of the primary colours every twentieth of a second.

621.397.5 763
New Directions in Color Television.—D. G. F. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 66–71.) Comparison of the field-sequential, line-sequential and dot-sequential methods of transmission. Principles of the C.B.S., C.T.I. and R.C.A. systems are discussed.

621.397.5 : 535.88 764
An Experimental Large-Screen Television Projector.—P. Mandel. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1462–1467.) Description of equipment for projection on a special screen of the directional type. The screen, of dimensions 3 m × 2.25 m, is an assembly of about 15 000 elementary screens, each consisting of 200 very small spherical mirrors stamped in a highly polished Al sheet. See also 2941 of 1948.

621.397.61 : 621.396.619.23 765
Mid-Level Modulation for TV Transmitters.—N. H. Young. (*Communications*, Sept. 1949, Vol. 29, No. 9, pp. 10–11.) Modulation is applied to the grid of the penultimate r.f. amplifier and the vestigial sideband characteristic is provided by a filter between the transmitter and the aerial. The size and cost of the modulator system are thus reduced.

621.397.62 766
Influence of the Choice of a Television Standard on the Construction of Receivers.—M. Chauvierre. (*Radio franç.*, Nov. 1949, No. 11, pp. 7–17.) Discussion with particular reference to receiver cost and quality of reception. Part 1 deals with the effect of synchronization and modulation methods on image stability. In part 2 the choice of the line standard is considered with respect to receiver cost. Part 3 presents the results of comparisons of the definition theoretically possible with that actually observed for about 1 000 receivers, 600 in the U.S.A., 100 in England and 300 in France. The majority of the receivers gave definition much inferior to that corresponding to the quality of the transmission. From the point of view of economical receiver construction, positive video modulation with a.m. for the sound channel is preferable. The line standard should be in the range from about 400 to about 600 lines. For very high definition in de-luxe receivers and for large-screen projection a standard of over 1 000 lines appears indispensable.

621.397.62 767
Study of a Sound Receiver for Television.—H. Gilloux. (*Radio prof., Paris*, Nov. 1949, Vol. 18, No. 178, pp. 14–16.) The miniature receiver described, working on 42 Mc/s, gave satisfactory results at distances up to 100 km from a standard transmitter. It uses rimlock

valves and has a normal sensitivity of 200 μV, using an EF42 h.f. stage with an input impedance of 75 Ω. Circuit details and constructional features are noted.

621.397.62 **768**
The Video-Frequency Stage.—R. Gondry. (*Télévis. franç.*, Nov. 1949, No. 53, pp. 6–9.)

621.397.62 : 621.318.4 **769**
Coils for Television Receivers.—F. Juster. (*Télévis. franç.*, Nov. 1949, No. 35, pp. 15–18, 24.) Graphical methods for designing h.f., i.f. and video-frequency coils with maximum Q.

621.397.62 : 621.396.615.17] : 621.385.2 **770**
The Efficiency Diode in Television Line Time Bases.—Coxall. (*See* 782.)

621.397.82 : 621.326 **771**
TV Interference from Incandescent Lamps.—D.G.F. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 132..148.) Intermittent contact of a lamp filament with its supports may produce short r.f. pulses in the 50–100-Mc/s region, which repeat at power-line frequency.

621.397.5 **772**
Basic Television. [Book Review]—B. Grob. Publishers: McGraw-Hill, New York, 1949, 596 pp., \$5.00. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 232, 234.) The author " has managed to present the entire field of television in a completely understandable and logical way which should appeal to the technician who is sincerely interested in what really goes on behind the picture tube".

TRANSMISSION

621.316.726 **773**
Simplified Frequency Stabilization.—O. A. Tyson. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, p. 1445.) About 1% of the output of a klystron is diverted by a directional coupler to a frequency discriminator comprising an unmatched hybrid junction, a phase changer, and a resonant cavity. The phase changer is adjusted to deliver equal modulated power to the detectors terminating the E and H arms of the hybrid when the cavity is detuned and the a.f.c. switch is 'off'. The cavity is then tuned to resonance, which again equalizes the power in the E and H arms, and the a.f.c. switch is turned to 'on'. Any subsequent frequency drift unbalances the system and the amplified and rectified detector outputs can be used to control the modulator valve and hence the amplitude of the square-wave output, which is applied to the steady-state klystron reflector voltage by derivative coupling, with the result that the oscillation frequency is stabilized. The scheme, with slight modification, can be made to work either with c.w. or a.m. output. Stabilization to within about 1 part in 10^5 is obtained.

621.396.61 **774**
Citizens' Band Transmitter.—A. R. Koch. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 118, 132.) Describes the construction of a small transmitter giving an output of 7 W at 450 Mc/s. The tripler and power-amplifier stages use capacitor-tuned parallel-plate resonant lines with lighthouse valves. For other articles on Citizens' Radio see 3482 of 1949 (Lurie) and back references.

621.396.61 : 621.396.97 **775**
Co-Ordinated Design of A.M. Broadcast Transmitters for a Range of Power Output.—P. R. Hellyar. (*Proc. Instn. Radio Engrs, Aust.*, July 1949, Vol. 10, No. 7, pp. 181–189.) 1948 Australian I.R.E. convention paper. A basic design of m.f. (540–1 600 kc/s) a.m. broadcast transmitters, for the output range 200 W–60 kW, is considered with particular reference to Australian requirements. Standardization of components and methods gives advantages in both design and manufacture without sacrifice of performance or appearance. Details of several standardized transmitters are included.

621.396.61.029.56/.58 **776**
S.F.R. 10-kW Short Wave Transmitter.—H. Grumel. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 344–357.) An illustrated description of a standardized communications transmitter designed for telegraphy and telephony operation in any climate on heavy-traffic commercial channels. Separate h.f. units provide for simultaneous operation in three bands which together cover the frequency range 2.5–23 Mc/s. Frequencies are crystal controlled and power input, from 230–400-V 50-c/s supply is 30, 75 or 90 kVA according to the equipment combinations in use.

621.396.61.029.56/.58 **777**
S.F.R. 2-kW and 20-kW Single-Sideband Transmitters.—G. Pembose. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 358–371.) An illustrated description, with block and circuit diagrams. The advantages of s.s.b. operation are outlined and the application of the normal suppression method to these transmitters is discussed. The use of quartz filters reduces the number of frequency conversions necessary to three, which are effected at 84 kc/s, at 2 520 kc/s and at a variable frequency. Each transmitter has a frequency range of 3.75–23 Mc/s and includes an automatic quick-action frequency-selection device. C.w. and a.m. telegraphy, and telephony operation can also be arranged; in s.s.b. working a 'pilot frequency' signal is transmitted for demodulation purposes at the receiver.

VALVES AND THERMIONICS

621.383.4 **778**
A New Germanium Photo-Resistance Cell.—J. N. Shive. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, p. 575.) A description of a device using a photoconductive property of germanium which combines high spatial resolving power with an over-all quantum efficiency greater than unity. The electrode geometry is similar to that of the double-surface transistor. The characteristics of the collector are modified by the photo-liberation of charge in the neighbouring semiconductor. The responsive area on the germanium is confined to a small region on the illuminated side immediately opposite the collector contact. Specimen static characteristics are given showing load power responses of the order of several tenths of 1 mW per millilumen. The cell response to different light modulation frequencies is flat up to the highest frequency studied, about 200 kc/s. The response rises slowly from the visible yellow to a peak at 1.5 μ and decreases rapidly beyond 1.6 μ.

621.385.032.213 : 537.581 **779**
Thermionic Electron Emission from Carbon.—Ivey. (*See* 604.)

621.385.2 **780**
Cathode Field in Diodes under Partial Space-Charge Conditions.—H. F. Ivey. (*Phys. Rev.*, 15th Aug. 1949, Vol. 76, No. 4, pp. 554–558.) A method is given for calculating the electric field at the cathode of a plane or cylindrical diode as a function of diode current. The results are believed to be applicable to any electrode geometry and to the study of thermionic cathodes in the Schottky emission region. The effect of anode voltage on cathode field, and the potential distribution in a plane diode are also discussed.

621.385.2 : 537.525.92 **781**
Diode Space Charge for Any Initial Velocity and Current.—L. Page & N. I. Adams, Jr. (*Phys. Rev.*, 1st Aug. 1949, Vol. 76, No. 3, pp. 381–388.) " The space charge equation is solved for any initial velocity which is the same for all electrons and for any realizable

current, for (*a*) the plane diode, (*b*) the cylindrical diode. For the plane diode it is shown that all cases can be obtained from a single pair of master curves. For the cylindrical diode a series valid for large distances from the axis is obtained first, the form of which shows that the complete group of solutions form a bounded set. Next three solutions valid for small distances from the axis are obtained by means of which the first set of solutions can be extended. In addition to master curves representing these solutions, curves are plotted for special values of the initial velocity and current."

621.385.2 : [621.397.62 : 621.396.615.17 **782**

The Efficiency Diode in Television Line Time Bases.—N. Coxall. (*Philips tech. Commun., Aust.*, 1949, No. 4, pp. 3–8.) Description of the miniwatt diode Type EA40, with emphasis on the increase in line timebase efficiency and on the circuit simplification possible when this diode is used.

621.385.3 **783**

New Triodes for Metre and Decimetre Waves.—L. Liot. (*Radio franç.*, Nov. 1949, No. 11, pp. 3–6.) A description is given of the Type T30H disk-seal triode constructed by the S.A.D.I.R. The electrodes are cylindrical and the valve is used in a vertical position. Maximum anode and grid voltages are 1 000 V and −200 V respectively. Maximum anode dissipation is 30 W and the upper frequency limit about 700 Mc/s. The construction details are given of a symmetrical twin-line oscillator using two such valves. Circuit characteristics and operating conditions are given for four frequencies in the range 220–400 Mc/s.

621.385.38 **784**

Pulse-Controlled Thyratron.—J. G. Skalnik. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 120..168.) A short positive pulse of variable phase with respect to the 60-c/s anode voltage of a positive-grid thyratron controls its conduction period.

621.385.83 : 538.691 **785**

Study of the Magnetic Focusing of Cylindrical Electron Beams.—G. Convert. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 279–288.) See 485 of February.

621.385.83 : 621.396.615.142 : 538.691 **786**

Magnetic Focusing of a Cylindrical [electron] **Beam with Density Modulation.**—R. Berterottière. (*Ann. Radioélect.*, Oct. 1949, Vol. 4, No. 18, pp. 289–294.) The transverse dispersive forces in an irregular electron beam are considered, and the behaviour of such a beam in a compensating magnetic field is discussed. Space-charge effects lead to considerable values of the radial debunching force, so that a magnetic field variable along the beam according to a certain law is necessary. Oscillations of electrons situated between two packets are minimized by using a sufficiently strong field.

621.396.615.142.2 **787**

Beam-Loading Effects in Small Reflex Klystrons.—W. W. Harman & J. H. Tillotson. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, pp. 1419–1423.) Beam-loading Q is determined from separate measurements of Q for valve and cavity (*a*) without and (*b*) with the accelerating voltage applied. Loading effects are much greater than predicted by published analyses; they vary approximately linearly with total oscillator load, a variation not previously noted. Analysis of loading effects produced by secondary electrons ejected into the intergrid space by the main electron stream shows the beam-loading to be large, with linear variation with load, and indicates the possibility of negative beam-loading.

621.396.622 **788**

Theoretical and Experimental Study of Detection by Silicon Crystals.—P. Lapostolle. (*Onde élect.*, Dec. 1949, Vol. 29, No. 273, pp. 429–448.) An account of research, extending over a period of two years, on a selection of detectors of British and German origin, together with full discussion of a theory based on the classical equivalent circuit. The method of showing the voltage/current characteristic on the screen of a c.r.o. is described and static characteristics for actual detectors are given. Methods of determining the impedance of detectors at low frequencies and at frequencies up to 10 Mc/s are described and rectification characteristics in the range 30–100 Mc/s and at 500 Mc/s are shown. Impedance and power measurements at decimetre wavelengths are considered in detail. Experimental results for powers above 10 mW are compared with values calculated from the theory given. Agreement is satisfactory and observed variations can be interpreted correctly by the theory, which indicates a slow decrease of detector sensitivity with increasing frequency and stresses the importance, even at v.h.f., of a very high backward resistance.

621.396.645 : 537.311.33 : 621.315.59 **789**

The Transistron Triode Type P.T.T.601.—R. Sueur. (*Onde élect.*, Nov. 1949, Vol. 29, No. 272, pp. 389–397.) Discussion of the properties of Ge, the effects at the point of contact between a conductor and a semi-conductor, and the mechanism, construction and applications of the transistron. See also 2978 of 1949 (Aisberg).

621.396.645.029.4/.52 : 621.396.822 **790**

Selective Amplification at Low Frequencies.—de Queiroz Orsini. (*See* 596.)

621.396.822 **791**

Spontaneous Fluctuations in Double-Cathode Valves.—K. S. Knol & G. Diemer. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, p. 345.) Measurements at 6 Mc/s on a valve with two indirectly heated plane cathodes 1 mm apart, and on a second valve with directly heated tungsten filaments of diameter 100 μ and 0.5 cm apart, do not support Fürth's theory (2418 and 2419 of 1948).

621.396.822 **792**

Note on Transit-Time Deterioration.—A. van der Ziel. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1949, Vol. 37, No. 12, p. 1447.) A simple derivation of some formulae recently published by MacDonald (2408 of 1949). See also 1890 of 1948 (Strutt & van der Ziel).

537.533 **793**

L'Émission Électronique. [Book Review]—J. Bouchard. Publishers: Librairie de la Radio, 160 pp. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, p. 379.) " A book which should interest radio technicians, particularly those concerned with the manufacture of transmitting and receiving valves, as well as students and physicists."

MISCELLANEOUS

061.3 : 621.3 **794**

A.I.E.E. Fall General Meeting Conference Papers Digested.—(*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, pp. 1091–1098.) Authors' summaries of 27 papers read at the meeting.

621.396 **795**

I.R.E. [Australia] **Radio Engineering Convention.**—(*Proc. Instn Radio Engrs, Aust.*, Oct. 1948, Vol. 9, No. 10, pp. 21–27.) Summaries of the technical papers presented at the convention held in Sydney, Nov. 1948.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

534.22 : [546.212 + 546.212.02 **796**

Velocity of Sound in Water and in Heavy Water as dependent upon Temperature.—P. P. Heusinger. (*Naturwissenschaften*, Sept. 1949, Vol. 36, No. 9, pp. 279–280.) Measurements were made at a frequency of 6.45 Mc/s in the temperature range 0°–100°C. The results are tabulated. For H_2O the velocity has a maximum value of 1 555.5 m/s at 73.4°C. For D_2O the maximum velocity (1 461.1 m/s) is at 75.1°C.

534.231 **797**

Elementary Treatment of the Fundamental Equations for the Radiation and Propagation of Sound.—F. A. Fischer. (*Frequenz*, Nov. 1949, Vol. 3, No. 11, pp. 320–328.) Discussion of (*a*) the two fundamental propagation equations, (*b*) spherical waves and their propagation through a sphere whose radius is small compared with the wavelength, (*c*) radiation from a piston membrane in an infinite rigid wall, (*d*) directed radiation, (*e*) radiation resistance.

534.231 **798**

Experimental Demonstration of a Theorem of Lord Rayleigh relative to the Production of Plane Waves.—J. Grunenwaldt. (*Ann. Télécommun.*, June 1949, Vol. 4, No. 6, pp. 203–209.)

534.6 : 621.395.623 : 534.771 **799**

Harmonic Distortion of Sound-Receivers and its Practical Consequences in Audiometry.—P. Chavasse, R. Caussé & R. Lehmann. (*Ann. Télécommun.*, May 1949, Vol. 4, No. 5, pp. 156–168.) The results of measurements of frequency response and harmonic distortion for high-quality receivers are presented in tables and curves as functions of frequency. The receivers included electrodynamic, piezoelectric and magnetic types. The response curves of the first two of these are regarded as satisfactory for audiometry purposes, though the piezoelectric receiver showed an antiresonance near 1 000 c/s. A telephone earpiece, however, showed a very pronounced resonance peak near 1 000 c/s, above which frequency the response decreased practically to zero at 5 000 c/s, making it quite unsuitable for any audiometry tests.

534.771 **800**

The Measurement of Hearing Loss.—J. T. Story. (*Marconi Instrumentation*, Nov./Dec. 1949, Vol. 2, No. 4, pp. 67–70.) General description of an audiometer, Type TF895, designed to the specification embodied in the Medical Research Council report on hearing aids (1245 of 1948). Ten tones in the range 125–8 000 c/s are provided, with simple intensity control which is calibrated relative to the normal threshold of hearing.

534.851 + 534.861/.862 + 621.395.625.3 **801**

New Audio Trends.—J. M. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 68–71.) Three methods of synchronizing magnetic-tape records with cinema film are described. A new directional ribbon microphone, designed to eliminate the microphone-boom problem in television studios, has a pick-up distance of up to 12 feet and a frequency range of 50–15 000 c/s. A 78 r.p.m. disk-recording technique capable of reproduction up to 20 000 c/s is mentioned.

534.86 : 534.322.1 **802**

Influence of Reproducing System on Tonal-Range Preferences.—H. A. Chinn & P. Eisenberg. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1949, Vol. 10, No. 11, pp. 297–306.) Reprint. See 2695 of 1948.

534.862.4 : 621.383.4 **803**

Lead-Sulfide Photoconductive Cells in Sound Reproducers.—Lee. (*See* 1027.)

534.862.4 : 621.395.625.3 **804**

The Reciprocal Relations between Magnetic Tape and Ring Head as affecting the Reproduction.—W. Guckenburg. (*Funk u. Ton*, Jan. 1950, Vol. 4, No. 1, pp. 24–33.) Discussion of the effect of the magnetic properties of the tape, and of the gap width used in the reproducing head, on the quality of the reproduction.

621.395.61 **805**

The Bantam Velocity Microphone.—L. J. Anderson & L. M. Wigington. (*Audio Engng, N.Y.*, Jan. 1950, Vol. 34, No. 1, pp. 12–14, 31.) Design of the KB-2C microphone is discussed; operational characteristics approximate to those of a conventional velocity microphone. Wind-screening, which is lower then normal due to proximity of screens to ribbon, is improved by addition of cotton or fibre-glass between the inner and outer screens, but with some resulting reduction in low-frequency response.

621.395.623.7 **806**

A Loudspeaker for the Range from 5 to 20 kc/s.—B. H. Smith & W. T. Selsted. (*Audio Engng, N.Y.*, Jan. 1950, Vol. 34, No. 1, pp. 16–18.) Theoretical design considerations and constructional details of a loudspeaker with a frequency response level to within ±2.5 db and an average efficiency of about 28%; it will handle a peak power of 5 W.

621.395.92 **807**

American Hearing Aids.—A. Dinsdale. (*Wireless World*, Jan. 1950, Vol. 56, No. 1, pp. 2–5.) Discussion of requirements and current practice in design and fitting. For comparable British information, see 1245 and 1246 of 1948.

AERIALS AND TRANSMISSION LINES

621.315.012.3 **808**

R.F. Transmission Line Nomographs.—P. H. Smith. (*Télévis. franç.*, Jan./Feb. 1950, No. 55, pp. 15–19.) French version of 1274 of 1949.

621.315.212 **809**

Reflection-Free Supporting Disks in Coaxial Cables.—H. Kaden & G. Ellenberger. (*Arch. elekt. Übertragung*, Dec. 1949, Vol. 3, No. 9, pp. 313–322.) For non-reflection the diameter ratio for the disks must be made larger than that of the conductors. The outer and inner conductors must therefore be recessed where the supports fit. The necessary groove depth, which depends on the dielectric constant of the disk material, is calculated. To avoid field distortion the disks must be specially shaped. Exact mathematical determination of the optimum shape appears impracticable, but an approximate solution is obtained by a conformal transformation method. Experimental results confirm the theory.

621.317.336 + 621.396.67 **810**

Antennas and Open-Wire Lines: Part 3 — Image-Line Measurements.—P. Conley. (*J. appl. Phys.*, Nov. 1949, Vol. 20, No. 11, pp. 1022–1026.) An open-wire line is formed by a single wire and its image in a reflecting sheet. This line is inherently balanced and well-shielded. By loading at the centre and feeding at the ends, discontinuity at the load and the need for dielectric supports are avoided. Measurements on a symmetrical line give a simple method of determining the load impedance. A description is given of apparatus for laboratory investigation and of its application to the study of the coupling between a dipole and an open-wire line. Characteristics of the line compared favourably with those of a good coaxial measuring-line. Parts 1 and 2: 281 and 399 of February.

621.317.336 **811**

Antenna Impedance Measurement by Reflection Method.—F. Istvánffy. (*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 285–291.) Reprint. See 2559 of 1949.

621.392.26† **812**

Principal Waves in Electromagnetic Waveguides.—J. Ortusi & J. C. Simon. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 12–20.) The application of Maxwell's equations to guided waves is considered and the general solution is applied to the transverse e.m. wave as defined by a velocity of propagation equal to that of light in free space. The characteristic functions of such waves (power, voltage, current, characteristic impedance) are invariant in any conformal transformation of coordinates. This theorem is proved and then used to evaluate the iterative impedance of coaxial and multi-wire lines from the characteristic impedance of two strips of unbounded plane, which corresponds to the simplest T.E.M. wave.

621.392.26† **813**

Waveguides [operating] **beyond the Cut-Off Frequency: Application to Piston Attenuators.**—A. Briot. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 57–63.) A detailed treatment is given of the characteristics of cylindrical piston attenuators for E_0 and for H_1 waves, and of rectangular attenuators for H_{01} waves. Matching of attenuators to waveguides or coaxial lines for a given frequency band is also discussed. See also 551 of March.

621.392.26† : 621.396.67 **814**

Slotted Waveguides and their Application as Aerials.—M. Bouix. (*Ann. Télécommun.*, March 1949, Vol. 4, No. 3, pp. 75–86.) A transmission line with 'small loads' distributed along it is first discussed. These loads are in the form of quadripoles whose shunt admittance and series impedance are small compared with the characteristic impedance of the line. Representation of such loaded lines by means of circle diagrams leads to the concept of an equilibrium cycle. A study is made of resonant slots in the wall of a waveguide, these slots constituting the 'small loads'. The disposition of slots for a desired radiation distribution is considered, in particular that giving (*a*) uniform distribution and (*b*) a 1 : 4 : 1 'gable' distribution. The relation between squint angle and the spacing of the slots is determined for different waveguides of American standard dimensions. A method of designing slot systems is outlined and the case is considered of a system of slots with $\lambda_g/2$ spacing, the waveguide being terminated by a short-circuiting plunger at a distance of $\lambda_g/4$ from the end slot. Applications of slotted aerials are briefly reviewed.

621.392.43.012.2 **815**

A Graphic Procedure for Calculations involving Transmitting-Line Systems.—de Onis. (*See* 837.)

621.396.67 **816**

Application of a Variational Principle to Biconical Antennas.—C. T. Tai. (*J. appl. Phys.*, Nov. 1949, Vol. 20, No. 11, pp. 1076–1084.) A theoretical examination is made of the impedance of a biconical aerial, using a method devised by Schwinger. An integral equation for the aperture field is obtained by fulfilling boundary conditions on a sphere. Hence an expression is derived for the effective terminating admittance. The solution of zero order is shown to be identical with that obtained by Smith by neglecting higher modes than the principal mode in the interior of the boundary sphere. For cones of small angle, the result agrees with exact solutions obtained by other methods. For cones of any angle, a first-order solution is obtained, and realized numerically for certain angles. See also 1588 of 1949.

621.396.67 **817**

Omnidirectional Wide-Band Aerials for Decametre and Metre Waves.—O. Zinke. (*Radio franç.*, Dec. 1949, No. 12, pp. 7–12.) The construction and impedance characteristics of different types of such aerials are considered. For a frequency coverage $f_{min} : f_{max}$ of 1 : 2 or 1 : 3, the diameter/length ratio should be large (about 0.5). The use of plates, tubes, wire mesh, and multi-wire aerials to obtain such a ratio is illustrated.

621.396.67 : 621.316.761.2 **818**

Wide-Band Aerials and Resonant Circuits with Simple and Double Compensation.—O. Zinke. (*Radio franç.*, Dec. 1949, No. 12, pp. 13–17.) The compensating reactance ratios for series and parallel circuits are determined. A s.w.r. of 2.6 can be reduced to 1.4 by the use of one equalizing circuit, and to 1.25 by using two circuits. Their application to a fan-type aerial of length $<\lambda/4$ is considered, and shows that the s.w.r. may be kept constant for variations of frequency from -16% to $+14\%$ of the resonance frequency. Near antiresonance a much wider frequency band is obtained, with a similar s.w.r. The equivalence of these compensating circuits to T and Π filters is noted.

621.396.67 : 621.397.62 **819**

Built-In Antennas for Television Receivers.—K. Schlesinger. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 72–77.) Electrical designs for three types of built-in aerials are given: a short dipole, a bi-resonant loop and a double loop. The characteristics of the aerials are described and their performance is compared with that of a $\lambda/2$ dipole. Measured values of signal attenuation at various locations in a 3-storey brick/steel building are given for three frequencies.

621.396.671 **820**

Gain of Aerial Systems.—D. A. Bell. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, p. 32.) Comment on 287 of February (Brown).

621.396.677 **821**

Aluminium aids Television.—(*Metal Ind., Lond.*, 27th Jan. 1950, Vol. 76, No. 4, pp. 71–73.) Details are given of the construction of the 14-ft paraboloid grid-type reflectors for the London/Birmingham link. These are constructed from Al-alloy tubes and castings, the tubes forming the actual reflectors being ⅜ in. in diameter and spaced 3 in. between centres. Insulated heater cables are fitted inside the reflector tubes to prevent icing, the heater system being divided into four sections; maximum power dissipated in either the two inner or the two outer sections is 6 kW.

621.396.67 **822**

Aerials for Metre and Decimetre Wavelengths. [Book Review]—R. A. Smith. Publishers: Cambridge University Press, London, 218 pp., 18s. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, pp. 30–31.) "The aerial systems described are mainly those which have been developed for the wavelength range of 12 m to 1 m, and only one short chapter is devoted specifically to decimetre-wave aerials. . . . a most lucid and valuable account of the subject. The book . . . may be unreservedly recommended."

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : [517.63+517.432.1 **823**

The Laplace Transformation and the Study of Transient Phenomena.—Colombo. (*See* 914.)

621.3.016.35 **824**

On the Stability Criterion of H. Nyquist.—F. Kirschstein. (*Arch. elekt. Übertragung*, Sept. 1949, Vol. 3, No. 6, pp. 195–198.) A discussion of Nyquist's rule that an automatic regulating device is stable against self-excitation if its 'C-curve' does not embrace the critical point (1, 0) in the complex plane. It is proved by an example that this rule does not always hold, and a practical criterion of stability is given.

621.3.016.35 : 621.3.012.2 **825**

Practical Stability Testing by means of Circle Diagrams.—F. Strecker. (*Elektrotechnik, Berlin*, Dec. 1949, Vol. 3, No. 12, pp. 379–388.)

621.314.2.012.3 **826**

Abacs for Output-Transformer Design.—P. L. Courier. (*T.S.F. pour Tous*, Jan. 1950, Vol. 26, No. 225, pp. 13–17.) The first abac gives the transformation and load distribution for optimum impedance matching; the second presents sets of curves from which l.f. and h.f. attenuation and the circuit constants can be determined. Practical numerical examples are given.

621.314.26 **827**

On the Frequency Conversion of Technical Alternating Currents to High Frequency by means of Valves.—E. Prokott. (*Fernmeldetech. Z.*, Oct. 1949, Vol. 2, No. 10, pp. 301–308.) A push-pull transmitter-amplifier is described which is fed with a.c. and gives a h.f. output modulated by a frequency which is twice the supply frequency. With two or more amplifier stages, good efficiency can be obtained. If high-emission valves are used, considerable power can be handled. The transmitter can be keyed and ph.m. or f.m. can be applied. If tone-frequency energy is used for supplying a push-pull stage, sidebands can be produced.

621.316.761.2 : 621.396.67 **828**

Wide-Band Aerials and Resonant Circuits with Simple and Double Compensation.—Zinke. (*See* 818.)

621.318.4 **829**

The Frequency Dependence of the Distortion for Coils with Laminated-Iron Cores.—H. Kämmerer. (*Arch. elekt. Übertragung*, Oct. 1949, Vol. 3, No. 7, pp. 249–256.) Starting from the Rayleigh hysteresis formula and eddy current theory, the frequency characteristic of the distortion factor is determined graphically. For very small field strengths, the calculated values agree well with measurements of the distortion for permenorm under no-load conditions. For larger field strengths, the measured distortion is less than the calculated value.

621.318.572 **830**

A Stepping Scale-of-Ten Counting Unit.—I. A. D. Lewis & J. F. Raffle. (*J. sci. Instrum.*, Jan. 1950, Vol. 27, No. 1, pp. 7–10.) The principle, operation and performance of the circuit are discussed in some detail with the aid of a circuit diagram and waveforms. Developed along the lines of the Miller integrator, the circuit comprises two pentodes and five diodes. It is primarily designed for connection to the output of a commercial scale-of-100 unit. Counting is achieved by the collection of discrete quantities of charge on a capacitor. The mechanical counter sets an upper limit of 9 counts per sec at the output.

621.318.572 **831**

Electronic Amplitude Selector with a Scaling-Down Circuit.—T. Kahan & A. Kwartiroff. (*J. Phys. Radium*, Dec. 1946, Vol. 7, No. 12, pp. 357–359.) Description with complete circuit diagram of apparatus which will select and record pulses irrespective of pulse shape, phase or duration. The associated *n*-scale circuit controls the number recorded according to the scale set.

621.318.572 : 621.384.5 **832**

Neon Diode Ring Counter.—J. C. Manley & E. F. Buckley. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 84–87.) An inexpensive 3-decade instrument with a counting speed up to 500 impulses per sec. Neon glow-discharge tubes and Ge diodes are used. Circuit details and the mode of operation are described. The counter can be reset instantaneously and the action can be reversed for subtraction. An arrangement is included which produces a special signal when any selected number up to 999 is reached.

621.392 **833**

Network Theorem.—V. Belevitch. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, p. 33.) The theorem discussed by Wigan (305 of February) has been proved by Cauer (392 of 1942) and applied to various problems in filter design.

621.392 834

Electrical Analogs of Linear Systems.—J. P. Corbett. (*Elect. Engng, N.Y.*, Dec. 1949, Vol. 68, No. 12, p. 1075.) Summary only. Discussion of transformations which can be used to change a linear system into one capable of being more easily represented electrically.

621.392 : 621.396.813 835

Some Aspects of the Theory of Bode.—H. Familier. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 36–53.) The general principles of the theory (3381 of 1948) are summarized and three basic relations between the real and imaginary components of the principal circuit function $\theta = A + jB$ are derived. These expressions are developed further to determine the attenuation curve corresponding to a given phase curve in the study of distortion in a selective circuit. The theoretical relations are then applied to negative-feedback amplifiers to determine their characteristics (gain, impedances, etc.) and stability. As an example, a wide-band video amplifier is studied and the optimum total feedback is calculated from given specifications. Two appendices deal respectively with (*a*) theorems relating to the physical realizability of circuits, (*b*) integration in the complex plane, with application of Cauchy's theorem.

621.392.43 836

The Exponential Line as a Transformer.—O. Zinke. (*Radio franç.*, Jan. 1950, No. 1, pp. 9–13.) See 672 of 1948.

621.392.43.012.2 837

A Graphic Procedure for Calculations involving Transmitting-Line Systems.—A. de Onis. (*Commun. News*, Oct. 1949, Vol. 10, No. 3, pp. 87–97.) A detailed account of the practical use of circle diagrams in calculations involving such devices as matching stubs or transmission-line transformers. Symmetrical branching of the line is also considered. The line is assumed to be lossless and to have a purely resistive characteristic impedance. These conditions are usually satisfied approximately by r.f. feeders, for which the methods described are particularly intended.

621.392.5 838

On Quadripoles having their Iterative Impedances Proportional to Those of a Given Quadripole.—M. Parodi. (*J. Phys. Radium*, May 1947, Vol. 8, No. 5, pp. 140–142.)

621.392.5 839

Analytical Conditions for Damping in an Electrical Network of *n* Independent Meshes. (Note on Hurwitz Polynomials in the Form of Determinants).—M. Parodi & F. Raymond. (*Ann. Télécommun.*, June 1949, Vol. 4, No. 6, pp. 231–232.) The necessary and sufficient conditions are determined for a symmetrical determinant, with real elements, of order n, $|a_{jk}z^2 + b_{jk}z + c_{jk}|$, to be a Hurwitz polynomial in z. A classical result in the theory of electrical networks is thus established. This result is generalized.

621.392.5.018.1 : 621.396.615 840

The Design of RC Oscillator Phase-Shifting Networks.—W. R. Hinton. (*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, pp. 13–17.) A method of applying matrix algebra to determine the coefficients used in the equations giving the operating frequency and the gain required to maintain oscillation in RC oscillators. Coefficients for the design equations for a number of different networks are given.

621.392.52 841

Design of Absorption Traps.—J. Avins. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 105–108.) Universal response curves show the ratio of the response of a tuned circuit, to which a trap circuit is inductively coupled, to the response without the trap, for typical values of attenuation and frequency separation. An abac for determination of the coupling factor is given. The response curves indicate that optimum performance is obtained when an absorption trap is coupled to a circuit which is relatively close in frequency.

621.392.52 842

Calculation of Band-Pass Filters using Piezoelectric Crystals in Lattice Structures.—A. Fromageot & M. A. Lalande. (*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 305–318.) Theory is developed and applied to the practical design of wide- and narrow-band filters. The attenuation curves are given of a filter for separating the channels in a s.s.b. R/T system, and also for the pilot-selecting filter for the receiver used in that system.

621.392.52 843

A Three-Stage High-Frequency Filter with Variable Bandwidth, and its Practical Realization.—W. Pfost. (*Arch. elekt. Übertragung*, Sept. & Oct. 1949, Vol. 3, Nos. 6 & 7, pp. 199–202 & 257–264.) The construction of the filter is described and performance figures are discussed. These indicate that the selective gain of such a filter is nearly independent of the effective bandwidth. With given maximum Q values for coils and circuit, maximum gain is obtained for $N = 5$, where N is the ratio of the sum of the loss angles of all circuits to that of the best circuit. It is advantageous to deviate slightly from the shape of the exact Tchebycheff attenuation curve within the pass band. Filters with N from 4 to 4.5 can then be designed with the same bandwidth and a sharper cut-off, without appreciable reduction in gain. Experiments confirm these conclusions.

621.392.52 : 621.3.094.1/.2 : 621.396.813 844

Modulation Distortion by Band-Pass Filters.—U. Finkbein. (*Funk u. Ton*, Jan. 1950, Vol. 4, No. 1, pp. 11–15.) Attenuation- and phase-distortion of the modulation frequency in a h.f. filter are calculated, for the steady state, from the amplitude and phase characteristics of the filter. With a symmetrical filter curve and accurate tuning, distortion is at a minimum. The use of a low modulation depth and quadratic rectification is also advantageous.

621.392.52 : 621.396.823 845

The Design of L-Type Inductance-Capacitance High-Frequency Filters for Suppressing Industrial Interference.—S. A. Lyutov. (*Radiotekhnika, Moscow*, Sept./Oct. 1949, Vol. 4, No. 5, pp. 28–40. In Russian.)

621.392.53 846

The Design of Reactive Equalizers.—A. P. Brogle, Jr. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 716–750.) "This paper describes a systematic method of approximating with a finite number of network elements a transfer characteristic which is a prescribed function of frequency, rather than a constant, over the useful frequency band. Although applied here only to input and output coupling networks as reactive equalizers and where loss equalization to an extremely high degree of precision over a wide frequency band is desired, the mathematical expressions which form the basis for the design are applicable to any 4-terminal network whose transfer characteristic is specified in a similar manner over the real frequency range.

"The selection of the appropriate form of the transfer function for equalization purposes is the fundamental consideration. A squared Tchebycheff polynomial is found to be particularly suitable to produce a desired cut-off characteristic without impairing the precision of equalization in the useful band.

"A method of polynomial approximation based on the transformation $\omega = \tan \phi/2$ is used to obtain the coefficients of the in-band approximating function. Predistorting the transfer specification and minimizing the mean-square error, the coefficients become the Fourier cosine coefficients for an infinite frequency range, and are the solutions of a linear set for a finite range, $0 \leqslant \phi \leqslant \pi/2$."

621.396.611.1 : 517.93 **847**

Harmonic and Subharmonic Response for the Duffing Equation.—M. E. Levenson. (*J. appl. Phys.*, Nov. 1949, Vol. 20, No. 11, pp. 1045–1051.) The Duffing equation $\ddot{x} + \alpha x + \beta x^3 = F \cos \omega t$, in which $\alpha > 0$, possesses periodic solutions with frequency ω/n for all integral values of n, provided β is sufficiently small. Two types of harmonic solutions and two types of subharmonic solutions exist if β is small enough. The perturbation method is used to find the approximate response curves for each of the four types of solution. The response curves obtained in the nonlinear case ($\beta \neq 0$) and in the linear case ($\beta = 0$) are compared and some properties of the solutions in the nonlinear case are discussed. For one particular type of subharmonic solution a comparison is made between the perturbation method and the iteration method used by Rauscher, in which F is assumed small instead of β. The main result obtained is that the two methods yield similar results for larger values of β than might be expected. See also 582 of March (Elias & Duinker).

621.396.615 : 621.392.52 **848**

Oscillators of High Frequency-Constancy.—W. Herzog. (*Arch. elekt. Übertragung*, Sept. 1949, Vol. 3, No. 6, pp. 203–207.) The Q value of an oscillator is defined in terms of the product of the feedback and amplification factors. Oscillators developed from filter circuits can be much improved by increasing the amplification and also by increasing the steepness of the sides of the filter attenuation curve. Improved forms of oscillators of the bridge and Heegner types are discussed.

621.396.615.029.63 **849**

On a Particular Characteristic of Disk-Seal Valves 2C40 and 2C43.—Liot. (*See* 1033.)

621.396.615.14 **850**

Coaxial Oscillator Circuit for Decimetre Waves.—L. Liot. (*Radio franç.*, Jan. 1950, No. 1, pp. 14–17.) A scale diagram and description of a 600-Mc/s oscillator giving a useful output of 18 W. The oscillator comprises a grounded-grid triode Type T30H (783 of March) with a $\lambda/2$ coaxial-line anode circuit and a $3\lambda/4$ coaxial-line cathode circuit. Maximum operating frequency is 714 Mc/s. Practical rules for simplifying design calculations for this type of oscillator will be given later.

621.396.615.17 **851**

A Flexible High-Voltage Square-Wave Generator.—L. C. Hedrick. (*Rev. sci. Instrum.*, Nov. 1949, Vol. 20, No. 11, pp. 781–783.) Description of a generator suitable for modulating the absorption cell of a microwave spectrograph. Peak-to-peak voltages up to 1 800 V have been produced at 100 kc/s, feeding into a capacitive load of 800 pF. Voltage adjustment is effected by variation of a single component. The instrument is kept effectively at ground potential automatically.

621.396.615.17 **852**

Transitron Relaxation Oscillators and the Transitron Integrator.—J. Moline. (*Radio franç.*, Dec. 1949, No. 12, pp. 20–23.) The principles of operation of the transitron relaxation circuit and of the Miller integrator are described. The combination of the two systems in one circuit is illustrated. This circuit generates a pure sawtooth waveform with good stability. Component values for such a circuit using an EF50 valve are noted.

621.396.615.17 **853**

Variable-Pulse-Length Generator.—J. C. May. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 109–111.) A cathode-coupled clipper circuit with regeneration provides pulses of width linearly variable from 0.5 μs to 24 μs and with peak voltages of 4.5–6.5 V.

621.396.619.16 **854**

Development in Pulse-Modulation Circuits.—F. Butler. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, pp. 12–16.) The pulses are generated across the common anode load of two valves fed in push-pull from a low-power primary oscillator whose frequency equals the desired recurrence frequency. Reactance modulator valves are used to vary the phase of the grid-cathode voltage of one valve with respect to that of the other, giving width-modulation of the pulses. The system is suitable for speech transmission and can be adapted to give several channels on a time-allocation multiplex basis.

621.396.621.5 **855**

Methods of Calculating the Sensitivity of Mixer Stages for Decimetre and Centimetre Waves.—H. F. Mataré. (*Arch. elekt. Übertragung*, Oct. 1949, Vol. 3, No. 7, pp. 241–248.) A knowledge of diode theory is assumed; previous work on the subject is reviewed and methods of calculating sensitivity are discussed. The application of these methods in the case of diode mixing is considered. A mathematical analysis shows that by introducing mean values into the expression for the noise function of the network, calculation of sensitivity and receiver circuit design are simplified. A numerical treatment of the mixer-stage equation, together with a comparison of calculated and experimental results, will be given in a later paper.

621.396.645 **856**

Design of an Amplifier with Circuits Tuned to Different Frequencies and such that the Phase/Frequency Function is Linear in a Given Range of Frequencies.—A. Fromageot & P. Belgodère. (*Ann. Télécommun.*, May 1949, Vol. 4, No. 5, pp. 169–176.) Expressions for the modulus and phase of the transfer constant of an n-stage stagger-tuned amplifier are derived which involve the Newtonian potential function and its conjugate. Certain properties of these functions are reviewed, in particular their behaviour with regard to conformal transformation. The continuous distribution of charge which corresponds to a linear variation of the phase function with frequency in a limited frequency band is considered, and an estimate is made of the order of approximation resulting from the adoption of a discontinuous distribution of point charges. The method of calculation enables the tuning frequencies and the Q values of the different circuits to be determined for an amplifier of given gain in a given frequency band.

621.396.645 **857**

High-Quality Amplifier.—D. T. N. Williamson. (*Wireless World*, Jan. 1950, Vol. 56, No. 1, p. 24.) Replies to readers' queries on 3101 of 1949 and 335 of February.

621.396.645 **858**

Reducing the Effect of Capacitance in Screened Cable.—G. H. Rayner. (*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, p. 33.) The input capacitance at a.f. of a cathode follower with customary connections is about 10 pF. To reduce this the valve should be mounted within a screen that can be connected to the cathode and the screen-grid should be coupled to the cathode and not by-passed to earth. The input capacitance can thus be reduced by a factor of about 10.

621.396.645 : 621.392.52 **859**

RC-Amplifier Filters.—C. H. Miller. (*Wireless Engr,* Jan. 1950, Vol. 27, No. 316, pp. 26–29.) "Simple expressions are derived for the approximate cut-off frequencies of amplifiers which use resistance-capacitance feedback networks to produce high-pass, low-pass, or band-pass frequency characteristics similar to those of conventional filters. The design of such amplifiers is discussed, and illustrations are given of the results obtained with simple amplifiers of this type."

621.396.645 : 621.392.52 **860**

On the Problem of Bandwidth Control.—J. Harmans. (*Funk u. Ton,* 1949, Vol. 3, Nos. 11/12, pp. 570–574.) The conditions necessary for an optimum frequency/amplification response curve (see 1889 of 1948) are realized by the use of two 2-stage filters with variable coupling. Sensitivity, selectivity and bandwidth are considered for two cases: (*a*) with one filter variable, the other fixed; (*b*) with both variable. With an overall bandwidth of 21.7 kc/s, a deviation of less than ± 5% from the ideal response curve is obtainable.

621.396.645 : 621.396.611.3 **861**

On the Connection between Amplification and Bandwidth in a Multi-Stage Amplifier with Circuits of the Same Resonance Frequency.—W. Kleen. (*Funk u. Ton,* 1949, Vol. 3, Nos. 11/12, pp. 584–591.) The circuit considered uses a single type of valve with given characteristics. The valves are connected in cascade and are coupled by simple rejection circuits. A formula is derived which gives the maximum attainable amplification for a given bandwidth, and the corresponding values are determined for number of stages, amplification per stage, load resistance and bandwidth for a single stage. A numerical example is calculated. Similarly, the maximum bandwidth for a given overall amplification is determined.

621.396.645.37 : 621.3.016.35 **862**

Investigation of the Conditional Stability of Feedback Amplifiers.—K. H. R. Weber. (*Frequenz,* Sept. 1949, Vol. 3, No. 9, pp. 253–259.) A theoretical and experimental investigation of the dependence of the stability on the parameter vK, where v is the voltage gain of the amplifier without feedback and K is the gain in the feedback path. For the amplifier used, conditional stability existed for values of vK between 4 000 and 100 000. The conditions for instability to exist and hence for self-oscillation to occur when switching on or off are summarized. The smaller the distance of the vK characteristic from the point (1, 0), the lower is the maximum permissible input voltage for self-oscillation not to occur. With the experimental amplifier, self-excitation commenced at an input voltage of 700 mV for $v = 100\,000$, $K = 1$, but at 180 mV for $v = 10\,000$, $K = 0.5$.

621.396.645.371 **863**

Negative-Feedback Amplifiers.—E. Chamagne & G. Guyot. (*Ann. Télécommun.,* April 1949, Vol. 4, No. 4, pp. 119–122.) Formulae are derived for the amplification factor and output impedance of a feedback amplifier and also for the transient response. Results are given for an amplifier designed to transmit a band of width 3 Mc/s.

621.396.662 **864**

A High-Power Attenuator for Microwaves.—D. Alpert. (*Rev. sci. Instrum.,* Nov. 1949, Vol. 20, No. 11, pp. 779–781.) The attenuator is for use with waveguides working at λ 10 cm. The attenuating material is a mixture of ethylene glycol and water which serves also to remove the absorbed energy. The variations in attenuation and power s.w.r. with mixture concentration are shown. Power up to 100 W can be absorbed. Attenuation is variable from 1.5 db to 40 db and power s.w.r. is less than 1.1 at all settings.

621.392 **865**

Networks, Lines and Fields. [Book Review]—J. D. Ryder. Publishers: Prentice-Hall, New York, 1949, 462 pp., $7.35. (*Electronics,* Jan. 1950, Vol. 23, No. 1, pp. 208, 210.) "A rather complete treatment on the undergraduate level of elementary network theory, filters, transmission lines at low and high frequencies, Maxwell equations, reflection of waves, and waveguides." ". . . will be useful not only to undergraduates but also to an average engineer for direct consultation."

621.396.662.3 + 621.396.645 + 621.396.62 **866**

Applications of the Electronic Valve in Receiving Sets and Amplifiers. [Book Review]—Dammers, Haantjes, Otte & van Suchtelen. (*See* 991.)

GENERAL PHYSICS

53.081 + 537.713 **867**

The Rationalized Giorgi System and its Consequences.—P. Cornelius & H. C. Hamaker. (*Philips Res. Rep.,* April 1949, Vol. 4, No. 2, pp. 123–142.)

530.12 **868**

Equations of Motion and Tensor of Matter for the System of Finite Mass in the General Theory of Relativity.—N. M. Petrova. (*Zh. eksp. teor. Fiz.,* Nov. 1949, Vol. 19, No. 11, pp. 989–999. In Russian.)

534 **869**

On Certain Cases of the General Problem of the Theory of Steady-State Oscillations.—D. I. Sherman. (*C. R. Acad. Sci. U.R.S.S.,* 21st Aug. 1947, Vol. 56, No. 6, pp. 567–570. In Russian.) An investigation of solutions of the two-dimensional wave equation which satisfy mixed boundary conditions containing derivatives of the wave function up to any finite order. The problem depends on the solution of an integral equation.

535.43 **870**

The Scattering Cross Section of Spheres for Electromagnetic Waves.—L. Brillouin. (*J. appl. Phys.,* Nov. 1949, Vol. 20, No. 11, pp. 1110–1125.) For the case of large spheres, where geometrical optics should apply, the rigorous classical theory yields a scattering cross-section equal to twice the actual cross-section of the sphere. The same holds good for large cylinders. An explanation of this anomalous result is given which shows the role played by the shadow and by the diffraction fringes surrounding the shadow. A reasonable system of approximations yields the well-known Babinet's principle. The physical interpretation is so general that it must apply to similar problems in acoustics or wave mechanics. Experiments designed by Sinclair and LaMer gave an accurate check of the theory.

537.291 : 537.525.92 **871**

Electron Flow in Curved Paths under Space-Charge Conditions.—B. Meltzer. (*Proc. phys. Soc.,* 1st Dec. 1949, Vol. 62, No. 360B, pp. 813–817.) A theoretical treatment of a particular example of 3-dimensional flow for which the electron trajectories all lie on hyperboloids and the equipotential surfaces are ellipsoidal. Some general theorems are deduced from the results of an earlier paper (3120 of 1949). Distinction is made between 'normal' flow, in which all electrons on a given equipotential have the same speed, and 'abnormal' flow in which the speeds are not the same. It is shown that in normal flow the velocity vector obeys the law $\mathbf{v} \times \text{curl}\,\mathbf{v} = 0$.

537.311.62 **872**

Anomalous Skin Impedance as a Function of the Field Strength.—K. F. Niessen. (*Philips Res. Rep.,* April 1949, Vol. 4, No. 2, pp. 143–153.) A study of the skin effect in a metal of high conductivity subjected to a strong h.f. field. See also 3403 of 1949.

537.525 **873**

Breakdown in Cold-Cathode Tubes at Low Pressure.—F. G. Heymann. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361B, pp. 25–41.)

537.525.92 : 621.385.029.63/.64 **874**

Increasing Space-Charge Waves.—J. R. Pierce. (*J. appl. Phys.*, Nov. 1949, Vol. 20, No. 11, pp. 1060–1066.) The equation for the gain per unit length of increasing waves in the presence of two streams of charged particles has been solved numerically for a wide range of values of plasma frequencies and stream velocities. The solutions are presented as curves of a gain parameter versus the ratio of the frequency to the plasma frequency of the faster stream, for various ratios of the stream velocities. Each graph corresponds to a different ratio of plasma frequencies. These curves apply to such effects as ion noise and double-stream r.f. amplification and it is shown that in certain circumstances the latter may occur in valves intended to have only a single electron stream. The case of streams moving in opposite directions is also considered. See also 3406 of 1949 (Bailey) and back references, 2486 of 1949 (Pierce & Hebenstreit).

537.562 **875**

Measurement of the Complex Conductivity of an Ionized Gas at Microwave Frequencies.—F. P. Adler. (*J. appl. Phys.*, Nov. 1949, Vol. 20, No. 11, pp. 1125–1129.) The positive column of a glow discharge is placed along the axis of a cylindrical cavity excited in the TM_{010} mode. The transmission of 3-cm waves through the cavity and the shift in resonance frequency are observed as a function of discharge current. It is shown that from these measurements values of the complex conductivity, $\sigma_r - i\sigma_i$, of the electron gas can be calculated. Curves of the measured conductivity components as functions of pressure and current are given. Using a theoretical formula for the conductivity (Margenau: 3246 of 1946) values of electron density can in turn be calculated from both σ_r and σ_i. Langmuir probe studies are carried out to check the results obtained, and adequate agreement is found.

538.56 : 537.71 **876**

Concerning 'The Impedance of Free Space'.—A. Foch. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 5–7.) Comment on the anomalies of the two systems of units, classical and rationalized, with an explanation of the apparent discrepancy between the values of free-space impedance for the two systems. See also 607 of March (Budeanu) and 877 below.

538.56 : 537.71 **877**

On the Impedance of Free Waves.—É. Brylinski. (*Bull. Soc. franç. Élect.*, Jan. 1950, Vol. 10, No. 100, pp. 37–40.) The ratio Z_0 of the e.s. field $\mathcal{E}$ to the e.m. field H of a free-space e.m. wave has the dimensions of a resistance but is not a true impedance. It is suggested that it should be called the pseudo-impedance of free space and measured in pseudohms. In the classic (non-rationalized) Giorgi system Z_0 would have the value 30 pseudohms. In the rationalized Giorgi system $Z'_0 = 4\pi Z_0 = 377$ pseudohms and Z'_0 can be distinguished by calling it the pseudo-impedance of free waves. It should be noted that Z_0, like the velocity c to which it is closely related, can be either a scalar or a vector quantity.

539.11 **878**

Some Electronic Properties of a One-Dimensional Crystal Model.—D. S. Saxon & R. A. Hutner. (*Philips Res. Rep.*, April 1949, Vol. 4, No. 2, pp. 81–122.) "The Kronig-Penney model of a one-dimensional crystal is studied further with the aid of the formalism of the Dirac δ-function. Both a Green's-function method and a scattering-matrix method are used to derive the energy levels and wave functions for the monatomic and the diatomic lattices. The scattering-matrix method is used to study the problems of a single impurity, both substitutionally and interstitially located, and the coupling between impurities. In the last section the general problem of a solid solution is discussed."

548.0 : 539.11 : 537.529 **879**

On the Theory of Electron Multiplication in Crystals.—F. Seitz. (*Phys. Rev.*, 1st Nov. 1949, Vol. 76, No. 9, pp. 1376–1393.) The non-polar coupling between electrons and lattice has an important effect on the retardation of electrons. This retardation is a maximum when the energy of the electron corresponds to the energy level near the boundary of the Brillouin zone. The retardation arising from purely polar interaction in polar crystals is a maximum when the energy is near that of the polar modes. Statistical fluctuations in the velocity of the electrons largely determine electron multiplication, and the value of the field producing breakdown in a standard specimen is no more than a fifth of that obtained from the criteria of von Hippel and Fröhlich.

621.3.011.4 : 513.466 **880**

Potential Problems and Capacitance for a Conductor Bounded by Two Intersecting Spheres.—C. Snow. (*Bur. Stand. J. Res.*, Oct. 1949, Vol. 43, No. 4, pp. 377–407.) Formal expressions, as series and integrals, are derived for the external potential, which takes on assigned values on the two spherical boundary surfaces, either when the body is alone or when it is in any given axially symmetric e.s. field. This is effected by representing a given function $f(x)$, for $1 < x < \infty$, as a complex integral whose variable is the parameter μ of a Legendre function $P_{\mu-\frac{1}{2}}(x)$ or $Q_{\mu-\frac{1}{2}}(x)$. The capacitance of the conductor is found as a series whose terms involve psi-functions. In case the two spheres intersect at an angle ω which is a rational function of 2π, the capacitance is given in finite terms involving complete elliptic integrals. The field or e.s. potential is given in finite terms when $\omega = n\pi/m$, where m is any positive integer, and $n = 1, 2, 3$ or 4. The cases $n = 3$, $n = 4$ involve elliptic functions. These would permit the exact computation in finite terms of the penetration of an external applied field into a cavity with any angular aperture.

53 **881**

The Physical Society Reports on Progress in Physics. Vol. 12 (1948-49). [Book Review]—Publishers: The Physical Society, London, 42s. (*Phil. Mag.*, Nov. 1949, Vol. 40, No. 310, p. 1178.) "The Physical Society has been remarkably successful in obtaining excellent articles on subjects of current interest from authors of eminence." A list of the articles, with authors, is given.

534.1 + 538.56 **882**

Einführung in die Lehre von den Schwingungen und Wellen. (Introduction to the Theory of Vibrations and Wave-Motion) [Book Review]—K. W. Wagner. Publishers: Dieterichsche Verlagsbuchhandlung, Wiesbaden, 1947, 640 pp., 34 DM. (*Arch. elekt. Übertragung*, Sept. 1949, Vol. 3, No. 6, pp. 230–231.) A second edition of the full course of lectures given by the author in the Technische Hochschule, Berlin. It is a book for the rising engineer and physicist, with a wealth of material for the teacher and professional man. Aspects dealt with are: forms of oscillation; dynamics of vibration; oscillations and waves in continuous systems; e.m. waves in the ionosphere; vibration systems; nonlinear systems. Examples of both mechanical and electrical oscillations are considered and the two types related. The book is considered by the reviewer to fill a former gap in the literature on the subject.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72 : 621.396.822 **883**

Solar Radio-Frequency Radiation of Thermal Origin.—J. L. Pawsey & D. E. Yabsley. (*Aust. J. sci. Res., Ser. A*, June 1949, Vol. 2, No. 2, pp. 198–213.) Numerous measurements of 'noise flux density' in the wavelength range from 1 cm to 4 m are examined. In addition to the occasional bursts, a relatively constant component, which has the characteristics of thermal radiation, is always found; its intensity increases uniformly with frequency from about 10^4 °K at 1.25 cm to about 10^6 °K at 1.5 m, in substantial agreement with Martyn's theory (2783 of 1948).

523.72 : 621.396.822 **884**

Bursts of Solar Radiation at Metre Wavelengths.—R. Payne-Scott. (*Aust. J. sci. Res., Ser. A*, June 1949, Vol. 2, No. 2, pp. 214–227.) The variable high-intensity radiation on 85, 65, 60, and 19 Mc/s was studied during part of 1948. Two types were observed: (*a*) circularly polarized long-duration radiation; (*b*) short unpolarized bursts. The bursts on 85 Mc/s arrive 0.7 sec before, and on 19 Mc/s 9 sec after the corresponding bursts on 60 Mc/s; they decay exponentially with a time constant of about 1.7 sec; double-humped bursts are common. Their characteristics agree with the hypothesis that they originate in the high corona, that the time constant depends on the collision frequency, and that the second hump is due to a reflection from the inner corona. The larger bursts are usually associated with solar flares.

523.72 : 621.396.822 **885**

The Noise-Like Character of Solar Radiation at Metre Wavelengths.—R. Payne-Scott. (*Aust. J. sci. Res., Ser. A*, June 1949, Vol. 2, No. 2, pp. 228–231.) Observations were made of the enhanced radiation on August 5 and 6, 1948. The output on 60 and 85 Mc/s of a receiver having a bandwidth of 1.5 Mc/s was fed into a biased diode detector whose current/bias curve was measured. No difference was observed in the amplitude distribution of solar and thermal noise. Solar radiation does not reach us as a series of discrete frequencies separated at intervals of more than 2 Mc/s.

523.72 : 621.396.822] : 538.566.2 **886**

The Wave Equations for Electromagnetic Radiation in an Ionized Medium in a Magnetic Field.—Westfold. (*See* 976.)

523.854 : 621.396.822 **887**

The Position and Probable Identification of the Source of Galactic Radio-Frequency Radiation Taurus-A.—J. G. Bolton & G. J. Stanley. (*Aust. J. sci. Res., Ser. A*, June 1949, Vol. 2, No. 2, pp. 139–148.) The source was discovered by an interference method (412 of 1948), using a frequency of 100 Mc/s. It has a width of less than 6′ and coincides with the Crab nebula—a former supernova.

551.510.535 **888**

Measurement of Height Distribution of Ionization in the Ionosphere.—G. Goubau. (*Arch. tech. Messen*, Nov. 1949, No. 166, pp. T99–T100.) Description of a method and apparatus used at Herzogstand for vertical-incidence measurements. Frequency ranges are 1–3 Mc/s and 3–9.5 Mc/s.

551.510.535 **889**

The Distribution of Ionization according to Height and the Recombination Coefficient of the Ionosphere F Layer.—A. A. Aynberg. (*Zh. eksp. teor. Fiz.*, June 1949, Vol. 19, No. 6, pp. 515–520. In Russian.) From experimental critical-frequency/height characteristics of the F layer the distribution of ionization n with height is determined. Two curves showing the daily variation of n at various heights from 230 to 350 km are plotted for July and November (Figs. 2a and 2b). A table is also given showing the day and night values of the recombination coefficient at various heights for the same two months. These values were calculated on the basis of the law of simple recombination. The results obtained in this paper are only approximate.

551.510.535 **890**

The Height of the F_2 Ionospheric Layer and the Relative Sunspot Number.—R. Eyfrig. (*Rev. sci., Paris*, Nov. 1948, Vol. 86, No. 3299, pp. 673–674.) The Huancayo monthly median values of the ratio of m.u.f. to critical frequency for the F_2 layer, for a reference distance of 3 000 km, are correlated with the corresponding Zurich mean values of the relative sunspot number for the period Jan. 1944 to April 1949. Both noon and midnight data are considered. The results show that the height of the F_2 layer increases during the increasing phase of the solar cycle and diminishes during the decreasing phase.

551.510.535 : 550.385 **891**

World Morphology of Ionospheric Storms.—E. V. Appleton & W. R. Piggott. (*Nature, Lond.*, 28th Jan. 1950, Vol. 165, No. 4187, pp. 130–131.) Superposed epoch analyses were made of noon f^0F_2 values during ionospheric storms. In temperate latitudes there is a marked rise in f^0F_2 for two days, followed by a sudden drop; recovery to normal takes several days. Near the equator, only the rise is found and this coincides with the drop at higher latitudes.

In temperate and high latitudes, sudden commencements are often accompanied by a rapid fall in f^0F_2 followed by a rise; this is often missed because it seldom lasts more than half an hour. Ionospheric storms are usually confined to a limited longitude range and are not equally developed in the north and south hemispheres.

551.510.535 : 621.3.087.4 **892**

Ionospheric Sounding Experiments in Germany.—W. Dieminger. (*Research, Lond.*, Dec. 1949, Vol. 2, No. 12, pp. 571–576.) A survey of recent experiments using high-power pulse transmitters (15–150 kW). The transmitters use master-oscillator and power-amplifier valves whose anodes are pulsed by a charged-line triggered-thyratron modulator. A variable-frequency sounder uses a servo motor to keep the transmitter in step with the receiver. For oblique-incidence work, transmitter pulse frequency and receiver timebase are controlled by crystal clocks to keep them in synchronism.

Experiments on the echoes scattered back to the transmitters via the E or the F regions and ground irregularities, and observations of the screening effect of the E region in oblique incidence transmission, preventing single-hop transmission via the F layer while permitting double-hop transmission, are described.

551.594.6 **893**

Study of the Wave-Forms of Atmospherics.—S. R. Khastgir & R. Roy. (*Phil. Mag.*, Nov. 1949, Vol. 40, No. 310, pp. 1129–1143.) Variations in the field strength of atmospherics were amplified in a wide-band amplifier (100–10 000 c/s) and applied to a c.r.o. with a linear timebase of duration normally between 1 and 10 ms. Drawings of the traces were made by hand. The waveforms were divided into eight types and their frequencies of occurrence determined. The main characteristics of these types are tabulated and discussed in relation to the physical properties of the lightning discharge.

LOCATION AND AIDS TO NAVIGATION

621.396.9 **894**

Surveillance Radar System at the Port of Le Havre.—R. Pélicant. (*Électronique, Paris*, Dec. 1949, No. 38, pp. 8–12.) A description of the shore-based installation which scans an area of 50-km radius around the port. The horizontal spreading of the beam precludes its use for precise navigation but it is in continual use at times of bad visibility for locating vessels and obstacles. Peak power is 180 kW; wavelength 10 cm; pulse duration 2μs with 1 000 pulses per sec; aerial height 45 m; angle of spread 3°; 4 different rotation speeds, the fastest being 10 r.p.m.

621.396.93 **895**

A Voltage Discriminator; its Application to Direction Discrimination.—J. Loeb, M. Jezo & C. Lombard. (*Ann. Télécommun.*, Feb. 1949, Vol. 4, No. 2, pp. 57–63.) A description of the principles, construction and performance of a v.h.f. d.f. device which has an angular sensitivity of 10^{-4} radian. The apparatus is basically a goniometer which compares two low-level h.f. voltages and gives a signal which actuates a motor in a direction determined by the sense of the input voltage. Signal-voltage difference sensitivity is of the order of 1 μV.

621.396.933 **896**

Crystal Control at 1 000 Megacycles for Aerial Navigation.—S. H. Dodington. (*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 272–278.) 1949 I.R.E. National Convention paper. A description of distance-measuring equipment, using the ground-beacon interrogation system, which is suitable for multiplex operation. Fifty-one 2-way channels are provided with a spacing of 2.4 Mc/s. Adjacent channel rejection is better than 70 db, while image rejection and all spurious responses within the distance-measuring band are at least 60 db down in both air and ground equipments. The ranging circuits provide an indication of distance up to 115 nautical miles; accuracy is within 0.2 mile.

629.13.052 : 621.396.933 **897**

Aircraft Radio Altimeters.—B. A. Sharpe. (*J. Inst. Nav.*, Jan. 1950, Vol. 3, No. 1, pp. 79–89.) A description of altimeters using (*a*) pulse radar systems, (*b*) f.m. of a c.w. carrier. Accuracy and sources of error are discussed. It is necessary to use both systems in order to cover the range 0–50 000 ft.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **898**

Symposium on High Vacuum.—(*Industr. Engng Chem.*, May 1948, Vol. 40, No. 5, pp. 778–847 & 938–941.) Papers presented at a symposium arranged by the National Research Corporation and the American Chemical Society, Cambridge, Mass., 30th & 31st Oct. 1947. These include :—

- Development of High-Vacuum Technique.—S. Dushman.
- Design of High-Vacuum Engineered Plants.—H. C. Weingartner.
- Design of High-Vacuum Systems.—C. E. Normand.
- New Techniques in the Measurement of Pressures below 10 mm.—G. L. Mellen.
- Measurement and Control of Leakage in High-Vacuum Systems.—R. B. Jacobs.
- Measurement and Comparison of Pumping Speeds.—B. B. Dayton.
- Surface Phenomena useful in Vacuum Technique.—L. Apker.
- Eight papers on practical industrial applications of vacuum technique are also included.

535.312 : 546.212 : 621.396.11 **899**

Measurements of the Reflection Coefficient of Water at a Wavelength of 8.7 mm.—D. G. Kiely. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361B, pp. 46–48.) An account is given of measurements (carried out in March 1947) of the reflection coefficient of water at a wavelength of 8.7 mm over a range of angles of incidence. The method employed is to measure the relative field strengths of the direct waves and waves reflected from a trough of water, using free-space propagation and high-gain aerials. The following electrical constants of water have been computed from the measured results (water temperature 11.1°C): refractive index 4.40 ± 0.24, dielectric constant 10.86 ± 2.21, absorption coefficient 2.91 ± 0.06, conductivity/frequency 12.82 ± 0.42, Brewster angle 79°.

535.312 : 546.212-16 : 621.396.11 **900**

Reflection Coefficient of Snow and Ice at V.H.F.—J. A. Saxton. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, pp. 17–25.) A general formula is given for the reflection coefficient of plane waves incident on a layer of ice or snow on the earth's surface, taking account of the multiple reflections within the layer. The reflection coefficients of ice on sea water and of snow on land are calculated for frequencies of 300 and 3 000 Mc/s, for three angles of incidence, both for vertically and for horizontally polarized waves. The presence of such layers may materially affect the reflection coefficient and hence the vertical-coverage diagram of a v.h.f. transmitter.

537.228.1 : 546.431.82 **901**

The Piezoelectric Effect in Barium Titanate.—A. V. Rzhanov. (*Zh. eksp. teor. Fiz.*, June 1949, Vol. 19, No. 6, pp. 502–506. In Russian.) Experiments were conducted with polycrystalline samples of barium titanate and the piezo-effect was investigated under static conditions when pressure was applied to the sample, and also under dynamic conditions when longitudinal vibrations were excited. A number of experimental curves are plotted and the values are determined of the piezo-moduli corresponding to the application of the force in the direction of polarization and at right angles to it. The material is quite suitable for use in piezoelectric transducers.

538.22 **902**

On the Variation of Thermo-Remanent and Isothermally Remanent Magnetization of Fired Earths as a Function of the Applied Field.—J. Roquet. (*C. R. Acad. Sci., Paris*, 28th Nov. 1949, Vol. 229, No. 22, pp. 1135–1137.)

538.221 **903**

Magnetic Properties of Nickel-Cobalt and Related Alloys.—E. P. Wohlfarth. (*Phil. Mag.*, Nov. 1949, Vol. 40, No. 310, pp. 1095–1111.)

538.221 **904**

Investigation of the Magnetic After-Effect in Commercial Silicon- and Nickel-Iron Laminations.—H. Wilde. (*Frequenz*, Nov. & Dec. 1949, Vol. 3, Nos. 11 & 12, pp. 309–319 & 348–353.)

538.221 **905**

Some Ferromagnetic Properties of Mixed Ferrites of Nickel and Zinc.—C. Guillaud & M. Roux. (*C. R. Acad. Sci., Paris*, 28th Nov. 1949, Vol. 229, No. 22, pp. 1133–1135.)

538.221 **906**

Macroscopic Magnetic Texture of Permalloy Tape.—I. Épelboïm & A. Marais. (*C. R. Acad. Sci., Paris*, 28th Nov. 1949, Vol. 229, No. 22, pp. 1131–1133.)

538.221 : 061.3 **907**

Ferro-Magnetic Materials.—(*Elect. Times*, 10th Nov. 1949, Vol. 116, No. 3027, pp. 655–660.) A complete list of titles and authors of 20 papers read at a recent I.E.E. symposium, with brief summaries of 10 of these papers.

538.221 : 621.318.22 **908**

Structure and Properties of the Permanent-Magnet Alloys.—A. H. Geisler. (*Elect. Engng, N.Y.*, Jan. 1950, Vol. 69, No. 1, pp. 37–44.) Essentially the full text of a paper presented at the symposium on magnetics at the 1949 A.I.E.E. Winter Meeting, New York. The reactions during the formation of such alloys, and their properties during and after formation, are described.

621.315.59 **909**

The Mechanism of Electrical Conduction in Semi-conductors, and their Technical Application.—K. Grosskurth. (*Fernmeldtech. Z.*, Jan. 1950, Vol. 3, No. 1, pp. 22–27.)

621.315.59 **910**

The Electrical Conductivity of Simple Semiconductors.—W. Ehrenberg. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361A, pp. 75–76.) By combining an approximate expression for $f_{\frac{1}{2}}$ of the Busch-Labhart type (1820 of 1947) with Shifrin's results (2218 of 1946), an analytical expression for the conductivity of semiconductors valid for all temperatures becomes available, as well as a simple procedure for determining the constants. The expression is derived under certain limiting assumptions.

621.315.612.4 **911**

Alkaline-Earth Titanates as Dielectrics and a New Group of Piezoelectric Materials.—W. M. H. Schulze. (*Elektrotechnik, Berlin*, Dec. 1949, Vol. 3, No. 12, pp. 365–372.) A detailed discussion of the physical and electrical properties of these ceramics, with explanatory theory.

621.318.33 **912**

A Simply-Constructed Small Electromagnet of High Performance.—R. P. Hudson. (*J. sci. Instrum.*, Dec. 1949, Vol. 26, No. 12, pp. 401–404.) A Weiss-type electromagnet is described which will produce fields of 20 kilogauss in a pole gap of width 3 to 5 cm. The coils, designed to dissipate 100 kW, are layer wound with enamelled copper strip and encased in insulating material. Cooling is provided by circulating distilled water through a heat exchanger which is cooled by mains water. The coil cases are made watertight by means of rubber gaskets and can be dismantled easily for inspection.

668.3 : 621.396.611.21 **913**

Uses of a New Adhesive in Production of Piezoelectric Vibrators.—J.E.T. (*P.O. elect. Engrs' J.*, Jan. 1950, Vol. 42, Part 4, pp. 187–188.) An account of various applications of a thermosetting adhesive, Araldite, in the production of crystal vibrators. Araldite makes very strong joints between glass, ceramic and metal surfaces when cured at 160–240°C. It has been used (*a*) for attaching thin wires to crystal plates to act as supports and connections to electrodes, and (*b*) for cementing abrasive powders to the rim of disks used for cutting crystal slices. See also 3450 of 1949.

MATHEMATICS

517.63 + 517.432.1] : 621.3.015.3 **914**

The Laplace Transformation and the Study of Transient Phenomena.—S. Colombo. (*Ann. Télécommun.*, June & July 1949, Vol. 4, Nos. 6 & 7, pp. 210–222 & 233–249. Errata, Nos. 8/9, p. 306 & p. 328. Appendices, No. 10, pp. 358–362.) The first part of this article is concerned with generalities relating to functional analysis and to the mathematical study of transient electrical phenomena. Part 2 discusses the operational methods of Heaviside and the Bromwich-Wagner integral. In part 3 the theories of the symbolic calculus are outlined and their application to various problems of wave propagation is considered. The methods of the symbolic calculus are applied to the solution of integral equations and to the determination of certain asymptotic developments which occur in the mathematical treatment of transients in electrical circuits.

517.93 : 621.396.611.1 **915**

Harmonic and Subharmonic Response for the Duffing Equation.—Levenson. (*See* 847.)

681.142 **916**

Mathematical Machines.—H. M. Davis. (*Sci. Amer.*, April 1949, Vol. 180, No. 4, pp. 28–39.) A general discussion of the historical development of calculation machines, with some speculations about future developments.

681.142 **917**

The EDSAC — An Electronic Calculating Machine.—M. V. Wilkes & W. Renwick. (*J. sci. Instrum.*, Dec. 1949, Vol. 26, No. 12, pp. 385–391.) A large-scale electronic calculator which works in the binary system and uses ultrasonic delay units for the storage of orders and numbers. Punched tape is used for the input and a teleprinter for the output. The functions of the various units are described and the means by which orders are taken one by one from the store and executed are explained. See also 3448 of 1948; 1425, 2823 and 3458 of 1949.

681.142 **918**

Nonlinear Functions in an Analog Computer.—G. D. McCann, C. H. Wilts & B. N. Locanthi. (*Elect. Engng, N.Y.*, Jan. 1950, Vol. 69, No. 1, p. 26.) Summary of a paper presented at the 1949 A.I.E.E. Summer Meeting on 'Application of the California Institute of Technology Computer to Nonlinear Mechanics and Servomechanisms'. Two basic types of device have been developed for use with the computer. These are (*a*) resistance-switching Ge-diode circuits; (*b*) a c.r. tube/template/photocell servo system. Both devices can be used to represent general nonlinear impedances or amplification factors. Their application in different analyses is described. See also 3176 of 1949.

681.142 : 621-526 **919**

Electronics and Experimental Mathematics.—F. H. Raymond. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 30–44.) The basic principles of mathematical machines of the algebraic (analogue) and arithmetical types are briefly discussed. A general theory of linear servomechanisms with many variables is presented, their accuracy and stability are assessed and their application in the analogue type of computer is considered. The construction of computers of the type OME (Opérateur Mathématique Électronique), made by the Société d'Électronique et d'Automatisme, is based on servomechanism theory. These computers are designed for obtaining integro-differential equation solutions which satisfy either the conditions of Cauchy or given initial conditions. Nonlinear equations can be solved. The functional characteristics of the OME are described and its stability conditions are analysed.

517.53 : 621.392 **920**

Applications Physiques de la Transformation de Laplace. [Book Review]—M. Parodi. Publishers: Centre National de la Recherche Scientifique, Paris, 1948, 174 pp. (*Ann. Télécommun.*, March 1949, Vol. 4, No. 3, p. 104.) The first of a series of monographs on mathematical processes undertaken by the Centre of Mathematical Studies. It presents in condensed form the principal practical aspects of the Laplace transformation.

MEASUREMENTS AND TEST GEAR

531.76 **921**

Electrostatic Short-Time Measurement.—W. Schaaffs. (*Frequenz*, Oct. 1949, Vol. 3, No. 10, pp. 295–299.) Description of several simple capacitor methods for the measurement of times down to 0.5 ms.

531.764.5 : 621.396.91 **922**

On the Monitoring of the Rate of Quartz Clocks by means of Time Signals.—F. Conrad. (*Frequenz*, Sept. 1949, Vol. 3, No. 9, pp. 270–273.) Discussion of accuracy attainable. An example is given of records, for the month of September 1948, of time signals from Rugby (GBR) and Washington (WWV); the two curves are essentially parallel.

531.765 **923**

Millisecond Measurements in Research.—D. W. Gillings. (*Instrum. Practice*, May & June 1949, Vol. 3, Nos. 7 & 8, pp. 277–287 & 333–341.) A comparative survey of four basic types of millisecond chronograph is given, with details of the construction and performance of particular instruments. The recording units usually consist either of a moving-film camera which photographs the trace given by an ordinary oscillograph, or of a static camera in combination with an oscillograph giving a spiral trace. One non-recording type measures the potential of a standard capacitor charged at a known constant current during the time interval to be measured. Another uses an electronic counter to count the oscillations of a fixed-frequency oscillator during the required interval, and is particularly suitable for making routine measurements 'by the thousand'.

534.1 : 621.317.333.4 : 621.394/.396].6 **924**

Fault Location in Transmission Equipment by Vibration Testing and Continuous Monitoring.—H. G. Myers. (*P.O. elect. Engrs' J.*, Jan. 1950, Vol. 42, Part 4, pp. 189–197.) The various types of fault in both transmitting and receiving equipment that can be readily discovered by means of suitable mechanical-vibration tests are discussed. Vibration test methods and apparatus are described and also continuous-monitoring methods which provide invaluable help to the maintenance engineer in solving recurrent-fault problems.

538.71 **925**

Three-Component Magnetometer.—J. W. Seaton. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 165–171.) A small saturable reactor is used for each component of the field. Each reactor is operated at 800 c/s, the magnitude and sense of the component being derived from observations of the amplitude and phase of the resulting 1 600 c/s voltage developed in the winding. A null method is used in which the steady magnetic component under observation is balanced out by the field derived from a coil carrying d.c. Accuracy of measurement is within ±0.1 milligauss.

621.3.011.3(083.74) : 621.3.016.35 **926**

The Stability of Inductance Standards.—G. H. Rayner & L. H. Ford. (*J. sci. Instrum.*, Jan. 1950, Vol. 27, No. 1, pp. 19–21.) Information acquired at the National Physical Laboratory since 1917 is reviewed. A brief description is given of the present working standard of mutual inductance, an oil-immersed type with a range of −1 μH to 11 000 μH, whose value has remained constant to within ±2 parts in 10^5 during the past twelve years. This instrument, when used in a bridge, makes possible the certain detection of changes of 2 parts in 10^5 in the values of inductance or capacitance. The stability with time of substandard self-inductance and fixed mutual-inductance coils of various types is also discussed.

621.317.3 : 550.371 **927**

Apparatus for Measuring the Intensity of an Electric Field and its Applications.—I. M. Imyanitov. (*Zh. tekh. Fiz.*, Sept. 1949, Vol. 19, No. 9, pp. 1020–1031. In Russian.) Many papers have been published during the last two decades, describing various types of apparatus all utilizing the principle of the e.s. generator but designed to measure different electrical quantities such as current, voltage, charge, field strength etc. An attempt is made to generalize the theory of such apparatus, and a report is given together with a theoretical discussion of experiments with universal apparatus built by the author, in which an e.s. generator is used. The sensitivity of this apparatus is 0.01 V/cm per scale division, the area of the measuring plate 225 cm^2 and the minimum input impedance 15 MΩ. Various possible applications are discussed.

621.317.3 : 621.396.82 **928**

Electrical Noise. Experimental Correlation between Aural and Objective Parameters.—Maurice, Newell & Spencer. (*See* 989.)

621.317.3 : 621.396.822 **929**

A Broad-Band Microwave Noise Source.—W. W. Mumford. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 608–618.) The theory of measurement of receiver noise figure is discussed: an ordinary resistive noise source is unsuitable for accurate microwave measurements because it cannot be raised to a sufficiently high temperature. An alternative source is an electrical gas discharge, and investigation shows that a commercial fluorescent lamp is satisfactory. At 4 000 Mc/s its effective temperature is about 11 000 K, which is convenient for measuring noise figures of 20 db or less. The noise power is practically independent of the fluorescent coating and the current density, and is only slightly affected by the room temperature. The lamp lends itself readily to broad-band impedance matching in a waveguide.

621.317.3 : 621.396.822 : 621.396.645 **930**

Study of Some Experimental Methods used for Measurement of Noise of Centimetre-Wave Amplifiers.—M. Denis. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 27–35.) Noise factor and signal/noise ratio are defined. The measurement system considered comprises a crystal mixer to superimpose u.h.f. on a local oscillator signal of several Mc/s, an amplifier with a relatively very narrow bandwidth at this latter frequency, and a quadratic detector (crystal or thermocouple). The effect of amplifier and detector on the value found for the noise factor is discussed. The amplifier and mixer circuits are described. The measurement of signal/noise ratio where the output signal is large is then considered. The method consists of converting the noise frequency to one at which comparison can be made with a saturated diode. The methods used apply specially to measurements on travelling-wave valves; a report on experimental results will be published later.

621.317.3.029.64 **931**

Dynamical Measurement of Q-Factors and Natural Frequencies of Cavity Resonators with a Single Coupling Element.—M. Denis & S. Couybes. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 54–61.) A theoretical analysis and a description of the measurement equipment used. A reflex klystron source has a 16-db attenuator in an extension of the output line. Such an arrangement acts as if a source of e.m.f. were located at the output end of the attenuator. A detector loosely coupled to the attenuator input follows the power variations as a function of frequency. A transformer section couples the artificial source to the resonator. In this section is a second quadratic detector. Measurements are made by comparison of the two detector outputs on an oscillograph screen. The method is especially useful for measuring high-Q circuits and affords a quick means of obtaining the characteristics of a rhumbatron loaded by an electron beam, under varying circuit conditions. See also 1076 of 1948.

621.317.331 **932**

An Absolute Measurement of Resistance by the Wenner Method.—J. L. Thomas, C. Peterson, I. L. Cooter & F. R. Kotter. (*Bur. Stand. J. Res.*, Oct. 1949, Vol. 43, No. 4, pp. 291–353.) A full report of the apparatus and method developed for the measurement of resistance in terms of length, time, and the permeability of free space. A mutual inductor was constructed and its inductance determined from its dimensions to within a few parts in a million. Using Wenner's commutated d.c. method, the value found for the unit now maintained at the Bureau was 0.999 994 absolute ohm.

621.317.336 + 621.396.67 **933**

Antennas and Open-Wire Lines: Part 3 — Image-Line Measurements.—Conley. (*See* 810.)

621.317.336 **934**

Methods for measuring Impedances of Circuits shunted with a Negative Resistance.—Kh. I. Cherne. (*Radiotekhnika, Moscow*, Sept./Oct. 1949, Vol. 4, No. 5, pp. 63–70. In Russian.)

621.317.336 : 621.315.6.029.6 **935**

Abac of the Function tanhz/z for the study of Dielectrics at U.H.F.—J. Benoit. (*Ann. Télécommun.*, Jan. 1949, Vol. 4, No. 1, pp. 27–32.) This function of the complex number $z = u + j.2\pi w$ occurs in measurements of the impedance of a section of dielectric inserted at the end of a short-circuited line. The method of construction of the abac, which relates measured impedance with dielectric characteristics ϵ' and ϵ'', is described and geometric properties are established which greatly simplify the plotting of the curves for u = C and w = C.

621.317.35 **936**

Frequency Analyser with Rapid Automatic Scanning.—L. Pimonov. (*Ann. Télécommun.*, July 1949, Vol. 4, No. 7, pp. 257–272.) The principal automatic analysis systems are reviewed. The principle of sound analysis by the heterodyne method is illustrated by a detailed description of an analyser comprising (*a*) input amplifier, (*b*) triode-hexode phase converter, (*c*) compensated modulator, (*d*) high-Q oscillator, (*e*) quartz filter, (*f*) measuring device. The relation of speed of analysis to selectivity is considered and the analysis of ultrasonic frequencies is discussed. Different applications of the analyser are considered and records of different sound spectra are reproduced.

621.317.7 : 621.396.813 **937**

Study and Construction of a Distortion Meter.—F. Haas. (*Toute la Radio*, Feb. 1950, Vol. 17, No. 143, pp. 87–91.) A band-stop filter is interposed between an amplifier and a valve voltmeter to cut out the fundamental frequency. The filter consists of a resonance bridge between two attenuators. Measurement is made either on the valve voltmeter or on an oscillograph. Full circuit details, with component values, are given.

621.317.723 : 621.317.733 **938**

The Electrometer as Bridge [balance] Indicator.—T. Gast. (*Frequenz*, Sept. 1949, Vol. 3, No. 9, pp. 264–270.) Detailed discussion of the use of e.s. instruments as null indicators. Advantages are that they take no power, are practically independent of frequency and can be readily adapted for remote indication or for use in self-balancing bridges.

621.317.725.024.2 **939**

A Single-Pulse Voltmeter.—G. T. Rado, M. H. Johnson & M. Maloof. (*Rev. sci. Instrum.*, Dec. 1949, Vol. 20, No. 12, pp. 927–929.) The instrument consists of a gated cathode-follower bridge in conjunction with a ballistic indicator. It measures the average amplitude of a single pulse over an arbitrarily selected interval of 2 ms, with a random error of 0.2% of full-scale deflection.

621.317.73 **940**

Impedance Measurements with Directional Couplers and Supplementary Voltage Probe.—B. Parzen. (*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 338–343.) Reprint. See 155 of January.

621.317.733 **941**

A New Design of Wheatstone Bridge.—W. L. Surman. (*P.O. elect. Engrs' J.*, Jan. 1950, Vol. 42, Part 4, pp. 209–212.) Some disadvantages of the Post-Office-box type of bridge have been eliminated in the No. 2 bridge, which is self contained, measures resistances from 1 to 9 990 Ω and has an accuracy of ±0.5 to ±1%. A commercial version, No. 3, has P.O. box accuracy of ±0.2%. Four decade resistor combinations are included in the comparison arm; operation of the range switch gives a visual indication of the position of the decimal point.

621.317.733 **942**

New Bridge Technique.—T. Roddam. (*Wireless World*, Jan. 1950, Vol. 56, No. 1, pp. 8–10.) Comment on 2271 of 1949 (Yates). Square-wave excitation, instead of sine-wave, can be used for measuring complex impedances, the bridge output being applied to a c.r.o. The waveform obtained gives an indication of the type of impedance being measured and so facilitates balancing.

621.317.733 **943**

The Impedance Bridge (No. 2135) constructed by the S.A.C.M. [Société Alsacienne de Constructions Mécaniques] **for the Service of L.S.G.D.** [Lignes Souterraines à Grande Distance].—G. Chardon & R. Blondé. (*Câbles & Transmission, Paris*, Jan. 1950, Vol. 4, No. 1, pp. 58–65.) The construction of this portable bridge is described and performance figures are given. Its chief features are a series arrangement of resistance and capacitance standards for the measurement of impedance, and plug-in resistor and capacitor units for measurement of zero and positive reactance. A similar system converts the instrument for measuring admittance unbalance. Precision measurements can be made up to 10 000 Ω between 200 c/s and 10 kc/s and up to 400 Ω at 300 kc/s.

621.317.733 **944**

Capacitance Bridge with Mechanical Rectifier and Mirror Galvanometer. Elimination of Errors due to Harmonics.—F. Koppelmann. (*Frequenz*, Sept. 1949, Vol. 3, No. 9, pp. 259–264.) An account of improvements of the bridge previously described (3181 of 1948) and investigation of sources of error. Adjustment of the timing of the rectifier contacts enables different harmonics of the supply to be cut out. See also 1429 and 3464 of 1949.

621.317.763 : 621.392.26† **945**

Interferometer for Hertzian Microwaves.—T. Kahan. (*J. Phys. Radium*, June 1947, Vol. 8, No. 6, p. 192.) Description of apparatus used to measure wavelengths in the 3-cm band. Two sections of rectangular waveguide (30 × 10 mm) are soldered together in the form of a cross to make the four arms of the instrument. The ends, A and B, of two opposite arms are fitted with horns to concentrate the linearly polarized beams. The klystron generator output is fed into A. A thin trolitul plate fitted with parallel strands of wire is fixed inside the waveguides diagonally across the junction of the four arms. This performs the same function as the semi-transparent plate in Michelson's interferometer. By means of an adjustable reflector R_1 facing the end B and a fixed, grid-type reflector R_2 at the end of the third arm, the two reflected waves are superimposed in the fourth arm, which is terminated with a piston wave trap. Here a crystal detector, which is coupled to an oscilloscope, can be adjusted in position along a fine longitudinal slot. By modulating the generator input at 1 000 c/s and controlling the wave-train by adjustment of R_1, the wavelength may be measured on the oscilloscope. The reflection coefficient of the disk R_2 and terminal impedance may also be measured.

621.396.615 **946**

The New General-Radio Generator 1001-A.—A. G. Bousquet. (*Toute la Radio*, Feb. 1950, Vol. 17, No. 143, pp. 93–96.) A detailed description of the construction and performance of an instrument which replaces the former standard model No. 605. It covers from 5 kc/s to 50 Mc/s in 8 ranges. The output may be modulated in amplitude up to 80% either by an external source with a frequency range from 20 c/s to 15 kc/s, or by a 400-c/s internal source. Output jacks provide (*a*) a voltage continuously variable between 0.05 μV and 200 mV or (*b*) a fixed voltage of 2 V. A complete circuit diagram giving all component values is shown.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

536.5 : 621.396.822 **947**

An Absolute Noise Thermometer for High Temperatures and High Pressures.—J. B. Garrison & A. W. Lawson. (*Rev. sci. Instrum.*, Nov. 1949, Vol. 20, No. 11, pp. 785–794.) A null device for determining the ratio of two absolute temperatures by balancing the thermal noise voltages developed across two resistors at the relevant temperatures. Temperatures up to 1 200°K have been measured with an accuracy of 0.1%, with an observation time of 2 minutes. Calibration of the thermometer elements is independent of the chemical composition and past physical history of the resistance material used and of the absolute pressure.

539.16.08 **948**

Dead Times of Self-Quenching Counters.—B. Collinge. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361B, pp. 15–24.)

551.508.11 : 621.396.91 **949**

The Swiss Radiosonde.—J. Lugeon, P. Ackermann & M. Bohnenblust. (*Annales de la Station centrale suisse de Météorologie*, 1948, 17 pp. In French. Reprint.) Illustrated description of the different components and discussion of their operation. The bimetallic-spiral thermometer, aneroid barometer and goldbeaters'-skin hygrometer are mechanically coupled to pointers carrying at their ends small capacitor plates whose location is scanned by a similar plate carried on a clockwork-driven arm rotating once every 30 sec. This arrangement is used for f.m. of a small 100-Mc/s transmitter. The equipment used for receiving and recording the transmitted signals is also described.

551.508.5 : 621.317.755 **950**

Acoustic Anemometer-Anemoscope.—R. E. Corby. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 88–90.) An instrument giving an instantaneous display of wind direction and velocity on a c.r.o. screen. 60-c/s pulses from an acoustic transmitter are received by transducers equidistant from the transmitter in the four cardinal directions. A discriminator analyses the Doppler effect of the wind on the time of arrival of the signals at the four receivers, and actuates an indicator. Wind speed is given by the length of the radial trace on the c.r.o. screen.

621.318.572 : 531.77 **951**

Precision Measurement of Rotary Motion.—H. J. Finden. (*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, pp. 2–8.) The measurement is carried out by obtaining a pulsed signal whose pulse repetition rate is directly proportional to rotation speed, and then electronically counting the number of pulses per second, the time scale being derived from a reference standard. Circuits of frequency dividers, gate relays, amplifiers and counters are given for equipment designed to give visual indication of r.p.m. for speeds varying from 500 to 20 000 r.p.m. A counter sufficiently light and compact for flight test work can be constructed to read to the nearest 10 r.p.m. over a range of 4 000–20 000 r.p.m.

621.365.54† : 621.314.57 **952**

A New Method for Converting D.C. Energy into High-Frequency A.C. Energy with a High Efficiency, specially intended for High-Frequency Induction Heating.—T. Douma. (*Commun. News*, June & Oct. 1949, Vol. 10, Nos. 2 & 3, pp. 52–68 & 69–82.) The method consists essentially in charging the capacitor of a resonant circuit from a d.c. source through a special type of Hg-vapour valve. During a controllable period following the charging process, an oscillatory discharge can take place through a load coil. The experimental Hg-discharge tubes are semicircular in form, with ends shaped like large flat dishes to accommodate the pools of Hg used for anode and cathode. A capacitive igniter projects through the cathode pool and positive h.v. pulses are applied to it in order to render the valve conducting. Detailed mathematical theory of the operation of such a device is given. An efficiency of 90% is possible at frequencies up to about 10 kc/s. Operational difficulties are briefly discussed. An output of 10 kW (4 A at 2 500 V) has been reached with a relatively small valve, but after 60 hours operation at this loading, operation became unsatisfactory. With a larger valve and better cooling arrangements, an output of 40 kW has been obtained for 30 hours, an output of 80 kW being reached occasionally. Valves or combinations of valves are aimed at which can handle continuously an output of 100 to 300 kW.

621.365.54† : 621.785.6 **953**

Automatic Induction Hardening speeds Dodge Output.—C. H. Wick. (*Machinery, N.Y.*, Nov. 1949, Vol. 56, No. 3, pp. 194–198.) Applications of induction heating in selective surface hardening of countershaft cams, resulting in faster heating and reduced distortion and scaling.

621.365.55† **954**

The Physical Principles of Electrical Dielectric Heating of Nonconducting Materials.—F. Walter. (*Frequenz*, Oct. 1949, Vol. 3, No. 10, pp. 299–306.)

621.38 **955**

Papers Summarized for Conference on Electronic Instrumentation.—(*Elect. Engng, N.Y.*, Jan. 1950, Vol. 69, No. 1, pp. 68–71.) Authors' summaries of the following papers presented at the joint A.I.E.E. and I.R.E. Conference on Electronic Instrumentation in Nucleonics and Medicine, New York, 1949:

- Low-Frequency Spectrography: Some Applications in Physiological Research.—R. R. Riesz.
- Electrical Methods of Blood-Pressure Recording.—F. Noble.
- A Stable D.C. Amplifier for Biological Recording.—H. Grundfest.
- A 25-Channel Recorder for Mapping the Electric Potential Gradients of the Cerebral Cortex: Electro-iconograms.—J. C. Lilly.
- Medical Application of Ionizing Radiations.—E. H. Quimby.

An Automatic Isodose Recorder.—G. J. Hine.
The Measurement of Low-Energy Beta Ray Emitters: Ionization Chamber Techniques.—N. A. Bailey.
Proportional Counters for the Measurement of Soft Radiation.—C. J. Borkowski.
Small Geiger Counters for Biological Applications.—C. V. Robinson.
Phosphors for Scintillation Counters.—R. H. Gillette.
Solids for Radiation Detection.—R. M. Lichtenstein.
Some Design Features of Electrical Counting Systems.—N. F. Moody.
Desirable Improvements in Nucleonics Instrumentation.—J. B. H. Kuper.
Criteria in the Selection of Radioisotopes for Industrial Use.—F. T. Clarke.

621.38.001.8 **956**

Electronic Instruments in Research and Industry.—(*Nature, Lond.*, 4th Feb. 1950, Vol. 165, No. 4188, pp. 181–182.) Report of the second symposium arranged by the Electronics Group of the Scientific Instrument Manufacturers' Association, London, November 1949, with short summaries of the papers presented. See also 957 below.

621.38.001.8 **957**

Electronic Equipment.—(*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, pp. 34–35.) Descriptions of a selection of equipment exhibited at the Scientific Instrument Manufacturers' Association Symposium, London, November, 1949.

621.38.001.8 : 621.791.7 **958**

Some Particular Applications of Electronic Circuits to the Control of Resistance-Welding Machines.—E. Thirion. (*Bull. Soc. franç. Élect.*, Jan. 1950, Vol. 10, No. 100, pp. 47–53.) A review of some recent developments in precision welding technique.

621.383 : 621.365.54† : 621.791.052 **959**

Phototube Controls R.F. Welding.—H. H. Wittenberg. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 91–93.) Precise automatic control of the welding of small parts is provided by photocell equipment operated by the radiation from the glowing weld. The generator is switched off half a second after the welding metal flows.

621.384.611.2† **960**

On the Capture of Particles into Synchrotron Orbits.—T. R. Kaiser. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361A, pp. 52–66.) Theory is given for the case in which the r.f. accelerating voltage rises from zero to its maximum value in a finite time. If this time is long enough, all particles originally within a band of width $1/\sqrt{2}$ times the maximum width of the final stable region for synchrotron phase oscillations will be captured, irrespective of the initial phase at which they enter the accelerating gap. This conclusion appears to be in agreement with the observed characteristics of existing electron synchrotrons.

621.384.611.2† **961**

Experiments on Electron Capture and Phase Stability in a 14-MeV Synchrotron.—T. R. Kaiser & J. L. Tuck. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361A, pp. 67–74.) Observations were made of the effects on output of interrupting the r.f. accelerating voltage for definite intervals during the acceleration process. Capture is more efficient than expected and for short interruption periods the particle loss is negligible. The results are in quantitative agreement with Kaiser's theory (960 above).

621.384.612.† **962**

Operation of the 184-in. Cyclotron.—L. R. Henrich, D. C. Sewell & J. Vale. (*Rev. sci. Instrum.*, Dec. 1949, Vol. 20, No. 12, pp. 887–898.) The operation is reviewed in terms of the theory developed by Bohm & Foldy (1542 of 1947 and 793 of 1948). Certain relevant data on the properties of the magnet and rotating capacitor are presented.

621.385.38.001.8 **963**

Examples of the Industrial Application of Gas-Filled Valves.—R. Kretzmann. (*Z. Ver. dtsch. Ing.*, 15th Sept. 1949, Vol. 91, No. 18, pp. 457–462.) Specific applications of thyratrons and relay valves for control purposes. An extensive bibliography is given.

621.385.833 **964**

An Electron Gun for an Electron Microscope.—V. N. Vertsner. (*C. R. Acad. Sci. U.R.S.S.*, 11th Aug. 1947, Vol. 57, No. 5, pp. 459–461. In Russian.) Description of a gun developed at the State Optical Institute. The main feature of the gun is that the filament can be accurately displaced, horizontally as well as vertically, with respect to the diaphragm aperture while the microscope is in use.

621.385.833 **965**

Electron Optics of the Three-Stage Electron Microscope.—C. E. Challice. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361B, pp. 59–61.) Calculations by Gaussian optical methods, with ray diagrams deduced from the tabulated numerical results.

621.385.833 **966**

An Improved Method of Numerical Ray Tracing through Electron Lenses.—G. Liebmann. (*Proc. phys. Soc.*, 1st Dec. 1949. Vol. 62, No. 360B, pp. 753–772.) The general ray equation is integrated with the help of Taylor's series, including terms up to those of the fourth order. The method is first developed for combined e.s. and e.m. lenses and then specialized for lenses of pure e.s. or pure e.m. type. Space-charge effects within the lenses are also considered.

621.385.833 **967**

Electron-Optical Observation of Magnetic Fields.—L. Marton & S. H. Lachenbruch. (*Bur. Stand. J. Res.*, Oct. 1949, Vol. 43, No. 4, pp. 409–428.) A description of the electron optical analogue of the schlieren method and a related shadow method. See also 199 of January.

621.396.615 : 534-6 **968**

An Ultra-Low-Frequency Oscillator.—J. E. Stone. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 94–95.) The thermal lag of a current-carrying thermistor enables it to be used as an inductance in the resonant circuit of a subsonic oscillator. An approximately sinusoidal waveform can be obtained over a frequency range of 0.1–0.02 c/s.

621-57 : 621.318 **969**

Magnetic Fluid Clutch.—K. E. Wakefield. (*Gen. elect. Rev.*, Dec. 1949, Vol. 52, No. 12, pp. 39–43.) An account of the results of investigations with special reference to high-duty devices capable of handling several thousand horsepower. See also 50 of January (Parker) and 237 of January (Nelson).

621.791.3 : 534.321.9 **970**

Ultrasonic Soldering Iron for Light Alloys.—(*Engineer, Lond.*, 23rd Dec. 1949, Vol. 188, No. 4900, p. 737.) A removable copper bit is mounted in front of a magnetostriction transducer excited from a separate generator. Ultrasonic vibrations at about 20 kc/s destroy the oxide film on the working surface. No flux is needed.

621.791.352 : 621.365.54† **971**

Industrial Brazing by Pulse Techniques.—J. L. Reinartz. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 78–80.) Extremely high values of peak r.f. power are applied in short-duration pulses in order to reduce the heating, by thermal conduction, of parts near to the joint being brazed. The method was developed for valve manufacture but may have many other applications.

629.13.055.2 **972**

A Shielded Hot-Wire Anemometer for Low Speeds.—L. F. G. Simmons. (*J. sci. Instrum.*, Dec. 1949, Vol. 26, No. 12, pp. 407–411.) "A low-speed anemometer is described which comprises an electrically heated wire and a thermocouple contained in a double-bore silica tube. In an air current the temperature change caused by heat loss is registered by the thermocouple and, when the instrument is suitably calibrated, the e.m.f. developed serves as a measure of the speed of flow."

621.365.54/.55† **973**

Radio-Frequency Heating. [Book Review]—L. Hartshorn. Publishers: Allen & Unwin, London, 237 pp., 21s. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, p. 31.) "This book covers both induction and dielectric heating and is concerned mainly with the principles of r.f. heating . . . A good point about the book is that it deals mainly with just those points upon which general information is lacking—the heating coil or electrode and the material itself. . . . Each chapter contains an extensive bibliography and the book undoubtedly forms a useful contribution to the literature."

621.38.001.8 **974**

Basic Electronics. [Book Review]—R. G. Kloeffler & M. W. Horrell. Publishers: J. Wiley & Sons, New York, and Chapman & Hall, London, 1949, 435 pp., $5.00. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 211–212.) "Coverage of the field of electronics from high-powered industrial circuits to low-level communications circuits is complete and comprehensive without being sketchy. Liberal references to the literature suggest further study for those whose interests or needs go beyond the scope of the general text."

PROPAGATION OF WAVES

538.566 **975**

The Normal-Wave Method and its Application to Multi-Layer Plane Media.—P. E. Krasnushkin. (*C. R. Acad. Sci. U.R.S.S.*, 1st Sept. 1947, Vol. 56, No. 7, pp. 687–690. In Russian.) A mathematical investigation of wave processes due to given currents in an unlimited, isotropic, non-magnetic ideal medium, the dielectric constant of which depends only on one Cartesian coordinate.

538.566.2 : 523.72 : 621.396.822 **976**

The Wave Equations for Electromagnetic Radiation in an Ionized Medium in a Magnetic Field.—K. C. Westfold. (*Aust. J. sci. Res., Ser. A.*, June 1949, Vol. 2, No. 2, pp. 169–183.) In the atmospheres of the sun and earth, the refractive index is, in general, a function of the angle between the direction of propagation and the magnetic field, the intensity of this field, electron density, and frequency. Surfaces of constant refractive index cannot be realized and the classical theory is inadequate.

The new treatment is based on axes parallel to the principal directions of the medium. A new form of the Appleton-Hartree equation for complex refractive index is obtained. Three possible types of plasma oscillation and their application to solar noise bursts are discussed. See also 884 and 885 (Payne-Scott).

538.566.2 : 621.396.11 **977**

Propagation of Electromagnetic Waves in a Stratified Medium.—G. Eckart. (*Ann. Télécommun.*, May & June 1949, Vol. 4, Nos. 5 & 6, pp. 142–154 & 223–230.) A mathematical treatment for propagation in a medium whose dielectric constant ϵ is a linear function of the z coordinate. The case of waves which transform into plane waves if the slope (α) of the ϵ curve tends towards zero is particularly considered, and also that of a medium consisting of two or three layers with different values of α. In the latter case reflection occurs at the discontinuities. Numerical calculations are made.

A solution for the general case, when the values of α are small, is developed in powers of α, and the coefficients of reflection and transmission are determined. Both horizontal and vertical polarization are discussed. Theory is also given of the Zenneck surface wave in a stratified medium.

621.396.11 **978**

Coupling of the Ordinary and Extraordinary Rays in the Ionosphere.—T. L. Eckersley. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361 B, pp. 49–58.) An approximate solution to the wave equation is given for propagation in an ionosphere in which the gradient of the density N is in the vertical, z, direction only, and in which account is taken of the earth's magnetic field. It corresponds exactly to the ray theory and expresses a quantity Z, which is the z derivative of the phase function S, by a quartic equation. Z can be represented as a function of ζ (which is proportional to N) on a four-sheeted Riemann surface, and the branch points are studied for the case of vertical incidence for which Z becomes the refractive index. By considering the branch points in the complex ζ plane, the amount of the coupling between the ordinary and the isolated extraordinary branches of the (Z, ζ) curves can be expressed as a function of the obliquity of the magnetic field. The triple splitting of rays reflected from the ionosphere, observable where the field is nearly vertical, can thus be explained, and the theory is substantiated by the observation that the polarizations of the echoes on the (P', f) records are ordinary, ordinary and extraordinary in order of increasing critical frequencies, as given by the branches of the (Z, ζ) curves.

621.396.11 : 535.312 : 546.212 **979**

Measurements of the Reflection Coefficient of Water at a Wavelength of 8.7 mm.—Kiely. (*See* 899.)

621.396.11 : 535.312 : 546.212-16 **980**

Reflection Coefficient of Snow and Ice at V.H.F.—Saxton. (*See* 900.)

621.396.11 : 550.837.7 **981**

Propagation of Electromagnetic Waves in Earth.—O. C. Haycock, E. C. Madsen & S. R. Hurst. (*Geophys.*, April 1949, Vol. 14, No. 2, pp. 162–171.) Consideration of attenuation, present-day transmitter technique, and aerial-length limitations, indicates that frequencies in the range 300–1 000 kc/s are the most practical for propagation through considerable thicknesses of ground.

621.396.11 : 621.396.8].029.6 **982**

The Propagation of Ultra-Short (Quasi-Optical) Waves.—W. Lehfeldt. (*Arch. elekt. Übertragung*, July–Dec. 1949, Vol. 3, Nos. 4–9, pp. 137–142, 183–186, 221–228, 265–269, 305–312, 339–346.) A comprehensive review including both theory and experimental results. Part 1 discusses (*a*) s.w. propagation characteristics ($\lambda < 10$ m); (*b*) refraction in a homogeneous troposphere and calculation of range; (*c*) discontinuities in refractive index causing reflection, and fading or extreme ranges of s.w. signals; (*d*) steep refraction gradients leading to total reflection; (*e*) an estimation of the limiting wavelength (about 5 m) for sky-wave propagation; effects due to ion concentration; (*f*) scattering and absorption by water drops.

Part 2 deals with propagation measurements for wavelengths from about 6 m to 9 cm. The experiments were conducted in both hilly and flat country and also over the Baltic Sea. Equipment and measurement technique are described. A special section discusses the statistical evaluation of the distribution of atmospherics. Abnormal ranges are noted. Theoretical and experimental results are compared.

621.396.812.029.63 **983**

Interference Fading in the Decimetre-Wave Band caused by Humidity and Temperature Changes in the Lower Layers of the Atmosphere.—A. Grün & W. Kleinsteuber. (*Arch. elekt. Übertragung*, Sept. 1949, Vol. 3, No. 6, pp. 209–219.) Observed interference phenomena are explained in terms of (*a*) the bending of rays caused by gradients of the refractive index due to weather conditions, and (*b*) the interaction between the direct ray and the ray reflected from the earth. Consideration of the path difference of the two rays confirms that field strength variations may be calculated from the known behaviour of the refractive index. Graphical methods of calculation are described. Mean values and variations of the refractive-index gradients derived from observations of received signals are in good agreement with meteorological observations. A wavelength of about 50 cm appears especially advantageous for communication. The possible application of such observations for meteorological purposes is indicated.

621.396.97 : 621.396.619.13 : 621.396.8 **984**

Propagation Measurements near Geneva for Experimental F.M. Broadcasting Transmissions on 93 Mc/s.—W. Ebert. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st Oct. 1949, Vol. 27, No. 5, pp. 209–223. In German.) The Philips' equipment used for these tests is described; circuit diagrams of the Type-FZ115a transmitter and Type-FM46 receiver are given. During the measurements the 750-W transmitter was operated at about half power. Field strength and quality of reception are recorded for 49 locations within a radius of 60 miles from the transmitter, (*a*) using a $\lambda/2$ dipole with vertical polarization, (*b*) using a horizontally polarized turnstile array. The latter gave appreciably better results, the field strength at any particular point being approximately 2.5 times that obtained with a vertical dipole and the same transmitter power. A further report is to be given later.

621.396.11 **985**

Radio Research Special Report No. 19. Lateral Deviation of Radio Waves reflected at the Ionosphere. [Book Notice]—W. Ross. Publishers: H. M. Stationery Office, London, 9d. (*Govt Publ., Lond.*, Nov. 1949, p. 19.)

RECEPTION

621.396.621 : 621.385 **986**

The Sensitivity of Receiving Valves.—H. Rothe. (*Arch. elekt. Übertragung*, Oct. 1949, Vol. 3, No. 7, pp. 233–240.) The noise factor which limits receiver sensitivity is calculated for grounded-cathode, grounded-grid and grounded-anode amplifier circuits. Neglecting the reactive effect of the output circuit, all three types of circuit have the same noise factor. The characteristics of various valves are compared and discussed with reference to operation at high frequencies. The grounded-grid triode circuit, on account of its lower equivalent noise resistance, gives at v.h.f. a greater sensitivity than the grounded-cathode pentode circuit.

621.396.621.029.62 : 621.396.933 **987**

Airways V.H.F. Communications Receiver.—A. H. Wulfsberg. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 81–83.) A receiver covering the range 108–136 Mc/s and using the double superheterodyne principle has a 100-db image-rejection ratio and an 80-db attenuation of other spurious responses. Series and shunt noise limiters are used in a special noise-balancing circuit, full details of which are given. Both the first and second local-oscillator frequencies are crystal-controlled. Output is 1 W into a 600-Ω load.

621.396.621.5 **988**

Methods of Calculating the Sensitivity of Mixer Stages for Decimetre and Centimetre Waves.—Mataré. (*See* 855.)

621.396.82 : 621.317.3 **989**

Electrical Noise. Experimental Correlation between Aural and Objective Parameters.—D. Maurice, G. F. Newell & J. G. Spencer. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, pp. 2–12.) The dependence of the amount of annoyance, defined as the disturbance caused by noise interference in the presence of a broadcast programme, upon the objective parameters of the noise was studied in order to devise a suitable measuring instrument which will simulate a listener's ear. The significant parameters are the receiver bandwidth and the pulse repetition frequency, considering the noise as repeated Heaviside unit impulses and the effect of the peak value on the annoyance to be logarithmic. Random fluctuation noise in the band 250 c/s to 10 kc/s was used as a standard; a number of observers compared this with seventeen different types of test noise under various combinations of the parameters. Simultaneously, the noise levels were recorded on six different types of noise meters preceded by aural-weighting networks. The results showed that a meter indicating the mean square value of the input waveform less the mean value was the most suitable of those available for the subjective measurement of the interference; suggestions for its improvement are given.

621.396.82 : 621.396.619.13 **990**

Investigation of Interference Phenomena in the Region between Two F.M. Common-Wave Transmitters.—H. Fricke, L. Pungs & K. H. Schmitter. (*Frequenz*, Oct. 1949, Vol. 3, No. 10, pp. 277–289.) The output voltage curve of a receiver situated between two f.m. transmitters operating on the same carrier frequency exhibits pronounced peaks which are due to h.f. and i.f. phase shifts. The number of these peaks within a given frequency band serves as a measure of the interference to programme reception. Harmonic analysis indicates that with increasing number of such peaks the energy distribution trends more and more towards the higher frequencies, so that by using a suitable low-pass filter the interference can be almost completely eliminated. Measurements on model equipment are described which confirm the theoretical conclusions.

621.396.62 + 621.396.662.3 + 621.396.645 **991**

Applications of the Electronic Valve in Receiving Sets and Amplifiers. [Book Review]—B. G. Dammers, J. Haantjes, J. Otte & H. van Suchtelen. Publishers: Philips Telecommunication Industries, Hilversum, Holland, 467 pp. (*Commun. News*, Oct. 1949, Vol. 10, No. 3, pp. 98–100.) The first volume of a series of three books on this subject. Only a.m. is considered. The various sections deal with (*a*) r.f. and i.f. amplification, (*b*) frequency changing, (*c*) determination of the tracking curve, (*d*) parasitic effects and distortion due to curvature of valve characteristics, (*e*) detection. "A work which should not be absent from any technical library."

STATIONS AND COMMUNICATION SYSTEMS

061.3 : 621.396.1 : 621.396.97 **992**

Results of the Conferences in Copenhagen and Mexico.—E. Metzler. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1949, Vol. 27, No. 5, pp. 223–231. In German.) Comment on these two conferences, the first on reorganization of European broadcasting channels, the second on international s.w. broadcasting.

621.39.001.11 **993**

Communication Theory of Secrecy Systems.—C. E. Shannon. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 656–715.) Analysis of the basic mathematical structure of secrecy systems and discussion of 'theoretical secrecy' and 'practical secrecy'. See also 1361 of 1949.

621.395 **994**

15th Plenary Session of the Comité Consultatif International Téléphonique (C.C.I.F.), Paris, July 1949.—R. Sueur. (*Câbles & Transmission, Paris*, Jan. 1950, Vol. 4, No. 1, pp. 3–8.) Summaries of the discussions on various subjects.

621.395.44 : 621.315.052.63 **995**

Single-Sideband Methods or Frequency Modulation for Power-Line Telephony?—J. Herrmann & J. Erben. (*Frequenz*, Dec. 1949, Vol. 3, No. 12, pp. 341–348.) Discussion of the relative merits of the two systems, with particular reference to corona interference and to distortion due to sideband clipping in f.m. systems.

621.396.41.029.63 : 621.396.97 **996**

Experimental Ultra-High-Frequency Multiplex Broadcasting System.—A. G. Kandoian & A. M. Levine. (*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 292–304.) Reprint. See 2629 of 1949.

621.396.5/.6 **997**

Description and General Characteristics of [12-channel] Pulse Multiplex Equipment Studied and Perfected at the C.N.E.T. [Centre National d'Étude des Télécommunications].—J. Icole & G. Potier. (*Ann. Télécommun.*, Aug./Sept. 1949, Vol. 4, Nos. 8/9, pp. 315–318.)

621.396.5 : 621.396.619.16 **998**

Pulse Multiplex Equipment for 24-Channel Telephony.—L. J. Libois. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 23–29.) 0.5-μs pulses with a repetition frequency of 8 000 per sec are used. Time distribution of the pulses is effected by means of delay lines. Amplitude modulation of the channel pulses is transformed into pulse-position modulation, a common modulation transformer being used for (*a*) the even-numbered and (*b*) the odd-numbered channels. The transformation procedure is reversed in the receiver. Synchronization pulses are distinguished by their longer duration. Operation of the equipment is satisfactory with a non-stabilized supply. Component tolerances are quite large and though similarity of transmitter and receiver delay lines is important, the precision required does not rule out the possibility of mass production.

621.396.5.029.62 : 621.396.932 **999**

The Thames Radio Service.—J. Neale & D. W. Burr. (*P.O. elect. Engrs' J.*, Jan. 1950, Vol. 42, Part 4, pp. 213–220.) A description of the recently developed public R/T service for small craft. Full duplex operation is provided. Low-power crystal-controlled transmitters operating in the 160-Mc/s band are used both for the shore-station and the mobile equipments. Mainly because of ease of maintenance and relative cost of equipment, a.m. was adopted for the service in preference to f.m. A selective-calling system is being developed. Details of signalling systems, precautionary measures and maintenance facilities are given. The use of more than one shore transmitter is considered.

621.396.6 : 621.396.932 **1000**

The Radio Equipment of the Liner "Ile-de-France".—J. Leclère-Courbe. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 21–26.) General description of the functions and disposition of new apparatus which, except for the emergency equipment, is all grouped in one room. It includes magnetostriction and piezoelectric depth-sounding recorders, radar equipment, general communication equipment for both telegraphy and telephony, and radiogoniometer.

621.396.619.13 **1001**

Quality Gain in Carrier-Frequency Systems using Frequency Modulation of Metre and Decimetre Waves.—P. Barkow. (*Arch. elekt. Übertragung*, Nov. 1949, Vol. 3, No. 8, pp. 287–292.) Formulae are derived for the improvement factors, which are dependent on relative frequency swing and which are represented graphically for different numbers of channels. A numerical example is calculated and two methods are suggested by which equalized signal/noise ratio and additional gain in quality may be obtained, especially for the upper channels.

621.396.619.13 : 621.395.813 **1002**

Method of Calculating the Nonlinear Distortion of F.M. Signals as a Function of Amplifier Propagation-Time Variations.—J. Fagot. (*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 8–11.) Phase variation and propagation time of a f.m. signal are defined mathematically and the following simple relation is derived for third-harmonic distortion: $D_3 = \omega\Delta t/4$, where ω is 2π times the modulation frequency and Δt the variation of propagation time. The formula is used to find the maximum permissible variation of t for a given distortion in a 12-channel and a 240-channel carrier-current telephony system.

621.396.619.16 **1003**

Pulse-Code Modulation and its Distortion with Logarithmic Amplitude Sampling.—H. Holzwarth. (*Arch. elekt. Übertragung*, Nov. 1949, Vol. 3, No. 8, pp. 277–285.) A characteristic of p.c.m. is the increase in distortion with decreasing modulation. This may be partly compensated by a logarithmic pre-distortion of the signals; this acts as a logarithmic sampling of the undistorted signal. Under certain conditions, distortion may be kept at an almost constant value throughout a wide modulation band. An approximate formula is given for the distortion in terms of the degree of pre-distortion and the sampling rate. The method also gives an increased volume range. For the same number of channels, a 7-unit p.c.m. system requires about the same minimum bandwidth as a p.ph.m. system. With a 5-unit code the requirements regarding transmission quality could probably not be fulfilled.

621.396.65 : 621.396.5 **1004**

A New V.H.F. Multi-Circuit Radio Telephone System: Part I.—J. J. E. Aspin. (*G.E.C. Telecommun.*, 1949, Vol. 4, No. 2, pp. 62–78.) The possibilities of the application of v.h.f. trunk radio systems are summarized, the features of v.h.f. propagation are outlined, and frequency separation is discussed. The effect of sites and aerial heights is explained and figures for attenuation due to the radio path are quoted. An outline of design requirements leads to an illustrated description of equipment of two types: (*a*) the 6-circuit system, which handles seven channels of width 4 kc/s; (*b*) the 12/24-circuit system, which handles 24 such channels. Power output from terminal and relay transmitters is 20 W or, with an additional amplifier, 100 W. Relay spacing may be up to 60 miles. Two rows of 4 centre-fed dipoles, with $\lambda/2$ dipole spacing and λ row spacing, $\lambda/4$ in front of a wire-mesh screen, form the directional aerial array. Part 2 will describe the automatic changeover and fault-signalling system associated with the duplicate equipment at repeater stations.

621.396.65 : 621.396.619.16 **1005**

Port Elizabeth/Uitenhage Time-Sharing-Modulation Radio Link.—(*Elect. Commun.*, Dec. 1949, Vol. 26, No. 4, pp. 269–271.) Illustrated description of equipment operating on frequencies of 440 Mc/s and 475 Mc/s in the two directions, with peak power of the pulsed transmitters of 150 W.

621.396.65 : 621.397.5 **1006**

The London/Birmingham Television Radio-Relay Link.—D. C. Espley & R. J. Clayton. (*G.E.C. J.*, Jan. 1950, Vol. 17, No. 1, pp. 3–10.) An illustrated general description of the present single-channel reversible link. A more detailed technical account will be given on completion of the two-way link. See also 471 of February.

621.396.65(494) **1007**

Transalpine Communication by Radio Beams.—W. Gerber. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1949, Vol. 27, No. 5, pp. 231–235. In French.) General discussion, with suggestions for the development of a system linking the regions north and south of the Alps. See also 546 of 1948 (Gerber & Tank) and 2326 of 1949 (Klein).

621.396.822 : [621.396.65 + 621.395.44 **1008**

Noise Level in F.M. Radio Relay Links for Multichannel Carrier Telephone Systems.—A. van Weel. (*Commun. News*, Oct. 1949, Vol. 10, No. 3, pp. 83–86.) The effective signal/noise ratio of radio links is compared theoretically with that of telephone land lines over the same circuits. It is possible to get comparable performance for the radio link only by using highly directive aerials, involving the use of wavelengths $<$ 30 cm. Economic considerations favour the radio link, since for land lines a repeater is required every 25 km, whereas for the radio link the distance is about 45 km.

621.396.933 **1009**

Modern Aircraft Radio Equipment as Fitted to Convair Liner.—J. H. Gerrand. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1949, Vol. 10, No. 11, pp. 306–310.) 1948 Australian I.R.E. Convention paper. The three main requirements of such equipment are light weight, reliability and ease of servicing, and simplicity of operation. Various units of the Convair communication and navigation equipment are described, with emphasis on the way in which they meet these requirements.

621.39 **1010**

Die Systemtheorie der elektrischen Nachrichtenübertragung. (Theory of Electrical Communication Systems) [Book Review]—K. Küpfmüller. Publishers: S. Hirzel, Stuttgart, 386 pp. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, p. 30.) "It is a systematic investigation of the transmission of electrical signals of all kinds under all possible conditions. It deals with telegraphic signals, speech, amplitude, frequency and pulse modulation, and all the various types of distortion. The amount of material in the book is very impressive and the treatment is very thorough and detailed and well illustrated with numerous diagrams. When any lesser known mathematical functions are introduced they are carefully explained and illustrated with numerical examples and diagrams. This is certainly a book that can be unreservedly recommended to anyone with a knowledge of German."

SUBSIDIARY APPARATUS

541.136.2 : 541.133 **1011**

The Internal Resistance and the Electrolytes of Galvanic Cells.—C. Drotschmann. (*Funk u. Ton*, 1949, Vol. 3, Nos. 9/10 & 11/12, pp. 506–524 & 594–600.)

621-526 : 681.142 **1012**

Electronics and Experimental Mathematics.—Raymond. (*See* 919.)

621.316.722 **1013**

Photo-Tube Input Impedance for a Voltage Stabilizer.—E. N. Strait & W. W. Buechner. (*Rev. sci. Instrum.*, Nov. 1949, Vol. 20, No. 11, pp. 783–785.) A photocell under constant illumination is used as an input impedance, eliminating the necessity for d.c. amplification of the error signal, which is applied directly to the control grid of a pentode, Type 5693, that is used to control corona leakage current to the h.v. terminal of an e.s. generator.

621.384.5 **1014**

Variations in the Characteristics of some Glow-Discharge Voltage-Regulator Tubes.—F. A. Benson, W. E. Cain & B. D. Clucas. (*J. sci. Instrum.*, Dec. 1949, Vol. 26, No. 12, pp. 399–401.) "The variations in the characteristics of two commercial types of glow-discharge voltage-regulator tube have been studied in detail experimentally. The results of short- and long-term tests to determine voltage drift, together with measurements of temperature coefficient, are presented. The properties of tubes run with the cathode potential positive with respect to the anode are discussed."

621.396.69 **1015**

Telescopic Mountings in Electronic Equipment.—C. H. Davis. (*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, pp. 27–31.) A description is given of different methods of mounting chassis on roller bearings or pivots, for easy withdrawal from racks or other equipment and for convenience in servicing. The use of flexible cable harness ensures permanent circuit connections in both open and closed positions. Plug and socket connections are used if the equipment is to be 'dead' in the open position.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 **1016**

1029-Line Television.—W. Dillenburger. (*Elektron Wiss. Tech.*, Jan. 1950, Vol. 4, No. 1, pp. 1–10.) The suitability of different scanning methods for high-definition pictures is discussed and their efficiency considered. Tests made with a 1029-line image dissector tube indicate that this line number is too high and that the physical limit for scanning tubes is too closely approached. The cost of transmitters and receivers is considered. The proposed 625-line system for German television seems a good choice, guaranteeing satisfactory picture quality and being economical.

621.397.5 : 621.396.65 **1017**

The London/Birmingham Television Radio-Relay Link.—Espley & Clayton. (*See* 1006.)

621.397.62 **1018**

Technique and Developments of High-Definition Television Receivers.—P. Mandel. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 45–46.) Paper presented at the 1949 International Television Congress, Milan. An examination of problems of technique and economy. The technical aspects discussed are: aerials and h.f. feeders; h.f. amplification and frequency-changing; i.f. amplifiers and detection; electron beam deflection and image distortion. The relative cost of high- and low-definition receivers is considered and the importance of the standardization of components is stressed.

621.397.7 **1019**

Extending Television.—(*Wireless World*, Jan. 1950, Vol. 56, No. 1, pp. 14–15.) Brief description of Sutton Coldfield television station, which operates at 61.7 Mc/s, with a power of 35 kW, and is the second of a chain of 10 stations which are planned for extending the service to 80% of the population of Great Britain by 1954.

TRANSMISSION

621.39.001.11 **1020**

Analytical Signals with Limited Spectrum: Part 1.—J. Ville. (*Câbles & Transmission, Paris*, Jan. 1950, Vol. 4, No. 1, pp. 9–23.) The properties of signals whose spectra lie within a given frequency band are studied mathematically. Such signals are completely defined by their values at instants in arithmetical progression with a sufficiently small common difference. The extension of this result to analytical signals permits the study of circuits whose indicial admittance is distributed in time. This enables the relation between the bandwidth and the quantity of information carried by the signal to be determined.

621.396.612.1.029.64 **1021**

A New Transmitter for Ultra-Short Damped Waves.—J. Le Bot. (*J. Phys. Radium*, May 1947, Vol. 8, No. 5, pp. 142–145.) Description of a Hertzian doublet type of oscillator of simple construction. Two tungsten or platinum wires, of diameter 1 mm and length 4.5 mm, are arranged as a $\lambda/2$ doublet with a gap of some hundredths of a millimetre which has a micrometer adjustment. The doublet is immersed in a mineral oil and fed through fine resistance wires connected through a high resistance to an 8–10-kV a.c. supply. At breakdown the spark discharge carbonizes the oil to form an effective short circuit for the h.f. oscillation generated. The resistive component of the impedance of the doublet being very small, a damped wave-train is radiated at each succeeding half-cycle. The apparatus functions for several hours without adjustment. Radiated power is of the order of 10–20 mW and wavelength about 4.4 cm. Some experiments with cm waves are described, using this transmitter coupled to a short waveguide and horn radiator.

621.396.615 : 621.396.619.13 **1022**

Reactance-Tube Modulation of Phase-Shift Oscillators.—F. R. Dennis & E. P. Felch. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 601–607.) A basic circuit is described and the design of suitable oscillators for a range of frequencies from a.f. to u.h.f. is discussed. The phase-shift networks are conveniently of the RC, LC, and transmission-line types for the lower, medium and higher frequencies respectively. Typical circuits and performance curves are given.

621.396.619.13 **1023**

Calculation of the Bandwidth of a Sinusoidal Transmission with Sinusoidal F.M.—L. Robin. (*Ann. Télécommun.*, Jan. 1949, Vol. 4, No. 1, pp. 19–26.) The bandwidth necessary to satisfy the requirements fixed at the Atlantic City Convention is determined for any value of the modulation index. The treatment involves Bessel functions of the first kind and a series formed by the squares of these functions. It is found necessary to introduce an asymptotic development of Bessel functions for neighbouring values of their index and argument. The results of the calculations are shown on four graphs. Two of these give the ratio of f.m. bandwidth to a.m. bandwidth for any value of the modulation index; the others show the relation between the f.m. bandwidth and the frequency swing.

621.396.619.13 **1024**

Reactance Valves and their Use in Frequency-Modulation Circuits.—A. G. Wray. (*Marconi Instrumentation*, Nov./Dec. 1949, Vol. 2, No. 4, pp. 63–67.) Simple theory is given of the operation of a typical reactance-valve circuit. This indicates that a valve giving a linear change of mutual conductance with linear variation of control-grid voltage is suitable for use as a reactor. Experiments with a variable-μ valve showed a reduction in second-harmonic content but an increase of the third harmonic, so that no improvement of the total distortion resulted. With a 'straight' valve the third harmonic is practically non-existent and by careful adjustment of bias voltage the second harmonic can also be made negligible for a particular valve. Bias readjustment will probably be necessary if the valve is changed for one of the same type. Using an EF91, EL91, or EF92 valve in the circuit given, a deviation of 0.5% of the carrier frequency can be obtained. Much better performance is obtained with a push-pull circuit, full details of which are given. A deviation of 2% of the carrier frequency is possible with this circuit, using EF91 valves for both reactor and oscillator. Overall envelope distortion is $<1\%$. The system has the advantage that random changes due to supply-voltage fluctuations are cancelled.

621.396.619.23 **1025**

Study of Rectifier-Type Ring Modulators with regard to their Application in Terminal Installations for 600- or 960-Channel Coaxial-Cable Links.—P. Moll. (*Câbles & Transmission, Paris*, Jan. 1950, Vol. 4, No. 1, pp. 24–46.) The characteristics of Westinghouse rectifiers 30S9A and 28S4F and their associated input and output transformers are studied at different frequencies between 10 kc/s and 10 Mc/s. Laboratory tests and methods of measurement of circuit losses and nonlinear distortion are described. Results are tabulated and shown graphically. The 30S9A rectifier is well suited for ring-modulator use between 300 c/s and 4 Mc/s.

VALVES AND THERMIONICS

537.311.33 : 621.315.59 **1026**

Transistors.—J. A. Becker. (*Elect. Engng, N.Y.*, Jan. 1950, Vol. 69, No. 1, pp. 58–64.) Discussion of recent advances in the theory, circuit performance and potential applications of transistors, based on the following papers presented at the 1949 A.I.E.E. Summer Meeting:

Theory of Transistor Action.—W. Shockley.

Equivalent Circuits for Transistor Action and Noise.—R. M. Ryder.

The Possible Significance of Transistors in the Power Field.—J. A. Hutcheson.

See also 240 of January.

621.383.4 : 534.862.4 **1027**

Lead-Sulfide Photoconductive Cells in Sound Reproducers.—R. W. Lee. (*J. Soc. Mot. Pict. Engrs*, Dec. 1949, Vol. 53, No. 6, pp. 691–703. Discussion, pp. 703–706.) Results are given of measurements of sensitivity or signal output for a wide range of conditions in a standard 16-mm sound projector, using silver, silver-sulphide, dye-image, and iron-toned sound tracks. The effect of the colour temperature of the exciter lamp on frequency response and signal output is also discussed.

621.384.5 **1028**

Variations in the Characteristics of some Glow-Discharge Voltage-Regulator Tubes.—Benson, Cain & Clucas. (*See* 1014.)

621.385 : 621.318.572 **1029**

Switching Valves.—W. Kleen. (*Elektron Wiss. Tech.*, Jan. 1950, Vol. 4, No. 1, pp. 11–16.) The principle of operation, application and development of the gas-filled transmit-receive switch.

621.385 : 621.396.621 **1030**

Modern Receiving Valves: Miniature Valves.—R. Suart. (*Radio franç.*, Jan. 1950, No. 1, pp. 3–8.) An illustrated description of their development and of methods of manufacture. Operating characteristics compare favourably with those of the corresponding normal and acorn types of valve. Some 40 types of miniature valve are classified.

621.385 : 621.396.621 **1031**
The Sensitivity of Receiving Valves.—Rothe. (*See* 986.)

621.385.029.63/.64 : 537.525.92 **1032**
Increasing Space-Charge Waves.—Pierce. (*See* 874.)

621.396.615.029.63 **1033**
On a Particular Characteristic of Disk-Seal Valves 2C40 and 2C43.—L. Liot. (*Radio franç.*, Feb. 1950, No. 2, pp. 9–13.) The physical construction of these valves allows them to be used as reentrant-cavity oscillators for the frequency range 1 600–2 400 Mc/s. Maximum output power using a Type-2C40 valve on 2 000 Mc/s is 200 mW, falling to 70 mW at the limiting frequencies. A scale diagram is given showing the construction adopted.

621.396.615.142 **1034**
On the Theory of Velocity-Modulation Transit-Time Valves: Part 2.—H. Döring. (*Arch. elekt. Übertragung*, Nov. 1949, Vol. 3, No. 8, pp. 293–300.) The general reflex type of valve is investigated. Behind the infinitely short alternating field is located the field-free drift space Θ_L and a uniform retarding field Θ_B of finite length. This arrangement is comparable with the two-field, two-circuit valve with fixed reaction, so that discrete oscillation regions appear when the static transit-time angle is varied. When $\Theta_L > \Theta_B$ the oscillation regions correspond to those of the Heil generator with antiphase alternating fields. When $\Theta_L < \Theta_B$ the motion in the retarding field is predominant and the oscillation regions coincide with the damping regions of the Heil generator. For equal transit-time angle in the drift space and retarding field ($\Theta_L = \Theta_B$), only slight density modulation occurs and the efficiency of the generator tends to zero. Two arrangements giving the greatest conversion efficiency are described. The first uses an electrical double layer for the retarding field ($\Theta_B = 0$). In this case, oscillation regions and efficiency are identical with those of the Heil generator. Maximum efficiency of 26% occurs in the second region with $\beta = 0.5$ and $\Theta_L = 2.3\pi$. In the second arrangement $\Theta_L = 0$ and the maximum efficiency of 25.5% occurs in the first region with $\Theta_B = 1.55\pi$ and $\beta = 0.5$. Exact calculations are made for the first and sixth regions. Approximate formulae may be derived for the maximum efficiency in the higher oscillation regions. Part 1: 2175 of 1944.

621.396.822 **1035**
Spontaneous Fluctuations in Double-Cathode Valves.—R. Fürth. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, p. 33.) Reply to comment by Knol & Diemer (791 of March) on Fürth's theory (2418 and 2419 of 1948). See also 1247 of 1949 (MacDonald).

621.396.822 **1036**
Hum in A.C. Valves.—Z. Imre. (*Electronic Engng*, Jan. 1950, Vol. 22, No. 263, p. 33). See also 916 of 1949, where the author's name should be as above.

621.38 **1037**
Fundamental Electronics and Vacuum Tubes. [Book Review]—A. L. Albert. Publishers: Macmillan & Co., 2nd edn, 1947, 499 pp., $6.00. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1949, Vol. 37, No. 11, pp. 1304–1305.) Intended "for use in courses in electronics required of all electrical engineering students. The treatment is largely non-mathematical." The first edition was noted in 2783 of 1939.

621.385 **1038**
International Radio Tube Encyclopedia. [Book Review]—B. R. Babani (Ed.). Publishers: Bernards Ltd, London, 410 pp., 42s. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, p. 412.) Gives the characteristics and base connections of 15 000 British, American and European valves, classified according to type and arranged in alphabetical and numerical order.

621.385 **1039**
Les Tubes Électroniques et leurs Applications: Tome 1 — Principes généraux. [Book Review]—H. Barkhausen. Publishers: Dunod, Paris, 228 pp. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, pp. 377–378.) 2nd French edition, being a translation by C. Poitrat of the 5th German edition. "This book, like the earlier edition, will be of great value to radio engineers and technicians." Further volumes will deal with amplifiers (vol. 2), self-excitation and feedback (vol. 3), and rectifiers and receivers (vol. 4).

MISCELLANEOUS

06.064 : 621.396 **1040**
Amateur Exhibition.—(*Wireless World*, Jan. 1950, Vol. 56, No. 1, pp. 12–13.) Brief descriptions of some of the exhibits at the 3rd annual show of the Radio Society of Great Britain.

530.12 **1041**
Albert Einstein on His Seventieth Birthday.—R. A. Millikan. (*Rev. mod. Phys.*, July 1949, Vol. 21, No. 3, pp. 343–345.) A short appreciation of Einstein and his work.

The rest of this number (pp. 345–540) contains 37 papers on various aspects of the theory of relativity. Each of the authors would wish to express his debt to Einstein, but editorial arrangements made it necessary for such expressions to be voiced only by R. A. Millikan, L. de Broglie, M. von Laue and P. Frank.

621.3 : 371.3 **1042**
Philosophy of the Teaching of Electricity.—L. Bouthillon. (*Bull. Soc. franç. Élect.*, Nov. 1949, Vol. 9, No. 98, pp. 619–640.)

621.385 **1043**
Birth Centenary of Ambrose Fleming.—J. T. MacGregor-Morris. (*Electronic Engng*, Dec. 1949, Vol. 21, No. 262, pp. 442–447 & Jan. 1950, Vol. 22, No. 263, pp. 22–26.) A review of Fleming's life and work, with particular reference to the sequence of events leading to his invention of the thermionic valve and to its use for radio reception.

621.396.029.64 **1044**
Some Experimental Demonstrations with Electromagnetic Centimetre Waves.—E. Meyer & H. Severin. (*Z. Phys.*, 30th Aug. 1949, Vol. 126, Nos. 7/9, pp. 711–720.) Description of simple experiments in an auditorium of Göttingen University during the course of a lecture on "Physical Fundamentals of High-Frequency Technique". A 10-cm tone-modulated magnetron was used as transmitter.

621.396.97 : 061.3 **1045**
Proceedings of the Broadcast Engineers Conference, May 23-25, 1949.—M. A. Honnell (Ed.). (*Georgia Inst. Technol. State Engng Exp. Station Circular, Atlanta*, Oct. 1949, Vol. 9, No. 8, 82 pp.) Essential substance of 14 papers read at the conference.

43-3 = 2 = 4 : 621.3 **1046**
Technical Dictionary: Vol. 2, German-English-French. [Book Review]—H. Thali. Publishers: H. Thali & Co., Hitzkirch, Switzerland, 1948, 311 pp., 35s. (*Electronic Engng*, Nov. 1949, Vol. 21, No. 261, p. 437.) A 24 000-word dictionary concerned mainly with electrical engineering, radio, television and telecommunications. It includes also the most important terms of acoustics, illumination, mathematics, materials, optics, heating, etc. Vol. 1, English-German-French, was noted in 906 of 1948.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **1047**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 66–70.) Continuation of 521 of March.

534 : 061.3 **1048**

Subject Matter of the Acoustics Conference organized by the Acoustics Commission of the Academy of Sciences, U.S.S.R., Moscow, 26th February-1st March, 1949.—(*Bull. Acad. Sci. U.R.S.S., sér. phys.*, Nov./Dec. 1949, Vol. 13, No. 6, pp. 631–747. In Russian.) Report of 22 papers on various acoustical subjects presented at the conference. Many of the papers review Russian research in architectural acoustics, sound recording and reproduction, speech analysis, noise, etc.

534.131 **1049**

Acoustical Properties of Anisotropic Materials.—W. J. Price & H. B. Huntington. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 32–37.) Investigation of ADP and KDP single crystals by pulsed ultrasonic methods. Results are analysed.

534.231 + 538.566.2 **1050**

A New Method for Solving the Problem of the Field of a Point-Radiator in a Multilayer Nonuniform Medium.—Brekhovskikh. (*See* 1216.)

534.231 **1051**

The Sound Field near a Freely Oscillating Piston Membrane.—J. Meixner & U. Fritze. (*Z. angew. Phys.*, Dec. 1949, Vol. 1, No. 12, pp. 535–542.) The results of calculations for several wavelengths, of the order of magnitude of the membrane diameter, are presented graphically and compared with the sound field of an oscillating piston membrane in a rigid wall. The results are used to investigate the diffraction of a plane wave incident perpendicularly on a circular disk. For a wavelength about a third of the disk diameter, the sound fields of the incident and diffracted waves are determined, for both sides of the disk, and compared with approximations from Kirchhoff's diffraction theory. Comparison is also made between the sound field of a freely oscillating membrane and the lines of equal intensity behind a circular opening in a perfectly conducting plane on which a plane e.m. wave is incident perpendicularly.

534.26 **1052**

Variational Principles in Acoustic Diffraction Theory.—H. Levine. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 48–55.) "The diffraction of a plane harmonic sound wave by an aperture in an infinitely thin rigid plane screen is investigated theoretically. Variational principles for the diffracted spherical wave amplitude at large distances from the aperture are derived. In the first of these, the stationary property is exhibited for the class of functions comprising the normal derivative of the aperture velocity potentials, whose distributions are governed by a generally insolvable integral equation. The second involves functions which characterize the discontinuity in velocity potentials at the screen (or their deviation from infinite screen distributions), and are specified by another integral equation. A comparison of the two variational principles is given, which indicates that their over-all agreement, following use of approximate functions, is a measure of the accuracy obtained. The plane wave transmission cross section of the aperture is related to the imaginary part of the diffracted amplitude in the direction of incidence and is cast in stationary forms. Particular attention is given to the low and high frequency behavior of the various forms of cross section, including comparison with Kirchhoff theory predictions."

534.26 **1053**

The Diffraction of Sound by Rigid Disks and Rigid Square Plates.—F. M. Wiener. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, p. 47.) Correction to 3000 of 1949.

534.321.9 : 534.14 **1054**

Generation and Analysis of Ultrasonic Noise.—S. C. Ghose. (*Nature, Lond.*, 14th Jan. 1950, Vol. 165, No. 4185, pp. 66–67.) A brief description of apparatus used in the study of ultrasonic noise from turbo-jet engines. Special microphones and calibrating generators operating at frequencies up to 100 kc/s are described, and some details are given of a siren generator of ultrasonic noise of high intensity.

534.321.9 : 534.2 (26.03) **1055**

Transmission of 24-kc/s Underwater Sound from a Deep Source.—M. J. Sheehy. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 24–28.) Experimental methods are described. Preliminary results indicate that (*a*) the attenuation decreases with depth as both transmitter and hydrophone are lowered from 150 to 1 000 ft, (*b*) the average attenuation below 300 ft is about 6 db per 1 000 yd, (*c*) the magnitude of the amplitude fluctuations of the directly transmitted signals increases roughly as the square root of the range, from about 10% at 100 yd to 45% at 3 000 yd, (*d*) surface-reflected signals show greater fluctuations than the direct signals.

534.321.9 : 534.373 **1056**

Ultrasonic Absorption in Liquids.—G. W. Hazzard. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 29–32.) An experimental study of the effect of molecular symmetry on absorption.

534.373 : 534.6 **1057**

Attenuation in a Rectangular Slotted Tube of (1,0) Transverse Acoustic Waves.—H. E. Hartig & R. F. Lambert. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 42–47.) Details are given of a pickup device for measuring the s.w.r. of transverse waves. Results for the frequency range 2 400–4 200 c/s are discussed.

534.6 : 621.395.6 **1058**

An Artificial Mouth for Acoustic Tests.—P. Chavasse. (*C. R. Acad. Sci., Paris*, 30th Jan. 1950, Vol. 230, No. 5, pp. 436–438.) Description of an artificial head which when used with an artificial voice (3404 of 1947) produces sounds which can with advantage replace the human voice in many tests of communication equipment.

534.61 + 534.83 **1059**

The Objective Measurement of Noise: its Possibilities and Limitations.—P. Baron. (*Ann. Télécommun.*, Oct. 1949, Vol. 4, No. 10, pp. 330–340.) A critical examination of various methods of measurement of noise intensity and a discussion of the merits of proposed methods based on the spectral distribution of energy.

534.612.4 **1060**

A Method for the Absolute Calibration of Sound Receivers by the Reciprocity Method.—M. V. Kazantseva. (*C. R. Acad. Sci. U.R.S.S.*, 11th Dec. 1947, Vol. 58, No. 8, pp. 1649–1651. In Russian.) Usually the absolute calibration of sound receivers is carried out in a free field and in chambers small in comparison with the sound wavelength. A method using a tube not shorter than half the sound wavelength is considered.

534.614 : 534.154 **1061**

A Crystal Pick-Up for Measuring Ultrasonic Wave Velocity and Dispersion in Solid Rods.—A. E. Bakanowski & R. B. Lindsay. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 14–16.) A description of a pickup which has been successfully applied to determine the internodal distances in a solid metal rod vibrating in resonance with the applied oscillator frequency. Accuracy is similar to that obtainable by the powder method; the pickup can be applied to cases for which that method is unsuitable.

534.64 **1062**

Reciprocity Pressure Response Formula which includes the Effect of the Chamber Load on the Motion of the Transducer Diaphragms.—M. S. Hawley. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 56–58.)

534.75 + 534.792 **1063**

The Masking of Pure Tones and of Speech by White Noise.—J. E. Hawkins, Jr, & S. S. Stevens. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 6–13.) The results of a study of monaural masking at eight sensation levels in the range 20–90 db.

534.771 **1064**

The Watch, as an Apparatus for Measuring Acuteness of Hearing.—P. Chavasse, R. Caussé & R. Lehmann. (*Ann. Télécommun.*, Dec. 1949, Vol. 4, No. 12, pp. 413–424.) The ticking of a watch is submitted to spectral analysis and its sound intensity and the principal components of the spectrum are considered. Different methods of noise measurement are compared. A watch affords a ready means for rapid measurements of hearing acuity; the physiological deductions which can be made from such measurements are discussed.

534.771 **1065**

A Method of Calculating Hearing Loss for Speech from an Audiogram.—H. Fletcher. (*J. acoust. Soc. Amer.*, Jan. 1950, Vol. 22, No. 1, pp. 1–5.)

534.83/.84 : 061.3 **1066**

Symposium on Noise, London, 14th–19th July 1948.—P. Chavasse. (*Ann. Télécommun.*, Nov. 1949, Vol. 4, No. 11, pp. 377–382.) General comment on and review of the proceedings. 34 of the papers presented are listed with authors' names. 26 of these are summarized. They concern architectural acoustics; noise in aircraft, ships, and public halls; noise analysis; loudness measurement etc. See also 2115 of 1949 (Beranek).

534.85 : 621.396.645 **1067**

Phonograph Reproduction: Part 1.—McProud. (See 1117.)

621.395.61 **1068**

On the Application of Negative Feedback to Electro-acoustic Systems.—P. Chavasse & P. Poincelot. (*C. R. Acad. Sci., Paris*, 6th Feb. 1950, Vol. 230, No. 6, pp. 529–530.) The response curve of a reversible electrodynamic microphone was improved by the application of up to 32 db negative feedback.

621.395.623.7 **1069**

Duo-Cone Loud Speaker.—H. F. Olson, J. Preston & D. H. Cunningham. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 490–503.) Full account of modifications of an earlier model which were noted in 17 of January.

621.396.645.37 : 621.395.623.7 : 621.3.018.8 **1070**

Output Impedance Control.—T. Roddam. (*Wireless World*, Feb. 1950, Vol. 56, No. 2, pp. 48–49.) A method is described for varying the damping of a loudspeaker without alteration of the output level. Negative voltage feedback is used to keep the amplifier gain constant while the output impedance is varied by positive current feedback.

621.395.623.7 + 534.85 **1071**

Sound Reproduction. [Book Review]—G. A. Briggs. Publishers: Wharfedale Wireless Works, Bradford, England and British Industries Corporation, 315 Broadway, New York 7, 1949, 143 pp., $2.95. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 236–237.) "The book consists of two major parts: Part I: Loudspeakers; Part II: Records. The part on loudspeakers extends the discussion of the previous book, 'Loudspeakers: The Why and How of Good Reproduction' (3333 of 1948) . . . The part on records surveys recording techniques and characteristics and discusses the various ills the art is heir to, such as tracking error, surface noise and motor rumble. The most interesting feature of the book from the reviewer's viewpoint is the series of photomicrographs, taken by C. E. Watts, of needles and grooves. The 200 × pictures show the effects of wear after various numbers of playings with different types of needles. They provide an excellent objective argument for using as hard a material for the tip of a pickup needle as possible."

AERIALS AND TRANSMISSION LINES

621.315.212 **1072**

Theory of the Coaxial Cable: Part 1.—F. Pollaczek. (*J. Phys. Radium*, July 1947, Vol. 8, No. 7, pp. 215–224.) By means of the ideas and methods of classical mathematical physics, making use of Green's functions, integral equations and developments in series, a rigorous theory of the coaxial cable in the periodic regime is established which is directly based on Maxwell's equations. A particular study is made of that part of the field which does not undergo exponential attenuation and which is completely neglected in the elementary theory of cables based on Kirchhoff's equations.

621.315.212 **1073**

Statistical Study of Irregularities in Coaxial Cables.—A. Sarti. (*Alta Frequenza*, Oct. 1949, Vol. 18, No. 5, pp. 195–204.)

621.392.21+621.392.26† **1074**

Impedance of Resonant Transmission Lines and Wave Guides.—W. W. Harman. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1252–1255.) Universal curves relating the *Q* value and the resonance impedance of capacitively terminated transmission-line and waveguide sections are given and discussed. Their use in the design of cavity resonators and for determining resonator shunt resistance is considered.

621.392.26† **1075**

The Excitation of a Circular Waveguide by a Ring Aerial.—A. Gaponov-Grekhov & M. Miller. (*Zh. tekh. Fiz.*, Nov. 1949, Vol. 19, No. 11, pp. 1260–1270. In Russian.)

621.392.26† **1076**

Waveguide Field Patterns in Evanescent Modes.—A. L. Cullen. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, pp. 317–322.) Field patterns in a waveguide at frequencies below cut-off are calculated, both for a single evanescent field, and for two oppositely attenuated ('incident' and 'reflected') fields. Isometric projection of the surface depicting the electric field in the guide is found to provide a useful picture of the field distribution.

621.392.26† **1077**

Application of Picard's Method of Successive Approximations to the Study of Discontinuities in Waveguides.—T. Kahan. (*C. R. Acad. Sci., Paris*, 6th Feb. 1950, Vol. 230, No. 6, pp. 527–529.) A general solution of the problem of the echo pattern in a waveguide having a slight nonuniformity. The solution is given in the form of an infinite series converging more rapidly the smaller the nonuniformity.

621.392.26† : 538.566 **1078**

On the Theory of the Propagation of Electromagnetic Waves in Tubes with Abruptly Varying Cross-Sections.—G. V. Kisun'ko. (*C. R. Acad. Sci. U.R.S.S.*, 11th Dec. 1947, Vol. 58, No. 8, pp. 1653–1656. In Russian.) A mathematical investigation of the propagation of e.m. waves, without reflection, through joints between two waveguides or through a combination of elements such as diaphragms, transformers and other similar devices.

621.392.26† : 621.315.611 **1079**

An Investigation of Dielectric Rod as Wave Guide.—C. H. Chandler. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1188–1192.) An experimental investigation indicates that the guiding effect is retained even when the rod is only a fraction of a wavelength in diameter. The greater part of the guided energy is then outside the dielectric, so that a very-low-loss waveguide results. Measurements at a wavelength of 1.25 cm indicate attenuations down to 0.004 db/m in polystyrene rod and show good agreement with theoretical predictions. A resonator using a dielectric-rod waveguide is described; this has a maximum *Q* of about 53 000.

621.392.26† : 621.315.611 **1080**

Attenuation in a Dielectric Circular Rod.—W. M. Elsasser. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1193–1196.) Analysis is given of the non-radiating modes propagated along a cylindrical dielectric rod, with discussion of dielectric loss. The attenuation for the three lowest modes in a rod of polystyrene is computed; the results agree with the values found experimentally by Chandler (1079 above).

621.392.5 : 621.392.26† **1081**

Microwave Directional Couplers.—S. Freedman. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Feb. 1950, Vol. 14, No. 2, pp. 11–13..25.) An illustrated description of various types of waveguide coupling and their use in microwave measurements.

621.396.67 **1082**

The Concept of an Angular Spectrum of Plane Waves, and its Relation to that of Polar Diagram and Aperture Distribution.—H. G. Booker & P. C. Clemmow. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 11–17.) "A critical examination is made of the somewhat loose and incomplete statement that a polar diagram is the Fourier transform of an aperture distribution. By aperture distribution it is necessary to understand, in the two-dimensional case, distribution across the aperture of the component along the aperture plane of the electromagnetic field in the plane of propagation. Furthermore, the concept of the polar diagram has to be replaced by that of an angular spectrum, except in the common case when the aperture may be considered more or less limited in width, and the field is being evaluated at a point whose distance from the aperture is large compared with the width of the aperture (and the wavelength). For example, it is convenient for some purposes to regard the problem of diffraction of a plane wave by a semi-infinite plane screen, with a straight edge, as a problem about an aperture distribution in the plane of the screen. This is a case for which the concept of a polar diagram is not in general applicable, and has to be replaced by that of an angular spectrum. The field at all points in front of a plane aperture of any distribution may be regarded as arising from an aggregate of plane waves travelling in various directions. The amplitude and phase of the waves, as a function of their direction of travel, constitutes an angular spectrum, and this angular spectrum, appropriately expressed, is, without approximation, the Fourier transform of the aperture distribution. If the aperture distribution is of such a nature that the concept of the polar diagram is applicable at sufficiently great distances, then the polar diagram is equal to the angular spectrum. But the angular spectrum is a concept that is always applicable, whereas the polar diagram is one that is liable to be invalid (for example, in the Sommerfeld theory of propagation over a plane, imperfectly reflecting earth)."

621.396.67 **1083**

Constructing Helical Antennas.—E. D. Smith. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 72–75.) Construction details are given for several helical aerials suitable for the 435-Mc/s amateur band and for citizens' radio on 465 Mc/s. A simple impedance-matching unit for coaxial-cable feeder is also described.

621.396.67 : 530.1 **1084**

Electromagnetic Similitude: General Principles and Application to the Study of the Aerial.—S. Colombo. (*Ann. Télécommun.*, Nov. 1949, Vol. 4, No. 11, pp. 370–376.)

621.396.67 : 621.397.62 **1085**

Trends in TV Receiver Antenna Design.—I. Kamen. (*TV Engng, N.Y.*, Jan. 1950, Vol. 1, No. 1, pp. 8–11.) A critical analysis, with illustrations, of eight types of aerial particularly suitable for vision and sound reception in the U.S.A.

621.396.671 **1086**

Gain of Aerial Systems.—D. A. Bell. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, p. 380.) Correction to 3057 of 1949.

621.396.671 **1087**

Impedance/Frequency Characteristics of Some Slot Aerials.—J. W. Crompton. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 39–44.) Measurements were made by the earth-plane method, using a coaxial standing-wave indicator, of the input impedance near half-wave resonance of (*a*) simple centre-fed slot aerials of various widths, (*b*) two dumb-bell slot aerials, (*c*) an end-fire slot aerial, over the frequency range 130–370 Mc/s.

621.396.677 **1088**

The Design of Metallic Delay Dielectrics.—J. Brown. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 45–48.) "A theory of metallic delay dielectrics, which is more accurate than existing ones and is based on an analogy with shunt-loaded transmission lines, has been developed for the simplest case, when the delay medium consists of an array of infinitely long conducting strips. Formulae have been obtained for the refractive index, impedance and cut-off wavelength of such a medium, and the more important results are presented graphically. A procedure for designing such dielectrics to have a desired refractive index is outlined, and some limitations in the use of metallic delay lenses are pointed out."

621.396.67 **1089**

Radio Aerials. [Book Review]—E. B. Moullin. Publishers: Oxford University Press, London, 514 pp., 50s. (*Wireless World*, Feb. 1950, Vol. 56, No. 2, p. 70.) "The first section of the book is theoretical. The Lorentz vector and scalar retarded potential functions are first established and then applied to specific problems. These include the fields due to filaments, the effect of flat-sheet and V-shaped reflectors, and problems relating to cylinders immersed in electromagnetic fields.

Some hypothetical problems are solved rigorously, usually in terms of Bessel functions, and practical problems are considered as approximations—usually very close ones—to the hypothetical cases. The power gain of typical arrays with various current distributions is calculated, and methods of suppressing the side-lobes discussed. A short section is devoted to the isolated aerial.

The remaining one-third of the book describes experimental procedure, and the results of measurements made on some of the aerials described in the first section. Results for V aerials are given in great detail, and include the radiation patterns for various V angles and sizes of sheet."

Attention is drawn to many practical design considerations, such as the permissible tolerance on reflector shape, the use of netting and rods instead of continuous sheet, and similar problems. "The treatment is mainly mathematical" and the book "will therefore appeal more to the aerial specialist or post-graduate student". It "will be found valuable not only as a book of reference on the types of aerial covered, but also for the clear and logical development of the general theory".

CIRCUITS AND CIRCUIT ELEMENTS

621.318.572 **1090**

Direct-Reading Electronic Timer.—R. R. Freas. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 554–566.) "The application of resistance-coupled multivibrators to binary and decade counter chains is described, with suggestions for improved stability. Several independent counts may be selected and registered on counter dials from one continuously operating electronic counter with the coincidence indicator circuits shown. The electronic counter may be automatically reset to zero or any advance count with the reset circuit presented." Applications to loran receivers are mentioned.

621.318.572 : 621.317.755.087 **1091**

A Beam-Switching Circuit.—R. Milne. (*Electronic Engng*, Feb. 1950, Vol. 22, No. 264, pp. 54–56.) A trigger circuit with particular application to the recording of transient effects. The beam of a c.r.o. is switched on for a single sweep of the timebase.

621.318.572 : [621.385.3 : 621.315.59 **1092**

Counter Circuits using Transistors.—E. Eberhard, R. O. Endres & R. P. Moore. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 459–476.) A flip-flop circuit using two transistors is compared with the Eccles-Jordan circuit and its use in a decade counter is described. A flip-flop circuit using a single transistor is analysed and stability limits with respect to load resistance and transistor parameters are indicated; practical component values are given for this circuit, which can be operated up to 500 kc/s. Transistor relaxation oscillators have been synchronized in a frequency divider which converts from 100 kc/s to 25 c/s and operates from a 45-V supply, from which it takes 675 mW. Present transistors are unstable with time and temperature and differ widely in characteristics and hence cannot yet be used for reliable counting.

621.392.4 **1093**

Constant-Phase-Shift Networks.—W. Saraga. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, p. 380.) Comment on 3078 of 1949 (Rowlands).

621.392.43 **1094**

Theoretical Limitations on the Broadband Matching of Arbitrary Impedances.—R. M. Fano. (*J. Franklin Inst.*, Jan. 1950, Vol. 249, No. 1, pp. 57–83.) Technical Report No. 41, Massachusetts Institute of Technology, Research Laboratory of Electronics.

621.392.43 **1095**

Impedance Matching using a Special Type of Exponential Line.—A. Niutta. (*Poste e Telecomunicazioni*, Aug. 1949, Vol. 17, No. 8, pp. 417–423.) For matching low-impedance lines to aerials with high input impedance. Formulae are derived from which the dimensions of a suitable 4-wire exponential line can be calculated. This line is inserted between half-section high-pass filters. Measurements show that the impedance remains satisfactorily uniform over the frequency range 4–24 Mc/s. A numerical example illustrates the method.

621.392.5 **1096**

The Solution of Linear-Network Problems by the Method of Nodal Equations.—M. Soldi. (*Alta Frequenza*, Oct. 1949, Vol. 18, No. 5, pp. 213–231.) The practical advantages of the method are illustrated. Suitable equivalent networks are shown for valves, transformers and, in particular, the ideal transformer.

621.392.5 **1097**

Contribution to the Theory of Networks.—M. Prudhon & P. M. Prache. (*Ann. Télécommun.*, Jan. 1948, Vol. 3, No. 1, pp. 24–30.) Relations are established between the impedances of the various branches and the coefficients of the link and nodal equations. Formulae are then derived from which the nodal equations may be simply obtained when the parts of the network are connected by mutual-impedance coupling. Simple applications of the formulae to a transformer and to a valve are given.

621.392.5.018.1 : 621.396.615 **1098**

The Effect of Valve Impedance on Phase-Shift Oscillators.—R. Townsend. (*Electronic Engng*, March 1950, Vol. 22, No. 265, pp. 116–117.) Comment on 840 of April. Curves are given for the frequency and attenuation constants in 3-section and 4-section RC networks and also CR networks.

621.392.52 **1099**

Dissipative Band-Pass Filters.—F. Juster. (*Radio prof., Paris*, Jan. 1950, Vol. 19, No. 180, pp. 28–30.) Formulae are given for practical application of the methods of design given by Dishal (3369 of 1949).

621.392.52 **1100**

Filters: Part 2.—"Cathode Ray". (*Wireless World*, Feb. 1950, Vol. 56, No. 2, pp. 61–65.) Discussion of the properties of filters, using the simplest possible mathematics. Part 1: 578 of March.

621.392.53 : 621.3.015.3 **1101**

The Exact Solution for Transient Distortion in Networks.—D. C. Espley. (*Electronic Engng*, March 1950, Vol. 22, No. 265, pp. 82–87.) Paper presented at the 1948 Television Congress, Paris. Summary noted in 652 of 1949. A rigorous and systematic method of distortion correction in electrical networks. The distorting system is represented by a hypothetical simulating network defined entirely in terms of input and output waveforms. The input waveform is considered as a pulse with an energy content appropriate to the expected frequency range of the transmission path, and the output waveform as the desired signal appearing after the nominal propagation time and followed by a finite series of echoes defined by amplitude, time and sign. The correction network is derived by inversion from the distortion simulating network and the passage of the distorted output current through it will produce across its terminals a voltage of the original undistorted form.

621.396.611.1.015.3 : 621.3.012 **1102**

Detuned Resonant Circuits.—H. Elger. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 360–364.) A method of calculating or graphically tracing the transients in such circuits is shown in connection with a simple memory rule. The application of the method to similar mechanical and supersonic problems is considered. The real response of resonant circuits when using p.m. or any other kind of shock excitation (such as static), the change of time constant due to detuning, and the signal/noise ratio are considered.

621.396.611.3 : 517.2/.3 **1103**

Time-Constant Selection in the Application of RC Differentiating and Integrating Circuits.—R. J. Jeffries. (*Instruments*, Dec. 1949, Vol. 22, No. 12, p. 1106.) The performance of the basic circuit for both operations is presented graphically in terms of M (the product of R in ohms, C in farads and f in c/s) and the phase characteristic. The useful operating ranges of the circuit are found for values of M less than about 0.01 for differentiation and greater than about 3.0 for integration. Numerical examples are given.

621.396.611.4 **1104**

On the Characteristics of Electromagnetic Resonant Cavities formed by Two Concentric Spheres.—J. Broc. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, pp. 198–199.) For resonance on a fixed wavelength in the magnetic mode, the outer radius (R_2) of such a cavity is greater than that of a completely hollow sphere resonant on the same wavelength, and as the ratio $s(=R_1/R_2)$ approaches unity, $R_2 \to \infty$. For the electric mode, R_2 is less than the radius of the equivalent hollow sphere and approaches a finite limit, not zero, as the ratio s tends to unity. Calculated values of R_2 and Q for λ 10 cm are tabulated for values of s ranging from 0 to 1.

621.396.611.4 **1105**

On the Variation of the Natural Frequency of Cavity Resonators formed by Concentric Spheres, for Small Displacements of the Inner Sphere.—J. Broc. (*C. R. Acad. Sci., Paris*, 16th Jan. 1950, Vol. 230, No. 3, pp. 285–286.) For the H_{110} mode, a displacement e produces a reduction Δf of the natural frequency f_0 such that $\Delta f/f_0 = -2(e/R_2)^2/(1-s^2)^2$, where $s = R_1/R_2$ and R_1 and R_2 are the radii of the inner and outer spheres respectively. For larger displacements (e/R_2 0.01) the approximations used in the derivation of this expression do not hold. See also 1104 above.

621.396.615 **1106**

Operating Conditions for Cathode-Coupled Flip-Flops.—D. W. Thomasson: J. D. Storer. (*J. Brit. Instn Radio Engrs*, Jan. 1950, Vol. 10, No. 1, pp. 12–14.) Comment of 3083 of 1949 (Storer) and Storer's reply. The conditions for oscillation and the effects of using different component values are discussed.

621.396.615 : 621.396.611.21 **1107**

A High-Stability Quartz Oscillator.—M. Indjoudjian. (*Onde élect.*, Feb. 1950, Vol. 29, No. 275, pp. 76–78.) The oscillator is basically a 2-stage amplifier with negative feedback. A Y-cut 100-kc/s crystal vibrating longitudinally couples the anode circuit of the second valve to the grid of the first valve. In this grid circuit is a thermistor indirectly heated by the feedback current from the output transformer secondary; its resistance varies in value from 50 kΩ when cold to 500 Ω during normal working. Variations of oscillation amplitude and of supply voltages produce negligible phase change. The short-period stability during a year's test was $< \pm 0.5 \times 10^{-7}$ and the monthly drift of the order of 1×10^{-7}. The tests included deliberate valve changing and stoppages. The method of frequency checking is described.

621.396.615.14 : 621.385.18 **1108**

Plasma Oscillator.—G. Wehner. (*J. appl. Phys.*, Jan. 1950, Vol. 21, No. 1, pp. 62–63.) R.f. oscillations are found to occur in low-pressure arc-discharge tubes in which a repeller electrode is inserted in the electron beam between the grid and anode. The resonant circuits are formed by thin oscillation layers inside the plasma. The oscillations are of well-defined frequency, tunable between 1 kMc/s and 4 kMc/s by changing the anode voltage and current. They occur in different modes; a relation is given between beam velocity, frequency and mode number for a typical tube construction.

621.396.615.14.029.63 **1109**

New U.H.F. Oscillator.—D. H. Preist. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 120 . . 162.) Advantages claimed for this circuit, which largely resembles a grounded-grid amplifier, are that a wide range of adjustment of phase and amplitude of the feedback is available, adjustments are simple to make, and power-handling capacity is high. Satisfactory results are obtained at frequencies from below 100 Mc/s to over 2 kMc/s at power levels up to many kilowatts.

621.396.615.17 **1110**

Asymmetrical Multivibrators.—R. Feinberg. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, pp. 325–330.) "The frequency and the waveform of oscillation of an asymmetrical multivibrator with pentodes can be computed with the help of simple formulae provided the circuit is so designed that one of the two anode voltages is of rectangular or near-rectangular shape when the multivibrator is in the steady state of operation. The waveform of the other anode voltage may be rectangular or triangular and may be varied within a fairly wide range without interfering with the frequency of oscillation. The frequency of oscillation may be altered without disturbing the waveform by changing the capacitance values but keeping their ratio constant. Predicted frequencies and waveforms are verified by experiment."

621.396.615.17 **1111**

The Miller Circuit as a Low-Speed Precision Integrator.—I. A. D. Lewis. (*Electronic Engng*, Feb. 1950, Vol. 22, No. 264, pp. 66–68.) Errors caused by drifts, by nonlinearity in time (assuming all the circuit elements to be linear) and by the operation of resetting between cycles of integration, are considered in some detail. The analysis includes the effects of stray capacitance in the circuit and is, therefore, also applicable to high-speed integrators.

621.396.615.17 : 621.317.755 **1112**

A Self-Adjusting Time-Base Circuit.—H. Asher. (*Electronic Engng*, Feb. 1950, Vol. 22, No. 264, pp. 61–65.) A type of timebase in which the only frequency control is a range switch which selects one of three wide frequency ranges. Inside these ranges, the frequency of the timebase will be rigidly locked to that of the signal, and at the same time the amplitude of the timebase sweep voltage will remain constant.

621.396.615.18.029.64 **1113**

Microwave Frequency Dividers.—H. Lyons. (*J. appl. Phys.*, Jan. 1950, Vol. 21, No. 1, pp. 59–60.) Methods of division for frequencies up to 20 kMc/s or more are of importance for applications such as atomic clocks. A regenerative-modulator type of circuit dividing from 9.3 kMc/s to 3.1 kMc/s is described; tests show that the output is one-third of the input frequency to an accuracy within one part in 10^{10}. This circuit uses klystron multiplier and amplifiers, and the amplifiers are needed to work only at the output frequency and not at the higher input frequency. A modified circuit is proposed in which the regenerative-modulator divider is provided with a second regenerative channel and thus provides its own input. A suggested arrangement for an atomic oscillator and clock is described. Suitable equipment for this method, using the ammonia line at 24 kMc/s, is being investigated, but alternatively a convenient line at about 9 kMc/s could be used.

621.396.645 **1114**

Stagger-Tuned Low-Pass Amplifiers.—W. E. Thomson. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 357–359.) The method of design of band-pass amplifiers by stagger-tuning, in its wider sense, may be simply extended to low-pass amplifiers to specify the frequency response. The determination of networks with the desired frequency response presents a fresh problem. Suitable networks are given for a multistage low-pass amplifier with a gain, as a voltage ratio, of $g_m/\omega_0 C$ per stage, a bandwidth of $\omega_0/2\pi$ c/s, or slightly more, and a reasonably flat pass-band; g_m is the mutual conductance of the valves used, ω_0 the nominal bandwidth and C the interstage capacitance.

621.396.645 **1115**

The Cathode-Follower Output Stage.—R. M. Mitchell. (*Audio Engng, N.Y.*, Feb. 1950, Vol. 34, No. 2, pp. 12–13..32.) Advantages and disadvantages are discussed.

621.396.645 **1116**

On the Input and Output Admittances of Amplifiers.—L. Vallese. (*Alta Frequenza*, Oct. 1949, Vol. 18, No. 5, pp. 205–212.) The input and output admittances of linear amplifiers can be represented by means of networks consisting of the passive quadripole equivalent circuit with the addition of appropriate series or parallel elements the admittances of which are functions of the amplification factor. The consideration of such networks gives a clear picture of the working of the amplifier.

621.396.645 : 534.85 **1117**

Phonograph Reproduction: Part 1.—C. G. McProud. (*Audio Engng, N.Y.*, Feb. 1950, Vol. 34, No. 2, pp. 24..31.) Discussion of the design of a control unit for use with the musician's amplifier (70 of January). Needle scratch is effectively reduced.

621.396.645.029.3 **1118**

Push-Pull A.F. Amplifiers.—K. R. Sturley. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, pp. 338–343.) "Problems of the position of the composite load line and the construction of the valve load curves for classes A, B and C audio-frequency push-pull amplifiers are discussed and it is shown that B. J. Thompson's original work on class-B amplifiers with matched valves can be extended to cover all classes of push-pull amplification under matched or unmatched conditions. Deductions regarding composite and valve-load curves as a result of voltage and current measurements are confirmed by photographs of valve-load curves obtained on the screen of a cathode-ray tube."

621.396.645.029.3 **1119**

Study of a High-Quality Voltage Amplifier.—J. Mey. (*Ann. Télécommun.*, Nov. 1949, Vol. 4, No. 11, pp. 383–384.) Description of a 5-stage audio amplifier, with circuit diagram and performance figures. It has low distortion and background noise, high and linear gain, and satisfactory stability with normal supply-voltage variations.

621.396.645.029.4/.52 : 621.396.822 **1120**

Selective Amplification at Low Frequencies.—L. de Queiroz Orsini. (*Onde élect.*, Feb. 1950, Vol. 29, No. 275, pp. 91–102.) For parts 1 and 2 see 596 of March. Part 3 describes the apparatus, method and results of measurement of flicker effect. The following conclusions are drawn: (*a*) the current due to shot effect in saturated diodes is well represented by Macfarlane's equation (4087 of 1947); (*b*) at l.f. tungsten filaments are much better than oxide-coated filaments; (*c*) the presence of space charge does not affect the spectral distribution of noise; (*d*) the equivalent resistance of the l.f. noise in triodes and the noise voltage at the grid are given by simple formulae and can be calculated approximately from the values given for certain parameters.

621.396.645.35 **1121**

A D.C. Amplifier using an Electrometer Valve.—D. H. Peirson. (*Electronic Engng*, Feb. 1950, Vol. 22, No. 264, pp. 48–53.) Description, with circuit details, of a balanced d.c. amplifier of the bridge type in which the controls are reduced to the minimum required for zero-balancing by use of a highly stable power pack. Under these conditions external temperature variation exerts a limiting effect upon amplifier stability. The effect is minimized by using a new indirectly-heated double electrometer valve, Type DBM8A, which has a temperature coefficient not greater than 0.2 mV/°C, a grid current of about 3×10^{-15} A and grid insulation, when carefully cleaned, $> 10^{16}\,\Omega$.

621.396.645.3 : 621.317.39 **1122**

A D.C. Amplifier with Cross-Coupled Input.—J. N. Van Scoyoc & G. F. Warnke. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 104–107.) A compact unit with cross-coupled input stage for use with either single-ended or push-pull circuits. Two amplification stages, with a cathode-follower output and feedback amplifier, provide an output of 310 V peak-to-peak to feed a c.r. tube. Gain is variable in 20 steps of 2 db from a maximum of

50 000. Input impedance is 100 MΩ and frequency response extends from zero to 60 kc/s. A preamplifier has a maximum usable gain of about 250 000.

621.396.645.371 **1123**

Negative-Feedback Amplifiers.—C. F. Brockelsby. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, p. 380.) Reply to comment by McLeod (3111 of 1949) on 2768 of 1949.

621.396.69 **1124**

New Radio Components in the World Market.—M. Alixant. (*Radio tech. Dig., Édn franç.*, Feb. 1950, Vol. 4, No. 1, pp. 3–41.) New edition of 2770 of 1949 and including, in addition, resistors, potentiometers, RC subassemblies, and materials. Most of the novelties brought out since the last Paris Salon de la Pièce détachée are noted.

GENERAL PHYSICS

530 081 + 621.3.081 **1125**

The Introduction of the Giorgi System of Units.—H. König, M. Krondl & M. Landolt. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1949, Vol. 27, No. 6, pp. 257–278. In French and German.) A general discussion of the system and its practical application. Tables are included giving the corresponding values of all the principal electrical quantities in the c.g.s. e.m. and e.s. systems and in the Giorgi system, with conversion factors.

530.1 : 621.396.67 **1126**

Electromagnetic Similitude: General Principles and Application to the Study of the Aerial.—S. Colombo. (*Ann. Télécommun.*, Nov. 1949, Vol. 4, No. 11, pp. 370–376.)

537.212 **1127**

Effect of an Arbitrary Field on a Sphere or on a Circular Cylinder.—E. Durand. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, pp. 188–190.) A solution of the Laplace equation which is constant over the conductor. Analogous solutions for a dielectric sphere or cylinder are obtained.

537.533 **1128**

Production and Application of Directional Electron Beams.—A. A. Rusterholz. (*Bull. schweiz. elektrotech. Ver.*, 4th Feb. 1950, Vol. 41, No. 3, pp. 65–77. In German, with French summary.) The development of high-power electron guns is principally a question of design. The efficiency of such systems is limited by certain factors, of which the effect of space charge is of major importance. Approximate methods of investigating the effect of these factors are examined. The best solution of the problem at present appears to be that proposed by Pierce (1419 and 4275 of 1940), which greatly simplifies calculation. As an example, the design of the electron injector for a betatron is considered.

538.114 **1129**

Physical Theory of Ferromagnetic Domains.—C. Kittel. (*Rev. mod. Phys.*, Oct. 1949, Vol. 21, No. 4, pp. 541–583.) Survey of domain theory and of the crucial experiments relating to it. The interpretation of coercive force, reversible permeability, hysteresis and the Barkhausen effect is outlined in terms of domains. The theoretical analysis of domain energy is discussed and expressions are given for the exchange, magnetocrystalline, magnetoelastic and magnetostatic energy components. The properties of the Bloch wall, across which the spin direction in adjacent domains reverses, are reviewed. Various domain structures are considered theoretically and compared with experimental data derived from magnetic powder pattern technique in which a thin liquid layer containing a colloidal suspension of a fine ferromagnetic powder is applied to the surface of the sample. The single domain behaviour of small particles is described; the dependence of initial permeability and coercive force on nonuniformities of the material is outlined.

538.566 **1130**

The Symmetrical Excitation of an Infinitely Long Dielectric Cylinder.—B. Z. Katsenelenbaum. (*Zh. tekh. Fiz.*, Oct. 1949, Vol. 19, No. 10, pp. 1168–1181. In Russian.) A mathematical investigation of the e.m. oscillations due to excitation of the cylinder by an elementary dipole mounted on the axis.

538.566 **1131**

The Asymmetrical Oscillations of an Infinitely Long Dielectric Cylinder.—B. Z. Katsenelenbaum. (*Zh. tekh. Fiz.*, Oct. 1949, Vol. 19, No. 10, pp. 1182–1191. In Russian.) A mathematical investigation of free and forced e.m. oscillations due to excitation by an elementary dipole.

538.566 **1132**

On the Focusing of a Wave.—J. Ortusi & J. C. Simon. (*C. R. Acad. Sci., Paris*, 6th Feb. 1950, Vol. 230, No. 6, pp. 521–523.) The conditions under which focusing occurs are discussed. The focusing obtained by phase displacement at surfaces with circular holes is contrasted with optical focusing by means of lenses. Experiments with 8-cm waves are briefly described.

539 **1133**

On the Asymptotic Distribution of Eigenvalues.—J. S. de Wet & F. Mandl. (*Proc. roy. Soc. A*, 22nd Feb. 1950, Vol. 200, No. 1063, pp. 572–580.) Application of the methods of Courant & Hilbert leads very simply to a proof that the asymptotic distribution of the eigenvalues of the one-dimensional Schrödinger equation is given by the W.K.B. formula. Analogous formulae are also found for the 2- and 3-dimensional equations.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.7 **1134**

A Tentative Model of the Sun.—R. H. Woodward. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 387–396.)

523.72 **1135**

Investigations of Solar Radiation by the Brazil Expedition of the Academy of Sciences of the U.S.S.R. for Observing the Solar Eclipse of 20th May 1947.—S. E. Khaykin & B. M. Chikhachev. (*C. R. Acad. Sci. U.R.S.S.*, 21st Dec. 1947, Vol. 58, No. 9, pp. 1923–1926. In Russian.) A report on observations made in a ship off the Brazilian coast. The results are plotted and discussed; they show (*a*) that the minimum r.f. radiation intensity of the eclipsed sun is about 40% of that when the sun is not eclipsed, (*b*) that the variation of the intensity is displaced with regard to the geometrical eclipse. It is concluded that the observed r.f. radiation is generated in the upper layers of the sun's atmosphere not covered by the moon's shadow, and that the radiation intensity is not uniformly distributed over the surface of the radiating sphere.

523.72 : 621.396.81 **1136**

Solar Noise and Ionospheric Fading.—Smith-Rose. (*See* 1228.)

523.746 **1137**

On the Mathematical Characteristics of Sunspot-Variations.—A. F. Cook. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 347–354.) New relations among the monthly relative numbers and their maxima and minima are applied to Stewart & Panofsky's formula to compute a new family of curves. See also 3454 of 1939 (Stewart & Eggleston).

523.746"1949.07/.09" **1138**
Provisional Sunspot-Numbers for July to September, 1949.—M. Waldmeier. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, p. 398.)

538.12 : 521.15 **1139**
The Fundamental Relation between the Magnetic Moment and the Structure of Rotating Celestial Bodies.—H. P. Berlage. (*Nature, Lond.*, 11th Feb. 1950, Vol. 165, No. 4189, pp. 242–243.) Simple derivation of Blackett's formula, assuming that celestial bodies possess a nucleus from which free electrons migrate into the outer shell more easily than positive ions.

550.38"1949.04/.06" **1140**
International Data on Magnetic Disturbances, Second Quarter, 1949.—J. Bartels & J. Veldkamp. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 399–400.)

550.38 "1949.07/.09" **1141**
Cheltenham [Maryland] **Three-Hour Range Indices *K* for July to September, 1949.**—R. R. Bodle. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, p. 398.)

550.384 **1142**
Sudden Commencements in Geomagnetism: their Dependence on Local Time and Geomagnetic Longitude.—V. C. A. Ferraro & W. C. Parkinson. (*Nature, Lond.*, 11th Feb. 1950, Vol. 165, No. 4189, pp. 243–244.) Preliminary analysis of data from six observatories.

550.385"1949.04/.09" **1143**
Principal Magnetic Storms [April–Sept. 1949].—(*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 401–402.)

551.508.1 : 551.594.11 **1144**
A Radiosonde Method for Potential-Gradient Measurements in the Atmosphere.—Kreielsheimer. (*See* 1204.)

551.510.535 **1145**
Ionosphere Review: 1949.—T. W. Bennington. (*Wireless World*, Feb. 1950, Vol. 56, No. 2, pp. 53–56.) Sunspot cycle and s.w. propagation survey, with forecast for 1950.

551.510.535 **1146**
The Problem of the Ionospheric Regions.—M. Nicolet. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 373–381. In French, with English summary.) The dissociation and ionization processes in the upper atmosphere due to solar radiation are discussed. Assumptions are made as to the scale height and molecular density at different heights and the most likely processes assigned to each layer. Molecular and atomic oxygen are the main sources of ions in the E and F_1 regions respectively. In the F_2 region atomic nitrogen and oxygen are both important and their relative concentrations are deduced. The conditions under which molecular nitrogen is important are discussed.

551.510.535 **1147**
On Investigations of the F_2 Layer of the Ionosphere during the Total Solar Eclipse of 20th May, 1947.—Ya.L.Al'pert. (*C. R. Acad. Sci. U.R.S.S.*, 21st Dec. 1947, Vol. 58, No. 9, pp. 1919–1922. In Russian.) Using pulse equipment previously described (2003 of 1947), observations of the F_2 layer of the ionosphere were carried out in Brazil from 17th to 24th May inclusive. Measurements of the effective height of the layer were made at a frequency of 9.5 Mc/s. In addition, measurements were made at various times at frequencies from 5 to 15 Mc/s. The results obtained are plotted and discussed. One of the conclusions reached is that in addition to variations in the ionization, a considerable expansion of the layer took place during the eclipse. It is considered that measurements of critical frequencies only are not sufficient for studying the properties of the layer. See also 2893 of 1946.

551.510.535 **1148**
Nocturnal Ionization in the F_2 Ionospheric Region.—N. C. Gerson. (*Rev. mod. Phys.*, Oct. 1949, Vol. 21, No. 4, pp. 606–624.) The structure and composition of the earth's atmosphere to a height of 300 km are reviewed and also the photochemical and photoionization processes which occur in sunlight. Whereas the Chapman model accounts well for the E region and roughly for the F_1 region, it is not relevant to the F_2 region. A study of the various oxygen and nitrogen reactions shows that the F_2 region should dissipate during darkness at a greater rate than is observed; consideration is given to possible non-solar sources of ionization and of these only meteoric bombardment is likely to be significant. Examination of the vertical, horizontal and turbulent transportation of ions suggests that these may be important in maintaining the nocturnal ion concentration in the F_2 layer.

551.510.535 **1149**
The Distribution of Atomic and Molecular Oxygen in the Upper Atmosphere.—R. Penndorf. (*Phys. Rev.*, 15th Feb. 1950, Vol. 77, No. 4, pp. 561–562.)

551.510.535 **1150**
Electron Diffusion in the Ionosphere.—R. Seeliger. (*Ann. Phys., Lpz.*, 1st Aug. 1948, Vol. 3, pp. 297–304.) Discussion of ionosphere structure and the layer theory. The lack of sufficient reliable observations prevents definite conclusions being drawn.

551.510.535 **1151**
Stratification of the F_2-Layer of the Ionosphere over Singapore.—Hon Yung Sen. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 363–366.) Measurements during January and February, 1946, indicated that the F_2 layer was daily stratified into three discrete layers during the daylight hours. Typical daytime h'/f and diurnal-variation curves are reproduced.

551.510.535 **1152**
Analysis of Virtual-Height/Frequency Records.—U. C. Guha. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 355–362.) For a Chapman layer an approximate expression is derived for virtual height h' at frequency f as a function of f/f_c, where f_c is the critical frequency. The fit is very close both for the theoretical Chapman distribution and also for experimental h'/f curves for the F_2 region with and without a retarding E region. The extension to non-Chapman distributions is discussed.

551.510.535 : 551.506.2 **1153**
Ionosphere and Weather.—E. Gherzi. (*Nature, Lond.*, 7th Jan. 1950, Vol. 165, No. 4184, p. 38.) Discussion of weather forecasting based on a correlation, as yet unexplained, between the usual ionosphere echoes and the movement of polar, maritime and equatorial air masses. See also 2771 of 1947.

551.510.535 : 621.396.11 **1154**
Calculation of the Absorption Decrement for a Parabolic Ionospheric Layer in the case of Oblique Incidence.—É. Argence & K. Rawer. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 69–70.) A treatment of the problem by geometrical optics to derive a final expression for the case of reflection. See also 627 of March.

551.510.535 : 621.396.11 **1155**
Manifestations of the Sporadic-E Layer on Metre Waves in 1949, and Observation of a Concomitant Noise.—Revirieux. (*See* 1222.)

551.510.535 : 621.396.11 **1156**
Sporadic Ionization at High Latitudes.—J. H. Meek. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 339–345.) See 725 of March.

551.510.535 : 621.396.11 1157
Effect of the D-Ionospheric Layer on Very Low Frequency Radio Waves.—W. Pfister. (*J. geophys. Res.* Dec. 1949, Vol. 54, No. 4, pp. 315–337.) See 723 of March.

551.510.535 : 621.396.812.3 1158
The Analysis of Observations on Spaced Receivers of the Fading of Radio Signals.—Briggs, Phillips & Shinn. (*See* 1233.)

LOCATION AND AIDS TO NAVIGATION

621.396.93 1159
Rotating Aerial for an Automatic Radiogoniometer.—P. Bodez. (*Ann. Télécommun.*, Oct. 1949, Vol. 4, No. 10, pp. 341–346.) Theory and principle of operation of a system comprising three vertical $\lambda/4$ dipoles asymmetrically spaced at the corners of a horizontal triangle and turning together on a vertical axis. A field-strength pattern with a single sharp minimum is obtained. An experimental model operating on 120 Mc/s gave satisfactory results. Sensitivity is about the same as with Adcock systems.

621.396.932.1 : 2 1160
A New Direct-Reading Loran Indicator for Marine Service.—F. E. Spaulding, Jr, & R. L. Rod. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 567–585.) The pulse rate of the receiver-indicator is automatically controlled by means of a pulse-phase discriminator and a reactance valve which correct the frequency of the receiver's 100-kc/s crystal oscillator. Frequency division from 100 kc/s is performed by binary and decade counters using double-triode trigger circuits (see 1090 above); any one of 24 station pulse rates may be selected. After matching the pulses on the screen of a 3-in. c.r. tube, time-difference readings are directly displayed on a five-digit dial. An extra sweep is available for self-checking the performance and accuracy; the error due to signals differing in amplitude by as much as 1000 : 1, with 10-V maximum peak signal, does not exceed 0.5 μs.

621.396.933 1161
Electronic Aids to Air Navigation.—A. A. McK. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 66–71.) Elementary and brief accounts of the principal features of various navigation aids now in use or about to be used in U.S. civil aircraft. These include compass systems, direction finders, radio ranges, distance measuring equipment, approach and landing equipment, and markers.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 1162
On the Kinetics of the Luminescence of Sulphide Phosphors with Several Activators.—M. Schön. (*Ann. Phys., Lpz.*, 1st Aug. 1948, Vol. 3, pp. 333–342.)

535.37 1163
Note on the Width of the Emission Bands of Sulphide Phosphors.—M. Schön. (*Ann. Phys., Lpz.*, 1st Aug. 1948, Vol. 3, pp. 343–344.)

535.37 1164
Effect of Temperature on the Extinction of the Luminescence of Sulphides by Electric Fields.—J. Mattler. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 76–77.)

537.58 : 539.234 1165
Thermionic Emission of Thin Films of Alkaline Earth Oxide Deposited by Evaporation.—G. E. Moore & H. W. Allison. (*Phys. Rev.*, 15th Jan. 1950, Vol. 77, No. 2, pp. 246–257.) Monomolecular films of BaO and SrO on tungsten and molybdenum surfaces are shown to give thermionic emissions of the same magnitude as commercial oxide-coated cathodes. The effect is qualitatively explained by considering the adsorbed molecules as oriented dipoles, and the theory is compared with the semiconductor theory for bulk oxide coatings. Full experimental details are given.

538.221 1166
Saturation Magnetization of Certain Ferrites.—L. Néel. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, pp. 190–192.) A study of the different affinities of the divalent M ion in ferrites of the type Fe_2O_3MO, from consideration of the energy expended in movement of the M ion from an octahedric to a tetrahedric position. A formula for the magnetic moment at saturation at absolute zero of the Fe_2O_3MO molecule gives results in good agreement with experiment for ferrites in which M is replaced by Mn, Fe, Co, Ni, Cu or Zn. See also 3159 of 1949.

538.221 1167
Spontaneous Magnetization of Ferromagnetic Ferrites of Spinel Structure.—E. W. Gorter. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, pp. 192–194.) Experimental results which verify Néel's theory (1166 above).

538.221 1168
Magnetization Curves and Energies, Coercive Field and Magnetostriction of a Ferrite of Cobalt [vectolite].—C. Guillaud, R. Vautier & S. Medvedieff. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 60–62.)

538.221 1169
On the Decrease of the Thermo-Remanent and Isothermally-Remanent Magnetizations of Fired Earths by Reheating at Successively Higher Temperatures.—J. Roquet. (*C. R. Acad. Sci., Paris*, 16th Jan. 1950, Vol. 230, No. 3, pp. 282–285.) See also 902 of April.

538.221 1170
The Molecular-Field Coefficients for Mixed Ferrites of Nickel and Zinc.—L. Néel & P. Brochet. (*C. R. Acad. Sci., Paris*, 16th Jan. 1950, Vol. 230, No. 3, pp. 280–282.)

538.221 1171
Saturation Magnetization of Mixed Ferrites of Nickel and Zinc.—L. Néel. (*C. R. Acad. Sci., Paris*, 23rd Jan. 1950, Vol. 230, No. 4, pp. 375–377.) Some experimental results are interpreted satisfactorily by the author's theory (1166 above and 3159 of 1949).

538.221 : 621.318.323.2.042.15 1172
Effective Permeability and Q Factor of Magnetic Powders.—A. Colombani. (*C. R. Acad. Sci., Paris*, 6th Feb. 1950, Vol. 230, No. 6, pp. 523–525.) A derivation of general formulae.

538.221.029.64 1173
The Properties of Ferromagnetic Compounds at Centimetre Wavelengths.—J. B. Birks. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 65–74.) Measurements of the magnetic and dielectric properties of γ-Fe_2O_3, Fe_3O_4, Mn/Zn and Ni/Zn ferrites at wavelengths in the range 60–1.23 cm are described and discussed.

538.222 1174
Magnetic Properties of Palladium Alloys.—J. Wucher. (*C. R. Acad. Sci., Paris*, 14th Dec. 1949, Vol. 229, No. 24, pp. 1309–1310.) Results of measurements of the paramagnetism of alloys of Pd with Cu, Ag, Au, Al, Sn, Pb and Al, and comparison with results for Ni alloys.

539.23 : 537.311.1 **1175**

The Resistivity of Thin Metallic Films.—R. A. Weale. (*Proc. phys. Soc.*, 1st Feb. 1949, Vol. 62, No. 350A, pp. 135–136.) A formula is derived for the effective temperature coefficient (α) of resistance of thin films; this shows that α is zero for a particular thickness of any given material and that it should be negative for smaller thicknesses. It is to be expected that α will be negative for comparatively thick films of Bi, in which metal the mean free path of the electrons is exceptionally long. The results of van Itterbeek & de Greve on Ni films (3305 of 1946) are in good agreement with the formula given.

546.287 : 621.315.61 **1176**

Silicones: Composition; Properties; Applications.—O. Regert-Monod & P. Seguin. (*Ann. Télécommun.*, Dec. 1949, Vol. 4, No. 12, pp. 431–440.) A comprehensive study of commercial silicones.

546.821 : [537.533 + 621.3.011.2 **1177**

The Physical Properties of Titanium: Part 1 — Emissivity and Resistivity of the Commercial Metal.—W. C. Michels & S. Wilford. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1223–1226.)

549.514.51 : 621.924 **1178**

Mechanical Production of Very Thin Oscillator Plates.—L. T. Sogn & W. J. Howard. (*Bur. Stand. J. Res.*, Nov. 1949, Vol. 43, No. 5, pp. 459–464.) The thickness at which the crystal carrier stretches or buckles is the limiting factor in conventional apparatus. To produce quartz oscillator plates thinner than 0.005 in. (i.e. for operation above 14 and 20 Mc/s for AT and BT cuts respectively) the usual lapping methods and machinery have been modified by replacing the conventional top lapping plate and changing the crystal carrier correspondingly. The development of different methods is traced from the simple pressure-block method to the more elaborate forms using automatic truing. The improved equipment is capable of producing quartz crystals 0.001 in. thick, and equally thin wafers of other materials. For a shorter account see *Radio & Televis. News, Radio-Electronic Engng Supplement*, Feb. 1950, Vol. 14, No. 2, pp. 7, 30.

620.197 : 621.314.2 **1179**

Some Mechanical Aspects of Hermetically Sealed Transformer Technique.—C. Evans. (*J. Brit. Instn Radio Engrs*, Jan. 1950, Vol. 10, No. 1, pp. 20–36.) A discussion of the problems of sealing oil-filled and air-filled transformers, and of practical methods recently used.

621.319.4 : 620.197.119 **1180**

Hermetic Sealing of Capacitors.—P. R. Coursey. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 56–64.) A review of the development of modern types of terminal insulation.

669.15.26 : 666.1.037.5 : 621.385.832 **1181**

The Evaluation of Chromium-Iron Alloys for Metal Kinescope Cones.—A. S. Rose & J. C. Turnbull. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 593–599.) Description of tests to determine the suitability of Cr Fe alloys for sealing to the glasses used in the production of c.r. tubes with metal cones.

MATHEMATICS

517.432.1 **1182**

Justification of Heaviside Methods.—J. J. Smith & P. L. Alger. (*Elect. Engng, N.Y.*, Feb. 1950, Vol. 69, No. 2, p. 116.) Summary of A.I.E.E. 1949 Summer Meeting paper. The Schwartz method of representing a discontinuous function as a distribution in mass-space gives equations exactly parallel to those obtained by use of Heaviside's method.

681.142 **1183**

Static Magnetic Storage and Delay Line.—An Wang & Way Dong Woo. (*J. appl. Phys.*, Jan. 1950, Vol. 21, No. 1, pp. 49–54.) "Magnetic cores with a rectangular hysteresis loop are used in a storage system which requires no mechanical motion and is permanent. The binary digit '1' is stored as a positive residual flux, and the binary digit '0' as a residual flux in the opposite direction. When a negative probing field is applied to the core, a large voltage is induced in another winding if the digit stored has been a '1', and very small voltage if it has been a '0'. The induced voltage in the former case is large enough to magnetize another core of identical construction. Binary digits can thus be transferred from one core into another. Many cores are arranged in tandem to form an information delay line. Binary digits can be advanced along the line step by step. The present upper limit of the speed of propagation is about 35 000 digits per second, and there is no lower limit."

681.142 **1184**

Use of the Relay Digital Computer.—E. G. Andrews & H. W. Bode. (*Elect. Engng, N.Y.*, Feb. 1950, Vol. 69, No. 2, pp. 158–163.) The machine whose use is described is the Bell Telephone Laboratories Model V computer. Control is by perforations on teletype tapes. Illustrative applications include binomial expansions in probability theory, and the solution of ordinary and partial differential equations. A simple example of coding is given. For efficient operation, problems should be repetitive.

MEASUREMENTS AND TEST GEAR

531.76 **1185**

On the Use of Crystal Controlled Synchronous Motors for the Accurate Measurement of Time.—V. E. Hollinsworth. (*Canad. J. Res.*, Dec. 1949, Vol. 27, Sec. F, No. 12, pp. 470–478.) An illustrated description of an electronic frequency converter which uses a 1 kc/s supply controlled by the 50-kc/s quartz frequency standard of the Dominion Observatory to derive sufficient power for operating several standard 60-c/s motors. These are used for driving drum chronographs and other recorders. Circuit diagrams are given of the 100-c/s and the 10-c/s frequency dividers, the 60-c/s frequency multiplier, the 60-c/s power amplifier and the supply unit.

621.317.2.089.6 **1186**

A Royal Air Force Calibration Centre.—W. H. Ward and the Staff of the Measurements Division, T.R.E. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 49–55.) Discussion of the general principles governing the planning of a centre for maintaining the calibration of R.A.F. radio and radar test equipment, and some details of the methods and apparatus used.

621.317.3.029.5/.6 **1187**

Measurements at Radio Frequencies.—G. A. Day. (*Aust. J. Instrum. Tech.*, Sept. 1949, Vol. 5, No. 5, pp. 190–210.) Outline of r.f. methods used for the measurement of various electrical quantities.

621.317.73.029.62/.63 **1188**

Discontinuities in Concentric-Line Impedance-Measuring Apparatus.—M. H. Oliver. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 29–38.) Three methods of investigating such discontinuities are described: (*a*) the narrow-band frequency-variation method; (*b*) the wide-band frequency-variation method; (*c*) the reactance-variation method. The last method has certain advantages. The effect of discontinuities on the measurement of resistance and reactance, of conductance and susceptance, and of cable characteristics, is discussed and practical measurement techniques are suggested.

621.317.733.083.4 **1189**

Differential-Amplifier Null Detector.—M. Conrad. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 96–97.) The advantages of this instrument are reduction in weight and cost, very high input impedance, guarded shielding, and adaptability to very low frequencies where transformers are not advantageous. On the other hand, it requires balancing and in general it is more complex than a transformer. When used as a null-detector for an equal-arm a.c. resistance bridge, the instrument will detect an unbalance of less than 0.1%, and the discrimination against common-mode signals is greater than 70 db.

621.317.77 **1190**

An Improved Audio-Frequency Phase Meter.—O. E. Kruse & R. B. Watson. (*Audio Engng, N.Y.*, Feb. 1950, Vol. 34, No. 2, pp. 9–11, 46.) The instrument described can be used to measure without ambiguity the phase angle between two sinusoidal signals in the frequency range 40 c/s to 29 kc/s with an error $<2\%$. Up to 20 kc/s the error is $<1\%$. An alternative circuit arrangement overcomes the instability of reading which normally occurs in a phase meter when the phase angle is very near 0° or 360°.

621.317.78.029.65 **1191**

Discrepancies in the Measurement of Microwave Power at Wavelengths below 3 cm.—J. Collard, G. R. Nicoll & A. W. Lines. (*Proc. phys. Soc.*, 1st March 1950, Vol. 63, No. 363B, pp. 215–216.) Measurements of 20-mW power were made at T.R.E. for the wavelength range 7.5–12.5 mm, using (*a*) a water calorimeter, (*b*) an enthrakometer (2020 of 1948), (*c*) a thermistor bead. More accurate comparisons between enthrakometer and thermistor for a power of 1 mW and wavelength of 9 mm, and between enthrakometer and calorimeter for a power of 50 mW and the same wavelength, were consistent with the direct comparison of all three instruments. The results obtained with the enthrakometer and the calorimeter agreed to within a few per cent, but the readings given by the thermistor were only about half those obtained by the other two methods. Thermistor beads of a particular type give fairly consistent results, so that it may be possible to dispense with individual calibration and apply a simple correction factor.

621.396 : 621.3.018.4(083.74) **1192**

[British] **Standard-Frequency Transmissions.**—(*R.S.G.B. Bull.*, Feb. 1950, Vol. 25, No. 8, p. 264.) Daily transmissions, arranged by the Department of Scientific and Industrial Research, commenced on 1st February 1950 from the G.P.O. station at Rugby on frequencies of 60 kc/s (1029 to 1045 GMT), 5 Mc/s (0544 to 0615 GMT) and 10 Mc/s (0629 to 0700 GMT). The transmitter power in each case is 10 kW. The frequencies are maintained within 2 parts in 10^8 of the nominal frequencies and are monitored at the National Physical Laboratory. The transmissions are arranged in cycles of 15 minutes, each starting with a 1-minute transmission of the Morse call sign MSF, with spoken announcements; the carrier wave is then modulated at 1 000 c/s for 5 minutes and is unmodulated for the remaining 9 minutes. 1-c/s pulses will at some future date be added during the first 5 minutes of the unmodulated transmission. See also 134 of 1949.

621.396.662.029.6 **1193**

Calibrated Piston Attenuator.—A. C. Gordon-Smith. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, pp. 322–324.) The attenuator, which operates in the evanescent H_{11} or TE_{11} circular mode, consists of a pair of telescopic brass tubes. "The outer tube has a diameter such that when filled with air the attenuation is about 7 db per mm. The inner tube is filled with polystyrene and acts as a non-attenuating waveguide for the H_{11} mode but does not transmit other modes. The attenuation per mm of movement has been measured, after frequency conversion, in terms of a standard piston attenuator and agreement obtained between the measured and theoretical values within the limits of experimental accuracy. It has also been confirmed that the crystal mixer and its associated circuit is a linear converter at a wavelength of 6 mm."

621.397.62.001.4 **1194**

Measurement of Transient Response of TV Receivers.—J. Van Duyne. (*TV Engng, N.Y.*, Jan. 1950, Vol. 1, No. 1, pp. 14–18.) Discussion of the requirements of measurement equipment for studying the electrical fidelity of the picture channel, and description of suitable apparatus. 60 c/s, 2.4 kc/s and 94.5 kc/s are selected as the repetition rates for the rectangular test signals.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.767 **1195**

Gas-Flow Speedometer.—G. L. Mellen. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 80–81.) Measurement of the transit time of an ion cloud in the gas over a known distance gives rate of flow without introducing impurities. Range of speeds is 20–400 m.p.h.

534.321.9 : 616.36-073 **1196**

Lupam — an Ultrasonoscope Locator for Medical Applications.—R. P. McLoughlin & G. N. Guastavino. (*Rev. telegr., Buenos Aires*, Sept. 1949, Vol. 38, No. 444, pp. 507–517, 543.) Basic principles for such units are reviewed, and equipment is described in which the reflection of ultrasonic pulses is applied to locate gall-stones or other small objects. C.r.o. presentation similar to type-A radar display is used. Calibration methods are indicated.

538.569.2.047 : 621.38 **1197**

Dielectric Properties of Some Animal Tissues at Meter and Centimeter Wave Lengths.—E. R. Laird & K. Ferguson. (*Canad. J. Res.*, Nov. 1949, Vol. 27, Sec. A, No. 6, pp. 218–230.) Measurements of the dielectric constant and the absorption coefficient of different tissues, using wavelengths of 1.72 m, 9.5 cm and 3.2 cm. For most of the substances tested the dielectric constant decreased considerably with increasing frequency; the absorption, on the other hand, increased largely.

539.16.08 **1198**

Photomultipliers for Scintillation Counting.—G. A. Morton. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 525–553.) A review of various commercially available multipliers and discussion of their characteristics.

539.16.08 **1199**

A Stabilizer for Proportional Counters.—D. H. Wilkinson. (*J. sci. Instrum.*, Feb. 1950, Vol. 27, No. 2, pp. 36–38.) The introduction of an α-particle group into a counter enables high precision to be attained over long periods by deriving control of the voltage applied to the counter from this group. Theory of the method is given and a suitable circuit is described.

539.16.08 **1200**

A Portable Geiger Counter.—M. Michaelis & R. O. Jenkins. (*Electronic Engng*, March 1950, Vol. 22, No. 265, pp. 112–115.) Detailed description of equipment including a standard G.E.C. Type G.M.2 or G.M.4 self-quenching tube and suitable for either β-, γ- or X-ray detection.

539.16.08 **1201**

Temperature Effects in the Spurious Discharge Mechanism of Parallel-Plate Counters.—F. L. Hereford. (*Phys. Rev.*, 15th Feb. 1950, Vol. 77, No. 4, pp. 559–560.)

539.16.08 : 549.211 **1202**

Effect of Light on a Diamond Conduction Counter.—R. K. Willardson & G. C. Danielson. (*Phys. Rev.*, 15th Jan. 1950, Vol. 77, No. 2, pp. 300–301.) The accumulation of space charge field resulting from the trapping of charge carriers reduces the rate of counting. The effect may be completely eliminated in some diamonds by irradiation with violet light. After treatment the diamond is in an activated condition and the counting rate is maintained indefinitely. The effect is thus different from the ordinary release of space charge by red light, which has only a temporary effect on the counting rate.

539.16.08 : 615.849 **1203**

Geiger-Müller Tubes in Industrial Radiography.—O. J. Russell. (*Electronic Engng*, March 1950, Vol. 22, No. 265, pp. 94–98.)

551.508.1 : 551.594.11 **1204**

A Radiosonde Method for Potential-Gradient Measurements in the Atmosphere.—K. Kreielsheimer. (*The New Zealand Science Congress*, 1947, pp. 91–98.) Details of modifications of the Bureau of Standards radiosonde (315 of 1941) to adapt it for recording potential gradients, and discussion of results obtained. A preliminary account was noted in 1955 of 1946 (Kreielsheimer & Belin).

621.318.572 **1205**

An Electrical Transient Display System.—J. A. Lyddiard & J. W. Osselton. (*J. sci. Instrum.*, Feb. 1950, Vol. 27, No. 2, pp. 38–41.) Description of apparatus designed to facilitate the observation of transients in networks including iron-cored reactors operated at 50 c/s, by providing a succession of identical transients which can be viewed for any length of time on the screen of a c.r.o. Electronic methods are used. Switching cycles are accurately controlled. The equipment can also be used to generate square waves of very low frequency.

621.38.001.8 : 578.088.7 **1206**

An Electronic Stimulator for Biological Research.—V. H. Attree. (*J. sci. Instrum.*, Feb. 1950, Vol. 27, No. 2, pp. 43–47.) Circuit details and operation of a 0.005–500-c/s generator with three outputs simultaneously available, one providing exponential pulses, the other two giving square pulses.

621.38.001.8 : 616-07 **1207**

Electronic Instruments in Diagnostic Medicine.—H. A. Hughes. (*Electronic Engng*, Feb. & March 1950, Vol. 22, Nos. 264 & 265, pp. 43–47 & 88–93.) Discussion of equipment for electroencephalography, electrical stimulation, electrocardiography, etc.

621.384.6 **1208**

Phase Focusing in Linear and in Spiral Accelerators.—W. Dällenbach. (*Ann. Phys., Lpz.*, 1st Aug. 1948, Vol. 3, pp. 89–100.)

621.384.611.1 **1209**

Betatrons with and without Iron Yoke.—A. Bierman & H. A. Oele. (*Philips tech. Rev.*, Sept. 1949, Vol. 11, No. 3, pp. 65–78.) The fundamental principles of the betatron are outlined, with a description of two recently constructed machines. One, on conventional lines, uses an iron circuit for the magnetic field, with 500-c/s a.c. excitation, and accelerates electrons to 5 MeV. In the second apparatus the magnetic field is obtained by means of coils through which the discharge current from a battery of capacitors flows. A small iron core weighing only 5 kg is used. The flux, being obtained from damped oscillations, at a frequency of 2 500 c/s, reaches the required intensity only during the first few cycles of each discharge and thus the output from the apparatus is pulsed. Electron energies of 9 MeV are obtained. The practical elimination of iron in this model results in a very great saving in weight. See also 2015 of 1949 (Bierman).

621.385.833 **1210**

The Field in an Electron-Optical Immersion Objective.—L. Jacob. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 75–83.)

621.385.833 **1211**

Electron Optical Mapping of Electromagnetic Fields.—L. Marton & S. H. Lachenbruch. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1171–1182.) See also 967 of April.

621.385.833 **1212**

Fringe Fields of Ferromagnetic Domains.—L. Marton, S. H. Lachenbruch, J. A. Simpson & A. Van Bronkhorst. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, p. 1258.) Photographs showing (*a*) the distorted mesh pattern due to the fringe field along the edge of a cobalt single crystal, (*b*) the pattern obtained with a small $BaTiO_3$ crystal, using the new 'shadow' technique (199 of January), are briefly discussed.

621.385.833 **1213**

On the Theory of the Independent Electrostatic Lens with Three Diaphragms.—É. Regenstreif. (*C. R. Acad. Sci., Paris*, 14th Dec. 1949, Vol. 229, No. 24, pp. 1311–1313.) Formulae are derived which give results in good agreement with experiment and permit accurate determination of the voltage which must be applied to the central diaphragm to convert the lens into a reflector.

621.385.833 : 669 **1214**

Metallurgical Applications of the Electron Microscope.—(*Engineering, Lond.*, 9th & 16th Dec. 1949, Vol. 168, Nos. 4376 & 4377, pp. 625 & 652.) Report of the meeting organized by the Institute of Metals in November 1949, with summaries of 13 papers presented and of the discussions on them. See also *Nature, Lond.*, 11th March 1950, Vol. 165, No. 4193, pp. 390–393.

621.398 **1215**

Remote Control by A.F. Discrimination.—R. B. McNeil. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 142..150.) The equipment is designed to have a bandwidth no greater than that used for normal a.m. communications, and considerably simplified control equipment, which comprises a tone-modulated transmitter at each master station, and an amplifier-relay unit at each of the relay stations, operating in conjunction with a receiver and constant-output amplifier. The modulator unit may be used for voice modulation of the transmitter. The equipment operates well through interfering signals and noise.

PROPAGATION OF WAVES

538.566.2 + 534.231 **1216**

A New Method for Solving the Problem of the Field of a Point-Radiator in a Multilayer Nonuniform Medium.—L. M. Brekhovskikh. (*Bull. Acad. Sci. U.R.S.S., sér. Phys.*, July/Aug. 1949, Vol. 13, No. 4, pp. 409–420. In Russian.) The theory of propagation of waves in multilayer media is important not only for electromagnetic but also for sound waves, especially when the latter are propagated in the sea, where ducts may be formed. In this paper the field due to a point-radiator of either electromagnetic or sound waves is investigated mathematically. The spherical wave is resolved into a number of plane waves which are integrated in a complex plane.

538.566.2 1217

The Reflection of Plane Waves from Multilayer Non-Uniform Media.—L. M. Brekhovskikh. (*Zh. tekh. Fiz.*, Oct. 1949, Vol. 19, No. 10, pp. 1126–1135. In Russian.) Mathematical analysis for multilayer media with arbitrary variation of the parameters. The theory proposed is not based on the wave equation but on an equation of the first order of the reflection coefficient. Two methods of successive approximations are indicated for expressing the reflection coefficient in the form of convergent series. An example shows the rate of convergence of these series.

538.566.2 1218

Application of Huyghens' Principle to Refraction. Expressions for the Reflected and Refracted Waves.—J. Brodin. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 67–69.)

621.396.11 : 535.42 1219

On the Diffraction of Radar Waves by a Semi-Infinite Conducting Screen.—C. W. Horton & R. B. Watson. (*J. appl. Phys.*, Jan. 1950, Vol. 21, No. 1, pp. 16–21.) Measurements of the diffraction patterns of cm waves at the edge of a semi-infinite copper screen are described. A receiving horn was revolved about the centre of the edge at a radius of 15 in. or 30 in. and angles of incidence upon the screen of 0° and $-22\frac{1}{2}°$ were investigated. The results are shown as polar diagrams, which agree well with theoretical patterns.

621.396.11 : 551.510.535 1220

Ionospheric Cross-Modulation at Oblique Incidence.—L. G. H. Huxley. (*Proc. roy. Soc. A*, 22nd Feb. 1950, Vol. 200, No. 1063, pp. 486–511.) Systematic investigation of ionospheric cross-modulation, using selected pairs of B.B.C. transmitters in special night-time tests. Evidence supports the assumption that the seat of cross-modulation is highly localized in the E region, in one or two regions near the lower of the surfaces of reflection of the wanted and disturbing waves. The quantities measured are $G\nu$, (ν is the mean electron collision frequency and G a constant for the gas at the seat of cross-modulation) and T_0, the percentage transferred modulation depth at 'zero' modulation frequency. Nocturnal and seasonal changes in these quantities are discussed. An estimate is made of the gradients of electron concentration and collision frequency at a height of about 86 km.

621.396.11 : 551.510.535 1221

Discussion of the Ionosphere Reflection Factor. Scattering of Ground-Wave Energy and its Conversion into Space-Wave Energy.—C. Glinz. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1949, Vol. 27, No. 6, pp. 279–283. In German.) Methods of calculating the reflection coefficient are discussed. Vilbig (887 of 1939) considers that a relation exists between this coefficient and ground conductance. It seems that such a relation can only be apparent, since in the wavelength range 200–2 000 m ionospheric absorption cannot be neglected. From the C.C.I.R. field-strength curves it can only be deduced with certainty that the indirect radiation reaches a maximum for distances of 400–600 km. In the area covered by the direct radiation of a transmitter, part of the energy is scattered by irregularities of the ground. Such scattering increases the ratio of space-wave to ground-wave energy, so that modifications of a transmitting aerial designed to reduce the ratio do not result in the calculated improvement in reception. The ground wave undergoes no appreciable dispersion when propagation is over the sea. This may partly explain the dependence of the indirect radiation on the ground conductance.

621.396.11 : 551.510.535 1222

Manifestations of the Sporadic-E Layer on Metre Waves in 1949, and Observation of a Concomitant Noise.—P. Revirieux. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, p. 200.) Manifestations were frequent in June/July on 50–52 Mc/s. 18th June is cited as a favourable example. After 1700 GMT, a 100-W transmitter at Oslo produced a field strength at Meudon of above 100 μV/m on 50.1 Mc/s. Other distant stations were heard. During this time a characteristic noise was received on 145 Mc/s, using a Yagi aerial with 4 horizontal elements. The noise level was some 5–10 db above that of the receiver. The direction of the noise source coincided with that of the E_s layer causing the long-range reception on 50 Mc/s.

621.396.11 : 551.510.535 1223

Effect of the D Ionospheric Layer on Very-Low-Frequency Radio Waves.—W. Pfister. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 315–337.) See 723 of March.

621.396.11 : 551.510.535 1224

Sporadic Ionization at High Latitudes.—J. H. Meek. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 339–345.) See 725 of March.

621.396.11 : 551.510.535 1225

Calculation of the Absorption Decrement for a Parabolic Ionospheric Layer in the case of Oblique Incidence.—Argence & Rawer. (*See* 1154.)

621.396.11 : 621.396.81 1226

A Relation between the Sommerfeld Theory of Radio Propagation over a Flat Earth and the Theory of Diffraction at a Straight Edge.—H. G. Booker & P. C. Clemmow. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 18–27.) The field strength at a point above an imperfectly reflecting flat earth, due to vertically polarized radiation from a line source parallel to the earth's surface, is considered as that due to reflection by a perfectly conducting earth added to that due to the Zenneck wave diffracted, in the two-dimensional case, under the image line. For the three-dimensional case, the diffraction would be through a slot extending downwards from the image point. For points well above the earth's surface this diffracted wave is the edge-wave from the diffracting edge. The field strength is then the same as calculated on the ray theory with the ordinary Fresnel image of the source in the imperfectly conducting source. For points close to the earth's surface, the diffracted wave must be calculated using the Fresnel integral. This gives the Sommerfeld formula for propagation over a flat earth. The advantages of this derivation of Sommerfeld's formula in considering propagation over a land/sea boundary are briefly indicated.

621.396.11.029.55 1227

New Observations on the Doppler Effect in the Propagation of Decametre Radio Waves.—B. Decaux & M. Crouzard. (*C. R. Acad. Sci., Paris*, 12th July 1948, Vol. 227, No. 2, pp. 116–117.) From observations in Paris of the standard-frequency transmissions from Washington on 5, 10, 15 and 20 Mc/s from the 12th to 15th April 1948 between 0800 and 2200 GMT, and from former observations (1725 of 1948), the mean values of frequency variation during 24 hours are plotted. A positive maximum appears during sunrise over the propagation path; a corresponding frequency minimum occurs during sunset. The maximum frequency changes range from 5×10^{-8} at 20 Mc/s to 20×10^{-8} at 5 Mc/s. Between 1400 and 1500 GMT and at 0200 GMT no variation is observed.

621.396.81 : 523.72 **1228**

Solar Noise and Ionospheric Fading.—R. L. Smith-Rose. (*Nature, Lond.*, 7th Jan. 1950, Vol. 165, No. 4184, pp. 37–38.) Solar noise measurements at Slough on 30, 42, 73 and 155 Mc/s, made simultaneously with field-strength measurements of signals from South Africa and Germany on 18.89 Mc/s and 191 kc/s, show that bursts of noise are frequently accompanied by a fade-out of the h.f. signal and a marked fluctuation in level of the l.f. signal.

An outstanding example, which occurred on 21st May 1948, is discussed in detail; the variation of the l.f. signal is characteristic of interference between ground and ionosphere waves caused by a change in phase and amplitude of the latter. This can be explained by a change in the equivalent height of reflection, together with an increase in the effective reflection coefficient of the ionosphere.

621.396.81 : 551.510.535 **1229**

Field Intensity at the Receiver as a Function of Distance.—P. Lejay & D. Lepechinsky. (*Nature, Lond.*, 25th Feb. 1950, Vol. 165, No. 4191, pp. 306–307.) A graphical method is described for finding, from a vertical-incidence *h'f* trace, the virtual path followed by a wave reflected obliquely from the ionosphere. A reflectrix, or locus of the reflection point for the virtual ray as the angle of incidence is varied, can be found by a simple graphical construction if a plane earth is assumed. For a curved earth and curved ionosphere a more laborious method, not described, must be used. From the shape of the reflectrix the field set up at a distant point on the earth's surface can be found. Focusing and interference effects produce a high field, rapidly fluctuating with distance, just beyond the skip distance, and a high field at the limiting distance for the tangential ray.

621.396.81 : 551.510.535 **1230**

'M-Mode' Propagation Possibilities.—D. Lepechinsky. (*Nature, Lond.*, 25th Feb. 1950, Vol. 165, No. 4191, p. 307.) The ionization density of the E layer being greatest at the subsolar point, a two-hop ray passing near this point may be unable to penetrate the E layer to reach the ground, and be reflected instead back to the F layer, with resulting lower absorption. Outstandingly good reception has been observed on frequencies of 19 Mc/s and 14 Mc/s when this type of propagation had been predicted.

621.396.81.029.45 **1231**

Round-the-World Signals at Very Low Frequency.—J. N. Brown. (*J. geophys. Res.*, Dec. 1949, Vol. 54, No. 4, pp. 367–372.) Pulses were radiated from an omnidirectional aerial at Annapolis, Maryland, and were received on a vertical loop 50 miles away. Transmitter power was 350 kW and frequency 18 kc/s. In March 1949, the delay time was 0.1373 sec, corresponding to about 55 hops between an ionosphere layer at a height of 65 km and the ground. During an ionospheric storm the time fell to 0.1365 sec. The maximum attenuation of round-the-world signals is about 70 db; near local sunset it falls to a sharp minimum of about 56 db.

621.396.81.029.58 **1232**

Study of the Propagation of Decametre Waves by means of Standard-Frequency Transmissions.—B. Decaux, M. Barré & G. Bertaux. (*C.R. Acad. Sci., Paris*, 23rd Jan. 1950, Vol 230, No. 4, pp. 378–380.) A résumé of the measurements of the frequencies and field strengths at Bagneux of the transmissions from Washington WWV and Hawaii WWVH. During breaks in the WWVH transmission, frequency stability of the WWV signal clearly improved. Permanent recordings were made at Bagneux of the 15- and 20-Mc/s carriers and of the 440-c/s modulation. Better reception of WWVH on 15 Mc/s, despite greater distance and lower power, was particularly evident in the early morning. Identical conclusions can be drawn from records obtained on the s.s. *Commandant Charcot* during her voyage between South Africa and Australia, especially in the late afternoon and at nightfall. Typical records are reproduced. See also 1227 above and 1725 of 1948 (Decaux).

621.396.812.3 : 551.510.535 **1233**

The Analysis of Observations on Spaced Receivers of the Fading of Radio Signals.—B. H. Briggs, G. J. Phillips & D. H. Shinn. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 106–121.) The fading of a radio wave once reflected from an irregular ionosphere is discussed in terms of the variable diffraction pattern produced at the ground. Fading may arise either from a drift of the pattern past a receiver, or from irregular time variations in the pattern, or both. Observations at three receiving points can be used to deduce the rate at which the pattern changes and the drift velocity with respect to the ground. For practical results see 96 of January (Mitra).

RECEPTION

621.396.621 **1234**

Denco Model DCR19 Communications Receiver.—(*Wireless World*, Feb. 1950, Vol 56, No. 2, pp. 50–52.) Test report of a receiver with six overlapping ranges covering the band 175 kc/s–36 Mc/s. Special features include a crystal calibrator and a well-made rotary coil-turret which removes all idle coils from the circuit and short-circuits any that might act as absorbers for the coils in use. Circuit details are given of the interstage coupling following the first i.f. valve, and also of the first a.f. amplifier, which includes a negative-feedback circuit acting as a filter.

621.396.621 **1235**

Communication Receiver Design.—D. W. Heightman. (*R.S.G.B. Bull.*, Feb. 1950, Vol. 25, No. 8, pp. 253–258.) Technical and economic factors governing the efforts of the set designer and manufacturer to meet the requirements of the average buyer and operator are reviewed. Only a.m. telephony and telegraphy reception in the range 150 kc/s to 35 Mc/s is considered. Emphasis is on amateur requirements. The design of r.f., mixer and i.f. stages is discussed and certain refinements are recommended.

621.396.621 : 621.385 **1236**

A Gated Beam Tube.—Adler. (*See* 1292.)

621.396.621.22 **1237**

Marine Communal Aerials.—(*Wireless World*, Feb. 1950, Vol. 56, No. 2, pp. 73–74.) Description of two systems providing interference-free reception on a large number of receivers. Filter circuits in the communal aerial reject the interference due to the ship's transmitters, and in one system feed three basic output stages, which in turn may feed other supplementary units whose number depends on the size of the ship. In the second system the filtered output from the communal aerial is fed via a cathode follower to two wide-band amplifiers, one covering the medium- and long-wave bands and the other the short-wave broadcasting bands. The output from each chain is then distributed, after further amplification, by low-impedance lines throughout the ship.

621.396.664 **1238**

An Aerial Comparator and Monitor Unit.—J. D. Storer & S. Southgate. (*J. Brit. Instn Radio Engrs*, Jan. 1950, Vol. 10, No. 1, pp. 4–9.) An improved system for aerial selection and signal monitoring at receiving centres. Any available aerial may be applied, via a coaxial switch, to a monitor receiver the i.f. output of which is displayed on the screen of a c.r. tube. Any two aerials may be switched alternately to the monitor receiver, either manually or at high speed by electronic means, to obtain a visual comparison on the c.r. tube, the timebase being locked to the aerial switching speed.

621.396.822 **1239**

On the Spectral Distribution of Energy of Voltage Fluctuations at the Output of a Radio-Noise Receiver.—J. Mosnier & J. L. Steinberg. (*C. R. Acad. Sci., Paris*, 30th Jan. 1950, Vol. 230, No. 5, pp. 438–440.) Three conclusions are drawn from the results of experiments in which the noise spectrum of a receiver was compared with the uniform spectrum of current fluctuations of a saturated diode: (*a*) there exists in the receiver itself a hitherto unnoticed source of fluctuations which must be looked for in the valves themselves; (*b*) the spectrum of these fluctuations has a hyperbolic trend and the amplitude becomes negligible with respect to normal fluctuations only towards 500 c/s; (*c*) a system of periodic commutation at a.f. proposed by Dicke (475 of 1947) must be operated at above 500 c/s to eliminate these parasitic fluctuations.

621.396.828 **1240**

Radio Interference: The Work of the E.R.A. on Suppression of Interference from Electrical Equipment.—(*Beama J.*, Dec. 1949, Vol. 56, No. 150, pp. 412–413.) Brief outline of investigations of radio interference from domestic and industrial electrical equipment and from combustion engines. The relevant British Standards publications are listed.

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **1241**

Theory of Communications.—P. Aigrain. (*Ann. Télécommun.*, Dec. 1949, Vol. 4, No. 12, pp. 406–411.) Statement of the recently developed theory of Shannon (1361 of 1949) showing the relations existing between the bandwidth of a communication channel, the type of signal transmitted, and the signal/noise ratios at the input and the output of the receiver used.

621.394.5 + 621.396.71 **1242**

The Italcable Radio-Receiving and Submarine-Cable Station at Acilia.—A. Niutta. (*Poste e Telecomunicazioni*, July 1949, Vol. 17, No. 7, pp. 373–386.) General description of a new station, some 24 km from Rome, to replace stations lost during the war. World-wide radio and cable links are provided. The space-diversity system is used for reception, the rhombic aerials simultaneously receiving signals from two opposite directions. To avoid interference, all cable equipment is enclosed in a Faraday cage.

621.395.44 : 621.315.052.63] : 621.395.658.076.7 **1243**

Voice-Operated Switching of Carrier Systems.—R. C. Fox, F. S. Beale & G. W. Symonds. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 92–95.) An all-electronic transfer unit provides two-way or party-line communication over power line or radio carrier systems using a single frequency. The equipment functions at a high speed and makes it possible for the speaker to be interrupted by the listener. Oscillograms show negligible speech clipping at the start.

621.395.5 : 621.315.212 **1244**

Coaxial-Cable Telephony Transmission Systems.—L. Albanese & P. Schiaffino. (*Poste e Telecomunicazioni*, March 1949, Vol. 17, No. 3, pp. 141–167.) A comprehensive survey covering problems of design peculiar to coaxial-cable telephony, and the solutions arrived at in current practice for cable dimensions, channel frequency allocation, transmitting equipment, supervisory gear and power supply. Line-amplifier problems, in particular interstage valve coupling, distortion, and output-impedance matching, are treated in some detail.

621.396.1 **1245**

The Provisional Frequency Board.—P. F. Siling. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 600–607.) Short account of the functions of the Board as laid down at the Atlantic City conference, and of its work up to the present.

621.396.5 **1246**

Citizens Radio Range.—(*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 136, 138.) A short account of tests carried out by the Hallicrafters Company with experimental equipment operated from batteries. The transmitters used grid modulation of about 30% on peaks, and λ/2 folded dipoles served as aerials. The maximum ranges for two hand-held transceivers varied from 7 miles, both sets being 33 ft above ground level and intervening terrain flat and clear, to 0.2 miles with both sets at a height of 6 ft and intervening terrain entirely wooded. When one dipole aerial was replaced by a highly directional corner-reflector type of aerial, the maximum ranges were three times greater.

Using a mobile unit with a ground-plane aerial mounted on top of a car and another unit which fed 15-W r.f. power into a corner-reflector aerial mounted on top of a 75-ft tower, reasonable communication was possible at distances up to 3 miles in a typical residential section, and up to 9 miles in less-populated areas.

621.396.931 **1247**

V.H.F. Radio Equipment for Mobile Services.—D. H. Hughes. (*Radio tech. Dig., Édn franç.*, Dec. 1949, Vol. 3, No. 6, pp. 365–368 & Feb. 1950, Vol. 4, No. 1, pp. 43–49.) French version of 1797 of 1949, with added bibliography.

621.396.931 **1248**

Planning V.H.F. Mobile Systems.—E. R. Burroughes. (*Marconi Rev.*, Jan./March 1950, Vol. 13, No. 96, pp. 37–46.) Discussion of the advantages obtainable from a correctly planned v.h.f. system, and information on the type of equipment available for mobile services.

621.396.933 : 621-526 **1249**

Electrical Remote-Control and Indicating Systems in Airborne Radio Equipment.—Gamlen. (*See* 1254.)

621.396.97 : 654.191 **1250**

Economies in the Planning, Design and Operation of a Sound Broadcasting System.—R. T. B. Wynn. (*Proc. Instn elect. Engrs*, Part III, Jan. 1950, Vol. 97, No. 45, pp. 1–10. Summaries in *Proc. Instn elect. Engrs*, Part I, Jan. 1950, Vol. 97, No. 103, pp. 7–8 & *Engineer, Lond.*, 2nd Dec. 1949, Vol. 188, No. 4897, pp. 636–640.) Inaugural address as Chairman of the Radio Section of the I.E.E. The development of continuity working and programme input equipment in studio centres is considered. Automatic monitors designed by B.B.C. engineers are described and economies effected by the use of such monitors are discussed. The problem of economic balance between station installation and running costs and freedom from breakdown is considered: details are tabulated of capital costs (1943) for the construction of the Skelton s.w. transmitting station, and also comparative running costs of the Droitwich medium- and long-wave, Start Point medium-wave, and Skelton short-wave stations. Unattended transmitting stations are also discussed and the arrangements at present in use at various B.B.C. stations of this type for automatic frequency adjustment, routine checking and maintenance are outlined.

SUBSIDIARY APPARATUS

621-526 **1251**

Analysis of the Operation of Discontinuous Physical Systems and its Application to Servomechanisms.—F. H. Raymond. (*Ann. Télécommun.*, July–Oct. 1949, Vol. 4, Nos. 7–10, pp. 250–256, 307–314 & 347–357.)

621-526 **1252**

An Analysis of Relay Servomechanisms.—D. A. Kahn. (*Elect. Engng, N.Y.*, Feb. 1950, Vol. 69, No. 2, p. 155.) Summary of A.I.E.E. 1949 San Francisco Meeting paper. The differential equations governing a relay-controlled system are nonlinear and cannot be solved by conventional methods. Application of Laplace-transform theory to such a system yields a response expressed in the form of a series from which the behaviour of the system may be determined. The method is applicable to any controlled system with a unilateral transfer function, such as a motor, valve circuit, or a complete servomechanism. Information concerning periodic oscillations and stability of such systems can be derived.

621-526 **1253**
Servomechanisms and Telecontrol.—Y. Rocard & J. Loeb. (*Ann. Télécommun.*, Nov. 1949, Vol. 4, No. 11, pp. 397–404.)

621-526 : 621.396.933 **1254**
Electrical Remote-Control and Indicating Systems in Airborne Radio Equipment.—D. R. Gamlen. (*Marconi Rev.*, Jan./March 1950, Vol. 13, No. 96, pp. 1–20.) Remote-control systems for receivers, transmitters and radio compasses, which are small and adapted to conventional aircraft voltage supplies, are discussed. Devices used in these systems are described and include a controller switch drive, a preselector unit and a.c. and d.c. selsyns, both the self-synchronous and "Motaysynn" a.c. systems being treated.

621.355.8 **1255**
New Lightweight Accumulator.—C. L. Chapman. (*Elect. Rev., Lond.*, 24th Feb. 1950, Vol. 146, No. 3770, pp. 345–347.) A special method of construction, using Ag and Zn electrodes in KOH electrolyte, provides an unspillable, rechargeable battery of $\frac{1}{3}$ the size and $\frac{1}{4}$ the weight of the lead/acid accumulator of equivalent capacity. It requires normal maintenance and its characteristics are similar to those of the Ni-Fe cell. Nominal voltage during discharge is 1.5 V. Types to be made available comprise 0.5, 1, 3, 5, 15, 20 and 40 A.hr units. A 1-A.hr cell only weighs 1 oz. Specifications of various types are tabulated. 40 W.hr/lb weight is a standard production achievement. When being charged, only minute quantities of hydrogen are evolved.

621.396.68 : 621.397.5 **1256**
Metal-Rectifier Voltage Multipliers for E.H.T. [extra-high-tension] **Supplies.**—A. H. B. Walker. (*J. Televis. Soc.*, Sept. 1949, Vol. 5, No. 11, pp. 311–317.) Discussion of the operating principles and characteristics of cascade voltage multipliers of the Cockcroft type, and description of a multiplier giving an output of 10 kV and operated from the 350-0-350-V secondary of a centre-tapped transformer. Pulse-operated multipliers are also considered briefly.

621.396.682.027.5/.6 **1257**
Variable High-Voltage Power Source.—W. S. Ramsey. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 98–101.) Two separate units for the ranges 5–10 kV and 10–30 kV, with regulation better than 0.05%. In series they will give a current of 2 mA at 40 kV with $<$0.1% ripple voltage.

621.398 **1258**
Radio Synchro-Motor [selsyn].—J. Loeb, J. R. Duthil & A. Jeudon. (*Ann. Télécommun.*, March 1949, Vol. 4, No. 3, pp. 87–102.) A study of different transmission systems in which angular motion or intelligence is represented by phase modulation.

TELEVISION AND PHOTOTELEGRAPHY

621.397.331 **1259**
Improved Television Modulator.—J. Haughawout. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 86–88.) A circuit is described, with complete component details, which gives a constant synchronization signal and holds the output black level at a predetermined voltage. When this modulator is used, on switching from one programme source to another, the receiver picture fades out and does not return till the resynchronization process is completed. Provision is also made for emergency operation in case the keyed clamping circuit fails.

621.397.331.2 **1260**
A New Image Orthicon.—R. B. Janes, R. E. Johnson & R. R. Handel. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 586–592.) "The design of a new panchromatic high-sensitivity photo-surface has resulted in the development of a new image orthicon, RCA-5820, which permits the televising of low-level illuminated scenes with a faithful gray-scale rendition of colors. Performance results of this new tube in comparison with other types for both remote and studio pickup are given."

621.397.331.2 **1261**
Some Considerations on a Scanning Tube for Film.—N. Schaetti. (*Le Vide, Paris*, Jan. 1950, Vol. 5, No. 25, pp. 739–747.) A general discussion of cathode coatings for photoelectric and electron multiplier tubes, and a description of a tube designed for 729-line scanning of cinematograph film. This operates on the principle of Farnsworth's image dissector, transmitting 25 frames per second. An Sb/Cs cathode is used. A 1-V signal is obtained, so that additional amplification is not required. Investigations are to be made with a concave cathode and with interlaced scanning.

621.397.331.2 **1262**
Manufacturing Metallized Picture Tubes.—E. R. Ewald. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 76–79.) Details of techniques by which the phosphor coating of a television picture-tube screen is covered by a film on which a thin coating of Al is evaporated, the film being removed by heat prior to the final evacuation.

621.397.5 **1263**
A Six-Mc/s Compatible High-Definition Color Television System.—R.C.A. Laboratories Division. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 504–524.) Colour-picture sampling and time-multiplex transmission together with the 'mixed-highs' principle enable the colour transmission to be compressed into a 4-Mc/s band suitable for a total channel assignment of 6 Mc/s. Each primary colour signal passes through a low-pass filter (0–2 Mc/s) and is then passed to an electronic commutator. The three-colour signals are also sent to a band-pass filter (2–4 Mc/s) the output being the 'mixed-high' signal which is added to the signals from the commutator and then passed through a low-pass filter (0–4 Mc/s). Various receivers and colour converters are illustrated and described. The standard scanning speeds are used so that a monochrome picture can be received on existing receivers.

621.397.5 **1264**
Dot Systems of Color Television.—W. Boothroyd. (*Electronics*, Dec. 1949, Vol. 22, No. 12, pp. 88–92 & Jan. 1950, Vol. 23, No. 1, pp. 96–99.) Short accounts of several sequential sampling and multiplex methods that permit reception either in colour or monochrome with the appropriate receiver.

621.397.5 **1265**
Geometrical Study of the Optimum Number of Channels for Television.—Payen. (*Onde élect.*, Nov. 1949, Vol. 29, No. 272, pp. 398–401.) Discussion of the problem of providing satisfactory service over extensive territory by means of a number of suitably located stations transmitting the same programme on selected frequencies.

621.397.5 : 535.88 **1266**
Stereoscopic Television.—F. Lachner. (*Radio Tech., Vienna*, Dec. 1949, Vol. 25, No. 12, pp. 699–701.) Different methods of stereoscopic viewing and projection are reviewed, particularly those requiring the viewer to wear special eye-pieces. The application of a special c.r. tube to stereoscopic colour television is described. This tube is divided into six chambers for left and right scanning in the three primary colours; a combination of prisms and reflectors is used for composition of the coloured image.

621.397.5 : 621.315.212 1267
Television Terminals for Coaxial Systems.—L. W. Morrison, Jr. (*Elect. Engng, N.Y.*, Feb. 1950, Vol. 69, No. 2, pp. 109–115.) By double modulation the L-1 coaxial-line terminal equipment transforms the video frequencies to frequencies 200 kc/s higher, which can be transmitted efficiently over the line (transmission band 64–3 100 kc/s). The original frequencies are restored in the receiver by a double demodulation process. Vestigial-sideband transmission is used. The equipment and its operation are described.

621.397.5 : 621.396.68 1268
Metal-Rectifier Voltage Multipliers for E.H.T. [extra-high-tension] **Supplies.**—Walker. (*See* 1256.)

621.397.5 : 621.396.813 1269
Artificial Lines for Video Distribution and Delay.—A. H. Turner. (*RCA Rev.*, Dec. 1949, Vol. 10, No. 4, pp. 477–489.) Delay distortion may be reduced by the use of mutual inductance between adjacent half-sections of a low-pass filter. A combination of such T sections and bridged-T sections gives small delay distortion up to 0.85 of the cut-off frequency. The quality of picture signals transmitted through several experimental lines of 20 sections each confirmed this theory. Each section provides a low-impedance feed point and the branch lines from these points must behave as lumped capacitors; they must therefore be unterminated and short compared with the signal wavelength. Input and output voltages are sketched for various values of mutual coupling. The work of other investigators is briefly reviewed and 14 relevant publications are noted.

621.397.61 1270
Low-Power Television Transmitter.—L. Voorhees. (*Elect. Engng, N.Y.*, Feb. 1950, Vol. 69, No. 2, pp. 151–154.) Description, with block diagrams, of equipment designed for local coverage. The sound transmitter has an output of 250 W; that of the video transmitter is 500 W. Separate transmitters are used for the low and the high television-frequency bands.

621.397.62 1271
The Simplification of Television Receivers.—W. B. Whalley. (*Sylvania Technologist*, Jan. 1950, Vol. 3, No. 1, pp. 9–12.) An investigation of general means of simplifying television receivers so as to reduce the costs of production and servicing. The operation of a television receiver is analysed from the standpoint of the minimum number of necessary functions, and then the simplest possible circuit to perform each function is planned, taking into consideration the possibility of combining two functions in the same circuit.

621.397.62 1272
Fixed-Tuned Broad-Band Television Booster.—A. Newton. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 116 . . 134.) The booster is intended to improve the overall noise figure and raise the useful gain of a receiver. The first r.f. stage, a grounded-grid triode amplifier, is coupled to the second stage by a double-tuned inductively coupled circuit, the output of which is fed to the receiver through a 300-Ω input resistance. Separate high-band and low-band amplifiers are used and the respective inputs and outputs are connected through a crossover network consisting of $\lambda/4$ sections. Total gain is about 8.

621.397.62 : 621.396.67 1273
Trends in TV Receiver Antenna Design.—Kamen. (*See* 1085.)

621.397.62.001.4 1274
Measurement of Transient Response of TV Receivers.—Van Duyne. (*See* 1194.)

621.397.62.029.63 : 621.385.2 : 621.315.59 1275
Germanium Diodes for U.H.F. TV.—Lingel. (*See* 1307.)

621.397.822 1276
Perception of Television Random Noise.—P. Mertz. (*J. Soc. Mot. Pict. Television Engrs*, Jan. 1950, Vol. 54, No. 1, pp. 8–34.) The problem is studied by analogy with graininess in a photographic image. Effective random noise power is obtained by cumulating and weighting actual noise powers over the video frequencies with a weighting function diminishing with increasing frequency. Values obtained check reasonably well with preliminary experiments. The effect of changing the tone rendering and contrast of the television image is analysed.

621.397.828 1277
Television Interference seldom comes from Power Systems.—F. L. Greene. (*Elect. World, N.Y.*, 16th Jan. 1950, Vol. 133, No. 3, pp. 55–59 . . 128.) The principal causes of interference with television reception so far encountered are listed and their effects on the television screen illustrated. Methods of eliminating the interference are suggested. Ignition systems cause most interference; domestic and industrial apparatus are less troublesome. Interference from power lines is slight.

621.397.828 1278
Some Devices for Reducing the Effects of Fading and Interference: Part 1.—D. McMullan. (*J. Televis. Soc.*, Sept. 1949, Vol. 5, No. 11, pp. 318–328.) The various types of interference encountered in the reception of television signals are reviewed and methods of reducing such interference are discussed, with special reference to circuit techniques which may be used in the design of the receiver. Future problems are considered, and the respective merits of positive and negative modulation are discussed from the point of view of their susceptibility to interference.

621.397.828 1279
Suppression of TVI.—F. T. Wilson. (*Short Wave Mag.*, Dec. 1949 & Jan. 1950, Vol. 7, Nos. 10 & 11, pp. 740–745 & 828–832.) A detailed account of an investigation of the source of television interference in an amateur transmitter and of its elimination by means of low-pass filters, effective screening and suitable modification of the power amplifier. A circuit diagram, with component values, is given of a push-pull amplifier including harmonic-suppression arrangements. Final tests of the modified transmitter when radiating 100 W on a frequency of 14 Mc/s showed only a trace of interference with a television receiver only 2 ft away from the transmitter.

Reception tests on local amateur stations, with the receiver tuned to frequencies of the order of 42–43 Mc/s, showed that the strongest harmonics were received from transmitters using single-ended output stages with beam tetrodes, while transmitters using variable-frequency oscillators had very weak harmonics.

TRANSMISSION

621.316.726 1280
Carrier Frequency Control: Automatic System for Unattended Transmitting Stations.—J. C. Gallagher. (*B.B.C. Quart.*, Winter 1949/50, Vol. 4, No. 4, pp. 249–256.) The Droitwich standard-frequency transmission of 200 kc/s is used to effect the near synchronization of unattended transmitters. Frequency dividers and pulse-shaping circuits are used to generate a train of 0.6-μs pulses with a recurrence frequency of 1 000 per sec, which are fed together with the locally generated carrier into two integrating circuits; from these pulses are derived, each corresponding to a frequency change of ± 2 parts in 10^8. The pulses drive an impulse motor coupled to a series capacitor in the crystal-oscillator circuit.

621.396 : 621.394.611.2 **1281**

An Electronic Keyer.—B. Bröndum-Nielsen. (*R.S.G.B. Bull.*, Feb. 1950, Vol. 25, No. 8, pp. 259–260, 262.) Description of an easily constructed semi-automatic keying unit. Dash/dot and mark/space ratios can be adjusted to be correct for any sending speed within the range of the unit. The resulting Morse signals compare favourably with those of an automatic tape transmitter.

621.396.61 **1282**

Aircraft Communications Transmitter Type AD.107.—W. R. Bitcheno. (*Marconi Rev.*, Jan./March 1950, Vol. 13, No. 96, pp. 21–36.) Transmitters are described for h.f. and m.f., each comprising four units: driver and modulator, amplifier, aerial and power units. The h.f. transmitter, weighing 85 lb, with a maximum power of 150 W, operates on 10 crystal-controlled spot frequencies in the range 2–18.5 Mc/s. The 80-lb m.f. transmitter, with maximum output of 120 W in the range 320 to 520 kc/s, has identical controls and the same number of crystal-controlled frequencies as the h.f. equipment.

621.396.61 **1283**

Band-Switch QRO Transmitter.—J. N. Walker. (*Short Wave Mag.*, Jan. 1950, Vol. 7, No. 11, pp. 818–827.) Full circuit and construction details of a 3-stage transmitter for full-power operation in the range 3.5–28 Mc/s. Switched coil turrets are used for both driver and power-amplifier. Only a keyed v.f.o. is needed for c.w. working. The set is adaptable for either screen or anode-and-screen modulation of the power amplifier for telephony. Standard British components are used throughout.

621.396.615 **1284**

3-kW M.F. Transmitter Design.—I. F. Deise & L. W. Gregory. (*Communications*, Oct.-Dec. 1949, Vol. 29, Nos. 10–12, pp. 12–14, 35, 12–13 & 30–31.) In order to reduce the size of the transmitter, h.f. iron-cored transformers are used; the construction and the operational characteristics of these are described. The cores are of hipersil iron. An autotransformer with 5% tappings is used for matching the reflected aerial impedance to that of the power amplifier. The working frequency can be anywhere in the range 250–540 kc/s and arrangements are provided for immediate switching, when desired, to a second frequency in the same range.

621.396.619.15 **1285**

Square-Wave Keying of Oscillators.—J. C. Seddon. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 162 . . 172.) A low-power circuit is described which makes possible square-wave grid-modulation of oscillators over a wide range of pulse widths and duty cycles. 750-V positive pulses can be produced from 15-V negative pulses with a maximum current of 15 mA, the rise and decay times being $< 1\ \mu$s. 15-W average power will easily control an oscillator giving 7.5 kW peak power output.

VALVES AND THERMIONICS

537.122 : 531.112 : 537.525.92 **1286**

Electron Transit Time in Space-Charge-Limited Current between Coaxial Cylinders.—P. L. Copeland & D. N. Eggenberger. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1148–1151.) The transit time of electrons between a cylindrical cathode and an external concentric anode can be determined if the potential distribution between the cylinders is known. Taylor series expansions are developed for this in a form which enables the transit times to be readily calculated to within 0.1%.

537.58 : 539.234 **1287**

Thermionic Emission of Thin Films of Alkaline Earth Oxide Deposited by Evaporation.—Moore & Allison. (*See* 1165.)

621.383 **1288**

Design Features of a New Photocell.—J. H. Crow & V. C. Rideout. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Feb. 1950, Vol. 14, No. 2, pp. 8–9, 28.) The photocell Type CE-70V is a high-vacuum, end-on type of tube, with two ring anodes and a flat disk-type cathode, which may be used as a combination modulator and photocell at carrier frequencies up to at least 200 kc/s. The inner ring is the control anode and serves to vary the emission current reaching the load anode. Light striking the cathode controls the emission. Its application in an electro-optical pyrometer is described, where the comparison of the light intensities at two wavelengths is used to determine the absolute temperature of a luminous flame.

621.385 **1289**

New Valves.—J. Steiger. (*Bull. schweiz. elektrotech. Ver.*, 18th Feb. 1950, Vol. 41, No. 4, pp. 112–121. In French.) An illustrated review of the most recent thermionic valves, camera tubes, magnetrons, memory tubes, electron multipliers, electron couplers, and of the 'selectron' developed in the R.C.A. laboratories.

621.385 **1290**

New Subminiature Valves.—C. C. Gee. (*Wireless World*, Feb. 1950, Vol. 56, No. 2, pp. 46–47.) These are flat types with filament currents of only 15 mA. Performance is comparable with that of the corresponding Mullard 10-mm valves (2410 of 1948), but anode and filament currents are both much lower and the reduced size and flat shape results in a saving of space of about one-third compared with the 10-mm valves, when three valves are fitted in a hearing aid. The 10-mm range is also being extended for both mains and battery operation, for use in miniature equipment.

621.385 : 621.396.621 **1291**

A Survey of Modern Radio Valves: Part 3 — Receiving Valves for Use below 30 Mc/s.—K. D. Bomford. (*P.O. elect. Engrs' J.*, Jan. 1950, Vol. 42, Part 4, pp. 201–208.) The modes of operation of the more widely used types of receiving valve are discussed and contrasted and the various factors limiting their performance are considered. Data are included on the physical form and the characteristics of modern valves, and the operating conditions conducive to long life are discussed. Parts 1 and 2: 482 and 483 of February.

621.385 : 621.396.621 **1292**

A Gated Beam Tube.—R. Adler. (*Electronics*, Feb. 1950, Vol. 23, No. 2, pp. 82–85.) This valve, Type 6BN6, uses a sharply-focused electron beam passing through two control grids, each of which has an unusually steep and linear transfer characteristic. It is suitable for use in f.m. discriminator circuits, as a synchronization-pulse separator, or as a square-wave generator. The assembly fits into a miniature-valve envelope with a 7-pin base.

621.385 : 621.396.621 **1293**

Contour Analysis of Mixer Valves.—N. E. Goddard. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 350–356.) "The characteristics of a mixer valve are completely defined by a series of three-dimensional surfaces. Two of the coordinates, grid voltage and heterodyne-oscillator voltage, determine the operating conditions for small signal voltages. The third coordinate is one of a number of valve parameters: fundamental or harmonic conversion conductance, cathode current or grid current. Each surface is described by a contour map on which load lines are drawn for several automatic-bias circuits. The method is illustrated by Fourier analysis of a theoretical mutual-conductance curve and by experimental measurements on an EF42 pentode."

621.385.029.63/.64 + 621.396.615.14 **1294**

The Amplification of Centimetre Waves: Travelling-Wave Valves.—G. Goudet. (*Onde élect.*, Jan. 1950, Vol. 29, No. 274, pp. 8–12.) Some typical performance figures are given for klystrons and triodes at 3 000 Mc/s and the development of the travelling-wave valve in different laboratories is reviewed. Details are given of the design and construction of the valves produced in the Laboratoire Central de Télécommunications. Their mean operating frequency is 2 600 Mc/s; pass band, 400 Mc/s; output power, 50 mW; noise factor, 18 db; gain, 35 db for a useful current of 3 mA. The bibliography includes 42 references.

621.385.029.63/.64 + 621.396.615.14 **1295**

Valves for Communication on Frequencies above 1 000 Mc/s: Part 2.—H. Schnitger. (*Fernmeldetech. Z.*, Jan. 1950, Vol. 3, No. 1, pp. 13–22.) An illustrated description and comparison of three types of microwave amplifiers: (*a*) the disk-seal triode; (*b*) the klystron; (*c*) the travelling-wave valve. The disk-seal triode is very useful for wavelengths near 10 cm, where its noise factor is about 8, rising to about 60 for 3-cm wavelength. The noise factor of the travelling-wave valve is appreciably higher and the klystron has both higher noise factor and relatively small bandwidth. Part 1: 2105 of 1949.

621.385.029.63/.64 **1296**

The Traveling-Wave Tube (Discussion of Waves for Large Amplitudes).—L. Brillouin. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, pp. 1196–1206.) Equations are developed for the interaction of an electron beam with an e.m. wave in a simplified linear model with infinitely short sections. Hence the usual theory for waves of small amplitude, assuming a strong beam with a weak signal, is derived and the precise limits of the validity of this theory are defined. For waves of large amplitude, the amplified wave is progressively distorted until a final stage is reached, dependent essentially upon the details of the tube structure, when no further amplification is possible. In some cases, a type of shock wave results, with a complete bunching of the space charge. A similar solution applies also to linear accelerators and to synchrotrons.

621.385.029.63/.64 **1297**

Travelling-Wave Valve T.P.O.85.—(*Ann. Radioélect.*, Jan. 1950, Vol. 5, No. 19, pp. 62–63.) A linear amplifier valve made by the Compagnie Générale de T.S.F. for operation between 1 500 and 5 000 Mc/s. Max. output power, 1 W; gain, 15–19 db; pass band, 80–100 Mc/s; total length, about 460 mm, max. diameter, about 41 mm.

621.385.029.63/.64 **1298**

Recent Developments in Traveling-Wave Tubes.—L. M. Field. (*Electronics*, Jan. 1950, Vol. 23, No. 1, pp. 100–104.)

621.385.029.63/.64 : 621.396.822 **1299**

Transit-Time Effects in U.H.F. Valves.—A. H. Beck: J. Thomson, (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 379–380.) Comment on 3312 of 1949 (Thomson) and Thomson's reply.

621.385.032.213 **1300**

Activation Phenomena with Thoria Cathodes.—O. A. Weinreich. (*J. appl. Phys.*, Dec. 1949, Vol. 20, No. 12, p. 1256.) An investigation has been carried out into the activation of thoria-coated tungsten cathodes by (*a*) reverse electron current, (*b*) exposure to evaporation products from a nearby operating thoria cathode. The highest emission at temperatures at which thermal activation is negligible is given by the reverse electron current method. In some cases the emission passes through a maximum when plotted against the time during which reverse electron current is drawn. Procedure (*b*) was used for the activation of a pulsed thoria cathode, from which high emission could be maintained if a small d.c. emission was drawn from an auxiliary thoria cathode to the common anode.

621.385.032.213.2 : 621.317.336.1 **1301**

Change of Mutual Conductance with Frequency.—W. Raudorf. (*Wireless Engr*, Oct. 1949, Vol. 26, No. 313, pp. 331–337.) This phenomenon occurs in receiving valves with indirectly-heated cathodes after operation for about 1 000 hours. It is "due to the deterioration, during operation, of the contact between the oxide coating and the metal sleeve which forms the core of the cathode. It can be greatly reduced by giving the metal sleeve an appropriate shape. By applying Holm's theory of electric contacts it is possible to estimate the number and size of the contact spots (*a*-spots) between coating and core metal. For an average size of 3 μ for the oxide grain, for instance, and a contact resistance of about 40 Ω per cm^2 of the cathode surface, the number of *a*-spots is about 3×10^4 per cm^2 and their average diameter about 1 μ. The contact resistance and the liability to cathode sparking seem to be connected. In general, cathode sparking is unlikely up to a specific emission of 1 A/cm^2. To prevent sparking at pulse currents of 10 A/cm^2 of $<$ 1-ms duration, the contact resistance between coating and core must be $< 10\Omega$/cm^2."

621.385.032.216 **1302**

Distribution of Potential in the Coating of an Oxide Cathode during a Pulse of Great Current Density.—R. Loosjes & H. J. Vink. (*Le Vide, Paris*, Jan. 1950, Vol. 5, No. 25, pp. 731–738.) The distribution was investigated by applying the method previously described (2414 of 1948) to specially constructed diodes having up to 3 metal probes inserted in the cathode coating. No barrier layer at the metal/oxide interface was found, but it was established that a great part of the potential drop occurs close to the emitting surface.

621.385.032.316 **1303**

Comparison between the Electronic and the Thermodynamic Temperature of Oxide Cathodes.—R. Champeix. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 64–65.) From results of experimental tests on some ten valves whose thermodynamic temperature Θ was varied between 850° and 1 200°K, the following conclusions are drawn: (*a*) the electronic temperature T is from 2% to 40% greater than Θ; (*b*) the difference decreases with increasing temperature; (*c*) the difference is about halved if a plate electrode is used instead of a grid; (*d*) within the above temperature range $T \approx a\Theta + b$, where $a < 1$. A theoretical explanation of the results will be given later.

621.385.032.216 : 537.583 **1304**

Thermionic Emission from Oxide Cathodes: Retarding and Accelerating Fields.—C. S. Hung. (*J. appl. Phys.*, Jan. 1950, Vol. 21, No. 1, pp. 37–44.) The effects of applied fields ranging from retarding fields up to accelerating fields of 50 kV/cm were studied. For strong retarding fields, excellent agreement with theory was obtained. Near zero field, cathode inhomogeneity or patch effect may be responsible for the deviations found; with the large cathode used, the existence or non-existence of a reflection effect could not be determined. For accelerating fields, deviations of the results from those predicted by the Schottky mirror-image theory are explainable by patch effect and by field intensification at sharp points of the rough cathode surface.

621.385.2 : 621.315.59 **1305**

Backward Current of Germanium Diodes.—P. Aigrain. (*C. R. Acad. Sci., Paris*, 2nd Jan. 1950, Vol. 230, No. 1, pp. 62–63.) Theory is given which leads to values of backward current in agreement with experimental values.

621.385.2 : 621.315.59 **1306**

Backward Current and Capacitance of Germanium Diodes.—P. Aigrain. (*C. R. Acad. Sci., Paris*, 9th Jan. 1950, Vol. 230, No. 2, pp. 194–196.) An experimental verification of the theory (see 1305 above) for the extreme cases of low and high back resistance, represented respectively by a transistor with the emitter disconnected and a Type-1N54 diode. Calculated and observed values of current for different voltages are tabulated. The calculated l.f. shunt capacitance for the transistor is 0.46 pF at 10 V; for the Type-1N54 diode, 0.1 pF.

621.385.2 : 621.315.59 : 621.397.62.029.63 **1307**

Germanium Diodes for U.H.F. TV.—F. J. Lingel. (*TV Engng, N.Y.*, Jan. 1950, Vol. 1, No. 1, pp. 12–13, 39.) The construction and application of mixer diodes for frequency conversion in the 475–890-Mc/s television band. The diodes can withstand microsecond pulses of 500 mA in the forward direction and 1 mA in the backward direction. The contact point is welded to the Ge pellet.

621.385.2 : 621.396.822 **1308**

Valve Noise and Electron Transit Time.—D. A. Bell. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, p. 379.) Comment on 2097 of 1949 (Fraser).

621.385.2/.3].029.64 **1309**

Electronic Admittances of Parallel-Plane Electron Tubes at 4 000 Mc/s.—S. D. Robertson. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 619–646.) The general features of the mechanism of electron transit in close-spaced diodes are briefly reviewed. Measurements were made of the electronic admittance of close-spaced parallel-plane diodes and BTL1553 triodes (2964 of 1949) at 4 060 Mc/s, r.f. power being fed to the valve from a waveguide source through a waveguide-cavity transformer. The theory and practice of the method are described in detail. The diode conductance is found to be much greater than the l.f. value, and increases with decreasing electrode spacing. The susceptance decreases with increasing current. For the triode, the input short-circuit admittance departs considerably from values predicted by single-velocity theory, but the transadmittance is only slightly lower than the l.f. value. See also 1315 below.

621.385.3 : 621.315.59 **1310**

Characteristics of Transistors.—P. Aigrain & C. Dugas. (*C. R. Acad. Sci., Paris*, 23rd Jan. 1950, Vol. 230, No. 4, pp. 377–378.)

621.385.3 : 621.315.59 **1311**

Physical Interpretation of Type-A Transistor Characteristics.—L. P. Hunter. (*Phys. Rev.*, 15th Feb. 1950, Vol. 77, No. 4, pp. 558–559.) The relative efficiencies of the processes taking place in a transistor are discussed. For saturation conditions it appears that the poor performance of some transistors is due to low hole-injection efficiency. Below saturation the emitter may remove some electrons from the crystal, or the collector voltage may be insufficient for all the holes to reach the collector; either effect would cause a reduction in efficiency.

621.385.3 : 621.315.59 **1312**

The Germanium Crystal Triode.—H. Heins. (*Sylvania Technologist*, Jan. 1950, Vol. 3, No. 1, pp. 13–18.) The electrical properties of semiconductors are briefly discussed. The construction and characteristics of the crystal triode are then described and a few typical circuits are shown.

621.385.3.011.4 **1313**

Interelectrode Capacitance of Valves.—E. E. Zepler. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 378–379.) Further discussion. See 2101 (Zepler & Hekner), 2102 (Humphrey & James) and 2962 (Booth) of 1949.

621.385.3.029.63 **1314**

Two Triodes for Reception of Decimetric Waves—K. Rodenhuis. (*Philips tech. Rev.*, Sept. 1949, Vol. 11, No. 3, pp. 79–89.) A description of two receiving valves for frequencies higher than 300 Mc/s: a triode, Type EC80, for amplifying and mixing at frequencies up to about 600 Mc/s, and an oscillator, Type EC81, with an upper frequency limit of about 1 500 Mc/s. The nine copper-plated pins sealed through the glass base have a very low h.f. resistance. In contrast to the disk-seal valves commonly used for u.h.f. operation, these valves are similar in appearance to conventional types and enable receivers to be built which are simple in construction and easy to operate.

621.385.3.029.64 **1315**

Passive Four-Pole Admittances of Microwave Triodes.—S. D. Robertson. (*Bell Syst. tech. J.*, Oct. 1949, Vol. 28, No. 4, pp. 647–655.) Measurements at 4 060 Mc/s for a wide range of cathode/grid and grid/anode spacings are described. Two grids were used: (*a*) a parallel-wire grid of 0.3-mil tungsten wire wound at 1 000 turns/inch; (*b*) a criss-cross grid of the same wire wound at 550 turns/inch. The microwave transadmittances were found to be much higher than the values measured at l.f. See also 1309 above.

MISCELLANEOUS

43-3 = 2 **1316**

Technisches Wörterbuch (Deutsch-Englisch): Vol. 1. [Book Review]—R. Ernst. Publishers: Tauchnitz Edition, Hamburg, 612 pp., 16.50 DM. (*Elektrotechnik, Berlin*, May 1949, Vol. 3, No. 5, p. *iv*.) "The problem of including as many technical words as possible in a handy volume has been solved surprisingly well. Space economies in the case of related words and those common to the two languages might have been extended to include other less familiar equivalents, such as geschwindigkeitsmodulierte Röhre = klystron. More verbs are included than is usual in most technical dictionaries, and also the principal expressions for mathematical operations."

45-3 = 2 : 621.396 **1317**

Dizionario Tecnico della Radio. Italiano-Inglese. Inglese-Italiano. [Book Review]—L. Bassetti. Publishers: Il Rostro, Milan, 275 pp., 900 lire. (*Radio, Turin*, Nov. 1949, No. 8, pp. 5–6.) Radio terms and terms in physics and electronics connected with radio are explained. A list of abbreviations and symbols for circuit diagrams is included.

621.396 **1318**

Radio Engineering: Vol. 2. [Book Review]—E. K. Sandeman. Publishers: Chapman & Hall, Ltd, London, 579 pp., 40s. (*Wireless Engr*, Dec. 1949, Vol. 26, No. 315, pp. 412–413; *Wireless World*, Jan. 1950, Vol. 56, No. 1, p. 10.) The subject matter of this second half of the work includes interference and noise, receivers, measuring equipment, equalizer design, feedback, network theory, and filters. Appendices contain a large collection of formulae and information on a variety of subjects. Vol. 1 was noted in 600 of 1949.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

534+621.395.62 **1319**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

14. Representations of Speech Sounds and some of their Statistical Properties.—Sze-Hou Chang, G. E. Pihl & M. W. Essigmann.
127. Sound-System Design for Reverberant Auditoriums.—L. L. Beranek, W. H. Radford & J. B. Wiesner.
128. High-Efficiency Loudspeakers for Personal Radio Receivers.—H. F. Olson, J. C. Bleazey, J. Preston & R. A. Hackley.
129. A Review of Direct Radiator Loudspeakers.—F. H. Slaymaker.
130. Loudspeaker Housings.—W. F. Meeker.
131. A Miniature Condenser-Type Microphone.—J. K. Hilliard.
148. Noise Considerations in Audio Systems.—F. L. Hopper.
149. Considerations of Noise in Sound Recording and Reproducing Systems.—A. W. Friend.
150. Magnetic Recording Frequency Response—Measurement Procedures and Pitfalls.—R. E. Zenner.
151. Distortions in Recording Systems.—H. E. Roys.
152. Perceptibility of Flutter in Recorded Speech and Music.—H. Schecter.

534.231 **1320**

On the Energy Flux in the Fields of Spherical Sound Radiators.—S. N. Rzhevkin. (*Zh. tekh. Fiz.*, Dec. 1949, Vol. 19, No. 12, pp. 1380–1396. In Russian.) Using Bessel and Neumann spherical functions, a generalized expression is derived determining the sound field of a complex spherical radiator. A relation is established between the Stokes-Rayleigh functions $f(jkr)$ and $F(jkr)$ normally used and the more convenient new functions $G(kr)$, $D(kr)$, $\epsilon(kr)$ and $\delta(kr)$. Tangential energy fluxes are absent in the fields of simple radiators but are always present in the fields of complex radiators. As an example, the radiator with two modes of oscillation is discussed in detail. Zonal and sectoral radiators are also considered.

534.231 : 534.26 **1321**

On the Freely Vibrating Circular Disk and the Diffraction by Circular Disks and Apertures.—C. J. Bouwkamp. (*Physica, 's Grav.*, Jan. 1950, Vol. 16, No. 1, pp. 1–16. In English.) A theory is developed for the acoustic field produced by a freely vibrating rigid disk when the wavelength is large compared with the radius a of the disk. By analysis based on integral equations, an expression for the field is derived in the form of a series of ascending powers of ka, where k is the wave number. The results are equally applicable to the diffraction of plane scalar waves incident normally upon a circular disk or aperture.

534.232+534.39 **1322**

Powerful Acoustic Waves.—P. Alexander. (*Research, Lond.*, Feb. 1950, Vol. 3, No. 2, pp. 68–73.) Discussion of various methods of producing high-power ultrasonic oscillations, and of the chemical and physical effects produced by such oscillations in solids and liquids. The many diverse phenomena occasioned by ultrasonic irradiation are ascribed either to cavitation or to the enormous acceleration of particles in the sound field.

534.321.9 **1323**

Ultrasonic Vibrations.—E. Skudrzyk. (*Elektrotech. u. Maschinenb.*, March 1950, Vol. 67, No. 3, pp. 76–84.) Discussion of the production and effects of ultrasonic vibrations in gases, liquids and solids, the conditions being fundamentally different in the three cases.

534.321.9 : 534.373 **1324**

Ultrasonic Reverberation Measurements in Liquids: Part 2.—C. E. Mulders. (*Appl. sci. Res.*, 1950, Vol. B1, No. 5, pp. 341–357.) Measurements of the absorption of ultrasonic waves in various solutions suggest that the high absorption in sea water may be due to perturbation of the reaction $MgSO_4 \rightleftharpoons Mg + SO_4$ and is not associated with NaCl, as has been suggested by Liebermann (613 of 1949). Part 1: 932 of 1949.

534.6 : 621.395.632.11 **1325**

Acoustical Study of Telephone Bells of the French P.T.T. Administration.—(*Ann. Télécommun.*, Jan. 1950, Vol. 5, No. 1, pp. 21–28.) Description of the apparatus and methods used to study telephone ringing, with a view to establishing new standards for intensity and spectral composition of the sound emitted.

534.62 **1326**

Room for Acoustic Tests of Loudspeakers and Microphones.—M. Milosevic. (*Rev. tech. Comp. franç. Thomson-Houston*, Feb. 1950, No. 13, pp. 33–42.) The room is constructed according to principles discussed in 2699 of 1949. Overall dimensions are: length 5.5 m, width 2.7 m, height 3 m. The test chamber, about 3 m long, is paraboloidal at the end which houses the loudspeaker and opens out to cylindrical shape. The walls of the chamber are thickly lined with glass wool. Test results are shown in many diagrams. Measurements in the test chamber on loudspeakers and microphones give results in good agreement with free-field measurements.

534.771 **1327**

The Development of Hearing-Test Methods.—W. Beindorf. (*Funk u. Ton*, Feb. 1950, Vol. 4, No. 2, pp. 76–84.)

534.78 : 621.395.822 : 629.13 **1328**

Telephony and the Problem of Noise in Aircraft.—P. Chavasse & R. Lehmann. (*Ann. Télécommun.*, Feb. 1948, Vol. 3, No. 2, pp. 45–56.) Discussion of the noise level and noise spectra in different types of aircraft and their combined effect in masking speech sounds.

534.782 **1329**

The Reproduction of Natural Speech Sounds.—H. Koschel. (*Fernmeldetech. Z.*, Feb. 1950, Vol. 3, No. 2, pp. 48–53.) A review of methods of producing artificial speech sounds for technical purposes.

534.782.07 **1330**

The Phonetic Steno-Sonograph.—J. Dreyfus-Graf. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st March 1950, Vol. 28, No. 3, pp. 89–95. In French, with German summary.) Electroacoustic apparatus which records the spoken word in written characters, examples of which are shown.

534.84 **1331**

The Intelligibility Ratio as the Criterion of the Acoustic Quality of a Hall.—A. Moles. (*Ann. Télécommun.*, Feb. 1950, Vol. 5, No. 2, pp. 57–64.) Reverberation time and sound distribution are insufficient to determine precisely the acoustic quality of a hall. A better criterion is provided by measurements of the intelligibility of articulated sounds at different points in the hall. Based on an analysis of the occurrence of different sounds in speech, two lists are compiled of 100 French logatoms, each consisting of two consonants and a vowel, suitable for use in such measurements.

534.862.4 **1332**

Direct Methods of Frequency Linearization of the Output from the Reproducing-Head Circuit.—F. Grammelsdorff & W. Guckenburg. (*Funk u. Ton*, Feb. 1950, Vol. 4, No. 2, pp. 66–75.) The effects of introducing resistance, capacitance and inductance in the reproducing-head circuit on the shape of the response curve are examined and shown in diagrams. With a suitable combination the output voltage can be kept nearly constant at about 3 mV from 40 c/s to 50 kc/s. With better design of the equipment, the output voltage can be raised to about 10 mV. Any further increase depends on improvement of the magnetic properties of the tape used.

621.3.012 : 621.317.089 **1333**

A Modern Electroacoustic Frequency-Response Recording Unit.—Lehner. (*See* 1449.)

621.395.625.2 **1334**

Disc-Recording Standards.—B. E. G. Mittell. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1950, Vol. 11, No. 1, pp. 5–14.) 1948 Australian I.R.E. Convention paper reviewing the development of standards for commercial disk recording. Present standards and methods of testing used in the laboratories of Electric and Musical Industries Ltd, Hayes, Middlesex, are discussed. A comprehensive table is given of current practice and recommended standards. See also 1243 of 1948.

621.395.92 **1335**

Crystal Earpieces for Portable Hearing-Aids.—W. Güttner. (*Z. angew. Phys.*, Jan. 1950, Vol. 2, No. 1, pp. 33–39.) The construction is described of an earpiece in which a double crystal plate of Rochelle salt is coupled to a Helmholtz resonator. From the equivalent electrical circuit the sound pressure produced in the earpiece may be simply calculated. The characteristics of two such earpieces are plotted. The range of coupling, tuning and damping of the crystal and resonator combination is relatively narrow for linearity of the response curve.

621.396.645.37 : 621.395.623.7 : 621.3.018.8 **1336**

Output Impedance Control.—D. W. Thomasson. (*Wireless World*, March 1950, Vol. 56, No. 3, pp. 116–117.) Comment on 1070 of May (Roddam).

621.396.645.37 : 621.395.623.7 : 621.3.018.8 **1337**

Output Impedance Control.—T. Roddam: P. J. Baxandall: H. Pursey: E. Jeffery: H. J. Pichal. (*Wireless World*, April 1950, Vol. 56, No. 4, pp. 155–157.) Author's reply to 1336 above, and further comment on 1070 of May.

AERIALS AND TRANSMISSION LINES

621.392.26† + 621.396.67 **1338**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

32. Waveguide Applications of Artificial Metallic Dielectrics.—W. E. Kock.
33. The Effects of Anisotropy in a Three-Dimensional Array of Conducting Disks.—G. Estrin.
34. A Study of Single-Surface Corrugated Guides.—W. Rotman.
35. A Study of the Current Distribution on the Helix.—J. A. Marsh.
36. Diffracted Beams in Metal Lenses.—A. E. Heins.
57. On the Relation between the Geometry and the Impedance Characteristics of Typical Radiating Systems.—T. H. Crowley & V. H. Rumsey.
58. A Method for Studying the Response of Loops to the Electromagnetic Field.—B. C. Dunn, Jr.
59. Measurement of the Radiation Efficiency of Elliptically and Linearly Polarized Antennas.—J. Rowen.
60. Broad-Band Unidirectional Antenna 50 to 170 Mc/s.—V. J. Colaguori & R. Guenther.
61. Antenna System for Very-High-Frequency Radio Ranges and Direction Finding.—F. J. Lundburg & F. X. Bucher.
73. Radiation from Circular Current Sheets.—W. R. LePage, C. S. Roys & S. Seely.
74. Radiation Patterns of Circular and Cylindrical Arrays.—J. E. Walsh.
75. Properties of Guided Waves on Inhomogeneous Cylindrical Structures.—R. Adler.
79. A Supergain U.H.F. Television Transmitting Antenna.—O. O. Fiet.
122. Surface-Wave-Transmission Lines.—G. Goubau.
123. Frequency-Modulation Distortion in Linear Systems having Small Sinusoidal Irregularities in Transfer Characteristics, with Application to Lossless Waveguides.—F. Assadourian.
124. The Representation, Measurement, and Calculation of Equivalent Circuits for Slots in Rectangular Waveguide.—J. Blass, L. Felsen, H. Kurss, N. Marcuvitz & A. A. Oliner.
125. Dielectric Tube Antennas.—R. E. Beam & D. G. Harman.
126. Measurement of Current and Charge Distributions on Antennas and Open-Wire Lines.—D. J. Angelakos.

621.392.43 **1339**

Two-Band Antenna-Matching Networks.—J. G. Marshall. (*QST*, Feb. 1950, Vol. 34, No. 2, pp. 36–39, 90.) Continuation of 34 of January. To demonstrate the use of the design formulae previously given, numerical examples are calculated for a simple aerial operating on its fundamental and second-harmonic frequencies, using different types of transmission line.

621.396.67 : 621.315.625.015 **1340**

Investigation of the Voltages on Insulators in the Guy Wires of Tower Aerials.—A. A. Metrikin. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 59–62. In Russian.)

621.396.671 **1341**

The Transmission and Reception of Elliptically Polarized Waves.—G. Sinclair. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 148–151.) A vector parameter is defined which represents a generalization of the effective length of an aerial to include a specification of the polarization of the field radiated by the aerial. The parameter so defined is also useful in calculating the voltage at the terminals of the aerial when it is used to receive plane waves of arbitrary (elliptical) polarization.

621.396.677 **1342**

Triplet Reflector Array.—R. W. Hogg. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 47–53.) The basic system described consists of a horizontal dipole with a reflector system in which the usual single parasitic element is replaced by three elements spaced vertically $\lambda/8$ apart; arrays of one and two such units are considered. From theoretical considerations this design was expected to give not only an improved back-to-front ratio, but also, due to its decreased sensitivity to frequency variation, a bandwidth over twice that for the single reflector system. The improvement observed in practice fell short of that predicted theoretically, the bandwidth for a wavelength of 6 m increasing from 2 Mc/s for a 2-stack single-reflector array to 3 Mc/s for the corresponding triplet array.

621.396.677 **1343**

Calculations for [parabolic] Reflectors.—R. Brendel. (*Funk u. Ton*, Feb. 1950, Vol. 4, No. 2, pp. 93–99.) A general formula is derived for the gain of a parabolic reflector, and the direct radiation and the reaction of the reflector on the transmitting dipole are discussed. The field distribution is calculated for parabolic and cylindro-parabolic reflectors of various apertures and the resulting curves are compared with Köhler's results for sheet-metal and grid-type reflectors (1932 Abstracts, p. 525). The radiation characteristics are determined for a parabolic reflector without assuming a uniform intensity distribution over the surface of the reflector.

621.396.677 **1344**

An Experimental Verification of the Theory of Parallel-Plate Media.—C. A. Cochrane. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 72–76.) The transmission coefficient and deviation for various angles of incidence of a plane wave on a parallel-plate prism were measured. The results obtained are compared with values calculated from an idealized theory in which plate thickness and resistivity are neglected and an infinite number of plates is assumed. This theory explains qualitatively the action of the prism, but the plate thickness must be taken into account to obtain quantitative agreement with experimental results.

621.396.677 **1345**

Wide-Angle Metal-Plate Optics.—J. Ruze. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 53–59.) 1949 I.R.E. National Convention paper. A description of microwave metal-plate lenses of the 'constrained' type, in which focusing takes place normal to the electric vector. These are shown to have exceptional wide-angle scanning properties. General design formulae and expressions for phase aberration and the effect of refocusing are derived. Particular designs are investigated and their properties tabulated, together with a graph giving maximum scanning angle as a function of bandwidth for each type. A wide-angle 2-medium lens is also discussed.

621.396.67 **1346**

The A.R.R.L. Antenna Book. [Book Review]—Publishers: American Radio Relay League, West Hartford, Conn., 1949, 265 pp., $1.00. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, p. 191.) "Amateurs, experimenters, and practical radio men will find this book replete with useful information on antennas intended chiefly for amateur applications. The book is a thoroughly revised version of the previous edition."

CIRCUITS AND CIRCUIT ELEMENTS

621.3.07 + 621.396.645.37 **1347**

Control, Positive and Negative Feedback and Negative Resistance Coordinated.—W. Reichardt. (*Elektrotechnik, Berlin*, Feb. & March 1950, Vol. 4, Nos. 2 & 3, pp. 47–53 & 73–80.) A 'control theory' is developed and different applications of feedback are considered as special cases of the basic control circuit.

621.314.3† **1348**

The Magnetic Amplifier.—N. R. Castellini. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 151–158.) "The 'small-signal' theory of the magnetic amplifier is developed under certain simplifying assumptions. Expressions for the amplification are derived in terms of electrical and magnetic quantities, and conditions for optimum amplification are obtained. The predictions of the theory are found to agree qualitatively with experimental results of other workers."

621.316.729 **1349**

Synchronization of Quasi-Sinusoidal Oscillators.—G. Francini. (*Alta Frequenza*, June/Aug. 1949, Vol. 18, Nos. 3/4, pp. 125–133. In Italian, with English, French and German summaries.) The equation representing the behaviour of the fundamental types of oscillator is examined by considering the effect of injecting an external voltage or current. By limiting the study to the steady state, and by the use of a simplifying hypothesis, the performance of the oscillator can be determined and, in particular, the limits within which the frequency and amplitude of the applied signal must lie for synchronization to be effected. Various possible circuits for the injection of the synchronizing signal are considered.

621.316.86 **1350**

The Application of Thermistors to Control Networks.—J. H. Bollman & J. G. Kreer. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 20–26.) Equations are developed for the relations between current, voltage, resistance and power in thermistors under steady-state conditions. Voltage/current characteristics are illustrated for directly heated thermistors in series or parallel with external resistance. Their behaviour for zero incremental circuit resistance is studied. The complete differential equation for the time variation of resistance of a directly heated thermistor is obtained in a form which can be solved by use of various linear approximations.

621.318.4 : 621.396.615.17 **1351**

Nonlinear Coil Generators of Short Pulses.—L. W. Hussey. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 40–44). The construction is described of small permalloy coils for the production of pulses of duration $<0.1\ \mu s$ at repetition rates up to a few megacycles/sec. Circuits suitable for various frequency ranges are discussed.

621.318.423.013.78 : 621.3.017.22 **1352**

The Eddy-Current and Screen Losses of a Screened Single-Layer Solenoid.—F. M. Phillips. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 77–87.) Butterworth's method for determining the h.f. resistance of an isolated single-layer solenoid is outlined. A modification is proposed which, however, increases the discrepancy between the theory and experimental measurements. The effect of a concentric screening can is also considered and the losses arising in the can itself are calculated. The calculations are in good agreement with Bogle's empirical formula (821 of 1941). The effect of the screening can on the Q value is determined for a particular coil for which all the losses are calculated.

621.318.572 **1353**

Speed of Electronic Switching Circuits.—E. M. Williams, D. F. Aldrich & J. B. Woodford. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 65–69.) "Methods of analysis of electronic switching circuits are described which lead to determination of triggering delay and switching wave forms. These methods are illustrated with particular reference to multivibrators."

621.385.12 : 621.318.572 **1354**

The Use of Cold Cathode Relay Valves with Grid-Cathode Circuits of High Resistance.—R. J. Hercock & D. M. Neale. (*Brit. J. appl. Phys.*, Feb. 1950, Vol. 1, No. 2, pp. 53–55.) The grid current drawn by a cold-cathode relay valve near the critical grid potential normally precludes the use of a valve of this type where the grid circuit contains a high series resistance. By superimposing a train of voltage pulses on the applied grid potential this limitation may be removed. The instantaneous grid current may then be high whilst the mean value is much less. The value of the limiting resistance in the grid circuit may then be increased a hundredfold or more. In many cases the pulses may conveniently be derived from the rectifier ripple. Practical applications of the principles are described.

621.39 **1355**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

9. Transistor Trigger Circuits.—H. J. Reich & P. M. Schulteiss.
12. Mathematical Theory and Applications of Silicon Crystals for Mixing and Harmonic Generation at Microwave Frequencies.—P. D. Strum, J. W. Kearney & J. C. Greene.
28. A Comparison of Frequency and Time Domain Viewpoints in Circuit Design.—W. H. Huggins.
29. Study of Transient Effects by a New Method of Integral Approximation.—M. V. Cerrillo.
30. Applications of the Integral Approximation Method of Transient Evaluation.—W. H. Kautz.
52. Frequency Analysis of Variable Networks.—L. A. Zadeh.
53. Distortion Bandpass Considerations in Angular Modulation Systems.—A. A. Gerlach.
54. Concerning the Lowest Possible Unloaded Resonant Circuit Q's which can be used in Multiple Resonant Circuit Filters.—M. Dishal.
55. Tunable Microwave Waveguide Filters.—W. Sichak & H. A. Augenblick.
56. Filters for Television Interference.—A. M. Seybold.
70. Modern Methods of Servo Synthesis.—R. McCoy & D. Herr.
80. Design of a Hybrid Ring Diplexer for Ultra-High-Frequency Television Use.—W. H. Sayer & J. M. De Bell, Jr.
84. The Design of Diode Gate Circuits.—R. J. Slutz.
88. Monoformer.—A. C. Munster.
93. The Analysis and Design of a Band-Pass Distributed Amplifier.—V. C. Rideout & T. P. Tung.
94. An Investigation of the 400-Mc/s Amplifier Performance of the Type SN-973B Subminiature R.F. Pentode.—N. B. Ritchey.
95. An Extension to Stagger-Tuned Amplifier Design.—J. M. Pettit.
96. Ultra-High-Gain Direct-Coupled Amplifier Circuits.—W. K. Volkers.
97. Analysis and Design of Self-Saturable Magnetic Amplifiers.—S. Cohen.
99. Behaviour of Resistors at High Frequencies.—G. R. Arthur, H. L. Krauss, P. F. Ordung & S. E. Church.
100. Inductors, their Calculation and Losses.—R. F. Field.
101. Transformer Performance and Measurements.—R. Lee.
163. Miniaturization Techniques: A Discussion and Proposal.—M. Abramson & S. Danko.
164. The Exponential-Line Pulse Transformer.—F. R. Schatz & E. M. Williams.
168. The Transient Behavior of a Class-C Oscillator.—C. H. Page.
169. Mode Suppression in Broad-Band Reflex Klystron Oscillators.—A. H. Sonnenschein & H. A. Finke.
170. Telemetering Blocking Oscillator.—W. Todd.
171. Some Aspects of R.F. Phase Control in Microwave Oscillators.—E. E. David, Jr.
172. Seven-League Oscillator.—F. B. Anderson.

621.392 **1356**

Synthesis of Wideband Two-Phase Networks.—H. J. Orchard. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 72–81.) "Hitherto, networks providing a two-phase supply from a single-phase supply over a wide band of frequencies have been designed empirically. A synthesis technique is now available which gives exact design formulae both for the network components and also for the relations between the design parameters. It is shown that the most general circuit meeting the requirement is essentially a pair of all-pass networks. By utilizing elliptic functions, such networks can be designed to have a Tchebycheff approximation to the ideal requirement: this represents the most efficient condition. Simple computing schemes, design curves and a numerical example are included."

621.392 **1357**

Recurrent Network with Inductively Coupled Elements.—G. G. Sacerdote. (*Alta Frequenza*, Dec. 1949, Vol. 18, No. 6, pp. 268–276. In Italian, with English, French and German summaries.) For certain ranges of frequency the operation of such networks with purely reactive elements is analogous to that of networks consisting of elements not purely reactive.

621.392.011.2 **1358**

Reciprocity between Generalized Mutual Impedances for Closed or Open Circuits.—A. G. Clavier. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 69–74.) Equations are developed for the relations between voltages and currents in a pair of open wires of any shape. For sinusoidal voltages, the mutual impedances are reciprocal for closed networks, and also for open wires provided the points of application of voltage and measurement of current are exactly interchanged. Extensions to transient currents and n coupled circuits are suggested. Applications to quadripoles, linear aerials and wave projectors are discussed. Limitations of the theory are indicated.

621.392.4.018.12 **1359**

Realization of a Constant Phase Difference.—S. Darlington. (*Bell Syst. tech. J.*, Jan. 1950, Vol. 29, No. 1, pp. 94–104.) Analysis of the problem of obtaining over a wide frequency range the best approximation to a constant phase difference between the outputs of a pair of constant-resistance phase-shifting networks fed from a common source. The phase variation over a frequency range of ratio ω_2/ω_1 is derived generally for networks of n sections with optimum circuit constants, using Cauer's functions based on a Tchebycheff approximation. The determination of the parameters of the network sections is described.

621.392.41 : 621.317.729 **1360**

An Electrolytic Tank for the Measurement of Steady-State Response, Transient Response and Allied Properties of Networks.—A. R. Boothroyd, E. C. Cherry & R. Makar. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 126–128.) Long summary of 2743 of 1949.

621.392.43 **1361**

Theoretical Limitations on the Broadband Matching of Arbitrary Impedances.—R. M. Fano. (*J. Franklin Inst.*, Feb. 1950, Vol. 249, No. 2, pp. 139–154.) Conclusion of 1094 of May.

621.392.43 **1362**

Two-Band Antenna-Matching Networks.—Marshall. (*See* 1339.)

621.392.43 : 621.396.67 **1363**

Design Procedures for Pi-Network Antenna Couplers.—L. Storch. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, p. 158.) Correction to 571 of March.

621.392.5 **1364**

Method of Calculating the Response of a Linear System to an Arbitrary Stimulus.—M. D. Indjoudjian. (*Ann. Télécommun.*, Feb. 1948, Vol. 3, No. 2, pp. 34–44.) The concept of admittance of a network is generalized by the introduction of a response factor and methods are indicated for determining the response of a system to an arbitrary stimulus from its response to certain particular stimuli. Comparison is made between Fourier series, the Fourier integral and Laplace integral, indicating their fields of application and explaining the successful results obtained by means of the Laplace transformation, closely related to the fact that the Laplace transforms of voltages and currents follow Ohm's law. The most important formulae connected with the Laplace transformation are listed and the method is applied to determine the response of a linear system to an impulsive, transient or suddenly applied sinusoidal stimulus, introducing Heaviside developments in series. The particular case of a low-pass filter is considered. The relation between the continuous spectrum of an isolated signal and the line spectrum of a train of recurrent signals is discussed. Other applications of the Laplace transformation to differential and integral equations and to finite-difference equations are explained.

621.392.52 **1365**

The Analysis of Broad-Band Microwave Ladder Networks.—M. C. Pease. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 180–183.) When line effects are present, analysis of multi-element networks by normal methods is complicated. Pauli spin matrices are applied to structures with 2, 3, 4 or 5 elements, and explicit formulae for the transmission function of quarter-wave coupled filters are derived. Curves for the mid-band $\lambda/4$-spacing case are given; from these the exact voltage s.w.r. of a low-Q filter can be readily calculated.

621.392.52 : 621.315.212 **1366**

Spurious Modes in Coaxial-Transmission-Line Filters.—D. E. Mode. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 176–180.) Poor agreement between observed and calculated lower TEM cut-off frequencies is shown to be due to the transmission of higher, or spurious, modes past the shunt rods, or to resonances occurring when the circumference of either coaxial conductor is a multiple of the wavelength. A more exact method for calculating the TEM cut-off frequencies is given.

621.392.52 : 621.397.82 **1367**

Eliminating TVI with Low-Pass Filters.—G. Grammer. (*QST*, Feb.–April 1950, Vol. 34, Nos. 2–4, pp. 19–25, 20–25, 104 & 23–30.) Part 1 deals with the installation and operation of amateur transmitting equipment to minimize interference with television reception. Part 2 discusses operating characteristics of filters and practical design considerations. Part 3 describes simplified graphical methods for filter design.

621.392.52.029.63 **1368**

A Coupled 'Coaxial' Transmission-Line Band-Pass Filter.—J. J. Karakash & D. E. Mode. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 48–52.) Design of a microwave filter formed by two parallel conductors within a conducting cylinder. Expressions are derived for cut-off frequencies, attenuation and impedances, and matching conditions are considered. Experimental results are in fair agreement with theory.

621.392.53 : 621.397.645 **1369**

The Design of Complex Correcting Circuits for Television Amplifiers.—G. V. Braude, K. V. Epaneshnikov & B. Ya. Klimushev. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 24–33. In Russian.) The operation of the correcting circuit using inductances in the grid and anode circuits of the valve (Fig. 5) is discussed. Use is made of the method of transient characteristics determining the transmission of a single impulse by the amplifier, and parameters of the circuit are so chosen as to ensure the best compromise between the frequency and phase corrections. The characteristics so obtained are much better than those of a simple circuit (inductance in the anode circuit only) and approach very near the ideal characteristics.

621.395/.396.665 : 621.3.015.33 **1370**

Transient Response of a Regulator Chain.—H. Jefferson. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 83–85.) An expression is derived which characterizes the output of a chain of identical automatic level regulators following a change of input level. A system having n sections has an output response characteristic which crosses the reference-level axis $n-1$ times. The time scale depends only on a constant k, a characteristic of the regulators, but the amplitude is independent of k and depends only on the magnitude of the initial disturbance. Further expressions are derived for the case when k is not the same for all the regulators in the chain, and for the practical case when the integration process is imperfect owing to leakage.

621.396.6 **1371**

1950 Components Exhibition, Paris.—J. Rousseau. (*T.S.F. pour Tous*, March 1950, Vol. 26, No. 257, pp. 91–96.) Short review with classification of exhibits, and descriptions and illustrations of valves, c.r. tubes, coils, assembled units and capacitors. Other types of equipment will be considered in subsequent articles. For other accounts see *Radio prof., Paris*, Feb. 1950, Vol. 19, No. 181, pp. 20–29, and *Toute la Radio*, March/April 1950, Vol. 17, No. 144, pp. 128–137.

621.396.6 **1372**

The Design of Electronic Equipment using Subminiature Components.—M. L. Miller. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 130–135.) A general survey with particular attention to the heat dissipation of the units and the operating temperatures of the components.

621.396.611.1 : 536.49 **1373**

Nomographic Determination of Temperature Compensation for Oscillatory Circuits.—H. Geschwinde. (*Funk u. Ton*, Feb. 1950, Vol. 4, No. 2, pp. 85–89.) Values of compensating ceramic capacitors are given by a simple abac.

621.396.611.1.015.3 : 621.3.012 **1374**

Detuned Resonant Circuits.—D. G. Tucker: H. Elger. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 64–65.) Comment on 1102 of May (Elger) and Elger's reply.

621.396.611.21 **1375**

Crystal-Controlled Oscillators.—C. V. Chambers. (*QST*, March 1950, Vol. 34, No. 3, pp. 28–33.) An investigation to determine optimum operating conditions using the new small type of crystal in three popular oscillator circuits: (*a*) grid-anode circuit, (*b*) triode-tetrode circuit, (*c*) modified Pierce circuit. Valves used were Types 6AG7, 6F6, 6V6GT and 6L6. Circuits are shown and performance curves are analysed. The 6AG7 was found the best valve from every standpoint. The triode-tetrode circuit gives the highest output and the modified Pierce circuit the lowest crystal current. Screen-voltage regulation is recommended for good keying.

621.396.611.3 : 621.365.5 **1376**

Output Coupling of Valve Generators for Industrial Heating Purposes.—M. Krüger. (*Arch. Elektrotech.*, 1950, Vol. 39, No. 9, pp. 619–632.) A systematic study of various methods of coupling to the load circuit, particularly transformer coupling, for which graphical design methods are given.

621.396.611.4 **1377**

On Avoiding Low Frequencies in a Rectangular Cavity Resonator used as Part of a Triode Generator.—K. F. Niessen. (*Appl. sci. Res.*, 1950, Vol. B1, No. 5, pp. 325–340.) Reprint. See 1330 of 1949.

621.396.615 **1378**

Phase-Shift Oscillator.—W. R. Hinton: W. P. N. Court. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 65–66.) Comments on 324 of February (Vaughan).

621.396.615 **1379**

On the Design of RC Oscillators.—V. G. Kriksunov. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 49–58. In Russian.) Several variants of the RC oscillator are examined critically and the advantages of the type in which the feedback voltage from the load resistance is applied to the phase-shift circuit through a cathode follower (Fig. 2) are pointed out. The operation of this type of oscillator is discussed in detail and separate design formulae are derived for the cases when the phase-shift circuit consists of three and four links respectively. Formulae are also derived for determining the frequency stability and amplitude of steady-state oscillations. A diagram is given of the oscillator with which the theoretical conclusions were verified.

621.396.615 **1380**

Investigations of a Transitron Relaxation Oscillator.—V. V. Migulin & T. N. Yastrebtsova. (*Elektrotechnik, Berlin*, Feb. 1950, Vol. 4, No. 2, pp. 42–45.) German account of 3054 of 1948.

621.396.615.12 : 621.365.5 **1381**

High-Power, High-Frequency Oscillators for Industrial Uses.—C. Beurtheret. (*Rev. tech. Comp. franç. Thomson-Houston*, Feb. 1950, No. 13, pp. 5–16.) Two design principles have been adopted for simplifying industrial heating apparatus. These are: (*a*) the intermittent operation of valves with high thermal inertia, permitting a tenfold increase of the normal maximum anode dissipation; (*b*) the coupling of thyratron or other rectifiers direct to h.v. polyphase mains. Illustrations of a 12–120-kW and a 50–500-kW generator incorporating these principles are shown.

621.396.619.23 **1382**

Non-Linear Effects in Rectifier Modulators.—D. G. Tucker & E. Jeynes. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, p. 66.) Comment on 2184 of 1949 (Belevitch).

621.396.615.17 **1383**

High-Power Sawtooth Current Synthesis from Square Waves.—H. E. Kallmann. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 60–64.) 1949 I. R. E. National Convention paper. A high-power sawtooth oscillation may be obtained by adding a series of square waves whose amplitudes and periods decrease as $1/2^n$. For n square waves, the first (2^n-1) harmonics of the true and synthesized sawtooth waves are identical, and a basic circuit using push-pull connections for addition of four square waves is illustrated. The requirements of filters for smoothing the step-ripple of the output are discussed. The efficiency of the basic circuit is $<50\%$, but by a gating system which permits only addition of the current in the 'push' and 'pull' valves, this can be raised to nearly 100%.

621.396.615.17 : 621.315.612.4 **1384**

Aperiodic Frequency-Doubling by means of 'Pluri-Terminal' Titanate Capacitors.—A. A. Pascucci & H. W. Stawski. (*Nature, Lond.*, 18th March 1950, Vol. 165, No. 4194, p. 441.) The dependence of the permittivity of titanate ceramic dielectrics upon applied field strength holds both for crossed and for parallel superimposed fields. In measurements demonstrating this effect, application of a sufficiently high a.c. voltage to one pair of opposite faces of a parallelepiped of the material, and a polarizing voltage to the orthogonal pair, produced a frequency-doubled output, the fundamental frequency being almost completely suppressed. See also 1612 of 1949 (No. 53: Pascucci).

621.396.645 **1385**

New High-Efficiency Methods of Amplifying Modulated Oscillations.—N. V. Trunova. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 63–73. In Russian.) A modified Doherty modulation circuit is proposed in which two modulated channels with a single impedance inverter are provided (Fig. 2). This method is compared with the one used in the Dutch (Nozema) 125-kW transmitter in which four modulated channels with three impedance inverters are used (Fig. 5). The operation of both systems is discussed and the design of the grid circuit is considered in detail. The Nozema system is expensive and gives only a slight increase (from 3 to 6%) in the efficiency. The single inverter system on the other hand ensures a sufficiently high efficiency (approx. 60%) and a low level of nonlinear distortion.

621.396.645 **1386**

Graphical and Analytical Study of Cathode-Follower Problems.—S. Malatesta. (*Alta Frequenza*, June/Aug. 1949, Vol. 18, Nos. 3/4, pp. 134–147. In Italian, with English, French and German summaries.) Considering anode current as a function of the grid anode voltage rather than of the grid/cathode voltage, a family of characteristic curves and a set of differential parameters are derived; by means of these, cathode-follower problems can be solved by the conventional methods used for amplifiers.

621.396.645 **1387**
A New Phase-Inverter Stage for a Push-Pull Amplifier.—J. Lignon. (*T.S.F. pour Tous*, March 1950, Vol. 26, No. 257, pp. 102–105.) Description of a circuit using a double-triode for feeding an aperiodic amplifier. Chief advantages of such a stage are: (*a*) the voltage gain of about 30 dispenses with the need for a driver stage in a l.f. power amplifier; (*b*) the phase relation of the two output voltages remains constant from zero up to several megacycles/sec, so that phase distortion is eliminated.

621.396.645 **1388**
RC-Coupled Power Stage.—M. G. Scroggie. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 81–82.) Conditions are derived for maximum output.

621.396.645 : 534.85 **1389**
Phonograph Reproduction: Part 2.—C. G. McProud. (*Audio Engng, N.Y.*, March 1950, Vol. 34, No. 3, pp. 20–22.) Continuation of 1117 of May, giving full details of the preamplifier and equalizer circuits, with a complete list of components, for a control unit to be used with the Musician's Amplifier (70 of January).

621.396.645.37 **1390**
Combining Positive and Negative Feedback.—J. M. Miller, Jr. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 106–109.) Description, with full circuit details, of a 2-stage a.f. amplifier using a combination of local positive feedback in the first stage and a moderate amount of overall negative feedback. Results of distortion measurements for many different combinations of operating conditions are tabulated and shown graphically. Characteristics approaching those of more complex amplifiers with a greater degree of negative feedback can be obtained.

621.396.822 : 621.316.8 **1391**
The Linear Theory of Fluctuations Arising from Diffusional Mechanisms — An Attempt at a Theory of Contact Noise.—J. M. Richardson. (*Bell Syst. tech. J.*, Jan. 1950, Vol. 29, No. 1, pp. 117–141.) A general analysis of the power spectral density $S(\omega)$ of the fluctuations of the resistance of a contact which are linearly determined by thermally-excited concentration fluctuations in a diffusing medium. Special physical models are considered and the theoretical spectra derived are compared with Christensen & Pearson's experimental result: $S(\omega) = KV^{a-2}\bar{R}^{b+2}\omega^{-1}$, where V is the applied d.c. voltage, $\bar{R}$ the average value of the contact resistance and $a \approx 1.85$, $b \approx 1.26$. A system involving the contact between relatively large areas of rough surfaces covered with diffusing surface layers should have $S(\omega) \propto \omega^{-1}$ and a reasonable dependence of $S(\omega)$ on $\bar{R}$. A refinement of the theory removes the divergence at $\omega = 0$ of the integral of $S(\omega)$. The analysis is intended to elucidate the mechanism of voltage fluctuations in granular resistors, thin films, rectifying crystals and transistors when a d.c. voltage is applied.

GENERAL PHYSICS

53 **1392**
1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

5. News of the Nucleus.—U. Liddel.
76. Scattering of Plane Electromagnetic Waves by a Perfectly Conducting Hemisphere or Hemispherical Shell.—E. Kennaugh.
77. Diffraction by a Prolate Spheroid.—F. V. Schultz.

531.8 : 621.396.619 **1393**
From Linear to Nonlinear Mechanics.—J. Loeb. (*Ann. Télécommun.*, Feb. 1950, Vol. 5, No. 2, pp. 65–71.) By analogy with the linear transformation of a telecommunication signal by a nonlinear system, the modulator, a similar process can be used to linearize nonlinear electromechanical or mechanical systems such as relays, radiogoniometers, etc. A 'sweep function' in this case serves the same purpose as the radio carrier wave.

534.2 + 538.566 **1394**
Field Due to a Point Radiator in a Medium of Non-Homogeneous Layers.—L. M. Brekhovskikh. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, Sept./Oct. 1949, Vol. 13, No. 5, pp. 505–545. In Russian.) In previous papers the author investigated the propagation of sound and e.m. waves in layers with plane parallel boundaries. In the present paper the more general case is considered of a layer, the upper and lower boundaries of which are not sharply defined. A new method is proposed for determining the field due to a point radiator. In this method the radiated spherical wave is resolved into a number of plane waves and the propagation of each of these is examined separately. Equations determining the propagation of the waves are derived and their solutions found in the form of integrals. These integrals are discussed in detail and it is shown that the results obtained can be presented in a form suitable for calculation. Different combinations of waves become predominant at different distances from the radiator. The dependence of the sound pressure or intensity of the e.m. field on distance from the radiator is determined. Illustrative examples are given.

537.291 + 538.691] : 621.385.029.63/.64 **1395**
Electron Beams in Axially Symmetrical Electric and Magnetic Fields.—C. C. Wang. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 135–147.) Equations are obtained for the trajectories of electrons along the outer edges of beams for the general case in which both axial and radial fields are present. The effects of the combined fields can be expressed as a single generalized potential function depending only on the axial and radial space coordinates, thus permitting the force components to be expressed as components of the gradient of the potential function. Numerical solutions are obtained and normalized curves are given for practical cases. An equilibrium radius exists for which the net radial forces acting on the electron are zero and the outer radius of the beam oscillates about this value, the amplitude being nonsymmetrical and the distance between successive maxima depending on the amplitude.

538.322 **1396**
Attraction between Two Parallel Currents of Unlimited Length.—A. Liénard. (*J. Phys. Radium*, Jan. 1950, Vol. 11, No. 1, pp. 1–6.) The degree of approximation of known formulae for the force of attraction is determined by combining Kelvin's inversion method and the Schwartz method of alternation. Making use of the fact that the field around each conductor is the same as that due to doublets comprising two equal and opposite currents, an expression for the attraction is derived in the form of a rapidly converging series. Simple modifications of the formulae are indicated for the case in which the medium surrounding the conductors is not a vacuum.

538.56 : 537.71 **1397**
The Intrinsic Impedance of Space.—T. Tanasescu: É. Brylinski. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 63–64.) Further discussion. See also 607 of March (Budeanu), 870 of April (Foch) and 877 of April (Brylinski).

538.569.4 : 523.755 **1398**
On the Absorption of Radio Waves in the Solar Corona.—V. L. Ginzburg. (*Astronom. Zh.*, March/April 1949, Vol. 26, No. 2, pp. 84–96. In Russian.) Formulae for the absorption of radio waves in an ionized gas are discussed; they may be applied to the ionosphere, the solar corona and the interstellar gas. Differences between the absorption of radio waves and light waves are considered. The 'radiative depth' of the solar corona for wavelengths in the range 0.6–50 m is determined and the results are tabulated. Discussion of the effect of magnetic fields shows that both the ordinary and extraordinary waves are elliptically polarized and that they originate from different layers and can have very different intensities.

537.212 + 538.12 **1399**
Electric and Magnetic Fields. [Book Review]—S. S. Attwood. Publishers: Chapman & Hall, London, and J. Wiley & Sons, New York, 3rd edn 1949, 475 pp., 44s. or $5.50. (*Wireless Engr*, March 1950, Vol. 27, No. 318, p. 94; *Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, p. 191.) Intended to provide "training in the development of the fundamental concepts, formulas, terminology, and units used in electric and magnetic field study." "The rationalized m.k.s. system of units has been adopted, but tables are given showing the relations between the units in the various systems."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72 : 621.396.812.3 **1400**
Sudden Enhancements [of atmospherics] **on Very Long Waves.**—Bureau. (*See* 1499.)

523.72.029.64 : 621.396.822 **1401**
Distribution of Radiation from the Undisturbed Sun at a Wave-Length of 60 cm.—H. M. Stanier. (*Nature, Lond.*, 4th March 1950, Vol. 165, No. 4192, pp. 354–355.) Measurements made at this wavelength with spaced aerials showed that no apparent increase in radiation occurs at the limb and the intensity there is about 66% of that near the centre of the disk. About 30% of the total radiation comes from the region outside the visible disk.

523.74 : 621.396.11 **1402**
Unusual Ionospheric Storm.—Bennington. (*See* 1500.)

523.755 **1403**
The Solar Corona.—H. v. Klüber. (*Elektron Wiss. Tech.*, March 1950, Vol. 4, No. 3, pp. 77–88.) Observations made during eclipses are reviewed and the temperature and electron distribution in the corona are studied. Radiation intensity at different wavelengths is discussed. The 'betatron theory' may explain the heating of the corona to a temperature 10^6 degrees above that of the sun's surface, 6 000 degrees.

523.755 : 538.569.4 **1404**
On the Absorption of Radio Waves in the Solar Corona.—Ginzburg. (*See* 1398.)

523.856 : 621.396.822 **1405**
Point Sources of Radio Noise.—D. H. Menzel & D. J. Crowley. (*Nature, Lond.*, 18th March 1950, Vol. 165, No. 4194, p. 443.) A brief discussion of the origin of noise observed in radio-astronomy. It is tentatively suggested that the point sources may be comets within the solar system, which absorb ionizing energy from the sun and re-radiate it after conversion.

551.510.535 + 621.396.1 **1406**
Physical Society Conference [on the ionosphere] **at Cambridge, 14th to 16th July 1949.**—(*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 141–150.) Abstracts are given of 17 papers presented at the conference; these are all noted below, in this section or in the 'Propagation of Waves' section.

551.510.535 **1407**
Theoretical Considerations regarding the Formation of the Ionized Layers.—D. R. Bates & M. J. Seaton. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 129–140.) Physical Society Summer Conference paper. The detailed mechanisms involved in the formation of the E, F_1, F_2 and D layers by solar ultra-violet radiation are discussed. Use is made of the results of some recent calculations on the continuous absorption cross-section of atomic oxygen and nitrogen, and of the evidence on the ionic composition of the layers that is provided by the analysis of the emission spectrum of the upper atmosphere during twilight. The uncertainties existing at present are emphasized.

551.510.535 **1408**
The Formation of the Ionized Regions.—K. Weekes. (*Proc. phys. Soc.*, 1st Feb. 1950 Vol. 63, No. 362B, pp. 147–148.) Summary of Physical Society Summer Conference paper. Close comparison of observed results with Chapman's simple theory of absorption of ultra-violet light in an isothermal atmosphere reveals discrepancies, examination of which leads to a revision of the assumption that the electron recombination rate is independent of gas pressure. Gases which may be concerned in the various layers are discussed.

551.510.535 **1409**
Irregularities in the Horizontal Plane in Region E of the Ionosphere.—J. W. Findlay. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 148.) Summary of Physical Society Summer Conference paper. Experiments are described for measuring phase and amplitude variations of 2.4-Mc/s signals reflected from region E at vertical incidence, and the rapidity of phase fluctuation is taken as a measure of the irregularity of the reflecting region; daily and seasonal variations of this irregularity are shown. Measurements of the amplitudes of pulse signals returned to three ground receiving points about 100 m apart fit in with the assumption that the irregularities in region E have at any time random motions among themselves and also an overall horizontal drift. Theories are developed for determining these motions.

551.510.535 : 523.5 **1410**
Meteor Ionization in the Upper Atmosphere.—A. C. B. Lovell. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 149.) Summary of Physical Society Summer Conference paper. Recent progress in the study of the scattering of radio waves from meteor trails is described. Two significant facts are (*a*) the discovery of the great daytime meteor radiants active from May to September, and (*b*) the appreciation that only about 10^{-6} of the energy of the meteor is spent in ionization. Reflections from meteor trails have been investigated at various high frequencies, and it is established that all transient echoes in the altitude range 80 to 120 km are due to meteor ionization.

551.510.535 : 523.75 **1411**
Irregular Behaviour of the Ionosphere Associated with Solar Events.—W. R. Piggott. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 146.) Summary of Physical Society Summer Conference paper. Phenomena occurring in the lower regions of the ionosphere associated with solar flares are briefly discussed; the types of experimental data obtained are summarized, and the geophysical significance of the results is indicated. Two main types of ionospheric disturbance are identified, viz., type A, quasi-auroral, and type R, regular. Type A produces marked effects in the F region, associated with fluctuations in the local magnetic field; its relaxation time is a few minutes to one or two hours. Type R

consists of a positive phase (ionization density above normal) and a negative phase (ionization density below normal and recovering); it has not been found to be connected with magnetic variations; its relaxation time may be some hours or days.

551.510.535 : 621.396.11 **1412**
Scattering of Radio Waves from Region E.—Millington. (*See* 1488.)

551.510.535 : 621.396.11 **1413**
Scattered Echoes Near the Critical Frequencies of the F_2 region.—Rivault. (*See* 1487.)

551.510.535 : 621.396.81 **1414**
Measurements on Long and Very Long Waves.—Bracewell. (*See* 1495.)

551.510.535 (98) **1415**
(P', f) Records at Spitsbergen.—A. B. Whatman. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 145.) Summary of Physical Society Summer Conference paper. Sixty (P', f) records are shown, made with Admiralty Type-249 equipment in Spitsbergen in 1942–1943. These illustrate all the interesting normal and abnormal effects met with and supplement those recently published (2796 of 1949).

LOCATION AND AIDS TO NAVIGATION

621.396.9 **1416**
1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

18. The Statistical Properties of Noise Applied to Radar Range Performance.—S. M. Kaplan & R. W. McFall.
61. Antenna System for Very-High-Frequency Radio Ranges and Direction Finding.—F. J. Lundburg & F. X. Bucher.
120. Measurement and Analysis of Noise in a Fire-Control Radar.—R. H. Eisengrein.
143. Analysis of Course Errors in the V.H.F. Omni-directional Radio Range.—J. W. Leas.
144. Dynamic Aspect of Errors in Radio Navigation Systems, particularly in Case of Fast-Moving Receivers and Transmitters.—H. Busignies.
145. A New Basis for Analyzing Radio Navigation and Detection Systems.—N. L. Harvey.
146. Stochastic Processes as applied to Aerial Navigation and Direction Finders.—L. A. de Rosa.
147. 1 000-Mc/s Crystal-Controlled Airborne Transmitter for Distance Measuring Equipment.—B. Warriner.

621.396.9 : 371.3 **1417**
Aids to Training — The Design of Radar Synthetic Training Devices for the R.A.F.—G. W. A. Dummer. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 124–125.) Discussion on 2230 of 1949.

621.396.93 **1418**
Fixed H-Adcock Direction Finder for V.H.F.—B. G. Pressey & G. E. Ashwell. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 54–58.) "The paper describes an investigation into the practicability of the fixed type of H-Adcock direction finder for use at very high frequencies (30–100 Mc/s) under conditions in which the aerial system is remote from the operator. The experimental equipment consisted essentially of two crossed H-Adcock aerials mounted on a wooden tower 10 m high. The aerial system was connected by r.f. transmission lines to a goniometer and receiver situated in a hut near the base of the tower. By making adjustments to the length of the transmission lines and their point of connection to the aerial feeders a high instrumental accuracy was obtained on signals of mixed as well as vertical polarization. The sensitivity was such that bearings with a silent swing of $\pm 5°$ could be taken on field strengths varying between 0.5 and 14 μV/m over the frequency range."

621.396.93 **1419**
The Specification and Measurement of Polarization Errors in Adcock-Type Direction Finders.—W. Ross. (*Elektrotechnik, Berlin*, March 1950, Vol. 4, No. 3, pp. 90–92.) German version of 3143 of 1949.

621.396.93 : 621.396.11 **1420**
The Effects of Sky-Wave on the Planning of Navigational Aids using Frequencies in the 70-130 kc/s Band.—Sanderson. (*See* 1490.)

621.396.93 : 621.396.11 **1421**
The Characteristics of Low-Frequency Radio Waves Reflected from the Ionosphere, with particular reference to Radio Aids to Navigation.—Williams. (*See* 1489.)

621.396.93 : 621.396.11.029.58 **1422**
Very-Low-Frequency Propagation.—Smith & Tremellen. (*See* 1493.)

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **1423**
Construction and Applications of a New Design of the Philips Vacuum Gauge.—F. M. Penning & K. Nienhuis. (*Philips tech. Rev.*, Oct. 1949, Vol. 11, No. 4, pp. 116–122.) By modification of the electrode structure of the original design (1525 and 4265 of 1937) the range of the instrument has been extended to below 10^{-6} mm Hg. Its application as a leak detector is described.

535.215.4 **1424**
The Photoconductivity of Bismuth Sulphide and Bismuth Telluride.—A. F. Gibson & T. S. Moss. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 176–177.) Independent investigations by the two authors on Bi_2S_3 and Bi_2Te_3 photoconductive and photovoltaic layers of considerable sensitivity do not confirm the suggestion made by Fink & Mackay (U.S. Patent No. 2 406 139, 1946) that these substances may be photosensitive to wavelengths as great as 7μ. The measurements indicate that the Bi compounds behave in a similar way to the corresponding Pb compounds but are inferior to them.

535.37 **1425**
The Fluorescence of Zinc Sulphide Activated with Copper.—F. A. Kröger, J. E. Hellingman & N. W. Smit. (*Physica, 's Grav.*, Dec. 1949, Vol. 15, Nos. 11/12, pp. 990–1018. In English.) Experimental study, using controlled atmospheres at different temperatures, of the variation in the relative concentration of the fluorescence and quench centres with the conditions of preparation. Effects of refiring at a lower temperature are described. The physical behaviour of the system is discussed on the basis of the Schön-Klasens theory of energy transfer between centres.

537.122 : 621.315.6 **1426**
Time Dependence of Electronic Processes in Dielectrics.—H. Fröhlich & J. O'Dwyer. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 81–85.)

537.228.1 : 548.0 **1427**
Superpolarizable (Piezoelectric) Materials.—E. Granier. (*Rev. gén. Élect.*, Jan. 1950, Vol. 59, No. 1, pp. 33–45.) Study of the dielectric, hysteresis and piezoelectric properties of crystals derived from Rochelle salt.

537.228.1 : 548.0 **1428**
On the Ferroelectricity of KH_2PO_4 and KD_2PO_4 Crystals.—J. Pirenne. (*Physica, 's Grav.*, Dec. 1949, Vol. 15, Nos. 11/12, pp. 1019–1022. In English.) A new theory is proposed to explain the unusual isotopic effect observed with these crystals.

537.529 **1429**

The Time Delay in Conduction and Breakdown Processes in Amorphous Solids.—J. H. Simpson. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 86–100.) Theoretical determination of the time delay from Fröhlich's theory, and comparison with experimental values.

539.23 : 537.311.31 **1430**

The Resistivity of Thin Metallic Films.—R. A. Weale. (*Proc. phys. Soc.*, 1st Feb. 1949, Vol. 62, No. 350A, pp. 135–136.) A formula derived for the effective temperature coefficient α' of resistivity indicates that for a film of certain thickness α' will be zero and will be negative if the thickness is further reduced. Negative values are to be expected for comparatively thick films of Bi, in which the mean free path of the electrons is exceptionally long. The formula also shows that the temperature at which α' is zero is lower the thicker the film. The results of van Itterbeek & de Greve (343 and 3305 of 1946) for Ni films are in good agreement with the formula.

539.23 : 537.311.31 **1431**

Conductivity of Thin Metallic Films.—D. A. Wright: R. A. Weale. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 173–175.) Wright disagrees with Weale's treatment of the problem and points out that according to Appleyard & Lovell (1940 of 1937) metallic films, however thin, should have a positive temperature coefficient. Semiconductor effects could explain the existence of a negative coefficient below a certain temperature. Weale indicates a way of reconciling the two points of view.

620.197 **1432**

Tropicalization of some Materials and Assemblies used in the Construction of Valves.—G. Trebuchon. (*Le Vide, Paris*, Jan. & March 1950, Vol. 5, Nos. 25 & 26, pp. 748–752 & 777–780.) Discussion of materials affected, various specifications of methods to meet different conditions of use, test methods, and practical techniques.

621.3.011.5 : 532 **1433**

Refractive Indices and Dielectric Constants of Liquids and Gases under Pressure.—J. S. Rosen. (*J. chem. Phys.*, Dec. 1949, Vol. 17, No. 12, pp. 1192–1197.) Interpolation formulae are discussed.

621.3.011.5 : [546.815.831 + 546.431.831 **1434**

Dielectric Properties of Lead Zirconate and Barium-Lead Zirconate.—S. Roberts. (*J. Amer. Ceram. Soc.*, 1st Feb. 1950, Vol. 33, No. 2, pp. 63–66.) Methods are described for preparation of ceramic samples. The dielectric properties are measured at 1 Mc/s in the temperature range 25° to 350° C for samples with different proportions of lead and barium. High dielectric constants, of the order of 7 000, are obtainable even at room temperatures. Nonlinear dielectric properties and piezoelectric effects are also investigated.

621.315.61.011.5.029.62/.64 : 621.317.335.3 **1435**

Measurement of Dielectric Constant and Power Factor at Ultra-High Frequencies.—Briganti. (*See* 1452.)

621.385.032.21 + 666.1.037.5 **1436**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

158. A Vacuum Seal between Metals and Ceramics for High Temperature Applications.—H. W. Soderstrom & K. H. McPhee.
159. Effect of Coating Composition of Oxide-Coated Cathodes on Electron Emission.—E. G. Widell & R. A. Hellar.
160. Effects of Controlled Impurities in Nickel Core Metal on Thermionic Emission from Oxide-Coated Cathodes.—G. Hees.
161. Investigation of Contaminant in Vacuum Tubes.—P. D. Williams.
162. Hot Strength Properties of Filamentary Alloys.—B. Wolk.

666.968 : 621.315.612.6 : 621.315.613.1 **1437**

Vacuum-Tight Sealing of Glass and Mica.—J. Labeyrie. (*J. Phys. Radium*, Jan. 1950, Vol. 11, No. 1, p. 20.) Mica laminae as thin as 0.01 mm can be sealed to glass by means of a powdered enamel (G50) which softens at 354° and melts at 550 C. The same enamel may be used to seal mica to alloys with coefficients of expansion between 85 and 110×10^{-7} per degree C.

MATHEMATICS

51 : 621.396 **1438**

Mathematics in Radio.—E. Roubine. (*Rev. tech. Comp. franç. Thomson-Houston*, Feb. 1950, No. 13, pp. 17–32.) The subject is considered from two aspects: (*a*) the assistance given to the technician by different branches of mathematics; (*b*) the application of radio principles in the solution of mathematical problems. The processes of classical analysis, symbolic, tensorial, and matrix calculus, and infinitesimal geometry are outlined. Examples are given of their use. The principles of servomechanisms and computing machines are briefly examined. As an example of the difficulties which may occur in the application of analytical methods, the case of the cylindrical dipole radiator is discussed.

517.56 : 621.3 **1439**

Origin and Meaning of Circular and Hyperbolic Functions in Electrical Engineering.—A. Boyajian. (*J. Franklin Inst.*, Feb. 1950, Vol. 249, No. 2, pp. 117–131.)

517.9 **1440**

Determination of the Stable Periodic Solutions of Certain Quasi-Harmonic Differential Equations.—T. Got. (*C. R. Acad. Sci., Paris*, 13th Feb. 1950, Vol. 230, No. 7, pp. 612–614.)

681.142 **1441**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

83. Static Magnetic Pulse Control and Information Storage.—An Wang.
84. The Design of Diode Gate Circuits.—R. J. Slutz.
85. Marginal Checking as an Aid to Computer Reliability.—N. H. Tayler.
86. Development of the California Digital Computer.—D. R. Brown & P. L. Morton.
90. M.I.T. Electrostatic Storage Tube.—S. H. Dodd, H. Klemperer & P. Youtz.
117. A Discussion revealing some Late Developments in Electronic Analog Computer Techniques.—H. I. Zagor.
118. An Electronic Storage System.—E. W. Bivans & J. V. Harrington.
119. Experimental Determination of System Functions by the Method of Correlation.—J. B. Wiesner & Y. W. Lee.
121. A Digital Electronic Correlator.—H. E. Singleton.
166. A Compact Magnetic Memory.—P. L. Morton.

681.142 **1442**

Electrical Computer for Higher-Order Equations.—H. Glubrecht. (*Z. angew. Phys.*, Jan. 1950, Vol. 2, No. 1, pp. 1–8.) Seventh-order equations of the general form $w = a_n . z^n + a_{n-1} . z^{n-1} + \ldots + a_1 . z + a_0 = 0$ may be solved by the apparatus described. The unknown complex quantity z is represented by two sinusoidal oscillations with a phase difference of 90°. By combining the proposals of Tischner and Rasch, the z and w planes are displayed on a c.r. tube screen and the passage of the polar curves through zero is used to give the solution points in the z plane.

681.142 **1443**

On a General Type of Algebraic Mathematical Machine.—F. H. Raymond. (*Ann. Télécommun.*, Jan. 1950, Vol. 5, No. 1, pp. 2–20.) Further discussion of Type-OME machines (919 of April), their principles and applications. Type OME 14 can solve up to 10 simultaneous equations and uses one matrix of linear potentiometers. Types OME 12 and OME 13 use four such matrices and are designed for the solution of integro-differential equations.

501 **1444**

Introduction to Applied Mathematics. [Book Review]—F. D. Murnaghan. Publishers: Chapman & Hall Ltd, London, 1948, 389 pp., 30s. (*Beama J.*, Jan. 1950, Vol. 57, No. 151, pp. 12–13.) "The standard of the book is that of a graduate course in applied mathematics." It is the first of a series to be published on mathematical theories underlying physical science and on advanced mathematical techniques required for the solution of scientific problems. A "well-printed, well-produced" volume "suited to the needs of scientific workers in mathematics, physics, chemistry, and engineering."

517 **1445**

Höhere Mathematik für Mathematiker, Physiker, Ingenieure. [Book Review]—R. Rothe. Publishers: B. G. Teubner Verlagsg., Leipzig. Vol. 1: Differential Calculus and Basic Formulae of Integral Calculus, with Applications. 8th edn 1948, 208 pp., 6.20 DM. Vol. 2: Integral Calculus, Infinite Series, Vector Calculus, with Applications. 6th edn 1949, 208 pp., 6.20 DM. Vol. 4: Exercises with Solutions, Nos. 1/2, 5th edn 1949, 109 pp., 3.50 DM. Nos. 3/4, 4th edn 1949, 108 pp., 3.40 DM. (*Elektrotechnik, Berlin*, Feb. 1950, Vol. 4, No. 2, p. 64.)

MEASUREMENTS AND TEST GEAR

529.78 : 621.396.91 **1446**

The Synchronization of Clocks by means of Periodic Signals.—M. Lavet. (*Rev. gén. Élect.*, Jan. 1950, Vol. 59, No. 1, pp. 22–32.) Past and present systems of time-signal transmissions are reviewed and their application in various branches of science and industry is discussed. Methods are described for applying the accurate time signals now available to the synchronization of master clocks and recording chronometers, and to the regulation of ancient pendulum clocks in church towers or public buildings.

529.786 + 621.3.018.4(083.74) **1447**

Adjustment of High-Precision Frequency and Time Standards.—J. M. Shaull. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 6–15.) The basic equipment used by the C.R.P.L. of the National Bureau of Standards for broadcasting standard frequency and time signals is described and the application of these signals in the calibration of similar equipment is discussed. Several methods are described for checking the frequency of precision oscillators and the performance of precision clocks. Methods of recording performance data for such standards are suggested, Expected improvements in constancy and accuracy, and possible changes in the types of standards used in time measurement, are considered.

539.16.08 : 621.083.72 **1448**

A Pulse-Amplitude Analyser of Improved Design.—E. H. Cooke-Yarborough, J. Bradwell, C. D. Florida & G. A. Howells. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 108–121.) A discussion of the requirements and a detailed description are given of an instrument designed to measure the amplitude distribution of pulses in an ionization chamber or other source. There are five channels, so that the pulses are divided into five groups of different level. The instrument consists of an amplifying and pulse-expanding unit, a ladder sorting circuit, and five scaling units and registers. The circuits include a combined discriminator and cancelling circuit, and an automatic d.c. level control, which are new and contribute effectively to stability and simplicity of adjustment.

621.317.089 : 621.3.012 **1449**

A Modern Electroacoustic Frequency-Response Recording Unit.—H. Lehner. (*Funk u. Ton*, Feb. 1950, Vol. 4, No. 2, pp. 53–65.) The construction and operation of the instrument are described. Impedances of passive 2-pole networks, quadripole and transmission-line attenuations, microphone and loudspeaker response curves can be recorded automatically.

621.317.32 **1450**

A Negative-Feedback D.C. Amplifier with D.C.-Polarized Chokes and Grid-Controlled Valves.—W. Geyger. (*Arch. tech. Messen*, Feb. 1950, No. 169, pp. T22–T24.) An instrument is described in which the direct voltage to be measured is applied to the control windings of a magnetic amplifier and is opposed by the voltage across a compensating resistor in the circuit of a moving-coil recorder. The recorder is operated from a symmetrical double-triode circuit to which the output from the magnetic amplifier is applied. The range of the instrument is from zero to 0.5 mV.

621.317.321.027.2 **1451**

Method of Measurement of Small Direct Voltages.—H. H. Rust & H. Endesfelder. (*Z. angew. Phys.*, Jan. 1950, Vol. 2, No. 1, pp. 39–41.) The method consists in converting the direct voltage into a proportionate alternating voltage. A carbon microphone is energized by the voltage to be measured and responds to tone of constant frequency and amplitude from a loudspeaker. By suitable amplification of the microphone output, voltages down to 1 μV can be measured. Variable direct voltages may be measured if their pulsation frequency is lower than that of the tone source.

621.317.335.3 : 621.315.61.011.5.029.62/.64 **1452**

Measurement of Dielectric Constant and Power Factor at Ultra-High Frequencies.—E. Briganti. (*Alta Frequenza*, Dec. 1949, Vol. 18, No. 6, pp. 243–253. In Italian, with English, French and German summaries.) Description of a method of measurement based on determining the Q factor of a coaxial transmission line sustaining standing waves, with and without the dielectric. Simple formulae are given for calculating dielectric constant and power factor from the different lengths of the resonant line. Results obtained on 10-cm and 22.5-cm wavelengths are given for a few modern insulating materials.

621.317.361 : 621.396.611.21 **1453**

Crystal Resonators as Frequency Substandards.—F. J. M. Laver. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 93–99.) The phase response of a crystal resonator is a more sensitive indication of its resonance point than the amplitude response. Equipment using the phase-difference principle is described which enables the resonance frequency of quartz vibrators of frequency 100 kc/s ± 10 c/s to be determined to ± 1 part in 10^8, provided that the Q factor of the vibrator is greater than 10^5. Some results of long-period tests of vibrators with this equipment are given. Quartz resonators may usefully supplement the oscillator units of a large frequency-standard installation.

621.317.7 **1454**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

19. Accelerated Life Testing of Vacuum Tubes.—J. Rothstein.
20. Statistical Evaluation of Life Expectancy of Vacuum Tubes designed for Long-Life Operation.—E. M. McElwee.
26. Specification for Quality of the Visual Output of Picture Tube Screens.—A. E. Martin.
42. Oscillographic Presentation of Time Delay and Distortion in Broad-Band F.M. Systems.—A. R. Vallarino.
44. New Test Equipment for the U.H.F. Television Band.—J. Ebert & H. A. Finke.
45. Direct Reading Phasemeter.—L. H. O'Neill & J. L. West.
46. Measuring Procedure for Radioteletype Converters.—H. C. Hawkins.
98. Performance Measurement of Capacitors.—H. T. Wilhelm.
101. Transformer Performance and Measurements.—R. Lee.

621.317.71 **1455**

New Method of Measurement of Very Heavy Direct Currents.—R. Servant. (*Rev. gén. Élect.*, Jan. 1950, Vol. 59, No. 1, pp. 45–47.) Two flat arms at right angles, with hyperbolic profiles, are pivoted at the vertex and serve as formers for special windings fed by an auxiliary current source adjustable within wide limits. When held so that a conductor carrying heavy current is included in the angle between the two arms, the device is subjected to a couple proportional to the cable current and this couple is neutralized by adjustment of calibrated torsion springs. Partial readings obtained at various positions around the conductor are added. Currents in the range 1–10 kA can be measured.

621.317.733 : 621.317.37 **1456**

Development of Bridges for Dielectric Measurements.—T. Gast. (*Z. angew. Phys.*, Jan. 1950, Vol. 2, No. 1, pp. 41–48.) A review of a.c. bridges from the fixed-frequency hand-operated instrument to the fully-automatic two-component bridge with a wide frequency range. An automatic system of loss equalization for a pure capacitance bridge by means of an auxiliary current is described.

621.317.733.029.62/.63 **1457**

Two Simple Bridges for Very-High-Frequency Use.—D. D. King. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 37–39.) Two bridges for impedance measurement are described: (*a*) a hybrid junction tunable over the range 100–500 Mc/s and capable of great sensitivity; (*b*) an untuned Wheatstone bridge for use in the same frequency range. Design features and performance characteristics are given for both units.

621.317.755 **1458**

Simple Cathode-Ray Oscilloscope.—M. G. Scroggie. (*Wireless World*, March 1950, Vol. 56, No. 3, pp. 82–83.) Design details of a circuit comprising tube controls, variable-frequency timebase and single-valve amplifier. The timebase operates at frequencies from 12 c/s to 40 kc/s, while the amplifier has a flat response over the range 20–20 000 c/s and a continuously variable gain up to about 41 db at a.f. and to 20 db at higher frequencies.

621.317.755 **1459**

An Easily Portable Cathode-Ray Oscillograph.—E. E. Carpentier. (*Philips tech. Rev.*, Oct. 1949, Vol. 11, No. 4, pp. 111–115.) Description of the Type GM5655 c.r.o. of dimensions $4\frac{1}{2} \times 11\frac{1}{2} \times 9\frac{1}{2}$ in. and weight 14 lb. The normal frequency limit is 100 kc/s. Separate amplifiers are used for the horizontal and vertical deflections.

621.317.755 : 621.396.6.001.4 **1460**

Curve Tracer with Electronic Graph Lines.—J. W. Balde, J. C. Bregar & K. L. Chapman. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 100–103.) The response curve of the apparatus under test is displayed on the screen of a c.r.o. together with marker lines indicating the tolerance limits. Only a short time is required to adapt the equipment for testing a different type of apparatus. Production testing and adjustment of filters, amplifiers, discriminators, etc., are greatly facilitated.

621.317.755.089.6 **1461**

The Dynamic Sensitivity and Calibration of Cathode-Ray Oscilloscopes at Very-High Frequencies.—H. E. Hollmann. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 32–36.) The basic formula for dynamic sensitivity in terms of the transit-time angle of electrons in the deflecting field is modified to take account of (*a*) their displacement on leaving the field and (*b*) stray-field effects. Good agreement with experimental values is obtained.

621.317.761 **1462**

Measuring a Varying Frequency.—R. L. Chase. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 110–112.) A pulse-shaping circuit is used to convert the wave of unknown frequency to a series of sharp pulses. Measurement is initiated by an external starting pulse and the number of cycles of a standard 5-Mc/s oscillator occurring in an interval corresponding to a selected integral number of the derived pulses is counted. Frequencies in the range 100 kc/s–5 Mc/s can be measured to within 0.1% in about 200 μs. The equipment was designed to measure the frequency of the r.f. oscillator in a f.m. particle accelerator, but many other applications are possible.

621.395.813.083 **1463**

Intermodulation Distortion.—T. Roddam. (*Wireless World*, April 1950, Vol. 56, No. 4, pp. 122–125.) A simplified method of measurement not requiring a harmonic analyser.

621.396.615 : 621.316.726.078.3 **1464**

A Variable-Frequency Oscillator stabilized to High Precision.—L. F. Koerner. (*Bell Lab. Rec.*, Feb. 1950, Vol. 28, No. 2, pp. 66–71.) The oscillator is stabilized by locking to a combination of the *n*th harmonic of a standard frequency source and a l.f. interpolation oscillator. This stabilized frequency may then be multiplied by means of a harmonic generator. The ultimate accuracy is limited only by that of the frequency standard. Curves obtained by means of the equipment are given showing the response of a quartz-crystal network for frequencies near its 10-Mc/s fundamental and third harmonic.

621.396.822 : 621.316.8 **1465**

Resistor Noise.—E. Paolini & G. Canegallo. (*Alta Frequenza*, Dec. 1949, Vol. 18, No. 6, pp. 254–267. In Italian, with English, French and German summaries.) Study of the noise produced by spontaneous voltage fluctuations across resistors of different types. Two instruments for measurement of such noise are described.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.322.1 : 539.165 **1466**

Theory of a Magnetic Lens Type Beta-Ray Spectrometer.—N. F. Verster. (*Appl. sci. Res.*, 1950, Vol. B1, No. 5, pp. 363–378.)

539 + 621.3 1467

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

6. Particle Accelerators.—M. S. Livingston.
7. Radio-Frequency Problems associated with Particle Accelerators.—J. P. Blewett.
8. Detection of Nuclear Radiations.—J. R. Dunning.
43. Rockets Range Instrumentation.—E. R. Toporeck & F. M. Ashbrook.
51. Industrial Television System.—R. C. Webb & J. M. Morgan.
64. A High-Capacity Matrix-Commutated Radio Telemetering System.—J. P. Chisholm, E. F. Buckley & G. W. Farnell.
67. Use of Image Converter Tube for High-Speed Shutter Action.—A. W. Hogan.
68. Ultrasonic Pulse Instruments for Automatic Continuous Measurement of Physical Properties of Solids and Liquids.—S. R. Rich.
69. Electronic Duplicator Attachments for Automatic Machine Tool Operation.—W. Roth.
70. Modern Methods of Servo Synthesis.—R. McCoy & D. Herr.
71. An Electronic Flowmeter and its Industrial Applications.—E. Mittelmann & V. J. Cushing.
132. Effects of Intense Microwave Radiation on Living Organisms.—J. W. Clark.
133. A Differential Vectorcardiograph.—S. A. Briller & N. Marchand.
134. Electronic Mapping of the Electrical Activity of the Heart and Brain.—S. Goldman.
167. Synchro-Cyclotron Field Regulator.—C. S. McKown & W. P. Caywood, Jr.

539.16.08 1468

Fluctuations in Proportional Counters.—W. F. G. Swann. (*J. Franklin Inst.*, Feb. 1950, Vol. 249, No. 2, pp. 133–137.)

621.3.07 + 621.396.645.37 1469

Control, Positive and Negative Feedback and Negative Resistance Coordinated.—Reichardt. (*See* 1347.)

621.365.5 : 621.396.611.3 1470

Output Coupling of Valve Generators for Industrial Heating Purposes.—Krüger. (*See* 1376.)

621.384.6 1471

A New Method for Particle Injection into Accelerators.—W. B. Jones, H. R. Kratz, J. L. Lawson, G. L. Ragan & H. G. Voorhies. (*Phys. Rev.*, 1st April 1950, Vol. 78, No. 1, pp. 60–62.) A method involving rapid damping of the radial or vertical oscillations for as large a number of revolutions as possible, and subsequent removal of this damping.

621.384.61 1472

The Electron Cyclotron.—P. A. Redhead, H. LeCaine & W. J. Henderson. (*Canad. J. Res.*, Jan. 1950, Vol. 28, Sec. A, No. 1, pp. 73–91.) A magnetic-resonance electron accelerator is described which is based on the principles suggested by Veksler (1913 and 2315 of 1945). A constant magnetic field and an accelerating r.f. field of frequency 2 800 Mc/s are used. Final energies of 5 MeV have been obtained in an experimental accelerator with a vacuum chamber of diameter 14 in.

621.384.611.2 1473

Validity of Two-Dimensional Design of Synchrotron Pole-Faces.—J. J. Wilkins. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 177–178.)

621.385.833 1474

Work carried out with the Magnetic Electron Microscope.—G. Dupouy. (*Rev. d'Optique*, Feb. 1950, Vol. 29, No. 2, pp. 89–100.)

621.385.833 1475

Proton Microscope Design. Application of Ion Optics in Mass Spectrography.—C. Magnan. (*Rev. d'Optique*, Feb. 1950, Vol. 29, No. 2, p. 100.) Summary only.

621.385.833 1476

Electron-Optics of Electrostatic Lenses. Comparison of Theoretical Resolving Powers of Electron and Proton Microscopes.—P. Chanson. (*Rev. d'Optique*, Feb. 1950, Vol. 29, No. 2, p. 111.) Summary only.

621.385.833 1477

Simple Expression for the Focal Length and Chromatic Aberration of an Extensive Group of Electrostatic Lenses.—É. Regenstreif. (*C. R. Acad. Sci., Paris*, 13th Feb. 1950, Vol. 230, No. 7, pp. 630–632.) See also 1213 of May.

621.385.833 : 530.12 1478

Electron Lenses in Relativistic Mechanics.—J. Laplume. (*Rev. d'Optique*, Feb. 1950, Vol. 29, No. 2, pp. 106–111.)

621.386.1 1479

Application of Electron Optics to X-Ray Tubes of Great Intensity.—S. Goldsztaub. (*Rev. d'Optique*, Feb. 1950, Vol. 29, No. 2, pp. 101–105.)

PROPAGATION OF WAVES

538.566.2 1480

Solution of a Transcendental Equation by means of Conformal Representation.—G. Eckart & T. Kahan. (*Rev. sci., Paris*, Dec. 1948, Vol. 86, No. 3300, pp. 723–726.) The equation considered, which occurs in wave-propagation theory, is

$$[\sqrt{(\lambda^2 - k_1^2)} - \sqrt{(\lambda^2 - k_2^2)}] \,/\, [\sqrt{(\lambda^2 - k_1^2)} + \sqrt{(\lambda^2 - k_2^2)}] = -\exp[+2h\sqrt{(\lambda^2 - k_1^2)}]$$

where k_1^2, k_2^2 and h are real and positive and $k_1^2 > k_2^2$. By conformal transformation of the Riemann surface λ, the real positive roots of the equation are seen to lie on the real axis of λ in the interval $k_2 \leqslant \lambda < k_1$. Graphical methods are given for determining the values of the roots.

621.396.1 + 551.510.535] : 061.3 1481

Physical Society Conference [on the ionosphere] **at Cambridge, 14th to 16th July 1949.**—(*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 141–150.) Abstracts are given of 17 papers presented at the conference; these are all noted below in this section, or in the 'Geophysical and Extraterrestrial Phenomena' section.

621.396.11 + 62 .396.81 1482

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

135. Calculation of Effective Phase, Group, and Pulse Velocities of Wave Propagation.—A. Fischler, G. H. Sloan & D. Goldenberg.
137. Radio Wave Propagation in a Curved Ionosphere.—J. M. Kelso.
153. A Microwave Propagation Test.—J. Z. Millar & L. A. Byam, Jr.

621.396.11 + 621.396.81 1483

Comparison of Measured and Calculated Microwave Signal Strengths, Phase, and Index of Refraction.—A. W. Straiton, A. H. LaGrone & H. W. Smith. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 45–48.) Experimental signal-strength/height curves and phase-change/height curves for 3.2-cm waves are compared with those derived from the corresponding curves showing the variation of the measured modified refractive index with height. The latter curves and attenuation factors determined from radio observations are also compared with the corresponding curves and attenuations deduced from meteorological observations. Four sets of radio data, for path lengths of 12.3, 31.6, 40 and 47 miles, are considered.

621.396.11 **1484**

The Speed of Radio Waves and its Importance in some Applications.—R. L. Smith-Rose. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 16–20.) 1949 I.R.E. National Convention paper reviewing present knowledge. The available data on the velocity of light are noted. Recent measurements of the velocity of 3-kMc/s radio waves *in vacuo* have given higher values than that for light, indicating an unresolved discrepancy. Investigations associated with navigation-aid systems have given values for radio wave velocities over land and sea paths. A table of mean velocity values, with estimated measurement accuracies, is given for both pulsed and c.w. radio transmissions at frequencies between 100 kc/s and 3.3 kMc/s.

621.396.11 **1485**

The Application of Ionospheric Data to Short-Wave Transmission Problems.—W. J. G. Beynon. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 145.) Summary of Physical Society Summer Conference paper. "A short survey is presented of the fundamental theory underlying the application of normal-incidence ionospheric data to short-wave communication problems, with particular reference to calculating the maximum usable frequency (m.u.f.). Some aspects of the problem of applying normal-incidence data on ionospheric absorption to the calculation of field strength in long-distance transmission are also discussed."

621.396.11 **1486**

The Regular Behaviour of Long and Very Long Waves Returned from the Ionosphere.—J. A. Ratcliffe. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 142.) Summary of Physical Society Summer Conference paper, defining the scope of the first session, indicating how the main contributions fit into the plan of the discussion and outlining some of the work carried out in Cambridge. The frequencies considered lie between 10 kc/s and 300 kc/s. Observations have mainly been near the frequencies of 16 kc/s (GBR, Rugby) and 100 kc/s (Decca), the academic workers generally concentrating on reflection effects at nearly vertical incidence, while commercial organizations have been mainly concerned with experiments at oblique incidence.

621.396.11 : 551.510.535 **1487**

Scattered Echoes Near the Critical Frequencies of the F_2 region.—R. Rivault. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 126–128. In French.) Physical Society Summer Conference paper. Two types are observed in vertical soundings at Poitiers, France: (*a*) when the scattering is not too diffuse, several components can be seen at frequency intervals of about $\frac{1}{4}$ or $\frac{1}{8}$ of the gyro-frequency. This type of scattering is most frequent during long nights and disappears at sunrise. It may be connected with the breakdown of the regular day-time stratification. (b) a G layer is sometimes in evidence as a diffuse pattern extending from about 3 Mc/s up to 5.2 Mc/s; it disappears near sunrise. Such scattering is associated with magnetic storms and meteor showers. Many photographic records are reproduced.

621.396.11 : 551.510.535 **1488**

Scattering of Radio Waves from Region E.—G. Millington. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p. 149.) Summary of Physical Society Summer Conference paper. Sporadic echoes scattered directly back from the E layer show no definite correlation with visible meteors; it is suggested that they may be caused either by the sun or by the stars of the galaxy. Long-distance scattering, in which the sources are illuminated and the scattered signals received by reflection from the F layer, may be due to scattering centres in the E layer or on the ground. The risk of interference from an unwanted signal on a shared frequency as a result of long-distance scattering is discussed.

621.396.11 : 621.396.93 **1489**

The Characteristics of Low-Frequency Radio Waves Reflected from the Ionosphere, with particular reference to Radio Aids to Navigation.—C. Williams. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 143–144.) Summary of Physical Society Summer Conference paper. Observations at fixed and mobile (airborne) receiving points are used to determine changes of amplitude and phase in signals reflected by the E layer. From the results the relative amplitudes of ground and reflected waves are established as a function of distance from the transmitters, and the height of the reflecting layer and the reflection coefficient at oblique incidence during day and night are estimated.

621.396.11 : 621.396.93 **1490**

The Effects of Sky-Wave on the Planning of Navigational Aids using Frequencies in the 70-130-kc/s Band.—W. T. Sanderson. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p.143.) Summary of Physical Society Summer Conference paper. The accuracy of the Decca system depends on the stability of the phase-locked transmissions and observations have been made to determine the phase variation which can be expected at various ranges and times. Results indicate that in English latitudes the night sky wave effects persist throughout the day during mid-winter on 70 kc/s, falling to about half the night value at 120 kc/s. During the summer daylight (April–September) the effects are so small up to 300 miles that they are difficult to measure. Hawker has found that the secant of the sun's zenithal distance at noon gives a good approximation to the relative amplitude of the daylight errors throughout the year. The bearing of these results on the planning of medium-range c.w. navigation aids is discussed.

621.396.11.029.45 + 621.396.81.029.45 **1491**

The Ground Interference Pattern of Very-Low-Frequency Radio Waves.—K. Weekes. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 100–107.) Measurements in an aircraft of the strength of 16-kc/s signals at distances up to 850 km from the transmitter are described. At distances up to 300 km the results agree with those of previous experiments by Budden, Ratcliffe & Wilkes (3441 of 1939). The ionospheric reflection conditions which would account for these results are found to be no longer valid at the greater distances, and there appears to be a considerable change in these conditions at about 400 km. This applies to reflection coefficient, equivalent height (or phase change at reflection) and also polarization, which becomes approximately linear at 500 km.

621.396.11.029.58/.64 **1492**

Propagation of Short Radio Waves over Desert Terrain.—J. P. Day & L. G. Trolese. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 165–175.) The vertical distribution of field over a 190-ft interval was measured during daytime, when the atmosphere was well mixed, and at night, when a small-scale duct was formed, over an optical 26.7-mile path and a non-optical 46.3-mile path on various frequencies between 25 and 24 000 Mc/s. Transmitters and receivers were fitted in elevator cabs in 200-ft towers. The results are discussed and correlated with simultaneous meteorological measurements. Diffraction and partial-reflection effects were also studied. With frequencies up to 1 000 Mc/s the duct affects the magnitude but not the shape of the height/gain curves; with microwaves the shape is altered considerably.

621.396.11.029.58 : 621.396.93 **1493**

Very-Low-Frequency Propagation.—S. B. Smith & K. W. Tremellen. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p.143.) Short summary of Physical Society Summer Conference paper. Earlier experiments during 1920–1926 are discussed, with particular reference to (*a*) apparent abnormalities and other little known phenomena, (*b*) world atmospheric noise centres, seasonal and diurnal variations in direction and intensity, (*c*) d.f. using different techniques, with special reference to reception along various geomagnetic paths.

621.396.81 **1494**

On the Deduction of the Refractive Index Profile of a Stratified Atmosphere from Radio Field-Strength Measurements.—J. W. Green. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 80–88.) A method due to Macfarlane (2894 of 1947) derives the refractive index profile from the variations of received amplitude with height and range. Application to amplitudes calculated from standard diffraction theory and duct propagation theory confirmed the formal accuracy of the method, but suggested that it would be very sensitive to small measurement errors. Application to field-strength values observed over water and land for standard and non-standard atmospheric conditions confirmed this and showed that the formula was unsatisfactory except in a limited frequency range under standard conditions.

621.396.81 : 551.510.535 **1495**

Measurements on Long and Very Long Waves.—R. N. Bracewell. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, p.144.) Summary of Physical Society Summer Conference paper. Details are given of the regular daily and seasonal variations of waves of frequencies 16 kc/s and 100 kc/s observed, after reflection from the ionosphere, at distances of 90, 200 and 500 km. The night reflection coefficient for a 16-kc/s wave is found to be about 0.5 in all seasons; that for 70- and 113-kc/s waves is markedly lower, and decreases in summer. From round about sunrise the reflection coefficient for the 16-kc/s wave drops in summer, but not in winter; for the 70- and 113-kc/s waves the fall occurs both in summer and winter, though that in summer is far more marked. The reflection height, about 90 km at night in all seasons, exhibits corresponding decreases. Polarization conditions are also noted. When observations are made at a distance of 500 km from the transmitter, multiple reflections are important, and the sunrise variations are more rapid.

621.396.81.029.6 **1496**

Radio Propagation Variations at V.H.F. and U.H.F.—K. Bullington. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 27–32.) 1949 I.R.E. National Convention paper. Long-period observations of field-strength variation as a function of distance from the transmitter, of fading effects and of the influence of irregular terrain, buildings and trees are analysed and checked against theory where possible. Using median values together with a measure of the spread of values for fading and shadow losses, empirical formulae are obtained for the service area of and distance required between co-channel stations for any assigned ratio of signal to interference.

621.396.812.3 **1497**

The Variations in Direction of Arrival of High-Frequency Radio Waves.—W. Ross. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 149–150.) Summary of Physical Society Summer Conference paper. Bearings observed on h.f. transmissions are subject to continuous fluctuations, apart from those due to variable instrument errors. Both rapid and slow fluctuations occur, the latter with periods from a few minutes up to half an hour. These slow fluctuations are similar for bearings on neighbouring frequencies and transmission paths; they are apparently due to fairly localized tilting of the ionosphere layers. The rapid fluctuations are observed even when pulses are used, and hence may be caused by ionosphere irregularities of smaller scale than those causing slow fluctuations. The random irregularities may be due to the spreading of disturbances produced by perturbations in the regular diurnal changes in the ionosphere. See also 3424 of 1949 (Ross & Bramley).

621.396.812.3 **1498**

Some Work at Cambridge on Radio Fade-Outs.—K. Weekes. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 146–147.) Summary of Physical Society Summer Conference paper. Observations on the changes of 'phase path' and amplitude of the pulse reflected from the E region during fade-out were made (*a*) at vertical incidence on 2.0 and 2.4 Mc/s, (*b*) near vertical incidence on 70 and 113 kc/s, and (*c*) near vertical incidence on 16 kc/s and 40 kc/s. The 'phase path' may decrease initially by 2 to 4 km in case (*a*), and by as much as 20 km in cases (*b*) and (*c*); the amplitude decreases initially by a factor which is at least 200 in case (*b*), but is only of the order of 3 in case (*c*). There is rapid recovery to normal values as the fade-out ends. An ionization distribution which would account for the observed results is suggested.

621.396.812.3 : 523.72 **1499**

Sudden Enhancements [of atmospherics] **on Very Long Waves.**—R. Bureau. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362B, pp. 122–126. In French.) Physical Society Summer Conference paper. The increased level of atmospherics received on wavelengths of 11 000 m during a solar flare is usually accompanied by a Dellinger fade-out on short-wave circuits. Several instances have been found where the fade-out is preceded by an apparent short increase in recorded field-strength, which may be caused by the reception of solar radiation for a few seconds before it is absorbed by the increased ionization in the D region. Many photographic records are reproduced.

621.396.812.3 : 523.74 **1500**

Unusual Ionospheric Storm.—T. W. Bennington. (*Wireless World*, April 1950, Vol. 56, No. 4, pp. 131–132.) A giant sunspot crossing the sun's meridian on 20th Feb. 1950 was associated not only with the usual phenomena of an ionospheric storm, but with strong reception in Great Britain of transmissions from Leningrad and Stockholm in the 6-m band, and by very rapid fading of the medium-wave London Home Service transmission. The first phenomenon is probably due to the 'auroral' type of sporadic E and the second to exceptional turbulence of the F layer.

RECEPTION

621.396.621 **1501**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

13. Considerations in Low Noise Figure Microwave Receiver Design.—M. T. Lebenbaum & P. D. Strum.
66. Highly Selective Mobile Receiver.—R. T. Adams, R. A. Felsenheld & G. W. Sellers.
107. Frequency-Modulation Interference.—L. B. Arguimbau.
108. The Theory of Amplitude-Modulation Rejection in the Ratio Detector.—B. D. Loughlin.
109. An Improved Method of Frequency Conversion.—V. H. Aske & J. Grund.
110. Common-Frequency Carrier-Shift Radio-Teletype Converter.—R. R. Turner.
136. An Atmospheric Waveform Receiver.—W. J. Kessler & S. E. Smith.
154. Diversity Reception Techniques.—S. H. Van Wambeck & A. H. Ross.
155. Experimental Evaluation of Diversity Receiving Systems.—J. L. Glaser & S. H. Van Wambeck.

621.396.621 : 537.228.1 : 548.0 **1502**

Piezoelectric Crystals in Receiver Construction.—F. C. Saic. (*Elektrotech. u. Maschinenb.*, Feb. 1950, Vol. 67, No. 2, pp. 44–50.) A brief review of the characteristics of piezoelectric crystals and a discussion, illustrated by reactance diagrams, of their application in the i.f. stage of wideband radio receivers.

621.396.61 : 621.396.619.11/.13 **1503**

Signal-to-Thermal Noise Ratio.—M. V. Callendar. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 96–100.) Curves are given of output signal/thermal-noise ratio for a f.m. receiver. The signal/noise ratios range from very large values to values <1. Corresponding curves are also given for an a.m. receiver, and a comparison is made, emphasizing the effect of the ratio of pre-detector to post-detector bandwidth in each case. F.m. can give results at least equal to a.m. in respect of signal/noise ratio for communication work, provided that the pre-detector bandwidth is no greater than is necessary to accept the full deviation, and that the limiter is fully efficient: the deviation ratio for such work should not exceed a value of about 4. In practice, an a.m. receiver will in some instances give a slightly better result than a corresponding f.m. receiver, particularly if any slight mistuning is present.

621.396.621 : 621.396.822 **1504**

Design Factors in Low-Noise-Figure Input Circuits.—M. T. Lebenbaum. (*Proc. Inst. Radio Engrs*, Jan. 1950, Vol. 38, No. 1, pp. 75–80.) 1948 I.R.E. National Convention paper. A method is described for calculating the minimum noise figure attainable by the use of double-tuned circuits in the inputs of h.f. amplifiers; this provides simple data for designing the network. For active and passive valve input loading a graphical method is given for determining the constants of a double-tuned input circuit with minimum noise figure.

621.396.621.54 **1505**

The Diode as a Mixing Device in the U.H.F. Band.—H. F. Mataré. (*Elektron Wiss. Tech.*, Feb. 1950, Vol. 4, No. 2, pp. 48–52.) Analysis indicating the conditions under which the large reactive effect of a diode mixer may be used to advantage.

621.396.621.54 : 621.396.828 **1506**

Elimination of Radio Interference by Off-Frequency Inversion.—S. Freedman. (*Radio & Televis. News*, March 1950, Vol. 43, No. 3, pp. 53–57, 154.) Circuit, description and performance details of the Type-MCL4 signal splitter. Crystal oscillators operating respectively on frequencies 50 kc/s above and below the receiver i.f. frequency, and an asymmetrical high-pass filter, with cut-off frequency 50 kc/s, permit selection of the sideband giving greatest interference attenuation and give high selectivity. A further 1-kc/s heterodyne and filter give additional selectivity for c.w. reception. See also 811 of 1948 (McLaughlin).

621.396.822 **1507**

Induced Grid Noise and Noise Factor.—R. L. Bell. (*Nature, Lond.*, 18th March 1950, Vol. 165, No. 4194, pp. 443–444.) Assuming that all the induced grid noise is correlated with cathode/anode shot noise, the minimum noise factor obtained on adjusting conductive and susceptive components of grid-ground admittance is independent of lead inductance effects, space-charge capacitance, transit-time damping and induced grid noise itself. In this hypothetical case, the optimum detuning at the grid required for minimum noise factor is very nearly equal to the space-charge capacitance.

621.396.828 **1508**

The Main Principles of the Protection of Radio Receivers against Interference due to H.F. Oscillators for Induction Heating.—F. E. Il'gekit & K. V. Bazhenov. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 14–23. In Russian.)

621.396(.397).828 : 621.327.43 **1509**

Interference from Fluorescent Tubes.—"Diallist". (*Wireless World*, March 1950, Vol. 56, No. 3, pp. 93–94.) Production of r.f. oscillations in fluorescent tubes is investigated and a possible explanation given. Suppression of these oscillations is discussed and a suitable practical method described.

621.397.828 **1510**

Interference from Television Receivers.—M. G. Scroggie. (*Wireless World*, April 1950, Vol. 56, No. 4, pp. 126–129.) The line-scanning system of a television receiver is a source of magnetic and electric interference fields. Modern trends in design tend to decrease the magnetic but increase the electric field. The magnetic field chiefly affects portable receivers, but these can fortunately be moved out of the interference region. The electric field can be substantially decreased by the use of simple screening in the television receiver.

STATIONS AND COMMUNICATION SYSTEMS

621.39 **1511**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

15. Speech Transmission through Restricted Bandwidth Channels.—M. J. DiToro, W. Graham & S. Schreiner.
16. Application of Communication Theory to Periodic Radio Systems.—M. Leifer & N. Marchand.
17. Some Aspects of Data Transmission over Narrow-Band Communication Circuits.—M. M. Brenner.
31. Transient Response of Asymmetrical Carrier Systems.—G. M. Anderson & E. M. Williams.
37. Signal Corps High-Frequency Radio Communication Research and Development.—J. Hessel & H. F. Meyer.
38. Military Single-Sideband Equipment Development.—R. A. Kulinyi.
39. Radio Relay Design Data, 60 to 600 Mc/s.—R. Guenther.
40. Multiplex Microwave Radio Relay.—D. D. Grieg & A. M. Levine.
41. Cross Talk in Frequency- and Phase-Modulated Radio Relays used in Conjunction with Multichannel Telephony Equipment.—S. Fast.
62. Product Phase Modulation and Demodulation.—D. B. Harris & D. O. McCoy.
63. Some Novel Methods for the Generation of P.C.M.—N. R. Castellini, D. L. Jacoby & B. Keigher.
65. Techniques for Closer Channel Spacing at V.H.F. and Higher Frequencies.—C. F. Hobbs & W. B. Bishop.
110. Common-Frequency Carrier-Shift Radio-Teletype Converter.—R. R. Turner.
156. Comparison of Modulation Methods for Voice Communication over Ionospheric Radio Circuits.—M. G. Crosby, H. F. Meyer & A. H. Ross.
157. Comparison of Modulation Methods for Facsimile Communication over Ionospheric Radio Circuits.—M. Acker & B. Goldberg.

621.39.001.11 **1512**

Communication in the Presence of Noise — Probability of Error for Two Encoding Schemes.—S. O. Rice. (*Bell Syst. tech. J.*, Jan. 1950, Vol. 29, No. 1, pp. 60–93.) "Recent work by C. E. Shannon and others has led to an expression for the maximum rate at which information can be transmitted in the presence of random noise. Here two encoding schemes are described in which the ideal rate is approached when the signal length is increased. Both schemes are based upon drawing random numbers from a normal universe, an idea suggested by Shannon's observation that in an efficient encoding system the typical signal will resemble random noise. In choosing these schemes two requirements were kept in mind: (1) the ideal rate must be approached, and (2) the problem of computing the probability of error must be tractable."

621.39.001.11 **1513**
Calculation of Transmission Efficiency according to Hartley's Definition of Information Content.—A. G. Clavier. (*Ann. Télécommun.*, Jan. 1950, Vol. 5, No. 1, pp. 29–34.) French version of 2045 of 1949 correlated with 1241 of May (Aigrain).

621.391.63 **1514**
Comparative Study of the Propagation of Optical Radiations of Different Wavelengths in the Atmosphere.—G. Goebel. (*Fernmeldetech. Z.*, Feb. 1950, Vol. 3, No. 2, pp. 43–47.) Measurements were made of the received intensity of a light signal modulated at 1 kc/s and transmitted over a 3.2-km path, under different atmospheric conditions. No general inferiority of short waves to long waves was observed. Air movements and humidity variations had no measurable effect; warm air layers in the propagation path caused a 1–50-c/s short-duration scatter. Storms affected propagation only when accompanied by rain or electric discharges. No clearly defined parameters for distance attenuation were found. High ground-temperature caused short-term fading, while smoke and mist caused selective fading. Even in cloudy conditions the ratio of the received intensities of ultra-violet and deep-red did not exceed 10^2, so that with a receiving amplifier compensated for fading a sufficiently constant signal level should be ensured for communication over the whole optical range.

621.396.5 **1515**
Ten Years of Radio-Telephone Communications with Mountain Stations.—P. Häni. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st March 1950, Vol. 28, No. 3, pp. 112–121. In German and French.) A short account of developments since 1933–1936, when the first R/T links were installed, together with a description of the equipment now in use. The central transmitter gives about 4-W output at 57 to 75 Mc/s. The installation is mains operated and incorporates an automatic calling system by which the subscriber can call any station on the central network. Output from subscriber stations, which are battery operated, is 0.3 W at a frequency adjustable from 40 to 60 Mc/s.

621.396.619.13 : 621.396.41 **1516**
The Application of Frequency Modulation to V.H.F. Multi-Channel Radiotelephony.—J. H. H. Merriman & R. W. White. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 123–124.) Discussion on 3513 of 1948.

621.396.619.16 **1517**
Pulse Communication.—A. Bloch: E. Fitch. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, p. 107.) Comment on 2079 of 1948 (Cooke; Jelonek & Fitch; Oxford) and 2619 of 1948 (Fitch), pointing out the essential equivalence of the method described by Fitch of deriving the spectrum of a pulse transmission and the method previously given by Bloch.

621.396.619.16 **1518**
The Optimum Pulse-Shape for Pulse Communication.—J. H. H. Chalk. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 88–92.) The optimum pulse shape is determined for minimum adjacent-channel interference. The method is also applied to find the pulse shape making the energy available for detection a maximum for a receiver with a given pass band. In either case the optimum pulse shape depends only on the product of pulse length and bandwidth.

621.396.619.16 **1519**
Pulse Code Modulation.—D. G. Holloway. (*Electrician*, 3rd & 10th March 1950, Vol. 144, Nos. 3742 & 3743, pp. 679–683 & 763–765.) An outline of fundamental theory.

621.396.619.24 : 621.396.828 **1520**
Folded-Sideband Modulation.—J. L. A. McLaughlin. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 88–91.) The basic principles are described of a system in which bands of frequencies several kilocycles wide are transmitted sequentially in a narrow band on one side of a carrier. The width of the frequency spectrum used is less than the information bandwidth. Interfering beat notes produced by unwanted carriers falling within the sideband used are eliminated by shifting them to the other side of the carrier. See also 1782 of 1949.

621.396.65 **1521**
Résumé of V.H.F. Point-to-Point Communication.—F. Hollinghurst & C. W. Sowton. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 121–123.) Discussion on 2080 of 1948.

621.396.65 : 621.396.5 **1522**
Multiplex Telephony Systems and Radio Links.—J. P. Voge. (*Ann. Télécommun.*, Feb. & March 1950, Vol. 5, Nos. 2 & 3, pp. 73–88 & 90–97.) Analysis of modulation methods and comparison of different multiplex systems. Factors considered are number of channels available, signal/noise ratio, power and bandwidth required, reliability and secrecy. Characteristics of recently constructed radio multiplex systems are given, including two systems in use in the United States for communicating television programmes.

621.396.65 : 621.397.5 **1523**
A Microwave System for Television Relaying.—J. Z. Millar & W. B. Sullinger. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 125–129.) I.R.E. 1949 National Convention paper. Requirements for television radio relay links are discussed and a Philco system is described. This operates in the 6-kMc/s common-carrier band and uses heterodyne modulation with a klystron, Type SAC-19, developed by the Sperry Corporation specially for this application. The equipment has been installed by Western Union for transmission between New York and Philadelphia. Photographs show the repeater, the type of aerial used, and a square-wave signal and C.B.S. test pattern after transmission from one terminal to the other and back again. See also 1185 of 1949 (Forster).

621.396.712 **1524**
The National Transmitter at Beromünster with Unmodulated Aerial Power of 100-200 kW.—H. Affolter. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st March 1950, Vol. 28, No. 3, pp. 95–104. In German.) Illustrated description of the new transmitter and the general layout, showing particularly the h.v. and rectifier equipment with simple switching arrangements for supplying either the old or the new transmitter, the water-cooling system and the special tubular h.f. feeder line. The installation incorporates the latest ideas in high-power transmitter design. Performance figures are tabulated. Frequency range is 520–1 580 kc/s; overall efficiency at maximum power and 100% modulation is 40.8%.

621.396.931 **1525**

Small-Town Mobile F.M. Operation.—E. Cook. (*Tele-Tech*, Feb. 1950, Vol. 9, No. 2, pp. 26–28 . . 55.) Circuit details are given of a two-way R/T installation operating on 37.74 Mc/s. All receivers are tuned to a common frequency and their a.f. stages are biased to cut-off until a signal is received. An individual receiver responds when the carrier of the calling transmitter is modulated by a particular tone.

SUBSIDIARY APPARATUS

621-526 + 621.316.722 **1526**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

70. Modern Methods of Servo Synthesis.—R. McCoy & D. Herr.
114. High-Voltage Regulation by means of Corona Discharge between Coaxial Cylinders.—S. W. Lichtman.
165. Universal Precision Resolvers.—D. L. Herr.

621.3.027.3 : 621.3.032.4 **1527**

Heating the Filaments of Valves in a Cascade Generator by means of High-Frequency Current.—T. Douma & H. P. J. Brekoo. (*Philips tech. Rev.*, Oct. 1949, Vol. 11, No. 4, pp. 123–128.) Considerable simplification of the h.f. filament-heating circuits is made possible by the use of filament-current transformers with ferroxcube cores.

621.314.63 **1528**

Characteristics of Compound Barrier-Layer Rectifiers.—E. Billig & P. T. Landsberg. (*Proc. phys. Soc.*, 1st Feb. 1950, Vol. 63, No. 362A, pp. 101–111.) "The assumptions involved in Mott's and Schottky's theories of rectification are analysed and a potential barrier at the metal/semiconductor interface is proposed which enables one to pass continuously from one theory to the other."

621.316.721.076.7 **1529**

An Electronic Current Regulator.—N. F. Verster. (*Appl. sci. Res.*, 1950, Vol. B1, No. 5, pp. 358–362.) A method for stabilizing the magnet current of a β-ray spectrometer, derived from a 20-kW d.c. generator. A vibrating-contact d.c. amplifier is used to amplify the error voltage and control the field of an exciting generator which energizes the fields of the main generator. Stabilization is within 0.1% throughout the range 2–120 A.

621.316.722.1 **1530**

Design of a Voltage-Stabilizing Circuit with the Regulating Valve connected in Parallel.—K. B. Mazel'. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 74–79. In Russian.)

621.316.73 **1531**

A Magnetic Field Stabilization Circuit.—L. Katz, P. A. Forsyth, L. F. Cudney, G. W. Williams, H. E. Johns & R. N. H. Haslam. (*Canad. J. Res.*, Jan. 1950, Vol. 28, Sec. A., No. 1, pp. 67–72.) A rotating coil in the air gap of a large electromagnet generates an alternating voltage proportional to the field strength. A fraction of this voltage is balanced against a reference voltage derived from a similar coil rotating between the poles of a permanent magnet. Departures from balance are used to control the current supplied to the electromagnet so as to maintain a steady field. By varying the fraction used for balance, the field may be controlled at any value within a wide range.

621.396.682 **1532**

Stabilized Anode Supply Unit using Mazda-2050 Thyratrons.—L. Chrétien. (*T.S.F. pour Tous*, Feb. 1950, Vol. 26, No. 256, pp. 53–58.) A simple circuit including two thyratrons and also two Type-VR150 stabilizing tubes. The voltage change is about 3% for load variation from 50 mA to 300 mA or supply-voltage variation from 80 V to 160 V.

TELEVISION AND PHOTOTELEGRAPHY

621.396/.397].828 : 621.327.43 **1533**

Interference from Fluorescent Tubes.—"Diallist". (*See* 1509.)

621.397.5 **1534**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

26. Specification for Quality of the Visual Output of Picture Tube Screens.—A. E. Martin.
27. The Importance of Practical Design and Specifications for Effective Production and High Quality.—J. Manuele.
47. 5-kW Visual and 2.5-kW Aural Television Amplifiers.—P. Breen.
48. Design Considerations in TV Transmitters.—L. Pollack, E. Bradburd & I. Krause.
49. Wideband R.F. Problems in Television Transmitters.—E. Bradburd & L. Pollack.
50. The Vidicon—A New Photoconductive Television Pickup Tube.—P. K. Weimer, S. V. Forgue & R. R. Goodrich.
51. Industrial Television System.—R. C. Webb & J. M. Morgan.
56. Filters for Television Interference.—A. M. Seybold.
78. A 1-kW U.H.F. Television Transmitter.—T. M. Gluyas.
79. A Supergain U.H.F. Television Transmitting Antenna.—O. O. Fiet.
80. Design of a Hybrid Ring Diplexer for Ultra-High-Frequency Television Use.—W. H. Sayer & J. M. De Bell, Jr.
81. Construction and Operation of an Experimental U.H.F. Television Station.—R. F. Guy & F. W. Smith.
82. Electro-Optical Filters for Color Television.—V. A. Babits & F. Hicks, Jr.
102. Use of Miniature Pentode RCA-6CB6 in Television Intermediate-Frequency Amplifiers.—W. E. Babcock.
103. Noise Suicide Circuit.—H. E. Beste & G. D. Hulst.
104. Quality Rating of Television Images.—P. Mertz, A. D. Fowler & H. N. Christopher.
105. Television Image Reproduction by use of Velocity-Modulation Principles.—M. A. Honnell & M. D. Prince.
106. Design of Printed-Circuit Television Tuner.—D. Mackey & E. J. Sass.

621.397.5 **1535**

Colour Television in the U.S.A.—Comparison of Different Methods.—L. Chrétien. (*T.S.F. pour Tous*, March 1950, Vol. 26, No. 257, pp. 108–111.) Critical review of different systems, based on an article in *Electronics*, Dec. 1949, entitled 'New Directions in Colour Television'. See 763 of March (D.G.F.).

621.397.5 : 621.396.65 **1536**

A Microwave System for Television Relaying.—Millar & Sullinger. (*See* 1523.)

621.397.5 (083.74) **1537**

Report on the International Television Standards Conference.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, p. 116.) Extracted from a report by D. G. Fink on the C.C.I.R. conference at Zürich, July 1949. National attitudes on television standards are reviewed and conference conclusions and questions for further study are noted.

621.397.5(083.74) **1538**

Television Standards.—Y. Delbord. (*Ann. Télécommun.*, Nov. & Dec. 1949, Vol. 4, Nos. 11 & 12, pp. 388–396 & 425–429; Jan. & Feb. 1950, Vol. 5, Nos. 1 & 2, pp. 35–47 & 50–56.) In four parts: (*a*) historical review of the development of the various standards, including a comprehensive chart showing the systems adopted in different countries; (*b*) relative importance of the different standards; (*c*) reasons for international divergence; (*d*) the French point of view.

621.397.6 **1539**

New Television Equipment at Alexandra Palace.—(*Engineer, London*, 3rd Feb. 1950, Vol. 189, No. 4906, pp. 146–147.) General description of (*a*) film-dubbing suite for the production of newsreels and other films to which the sound track is added after filming; (*b*) telefilm recording room where television programmes are recorded on cinematograph film; (*c*) central room where films are televised for transmission in the programme; (*d*) the accommodation and proposed development of the television studio centre at Lime Grove, Shepherds Bush, London.

621.397.61 **1540**

The New Eiffel Tower [television] **Sound Transmitter.**—L. Thourel. (*Électronique, Paris*, March 1950, No. 40, pp. 27–31.) Description of the circuits and constructional features of the r.f. amplifier chain which delivers 5-kW useful carrier power at 42 Mc/s. It comprises three units housed in one case. The 7-Mc/s crystal-oscillator drive unit and the first amplifier/frequency-multiplier unit are removable; the main amplifier and power stages are built in. The anodes of the valves in the final stage are water-cooled. Efficiency of this stage is 54% with anode voltage 5.4 kV.

621.397.62 **1541**

Television Spot-Wobble.—R. W. Hallows. (*Wireless World*, March 1950, Vol. 56, No. 3, pp. 84–86.) Discussion of a method of eliminating the horizontal lines usually seen in a television picture, by giving the spot a rapid vertical oscillation of small amplitude so as not to overlap to any large extent the boundaries of a single scanning line. A slight loss of vertical definition results.

621.397.62 **1542**

Selectivity in Television.—W. T. C. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 69–71.) Selectivity is discussed in relation to television reception in Britain, the main problem being to prevent the sound signal from interfering with the picture signal. This is particularly difficult when, as in the Midlands transmission, only the lower of the vision sidebands, which lies between the vision and sound carriers, is transmitted. The merits of tuned-r.f. and superheterodyne receivers are compared. The choice between the two depends on whether or not it is feasible to obtain rejector circuits of sufficiently high Q at signal frequency, the important factor being the relation of the product of bandwidth and circuit Q to signal frequency.

621.397.62 : [621.385.2 : 621.315.59 **1543**

Application of Germanium Diodes in Veryhigh and Ultrahigh TV Sets.—J. H. Sweeney. (*TV Engng, N.Y.*, Feb. 1950, Vol. 1, No. 2, pp. 10–11, 36.) Discussion of the relative merits of the crystal diode as a replacement for the valve diode, particularly in video-detector, d.c.-restorer and a.f. discriminator circuits.

621.397.81 **1544**

Fringe-Area Television.—(*Wireless World*, March & April 1950, Vol. 56, Nos. 3 & 4, pp. 87 & 139.) Two maps show values of the video field-strength recorded with mobile equipment at many places about 70 miles from the Sutton Coldfield transmitter. The greatest variations observed were, as might be expected, in the hilly country of Wales.

621.397.813 : 621.397.62 **1545**

The Distortion of Video and Audio Signals in a Television Receiver.—G. I. Byalik. (*Radiotekhnika, Moscow*, Nov./Dec. 1949, Vol. 4, No. 6, pp. 34–46. In Russian.) The use of a single receiving channel for a.m. video signals and f.m. audio signals is limited by the presence of the nonlinear element, the detector, which causes intermodulation distortion. A mathematical analysis of this effect on the quality of the image and the sound is presented and suggestions are made for rendering the distortion of the audio signals negligible and reducing that of the video signals to a few per cent. It is shown by this analysis and also by experiments that a second i.f. amplifier is not required for the sound channel.

621.397.82 : 621.392.52 **1546**

Eliminating TVI with Low-Pass Filters.—Grammer. (*See* 1367.)

621.397.828 **1547**

Television Interference Suppression.—L. Varney. (*R.S.G.B. Bull.*, March 1950, Vol. 25, No. 9, pp. 290–294.) Synopsis of a paper read at a meeting of the Radio Society, Oct. 1949. Achievements in this field are reviewed and some recent improvements in technique are described. See also 2356 of 1949.

621.397.62 **1548**

The Principles of Television Reception. [Book Review]—A. W. Keen. Publishers: Pitman & Sons, London, 319 pp., 30s. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 94–95.) "The book can be recommended for those who have little or no knowledge of television but who have a good background of ordinary wireless theory and practice. It will enable them to obtain a good general, but hardly a detailed, knowledge of television."

TRANSMISSION

621.3.016.35 : 621.396.61 **1549**

Static and Dynamic Temperature Compensation of Transmitters.—E. Roske. (*Fernmeldetech. Z.*, Feb. 1950, Vol. 3, No. 2, pp. 53–61.) Discussion of the effect of temperature change on frequency stability and the possibilities of compensation by the use of ceramic components.

621.316.726 : 621.396.615 **1550**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) A summary is given of the following paper:

111. A Simple Crystal Discriminator for F.M. Oscillator Stabilization.—J. Ruston.

621.396.61.029.58 **1551**

Continuously-Tuned 50-kW Transmitter.—J. L. Hollis. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 70–73.) Circuit and construction details of the U.S. Navy transmitter Type AN/FRT-5 and AN/FRT-6. Motor-driven, servo-positioned units are used to tune individual stages and allow operation on any frequency from 4 to 26 Mc/s without tuned-circuit switching. Frequency changing is effected in less than two minutes.

621.396.619.23 **1552**

Non-Linear Effects in Rectifier Modulators.—D. G. Tucker & E. Jeynes. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, p. 66.) Comment on 2184 of 1949 (Belevitch).

621.397.61 **1553**

The New Eiffel Tower [television] **Sound Transmitter.**—Thourel. (*See* 1540.)

VALVES AND THERMIONICS

621.385 + 621.396.615.14 **1554**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

10. Glass-Sealed Germanium Diodes.—S. F. Amico.
11. High-Temperature Characteristics of Germanium Diodes.—L. S. Pelfrey.
19. Accelerated Life Testing of Vacuum Tubes.—J. Rothstein.
87. A New Class of Switching Tubes for Digital Applications.—J. Katz.
89. A New Type of Frequency-Control Tube.—R. W. Slinkman.
90. M.I.T. Electrostatic Storage Tube.—S. H. Dodd, H. Klemperer & P. Youtz.
91. Performance and Analysis of a Transverse Current Travelling-Wave Amplifier and Limiter.—L. M. Field.
92. An Experimental Electron Tube using Space-Charge Deflection of the Electron Beam.—J. T. Wallmark.
112. A New 'Soft Structure' for Rugged Receiving Tubes to Improve Resistance to Shock and Electron Emission.—G. W. Baker.
113. Hydrostatic Pressure in an Electron Gas: its Application to Electron-Beam/Electromagnetic-Wave Interaction.—P. Parzen & L. Goldstein.
115. Thyratron Grid Emission and the Trigger-Grid Thyratron.—L. Malter & M. R. Boyd.
116. High-Intensity Pulse-Distribution Tube.—P. M. G. Toulon.
138. Development of 10-cm High-Power Pulsed Klystron.—M. Chodorow, E. L. Ginzton, I. Neilsen & S. Sonkin.
139. Space-Charge Effects in Reflex Klystrons.—V. Westberg & M. Chodorow.
140. Recent Development in High-Power Klystron Amplifiers.—C. Veronda & V. Learned.
141. A New Super-Power Beam Triode.—W. N. Parker, W. E. Harbaugh, M. V. Hoover & L. P. Garner.
142. External-Cathode Inverted Magnetron.—J. F. Hull.
158. A Vacuum Seal between Metals and Ceramics for High Temperature Applications.—H. W. Soderstrom & K. H. McPhee.
159. Effect of Coating Composition of Oxide-Coated Cathodes on Electron Emission.—E. G. Widell & R. A. Hellar.
160. Effects of Controlled Impurities in Nickel Core Metal on Thermionic Emission from Oxide-Coated Cathodes.—G. Hees.
161. Investigation of Contaminant in Vacuum Tubes.—P. D. Williams.
162. Hot-Strength Properties of Filamentary Alloys.—B. Wolk.

621.385.029.63/.64 : [537.291 + 538.691 **1555**

Electron Beams in Axially Symmetrical Electric and Magnetic Fields.—Wang. (*See* 1395.)

621.385.15 **1556**

A New Secondary Cathode.—C. S. Bull & A. H. Atherton. (*Proc. Instn elect. Engrs*, Part III, March 1950, Vol. 97, No. 46, pp. 65–71.) The emission from the secondary cathode in a multiplier stage gradually decreases during its life; this is due to bombardment by the primary electron beam, which causes disintegration of the surface oxide layer and gradual exposure of the clean base metal of the secondary cathode. To avoid this, thicker coatings of MgO were tried but had too high a resistance. A new type of cathode, made from a mixture of MgO and $BaCO_3$, was found to be sufficiently conducting, and gave a secondary emission ratio of about 3. The emission remained sensibly constant for over 1 000 hours, with an operating temperature of 400 C and a primary bombarding current density of 20 mA/cm². The use of this cathode has made possible the development of an orbital-beam single-stage thermionic multiplier valve with a mutual conductance of 20 mA/volt and input capacitance of 8 pF.

621.396.615.141.2 **1557**

The Behaviour of Multiple-Circuit Magnetrons in the Neighbourhood of the Critical Anode Voltage.—W. E. Willshaw & R. G. Robertshaw. (*Proc. phys. Soc.*, 1st Jan. 1950, Vol. 63, No. 361B, pp. 41–45.) The mechanism of operation of the multiple-circuit magnetron oscillator in the region of minimum magnetic field and voltage, where the efficiency is commonly assumed to approach zero, should approach that of an oscillator of the travelling-wave-valve type, providing that a cathode of suitable size is used. Useful efficiencies should thus be obtainable under these conditions. Details of experiments are given in which an electronic efficiency of 12% was obtained at a wavelength of 3 cm at values of magnetic field and voltage several times lower than those used for high-efficiency operation. The mode of operation was determined by the value of the magnetic field, a given mode being maintained over a range of magnetic field of the order of 8%. The anode voltage was about 70% of the critical value. The experimental results generally support the hypothesis and suggest that the minimum-voltage regime should be of extreme importance for work at the highest radio frequencies.

621.396.615.142.2 **1558**

Two-Cavity Klystron.—B. Meltzer. (*Wireless Engr*, Nov. 1949, Vol. 26, No. 314, pp. 365–369.) Two fundamental differential equations governing electron flow in the drift space are derived. They are valid only while the motion preserves its single-stream character, the limiting condition being when overtaking occurs. Thermal variations of velocity and forces due to the magnetic field of the current are neglected. The equations are integrated and applied to discussion of the plane diode, effects in the drift space of the klystron and in the klystron with space-charge-limited cathode.

MISCELLANEOUS

539 + 658 **1559**

1950 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 192–211.) Summaries are given of the following papers:

1. Evolution and Growth of Industrial Designing.—J. Vassos.
2. Procedure in Industrial Designing.—C. Peterson.
3. Cost Reduction Possibilities in Industrial Design.—W. B. Donnelly.
4. Sales Attitude towards Industrial Design.—E. P. Toal.
5. News of the Nucleus.—U. Liddel.
20. Statistical Evaluation of Life Expectancy of Vacuum Tubes designed for Long-Life Operation.—E. M. McElwee.
21. Application of Statistics to Acceptance Specifications.—B. Koslow.
22. Statistical Methods in Research and Development.—L. Lutzker.
23. Statistical Engineering of Tolerances.—E. D. Goddess.
24. Top Management evaluates Quality in terms of Sound Engineering.—A. B. DuMont.
25. Statistics—A New Tool for the Planning and Analysis of Laboratory Experiments.—E. B. Ferrell.
163. Miniaturization Techniques: a Discussion and Proposal.—M. Abramson & S. Danko.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

534.212 1560

The Propagation of Sound Waves in an Open-Ended Channel.—W. Chester. (*Phil. Mag.*, Jan. 1950, Vol. 41, No. 312, pp. 11–33.) An exact solution is obtained for a harmonic wave propagated in the dominant mode along a channel formed by two semi-infinite parallel plates, and undergoing reflection at the open end of the channel. The reflection and transmission coefficients and the end correction are evaluated. The reflection coefficient is exp $[-2\pi b/\lambda]$ where $2b$ is the width of the channel and λ is the wavelength. Explicit formulae are also obtained for the change of phase in the returning wave, which is sensibly plane at large distances from the mouth, and for the transmitted energy.

534.232 : 534.321.9 : 621.3.087.6 1561

Pin-Pointing Ultrasonic Energy.—H. J. Dana & J. L. van Meter. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 84–85.) Article based on 1949 National Electronics Conference paper. A magnetostriction oscillator is described which uses a thin-walled Ni-alloy tube with pointed ends in which fine holes are drilled axially. When excited at the natural frequency of about 20 kc/s, powerful air jets are expelled from the holes and produce visible changes on chemically treated paper. The ultrasonic energy concentrated in the jets is about 2 W.

534.321.9 : 534.22-14 1562

Velocity of Propagation of Ultrasonic Waves in Liquid Mixtures.—D. Sette. (*Ricerca sci.*, Nov./Dec. 1949, Vol. 19, Nos. 11/12, pp. 1338–1379.) A detailed review of work done since 1932, with a 16-page appendix tabulating results for a large number of solutions and organic liquid mixtures.

534.522.1.07 1563

An Improved Schlieren Apparatus employing Multiple-Slit Gratings.—T. A. Mortensen. (*Rev. sci. Instrum.*, Jan. 1950, Vol. 21, No. 1, pp. 3–6.) Larger fields are attained with an objective lens of given aperture by substituting gratings for the conventional knife-edge elements. In some cases a greater intensity of image illumination is also obtained.

534.6 : 621.395.623 1564

The Artificial Ear of the Centre National d'Études des Télécommunications.—P. Chavasse. (*C. R. Acad. Sci., Paris*, 12th April 1950, Vol. 230, No. 15, pp. 1390–1392.) Description of a device simulating the acoustic impedance of a normal human ear, with curves showing the concordance of measurements made with it and corresponding aural observations by 44 different individuals. See also 1058 of May.

534.6 : 621.395.623 1565

Comparison between the Artificial Ears made by the [British] Post Office and by the Istituto Nazionale di Ultracustica.—I. Barducci. (*Ricerca sci.*, Nov./Dec. 1949, Vol. 19, Nos. 11/12, pp. 1312–1316.) Results of tests on these ears, using both Italian and British telephone receivers, showed their characteristics to be complementary. A systematic series of such comparisons should provide a basis for standardization.

534.833.4 1566

Coefficient of Acoustic Absorption for Materials made in Italy.—M. Nuovo. (*Ricerca sci.*, Nov./Dec. 1949, Vol. 19, Nos. 11/12, pp. 1327–1331.) Graphical presentation of results for materials of various types, including those with cork, wood-pulp, vegetable- or mineral-fibre base.

621.395.61 1567

The KB-3A High-Fidelity Noise-Cancelling Microphone.—L. J. Anderson & L. M. Wigington. (*Audio Engng, N.Y.*, April 1950, Vol. 34, No. 4, pp. 16–17..32.) A new design, providing improved discrimination against background noise.

621.395.623.7 : 621.396.621 1568

High-Efficiency Loudspeakers for Personal Radio Receivers.—Olson, Bleazey, Preston & Hackley. (See 1760.)

621.395.625.2 : 534.86 1569

Some Problems of Disk Recording for Broadcasting Purposes.—F. O. Viol. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 233–238.) Reprint. See 541 of March.

621.395.625.2 : 621.395.8 1570

Noise Considerations in Sound-Recording Transmission Systems.—F. L. Hopper. (*J. Soc. Mot. Pict. Televis. Engrs*, Feb. 1950, Vol. 54, No. 2, pp. 129–139.) Discussion of the unwanted noises that may be generated internally in sound-recording systems or introduced from external sources, and of the various methods used to limit the interferences. R.f. and a.f. disturbances, cross-talk, thermal noise, shot effect, microphonics, and a.c. hum are considered.

621.395.625.3 **1571**
Adjustments for Obtaining Optimum Performance in Magnetic Recording.—A. W. Friend. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 38–54.) Methods of recording are discussed briefly. Using the high-frequency bias method, the harmonic distortion and noise level may be reduced considerably by the addition of d.c. bias to the recording current. The improved system is discussed at length and the results obtained under optimum operating conditions with a particular recording system are shown in numerous curves.

621.395.625.3 **1572**
Magnetic Recording in Motion Pictures.—M. Rettinger. (*Audio Engng, N.Y.*, March & April 1950, Vol. 34, Nos. 3 & 4, pp. 9–12..35 & 18–20..43.) "The fundamental aspects of magnetic-tape recording, particularly for motion pictures, including a description of magnetic recording, reproducing and erasing head construction, and a discussion of a.c. biasing, together with experimental results."

621.395.667 : 621.392.5.012.3 **1573**
Equalizer Design Chart.—Boegli. (*See* 1620.)

621.395.92 **1574**
Miniature Electromagnetic Earpiece for Portable Hearing-Aids.—W. Güttner. (*Z. angew. Phys.*, Feb. 1950, Vol. 2, No. 2, pp. 76–83.) Fundamental principles of design are discussed and two earpieces are described in which a Helmholtz resonator is coupled (*a*) behind (*b*) in front of the membrane, to give sensitivity in the frequency range required. See also 1335 of June.

621.396.645.029.4 **1575**
For Golden Ears Only.—Marshall. (*See* 1641.)

621.396.645.029.4 **1576**
Rauland 1825 High-Fidelity Phono Amplifier.—(*See* 1642.)

681.85 **1577**
Design and Mounting of Pickup Arms.—K. Pfeil. (*Funk u. Ton*, March 1950, Vol. 4, No. 3, pp. 140–147.) Study of common faults in alignment, and calculation of distortion produced.

681.85 **1578**
A Variable-Speed Turntable and its Use in the Calibration of Disk Reproducing Pickups.—H. E. Haynes & H. E. Roys. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 239–243.) Paper presented at the 1949 National Electronics Conference, Chicago. To overcome the variable effects caused by changes in the physical wavelength of the undulations on the conventional variable-frequency type of test record, a procedure for obtaining the frequency response of a pickup has been devised in which variations of frequency are obtained by using a constant-frequency record on a variable-speed turntable. A suitable turntable is described and results obtained with it are discussed.

534.86 **1579**
Traité de Prise de Son (Treatise on Sound Pick-Up). [Book Review]—J. Bernhart. Publishers: Éditions Eyrolles, Paris, 1949, 382 pp., 2950 fr. (*Nature, Lond.*, 1st April 1950, Vol. 165, No. 4196, p. 501.) "There is . . no other text in which can be found the fruits of so varied an experience in all forms of sound pick-up, covering as it does auditorium and studio acoustics, broadcasting, the film, directive properties of typical microphones, and stereophonic reproduction."

AERIALS AND TRANSMISSION LINES

621.315 + 621.396.67].011.2 **1580**
Input Impedance of a Two-Wire Open Line and Center-Driven Cylindrical Antenna.—T. W. Winternitz. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 299–300.) "Using potential theory, a method of analysis of the input impedance of a transmission line terminated by a cylindrical antenna is described. The results of application of this method to a particular configuration of line and antenna are presented."

621.315.212 : 621.397.5 **1581**
A Multicore Television Camera Cable.—(*Engineer, Lond.*, 27th Jan. 1950, Vol. 189, No. 4905, pp. 132–133.) A flexible cable of twenty-two conductors performing fourteen different functions. Balanced screened twin units for video and other circuits are spaced in a six-plus-one arrangement around the central star-quad unit which carries the mains and the frame-scan currents. Six single wires are laid in the grooves between the six twins. All the units are solidly insulated. Overall diameter is 0.85 in.

621.392.26† **1582**
Waveguides [operating] beyond the Cut-Off Frequency: Application to Piston Attenuators.—In the journal reference of 813 of April please read Vol. 30 for Vol. 29.

621.392.43 **1583**
Improvement of the Transformation Properties of the Exponential Line by Compensation Arrangements.—A. Ruhrmann. (*Arch. elekt. Übertragung*, Jan. 1950, Vol. 4, No. 1, pp. 23–31.) A paper prepared for publication in 1943. By connecting series capacitors and shunt inductors and resistors of suitable values at the high-impedance and low-impedance ends of an exponential line, satisfactory operation is obtained over a much wider frequency band. Three arrangements are described, giving progressively better compensation. The high-pass network equivalent of an exponential line with compensation circuits is discussed. See also 672 of 1948 (Zinke).

621.396.67 **1584**
On the Effective Length of a Linear Transmitting Antenna.—C. J. Bouwkamp. (*Philips Res. Rep.*, June 1949, Vol. 4, No. 3, pp. 179–188.) King's definition of effective length of a cylindrical centre-driven aerial with a sine distribution of current is consistent with a new general extension for any distribution of aerial current. As an example, results for a top-loaded aerial are given in tables and diagrams.

621.396.67 **1585**
The Theory of *N* Coupled Parallel Antennas.—R. King. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 94–103.) The integral-equation theory of coupled aerials developed by King & Harrison (3474 of 1944), Tai (2450 of 1948) and Bouwkamp (960 of 1949) is generalized to apply to any number of units arranged symmetrically in a circle. The case of four aerials at the corners of a square is discussed in detail. Application to cage and corner-reflector aerials is indicated. The driving voltages required to maintain specified currents in N parallel aerials arranged in line are determined; the currents corresponding to specified voltages can only be found by solving simultaneous integral equations, but an approximate analysis is given for the special case of $\lambda/2$ dipoles.

621.396.67 **1586**
Aerials protected from Effects of Local Fields.—G. Güllner. (*Arch. elekt. Übertragung*, Feb. 1950, Vol. 4, No. 2, pp. 71–75.) Two compensation arrangements are described which greatly reduce the interference from electrical machines or other possible sources of r.f. radiation near a receiving aerial.

621.396.67 : 621.317.74.029.64 1587

A New Type of Slotted Line Section.—W. B. Wholey & W. N. Eldred. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 244–248.) Full paper. Summary abstracted in 2716 of 1949.

621.396.67 : 621.392.26† 1588

The External Field Produced by a Slot in an Infinite Circular Cylinder.—S. Silver & W. K. Saunders. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 153–158.) "Expressions are derived for the external field produced by a slot of arbitrary shape in the wall of a circular wave guide (of infinite extent and infinite conductivity), the tangential components of the electric field in the slot being assumed to have been prescribed. This is accomplished by matching a Fourier representation of the external field, built up by superposition of basic sets of cylindrical waves, to a Fourier expansion of the prescribed field over the surface of the cylindrical wave guide. The far-zone field is obtained by applying the method of steepest descent to the Fourier integrals that constitute the coefficients in the expansion for the external field. The results satisfy the radiation conditions for far-zone fields."

621.396.67 : 621.392.26† 1589

Radiation from a Transverse Slot in an Infinite Cylinder.—C. H. Papas. (*J. Math. Phys.*, Jan. 1950, Vol. 28, No. 4, pp. 227–236.) An expression is obtained for the radiation assuming the electric field to be parallel to the slot width and its distribution along the slot to be that of the incident dominant mode. A graphical example is given of the azimuthal distribution of the field radiated from a narrow slot of length $\lambda/2$ with a cosine distribution of the electric field along it.

621.396.67 : 621.392.26† 1590

The Radiation Characteristics of Conical Horn Antennas.—A. P. King. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 249–251.) Measurements at wavelengths of 3 cm and 10 cm of the radiation characteristics of conical horns with waveguide excitation are in good agreement with theoretical results for absolute gain. The variations of gain and effective area with dimensions are given and also a diagram for use in plotting the radiation characteristic for conical horns of optimum design.

621.396.67 : 629.13 1591

Shunt-Excited Flat-Plate Antennas with Applications to Aircraft Structures.—J. V. N. Granger. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 280–287.) 1949 I.R.E. National Convention paper. Impedance/frequency characteristics of various shunt-fed plates are given, and the effect of varying the tapping point is shown. Operation is explained as an extension of folded dipole theory. Making the shunt-feed conductor part of the leading edge of the wing is suggested as aerodynamically sound. Impedance measurements on such an arrangement for 3–14 Mc/s and 90–160 Mc/s are given.

621.396.671 1592

Gain of Aerial Systems.—J. Brown. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 132–133.) Further discussion. See 287 of February and 820 of April (Bell).

CIRCUITS AND CIRCUIT ELEMENTS

621.3.016.35 1593

When is Nyquist's Stability Criterion Valid?—J. Peters. (*Arch. elekt. Übertragung*, Jan. 1950, Vol. 4, No. 1, pp. 17–22.) A general criterion of stability is derived from consideration of matrix theory for active networks. Nyquist's criterion is found to agree with this general criterion only in the very important special case of no multiple negative feedback.

621.3.078 1594

The Design of Control Circuits with the Aid of Circle Diagrams.—W. Oppelt. (*Arch. elekt. Übertragung*, Jan. 1950, Vol. 4, No. 1, pp. 11–16.)

621.314.2 1595

Practical Aspects of the Design of Intermediate-Frequency Transformers.—C. E. S. Ridgers. (*J. Brit. Instn Radio Engrs*, March 1950, Vol. 10, No. 3, pp. 97–124.) The various factors involved are analysed and practical design equations are developed. Single- and double-tuned transformers and five different methods of coupling are considered. Comparisons are made between the calculated and observed performance of a particular design. Notes are included on two unconventional designs.

621.314.3† 1596

Transductors and their Application.—L. F. Borg. (*Elect. Times*, 23rd Feb. 1950, Vol. 117, No. 3042, pp. 269–273.) Fundamental considerations for the design of transductors are discussed and their properties examined. Suitable applications of these devices as magnetic amplifiers, rectifier controllers and voltage regulators for alternators are described and illustrated by circuit diagrams.

621.314.3† 1597

Fundamentals of a Theory of the Magnetic Amplifier.—W. Schilling. (*Elektrotech. Z.*, 1st Jan. 1950, Vol. 71, No. 1, pp. 7–13.)

621.314.3† 1598

The Magnetic Amplifier.—R. Feinberg. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 118–124.) "The transductor control characteristic is determined by the shape of the magnetization curve of the transductor core and by the ratio between the peak value of alternating magnetic-flux density and the value of magnetic-flux density at the knee of the magnetization curve. The control characteristic has an optimum form in regard to range of linear control, low initial load current and absence of backlash of control at zero control current if the magnetization curve has a sharp bend at the knee and high value of initial permeability, and when the peak value of alternating magnetic-flux density equals the value of magnetic-flux density at the knee of the magnetization curve."

621.314.3† 1599

Magnetic Amplifiers.—(*Elect. Times*, 16th March 1950, Vol. 117, No. 3045, pp. 417–419.) Summaries of and discussion on the following papers presented at an Institution of Electrical Engineers meeting:

A New Theory of the Magnetic Amplifier.—A. G. Milnes.

The Fundamental Limitations of the Second-Harmonic Type of Magnetic Modulator as applied to the Amplification of Small D.C. Signals.—F. C. Williams & S. W. Noble.

621.316.729 : 621.396.615 1600

Theory of Synchronization by Phase Control.—E. Labin. (*Philips Res. Rep.*, Aug. 1949, Vol. 4, No. 4, pp. 291–315. In French.) A method is described for synchronizing a self-oscillator with a pilot frequency, the oscillator frequency being governed by a control voltage applied to a reactance valve. This control voltage is derived from a mixing stage in which the phases of oscillator and pilot are compared. The method is first considered for the case where both oscillations are sinusoidal and then extended to the case where one of the two oscillations is pulsed, as in the I.G.O. system (Impulse-Governed Oscillator). Experimental results showing the practical possibilities of the method are discussed.

621.316.8 : 621.396.822 **1601**

Dimensions and Noise of Resistors.—A. Hettich. (*Frequenz*, Jan. 1950, Vol. 4, No. 1, pp. 14–25.) A distinction is drawn between spontaneous and current-excited noise, both types being thermal in origin, and a formula is derived for the latter in terms of the resistor length and cross-section. The constant in the expression is the 'specific noise coefficient' of the material. Increasing the dimensions of a resistor of fixed value while retaining geometric similarity reduces the current-excited noise. The two classes of noise may correspond respectively with longitudinal and transverse components of electron motion.

621.318.572 **1602**

New Application of Electronic Switches for Cathode-Ray Oscillographs.—P. Harmegnies. (*HF, Brussels*, 1950, No. 5, pp. 117–124.) The principles of electronic switching by grid-controlled thyratrons are discussed, by which means any number of phenomena may be viewed simultaneously on a c.r.o. Such a circuit may be applied in representing different phenomena as functions of another variant, e.g., anode voltage, the coordinate axes appearing on the c.r.o. screen at the same time. An auxiliary device causes a marker trace to appear on the curve displayed. A uniform phase displacement of the synchronizing pulse moves this trace slowly along the curve so that it indicates the direction in which the curve is traced. A circuit is shown.

621.318.572 **1603**

An Automatically Synchronized Electronic Switch.—W. A. Budlong & B. C. Lutz. (*Rev. sci. Instrum.*, Feb. 1950, Vol. 21, No. 2, pp. 167–168.) Square waves, 180° out of phase, are synchronized with either of two input signals and are used to cut off the respective signal amplifiers alternately. Operation is satisfactory from 25 to 15 000 c/s with any input over 1.5 V.

621.392 **1604**

A Note on the Synthesis of Electric Networks according to Prescribed Transient Response.—M. Nadler. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, p. 441.) A contribution to the solution of the problem of designing coupling networks for valve amplifiers to give a required response to a step function. The effect of the anode capacitance of the valves is to impose restrictions on the shape of the transient waveform if a realizable coupling network is to result. These restrictions are given in mathematical form. See also 2461 of 1949 and 3104, 3360 of 1949 (Aigrain & Williams).

621.392 **1605**

The Synthesis of Resistor-Capacitor Networks.—J. L. Bower & P. F. Ordung. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 263–269.) 1949 I.R.E. National Convention paper. A general method is described for deriving the balanced lattice with a prescribed output/input voltage ratio and with either unloaded output or a resistor-capacitor load. Methods of transformation to an unbalanced structure are outlined.

621.392 **1606**

A General Review of Linear Varying Parameter and Nonlinear Circuit Analysis.—W. R. Bennett. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 259–263.) 1949 I.R.E. National Convention paper. Variable and nonlinear systems are classified from the standpoint of their significance in communication problems. Methods of solution are reviewed and 41 relevant references are given.

621.392 **1607**

New Time Constants for the Study of Linear Electrical Lumped-Constant Circuits.—L. de Luca. (*Poste e Telecomunicazioni*, Dec. 1949, Vol. 17, No. 12, pp. 621–629.) Two new time constants are defined: (*a*) the time constant of integration T, given by Q/I_0, where Q and I_0 refer to the transient current, and (*b*) the time constant of differentiation τ_0, given by $-\vartheta_0/\vartheta_0'$ where ϑ_0 and ϑ_0' are the initial complex current and its differential respectively. These are applied to the symbolic and characteristic equations of LCR circuits, and expressions for the current and charge at various time intervals are developed. Various examples are explained.

621.392 **1608**

Direct Measurement of Bandwidth.—C. R. Ammerman. (*Elect. Engng, N.Y.*, March 1950, Vol. 69, No. 3, pp. 207–212.) The equivalent bandwidth of a network is defined as $f_2 - f_1 = \int_0^\infty (A_f^2/A_o^2)\,df$, where A_f is the amplification of the network, a function of frequency, and A_o is the maximum value of A_f. The bandwidth may be found directly by comparing the network under test with a standard network. A noise voltage is applied to the two networks and the two output voltages are measured, from which the required bandwidth is obtained in terms of the ratio of the maximum output voltages of the two networks at their respective resonance frequencies, with input voltage constant, and the known bandwidth of the standard. The equipment is described and practical details of the method are given, with typical experimental results.

621.392.001.11 **1609**

Remarks on the Basis of Network Theory.—R. M. Redheffer. (*J. Math. Phys.*, Jan. 1950, Vol. 28, No. 4, pp. 237–258.) Discussion of certain general theorems relative to transmission and reflection in transmission lines and networks.

621.392.001.11 : 621.3.015.3 **1610**

Applications of Network Theorems in Transient Analysis.—Y. P. Yu. (*J. Franklin Inst.*, Nov. 1949, Vol. 248, No. 5, pp. 381–398.) An account of the application of selected theorems (Thévenin's, equivalent current-generator, compensation and superposition) to the simplification of the solution of problems involving transients in electrical networks. In each case examples illustrating the method are given.

621.392.26† : 621.396.611.39 **1611**

A Note on Coaxial Bethe Hole Directional Couplers.—E. L. Ginzton & P. S. Goodwin. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 305–309.) Perfect directivity is theoretically obtainable at any wavelength if the diameter of the coupling hole is small compared with $\lambda/8$, but with such small holes the coupling is too weak for many applications. Increasing the coupling by enlarging the hole affects both s.w.r. and directivity, but these can be restored to their proper values over a large frequency range by neutralizing the series inductance caused by the hole by means of added lumped capacitance.

621.392.43 **1612**

A Broadband Transition from Coaxial Line to Helix.—C. O. Lund. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 133–142.) The transition section is a cylindrical conductor with a helical slot of pitch varying from infinity to that of the helical line, with a coaxial cylindrical outer conductor. An approximate theory for the section is outlined, based on an impedance concept for helical lines and the theory of tapered transmission lines. Transitions of reasonable length can be constructed with a voltage s.w.r. <1.5 over a very wide band.

621.392.43 **1613**

The Wide-Band Problem in Decimetre-Wave Technique.—H. H. Meinke. (*Elektrotechnik, Berlin*, May 1948, Vol. 2, No. 5, pp. 137–142.) Discussion of methods of compensating reactive elements to obtain minimum frequency dependence in the case of coupling circuits and wide-band aerials. Different circuit arrangements and various types of wide-band transformer are described.

621.392.43 **1614**

Impedance-Matching Networks.—R. O. Rowlands. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 113–118.) "A method is described of designing a four-terminal network whose image impedance at one pair of terminals is a constant resistance and at the other pair of terminals a complex quantity varying with frequency."

621.392.5 **1615**

Dissipative Quadripoles with Dual Iterative Impedance.—R. Possenti. (*Poste e Telecomunicazioni*, April 1949, Vol. 17, No. 4, pp. 225–230.) In certain cases a quadripole may have two physically realizable iterative impedances, only one of which is a pure reactance.

621.392.5 **1616**

Quadripoles.—M. Leroy. (*Bull. Soc. franç. Élect.*, March 1950, Vol. 10, No. 102, pp. 128–134.) Discussion of the problem of the synthesis of 4-terminal networks. An alternative method to that of Gewertz (1934 Abstracts, p. 514) is suggested.

621.392.5 **1617**

Frequency Analysis of Variable Networks.—L. A. Zadeh. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 291–299.) 1949 I.R.E. West Coast Convention paper. An approach to the analysis of linear networks with time-dependent impedance parameters is made by a frequency-domain technique in which a transfer factor or system function, which is a function of time, is used, as in the analysis of nonvariable networks. Two methods of deriving the system function are considered, the first based on Schelkunoff's wave-perturbation method and the second, a much simpler method, for use with slowly-varying parameters only. The two methods are applied to a low-pass bandwidth-modulated RC half-section, the same result being obtained in both cases for conditions in which the second method is applicable.

621.392.5 **1618**

Investigation of the Effect of Resistive Damping on the Phase Shift in Lattice Networks.—W. Taeger. (*Funk u. Ton*, March & April 1950, Vol. 4, Nos. 3 & 4, pp. 107–118 & 193–198.) Damping factor (δ) and phase constant are calculated for networks with small and with large losses. A phase change only occurs in the pass-band when ohmic resistance may be neglected, and in the suppression band when circuit elements are lossy. Small resistive damping, up to $\delta = 0.1$, has only slight effect on the phase shift in a simple lattice network, but where L and C appear together in one of the branches slight damping alters the characteristics considerably.

621.392.5 **1619**

Attenuation and Delay Equalizers.—W. R. Lundry. (*Elect. Engng, N.Y.*, March 1950, Vol. 69, No. 3, p. 216.) Summary of A.I.E.E. Fall Meeting paper, 1949, discussing equalizers for coaxial lines such as those of the New York/Chicago television circuit. Since such long lines may require about 30 equalizers, manufacturing tolerances must necessarily be small and provision must be made for individual adjustments of inductance and transmission loss.

621.392.5.012.3 : 621.395.667 **1620**

Equalizer Design Chart.—C. P. Boegli. (*Electronics*, April 1950, Vol. 23, No. 4, p. 114.) Bass and treble attenuation or accentuation of two types of RC equalizers are easily determined and curves thus obtained resemble those obtained by more exact computation.

621.392.5.018.1 : 621.396.615 **1621**

The Design of RC Oscillator Phase-Shifting Networks.—T. S. Dutton: W. R. Hinton. (*Electronic Engng*, April 1950, Vol. 22, No. 266, pp. 162–164.) Comment on 840 of April and author's reply.

621.392.52 **1622**

Admittance and Transfer Function for an *n*-Mesh RC Filter Network.—E. W. Tschudi. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 309–310.) The coefficients in the admittance and transfer functions of an n-mesh low-pass filter are exactly calculated as functions of n. If these functions are true for a particular value of n, they are also true for the value $(n + 1)$ and also when $n = 1$.

621.392.52.092 **1623**

Phase-Shift Calculation.—W. Saraga & J. Freeman. (*Wireless Engr*, Jan. 1950, Vol. 27, No. 316, pp. 32–33.) Discussion of various simple methods of deriving an approximation to the curve showing the image phase-shift coefficient of a multi-section filter as a function of frequency.

621.392.52.092 **1624**

Phase-Shift Calculation.—N. O. Johannesson. (*Wireless Engr*, April 1950, Vol. 27, No. 319, p. 133.) A more exact method of calculation than that described by Saraga & Freeman (1623 above), for the particular case where all minima in the image attenuation are equal to one another. Simple formulae give easier calculation with little loss of accuracy.

621.396.611.3 **1625**

Resonant Frequencies and Characteristics of a Resonant Coupled Circuit.—C. L. Cuccia. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 121–132.) The characteristics are derived and charted so that they may be used in predicting the performance of u.h.f. valves using an external resonant circuit for tuning, f.m., and control.

621.396.611.4 : 537.533 : 621.396.619 **1626**

Interaction of a Spiral Electron Beam and a Resonant Microwave Cavity.—F. K. Willenbrock & S. P. Cooke. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 114–125.) The particular cavity considered here is of the cylindrical TE_{11} type in a steady axial magnetic field. If the cavity is excited in a linearly polarized mode, the electromagnetic field will drive the electrons in a helical trajectory with an expanding radius, and the electrons will excite and transfer energy to a degenerate mode oriented spatially at right angles to the driving field. In the driving plane of polarization (both planes of polarization if the cavity is excited in a circularly polarized mode), the electron beam will excite a field in phase opposition to the driving field in a manner analogous to the counter e.m.f. in an electromechanical generator. The converse case of a TE_{11} cavity excited by a spiral beam of electrons is also considered. Possible applications in microwave generators and modulators are mentioned.

621.396.615 **1627**

High-Stability Oscillator.—G. G. Gouriet. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 105–112.) The factors governing frequency stability are analysed and a general expression for the stability of a series-resonant circuit is derived. The practical arrangement discussed is essentially a Colpitts oscillator in which a series LC circuit is substituted for the tuning inductance. Performance figures are given for the circuit used for many years as a variable-frequency driver for B.B.C. s.w. transmitters. See also 2193 of 1948 (Clapp).

621.396.615 1628

Phase-Shift Oscillator.—W. C. Vaughan. (*Wireless Engr*, April 1950, Vol. 27, No. 319, p. 129.) Corrections to paper abstracted in 324 of February.

621.396.615 : 621.396.611.21 1629

A High-Stability Quartz Oscillator.—In the journal reference of 1107 of May please read Vol. 30 for Vol. 29.

621.396.615.11 1630

Frequency Stability and Parasitic Oscillations in a Bridge-Stabilized Low-Frequency Oscillator.—H. Matthes. (*Frequenz*, Jan. & Feb. 1950, Vol. 4, Nos. 1 & 2, pp. 1–10 & 41–50.) Circle diagrams of the loop amplification are used to study methods of suppressing unwanted oscillations in Meacham's oscillator (3717 of 1938 & 263 of 1939), which incorporates an amplitude-limiting bridge circuit and combined feedback. Variations of the transformer tuning, imperfect phasing of feedback circuits and peculiarities of valve characteristics can cause spurious oscillations. Formulae are derived for calculating these effects. Suppression of oscillations above the nominal frequency (1 kc/s in the case considered) may lead to lower-frequency disturbance if the by-pass capacitances are too small. Bridge-stabilized oscillators with only one transformer may be somewhat more convenient; the design of wide-band circuits for this case is considered.

621.396.615.17 1631

The Miller Circuit as a Low-Speed Precision Integrator.—I. A. D. Lewis. (*Electronic Engng*, April 1950, Vol. 22, No. 266, p. 141.) Corrections to paper abstracted in 1111 of May.

621.396.619.23 1632

Balanced Rectifier Modulators without Transformers.—D. G. Tucker. (*Electronic Engng*, April 1950, Vol. 22, No. 266, pp. 139–141.) Two types of modulator are described, a shunt and a series type. An approximate mathematical analysis of their performance is given and a note on the carrier (or switching) circuit is included.

621.396.619.23 1633

Non-Linear Effects in Rectifier Modulators.—V. Belevitch. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 130–131.) A more detailed analysis, taking account of the finite conductances of the rectifiers and the finite carrier-source resistance. The results of the analysis are outlined for (*a*) a ring modulator, (*b*) a Cowan modulator with an auxiliary rectifier connected in opposite polarity, (*c*) a single Cowan modulator. See also 2184 of 1949 and 1552 of June (Tucker & Jeynes).

621.396.621.54 : 621.396.622.6 1634

On Mixing with Detectors.—A. Klemt. (*Frequenz*, Feb. 1950, Vol. 4, No. 2, pp. 50–54.) Discussion of general design principles of h.f. mixer circuits. In crystal detectors, if the back resistance is large enough, the same relations hold as for diodes having the same slope. This back resistance should not fall below about 30 kΩ for mixing with the oscillator fundamental, or below about 100 kΩ for mixing with the 2nd or 3rd harmonics. Maximum amplification in the mixer stage occurs for an oscillator voltage of 1–2 V. Circuit arrangements for measurement of amplification, resistance, and equivalent noise resistance are shown.

621.396.645 1635

On the Theory of Semi-Distributed Amplifiers.—J. L. Steinberg. (*Onde élect.*, March 1950, Vol. 30, No. 276, pp. 121–127.) For the same bandwidth the classical feedback amplifier requires fewer valves, but the distributed amplifier has a much lower noise factor. For a given bandwidth the noise factor of a distributed unit with n identical valves decreases as n is increased, but approaches a limit when $n = 6$. The semi-distributed amplifier described consists of a low-pass distributed input stage followed by a cascade m.f. amplifier. With such an amplifier it is possible to construct u.h.f. radiation meters whose performance is comparable with that of optical pyrometers.

621.396.645 1636

Transmission Factor of Differential Amplifiers.—D. H. Parnum. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 125–129.) A cathode-coupled input stage is used to illustrate the theory. The effect of an anti-phase signal applied between the two grids of the stage cancels in the common cathode resistor and output at full gain is obtained between the anodes. An interfering in-phase signal applied between earth and the two grids in common produces negative feedback, which cuts the in-phase output; but if the halves of the stage are not identical there will be an anti-phase output from this input. The ratio, anti-phase gain/in-phase gain, is thus insufficient to define performance; a knowledge of the 'transmission factor', defined as the ratio of (*a*) anti-phase gain due to anti-phase input, to (*b*) anti-phase gain due to in-phase input, is also required. A method of controlling the value of this factor is explained and recommendations are made for the design of a successful amplifier. See also 680 of 1948 (Johnston).

621.396.645 : 539.16.08 1637

Noise in Ionization-Chamber Pulse Amplifiers.—R. Wilson. (*Phil. Mag.*, Jan. 1950, Vol. 41, No. 312, pp. 66–76.) The general problem of the detection of heavy ionization particles in the presence of γ radiation and amplifier background noise is considered. The dependence of signal/noise ratio on the shape of the initial current pulse is discussed. For optimum signal/noise ratio the pulse should have a certain exponential form. A circuit suitable for the production of such pulses is described.

621.396.645 : 681.142 1638

Analog Computers for Servo Problems.—McDonald. (*See* 1715.)

621.396.645.012.3 1639

Graphical Methods for the Study of Cathode-Follower Circuits.—G. Salmet. (*Onde élect.*, March 1950, Vol. 30, No. 276, pp. 128–139.) Cathode-voltage/cathode-current characteristics analogous to those for anode loading afford a means of rapid determination of optimum conditions for cathode-follower operation. Secondary phenomena such as those caused by an unbalanced input can also be treated by this method, which applies equally for complex loads, as in the case of a video-frequency amplifier with a very large pass-band.

621.396.645.029.3 1640

The Amplification of Very-Low Frequency Electric Currents.—G. Lehmann. (*Onde élect.*, April 1950, Vol. 30, No. 277, pp. 169–177.) Review of different methods.

621.396.645.029.4 1641

For Golden Ears Only.—J. Marshall. (*Audio Engng, N.Y.*, April 1950, Vol. 34, No. 4, pp. 13–15, 32.) Description of a high-fidelity audio amplifier, including circuit diagram and component values. All components are standard commercial types. The circuit consists of a single-ended input stage transformer-coupled to a push-pull triode driver stage, again transformer-coupled to a push-pull triode output stage. Feedback is applied to each stage. The amplifier is capable of delivering 10 W over the range 20–20 000 c/s with less than 1% distortion. Below 8 W the distortion is too low to be measured accurately. Intermodulation distortion is approximately 1% at 10 W and 2% at 15 W.

621.396.645.029.4 **1642**

Raulard 1825 High-Fidelity Phono Amplifier.—(*Audio Engng, N.Y.*, April 1950, Vol. 34, No. 4, p. 25.) Includes a preamplifier which may be attached to the main amplifier or mounted separately.

621.396.645.029.4 **1643**

Selective RC Audio-Frequency Amplifier.—K. Feher & G. Kurtze. (*Frequenz*, March 1950, Vol. 4, No. 3, pp. 72–76.) Selectivity is achieved by use of a feedback circuit comprising a Wien-Robinson bridge, tuning being accomplished by adjustment of R and C in the bridge arms. In an amplifier illustrated, the frequency range is 25 c/s to 30 kc/s and amplification about 5×10^5. The bridge circuit may be switched out for wide-band operation with the same amplification.

621.396.645.029.4 **1644**

Audio-Frequency Selective Amplifiers.—S. W. Punnett. (*J. Brit. Instn Radio Engrs*, Feb. 1950, Vol. 10, No. 2, pp. 39–59.) Three types of frequency-discriminator feedback circuit are considered, the simple RC series-parallel arrangement, the twin-T network and the Wien bridge. The analysis covers the effective Q, bandwidth, gain variations and stability as functions of frequency. When constancy of the Q-factor of an amplifier is of primary importance, the twin-T network should be used, but it has the disadvantage of requiring variation of three components, which must be accurately ganged. When some variation of Q is permissible, the simple circuit with only two variable elements is preferable, being both cheaper and easier to align.

621.396.645.029.4/.52 : 621.396.822 **1645**

Selective Amplification at Low Frequencies.—In the journal reference of 1120 of May please read Vol. 30 for Vol. 29.

621.396.645.37 **1646**

On the Power Gain and the Bandwidth of Feedback Amplifier Stages.—A. van der Ziel & K. S. Knol. (*Philips Res. Rep.*, June 1949, Vol. 4, No. 3, pp. 168–178.) The effects of feedback on the power gain g and bandwidth B of an amplifier stage are treated theoretically. When the stability limit is reached for a given feedback value, g remains finite and for correct output coupling can only have very high values when B is very small. Application of the formulae to a grounded-grid triode stage indicates that small output losses can give a large decrease of g. Values of Bg are plotted against g for various values of feedback capacitance and output losses.

621.396.813 **1647**

The Nonlinearity of Valve Circuits due to the Voltage-Dependence of Valve Input Capacitance.—F. Feil. (*Arch. elekt. Übertragung*, Feb. 1950, Vol. 4, No. 2, pp. 65–70.) In consequence of the space-charge effect, the input capacitance of a valve, and hence the impedance of the valve circuit, varies with the alternations of the applied voltage. In a screen-grid valve with a slope of 10 mA/V the capacitance variation may be 0.5 to 1 pF per 1 V change at the grid. Calculated values of the nonlinear distortion agree with those measured.

534.01 + 538.56 **1648**

Theory of Oscillations. [Book Review]—A. A. Andronow & C. E. Chaikin. Publishers: Princeton University Press, Princeton, N.J., 1949, 336 pp., $6.00. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, p. 449.) Published originally in Russia in 1937 and now appearing as an edited translation by a group at Princeton University. A presentation of "the basic mathematics relating to the theory of nonlinear oscillatory systems". The book is recommended to all those who are interested in learning more about the analysis of such systems and the differential equations that describe them.

621.3.015.3 **1649**

Transients in Linear Electrical Systems. [Book Review]—K. A. Krug. Publisher: Gosenergoizdat, Moscow, 1948, 344 pp., 19 roubles. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Nov. 1949, No. 11, pp. 1741–1744. In Russian.)

621.392 **1650**

Communication Circuits. [Book Review]—L. A. Ware & H. R. Reed. Publishers: J. Wiley & Sons, New York, 1949, 396 pp., $5.00. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, p. 449.) "A very good book intended as first-course material for all students of communication engineering, regardless of the frequency range with which they will be concerned. The material is limited to lumped networks and transmission lines. No active circuits are included. For the field covered, the choice of material is good."

621.392.52 **1651**

Einführung in die Siebschaltungstheorie der elektrischen Nachrichtentechnik (Introduction to the Theory of Filter Circuits for Electrical Communications). [Book Review]—R. Feldtkeller. Publishers: S. Hirzel Verlag, Stuttgart, 160 pp., 12 DM. (*Wireless Engr*, April 1950, Vol. 27, No. 319, p. 134.) This volume does not deal with high frequencies, which are treated in the author's Theorie der Rundfunksiebschaltungen (584 of 1946). "The treatment throughout is very thorough and the book is undoubtedly a valuable addition to the literature of the subject."

621.396 **1652**

Electron-Tube Circuits. [Book Review]—S. Seely. Publishers: McGraw-Hill Book Co., New York, 529 pp., $6.00. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, April 1950, Vol. 14, No. 4, p. 28.) "This college text is the outgrowth of several courses organized by the author on electron-tube circuits and applications that covered many of the important circuits in use during the second world war." Circuits for performing mathematical operations and those developed in connection with radar applications are discussed in greater detail than in most textbooks of to-day.

GENERAL PHYSICS

53.081 + 537.712 **1653**

Proposals and Recommendations concerning the Definitions and Units of Electromagnetic Quantities.—P. Cornelius. (*Philips Res. Rep.*, June 1949, Vol. 4, No. 3, pp. 232–237.) A set of definitions of e.m. quantities and the corresponding units which follow the adoption of the rationalized Giorgi system, with suggestions that may be useful in the transfer from one of the older c.g.s. systems. See also 867 of April (Cornelius & Hamaker).

534.26 + 535.42 **1654**

On Certain Integral Equations in Diffraction Theory.—J. W. Miles. (*J. Math. Phys.*, Jan. 1950, Vol. 28, No. 4, pp. 223–226.) For diffraction of a plane wave by an infinite slit, the integral equation defining the field in the slit is given, with solution, and also its Fourier transform and solution. Corresponding equations are obtained for diffraction by a ribbon. These results lead to useful integral relations between the Mathieu functions.

535.8 **1655**

On the Aberrations of the Field-Flattened Schmidt Camera.—E. H. Linfoot & P. A. Wayman. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 5, pp. 535–556.) A general aberration theory is developed and applied to a comparison of the optical performances of the field-flattened and the plain Schmidt cameras in a typical special case.

537.226.2 : 546.431.82 **1656**

Dielectric Constants and Polarizabilities of Ions in Simple Crystals and Barium Titanate.—S. Roberts. (*Phys. Rev.*, 15th Oct. 1949, Vol. 76, No. 8, pp.1215–1220.)

537.52 **1657**

Plasma and the Langmuir Layer : On the Theory of Electrical Probes in Gas Discharges.—F. Wenzl. (*Z. angew. Phys.*, Feb. 1950, Vol. 2, No. 2, pp. 59–75.)

537.533 : 538.569 : 621.396.822 **1658**

Fluctuation Phenomena arising in the Quantum Interaction of Electrons with High-Frequency Fields.—D. K. C. MacDonald & R. Kompfner. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, p. 304.) Correction to 603 of March.

538.114 **1659**

Theory of Magnetic After-Effect for Massive Materials in the Rayleigh Domain.—L. Néel. (*J. Phys. Radium*, Feb. 1950, Vol. 11, No. 2, pp. 49–61.) Extension to massive materials of theory previously given for fine-grain materials. See also 3151 and 3152 of 1947, 2782 and 3159 of 1949.

538.114 **1660**

Laws Relating to Magnetic After-Effect.—L. Lliboutry. (*C. R. Acad. Sci., Paris*, 13th March 1950, Vol. 230, No. 11, pp. 1042–1044.) In weak fields, the after-effect resulting from a variation of the magnetic field may be measured by applying a small additional variation of the same sign; this variation should have a certain minimum value. The phenomena are discussed with reference to Néel's theory (1659 above).

538.114 **1661**

Magnetic After-Effect in the Rayleigh Domain.—J. C. Barbier. (*C. R. Acad. Sci., Paris*, 13th March 1950, Vol. 230, No. 11, pp. 1040–1041.) Experimental study of massive materials shows that the decrease of the square root of the remanent magnetization is proportional to the time elapsed from the suppression of the field, and is independent of the value of this field and the duration of its application. These results are in very good agreement with Néel's theory (1659 above).

538.24 **1662**

Practical Calculation of Magnetizing Force.—A. A. Halacsy. (*Proc. Instn elect. Engrs*, Part I, March 1950, Vol. 97, No. 104, pp. 37–42.) Any vector component of the magnetizing force at a point in space due to an electric current is directly related to a vector representing the surface swept over by the radius vector of length $1/\sqrt{r}$ with its origin and direction the same as those of the radius vector r directed from the point in question to consecutive points on the path of the influencing current. This relation enables magnetizing force, distribution of the magnetic field, electromagnetic forces, etc., to be calculated by means of simple geometry in all practical cases, including those in which no simple analysis has so far been possible.

538.56 **1663**

Fresnel's Laws for Centimetre Waves.—J. C. Simon. (*C. R. Acad. Sci., Paris*, 12th April 1950, Vol. 230, No. 15, pp. 1386–1388.) A note forming the introduction to a more comprehensive paper on diffraction effects obtained with perforated metal plates. Analogies with classical optical properties are confirmed experimentally; in particular, Brewster's law is verified.

538.56 **1664**

On the Focusing of a Wave.—J. C. Simon. (*C. R. Acad. Sci., Paris*, 24th April 1950, Vol. 230, No. 17, pp. 1513–1514.) Further discussion of the analogy between radio and light waves (1132 of May). In the case of nonisotropic media the analogy is rather with crystal optics.

538.56 **1665**

Graphical Study of the Dispersion of Electro-Magneto-Ionic Waves.—V. A. Bailey & J. A. Roberts. (*Aust. J. sci. Res., Ser. A.*, Sept. 1949, Vol. 2, No. 3, pp. 307–321.) A graphical method is given which leads to an approximate solution of the dispersion equation. The following information is readily obtained:— (*a*) the frequency bands in which undamped waves or wave-groups can grow as they progress, (*b*) the wave-number bands in which unattenuated waves can grow in time, (*c*) the phase and group velocities, refractive indices, and attenuation and damping coefficients, (*d*) the effect of collisions between electrons and other particles on the attenuation of a wave or wave-group.

538.56 : 537.71 **1666**

Concerning 'The Impedance of Free Space'.—In the journal reference of 876 of April please read Vol. 30 for Vol. 29.

538.561 : 537.533 : [537.29+538.6 **1667**

Generation and Amplification of Waves in Dense Charged Beams under Crossed Fields.—O. Buneman. (*Nature, Lond.*, 25th March 1950, Vol. 165, No. 4195, pp. 474–476.) Using plane electrodes without resonators or corrugations, a dense beam of charged particles may be made to produce oscillations similar to those in magnetrons, by a process which is purely electrostatic and can occur at low fields and low frequencies. The conclusions of a theoretical study of this phenomenon are discussed and expressions are given for the electric field distribution, the transverse particle-velocity distribution, the wave-velocity along the beam, and, in the case of a feedback system, the resonance frequency and amplification. The system may have value as a simple generator or amplifier for microwaves and the mechanism may possibly explain the production of solar noise. See also 3412 of 1949 (Haeff).

538.569.4+538.561.029.65 **1668**

Microwave Spectroscopy in the Region from Two to Three Millimeters.—O. R. Gilliam, C. M. Johnson & W. Gordy. (*Phys. Rev.*, 15th April 1950, Vol. 78, No. 2, pp. 140–144.) A description of the technique employed for spectroscopic measurements on gases such as CO at millimetre wavelengths. Wavelengths down to 1.96 mm have been generated by frequency multiplication using a silicon crystal and a klystron source.

538.569.4 **1669**

Measurements on the Absorption of Microwaves : Part 4 — Non-Polar Liquids.—D. H. Whiffen. (*Trans. Faraday Soc.*, Feb. 1950, Vol. 46, No. 326, pp. 124–130.) Experimental study and discussion of the small dielectric losses which occur in C_6H_6 and CCl_4 and in liquids with similar symmetrical molecules.

538.569.4 **1670**

Measurements on the Absorption of Microwaves: Part 5 — The Variation of Relaxation Time with Solvent.—D. H. Whiffen. (*Trans. Faraday Soc.*, Feb. 1950, Vol. 46, No. 326, pp. 130–136.) Description of a method of measurement of dielectric losses at 1.6-cm wavelength. Experimental results are given for 25 systems of polar molecules dissolved in non-polar solvents.

538.66 **1671**

Action of a Periodic Magnetic Field on a Thin Spherical Metal Film.—A. Colombani. (*C. R. Acad. Sci., Paris*, 20th March 1950, Vol. 230, No. 12, pp. 1149–1150.) Calculation of heating effects, based on electromagnetic potentials.

549.211 : 537.533.9 : 537.311.3 **1672**

Electron Bombardment Conductivity in Diamond: Part 2.—K. G. McKay. (*Phys. Rev.*, 15th March 1950, Vol. 77, No. 6, pp. 816–825.) Previously published results have been revised by use of an improved alternating-field method of internal space-charge neutralization. Lower limits are set for the mobilities of electrons and positive holes at room temperature. Measurements of the decay of current due to internal space-charge fields are in reasonable agreement with theory. A double-pulse technique is used to study the rates of release of positive holes and electrons from traps.

537 + 538 **1673**

Principles of Electricity and Electromagnetism. [Book Review]—G. P. Harnwell. Publishers: McGraw-Hill Book Company, New York, 2nd edn, 670 pp., $6.00. (*Rev. sci. Instrum.*, Jan. 1950, Vol. 21, No. 1, pp. 90–91.) A comprehensive textbook and valuable reference book for practising physicists and for electrical engineers whose work borders on physics. Much of the text has been rewritten. New topics added include electron structure of crystals, magnetic induction accelerators, nuclear induction, v.h.f. oscillators, the propagation of e.m. waves in metallic enclosures.

537.226 **1674**

Theory of Dielectrics. [Book Review]—H. Fröhlich. Publishers: Clarendon Press, Oxford, 1949, 179 pp., $4.50 or 18s. (*Rev. sci. Instrum.*, Jan. 1950, Vol. 21, No. 1, p. 90: *Trans. Faraday Soc.*, Nov. 1949, Vol. 45, No. 323, p. 1084.) " A systematic account of the theory of dielectric constant and of dielectric loss. The treatment, based on classical statistical mechanics, is rigorous and methodical . . . The book can be recommended without reserve, not only to specialists in the field of dielectrics but also to all physicists, chemists and applied scientists who wish to gain a clear and comprehensive grasp of this important field."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 **1675**

The Equations of Codazzi and the Relations between Electromagnetism and Gravitation.—A. Gião. (*Phys. Rev.*, 15th Sept. 1949, Vol. 76, No. 6, pp. 764–768.) See also 3128 of 1949.

523.53 : 621.396.9 **1676**

A Radio Echo Method for the Measurement of the Heights of the Reflecting Points of Meteor Trails.—Clegg & Davidson. (*See 1692.*)

523.7 : 538.122 **1677**

The Sun's General Magnetic Field.—P. A. Sweet. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 5, pp. 507–516.) The effects of large-scale convection currents and differential angular velocity on the solar magnetic field are studied in detail.

523.72 : 621.396.822 **1678**

Transients in an Ionized Medium with Applications to Bursts of Solar Noise.—J. C. Jaeger & K. C. Westfold. (*Aust. J. sci. Res., Ser. A*, Sept. 1949, Vol. 2, No. 3, pp. 322–334.) Mathematical solutions of a number of transient problems in linear propagation in a homogeneous ionized medium are given. Discussion of the effects of collisions, inhomogeneity of medium, and magnetic field is included. If a localized disturbance occurs in the solar atmosphere where the collision frequency is ν and the frequency of plasma oscillations is ω_0, radiation will be emitted on all frequencies greater than ω_0 with intensity determined by the nature of the disturbance, and with damping determined by ν. There is a small difference between the arrival times on different frequencies, and for each frequency there is a direct wave and an echo wave a few seconds later. Many of the phenomena of bursts of solar noise on frequencies between 85 Mc/s and 19 Mc/s are consistent with these predictions.

551.1 + 550.38 **1679**

The Earth's Interior and Geomagnetism.—W. M. Elsasser. (*Rev. mod. Phys.*, Jan. 1950, Vol. 22, No. 1, pp. 1–35.) A review of present knowledge of the earth's interior, excluding the extensive information available concerning the crust, with particular reference to seismic data, chemical composition, mechanical and thermal properties and magnetic phenomena.

551.510.5 **1680**

Cellular Atmospheric Waves in the Ionosphere and Troposphere.—D. F. Martyn. (*Proc. roy. Soc. A*, 22nd March 1950, Vol. 201, No. 1065, pp. 216–234.) Horizontally travelling disturbances of electron densities in the F_2 region, and the supposed vertically travelling disturbances of Wells, Watts & George (3279 of 1946) are both explainable as horizontally travelling atmospheric cellular waves, the theory of which is developed. These waves also appear to be the cause of the microbarometric oscillations in the troposphere. In the ionosphere, the earth's magnetic field affects the ionic motion and makes the horizontally travelling disturbances simulate vertically moving electron clouds. Consideration of the boundaries for the cellular waves indicates a value of γ, the ratio of the specific heats of air, considerably less than 1.4 in the F_2 region.

551.510.535 **1681**

On the Diurnal Variations of Electron Concentration of the F_2 Layer at Equatorial Stations.—R. Eyfrig. (*Naturwissenschaften*, Feb. 1950, Vol. 37, No. 3, pp. 67–68.) The mean hourly values of f^0 (F_2) for two equatorial stations with about 180° difference in longitude, Huancayo and Bandoeng, for March and September 1944 show a difference which is not explained by Appleton's temperature effect. The curve for Palau, March 1944, is similar to that for Huancayo. The magnetic inclinations of these two stations are + 0.3° and − 0.5°, that of Bandoeng being about − 32°. The flattening of the curve around noon is attributed to the influence of the geomagnetic field.

551.510.535 : 523.745 **1682**

The Effect of the Sun on the Normal E Layer of the Ionosphere.—E. Harnischmacher. (*C. R. Acad. Sci., Paris*, 27th March 1950, Vol. 230, No. 13, pp. 1301–1302.) Previous investigations have indicated that in Chapman's law for the variation of critical frequency with the sun's zenithal angle, the index n should be higher than $\frac{1}{4}$. Analysis of more recent measurements leads to a formula giving values of n lying between 0.29 and 0.32 in latitude 48°, and between 0.33 and 0.36 at the equator if the mean monthly relative sunspot number varies between 0 and 150.

551.510.535 : 551.542 **1683**

A Correlation between Ionospheric Phenomena and Surface Pressure.—M. W. Jones & J. G. Jones. (*Phys. Rev.*, 15th March 1950, Vol. 77, No. 6, p. 845.) Observations at College, Alaska, indicate that oscillations in the F layer are approximately in opposite phase to the oscillations of the air near the surface of the earth, as measured by the variations of barometric pressure.

551.510.535 : 621.396.11 **1684**

Ionospheric Recordings.—A. Bolle, S. Silleni & C. A. Tiberio. (*Ann. Geofis.*, July 1949, Vol. 2, No. 3, pp. 377–387.) Systematic ionosphere soundings were resumed at the Istituto Nazionale di Geofisica in August 1948. Graphs of F_2 critical frequencies for each month up to March 1949 are given, and items of special interest discussed briefly. These include a few examples of triple magneto-ionic splitting. As reported by Newstead (2595 of 1948) they were accompanied by strong sporadic-E ionization and preceded by a fall in critical frequency.

551.577 : 621.396.9 **1685**

An Investigation of the Dimensions of Precipitation Echoes by Radar.—J. R. Mather. (*Bull. Amer. met. Soc.*, Oct. 1949, Vol. 30, No. 8, pp. 271–277.)

551.577 : 621.396.9 **1686**

The Rain Required for a Radar Echo.—D. W. Perrie. (*Bull. Amer. met. Soc.*, Oct. 1949, Vol. 30, No. 8, pp. 278–281.)

551.594 **1687**

Observations of the Electric Field of the Atmosphere at Monaco.—J. Rouch. (*C. R. Acad. Sci., Paris*, 24th April 1950, Vol. 230, No. 17, pp. 1485–1487.) The mean value of 269 measurements made during 1949 at altitude 70 m is 366 V/m. The field exhibits a seasonal variation, with a maximum in winter and minimum in summer. Meteorological conditions are given for the 3 occasions when the field was >1 000 V/m.

551.594.5 **1688**

Radar Reflections from Auroras.—P. A. Forsyth, W. Petrie, F. Vawter & B. W. Currie. (*Nature, Lond.*, 8th April 1950, Vol. 165, No. 4197, pp. 561–562.) Systematic search for radar echoes on frequencies of 3 kMc/s and 106.5 Mc/s has been carried out at Saskatoon, Canada. Echoes have been observed regularly on the lower frequency, but not at all on the higher one, during auroral displays. Whether the reflections are from the lower and brighter parts of the auroras or from levels a few kilometres above them cannot at present be decided, as the 106.5-Mc/s equipment could only be rotated about a vertical axis.

LOCATION AND AIDS TO NAVIGATION

621.396.9 **1689**

The Port Radar at Antwerp.—(*HF, Brussels*, 1950, No. 5, p. VII.) Brief notice of experimental radar equipment for the river Scheldt. The scanning aerial is about 15 m above river level and the range is adjustable between 40 and 2 miles. Several scanning towers may be installed at different points along the river banks with a central observation station or, alternatively, only one or two very high towers with special equipment may be used.

621.396.9 **1690**

Radar for the Merchant Navy.—M. Gilli. (*Poste e Telecomunicazioni*, April 1949, Vol. 17, No. 4, pp. 233–236.) An account of radar technique and equipment from the standpoint of current British and American practice.

621.396.9 **1691**

Volume Scanning with Conical Beams.—D. Levine. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 287–290.) 1949 I.R.E. National Convention paper. "The equations of motion for a radar scan that provides a nearly constant number of pulses to all point targets are derived. In addition, the periods for this scan and for the more conventional one having constant angular velocities are presented. For these types of scanner it is found that the optimum cross-over point between adjacent beams is at the 2.1-db point of the antenna pattern."

621.396.9 : 523.53 **1692**

A Radio Echo Method for the Measurement of the Heights of the Reflecting Points of Meteor Trails.—J. A. Clegg & I. A. Davidson. (*Phil. Mag.*, Jan. 1950, Vol. 41, No. 312, pp. 77–85.) The range is determined from 60-Mc/s pulse echoes obtained by broadside reflection from the meteor trail and the elevation of the reflecting point is found by comparing the amplitudes of the echo signals picked up by two aerials mounted at different heights (usually $\lambda/2$ and $3\lambda/4$) above a plane, horizontal, perfectly reflecting surface. Results obtained during the Quadrantid shower of 1949 are in good agreement with visual observations.

621.396.9 : 629.13.052] : 621.396.6.001.2 **1693**

Mechanical Development of a Radio Altimeter.—Croft. (*See* 1837.)

621.396.933 **1694**

Pictorial Display in Aircraft Navigation and Landing.—L. F. Jones, H. J. Schrader & J. N. Marshall. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 391–400.) According to the 15-year plan prepared by the U.S.A. Radio Technical Commission for Aeronautics, a pictorial situation display is to be provided at the ground station and in aircraft, and is to be used in the traffic-control zone. Displays for traffic control and instrument landing are illustrated. In traffic control the picture can be used in various ways, which are discussed, with particular reference to the teleran system. Developments are described concerning self-identification in the picture, the use of graphechon storage tubes, altitude coding, and picture brightness. Both further technical development and psychological investigation are necessary before optimum display methods can be determined.

MATERIALS AND SUBSIDIARY TECHNIQUES

537.226.2 : 546.431.82 **1695**

Dielectric Constants and Polarizabilities of Ions in Simple Crystals and Barium Titanate.—S. Roberts. (*Phys. Rev.*, 15th Oct. 1949, Vol. 76, No. 8, pp. 1215–1220.)

537.311.31 : 538.221 **1696**

Improvements and Recent Results relating to the Measurements of the Temperature Variation of the Resistance of Ferromagnetic Materials.—G. Mannevy-Tassy. (*C. R. Acad. Sci., Paris*, 20th March 1950, Vol. 230, No. 12, pp. 1150–1152.)

538.221 **1697**

Study of Static and Dynamic Magnetostriction Phenomena of Austenitic Fe/Ni Alloys.—H. Devèze. (*Ann. Phys., Paris*, Jan./Feb. 1950, Vol. 5, pp. 80–144.) A thesis in four parts. The different apparatus used for static and dynamic measurements is described, particular attention being given to temperature stability. For measurement of elongation under a direct magnetizing force the optical interference method was preferred, as being both accurate and rapid. For dynamic measurements the radiation from the end of the ferromagnetic rod energized by a variable-frequency 400-W ultrasonic generator was directed upon a quartz microphone. Static magnetostriction is studied as a function of nickel content in a series of cylindrical rods and also in 4 invar alloys subjected to different heat treatments. The theory of dynamic magnetostriction is developed to determine the amplitude of oscillations. Experimental results are analysed and optimum operating conditions are established.

538.221 **1698**

The Preparation and Magnetic Properties of Ferrites of Manganese and Cobalt.—C. Guillaud & H. Creveaux. (*C. R. Acad. Sci., Paris*, 27th March 1950, Vol. 230, No. 13, pp. 1256–1258.)

538.221 **1699**

Ferromagnetic Properties of Mixed Ferrites of Cobalt and Zinc and of Manganese and Zinc.—C. Guillaud & H. Creveaux. (*C. R. Acad. Sci., Paris*, 17th April 1950, Vol. 230, No. 16, pp. 1458–1460.)

538.244.2 : 538.12 **1700**

The Magnetic Field inside a Solenoid.—J. R. Barker. (*Brit. J. appl. Phys.*, March 1950, Vol. 1, No. 3, pp. 65–67.) Convenient formulae are derived for computing the extent of the region of uniform field inside both thick and thin coils, and an estimate of their accuracy is made. A set of tables is included to simplify the calculations.

539.23 : 537.311.31 **1701**

Dependence on Applied Potential of the Resistance of Very Thin Deposited Metal Films at Low Temperatures.—N. Mostovetch & B. Vodar. (*C. R. Acad. Sci., Paris*, 6th March 1950, Vol. 230, No. 10, pp. 934–936.) Resistivity measurements for films of various metals in the temperature range 293°–2°K show marked departures from Ohm's law at low temperatures. A direct effect of the field on the conduction electrons is indicated.

546.431.82 : 621.315.612.4 **1702**

The Dielectric Properties of Barium Titanate at Low Temperatures.—R. F. Blunt & W. F. Love. (*Phys. Rev.*, 15th Oct. 1949, Vol. 76, No. 8, pp. 1202–1204.)

546.431.82 : 621.315.612.4 **1703**

Domain Structures and Phase Transitions in Barium Titanate.—P. W. Forsbergh, Jr. (*Phys. Rev.*, 15th Oct. 1949, Vol. 76, No. 8, pp. 1187–1201.)

546.431.82 : 621.315.612.4 **1704**

The Electric and Optical Behavior of $BaTiO_3$ Single-Domain Crystals.—W. J. Merz. (*Phys. Rev.*, 15th Oct. 1950, Vol. 76, No. 8, pp. 1221–1225.)

548.0 : 537.228.1 **1705**

Synthetic Crystals at Ultrasonic Frequencies.—C. E. Green. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 110–112.) Short discussion of the relative advantages of ADP and Rochelle-salt crystals as compared with quartz, for the frequency range 10–150 kc/s. Ease of production may for some applications offset their large temperature coefficients of frequency.

549.514.51 **1706**

Quartz, its Treatment and its Use in Telecommunications Technique.—R. Sueur, J. Norbert, P. Andrieux & M. Cornebise. (*Onde élect.*, Feb. & March 1950, Vol. 30, Nos. 275 & 276, pp. 67–75 & 140–148.) Illustrated description of production technique, methods of mounting and applications in oscillators and filters.

549.514.51 : 536.42 **1707**

The $\alpha\beta$ Transformation Point of Quartz indicated by the Dielectric Constant.—J. P. Pérez. (*C. R. Acad. Sci., Paris*, 6th March 1950, Vol. 230, No. 10, pp. 932–933.) Capacitance/temperature curves for quartz-plate capacitors exhibit kinks or discontinuities at the transformation point near 570°C.

621.315.61 **1708**

Fluid Dielectrics for the Decimetre and Centimetre Wave Band.—W. Endres & H. Köhler. (*Frequenz*, March 1950, Vol. 4, No. 3, pp. 57–63.) Discussion of composite dielectrics, which are of importance as offering a continuous range of values of dielectric constant. Measurements of the dielectric constant for different combinations of powdered ceramic materials with air or transformer oil confirm Lichtenecker & Rother's logarithmic law of mixtures.

621.315.612.4 **1709**

Properties of Calcium-Barium Titanate Dielectrics.—E. N. Bunting, G. R. Shelton & A. S. Creamer. (*Bur. Stand. J. Res.*, Sept. 1949, Vol. 43, No. 3, pp. 237–244.) Properties measured were shrinkage, water absorption, linear expansion, dielectric constant and power factor. The electrical properties were measured at 0.05, 1, 20 and 3 000 Mc/s, and the highest values of dielectric constant were found to be associated with high baria content. The properties of some specimens changed with time. The expansion coefficient of all specimens was relatively high and of the order of 10×10^{-6} per 1°C for the temperature range 25°–700°C.

778.3 : 621.396.9 **1710**

Single-Pulse Recording of Radar Displays.—L. C. Mansur. (*Tele-Tech*, Jan. 1950, Vol. 9, No. 1, pp. 30–33, 54.) Techniques are described which were originally developed for investigating fluctuations of fixed targets and their effect on the operation of moving-target indicators. Typical records are reproduced and various applications of the method are suggested.

535.37 **1711**

Fluorescence and Phosphorescence. [Book Review]—P. Pringsheim. Publishers: Interscience Publishers, New York and London, 1949, 794 pp., 120s. (*Nature, Lond.*, 29th April 1950, Vol. 165, No. 4200, pp. 659–660.) " Provides a clear, balanced, fair and complete account of present knowledge . . . an indispensable reference book for the student who requires either an overall picture of the subject or detailed information on any particular part."

MATHEMATICS

517.912.2 **1712**

A Note on the Numerical Integration of Differential Equations.—W. E. Milne. (*Bur. Stand. J. Res.*, Dec. 1949, Vol. 43, No. 6, pp. 537–542.) An integration method for ordinary differential equations is developed, in which the approximation formulae contain derivatives of higher order than those contained in the differential equation itself. The method is particularly useful for linear differential equations. Numerical examples are given for Bessel's differential equation.

519.283 : 621.39.001.11 **1713**

A Simplified Derivation of Linear Least-Square Smoothing and Prediction Theory.—H. W. Bode & C. E. Shannon. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 417–425.) The principal results of the Wiener-Kolmogoroff smoothing and prediction theory for stationary time series are developed by a new method. The mathematical procedure has, for the most part, a direct physical interpretation based on electric circuit theory and does not involve integral equations or the autocorrelation function. The cases treated are the ' infinite lag ' smoothing problem, pure prediction in the absence of noise, and the general smoothing prediction problem with noise present. The basic assumptions of the theory are discussed in order to clarify the question as to when the theory will be appropriate and to avoid possible misapplication.

681.142 : 621-526 **1714**

Electronics and Experimental Mathematics.—In the journal reference of 919 of April please read Vol. 30 for Vol. 29.

681.142 : 621.396.645 **1715**

Analog Computers for Servo Problems.—D. McDonald. (*Rev. sci. Instrum.*, Feb. 1950, Vol. 21, No. 2, pp. 154–157.) Exact equations are derived for the operational amplifiers used in analogue computers. By making certain approximations, simpler equations are obtained which indicate that in the case of servomechanisms the operational amplifiers may be of simpler type, with lower gain, than for more general problems.

501 **1716**

Applied Mathematics for Engineers and Scientists. [Book Review]—S. A. Schelkunoff. Publishers: D. van Nostrand, 1948, 472 pp., 36s. (*Phil. Mag.*, Jan. 1950, Vol. 41, No. 312, p. 108.) " The first half treats the general mathematical methods and the second half introduces the frequently occurring transcendental functions. The portion dealing with differential equations is particularly well written. The introductions to the use of Green's function and the Laplace transform method are two of the most valuable features of the book. The principles involved have been illustrated by concrete examples as far as possible. A chapter on tensors and matrices would perhaps have increased the general usefulness of the book."

MEASUREMENTS AND TEST GEAR

621.317.3 : 621.385.2 : 621.315.59 **1717**

Applications of Germanium Crystal Diodes in Precision-Measurement Technique.—A. Perlstain. (*Bull. schweiz. elektrotech. Ver.*, 28th May 1949, Vol. 40, No. 11, pp. 337–354. In German.) Basic circuits and the development of bridge and star modulator systems and their variants are considered. Detailed descriptions are given of (*a*) arrangements for the measurement of frequencies, voltage mean values, and capacitance, (*b*) a method for point-to-point curve plotting, (*c*) equipment for vector measurements, (*d*) a method for harmonic analysis of voltage curves. Auxiliary apparatus includes a circuit for producing square waves without using valves. Accuracy of measurement is indicated in each case and temperature effects are discussed. The indicator generally used is a d.c. galvanometer in a compensation circuit. The methods described can be used up to 200 kc/s.

621.317.329 : 537.291 **1718**

An Automatic Plotter for Electron Trajectories.—D. B. Langmuir. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 143–154.) A scale model of the e.s. field is produced in an electrolyte trough. The voltages picked up by a pair of wire probes determine the radius of curvature of the trajectory simulating that of an electron. Arrangements are provided so that when started from a selected point in a given initial direction the radius of curvature of the path of the probes is automatically adjusted so that they trace a simulated trajectory. Mechanical design, electrical circuits, and performance are discussed.

621.317.33 **1719**

Methods for Obtaining the Voltage Standing-Wave Ratio on Transmission Lines Independently of the Detector Characteristics.—A. M. Winzemer. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 275–279.) By means of the basic transmission line equations and the general law of detection, expressions are derived which give the voltage s.w.r. as a function of measurable electrical angles, the expressions being independent of the response law of the detector. Special cases of the general equations are discussed covering applications where high or low s.w.r. values are to be determined, with or without the use of the voltage maxima or minima. The extension of the methods to the case of attenuating transmission lines is considered.

621.317.336.029.64 **1720**

Directional Coupler for Impedance Measurement at U.H.F.—R. Musson-Genon & P. Brissonneau. (*C. R. Acad. Sci., Paris*, 27th March 1950, Vol. 230, No. 13, pp. 1258–1259.) The impedance to be measured terminates a waveguide to which is coupled, by means of a directional coupler of attenuation about 20 db, a section of waveguide terminated at one end by a sliding piston and at the other by an accurately matched crystal detector, the current in which varies with the position of the piston. The unknown impedance is readily found from measurements of the maximum and minimum currents. Accuracy is of the same order as when using a movable probe, but the construction of the apparatus is much simpler.

621.317.373.029.64 **1721**

Experimental Determination of Phase Characteristics of Centimetric Waveband Circuits.—M. Denis & P. Palluel. (*Microtecnic, Lausanne*, Sept. 1949–Feb. 1950, Vol. 3, Nos. 5 & 6, & Vol. 4, No. 1, pp. 218–224, 289–294 & 3–9.) English version of 682 of March.

621.317.74.029.64 : 621.396.67 **1722**

A New Type of Slotted Line Section.—W. B. Wholey & W. N. Eldred. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 244–248.) Full paper. Summary abstracted in 2716 of 1949.

621.317.755 : 621.396.645 **1723**

A Wide-Band Amplifier for Oscilloscopes.—(*Radio & Electronics, Wellington, N.Z.*, 1st March 1950, Vol. 5, No. 1, pp. 18–19.) A simple 5-valve circuit giving a balanced output from an unbalanced input and having a response useful up to 4.5 Mc/s. It is suitable for examination of square or irregular waveforms and will fill the screen of a 5-inch c.r. tube from an input of 1 V r.m.s.

621.317.772 **1724**

Wide-Band Audio Phasemeter.—J. R. Ragazzini & L. A. Zadeh. (*Rev. sci. Instrum.*, Feb. 1950, Vol. 21, No. 2, pp. 145–149.) A stabilized feedback amplifier is arranged to produce a 90° phase shift and its input is added to a variable fraction of its output to give a resultant e.m.f. of variable phase. This calibrated phase shift is matched to the unknown phase difference, using a c.r.o. as indicator. The error of measurement is $< 0.5°$ for frequencies from 20 c/s to 100 kc/s.

621.317.772 **1725**

A New Measuring Instrument for Time-Delay Measurements.—W. Dillenburger. (*Frequenz*, Jan. 1950, Vol. 4, No. 1, pp. 10–13.) Circuit details and description of a phase meter for the frequency range 100 kc/s to 20 Mc/s. Calibration is simple. Indication is direct and single-valued between 0° and 360° and within reasonable limits is independent of the intermediate frequency used in the meter and of the amplitude of the input signals.

621.317.784 **1726**

Dynamometer Type Wattmeter for Audio Frequencies.—D. Alvey. (*Electronic Engng*, April 1950, Vol. 22, No. 266, pp. 146–148.) The basic principles of operation at a.f. are summarized and expressions for frequency errors when used as a voltmeter, ammeter or wattmeter are derived. A range of instruments covers measurements of voltage to 300 V, current to 3 A and power to 500 W. Various applications are noted.

621.317.794 **1727**

Measurement of Small Powers at Centimetre Wavelengths.—J. Broc. (*Onde élect.*, March 1950, Vol. 30, No. 276, pp. 108–120.) Detailed account of methods and apparatus noted in 2860 of 1949.

621.317.794 : 621.317.733 **1728**

Analysis of the Direct-Current Bolometer Bridge.—D. M. Kerns. (*Bur. Stand. J. Res.*, Dec. 1949, Vol. 43, No. 6, pp. 581–589.) "The behavior of a direct-current Wheatstone bridge with a nonlinear element (bolometer) in one arm, as used in the measurement of microwave power, is analyzed. Results of rather general applicability are obtained by ascribing arbitrary values to the resistances making up the bridge-network and by employing a resistance law of a general form for the bolometer element. Emphasis is placed upon the development of first-order theory in convenient form. General characteristics of the behavior of the type of network (and nonlinear element) under consideration are indicated. Results obtained include expressions for the derivatives of galvanometer current with respect to radio-frequency power, ambient temperature, source-voltage, and source-resistance."

621.319.4 1729

The Temperature Coefficient of Standard Air Capacitors.—G. Zickner. (*Elektrotechnik, Berlin*, May 1948, Vol. 2, No. 5, pp. 147–152.) The factors which determine the coefficient are analysed and methods of reducing it are discussed. Descriptions are given of different designs of fixed and variable capacitors in which the temperature coefficient is much reduced by use of materials with different expansion coefficients in a 'grid-iron' type of construction. Physical constants of different conducting and insulating materials are tabulated.

621.397.6.001.4 + 621.397.6 1730

The Video-Frequency Stage.—Gondry. (*See* 1782.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.232 : 534.321.9 : 621.3.087.6 1731

Pin-Pointing Ultrasonic Energy.—Dana & van Meter. (*See* 1561.)

539.16.08 1732

Small Probing Geiger-Müller Counters.—C. V. Robinson. (*Rev. sci. Instrum.*, Jan. 1950, Vol. 21, No. 1, pp. 82–84.) Experiments with mixtures of argon and ethyl acetate in small counters are described. Construction details are given for two brain-probing counters of diameter 3 mm and 2 mm respectively.

621.3.083.7 : 621.396 1733

High-Accuracy Radio-Telemetry.—I. Podliasky & J. Zakheim. (*C. R. Acad. Sci., Paris*, 27th March 1950, Vol. 230, No. 13, pp. 1260–1262.) In a system for measuring the velocity of a moving object such as an aircraft, in which differently phased beats are produced at a series of ground stations receiving signals from both the moving object and a ground transmitter, it is important to keep the difference between the two signal frequencies constant. Servomechanisms are provided at the ground transmitter for this purpose. Instrumental accuracy to within about 1 part in 10^5 is possible, the overall accuracy being limited only by variation of propagation velocity in the vicinity of the ground.

621.317.39 1734

Electrical Device for the Calculation of Product Integrals.—O. Schäfer & G. Lander. (*Arch. elekt. Übertragung*, Feb. 1950, Vol. 4, No. 2, pp. 59–64.) Curves representing the two functions concerned are scanned simultaneously by oscillating light beams. The resulting outputs from the two photocells used are applied, after amplification, to an integrator. The time for a complete scan is about 2 minutes.

621.365.54† 1735

H.F. Heating speeds Steel Forging.—(*Elect. Times*, 9th March 1950, Vol. 117, No. 3044, pp. 355–362.) Description of press-forge plant at Bromsgrove, Worcestershire. For another account see 420 of February.

621.38 : 629.13 1736

Electronics in Aircraft Design.—A. L. Whitwell. (*J. Brit. Instn Radio Engrs*, March 1950, Vol. 10, No. 3, pp. 79–95.) A survey of electronic methods used in measurements on aircraft structures, both on the ground and in flight; strain, displacement, velocity, acceleration and pressure are dealt with, and multichannel apparatus developed for recording high-frequency vibrations is described.

621.384.6 1737

The Cyclosynchrotron.—M. L. Oliphant. (*Nature, Lond.*, 25th March 1950, Vol. 165, No. 4195, pp. 466–468.) A first model is under construction for installation in the School of Physical Sciences in the Australian National University, Canberra. Protons are accelerated in a synchrocyclotron and a synchrotron guiding field is produced about the final orbit in such a way that the passage from one type of acceleration to the other is smooth. Final particle energies of the order of 2–3 kMeV should be obtained.

621.384.611.2† 1738

Design Study for a 3 000-MeV Proton Accelerator.—M. S. Livingston, J. P. Blewett, G. K. Green & L. J. Haworth. (*Rev. sci. Instrum.*, Jan. 1950, Vol. 21, No. 1, pp. 7–22.) Discussion of a proton synchrotron, to be called a cosmotron, now under construction at Brookhaven National Laboratory, Upton, N.Y.

621.384.611.2† 1739

Betatron-Starting in Electron Synchrotrons.—J. J. Wilkins. (*Phil. Mag.*, Jan. 1950, Vol. 41, No. 312, pp. 34–53.)

621.385.15.001.8 1740

Recent Applications of Electron Multiplier Tubes.—Allen. (*See* 1815.)

621.385.833 1741

The Practice of Electron Microscopy.—(*J. R. micr. Soc.*, March 1950, Vol. 70, Part I, No. 349, pp. 1–141.) A comprehensive treatise compiled by the Electron Microscopy Group of the Institute of Physics and edited by D. G. Drummond. General optical considerations and basic techniques are discussed and methods are described for the examination of small particles, thin-film specimens, surface replicas, micro-organisms, and biological tissues. Special techniques, the calibration of magnification and resolving power, and photographic technique are also considered. Illustrative photographs and an extensive bibliography are included.

621.385.833 1742

A Three-Stage Electron Microscope with Stereographic Dark Field, and Electron Diffraction Capabilities.—M. E. Haine, R. S. Page & R. G. Garfitt. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 173–182.) A continuous range from × 1 000 to × 100 000 is covered by use of an intermediate projector lens.

621.385.833 1743

Principal Rays for a Family of Electron Lenses and Mirrors.—É. Regenstreif. (*C. R. Acad. Sci., Paris*, 27th March 1950, Vol. 230, No. 13, pp. 1262–1264.)

621.398 1744

Mains Control Installations: Report on the S.E.V. (Schweizerischer Elektrotechnischer Verein) Conference in Berne, Dec. 1949.—(*Bull. schweiz. elektrotech. Ver.*, 4th March 1950, Vol. 41, No. 5, pp. 153–200.) Introductory papers by E. Erb (in German), reviewing possible methods of control, and by M. Roesgen (in French), outlining the requirements of centralized remote control systems, are followed by: Research and New Productions of the Compagnie des Compteurs, by J. Pelpel (in French): description of different relays for carrier current control systems and consideration of optimum frequency; Principal Features of the Landis & Gyr Centralized Control System, by W. Koenig (in German): discussion of factors determining the choice of frequency for the pulse-width method; Mains Control Installations of the Zellweger A.G., Uster, by O. Grob (in German): description of a system using stored energy for the control signals; The Sauter Remote Control System, by E. Spahn (in German): pulse system operating on 2 kc/s and using a triode rectifier and synchronous selector at the receiving end. The concluding discussion (in German) includes descriptions of other systems and equipment.

629.13.055.6 : 621.317.733.011.4 **1745**

Airplane Fuel Gage.—C. R. Schafer. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 77–79.) The liquid fuel in the aircraft tank forms the dielectric in a tubular capacitor in one arm of a bridge, the unbalance voltage operating a servo-motor which restores the bridge balance and indicates fuel level mechanically. Advantages of the equipment are ruggedness, freedom from slosh effects, good accuracy, and indication of weight rather than volume of fuel.

621.317.083.7 : 621.396 **1746**

Principles and Methods of Telemetering. [Book Review]—P. A. Borden & G. M. Thynell. Publishers: Chapman & Hall, London, 1948, 230 pp., 27s. (*Beama J.*, Oct. 1949, Vol. 56, No. 148, p. 349.) "A work which presents a technically analytical and descriptive treatment of a large variety of telemetering devices. . . . It is an informative record of U.S. practice in telemetering."

621.38 **1747**

Elements of Electronics. [Book Review]—G. Windred. Publishers: Chapman & Hall, London, 1949, 185 pp., 15s. (*Beama J.*, Feb. 1950, Vol. 57, No. 152, pp. 46–47.) An elementary, non-mathematical introduction to the subject, giving a survey of principles and applications.

PROPAGATION OF WAVES

538.56 **1748**

Vectorial Space of Regular Waves outside a Closed Surface.—J. Brodin. (*C. R. Acad. Sci., Paris*, 12th April 1950, Vol. 230, No. 15, pp. 1388–1390.) The general expression of Huyghens' principle for a regular monochromatic wave outside a closed surface *S* and at infinity is given in the form of a series of waves produced by the basic layers of electric and magnetic dipoles tangential to *S*. The development involves arbitrary coefficients permitting its application to particular problems. See also 523 and 712 of March.

538.56 **1749**

Particular Case of Huyghens' Principle.—J. Brodin. (*C. R. Acad. Sci., Paris*, 3rd April 1950, Vol. 230, No. 14, pp. 1345–1347.) Extension of 712 of March to the case in which the solutions of the integral equation are not zero. See also 1218 of May.

538.566.2 **1750**

The Geometric Locus of the Coefficient of Reflection of Electromagnetic Waves due to a Discontinuity in the Gradient of the Dielectric Constant, in the case of Small Gradient.—G. Eckart. (*C. R. Acad. Sci., Paris*, 13th March 1950, Vol. 230, No. 11, pp. 1044–1045.)

621.396.11 **1751**

Velocity of Light and of Radio Waves.—L. Essen. (*Nature, Lond.*, 15th April 1950, Vol. 165, No. 4198, pp. 582–583.) Recent measurements of the velocity of light and radio waves are discussed. The value of 299 776 ± 4 km/sec quoted by Birge (1941) for light has been generally accepted, but the measurements described suggest that this figure is too low. Careful measurements with the Shoran radio system in America give a value of 299 792 ± 2.4 km/sec after making a refractive-index correction. Essen & Gordon-Smith have obtained a value of 299 792 km/sec, with an estimated maximum error of ± 9 km/sec, by measurements in vacuo of the resonance frequency of a metallic cavity of known dimensions. A later figure given by Essen is 299 792.5 ± 3 km/sec. Recent optical determinations by Bergstrand in Sweden using a Kerr cell and photocell give a value of 299 792.7 ± 0.25 km/sec.

621.396.11 **1752**

Some Remarks on the Ionospheric Double Refraction: Part 2.—H. Bremmer. (*Philips Res. Rep.*, June 1949, Vol. 4, No. 3, pp. 189–205.) Maxwell's equations for plane wave propagation through a stratified anisotropic medium are reduced to a set of four simultaneous first-order equations. A general method is indicated for deriving W.K.B. approximations from these equations and details are given for the simplified case of an isotropic medium. The intensities of the waves reflected by the stratified anisotropic medium are discussed and results combined with the saddle-point method of evaluating exponential integrals to find the geometric-optical approximation for the field strength after one ionospheric reflection. Part 1: 3519 of 1949.

621.396.11 **1753**

Ionosphere Data Deduced from Direct Tests on Radiotelegraphic Links in the [Italian] Army Network.—S. Silleni. (*Ann. Geofis.*, July 1949, Vol. 2, No. 3, pp. 388–399.) Results for the first three months of a year's survey of communications on 7.095 Mc/s. Values of the critical frequencies and their distribution were deduced from the data collected. Comparison with results obtained from ionosphere soundings showed fairly good agreement for mean values; distribution about the mean was more scattered in the case of the links by a factor which remained almost constant over the period considered.

621.396.11 : 551.510.535 **1754**

Ionospheric Predictions and Radiocommunication.—M. Nicolet. (*HF, Brussels*, 1950, No. 5, pp. 125–142.) General discussion of the factors influencing the propagation of short waves in the ionosphere. Methods for predicting usable frequencies and ionospheric conditions are explained. The theories underlying prediction calculations are outlined.

621.396.11 : 551.510.535 **1755**

Ionospheric Recordings.—Bolle, Silleni & Tiberio. (Sec 1684.)

621.396.11.029.6 **1756**

Reflection of Radio Waves from a Rough Sea.—L. V. Blake. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 301–304.) "At microwave frequencies, the sea cannot always be assumed to be a smooth, or mirror-like, reflecting surface. It is shown that when the sea is rough the reflected field will be a randomly fluctuating one, or will at least have a fluctuating component, even though the radiated signal is of constant amplitude and frequency. The central limit theorem of mathematical probability theory is used to derive the probability-density functions for the amplitude of the reflected signal, and for the amplitude of the combined reflected and direct-path signals. The possible practical significance of these results is discussed."

621.396.11.029.64 **1757**

A Theory of Radio Scattering in the Troposphere.—H. G. Booker & W. E. Gordon. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 401–412.) "The theory of scattering by a turbulent medium is applied to scattering of radio waves in the troposphere. In the region below the horizon of the transmitter, energy is received (*a*) by diffraction round the curved surface of the earth (modified as appropriate by atmospheric refraction), and (*b*) by scattering from turbulence in the region of high field strength above the horizon. At distances beyond the horizon that are not too great, we may think of (*a*) as giving the mean signal received, and (*b*) as giving the fading. However, contribution (*b*) usually decreases with distance more slowly than contribution (*a*). Beyond a certain distance, therefore, contribution (*b*) becomes predominant and the mean signal is no longer given by (*a*)." A graphical comparison of field strength according to the scattering theory (using expected values of atmospheric turbulence and departure of the refractive index from its mean value) with experimental results obtained over sea at a wavelength of 9 cm shows that the theory is fully adequate to explain the high field strengths observed at great distances.

621.396.81 **1758**

Approximate Formula for the Night Field-Intensity Curves established by the C.C.I.R.—C. Glinz. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st April 1950, Vol. 28, No. 4, pp. 147–151. In French.) The Committee's work in producing these curves is reviewed. Weyrich's theory (1928 Abstracts, p. 516) on radiation from a finite aerial between two perfectly conducting planes is applied to the propagation of waves of wavelength 200–2 000 m between earth and the ionosphere. Neglecting distance attenuation, the result of the effects of interference and superposition is a cylindrical wave with field varying as $1/\sqrt{r}$, where r is the transmission distance. The inclusion of damping according to Sommerfeld's function $f(\rho)$ leads to formulae which for large values of r serve as an approximation for the field intensity curves.

RECEPTION

621.396.621 **1759**

Frequency Conversion by Phase Variation.—G. Diemer & K. S. Knol. (*Philips Res. Rep.*, June 1949, Vol. 4, No. 3, pp. 161–167.) The highest theoretical conversion transconductance g_{cn} is obtained when the valve transconductance has its optimum positive value and the phase angle decreases linearly by $2\pi n$ radians during one cycle of the oscillator voltage. With these conditions g_{cn} equals the maximum h.f. transconductance and improves by a factor $\pi/2$ on the value of g_{cn} given by Herold's phase-reversal method. Experimentally the electron beam is modulated using for each voltage two systems giving deflections at right angles to each other and in phase quadrature, the i.f. current being taken in balance from two concentric annuli.

621.396.621 : 621.395.623.7 **1760**

High-Efficiency Loudspeakers for Personal Radio Receivers.—H. F. Olson, J. C. Bleazey, J. Preston & R. A. Hackley. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 80–98.) The direct radiator, combination direct radiator and acoustical phase inverter, horn, and combination horn and phase inverter types of loudspeaker are discussed. The measured response frequency characteristic of each type is compared with the theoretical response. An efficiency of 25% has been obtained with a combination of horn and phase inverter; this system has been incorporated in a complete 4-valve receiver of total volume only 25 cubic inches.

621.396.621.5 **1761**

Dual-Diversity Frequency-Shift Reception.—D. G. Lindsay. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1950, Vol. 11, No. 2, pp. 29–42.) A survey of frequency-shift systems and their advantages is followed by a general description of a receiver for 1.5–30-Mc/s teleprinter service, using the audio-filter method of separating mark and space signals (2 125 and 2 975 c/s respectively). Practical filter and limiter characteristics and typical performance figures for the receiver, limiter-detector, relay, frequency-deviation indicator and voice-frequency keying unit are given.

621.396.622 : 621.397.62 **1762**

Continuous Tuning for TV Sets.—B. K. V. French. (*FM-TV*, March 1950, Vol. 10, No. 3, pp. 9–11, 33.) Illustrated details and performance data of an input tuning system covering the range 54–216 Mc/s and permitting reception of f.m. broadcasts on 88–108 Mc/s without the addition of any other components. Another advantage of continuous as compared with step-by-step tuning is that necessary adjustments to compensate for aging do not require a serviceman. Variable-inductance tuning is used because of the wide range to be covered; a new inductuner developed for this purpose is described.

621.396.828 **1763**

Radio Interference Suppression.—S. F. Philpott. (*Electrician*, 31st March 1950, Vol. 144, No. 3746, pp. 1025–1029.) Interference caused by small motors is the main form considered, and means of reducing the interference voltages to < 0.5 mV at the equipment terminals are discussed, various arrangements of capacitors and chokes being shown. The interference voltages remaining after applying different methods of suppression to a small universal motor are tabulated. A set designed by the Radio Branch of the British Post Office for the measurement of asymmetric r.f. voltages between the terminals of a machine and earth is briefly described.

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **1764**

Recent Developments in Communication Theory.—C. E. Shannon. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 80–83.) A non-mathematical treatment of communication systems, discussing methods of coding information, its measurement, and the capacity of a channel in relation to bandwidth, noise and power. Ideal and practical systems are briefly considered, a speech-transmission method being suggested which requires a bandwidth of only 2.3 c/s on a channel with a signal/noise ratio of 20 db.

621.39.001.11 : 519.283 **1765**

A Simplified Derivation of Linear Least Square Smoothing and Prediction Theory.—Bode & Shannon. (*See* 1713.)

621.395.5 : 621.395.661.2 **1766**

Note on Matching the Impedance of Terminal Equipment to that of Modern Long-Distance Telephone Lines.—R. Sueur. (*Ann. Télécommun.*, March 1948, Vol. 3, No. 3, pp. 105–108.) Matching defects produce additional crosstalk on the symmetrical lines used for multichannel carrier-current telephony. Equipment for long-distance coaxial cables should be matched to the lines for the lowest frequencies transmitted. C.C.I.F. recommendations for long-distance lines are mentioned and considered with reference to the transmission of television signals.

621.396.41 : 621.39.001.11 **1767**

Theoretical Aspects of Asynchronous Multiplexing.—W. D. White. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 270–275.) 1949 I.R.E. National Convention paper. Recent work in communication theory by Shannon (1361 and 1649 of 1949) makes it possible to deduce the information capacity of a communication system in which isolated pulse transmitters share a common channel without synchronization. Under these conditions it is possible to add redundant information at the output of each transmitter and to separate the signals at the receiver in much the same manner as a wanted signal is separated from random noise. Some simple systems are discussed and specimen numerical data for a 6-station multiplex system are tabulated. Applications of such a system, especially to mobile communication, are suggested.

621.396.5 : 621.396.619.16 **1768**

Pulse Multiplex Equipment for 24-Channel Telephony.—In the journal reference of 998 of April please read Vol. 30 for Vol. 29.

621.396.619.16 **1769**

Pulse Modulation.—E. Prokott. (*Arch. elekt. Übertragung*, Jan. 1950, Vol. 4, No. 1, pp. 1–10.) Description of the basic methods: p.a.m., p.ph.m., p.f.m. and p.w.m. The latter is considered as higher-order amplitude modulation. The sideband theory of the different systems is developed, with particular reference to the structure of the pulse train and to application possibilities.

621.396.619.16 **1770**

Interference Characteristics of Pulse-Time Modulation.—E. R. Kretzmer. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 252–255.) 1949 I.R.E. National Convention paper. Mathematical and experimental analysis, with particular reference to pulse-duration and pulse-position modulation. Both 2-station and 2-path interference are considered. In 2-station interference the stronger signal is completely predominant and the noise has a random character. For single-channel pulse-duration modulation, 2-path interference generally permits fairly good reception of speech and music signals.

621.396.619.16 **1771**

On Distortion in Pulse-Width Modulation.—J. Müller. (*Arch. elekt. Übertragung*, Feb. 1950, Vol. 4, No. 2, pp. 51–58.) An investigation of the deformation of rectangular pulses due to the limited receiver bandwidth, as dependent on the ratio n of pulse period to pulse duration, and also of the distortion caused by subsequent amplitude limiting. Fourier analysis is used and, in an alternative method, the transfer functions of Küpfmüller. The bandwidth necessary for p.w.m. is determined and the relation of bandwidth to pulse ratio n is considered. Experiments confirm the theory.

621.396.65 **1772**

Problems of Decimetre-Wave Directional Links.—G. Megla. (*Elektrotechnik, Berlin*, April 1948, Vol. 2, No. 4, pp. 103–109.) Discussion of fundamental considerations in the technique, including choice of wavelength, aerial systems and bandwidth, height of stations, signal level, sensitivity, aerial gain.

621.396.712 + 621.397.7 **1773**

WTCN A.M. F.M. TV.—J. M. Sherman. (*Broadcast News*, Jan. Feb. 1950, No. 57, pp. 32–39.) Illustrated description of studio and transmitter facilities. The aerials and microwave relay receivers are installed at the top of the Foshay tower, the tallest building in the Minneapolis-St Paul area.

621.396.712 **1774**

KENI, Anchorage, Alaska.—A. G. Hiebert. (*Broadcast News*, Jan./Feb. 1950, No. 57, pp. 40–44.) Illustrated description of studio and transmitter equipment.

621.396.712 **1775**

Radio Istanbul covers Near East with 150-kW Transmitter.—P. C. Brown. (*Broadcast News*, Jan./Feb. 1950, No. 57, pp. 28–31.) Illustrations and a few details of equipment and studio facilities. The R.C.A. Type BTA-150A transmitter operates on 704 kc/s with a 725-ft aerial tower.

621.396.712 **1776**

Voice of America's 150-kW Transmitter.—E. L. Schacht. (*Broadcast News*, Jan./Feb. 1950, No. 57, pp. 24–27.) Brief details, with illustrations, of a new R.C.A. Type BTA-150A a.m. transmitter equipment installed in Munich, Germany, to relay on 1 195 kc/s the Voice-of-America programmes as they originate in the United States. The aerial system consists of a 4-element array of half-wave towers, giving three different beam patterns which can be selected by switching. The forward power gain on the main lobes is >6.

621.396.931 : 621.396.826 **1777**

Echoes in Transmission at 450 Mc/s from Land- to Car-Radio Units.—W. R. Young, Jr, & L. Y. Lacy. (*Proc. Inst. Radio Engrs*, March 1950, Vol. 38, No. 3, pp. 255–258.) 1949 I.R.E. National Convention paper. Examples of multipath echoes observed in a moving car in New York City are shown and discussed.

SUBSIDIARY APPARATUS

621-526 : 621.3.016.35 **1778**

Contribution to the Study of the Stability of Regulating Circuits and of Servomechanisms.—P. L. Dubois-Violette. (*C. R. Acad. Sci., Paris*, 12th April 1950, Vol. 230, No. 15, pp. 1380–1383.)

621.396.682 : 621.316.722 **1779**

Cathode Heater Compensation as Applied to Degenerative Voltage-Stabilized Direct-Current Power Supplies.—R. C. Ellenwood & H. E. Sorrows. (*Bur. Stand. J. Res.*, Sept. 1949, Vol. 43, No. 3, pp. 251–255.) Full description of the method noted in 468 of February.

TELEVISION AND PHOTOTELEGRAPHY

621.397.331.2 **1780**

TV Camera-Tube Design.—A. Lytel. (*TV Engng, N.Y.*, Jan.–March 1950, Vol. 1, Nos. 1–3, pp. 28–29, 22–25 & 24–26.) Mechanical, electronic and optical characteristics of nine types of pickup tube developed during the past twenty years.

621.397.6 : 621.385 **1781**

Encyclopaedia of New and Available Components for Television Equipment.—M. Alixant. (*Télévis. franç.*, April 1950, No. 57, pp. 9–12.) The first of a series of reviews. American and European c.r. tubes, receiving, rectifying, and transmitting valves are tabulated with their characteristics.

621.397.62 + 621.397.6.001.4 **1782**

The Video-Frequency Stage.—R. Gondry. (*Télévis. franç.*, Nov. & Dec. 1949, Nos. 53 & 54, pp. 6–9 & 13–17.) Possible circuit arrangements and adjustments for near-linear frequency response are discussed. Circuits of two useful test instruments are given: (*a*) a square-wave generator; (*b*) a tuned amplifier.

621.397.62 **1783**

Characteristics of High-Efficiency Deflection and High-Voltage Supply Systems for Kinescopes.—O. H. Schade. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 5–37.) The losses in the separate components of reactive deflection systems are examined individually and in relation to each other. By reducing valve and circuit losses, combined h.v. and deflection systems can be produced having high efficiency and low cost.

621.397.62 **1784**

Simplified Intercarrier Sound.—W. J. Stroh. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 106–109.) By using the new Type-6BN6 valve (1292 of May) as the limiter detector of an intercarrier sound system, a considerable reduction can be effected in the number of valves and tuned circuits of a television receiver. Such equipment compares favourably with other f.m. detectors as regards suppression of ignition interference and of the a.m. which usually accompanies f.m.

621.397.62 **1785**

TV Applications of the 6BN6.—R. O. Gray & W. J. Stroh. (*FM-TV*, March 1950, Vol. 10, No. 3, pp. 14–15, 30.) When used as an audio limiter-discriminator this valve replaces 3 conventional types. As a synchronization separator it also economizes in components, space, and wiring time. See also 1292 of May (Adler).

621.397.62 **1786**

A New Method of Synchronisation for Long-Range TV Reception.—T. B. Tomlinson. (*Electronic Engng*, April 1950, Vol. 22, No. 266, pp. 149–151.) The most objectionable feature of long-distance television reception is irregular triggering of the line timebase by noise in the synchronizing pulses. To overcome this a selective amplifier is used which extracts the fundamental component from the synchronizing pulse, which is then squared, differentiated and applied to the timebase. This system has been used outside the normal service area and consistently provides pictures with good entertainment value.

621.397.62 **1787**

Permanent-Magnet Lenses for Television Tubes.—D. Hadfield. (*Electronic Engng*, April 1950, Vol. 22, No. 266, pp. 132–138.) Permanent-magnet focusing systems are becoming increasingly popular for economic reasons. Methods of investigating the field and electron-optical characteristics are described. Magnet design, choice of materials and methods of varying the field and of magnetizing are considered.

621.397.62 **1788**

Technique and Developments of High-Definition Television Receivers.—In the journal reference of 1018 of April please read Vol. 30 for Vol. 29.

621.397.62 **1789**

A.V.C. System for Positive-Modulation Television.—E. G. Beard. (*Philips tech. Commun., Aust.*, 1949, No. 6, pp. 9–14.)

621.397.62 **1790**

Murphy V150 Television Set.—(*Wireless World*, April 1950, Vol. 56, No. 4, pp. 133–136.) Test report of a table model with unusual features and using a 12-in. c.r. tube.

621.385.2 : 621.315.59 **1791**

Use of Germanium Diodes at High Frequencies.—J. H. Sweeney. (*Elect. Engng, N.Y.*, March 1950, Vol. 69, No. 3, pp. 217–220.) A.I.E.E. Winter Meeting paper, 1950. Ge diodes may be substituted for vacuum tubes in detector, d.c.-restorer and mixer circuits if due allowance is made for the different characteristics of the two types of diode. Compared with the vacuum diode, the Ge unit has a greater forward conductance, though it has a finite back resistance. It has less shunt capacitance and has zero current flow at zero voltage. Its resistance in either direction varies with temperature.

621.397.62 : 621.396.662 **1792**

An Experimental Ultra-High-Frequency Television Tuner.—T. Murakami. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 68–79.) Circuits and detailed description of an experimental 500–700-Mc/s tuner to enable field tests to be made by standard television receivers on television transmission from the N.B.C. u.h.f. station, Bridgeport (see 1795 below). Each tuning element consists of two strips of copper foil on a cylindrical former, tuned by means of a copper or brass core. A double-heterodyne system converts the u.h.f. signals to the 21–27-Mc/s intermediate frequency of the standard television receiver. Performance figures are given.

621.397.62 : 621.396.662 **1793**

Continuous Tuning for TV Sets.—French. (*See* 1762.)

621.397.7 + 621.396.712 **1794**

WTCN A.M. F.M. TV.—Sherman. (*See* 1773.)

621.397.7 **1795**

Experimental Ultra-High-Frequency Television Station in the Bridgeport, Connecticut Area.—R. F. Guy, J. L. Seibert & F. W. Smith. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 55–67.) The first of a series of reports on the N.B.C. transmitter KC2XAK. Visual and aural signals from station WNBT, distant 54 miles, are received by a parabolic aerial and retransmitted on carrier frequencies of 530.25 and 534.75 Mc/s respectively, using a pylon slot aerial 330 ft above average ground level. Each transmitter will give power outputs of 0.5 kW aural and 1.0 kW peak visual. With an aerial gain of 17, the effective radiated power of the system is approximately 13.9 kW peak visual, the overall efficiency being approximately 80%.

621.397.7 **1796**

WHIO-TV, Dayton.—(*Broadcast News*, Jan./Feb. 1950, No. 57, pp. 48–57.) A fully illustrated description of the lay-out and equipment of the studios of the Miami Valley Broadcasting Corporation.

621.397.7 : 621.397.81 **1797**

U.H.F. Television Field Test.—R. F. Guy. (*Electronics*, April 1950, Vol. 23, No. 4, pp. 70–76.) A description of experimental equipment for obtaining data on range, field strength and interference effects in u.h.f. television reception. A 500-W commercial v.h.f. unit operating at 176.75 Mc/s is followed by a tripler and amplifier. A vestigial sideband filter is provided, picture and sound signals being combined in a notch filter and fed to the aerial through a single coaxial line. A unidirectional slot aerial gives a vertical beam-width of about 2° for the main lobe at half-power points, and a power gain > 17. Conventional valve technique is satisfactorily employed in the receiving equipment, which includes a special tuner and converter covering the range 500–700 Mc/s. See also 1792 and 1795 above.

621.397.828 **1798**

A Study of Co-Channel and Adjacent-Channel Interference of Television Signals.—R.C.A. Laboratories Division. (*RCA Rev.*, March 1950, Vol. 11, No. 1, pp. 99–120.) Television carrier synchronization has been found extremely advantageous in reducing co-channel interference. Offset-carrier operation gives even better results and is more economical to apply. Moreover, it is equally applicable to standard monochrome transmissions and to the dot-sequential and the field-sequential colour systems. For either monochrome or colour transmissions it is recommended that the carrier offset shall be 10.5 kc/s, in a 3-station combination one being above and another below the assigned frequency.

621.397.6 **1799**

Television for Radiomen. [Book Review]—E. M. Noll. Publishers: Macmillan & Co., London, 595 pp., 52s. 6d. (*Wireless Engr*, April 1950, Vol. 27, No. 319, p. 134.) "It covers all aspects of television receivers in an elementary manner and includes transmitting material only in just enough detail to give the reader a picture of the complete system . . . The book should prove extremely valuable to those for whom it is intended, that is, those who have to maintain and repair American television receivers. There is a good deal of material in it useful to those who handle British receivers."

VALVES AND THERMIONICS

621.383.032.217 **1800**

Optical and Photoelectric Properties of Antimony-Caesium Cathodes.—H. D. Morgulis, P. G. Borzyak & B. I. Dyatlovitskaya. (*C. R. Acad. Sci. U.R.S.S.*, 21st June 1947, Vol. 56, No. 9, pp. 925–928.)

621.385 **1801**

Ribbon-Beam Valves.—J. L. H. Jonker. (*Tijdschr. ned. Radiogenoot.*, March 1950, Vol. 15, No. 2, pp. 37–52. In Dutch, with English summary.) Results are presented of laboratory work on the development of special-purpose beam-deflection valves using ribbon beams, particularly for rapid switching, as in telephony. The replacement of the more common pencil beam by the ribbon beam permits designs having dimensions and anode voltages comparable with those of ordinary receiving valves.

621.385 **1802**

Miniature Valves in the French Radio Industry.—L. Thibieroz & H. Saucet. (*Tech. mod., Paris*, 1st/15th March 1950, Vol. 42, Nos. 5/6, pp. 65–73.) Illustrated account of the development, manufacture and testing of 7-pin miniature valves in the works of the Société Française Radio-Électrique.

621.385 : 621.396.621 **1803**

New One-Tube Limiter-Discriminator for F.M.—A. P. Hasse. (*Tele-Tech*, Jan. & Feb. 1950, Vol. 9, Nos. 1 & 2, pp. 21–23, 49 & 32–33. . 61.) Construction, characteristics and applications of the Type-6BN6 gated-beam valve. For another account see 1292 of May (Adler).

621.385 (083.72) **1804**

Standards on Electron Tubes: Definitions of Terms, 1950.—(*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 426–438.) A comprehensive list prepared by a committee of the Institute of Radio Engineers. Definitions of valve parameters have been generalized to apply to all valve types at any frequency, and definitions pertaining to beam valves are included.

621.385.012 : 621.3.032.213.2 **1805**

The Influence of the Heating on Valve Cathode Current.—G. Kessler. (*Arch. Elektrotech.*, 1950, Vol. 39, No. 9, pp. 601–619.) The relation between filament power and emitter temperature is established, and the effect of temperature change on cathode current is determined and expressed as an equivalent grid-voltage variation. The derived relations are confirmed by measurements, evaluated numerically, and applied to discussion of the design of amplifiers of improved performance at very low frequencies, e.g. <10 c/s.

621.385.015.3 **1806**

Some Calculations of Transients in an Electronic Valve.—D. R. Hartree. (*Appl. sci. Res.*, 1950, Vol. B1, No. 5, pp. 379–390.) "The integro-differential equation for the non-steady behaviour of a beam of electrons injected into the space between two plane parallel electrodes at given potentials is obtained. When the anode and grid are kept at the same potential V_0, the leading electrons reach the anode with energies greater than eV_0. If the front of the beam is sharp and the injected beam current is constant, then for the period until some electrons reach the anode and while the spatial order of electrons in the inter-electrode space remains the same as the time-order in which they passed through the grid, the integro-differential equation has an exact solution in terms of Airy functions. An example is given of results calculated from this solution, where applicable, and continued by numerical integration of the integro-differential equation."

621.385.029.6+621.396.615.14 **1807**

On the Physics and Technics of Modern Transmitting Valves for Ultra High Frequencies.—K. W. Reusse. (*Elektrotechnik, Berlin*, Feb. & March 1950, Vol. 4, Nos. 2 & 3, pp. 33–42 & 81–90.)

621.385.029.63/.64 + 621.396.615.14 **1808**

The Amplification of Centimetre Waves: Travelling-Wave Valves.—In the journal reference of 1294 of May please read Vol. 30 for Vol. 29.

621.385.029.63/.64 **1809**

Study of the Different Waves that can be propagated along a Line in Interaction with an Electron Beam. Application to the Theory of the Travelling-Wave Amplifier.—P. Lapostolle. (*Ann. Télécommun.*, Feb. & March 1948, Vol. 3, Nos. 2 & 3, pp. 57–71 & 85–104.) Detailed discussion of the possible waves in such systems and, in particular, of the wave whose amplitude increases along the line for certain values of the beam velocity. The study of particular models is generalized to apply to any type of delay line. The theory is applicable to beams of any diameter, intensity and velocity, and line losses are taken into account. Curves are provided which facilitate the solution of many problems associated with the specially important case of very intense beams.

621.385.029.63/.64 **1810**

Traveling-Wave Tubes.—J. R. Pierce. (*Bell Syst. tech. J.*, Jan. 1950, Vol. 29, No. 1, pp. 1–59.) Part 1 of a four-part presentation of the contents of a forthcoming book. Chapter 1 is a brief introduction which stresses the great practical advantage of very large bandwidth offered by the travelling-wave amplifier. Chapter 2 presents a simple theory of the gain for small signals on the assumption that all the electrons are acted on by the same a.c. field and are displaced by the field in the axial direction only: the gain is derived from the propagation constant of the forward wave with increasing amplitude. Chapter 3 discusses the helix, a high-impedance circuit capable of propagating slow waves with a phase velocity which is substantially constant over a wide frequency range. An approximation to the properties of a helix is obtained by considering a helically conducting cylindrical sheet of the same radius and pitch. Curves are given which enable the propagation constant, wave velocity, gain parameter and impedance parameter to be determined. The properties of a wire helix are discussed by 'developing' the helix into a flat sheet and considering the special cases of two turns or four turns per wavelength. Optimum design of the helix is treated in terms of the ratios of the beam radius to helix radius and of the wire diameter to pitch. The chapter concludes with a consideration of the transmission-line equivalent to a helix and of losses. Appendix 1 summarizes the field equations and the properties of the Bessel functions I and K and gives curves showing various series approximations to I_0, I_1, K_0 and K_1. Appendix 2 discusses propagation on a helically conducting cylinder.

621.385.029.64/.65 **1811**

Helix Parameters Used in Traveling-Wave-Tube Theory.—R. C. Fletcher. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 413–417.) Helix parameters used in the normal-mode solution for the travelling-wave valve are determined by considering the field equations for a thin electron beam, the two methods of treatment being found equivalent. Corresponding parameters for a thick electron beam are found by considering an equivalent thin beam with approximately the same r.f. admittance.

621.385.032.213.2 : 621.317.336.1 **1812**

Change of Mutual Conductance with Frequency.—A. Eisenstein. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 100–101.) Comment on 1301 of May (Raudorf). Experiments in which square voltage pulses were applied to the grid of a pentode are discussed. The results obtained support the view that an increase of cathode-interface thickness with valve life offers an explanation both of the observed frequency dependence of the mutual conductance g_m and of the reduction in capacitance with increasing resistance reported by Raudorf. See also 490 of February.

621.385.032.216 **1813**

Vacuum Factor of the Oxide-Cathode Valve.—G. H. Metson. (*Brit. J. appl. Phys.*, March 1950, Vol. 1, No. 3, pp. 73–77.) Measurements on a variety of new valves showed wide variations of vacuum factor k, but these values fell after a period of operation to an approximately constant value k_0 in the range 300–900 $\mu\mu$A/mA. The variations of k_0 were examined with respect to anode voltage, anode current, and to cathode and envelope temperatures. A theory is proposed to explain the anomalous form of variation with anode voltage, which has a bearing on the interpretation of ionization-gauge measurements for pressures $< 10^{-6}$ mm Hg.

621.385.15 **1814**

Receiving Tubes employing Secondary-Electron Emitting Surfaces exposed to the Evaporation from Oxide Cathodes.—C. W. Mueller. (*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 159–164.) The poisoning of the secondary emitting surface due to cathode evaporation is reduced by careful control of cathode materials and temperature, so that the surface can be exposed directly to the cathode evaporation. This evaporation, if not excessive, may even enhance the secondary emission. The construction and characteristics are described of a valve with a transconductance of 24 mA/V, a wide-band figure-of-merit two to three times that of conventional valves such as Types 6AG5 and 6AK5, and a life of at least 2 000 hours.

621.385.15.001.8 **1815**

Recent Applications of Electron Multiplier Tubes.—J. S. Allen. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 346–358.) Applications to the measurement of very small currents or the counting of single ions or electrons are considered. The characteristics of secondary-electron emitting surfaces suitable for use in multiplier tubes are discussed and recently developed tubes with one or more stages of electron multiplication are described. The statistical treatment of the size distribution of pulses from multiplier tubes is also discussed.

621.385.2 **1816**

The Current Build-Up in a Planar Diode.—E. H. Gamble. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 108–112.) An analytical study of the development of the space-charge cloud of electrons and its motion across the interelectrode space, and of the growth of current in the external circuit. Under space-charge-limited conditions the initial build-up is a function of higher powers of time than under temperature-limited conditions. The build-up may be considerably delayed or hastened by application of sine-wave signals of suitable amplitude.

621.385.2/.3 : 621.315.59 **1817**

Observations of the Rapid Withdrawal of Stored Holes from Germanium Transistors and Varistors.—L. A. Meacham & S. E. Michaels. (*Phys. Rev.*, 15th April 1950, Vol. 78, No. 2, pp. 175–176.) Investigations of transistor response to square pulses of applied voltage have shown bursts of collector current provoked by preceding emitter current in units employing N-type germanium. These are thought to be due to the rapid withdrawal of stored holes produced by the forward emitter current and existing in the germanium at the time of application of the collector potential.

621.385.2 : 621.315.59 **1818**

On the Surface Conductance of Germanium.—P. Aigrain. (*C. R. Acad. Sci., Paris*, 20th Feb. 1950, Vol. 230, No. 8, pp. 732–733.) The surface conductance of a diode of 20-kΩ back resistance was demonstrated by measuring voltage variations at two beryllium-bronze contact points equidistant from the input point but on opposite faces of the Ge disk; except at very low input currents the variation on the input face was much the greater. Since this variation depends only on input current, the transistor effect must be due to a modulation of the surface conductance. See also 1305 of May.

621.385.2 : 621.315.59] : 621.397.62 **1819**

Use of Germanium Diodes at High Frequencies.—Sweeney. (*See* 1791.)

621.385.3 : 621.396.615.14 **1820**

Electron Transit Time.—S. K. Chatterjee & B. V. Sreekantan. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 59–63.) Transit-time effects on the efficiency and limiting oscillation frequency were studied for Type 833A, 834, 304B, 316A, and 955 valves, using Gavin's expression for transit time (4358 of 1939), modified to take account of the negative grid bias and the alternating voltages on the anode and grid. The limiting frequency is reached for the first three of the above valves when the oscillation period is nearly four times the electron transit time from cathode to anode, and for the other two valves when the period is nearly three times the transit time.

621.385.4/.5 **1821**

Aligned-Grid Valves.—D. C. Rogers. (*Wireless Engr*, Feb. 1950, Vol. 27, No. 317, pp. 39–46.) An experimental investigation was made of the distribution of current density in the plane of the screen grid. In order to check the validity of existing assumptions about aligned-grid valves, and to determine the optimum distance between the control and screen grids, a demountable planar valve was used in which the screen grid was replaced by a plate with a 0.1-mm slot parallel to the grid wires. The current flowing to a collector electrode behind the slot was measured. Electrode distances were adjustable by means of micrometer screws and the slotted plate had similar adjustment in its plane at right angles to the slot. The control-grid pitch and total anode current were kept constant and the collector current was measured across the beam from the centre grid aperture at intervals of 0.1 mm, the grid being at cathode potential. The process was repeated for various electrode distances. The results indicate that for minimum screen current the screen should be as close as possible to the control grid and not, as is often assumed, in the plane of focus of the electron beam.

621.385.83 : 621.396.619.23 **1822**

The Electron Coupler: a Spiral-Beam U.H.F. Modulator.—C. L. Cuccia & J. S. Donal, Jr. (*Electronics*, March 1950, Vol. 23, No. 3, pp. 80–85.) A description based on that given in a 1949 I.R.E. National Convention paper. See 2975 of 1949.

621.385.832 **1823**

A Method of Reducing Deflection Defocusing in Cathode-Ray Tubes.—R. G. E. Hutter & S. W. Harrison. (*J. appl. Phys.*, Feb. 1950, Vol. 21, No. 2, pp. 84–89.) The causes of spot distortion are explained and an electron gun is described in which beam predistortion is used for spot correction. The method can be used for both e.s. and e.m. focusing and deflecting systems.

621.396.615.14 **1824**

Observations on Some Electronic Fundamentals of Microwave Valves.—W. Sigrist. (*Bull. schweiz. elektrotech. Ver.*, 21st Jan. 1950, Vol. 41, No. 2, pp. 35–42. In German.) A graphical method of integration is described by which the electron paths may be exactly traced after the fields at the electrodes have been determined by the use of an electrolyte tank.

621.396.615.14 **1825**

The Linear Theory of Transit-Time Valves.—F. W. Gundlach. (*Fernmeldetech. Z.*, Oct. 1949, Vol. 2, No. 10, pp. 319–328.) The operation of almost all transit-time valves can be referred to the fundamental problem of electron motion in a plane capacitor. Under the assumption of small alternating voltages and currents, analytical relations are derived for the electron motion and for the currents thereby produced in the capacitor. The results are applied to the diode oscillator, the retarding-field valve, the klystron and its reflex type, and to the Heil generator.

621.396.615.141.2 **1826**

The Flow of Standing Current in a Cylindrical Whole-Anode Magnetron.—V. M. Glagolev. (*Zh. tekh. Fiz.*, Aug. 1949, Vol. 19, No. 8, pp. 943–951. In Russian.)

621.396.615.141.2 **1827**

Phase Focusing in a Magnetron with Plane Electrodes.—B. M. Zamorozkov. (*Zh. tekh. Fiz.*, Nov. 1949, Vol. 19, No. 11, pp. 1321–1328. In Russian.) The idea of phase focusing was used by Golubkov in 1939 (*Bull. Acad. Sci. U.R.S.S.*, 1940, Vol. 4, p. 524) for providing a general theory which would be applicable to various types of u.h.f. oscillators. This theory is applied to a study of the magnetron. It is fully adequate for interpreting the operation of the magnetron and equation (11) is derived determining the critical conditions. The relation between the generated wavelength and the intensity of the magnetic field is determined from the general equation (13) of Okabe (*Radio Res. Rep. Japan*, 1935, Vol. 5, p. 69). The possibility is also suggested of the appearance of second-order foci and of oscillations due to interaction between these foci and the electrodes. The theoretical results have been confirmed experimentally.

621.396.615.141.2 **1828**

The Planar Magnetron under Static Conditions of Space Charge.—J. L. Delcroix & G. A. Boutry. (*C. R. Acad. Sci., Paris*, 13th March 1950, Vol. 230, No. 11, pp. 1046–1048.) The equations are stated for space-charge conditions when the anode potential is higher than the cut-off potential. When cut-off occurs, the space-charge conditions can be deduced from those for the preceding case. The electron paths in the two cases are arcs of one and the same geometric curve.

621.396.615.141.2 : 621.396.645 **1829**

A New Type of Magnetron Amplifier.—P. Marié. (*Onde élect.*, Jan., Feb. & April 1950, Vol. 30, Nos. 274, 275 & 277, pp. 13–22, 79–90 & 200–202.) The variation of a negative resistance as a function of voltage is studied, the internal mechanism of the magnetron is discussed, the threshold resistance calculated and the relative amplitudes of the reflected and incident waves are determined. The threshold resistance decreases with frequency and in a wide band centred on the mean frequency can be considered as the reciprocal of the characteristic impedance of a waveguide with a given cut-off frequency. Separation of the reflected and incident waves requires the generation of polyphase waves. Their theory and the construction of 3-phase directional couplers are discussed. The constructional details of the magnetron itself are described. It is of the split-anode type, with 12 anode segments strapped in interleaved groups of 4. Using this system of overlapping anodes, the directional coupling may be incorporated in the valve itself. Experimental results will be given later.

621.396.615.142.2 **1830**

On the Theory of the Klystron.—V. N. Shevchik. (*Zh. tekh. Fiz.*, Nov. 1949, Vol. 19, No. 11, pp. 1271–1275. In Russian.)

621.396.822 **1831**

Spontaneous Fluctuations in Double-Cathode Valves.—R. Fürth. (*Wireless Engr*, April 1950, Vol. 27, No. 319, p. 129.) Corrections to paper abstracted in 1035 of April.

621.396.822 **1832**

Are Transit-Angle Functions Fourier Transforms?—W. E. Benham. (*Wireless Engr*, April 1950, Vol. 27, No. 319, pp. 131–132.) Further discussion. See 2981 of 1949.

621.396.822 **1833**

Induced Grid Noise.—R. L. Bell. (*Wireless Engr*, March 1950, Vol. 27, No. 318, pp. 86–94.) Under favourable conditions there is an exact relationship between mean-square noise currents induced at the grid of a triode valve and the space-charge component of input capacitance measurable at that point. In practice this provides an approximate relation useful for estimating the total mean-square induced noise from other measurements. Techniques of grid-noise measurement are discussed and attention is drawn to the occurrence of various inherent errors. Results are presented of measurements of induced grid noise in microwave triodes at 200 Mc/s. Available three-halves power-law treatments are inadequate to explain the induction of shot noise at a control grid, but values of space-charge admittance measured on the valve together with other low-frequency measurements may be made to yield much closer estimates of induced grid noise in any structure, for moderate transit angles.

621.396.822 **1834**

Fluctuation Process as Oscillations with Random Amplitude and Phase.—V. I. Bunimovich. (*Zh. tekh. Fiz.*, Nov. 1949, Vol. 19, No. 11, pp. 1231–1259. In Russian.) It is known that fluctuations at the output of an oscillatory system have the form of sinusoidal oscillations with amplitude and phase varying more or less slowly. In many cases it is convenient to represent fluctuations in the form $E\cos\phi$ where E and ϕ have definite and statistically independent random values. An investigation is presented of the statistical properties of the amplitude and phase of a fluctuation process. The investigation is divided into the following sections: (*a*) envelope; (*b*) fundamental relations; envelope and phase of a random process; (*c*) laws governing the probability distribution; (*d*) probability distribution for the phase of fluctuations.

621.385 **1835**

Rundfunkröhren, Eigenschaften und Anwendung (Properties and Applications of Broadcasting Valves). [Book Review]—L. Ratheiser, revised and enlarged by H. Hönger & G. Hinke. Publisher: Regeliens Verlag, Berlin-Grunewald, 1949, 440 pp., 27DM. (*Arch. elekt. Übertragung*, Jan. 1950, Vol. 4, No. 1, p. 32.) "Helpful for all concerned with broadcast reception."

MISCELLANEOUS

621.396.6(083.75) **1836**

Standards on Designations for Electrical, Electronic and Mechanical Parts and their Symbols, 1949.—(*Proc. Inst. Radio Engrs*, Feb. 1950, Vol. 38, No. 2, pp. 118–124.)

621.396.6.001.2 : [621.396.9 : 629.13.052 **1837**

Mechanical Development of a Radio Altimeter.—R. T. Croft. (*J. Brit. Instn Radio Engrs*, Feb. 1950, Vol. 10, No. 2, pp. 62–71.) Discussion of the problems involved in converting a laboratory model into an engineered instrument suitable for production in quantity. The general principles are illustrated by considering the detailed construction of a radio altimeter designed by the research staff of the Telecommunications Research Establishment.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **1838**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 297–305.) Continuation of 1047 of May.

534.23 **1839**

Transient Radiation from Sound Sources, and Related Problems.—J. Brillouin. (*Ann. Télécommun.*, April & May 1950, Vol. 5, Nos. 4 & 5, pp. 160–172 & 179–194.) A mathematical introduction outlines the methods of the symbolic calculus used, indicates ways of representing discontinuities and shows how two polynomials, derived from Bessel functions and used in the calculations, can be evaluated. Formulae are derived for the flux and the densities of the radiated and nonradiative energy for the steady state, and examples are calculated for a pulsating and an oscillating sphere. Corresponding general formulae are derived for the waves outside the source under transient conditions. The existence of discontinuities in the wave front and in the end of the wave train is noted. Discussion of sinusoidal radiation shows the importance of the transient waves, for which the ratio of the initial amplitude (of pressure or radial velocity) to that of the steady-state wave increases very rapidly when the radius of the source tends towards zero. Calculations are again made for the pulsating and the oscillating sphere. General formulae are obtained for a rigid sphere subjected to an external force and the two cases of (*a*) unit impulse and (*b*) a sinusoidal force are considered. Various diffraction effects are discussed, with particular reference to the acoustic properties of surfaces with semicylindrical or hemispherical bosses, which act as virtual sources when sound waves reach them. Conclusions stress the importance of the transient waves, which in certain cases are the only ones to be observed.

534.24 **1840**

Phase Distortion of Acoustic Pulses Obliquely Reflected from a Medium of Higher Sound Velocity.—A. B. Arons & D. R. Yennie. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 231–237.) Since phase shift at reflection depends only on the acoustic parameters of the reflecting interface and the angle of incidence, and is independent of the frequency of the incident wave train, it is to be expected that pulses of arbitrary shape will be subjected to distortion upon reflection. The expected shape of the pressure wave reflected from a semisolid sea bottom at angles exceeding the critical angle of total reflection is derived for the exponentially decaying shock waves produced in underwater explosions, and agrees well with observed pressure/time curves of the first and successively higher-order reflections.

534.24 **1841**

On the Non-Specular Reflection of Sound.—V. Twersky. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 332–333.) Summary of American Physical Society 1950 Annual Meeting paper N2. The reflection of plane waves by rigid, nonabsorbent surfaces with bosses is analysed.

534.632 : 681.81 **1842**

A Stroboscopic Tuner for Musical Instruments.—A. Douglas. (*Electronic Engng*, May 1950, Vol. 22, No. 267, pp. 178–180.) The apparatus consists of a series of twelve rotating disks, each printed with seven concentric rings of alternate black and white segments, the number of segments increasing successively by a factor of 2 from centre to edge; all twelve are suitably geared together and driven by a common motor. They cover a frequency range of 31–4 000 c/s by semitone intervals. The motor is driven from a tuning fork whose frequency is adjustable over a limited range. The disks are illuminated by neon tubes which are energized, through a microphone and amplifier, by the note emitted by the instrument being tuned, which is thus readily compared with the standard fork frequency.

534.78 **1843**

The Intelligibility of Interrupted Speech.—G. A. Miller & J. C. R. Licklider. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 167–173.) It is easy to understand noise-free speech provided the interruptions (blanks) occur more than 10 times per second. With interrupting noise, if the ratio of average speech power to average noise power is constant, intelligibility is independent of interrupting frequency if >200/sec. Interrupted masking noise has least effect if interruption frequency is about 15/sec. When interrupted speech and interrupted noise alternate at frequencies below 10/sec, the noise does not impair intelligibility.

534.78 : 621.395 **1844**

The Perception of Speech and its Relation to Telephony.—H. Fletcher & R. H. Galt. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 89–151.) A very comprehensive survey of articulation tests carried out mainly at the Bell Telephone Laboratories and partly at Harvard University. Four sets of data are considered and analysed, covering the years 1919–1925, 1928–1929, 1935–1937 and 1944–1945 (effect of intense noise on intelligibility). "Functions are developed which permit the calculation of articulation index and hence of articulation for communication systems which include a wide range of response/frequency characteristics and of noise conditions, as well as several special types of distortion."

534.833.1 **1845**

Transmission of Reverberant Sound through Double Walls.—A. London. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 270–279; *Bur. Stand. J. Res.*, Jan. 1950, Vol. 44, No. 1, pp. 77–88.) The transmission of reverberant sound through a double wall consisting of two identical single walls coupled by an air-space is investigated both theoretically and experimentally. A theory is developed which gives good agreement with experiment.

534.845.1 : 534.846.5 **1846**

The Determination of Reverberant Sound Absorption Coefficients from Acoustic Impedance Measurements.—A. London. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 263–269.) A method of predicting the reverberation time of a room from measurements of the absorption coefficient of small samples of the material lining it, when these are used to terminate an acoustic impedance tube. The coefficient for normal incidence measured thereby can be related accurately to the random-incidence case of the room by an empirical statistical treatment.

534.86 : 621.396.712 **1847**

Developments in Studio Design.—L. L. Beranek. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 470–474.) 1949 I.R.E. National Convention paper. Discussion with particular reference to acoustic properties and studio construction methods used in Broadcasting House, Copenhagen, and Broadcasting House, Oslo.

621.395 : 534.78 **1848**

A Reference Telephone System for Articulation Tests.—J. Swaffield & R. H. de Wardt. (*P.O. elect. Engrs' J.*, April 1950, Vol. 43, Part 1, pp. 1–7.) Describes equipment supplied by the British Post Office and installed in the C.C.I.F. laboratory, Geneva, for developing and maintaining the proposed new international standards of telephone transmission based on articulation measurements. The equipment consists of a microphone-amplifier-receiver chain having the same transmission characteristics as a 1-m free-air path. Provision is made for the insertion of the telephone circuit under test and for the comparison of the attenuation and noise produced with that of a standard attenuator and noise generator. Apparatus is provided for measuring the speech voltage and the sensitivity or gain of all the elements in the chain, including the microphones and receivers.

621.395.61 **1849**

Miniature Condenser Microphone.—J. K. Hilliard. (*J. Soc. Mot. Pict. Televis. Engrs*, March 1950, Vol. 54, No. 3, pp. 303–314.) Description of microphone Type 21B, which has a high output level and a uniform frequency response. Its advantages over larger and heavier microphones are enumerated and placing and pickup techniques suitable for motion-picture sound recording are discussed. See also 1319 of June (No 131.)

621.395.61 **1850**

The "Bantam" Mike — KB-2C.—L. J. Anderson & L. M. Wigington. (*Broadcast News*, March/April 1950, No. 58, pp. 14–17.) An abstract of another account is given in 805 of April.

621.395.623.7 **1851**

The Acoustical Impedance of Closed Rectangular Loudspeaker Housings.—W. F. Meeker, F. H. Slaymaker & L. L. Merrill. (*J. acoust. Soc. Amer.*, March 1950, Vol. 22, No. 2, pp. 206–210.) Morse's method for calculating pressure distribution in rooms is applied to find the impedance presented to the back of a small loudspeaker by its rigid housing. In a typical case the impedance passes from negative to positive at about 70 c/s, when the maximum linear dimension of the enclosure is $< \lambda/7$. Experiments show that the results depend also on the loudspeaker diaphragm dimensions.

621.395.623.7 : 534.372 **1852**

Transients and Loudspeaker Damping.—J. Moir. (*Wireless World*, May 1950, Vol. 56, No. 5, pp. 166–170.) Some conflicting theories on optimum amplifier output impedance are investigated experimentally. Little or no improvement of loudspeaker transient reponse is obtained by reducing the amplifier output impedance below 10–20% of the voice-coil impedance. At high frequencies this improvement may be offset because a low output impedance gives a low acoustic output, since the impedance of the voice coil increases with frequency.

621.395.625.2 : 621.395.667 **1853**

Tone Control with RC Networks in Sound-Recording Technique.—A. Lennartz. (*Funk u. Ton*, April 1950, Vol. 4, No. 4, pp. 169–181.) Taking 1 000 c/s as the reference frequency, and the level at this frequency as reference level, four basic types of correction are defined, viz. bass boost, bass cut, top boost, and top cut; these may be combined as required. Examples of circuits are shown and approximate formulae are derived for component values.

621.395.625.3 **1854**

Magnetic Recording and its Application in the South African Broadcasting Corporation.—E. J. Middleton. (*Trans. S. Afr. Inst. elect. Engrs*, Feb. 1950, Vol. 41, Part 2, pp. 41–52.) Basic principles are outlined; an account is given of problems encountered in practice, and the main advantages and disadvantages of the system for a broadcasting service are indicated. At present 90% of the S.A.B.C. studio recording is done on disks, but the use of magnetic tape is steadily increasing; for outside work tape is rapidly superseding disk recording.

621.395.625.6 **1855**

Increased Noise Reduction by Delay Networks.—J. R. Whitney & J. W. Thatcher. (*J. Soc. Mot. Pict. Televis. Engrs*, March 1950, Vol. 54, No. 3, pp. 295–302.) Increased signal/noise ratio in optical sound-film recording is achieved by the use of networks which delay the application of sound currents to the modulator until after the noise-reduction bias current has been partially cancelled. Noise reductions as high as 30 db have been tried successfully and reductions of 15 db have frequently been used in practice.

681.85 **1856**

Applications of Dynamic Analogies to Cutters and Reproducers for Disks.—G. Bouchier. (*Radio franç.*, April 1950, No. 4, pp. 9–16.) Problems relating to disk recorders and reproducers are treated by analogy with the corresponding problems in electrical circuitry, L taking the place of moment of inertia, C of compliance, and R of mechanical resistance: the angular velocity of the stylus is then represented by current. The response at different frequencies is calculated for a magnetic lateral cutter and pickup with different degrees of mechanical damping; results are shown in tables and graphs.

534.6 **1857**

Acoustic Measurements. [Book Review]—L. L. Beranek. Publishers: J. Wiley, New York, 1949, 896 pp., $7.00. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 578; *Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, p. 387.) The author "has made a valuable addition to our technical literature and his reference volume should have a long life in the libraries of all engineers whose work touches on sound measurements."

AERIALS AND TRANSMISSION LINES

621.3.09 **1858**

Propagation of Electromagnetic Disturbances along a Thin Wire in a Horizontally Stratified Medium.—B. L. Coleman. (*Phil. Mag.*, March 1950, Vol. 41, No. 314, pp. 276–288.) " For a thin wire buried at finite depth in a semi-infinite homogeneous medium and subject to a disturbance at a given frequency, there exists an exponential attenuation of the current in the wire with a propagation constant equal to that of the medium. This result is extended to a medium with a number of layers, and to a wire lying in an interface."

621.3.09 : 621.385.029.63/.64 **1859**

Experimental Study of the Propagation along a Delay Line in the Form of a Helix.—M. Jessel & R. Wallauschek. (*Ann. Télécommun.*, Aug./Sept. 1948, Vol. 3, Nos. 8/9, pp. 291–299.) An investigation of the effect of variation of the following factors: (*a*) the material of the conductor (Cu, Fe, steel, and chrome alloys); (*b*) the diameter of the wire (0.33 to 0.7 mm); (*c*) the pitch of the helix; (*d*) the wavelength; (*e*) the diameter of the helix. Other factors affecting attenuation are considered. The method of measurement is described; experimental results are shown graphically.

621.392.26† : 621.3.09 **1860**

Electromagnetic Waves in Rectangular Waveguides.—K. S. Knol. (*Tijdschr. ned. Radiogenoot.*, March 1950, Vol. 15, No. 2, pp. 53–74. In Dutch, with English summary.) A résumé of waveguide theory is given. Brillouin's method for rectangular waveguides is treated in some detail and the solution of Maxwell's equations for the interior of a waveguide is found by considering the superposition on the incident wave of the three reflected waves resulting from the rectangular construction. An attenuator is described which uses a coaxial line of adjustable length within a waveguide excited at a wavelength much greater than the critical value.

621.392.26† : 621.3.09 **1861**

A Model for Studying Electromagnetic Waves in Rectangular Wave Guides.—K. S. Knol & G. Diemer. (*Philips tech. Rev.*, Nov. 1949, Vol. 11, No. 5, pp. 156–163.) A rubber-membrane model is described.

621.392.26† : 621.3.09 **1862**

Mode Conversion Losses in Transmission of Circular Electric Waves through Slightly Non-Cylindrical Guides.—S. P. Morgan, Jr. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 329–338.) A general expression is derived for the effective attenuation owing to mode conversions in a deformed section of waveguide. In the special case of elliptical deformation the theory gives results in agreement with experiment. The effects of random distortions in a long waveguide are analysed and typical examples of the magnitude of the loss are given.

621.396.67 **1863**

Antifading Broadcast Antenna.—H. Brueckmann. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 82–85.) In the case of base-fed towers the progressive wave along the aerial gives rise to high-angle radiation which results in fading due to interference between ground- and sky-waves. The aerial here described is composed of insulated sections and fed at the insulator, some way up, so that the effects of the progressive waves in the two sections cancel one another, giving an enlarged service area. The performance of such an aerial at Radio Frankfurt, operating on 1 195 kc/s, was measured and some results are tabulated.

621.396.67 : 621.317.79 **1864**

Ripple Tank for Phase-Front Visualization.—(*See* 1979.)

621.396.67 : 621.397.5 **1865**

High-Gain and Directional Antennas for Television Broadcasting.—L. J. Wolf. (*Broadcast News*, March/April 1950, No. 58, pp. 46–53.) Illustrated description of the R.C.A. Supergain aerial, with diagrams showing typical radiation patterns and installations with different combinations of the radiating elements.

621.396.67.012 **1866**

Radiation Characteristics of a Turnstile Antenna in a Cylindrical Shield.—D. S. Saxon, A. Baños, Jr, & L. L. Bailin. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 327.) Summary of American Physical Society 1950 Annual Meeting paper HA5. The aerial investigated consists of crossed wires excited in quadrature. The axis of the shield is perpendicular to the plane of the aerial; it is open at one end, and its diameter is a fraction of the driving wavelength. Excitation of an infinitely long circular waveguide is considered, and conditions under which only the dominant (TE_{11}) mode is important are determined; the radiation problem is then treated as one in which a semi-infinite circular guide, excited by a TE_{11} mode, radiates into free space. Using a solution obtained by Levine & Schwinger (not yet published) values of reflection coefficient and gain function have been computed. Results are compared with those found experimentally and by the Kirchhoff method.

621.396.67.012 **1867**

On the Radiation Patterns of Dielectric Rods of Circular Cross-Section.—C. W. Horton, F. C. Karal & C. M. McKinney. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 327–328.) Summary of American Physical Society 1950 Annual Meeting paper HA6. Theoretical patterns are calculated for different diameters, lengths and modes of excitation, the fields in the radiators being assumed the same as in an infinitely long dielectric guide. Correction is made for finite rod length by substituting an equivalent rod of smaller diameter with dielectric constant such that the wavelength of the guided wave is unchanged. In a particular case studied good agreement was found between theory and experiment.

621.396.677 **1868**

Theory and Application of Transit-Time Compensators in Transmitters and Receivers of Beamed Electromagnetic Waves.—H. Stenzel. (*Fernmeldetech. Z.*, March & April 1950, Vol. 3, Nos. 3 & 4, pp. 94–100 & 125–132.) By analogy with the principle of compensation as applied to a ship's sound-detection apparatus, general formulae are derived for the characteristics of compensated e.m. radiating systems. The use made of transit-time networks in the strip and the cylinder compensator is described. Straight-line grouping and circular grouping of radiators are considered. The grouping characteristic of arbitrary arrangements of radiators is investigated experimentally, using a c.r. tube as indicator. With quarter-circle grouping of the radiators a direct indication of signal bearing can be obtained on a c.r.o. by application of the sum-and-difference method of acoustics.

621.396.677.029.6 **1869**

Directional Antenna Systems at Microwave Frequencies.—C. A. Rosencrans. (*Broadcast News*, March/April 1950, No. 58, pp. 28–35.) Discussion of the practical solution of various problems associated with the design and installation of microwave radio links.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.016.35 : 621.392.5 **1870**

The Nyquist Criterion of Stability.—J. C. West. (*Electronic Engng*, May 1950, Vol. 22, No. 267, pp. 169–172.) A semi-graphical demonstration for the case of feedback systems.

621.314.2 : 621.3.017 **1871**

Current Density and Permissible Heating in Small Transformers.—U. Finkbein. (*Funk u. Ton*, April 1950, Vol. 4, No. 4, pp. 182–192.) The loading of a transformer is limited only by the permissible heating, which depends on the current density. Since the same laws hold for the steady flow of heat as for the steady flow of electricity, the calculations for the former case may be made by constructing equivalent circuit diagrams in which the values of the equivalent resistances are found from consideration of the conduction, convection and radiation processes. For heating due to copper and iron losses the equivalent circuit is a quadripole. For low-power transformers the current density may be allowed to reach 6 A/mm^2, but for powers of about 2 kVA it should not exceed about 1 A/mm^2.

621.314.2.083 : 621.317.612 **1872**

On the Measurement of the No-Load Losses of Small 50-c/s Transformers.—Medina. (*See* 1967.)

621.314.3† **1873**

Analysis of Transients and Feedback in Magnetic Amplifiers.—W. C. Johnson & F. W. Latson. (*Elect. Engng, N.Y.*, April 1950, Vol. 69, No. 4, pp. 353–359.) A.I.E.E. 1950 Winter General Meeting paper. The steady-state characteristics of a saturable reactor can be used to determine the effect of feedback on the properties of the reactor. The equivalent control circuits for saturable reactors are discussed and formulae are derived for computing the performance of certain types of magnetic amplifier.

621.318.4.011.3 **1874**

Inductance of Toroidal Coils.—R. Cazenave. (*Rev. gén. Élect.*, April 1950, Vol. 59, No. 4, pp. 169–174.) The inductance is greater than the approximate value calculated from elementary theory. For maximum inductance the greatest dimension of the winding cross-section should be perpendicular to the axis of the toroid. Suitable formulae are given for coils of various cross-sections commonly used.

621.318.42 + 621.314.2 **1875**

Inductors and Transformers for High Frequencies.—P. M. Prache. (*Câbles & Transmission, Paris*, April 1950, Vol. 4, No. 2, pp. 89–125.) The dynamic effect on the core of the e.m.f. generated by the variation of the magnetic field is not negligible at relatively high frequencies. This magnetodynamic propagation is analysed for metal-strip, wire, and dust cores. Its effect is to concentrate the magnetic flux towards the outer surface of the core; this 'magnetic skin effect' causes a reduction of the apparent permeability and the Q of an inductor. The variation of the reduction coefficient with frequency is calculated for the different types of core considered. The effect on the windings is dealt with similarly, calculations being made of the changes of inductance, distributed capacitance, resistance and loss caused by leakage of current between turns and between winding and core. The various parameters and their variation with frequency are determined in the two cases. Numerous experimental results confirm the theory.

621.392 **1876**

Method of Determining the 'Trees' ['arbres'] of a Network.—J. Lantieri. (*Ann. Télécommun.*, May 1950, Vol. 5, No. 5, pp. 204–208.) The term 'tree' is applied to an open-circuit combination of the branches of a network including all the junctions. Any network has a representative geometrical configuration defined by a matrix. The solution of certain network problems can be simplified by the use of matrix calculus, which is here applied to determine (*a*) the nature and number of the 'trees' in the Carey-Foster bridge, (*b*) the admittance of a passive 2-pole network with no mutual impedance, (*c*) the voltage across the second diagonal of a Wheatstone bridge.

621.392 : 681.142 **1877**

Diode Coincidence and Mixing Circuits in Digital Computers.—Tung Chang Chen. (*See* 1958.)

621.392.5/.6 **1878**

Construction of Quadripoles and Multipoles with given Frequency Characteristics.—V. A. Taft. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Feb. 1950, No. 2, pp. 216–232. In Russian.) Methods are indicated for constructing passive quadripoles and multipoles (for certain particular cases) with given frequency characteristics, and the necessary and sufficient conditions for their construction to be possible are established. The problem of the construction of circuits from passive elements R, L, C and M, which would be equivalent to a given system of ordinary differential equations is also discussed. This question is of practical importance in the design of electrical calculating machines. The methods developed can be used for constructing networks with given properties if the impedance (or admittance) function satisfies the conditions of realization and is expressed in the form of rational fractions. Otherwise the given relations must be first approximated by rational fractions.

621.392.5 **1879**

Complementary Note on the Synthesis of Passive, Resistanceless Four-Poles.—B. D. H. Tellegen. (*Philips Res. Rep.*, Oct. 1949, Vol. 4, No. 5, pp. 366–369.) Continuation of 2745 of 1949. By removing a pole at a finite value of the frequency a passive resistanceless quadripole of order n can be split up into two quadripoles, one of the second order and one of order $(n-2)$.

621.392.5 **1880**

Reciprocal Aspects of Transient and Steady-State Concepts.—W. J. Kessler. (*Elect. Engng, N.Y.*, April 1950, Vol. 69, No. 4, pp. 319–321.) "The transient response of a network can be defined in steady-state terms, and the steady-state behavior can be described in transient terms. The steady-state behavior is usually defined in terms of amplitude and frequency while the transient behavior is defined in terms of amplitude and time. Therefore, the transient and steady-state responses are regarded as nothing more than alternative viewpoints of network behavior when it is expressed in the time domain or the frequency domain respectively."

621.392.52 **1881**

Phase-Shift Band-Pass Filters.—D. H. Pickens & J. N. Van Scoyoc. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 96–99.) The phase shift of a bridged-T network changes by 180° as the frequency passes through its null value. By subtracting the output of such a network from that of a similar one with a different null frequency, frequencies between the null frequencies can be transmitted and those outside this band cancelled. Readily available components can be used, even at low audio frequencies. Circuits for the differential combination of the two outputs are described.

621.392.6.029.63 + 621.317.336/.34 **1882**

Theory and Technique of Multipole Networks at Ultra-High Frequencies.—G. Goudet & H. Jassin. (*Onde élect.*, April & May 1950, Vol. 30, Nos. 277 & 278, pp. 178–194 & 223–226.) The theory is reduced to a general form applicable to u.h.f. and lower frequencies by consideration of normalized impedance and electric and magnetic intensities and by application of matrix calculus. The multipole network may be terminated by any form of waveguide or transmission line. The second part of the paper describes a method of measurement at about 3 kMc/s of the impedance, attenuation and wave-propagation velocity of coaxial cables. A method is also given for measuring the transmission and reflection coefficients of coaxial plug connectors. Typical results are given.

621.396.6 + 621.317.7 + 621.38.001.8 **1883**

Physical Society's Exhibition.—(*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 158–163; *Wireless World*, May 1950, Vol. 56, No. 5, pp. 171–175; *Instrum. Practice*, March 1950, Vol. 4, No. 5, pp. 237–249; *Elect. Times*, 30th March 1950, Vol. 117, No. 3047, pp. 503–510; *Engineer, Lond.*, 31st March, 7th & 14th April 1950, Vol. 189, Nos. 4914–4916, pp. 397–398, 411–415 & 444–448; *Engineering, Lond.*, 7th & 14th April 1950, Vol. 169, Nos. 4393 & 4394, pp. 377–380 & 401–404.) Electronic equipment for research and measurement shown at the exhibition held in London from 31st March to 5th April 1950.

621.396.615 **1884**

Frequency and Amplitude Stability of the Cathode-Coupled Oscillator.—P. G. Sulzer. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 540–542.) The effects of supply-voltage variations are calculated, and the theoretical results are confirmed by experiment. Cathode-coupled oscillators can have excellent frequency stability.

621.396.615.14 + 621.396.645 **1885**

Annular Circuits for High-Power, Multiple-Tube, Radio-Frequency Generators at Very-High Frequencies and Ultra-High Frequencies.—D. H. Preist. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 515–520.) 1949 I.R.E. National Convention paper. A resonator is used which consists of a thick cylinder inserted between an axial and an outer conductor which are electrically connected. The inner and outer conductors are excited in antiphase to the thick cylinder. This construction makes possible multi-valve power amplifiers having the same upper frequency limit and efficiency as a single valve, and also permits the use of a coaxial output line without coupling probes or loops.

621.396.615.17 **1886**

The Multivibrator and its Recent Developments.—J. Moline. (*Radio franç.*, April & May 1950, Nos. 4 & 5, pp. 17–21 & 16–20.) Discussion of variants of the basic circuit, including flip-flop and scale-of-two circuits and a generator of square waves.

621.396.615.17.029.4 **1887**

Rectangular-Wave Generator for Biological Studies.—J. W. Moore. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 122..190.) Description of a circuit comprising multivibrator, univibrator, clipper and power amplifier, which has been used for over 2 years to produce negative pulses at repetition rates of $\frac{1}{3}$ to 400 c/s with pulse durations of 20 μs to 1.5 s.

621.396.645 : 539.16.08 **1888**

Linear Amplifiers.—M. A. Schultz. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 475–485.) The requirements of an amplifier for use with an ionization chamber in nuclear research are that it shall have an adjustable rise-time characteristic (0.1 to 20 μs) to handle a wide range of pulse widths and shall have a linear response to random pulses within the amplitude range 10 μV – 50 mV. The amplifier must also be capable of handling small pulses in the presence of large pulses and vice versa. Noise, bandwidth and overload considerations are discussed and practical circuits described.

621.396.645.35 **1889**

The Construction and Operation of a Highly Sensitive Direct-Voltage Amplifier.—H. Boucke & H. Lennartz. (*Funk u. Ton*, April 1950, Vol. 4, No. 4, pp. 161–168.) Discussion of the modifications to Kerkhof's design (1387 of 1943) necessary to overcome such difficulties as insufficient amplification, changing of bridge balance during long warming-up period, residual voltage at the output. Measures taken include increasing the selectivity of the h.f. circuits, introducing hum filters, and careful screening.

621.397.645 **1890**

Wide-Band Chain Amplifier for TV.—Tyminski. (*See* 2018.)

621.392 **1891**

Communication Circuit Fundamentals. [Book Review]—C. E. Smith. Publishers: McGraw-Hill Book Co., New York, 401 pp., \$5.00. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, April 1950, Vol. 14, No. 4, p. 28.) "The second of four books designed for a complete course in radio and communication engineering." The first book, Applied Mathematics for Radio and Communication Engineers, was noted in 112 of 1946.

621.392 **1892**

Matrix Analysis of Electric Networks. [Book Review]—P. Le Corbeiller. Publishers: Harvard University Press and J. Wiley, New York, 1950, 108 pp., \$3.00. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 576; *Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, p. 381.) "The first of a series of monographs on applied science to be published by Harvard University in order to make the results of University research available to a wider audience than would be reached by individual professional journals.... Its purpose is to offer a simplified and gradual approach to Kron's method of analysis of stationary electric networks.... It can be highly recommended to all radio engineers who want to keep in touch with modern advances in network theory."

GENERAL PHYSICS

501 + 53 **1893**
A Sampling of 1949 Books.—(*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 352–368.) Brief individual comments are given on a selected list of new books noted during late 1948 and 1949, mostly in the field of mathematics, physics, radiocommunications and electronics.

534.24 + 535.312] : 519.3 **1894**
A Variational Principle for the Computation of Reflection Coefficients.—G. Toraldo di Francia. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 298.) Previously used for computing phase shifts and transmission cross-sections, this principle is here applied to the calculation of the reflection coefficient of a potential barrier. See also 1052 of May (Levine).

535.13 **1895**
General Operator Field Equations Derived from a Variation Principle. Construction of "Divergence-Less" Four-Vector Operator.—C. Gregory. (*Phys. Rev.*, 15th May 1950, Vol. 78, No. 4, p. 479.)

535.222 **1896**
A Measurement of the Velocity of Light.—R. A. Houstoun. (*Nature, Lond.*, 10th Dec. 1949, Vol. 164, No. 4180, p. 1004.) A quartz crystal is substituted for the toothed wheel used in Fizeau's method of measurement and in an alternating electric field acts as an intermittent diffraction grating. The light in the first-order spectrum is interrupted 200 times as rapidly as by Fizeau's toothed wheel. Light, after passing through the quartz, travelled a distance of about 39 m and was then reflected back through the quartz to the eye of the observer. For a particular path length the intensity has a minimum value. The velocity deduced, when reduced to vacuum, is 299 775 km/s. Measurement accuracy is about the same as that of other recent determinations, but could be increased 10 times with a tenfold increase of range. A full account of the work will be published elsewhere. See also 42 of 1939, 3244 of 1941 and 2010 below.

535.42 + 534.26 **1897**
On the Theory of Diffraction by an Aperture in an Infinite Plane Screen: Part 2.—H. Levine & J. Schwinger. (*Phys. Rev.*, 1st May 1949, Vol. 75, No. 9, pp. 1423–1432.) In part 1 (83 of January) the problem of diffraction of a scalar plane wave was dealt with by a variational principle in which the aperture was regarded as coupling the two half-spaces on opposite sides of the screen. In part 2 a different variational principle is developed by considering the screen as an obstacle to the propagation of the wave. Calculated values of transmission coefficient are shown graphically against the ratio aperture-radius/λ for the particular case of circular aperture and normal wave incidence. Results are compared with exact values calculated by Bouwkamp; the degree of approximation is good.

535.42 **1898**
Diffraction by a Cylindrical Obstacle.—C. H. Papas. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 318–325.) The diffraction of a plane wave by an infinitely long perfectly conducting cylinder whose axis is parallel to the electric vector is treated by the variational method of Levine and Schwinger (83 of January and 1897 above) which avoids the difficulties of earlier methods. The scattering cross-sections for wavelengths large and small with respect to the radius a of the cylinder are computed and shown graphically. The cross-section approaches the value $4a$ as ka $(=2\pi/\lambda)$ approaches infinity.

537.226.001.11 **1899**
Properties of Slow Electrons in Polar Materials.—H. Fröhlich, H. Pelzer & S. Zienau. (*Phil. Mag.*, March 1950, Vol. 41, No. 314, pp. 221–242.) Energy problems in the interaction between an electron and a continuous dielectric medium are investigated theoretically by a variational method.

537.311.5 : 621.3.015.3 **1900**
Density Distribution of Transient Currents in Conductors.—L. M. Vallese. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 563.) Analysis of the distribution of an exponential-decay current and of a pulse current.

537.525 **1901**
The Collection of Positive Ions by a Probe in an Electrical Discharge.—R. L. F. Boyd. (*Proc. roy. Soc. A*, 26th April 1950, Vol. 201, No. 1066, pp. 329–347.) The Langmuir probe method for determining electron temperature gives anomalous results when applied to positive ions. The theoretical aspects of the collection of positive ions are discussed; the conclusions were tested in experiments using a special probe in an argon discharge. The probe consisted of a plane Pt foil screened by a fine wire grid whose potential could be adjusted separately; this device permitted the probe current to be separated into its electron and ion components.

537.581 **1902**
Convenient Methods for Thermionic Emission Calculations.—H. F. Ivey & C. L. Shackelford. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP24. Four simple methods are presented by which any one of the quantities Φ, A, T, J in Richardson's equation can be found if the others are known. In the first method, the equation is reduced to a simple form involving T only in the exponential term. Two other methods are graphical, and the fourth uses an abac. The accuracy is discussed in each case.

538.082.74 : 538.653.11 **1903**
On the Propagation of Large Barkhausen Discontinuities in Ni-Fe Alloys.—L. J. Dijkstra & J. L. Snoek. (*Philips Res. Rep.*, Oct. 1949, Vol. 4, No. 5, pp. 334–356.) "The propagation of the Bloch boundary between two macro-domains under the influence of an external magnetic field H is investigated for Ni-Fe wires of the composition 60-40 and 50-50 subjected to a tensile stress. The quantities involved are the axial rate of propagation v and the effective length λ of the discontinuity. . . . A review is given of the various factors determining the shape of the boundary and the rate of propagation v. The experimental results lead to the concept that the movement of the Bloch boundary is impeded by two causes of different origin, one being the eddy-current effect, the other probably a spin-relaxation effect."

538.569.4 + [621.396.11 : 535.312 **1904**
Absorption and Reflexion of U.H.F. Waves (300–500 Mc/s) by Sea Water.—S. K. Chatterjee & B. V. Sreekantan. (*Indian J. Phys.*, June 1949, Vol. 23, No. 6, pp. 273–279.) A parallel beam was passed through a solution simulating sea water. Intensity measurements indicated maximum absorption at 380 Mc/s and very little variation of the reflection coefficient over the frequency range investigated. Dielectric constant and conductivity increased with frequency. See also 1921 of 1949.

538.569.4 **1905**

A Square-Wave Modulation Method for Microwave Spectra.—T. R. Hartz & A. van der Ziel. (*Phys. Rev.*, 15th May 1950, Vol. 78, No. 4, p. 473.) The double-modulation method used by Gordy & Kessler (3125 of 1949) and Watts & Williams (1017 of 1948) is modified, with consequent improvement of sensitivity, by substituting a 50-kc/s square-wave voltage of 10 V or more for the sinusoidal r.f. modulation applied in conjunction with l.f. sawtooth voltage to the klystron reflector.

539.234 : 537.581 **1906**

The Use of Radioactive Sr in some Thermionic Experiments on Thin Films.—H. W. Allison & G. E. Moore. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 354–355.) Summary of American Physical Society 1950 Annual Meeting paper EP15. Electron emission measurements made by a tracer method at low temperatures on films of Sr and SrO 1–10 molecules thick evaporated on to tungsten ribbons indicate thermionic activity comparable with that of BaO-SrO cathodes. The technique is described and quantitative results given.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.9 **1907**

On Meteor Speed Measurements by the Radio Doppler Method at Low Frequencies.—D. D. Cherry & C. S. Shyman. (*Phys. Rev.*, 1st May 1949, Vol. 75, No. 9, pp. 1441–1442.) Measurements were made during the Geminid shower of 11th Dec. 1948 at 30.66 Mc/s and 12.8625 Mc/s simultaneously. Results are compared; the frequency used does not appear to affect the value of velocity found.

523.72 : 621.396.822 **1908**

Investigations of Radio-Frequency Radiations from the Sun during the Total Solar Eclipse of 20th May, 1947.—S. E. Khaykin & B. M. Chikhachev. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, Jan./Feb. 1948, Vol. 12, No. 1, pp. 38–43. In Russian.) See 1135 of May.

523.72 : 621.396.822 **1909**

The Growth of Circularly Polarized Waves in the Sun's Atmosphere and their Escape into Space.—V. A. Bailey. (*Phys. Rev.*, 15th May 1950, Vol. 78, No. 4, pp. 428–443.) The theory of plane waves in an ionized medium pervaded by static electric and magnetic fields (2785 of 1949) predicts wave amplification and consequent noise in certain frequency bands. For given frequency and electron drift velocity two independent trios of waves are produced, having circular and mutually opposed polarization. The conditions are established under which a growing flux of energy carried by the waves can pass normally through the boundary between two ionized media, and the theory is applied to show that powerful waves can arise from growth of random transverse perturbations above sunspots and that these waves can escape into space; observations of solar noise are correlated with these phenomena. The ultimate intensity attainable by such a perturbation is discussed.

523.745 : 550.385 **1910**

Geomagnetic Storms and Solar Activity 1949.—H. W. Newton. (*Observatory*, April 1950, Vol. 70, No. 855, pp. 84–86.) Geomagnetic activity was on the whole higher than during 1948, sunspot frequency about the same. Data are tabulated for magnetic storms recorded at Abinger.

523.75 **1911**

The Solar Flare of 1949 November 19.—M. A. Ellison & M. Conway. (*Observatory*, April 1950, Vol. 70, No. 855, pp. 77–80.) A short account of the development and spectrum of this flare, which was associated with the largest changes of cosmic-ray and neutron intensity ever recorded. The sky-wave signal disappeared abruptly on the three Decca frequencies (70, 113 and 127 kc/s) and did not reappear until about 5 hours later. There was a simultaneous enhancement of atmospherics recorded on a frequency of 22 kc/s and also a fade-out of signals in the frequency range 5–20 Mc/s.

551.51 **1912**

Physics and the Atmosphere.—G. M. B. Dobson. (*Proc. phys. Soc.*, 1st April 1950, Vol. 63, No. 364B, pp. 252–266.) Text of the 5th Charles Chree Address, given on 4th Nov. 1949. Includes an account of investigations of atmospheric ozone.

551.510.5 : 546.21 **1913**

The Distribution of Atomic and Molecular Oxygen in the Upper Atmosphere.—H. E. Moses & Ta-You Wu. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 333.) Summary of American Physical Society 1950 Annual Meeting paper N7. From the usual steady-state gas conditions, together with an appropriate form of the barometric equation, theoretical calculations are made of the number density of O_2 and O and of the temperature, all as functions of height, the temperature and its gradient being known at one height. According to these calculations, dissociation of O_2 is not complete till about 200 km, and the maximum number density of O, occurring at about 100 km, is about $10^{11}/cm^3$, which is considerably less than estimated by previous workers.

551.510.535 **1914**

On Investigations of the F_2 Layer of the Ionosphere during the Total Solar Eclipse of 20th May, 1947.—Ya. L. Al'pert. (*Bull. Acad. Sci. U.R.S.S., sér. phys.*, Jan./Feb. 1948, Vol. 12, No. 1, pp. 44–48. In Russian.) See 1147 of May.

551.510.535 **1915**

On the Frequency of Occurrence and the Structure of the E_2 Layer of the Ionosphere.—W. Becker & W. Dieminger. (*Naturwissenschaften*, Feb. 1950, Vol. 37, No. 4, pp. 90–91.) The reflection heights of the ordinary and extraordinary rays for the E_1, E_2 and E_3 layers are more clearly identified by the use of high-power equipment (see 892 of April). Two typical records obtained at the Max Planck Institute for Ionosphere Research are reproduced. Mean values of limiting frequencies for and heights of the E_2 layer at half-hourly intervals for August 1949 are tabulated and discussed. The slight thickness of the E_2 layer makes it probable that its existence is due to neutral corpuscles radiated by the sun. The sporadic-E layer should be distinguished according to its height and uniformity and the time of day.

551.510.535 : 621.396.11 **1916**

Radio Wave Propagation in a Curved Ionosphere.—Kelso. (*See* 2013.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 523.53 **1917**

On Meteor Speed Measurements by the Radio Doppler Method at Low Frequencies.—Cherry & Shyman. (*See* 1907.)

621.396.933 **1918**

Traffic Handling Capacity of 100-Channel Distance-Measuring-Equipment (DME) Standardized by R.T.C.A. SC-40 and I.C.A.O.—C. J. Hirsch. (*Proc. Radio Cl. Amer.*, 1950, Vol. 27, No. 2, pp. 3–25.) Normal operation of the equipment is discussed. Decreased efficiency may result from (*a*) transponder dead time, which occurs after each reply is transmitted, (*b*) 'bunching' of pulses from different pairs causing spurious replies by the transponder. An analysis of the characteristics determines how the time of initial search for a transponder reply and the memory of previous replies are affected by the number of interrogations received by a transponder. Results of actual tests confirm that the equipment satisfactorily complies with I.C.A.O. specifications. See also 365 of February.

621.396.933 **1919**

Principles Common to Certain Systems of Radio Navigation, and Study of a Particular Case: the Raydist System.—J. Rabier. (*Ann. Télécommun.*, April 1950, Vol. 5, No. 4, pp. 137–142.) Discussion of systems depending on knowledge of the velocity of propagation of e.m. waves. The Raydist system was noted in 3131 of 1947.

621.396.933 R.T.C.A. **1920**

The Radio Technical Commission for Aeronautics—its Program and Influence.—J. H. Dellinger. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 468–470.) 1949 I.R.E. National Convention paper.

621.396.9 **1921**

Frequency-Modulated Radar. [Book Review]—D. G. C. Luck. Publishers: McGraw-Hill, New York, 1949, 466 pp., $4.00. (*Electronics*, May 1950, Vol. 23, No. 5, p. 132.) Written originally as a U.S. Navy report, this book deals with basic theory, design and applications. Military systems take up a substantial portion, and some of the equipment discussed was not completed until after the war. For certain single-target problems f.m. has advantages over pulse radar; for multi-target problems further development is required.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.787.9 **1922**

The Pirani Effect in a Thermionic Filament as a Means of Measuring Low Pressures.—L. Spiers & W. P. Jolly. (*Brit. J. appl. Phys.*, May 1950, Vol. 1, No. 5, pp. 132–133.) Measurements on the tungsten filament of a simple ionization gauge showed that as the pressure P is reduced the filament-heating voltage required to maintain a given filament emission—90 μA in the particular case considered—falls. When the gas used is hydrogen, the relation between heating voltage and log P is linear. Advantages of a gauge of this type are enumerated.

535.215 **1923**

Photoconductivity of Lead Sulphide.—L. Genzel & H. Müser. (*Z. Phys.*, Jan. 1950, Vol. 127, No. 3, pp. 194–200.) Previous work on the internal photoeffect of PbS in the infra-red region is extended towards shorter waves; experimental results are discussed.

535.215.4 : 546.289 **1924**

Photoelectric Effects in Germanium.—B. J. Rothlein & F. A. Stahl. (*Sylvania Technologist*, April 1950, Vol. 3, No. 2, pp. 8–11.) Theories and experimental results on the photosensitivity of Ge in the wavelength range 0.5–2 μ are reviewed and the relation of the photosensitivity to the properties of the surface layers of the semiconductor is discussed. An a.c. photoswitch is described in which the power supplied to a dissipative load is controlled by an infra-red beam.

537.581 + 537.324 **1925**

Refractory Thermocouples and Emissivity Determination.—F. H. Morgan. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP9. The thermoelectric power was investigated for thermocouples of W/Ta, W/Mo, Ta/Mo, W/W-Mo up to temperatures of 3 000°C or near. The curve found for W/Ta, which was checked, differed from that previously recorded. Using these thermocouples, the spectral emissivity of thoria and other cathode materials was easily found.

537.581 : 546.92 **1926**

Effect of Impurities on Thermionic Emission from Platinum.—A. Ertel. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 353–354.) Summary of American Physical Society 1950 Annual Meeting paper EP10. An account of measurements of thermionic work function and emission constant for No. 1 grade and C.P. platinum. The former contained an electropositive impurity which, on receiving heat treatment, was 'cleaned up' at 1 850°–1 930°K; the latter contained both a similar impurity and another which yielded violent bursts of emission at 900°–1 100°K. Spectroscopic and X-ray diffraction analyses were also made.

537.581 : 666.76 **1927**

Certain Refractory Compounds as Thermionic Emitters.—D. L. Goldwater & R. E. Haddad. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP8. Some nitrides, borides and carbides are investigated and compared with thoria.

537.582 : 546.3 **1928**

A Preliminary Study of the Work Function of Contaminated Metal Surfaces.—P. H. Miller, Jr, & B. J. Rothlein. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 354.) Summary of American Physical Society 1950 Annual Meeting paper EP13. An electron beam is passed between a reference plate and the test surface (Ta, Zr or W); changes of work function produce field changes causing deflection of the beam. Changes of 0.05 V can be measured.

538.221 **1929**

Symposium of Papers on Ferromagnetic Materials.—(*Proc. Instn elect. Engrs*, Part II, April 1950, Vol. 97, No. 56, pp. 118–274.) Summaries are given of all the papers presented during the four sessions on 7th and 8th November 1949, together with the full text of those not published hitherto.

538.221 **1930**

***g*-Factors in Ferrite Materials.**—H. G. Beljers & D. Polder. (*Nature, Lond.*, 20th May 1950, Vol. 165, No. 4203, p. 800.) Microwave absorption measurements, using 3.2-cm waves, for ferrites containing various proportions of NiO and ZnO give g-factors near 2, in agreement with theory.

538.221 **1931**

Magnetization in Ferrites.—E. W. Gorter. (*Nature, Lond.*, 20th May 1950, Vol 165, No. 4203, pp. 798–800.) A study of the saturation magnetization of various ferrites with spinel structure.

538.221 **1932**

Anomalous Behavior of the Dielectric Constant of a Ferromagnetic Ferrite at the Magnetic Curie Point.—F. G. Brockman, P. H. Dowling & W. G. Stenbeck. (*Phys. Rev.*, 1st May 1949, Vol. 75, No. 9, p. 1440.)

546.841-3 + 666.76 **1933**
Notes on Thoria and Other Refractory Materials.—L. J. Croning. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 352.) Summary of American Physical Society 1950 Annual Meeting paper EP1. The chemistry of Th compounds is complex; thoria may contain over 3% impurities, and the 'specific surface' of samples from different sources varies enormously. Experimental work is described on the reaction of thoria with metals, the secondary/primary emission ratio of directly heated thoria cathodes, and the evaporation of a large variety of refractory materials.

546.841-3 : 621.3.011.2 **1934**
Electrical Conductivity of Sintered Thoria.—W. E. Danforth & F. H. Morgan. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP6. The thoria was studied in vacuo at temperatures up to 1 800°C. Specimens were subjected to currents up to several amperes per cm^2; the resistance variation is essentially linear over this range and may be as low as 1 ohm-cm at 1 200°C after prolonged passage of 10 A/cm^2. Exposure to atmospheric pressure causes de-activation. The effect of activation procedures on resulting activation energies is discussed.

546.841-3 : 621.385.032.216 **1935**
Rate of Disappearance of Thoria from Coated Filaments.—E. Shapiro. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 352.) Summary of American Physical Society 1950 Annual Meeting paper EP2. Dependence of the rate on temperature and emission was studied. A formula is given for the range 2 050–2 250°K, over which the rate is not affected by the current taken.

546.841-3 : 621.385.032.216 **1936**
Thermal Emissivity Changes of Thoria-Coated Tungsten Filaments.—O. A. Weinreich. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 352–353.) Summary of American Physical Society 1950 Annual Meeting paper EP3. An investigation with particular reference to the effects of processing. In some cases the changes observed can be correlated with changes of thermionic emission. Emissivity of fresh coatings was increased by high-temperature flashing and by electron bombardment.

621.315.57 : 666.3 : 621.385.032.21 **1937**
Ceramic Heaters and Cathodes for Electron Tubes.—Palumbo. (*See* 2065.)

621.315.59 : 546.28 **1938**
Nucleon-Bombarded Silicon.—K. Lark-Horovitz, M. Becker, R. E. Davis & H. Y. Fan. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 334.) Summary of American Physical Society 1950 Annual Meeting paper OA1. The effect of bombardment on resistivity is investigated experimentally.

621.315.59 : 546.289 **1939**
Impedance Characteristics of Grain Boundaries in High Resistivity *N*-Type Germanium.—N. H. Odell & H. Y. Fan. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 334.) Summary of American Physical Society 1950 Annual Meeting paper OA2.

621.315.59 : 546.289 **1940**
D.C. Characteristics of High-Resistance Barriers at Crystal Boundaries in Germanium.—W. E. Taylor & H. Y. Fan. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 335.) Summary of American Physical Society 1950 Annual Meeting paper OA5.

621.315.59 : 621.385.2 : 621.314.632 : 537.311.33 **1941**
D.C. Characteristics of Silicon and Germanium Point Contact Crystal Rectifiers: Part 2—The Multicontact Theory.—V. A. Johnson, R. N. Smith & H. J. Yearian. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 283–289.) An extension of the diode theory which accounts for the observed characteristics of these rectifiers.

621.315.612.4 **1942**
The Ferro-Electricity of Titanates.—G. H. Jonker & J. H. van Santen. (*Philips tech. Rev.*, Dec. 1949, Vol. 11, No. 6, pp. 183–192.) Discussion of the analogy between ferromagnetic phenomena and the piezoelectric properties of Rochelle salt, KH_2PO_4 and $BaTiO_3$. Outlines of a theory applicable to titanate dielectrics are given.

621.318.323.2 : 538.114 **1943**
Magnetic After-Effect in Laminated Coil-Cores in Weak Alternating Fields.—R. Feldtkeller. (*Fernmeldetech. Z.*, April 1950, Vol. 3, No. 4, pp. 112–117.)

621.795 : 621.385.833 **1944**
A Lapping Technique to Improve the Image Quality of Electron Microscope Lenses.—F. A. Hamm. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 271–278.)

533.5 + 531.788 **1945**
Vacuum Equipment and Techniques. [Book Review]—A. Guthrie & R. K. Wakerling (Eds). Publishers: McGraw-Hill, New York, 1949, 242 pp., $2.50. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 578; *Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, p. 381.) Concerned primarily with the development of equipment at the University of California Radiation Laboratory. "While . . . the volume does not cover fully all problems likely to be encountered in vacuum processes . . . workers in high-vacuum electronics should find it to be well worth their attention."

535.37 **1946**
An Introduction to the Luminescence of Solids. [Book Review]—H. W. Leverenz. Publishers: J. Wiley, New York, 1950, 471 pp., $12.00. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 577; *Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, p. 382). ". . . the author has wisely chosen to describe phosphors generally in terms of preparations, compositions, structures, and physical characteristics, using individual phosphors to illustrate each feature. In this way, a co-ordinated view of the entire subject is obtained, without sacrificing the utility of adequate descriptions of interesting and useful phosphors . . . Much of the author's original work is presented in this volume, together with extensive references to the available literature (the bibliography contains over 1 000 references) . . . . . . it will be invaluable . . . in training future specialists and in aiding scientists who wish to refresh and increase their knowledge of solid matter and its interactions with radiations . . ."

621.318.2 **1947**
Abriss der Dauermagnetkunde (Permanent-Magnet Technology). [Book Review]—J. Fischer. Publishers: Springer Verlag, Berlin, 248 pp., 36 DM or 39 DM (linen bound). (*Electrician*, 14th April 1950, Vol. 144, No. 3748, p. 1205.) A comprehensive treatise intended for students and engineers interested in permanent magnets of any size and application.

MATHEMATICS

517.512.2 **1948**
The Summation of Fourier Series by Operational Methods.—L. A. Pipes. (*J. appl. Phys.*, April 1950,

Vol. 21, No. 4, pp. 298–301.) A method using Laplace transforms is described by means of which graphical representations can easily be obtained of certain functions defined by Fourier series and of practical importance.

681.142 **1949**

The Electronic Isograph for Roots of Polynomials.—B. O. Marshall, Jr. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 307–312.) A polynomial $f(z) = \Sigma a_n z^n$ can be represented by $\Sigma a_n r^n \cos n\theta + j\Sigma a_n r^n \sin n\theta$ and a root occurs when these two terms are simultaneously zero. $\sin n\theta$ and $\cos n\theta$ are generated by a commutator, and potentiometers control the amplitudes corresponding to the coefficients a_n. The sums of the cos and sin terms are applied to the x and y plates respectively of an oscillograph, and r is varied by another potentiometer until the trace passes through the origin, indicating one of the roots; θ is determined by a stroboscopic device. Polynomials of degree 10 or less can be dealt with. Various applications are discussed.

681.142 **1950**

Principle and Realization of a Mathematical Machine, the 'Opérateur Mathématique Électronique' (O.M.E.).—B. A. Sokoloff. (*Ann. Télécommun.*, April 1950, Vol. 5, No. 4, pp. 143–159.) A detailed account of equipment noted in 1413 of June (Raymond)—Type OME 111.

681.142 **1951**

An Analog Computer.—J. G. Bayly. (*Rev. sci. Instrum.*, March 1950, Vol. 21, No. 3, pp. 228–231.) An integrator capable of solving equations of the form $dx/dt = -\lambda x + f(t)$.

681.142 **1952**

High Speed Digital Computers.—L. N. Ridenour. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 263–270.) An elementary survey of present developments and future trends.

681.142 **1953**

A Dynamically Regenerated Electrostatic Memory System.—Eckert, Lukoff & Smoliar. (*See* 2005.)

681.142 : 517.946.8 **1954**

Solution of Partial Differential Equations with a Resistance Network Analogue.—G. Liebmann. (*Brit. J. appl. Phys.*, April 1950, Vol. 1, No. 4, pp. 92–103.) A more extended account of the network and iteration method noted in 3460 of 1949. The network described is axially symmetrical, with 60 meshes in the z-direction and 20 in the r-direction, and has 50 current-feeding points. Accuracies to within 1 part in 10^3–10^4 can be attained much more quickly than by numerical methods of field plotting, and semi-skilled operators can handle the equipment satisfactorily.

681.142 : 517.946.8 **1955**

The Analog Solution of Simultaneous Partial Differential Equations by means of Passive and Active Electrical Networks.—J. H. Green, Jr, & V. B. Corey. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 328.) Summary of American Physical Society 1950 Annual Meeting paper HA7.

681.142 : 621.3.016.352 **1956**

Stabilization of Simultaneous Equation Solvers.—G. A. Korn. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 514.) Discussion on 3348 of 1949.

681.142 : 621.385.032.212 **1957**

The Dekatron.—Bacon & Pollard. (*See* 2066.)

681.142 : 621.392 **1958**

Diode Coincidence and Mixing Circuits in Digital Computers.—Tung Chang Chen. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 511–514.) "Basic circuits utilizing germanium diodes in electrically pulsed systems are described. The circuits are of the following types: (*a*) coincidence circuits—output signal occurs only when all the inputs receive signals simultaneously; (*b*) mixing circuits—output signal occurs when any one of the inputs receives a signal. The analyses of transient response of the output signal and input impedance are given." Pulse-repetition rates up to several Mc/s and rise and fall times of 0.05 μs are possible.

681.142 : 794.1 **1959**

Programming a Computer for Playing Chess.—C. E. Shannon. (*Phil. Mag.*, March 1950, Vol. 41, No. 314, pp. 256–275.) Full text of the paper noted in 1703 (f) of 1949. Has theoretical interest in relation to more practical problems such as concern machines for designing filters and switching circuits.

MEASUREMENTS AND TEST GEAR

537.291.082.1 **1960**

A Dynamic Electron-Trajectory Tracer.—J. W. Clark & R. E. Neuber. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 521–524.) The electrode structure in a sheet-rubber model is made to oscillate vertically, thus simulating the effect of applied r.f. voltage.

621.3.018.4(083.7) : 621.396.615.17/.18 + 621.317.761 **1961**

Frequency Generation and Measurement.—H. J. Finden. (*Electronic Engng*, June 1950, Vol. 22, No. 268, pp. 220–226.) Illustrated description of a frequency synthesizer covering the range 1 kc/s–1 Mc/s in 1-kc/s steps in a decade arrangement, and delivering 0.1 V into a 100-Ω load. A standard controlling frequency of 100 kc/s is obtained from a crystal maintained at 60°C; this is fed to amplifier and multivibrator circuits to produce oscillations at 1 kc/s, 10 kc/s, 100 kc/s and 1 Mc/s respectively, the lowest of these determining the minimum size of the variation step. The procedure for generating a required frequency, by selecting and combining appropriate harmonics, is given in detail.

621.317 : 061.3 **1962**

Instruments and Measurements Conference, Stockholm, 1949.—(*Instrum. Practice*, Nov. 1949, Vol. 4, No. 1, pp. 25–33.) Titles and authors are given of all the papers presented, with abstracts of those in English.

621.317.336/.34 + 621.392.6.029.63 **1963**

Theory and Technique of Multipole Networks at Ultra-High Frequencies.—Goudet & Jassin. (*See* 1882.)

621.317.35 : 621.314.2.029.3 **1964**

Test Methods for High-Quality Audio Transformers.—E. B. Harrison. (*Tele-Tech*, March 1950, Vol. 9, No. 3, pp. 40–41..65.) Square-wave inputs are applied at seven frequencies in the range 20 c/s–20 kc/s. The effect of winding resistance, leakage inductance and reflected primary impedance on the output waveform is discussed. Results obtained at the different frequencies with five commercial transformers are illustrated.

621.317.373 : 621.317.755 **1965**

Phase-Angle Measurements using a Cathode-Ray Tube.—F. A. Benson & A. O. Carter. (*Electronic Engng*, June 1950, Vol. 22, No. 268, pp. 238–242.) A discussion of errors in c.r.o. measurements due to trace width and presence of harmonics.

621.317.39 : 548.0 : 537.228.1 **1966**

An Arrangement for Indicating Piezo-Electricity of Crystals.—W. G. Perdok & H. van Suchtelen. (*Philips tech. Rev.*, Nov. 1949, Vol. 11, No. 5, pp. 151–155.) Describes apparatus of improved sensitivity for detecting piezoelectric effects in small fragments of crystal. These are placed between two flat electrodes connected in parallel with the tuning circuit of an oscillator which is tuned manually through the range 300 kc/s–30 Mc/s and at the same time modulated in frequency at 100 c/s by means of a vibrating capacitor. The dip in the amplitude of oscillation when tuning through a crystal resonance is detected by a separate valve and produces an audible rattle in a loudspeaker.

621.317.612 : 621.314.2.083 **1967**

On the Measurement of the No-Load Losses of Small 50-c/s Transformers.—L. Medina. (*Elektrotech. u. Maschinenb.*, April 1950, Vol. 67, No. 4, pp. 99–104.) Two methods are described, both giving accurate results. In the first method the losses are determined from the value of a resistor substituted for the transformer winding shunted by a capacitor adjusted to give a minimum total current through the combination, the resistor being adjusted to obtain the same current. An amplifier tuned to 50 c/s ensures adequate sensitivity for operating a moving-coil meter or c.r. indicator. The test transformer is fed from 50-c/s mains through an autotransformer and an isolating transformer with an earthed screen between the windings. The second method uses a simple resonance bridge. Typical results are tabulated. Complete circuit details of the tuned amplifier are given. See also 180 of 1947.

621.317.7 + 621.396.6 + 621.38.001.8 **1968**

Physical Society's Exhibition.—(*See* 1883.)

621.317.72 **1969**

A Millivoltmeter for a Large Range of Frequency and Voltage.—H. te Gude. (*Funk u. Ton*, April 1950, Vol. 4, No. 4, pp. 201–204.) Details of the design of an instrument intended for measurements on broadcast receivers and transmitters, and comprising a 6-stage amplifier, crystal detector, moving-coil meter and capacitance attenuator. Frequency range is 1 kc/s–30 Mc/s; the 11 voltage ranges extend from 1 mV to 1 000 V full scale.

621.317.725 **1970**

VTVM Circuits.—M. C. Selby. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 110–111.) A tabulated survey of basic valve-voltmeter circuits.

621.317.725 **1971**

Negative-Feedback Direct-Voltage Valve Voltmeters.—W. Geyger. (*Arch. tech. Messen*, March 1950, No. 170, pp. T31–T33.) An asymmetric single-triode bridge circuit with heavy negative feedback, the adjustment of which provides 4 ranges between 2 and 200 V without affecting the current drawn from the battery supply. Results of measurement are practically independent of alterations of valve characteristics and supply voltage fluctuations. Two-valve push-pull circuits are also shown, one battery-operated and the other supplied from a.c. mains.

621.317.733 **1972**

High-Frequency Bridge of the Société Anonyme de Télécommunications, for the Measurement of [cable] Impedance Deviations.—G. Fuchs & P. Fenouillet. (*Câbles & Transmission, Paris*, April 1950, Vol. 4, No. 2, pp. 126–132.) Direct-reading instrument operating over the range 50 kc/s–10 Mc/s and giving the real and imaginary parts of impedances near 75 Ω to within 1 part in 1 000.

621.317.733 **1973**

A Method of Decreasing the Effect of Earth Admittances in A.C. Bridges.—G. H. Rayner & R. W. Willmer. (*J. sci. Instrum.*, April 1950, Vol. 27, No. 4, pp. 103–104.) The bridge screen is connected to the cathode of a cathode follower, so that its potential follows that of the grid, which is connected to one of the detector terminals and thus has a negligible admittance to earth. The balance condition of the bridge is satisfied although the detector terminals are not at earth potential. Precautions taken to ensure a high input impedance for the cathode follower are described in detail.

621.317.733 : 621.317.794 **1974**

A Bolometer Bridge for Standardizing Radio-Frequency Voltmeters.—M. C. Selby & L. F. Behrent. (*Bur. Stand. J. Res.*, Jan. 1950, Vol. 44, No. 1, pp. 15–30.) The equipment described can be used to measure voltages between 20 mV and 1.9 V at frequencies below 700 Mc/s to an accuracy within ±1%. The equipment may also be used for the direct measurement of r.f. generator voltages, as a standard of r.f. impedance, and for accurate power measurement from 20 μW to 100 mW. Factors limiting the range of voltage measurement are described, and various independent methods are given by which the measured voltage can be checked.

621.317.733 : 621.396.611.21 : 621.3.012.8 **1975**

Measurement of the Equivalent Electrical Circuit of a Piezoelectric Crystal.—A. C. Lynch. (*Proc. phys. Soc.*, 1st May 1950, Vol. 63, No. 365B, pp. 323–331.) The value of the equivalent capacitance is deduced from measurements of the effective series capacitance of the crystal at two frequencies symmetrically disposed about the resonance frequency and differing from it by 0.5–5%. A substitution Schering bridge reading to 0.001 pF is used, connected so as to exclude effects of stray capacitance to earth. With a single resonance frequency the equivalent circuit parameters are measured to within 0.1% and the piezoelectric coefficient calculated to within 0.5%. When there is more than one resonance mode the equivalent circuits for each can be deduced by successive approximations.

621.317.756.089.6 : 621.396.662 **1976**

Design Analysis of a *TM*-Mode Piston Attenuator.—A. B. Giordano. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 545–550.) 1948 I.R.E. National Convention paper. The design of a system consisting of coaxial input and output sections separated by a cylindrical waveguide section operating below cut-off is described. The attenuation, input impedance and voltage s.w.r. are calculated and evaluated numerically for a model designed to operate at 10-cm wavelength. The calculations agree well with experimental measurements for coupling separations ⩾ 0.5 cm.

621.317.772 : 621.396.11 **1977**

A Method of Simulating Propagation Problems.—Iams. (*See* 2014.)

621.317.784 **1978**

Absolute Measurement of Microwave Power by Radiation Pressure.—A. L. Cullen. (*Nature, Lond.*, 6th May 1950, Vol. 165, No. 4201, p. 726.) Using the method previously described (1727 of 1949) the deflection observed with a 9.1-cm magnetron transmitter giving 1-μs pulses with a recurrence frequency of about 1 kc/s corresponded to a force of 0.014 dyne, equivalent to a power of 36 W, as compared with 32 W measured simultaneously but independently by a balanced calorimeter method. Projected further work with the apparatus evacuated may eliminate disturbing effects possibly due to heating.

621.317.79 : 621.396.67 **1979**

Ripple Tank for Phase-Front Visualization.—(*Electronics*, May 1950, Vol. 23, No. 5, pp. 120, 122.) An analogue method of determining phase-fronts associated with aerial systems. Magnetically driven pin points, representing the aerials, are actuated by an audio oscillator and produce water ripples. These are viewed as a stationary pattern on a ground glass screen above the tank, a synchronously controlled stroboscopic light source being used.

621.396.615 **1980**

Wide-Range Frequency-Modulated Oscillator.—P. M. Milner. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 118, 144..164.) A reactance valve is used as modulator, frequency variation being achieved by varying modulator grid voltage, without introducing frequency multiplication or conversion. From 15 Mc/s to 40 Mc/s the frequency dependence on modulator grid voltage (from 0 to 2.8 V) is linear to within ± 1%, and the output is 1 V r.m.s. to within ± 5%.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 **1981**

Summarized Proceedings of Symposium on Applications of Ultrasonics.—G. Bradfield. (*Proc. phys. Soc.*, 1st May 1950, Vol. 63, No. 365B, pp. 305–322.) This symposium, held on 18th Feb. 1949, included surveys of recent advances in (*a*) the investigation of the fundamental structure of matter, (*b*) telecommunication and allied applications, (*c*) the use of mechanical forces set up by intense waves.

539.16.08 **1982**

On the Velocity of Discharge Propagation in Externally Quenched Geiger Counters.—C. Balakrishnan & J. D. Craggs. (*Proc. phys. Soc.*, 1st April 1950, Vol. 63, No. 364A, pp. 358–366.) A new method for measuring this velocity is described. The results obtained with argon, hydrogen and neon are shown in graphs and tables, and discharge-propagation mechanisms are discussed briefly.

539.16.08 **1983**

On the Temperature Dependence of Counter Characteristics in Self-Quenching Geiger-Müller Counters.—O. Parkash & P. L. Kapur. (*Proc. phys. Soc.*, 1st May 1950, Vol. 63, No. 365A, pp. 457–461.)

539.16.08 **1984**

A Study of Plateau Slopes in Self-Quenching Geiger-Müller Counters.—S. C. Brown & C. Maroni. (*Rev. sci. Instrum.*, March 1950, Vol. 21, No. 3, pp. 241–244.)

539.16.08 **1985**

Time Lags in Geiger Counters.—A. R. Laufer. (*Rev. sci. Instrum.*, March 1950, Vol. 21, No. 3, pp. 244–251.)

539.16.08 **1986**

The Electric Field in a Geiger Counter.—A. R. Laufer. (*Rev. sci. Instrum.*, March 1950, Vol. 21, No. 3, pp. 252–254.)

539.16.08 : 621.315.59 **1987**

A Germanium Counter.—K. G. McKay. (*Phys. Rev.*, 15th Nov. 1949, Vol. 76, No. 10, p. 1537.) Bombardment of the barrier region of a Ge crystal under a point contact by an α-particle produces free electrons and positive holes in the barrier region, which are then swept out by the barrier field aided by the applied field. This effect is applied in a counter using N-type high-back-voltage Ge with a phosphor-bronze point contact. Connected to an amplifier covering the range 100 kc/s–15 Mc/s, this acted as an efficient counter for α-particles. The short rise and recovery times, small sensitive volume and ability to discriminate against β-particles, are advantageous in certain applications.

539.16.08 : 621.396.645 **1988**

Linear Amplifiers.—Schultz. (*See* 1888.)

620.179.16 **1989**

Ultrasonic Testing of Gas-Turbine Disks.—(*Metal Progress*, April 1950, Vol. 57, No. 4, pp. 468–472.) Flaw detection using a frequency of 2.25 Mc/s.

621.316.74 : 621.385.38 **1990**

A Continuously-Operating Thyratron Temperature-Control Device.—Aumont. (*See* 2032.)

621.316.74.076.7 **1991**

Electronic Temperature Control.—(*Overseas Engr*, May 1950, Vol. 23, No. 271, pp. 352–353.) A description of commercial control equipment for gas- or oil-fired furnaces. Variation of temperature causes movement of a metal vane between two coils, thus changing their inductance and operating a sensitive relay controlling the opening of the fuel valve.

621.317.083.7 **1992**

Analysis of Errors in a Phase-Shift Angle-Telemetering System.—J. V. Harrington. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 495.) Summary of thesis.

621.317.39 **1993**

An Electrical Displacement Meter.—A. Douglas. (*Electronic Engng*, June 1950, Vol. 22, No. 268, pp. 215–219.) The design and operation of available mains-frequency e.m. gauges for measuring small physical displacements are discussed, and their shortcomings pointed out. The non-resonant-bridge type has low sensitivity, and while the resonant-bridge type is better in this respect it is difficult to stabilize. A bridged-T circuit was therefore used, having a common point to which the a.c. source (a Colpitts oscillator at 20 kc/s), coil and detector could be earthed. Various practical applications of the instrument are mentioned. A more detailed paper on the subject, by the author and H. Ford, is published as Special Report No. 34 of the Iron and Steel Institute.

621.365.54† **1994**

Radio-Frequency Heating in the Fabrication of Precision Machines and Apparatus.—A. Leemann. (*Microtecnic, Lausanne*, Jan./Feb. 1950, Vol. 4, No. 1, pp. 33–36.) Advantages of the r.f. method and practical arrangements for heating small parts are discussed.

621.365.54† **1995**

Heating by High-Frequency Fields.—E. C. Witsenburg. (*Philips tech. Rev.*, Dec. 1949, Vol. 11, No. 6, pp. 165–175.) A formula is derived for the heating-coil efficiency, from which it appears that in simple cases the best results are obtained when the frequency is high enough to ensure that the penetration depth is not greater than about $\frac{1}{8}$ the diameter of the object being heated.

621.38 : 621.944 **1996**

Electronic Mill Control.—(*Elect. Times*, 27th April 1950, Vol. 117, No. 3051, pp. 699–701.) G.E.C. equipment installed 10 years ago in the cold-rolling section of Richard Thomas & Baldwin's Ebbw Vale works is described. It is designed to ensure constant tension in the strip while the latter is uncoiled, rolled, and re-coiled, and its use enables a thick-sheet mill to produce thicknesses suitable for tin plate.

621.38.001.8 : 621.396.6 + 621.317.7 **1997**
Physical Society's Exhibition.—(*See* 1883.)

621.38.001.8 **1998**
Electronics Symposium, 1949.—(*Instrum. Practice*, Oct. 1949, Vol. 3, No. 12, pp. 570–571.) Summaries are given of the following papers presented at the symposium organized by the Electronics Group of the Scientific Instrument Manufacturers' Association, London, 2nd–4th Nov. 1949:

Electronic Instrumentation in Atomic Research.—D. Taylor.
Electronic Amplifiers.—D. L. Banks.
Magnetic Amplifiers.—A. V. Hemingway.
Some Recent Improvements in Electronic Measuring Techniques.—C. H. W. Brookes-Smith & J. A. Colls.
The Measurement of some Transient Phenomena.—H. A. Dell.
An Industrial Servomechanism.—P. H. Briggs.
Co-operative Research at B.S.I.R.A.—A. J. Maddock.

See also 708 of March.

621.383 : 621-526 : 771.37 **1999**
Automatic Exposure Control.—G. Bruck, J. Higgins & J. Ward. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 74–78.) A photoelectric servo device for aperture control on motion-picture and television cameras in aerial work at speeds over 600 m.p.h.

621.384.621.1† **2000**
An Open-Type 800-kV Van de Graaff Generator.—P. Ohlin & O. Beckman. (*Ark. Fys.*, 22nd Oct. 1949, Vol. 1, Part 4, pp. 323–327. In Swedish.) General description of the generator and associated accelerator recently constructed at Uppsala.

621.385.83 **2001**
Electron Optics at High Frequencies and at Relativistic Velocities.—D. Gabor. (*Rev. d'Optique*, April 1950, Vol. 29, No. 4, pp. 209–231. In English.) When d.c. and a.c. fields are considered simultaneously, it is more convenient to represent the field by vector potentials and anti-potentials, particularly for systems with axial symmetry. The equations of motion including the relativistic term are considered for an electron, and the conditions for space and phase focusing are established. The results are applied to the case of a linear accelerator and it is concluded that only field-lenses with Alvarez windows will allow stability to be attained in practice.

621.385.833 **2002**
Note on Potentials Derived from Axial Values in Electron Optics.—F. Berz. (*Phil. Mag.*, March 1950, Vol. 41, No. 314, pp. 209–220.) "The determination of electrode systems which produce a precalculated distribution along the optic axis is examined. It is shown that an analytic potential distribution is completely determined when its values along any arbitrarily small interval on the axis are exactly known. On the other hand if, as usual, the value of the potential along a finite stretch of the axis is prescribed within arbitrarily small but finite limits, this is compatible with an infinity of different potential distributions which can be constructed without any singularity at finite distances, and which can assume prescribed values at any number of points outside the axis of symmetry."

621.385.833 **2003**
Laboratory Modifications in the R.C.A. Model EMC Electron Microscope.—S. G. Ellis. (*Rev. sci. Instrum.*, March 1950, Vol. 21, No. 3, pp. 255–257.) The modifications described are capable of being carried out in any laboratory machine shop, and increase the resolving power nearly to its ultimate value, about 50 Å.

621.398 : 538.74 **2004**
The Admiralty Transmitting Magnetic Compass.—A. Hine. (*Instrum. Practice*, Aug. 1949, Vol. 3, No. 10, p. 456.) A brief survey of the function and possible uses of the instrument. The principle is that of a Wheatstone bridge using the liquid in the master-compass as a resistance path between electrodes mounted on the card and in the bowl. The voltage developed between two points of the bridge depends on the compass setting and is used, after amplification, to operate follow-up equipment feeding as many repeaters as required.

681.142 **2005**
A Dynamically Regenerated Electrostatic Memory System.—J. P. Eckert, Jr, H. Lukoff & G. Smoliar. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 498–510.) 1949 I.R.E. National Convention paper. The fundamental theory is discussed of the processes by which charge patterns representing binary numbers are stored on the screen of a c.r. tube in an e.s. memory system. The influence of c.r. tube parameters and of associated circuits is analysed. Experiments with different systems show that the binary digits, 1 and 0, are best represented by a dot and a circle, the circle being produced by whirling the spot at a high radio frequency.

621.38/.39 **2006**
Advances in Electronics: Vol. 2. [Book Review]—L. Marton (Ed.). Publishers: Academic Press, New York, 1950, 378 pp., $7.60. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 134–135.) Includes 8 new monographs dealing with electron focusing, cathodoluminescence, breakdown in dielectrics, microwave magnetrons, ferromagnetic phenomena and spectroscopy. Vol. 1: 2889 of 1949.

621.38 : 539.17 **2007**
Electronics: Experimental Techniques. [Book Review]—W. C. Elmore & M. L. Sands (Eds). Publishers: McGraw-Hill, New York, 1949, 417 pp., $3.75. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 136..142.) National Nuclear Energy Series, Division V, Vol. 1. "This is not a treatise on experimental electronic techniques; it is a volume describing in detail a series of excellent devices which have been designed, tested and modified until they meet satisfactorily many of the needs of the nuclear physicist." This volume covers the work done at the Los Alamos Laboratories. "The usefulness of this book and its permanent value would have been greatly enhanced if . . . . a more complete treatment had been given of the basic circuit elements . . . ."

621.38.001.8 **2008**
A Symposium on Electronics. [Book Review]—A. G. Peacock (Ed.). Publishers: Chapman & Hall, London, 199 pp., 16s. (*Brit. J. appl. Phys.*, April 1950, Vol. 1, No. 4, p. 110.) A collection of ten papers read at the first symposium on Electronics, held in London in 1948; applications in research and industry are dealt with. See also 1145 of 1949.

PROPAGATION OF WAVES

538.566 **2009**
The Radiation from a Magnetic Dipole in a Spherically Symmetrical Stratified Medium.—G. Eckart. (*Ann. Télécommun.*, May 1950, Vol. 5, No. 5, pp. 173–178.) Primary radiation over a curved earth is considered for

the case in which the dielectric constant is a function of the radius r of the form $\epsilon = \alpha + \beta/r$. The equation derived for waves with the Fitzgerald potential Π is solved by separation of the variables and a solution is expressed in terms of Green's functions. A second solution for a homogeneous medium under particular conditions is derived. From the two solutions a theorem on hypergeometric functions is deduced. The physical interpretation of the results is briefly discussed.

621.396.11 + 535.222 **2010**

Velocity of Light and of Radio Waves.—L. Essen. (*Nature, Lond.*, 20th May 1950, Vol. 165, No. 4203, p. 821.) Houstoun's recent measurement of the velocity of light (1896 above) is noted as being in close agreement with the commonly accepted value of 299 776 km/s and not with other recent determinations by both radio and optical methods. Further careful measurements are needed to establish the value of the velocity. See also 1751 of July.

621.396.11 **2011**

On the Propagation of Medium Waves over Inhomogeneous Ground.—J. Grosskopf. (*Fernmeldetech. Z.*, April 1950, Vol. 3, No. 4, pp. 118–121.) The decrease in field strength in propagation over ground having different dielectric and conductivity constants along the propagation path, as in the case of successive stretches of land and sea, may be determined by a graphical method from the measured or estimated values of the ground constants, an appropriate modification of the formula for 'numerical distance' being applied. The kinks in the field-strength/distance curve which correspond to land/sea boundaries are interpreted quantitatively. See also 2122 of 1944.

621.396.11 : 535.312] + 538.569.4 **2012**

Absorption and Reflexion of U.H.F. Waves (300-500 Mc/s) by Sea Water.—Chatterjee & Sreekantan. (*See* 1904.)

621.396.11 : 551.510.535 **2013**

Radio Wave Propagation in a Curved Ionosphere.—J. M. Kelso. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 533–539.) "Using a double parabola approximation to the Chapman distribution of electron density as a function of height, and the assumption of a curved-ionosphere curved-earth geometry, analytic expressions are obtained for the true height of reflection, ray path, reflection coefficient, ground range and group path. Graphical results are given for the maximum usable frequency factor. Where possible, the above results are compared with results obtained by assuming a plane ionosphere."

621.396.11 : 621.317.772 **2014**

A Method of Simulating Propagation Problems.—H. Iams. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 543–545.) 1949 I.R.E. West Coast Convention paper. Problems relating to reflection, refraction or scattering can be simulated by propagating cm waves in a large sheet of low-loss dielectric material, conditions being varied by embedding objects in the sheet, altering its thickness or coating its surfaces. One surface of the sheet is then scanned with the probe of a phase-front plotter.

621.396.81 **2015**

U.H.F. Coverage in Pittsburgh.—R. N. Harmon. (*FM-TV*, May 1950, Vol. 10, No. 5, pp. 14–17.) A field-strength survey has been made by Westinghouse Radio to determine whether the method of calculation proposed by the F.C.C. for very hilly country is satisfactory. Considerable disagreement was found between the theoretical and the observed results.

621.396.81 **2016**

Microwave Angle Separation on a Two-and-One-Half Mile Overwater Path.—A. W. Straiton & A. H. LaGrone. (*J. appl. Phys.*, March 1950, Vol. 21, No. 3, pp. 188–193.) Three methods were used to measure the angular separation between the direct and water-reflected waves in transmissions across Lake Buchanan, Texas, using a wavelength of 3.2 cm. The separation was $<0.5°$ and the two intensities were nearly equal. The first method depends on measurements of the relative phases and signal strengths at three vertically spaced aerials. The second method requires the relative phases at two aerials and the signal strengths relative to the maximum and minimum signal from a height/gain curve. The third method requires a signal-strength record as the axis of a large parabolic aerial is tilted in the vertical plane containing the incoming rays. The first method is quick and in general accurate; the second is the most accurate, but the necessary height/gain measurements limit its usefulness.

621.397.81 **2017**

WTTG Field-Strength Survey.—Wakeman. (*See* 2050.)

RECEPTION

621.396.621 : 621.396.822 **2018**

Design Factors in Low-Noise-Figure Input Circuits.—M. T. Lebenbaum. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 539.) Correction to paper abstracted in 1504 of June.

621.396.621 **2019**

The Technique of Radio Design. [Book Review].—E. E. Zepler. Publishers: Chapman & Hall, London, 2nd edn 1949, 394 pp., 25s. (*Electronic Engng*, June 1950, Vol. 22, No. 268, p. 254; *Tele-Tech*, April 1950, Vol. 9, No. 4, p. 67; *J. sci. Instrum.*, April 1950, Vol. 27, No. 4, p. 112.) This book, originally published in 1943, deals with the development and testing of all types of radio receiving apparatus, and embodies the first-hand experience gained during many years by a designer in a large works laboratory.

621.396.621 **2020**

Recent Advances in Radio Receivers. [Book Review]—L. A. Moxon. Publishers: Cambridge University Press, London, 1949, 183 pp., 18s. (*Brit. J. appl. Phys.*, April 1950, Vol. 1, No. 4, p. 110.) One of a series of monographs on radio technique. The treatment is essentially physical, and the problem of receiver noise gets particular attention, the book being concerned mainly with receivers for radar and communications.

STATIONS AND COMMUNICATION SYSTEMS

621.395.47 + 621.396.86 **2021**

An Improved Speech-Inverter System.—L. L. Koros. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 86–89.) Details with diagrams are given of a privacy circuit for radio or line telephony using an a.f. inversion carrier modulated by the speech input and also controlled in accordance with its average level. An RC equalizer network corrects frequency response. Distortion and background noise levels are low.

621.395.6 : 621.395.44 **2022**

Carrier-Current and Pilot-Signal Generators Standardized by the Administration Française des P.T.T. for 600-Channel Telephony Links.—H. Dumas & P. Moll. (*Câbles & Transmission, Paris*, April 1950, Vol. 4, No. 2, pp. 150–179.) Illustrated description of the terminal equipment on the Paris-Toulouse-Brive-Bordeaux circuit. Bandwidth is 4 kc/s. Basic frequencies of 4, 12 and 124 kc/s are derived from a 4-kc/s master oscillator and provide respectively 12 channels between 60 and 108 kc/s, 60 channels between 312 and 552 kc/s, and 600 channels between 60 and 2 540 kc/s or 960 channels between 60 and 4 028 kc/s. Pilot signal frequencies are 60, 300 and 2 604 kc/s. Precautions taken against breakdown include triplication of the master-oscillator unit and duplication of the harmonic-generator/filter/amplifier chain; these are interchanged periodically.

621.396.41 : 621.396.97 2023

Multiplex Broadcasting.—E. A. Brettingham-Moore. (*Proc. Instn Radio Engrs, Aust.*, March 1950, Vol. 11, No. 3, pp. 55–62.) The present overcrowding of the 540–1 500-kc/s band in the Sydney area has made it essential to consider the use of new channels. United States experience in the u.h.f. band using pulse-time-division and frequency-division multiplex was reviewed and it was decided that equally good results should be attainable by use of frequency-division multiplex in the 100-Mc/s band. An experimental 2-channel system is described, operating on a main carrier of 91 Mc/s modulated in frequency by two a.m. subcarriers of frequencies 570 and 650 kc/s. The inherent economies of multiplex systems are pointed out.

621.396.619.16 2024

The Use of Modulation Converters in Pulse Multiplex Equipment.—G. Potier. (*Onde élect.*, April 1950, Vol. 30, No. 277, pp. 195–199.) Discussion of the principles of converting one type of pulse modulation to another type, particularly as applied to a p.t.m. transmission system in which p.a.m. is used initially. This reduces the number of valves required and limits the effects of overmodulation. General descriptions are given of a sawtooth waveform generator operating as a converter and a method of receiving p.p.m. signals with equipment designed for p.t.m.

621.396.65 : 621.396.619.16 2025

An Installation for Multiplex Pulse Modulation.—C. J. H. A. Staal. (*Philips tech. Rev.*, Nov. 1949, Vol. 11, No. 5, pp. 133–144.) The requirements which have led to the use of multiplex (time-sharing) p.m. cm-wave equipment in certain radio links for telephone services are discussed. An 8-channel p.t.m. system is described, with detailed discussion of the channel-selection circuits. An original feature of the receiver is the use of a valve with secondary-emission cathode in an anode-follower circuit to convert the received pulse samples of the audio waveform into a stepped replica of the waveform itself.

621.396.65 : 621.397.5 2026

Television Radio-Relay Links.—A. H. Mumford & C. F. Booth. (*P.O. elect. Engrs' J.*, April 1950, Vol. 43, Part 1, pp. 23–35.) A survey of the problems governing the choice of the system to be used in a television relay radio link and a statement of the requirements which have to be met, with brief details of an experimental 200-Mc/s single-frequency link between London and Cardiff and a full description of the London/Birmingham relay system. See also 471 of February.

621.396.712 : 534.86 2027

Audio-Frequency Equipment for Broadcasting Services.—J. E. Telfer. (*Proc. Instn Radio Engrs, Aust.*, May 1950, Vol. 11, No. 5, pp. 107–123.) Studio design is discussed and the special features of suitable equipment are described, including that of typical control rooms. A summary of permissible tolerances in frequency response, distortion, signal/noise ratio, and crosstalk level is given.

621.396.712 : 534.86 2028

Developments in Studio Design.—Beranek. (See 1847.)

SUBSIDIARY APPARATUS

621-526 2029

Analysis of a Sampling Servo Mechanism.—K. S. Miller & R. J. Schwarz. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 290–297.)

621-526 2030

Theory of Nonlinear Servomechanisms.—J. R. Dutilh. (*Radio franç.*, May 1950, No. 5, pp. 1–7.)

621.316.74 2031

A Thermostat Control Unit.—H. A. Vodden. (*J. Soc. chem. Ind., Lond.*, Feb. 1950, Vol. 69, No. 2, pp. 51–52.) A thermistor is used as the sensing element. The output from the thermistor bridge network, after amplification, provides grid-voltage control of the current in a gas-filled triode, the anode circuit of which contains the heating element. Temperature fluctuations are $<0.01°$ in the range 20°–70°C and $<0.025°$ up to 120°C.

621.316.74 : 621.385.38 2032

A Continuously Operating Thyratron Temperature-Control Device.—R. Aumont. (*Rev. gén. Élect.*, April 1950, Vol. 59, No. 4, pp. 175–178.) A bridge circuit is described in which the unbalance voltage produced by the temperature variation is applied, after amplification, to the thyratron grid. Arrangements are provided for ensuring the correct phase relation between this voltage and the invariable component of the grid voltage. The thyratron supply is taken from a separate source, this being important where high power is handled. A large temperature range is covered by simple adjustments.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 : 621.396.65 2033

Television Radio-Relay Links.—Mumford & Booth. (See 2026.)

621.397.5 : 621.396.67 2034

High-Gain and Directional Antennas for Television Broadcasting.—Wolf. (See 1865.)

621.397.5 : 621.317](083.74) 2035

Standards on Television: Methods of Measurement of Television Signal Levels, Resolution, and Timing of Video Switching Systems, 1950.—(*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 551–561.) I.R.E. Standard 23.S1 outlining suitable methods.

621.397.6 2036

Commercial Television at U.H.F.—J. H. Battison. (*Tele-Tech*, March 1950, Vol. 9, No. 3, pp. 48..69.) For an abstract of another account see 1795 of July (Guy, Seibert & Smith).

621.397.6 2037

High-Performance Television Monitors.—J. E. B. Jacob. (*J. Brit. Instn Radio Engrs*, April 1950, Vol. 10, No. 4, pp. 158–175.) A performance specification which should be met by a transmission station vision monitor is outlined. The use of stereographic projection to minimize picture distortion, and of spot wobbling to render the line structure less visible, is recommended. A monitor designed for the B.B.C. and incorporating most of the features discussed is described.

621.397.6 2038

Television Synchronizing Generator.—G. Zaharis. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 92–95.) "Standard synchronizing, blanking, horizontal and vertical driving signals are obtained from a generator based upon binary counters without variable controls. Synchronizing-signal parameters are fixed by circuit configuration rather than by RC or charge-accumulation circuits. Stability is high and independent of power supply regulation." Circuit diagrams of the whole system are included.

621.397.6 **2039**

Synchronization for Colour-Dot Interlace in the R.C.A. Colour-Television System.—(*J. Brit. Instn Radio Engrs*, April 1950, Vol. 10, No. 4, pp. 128–136.) Synchronization problems are discussed and means of obtaining colour-dot interlacing with a simplified receiver construction are outlined. A modification of the horizontal synchronizing pulse is required but this does not affect the operation of monochrome receivers. The necessary alterations to present transmitter equipment are described.

621.397.611.2 **2040**

The Vidicon Photoconductive Camera Tube.—P. K. Weimer, S. V. Forgue & R. R. Goodrich. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 70–73.) 1950 I.R.E. Convention paper. Photoconductive and photoemissive targets for television pickup tubes are compared. A tube one inch in diameter and six inches long, with a photoconductive target, is described and its operating characteristics and sensitivity are given. Simplicity of design, high sensitivity and good resolution make it suitable for industrial applications as well as for broadcasting use.

621.397.611.2 **2041**

Television Camera Tubes.—(*Wireless World*, May 1950, Vol. 56, No. 5, pp. 162–165.) A short illustrated account of the operation of image orthicons and discussion of manufacturing problems.

621.397.611.2 **2042**

The Marconi Mobile Camera Chain.—(*J. Televis. Soc.*, Dec. 1949, Vol. 5, No. 12, pp. 363–366.) The equipment comprises camera, electronic viewfinder, camera control and preview monitor, and regulated power supply. The characteristics of the various units are summarized and a short explanation of the operating principles and construction of the Type-5655 image orthicon is given.

621.397.62 **2043**

Deflector Coil Characteristics.—W. T. Cocking. (*Wireless World*, March–May 1950, Vol. 56, Nos. 3–5, pp. 95–97, 147–151 & 176–179.) A discussion of the performance of the main types, with special reference to their efficiency. The most efficient deflector coil is the one that produces the least external field for a given internal field. For reasonable efficiency an iron circuit is essential: the two basic forms are the iron-ring and the iron-core; a hybrid version in which the iron acts as ring for the line coils and core for the frame coils has also been used. Tables are given showing LI^2, R/L and RI^2 for a number of radar coils and for a set of specially made coils. From comparison of experimental results the iron-ring type with bent-up-end coils is best for both line and frame scan.

621.397.62 **2044**

More about Spot Wobble.—T. C. Nuttall. (*Wireless World*, March 1950, Vol. 56, No. 5, pp. 189–191.) Explanation of the way in which spot-wobble operates and discussion of its application to improve the recording of television pictures on film, to reduce screen-saturation effects in high-power c.r. tubes for large-screen projection, and to remove lininess from large, bright, directly viewed television pictures. See also 1541 of June (Hallows).

621.397.62 : 535.88 **2045**

A 15- by 20-Inch Projection Receiver for the R.C.A. Colour Television System.—(*J. Brit. Instn Radio Engrs*, April 1950, Vol. 10, No. 4, pp. 137–151.) A detailed description is given of an improved receiver in which conventional r.f., i.f., and a.f. circuits are used and a reflector system replaces the refractive system previously used, greater brightness being obtained. Picture reproduction is effected by means of separate green-, red-, and blue-phosphor projection tubes suitably located with respect to a pair of crossed dichroic mirrors, a 45° mirror and a viewing screen. A sampling procedure is used for sequential operation of the three tubes. Detailed circuit diagrams are given.

621.397.62 : 621.396.662 **2046**

Broad-Band Television Tuners.—A. Newton. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 102–106.) An i.f. above 30 Mc/s is chosen, so that the image spectrum falls well outside the television bands; the r.f. stage can then be designed to have a single pass-band wide enough to accept all the television channels and sufficiently selective to reject all image signals. Station selection is accomplished by tuning the local oscillator only, and the i.f. selectivity eliminates adjacent channel interference. Various alternative circuits are compared from the point of view of gain and noise.

621.397.621.2 : 535.371.07] : 535.88 **2047**

The "Double-Layer" Projection Tube Screen for Television.—M. Sadowsky. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 496–498.) 1949 I.R.E. Electronic Conference paper. An account of the development of a screen with good efficiency and little colour shift with change of beam current.

621.397.645 **2048**

Wide-Band Chain Amplifier for TV.—W. V. Tyminski. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, April 1950, Vol. 14, No. 4, pp. 14–16, 29.) A description of an amplifier with a bandwidth of 200 Mc/s, covering all television and f.m. bands and suitable for connecting several receivers to a single aerial system. The amplifier is analogous to a lumped-constant transmission line, of characteristic impedance 180 Ω, in which some components are valves. A gain of 9 db is obtained from an amplifier stage with six valves. Further gain is best obtained by arranging two or more stages in cascade. See also 594 and 595 of February (Kennedy & Rudenberg).

621.397.7 **2049**

Bridgeport U.H.F.-TV Test Results.—R. F. Guy. (*FM-TV*, May 1950, Vol. 10, No. 5, pp. 11–13.) A first report of results obtained in 1 000 hours of operation.

621.397.81 **2050**

WTTG Field-Strength Survey.—R. P. Wakeman. (*Tele-Tech*, March 1950, Vol. 9, No. 3, pp. 27–29, 70.) Continuous field-strength measurements along eight roughly equispaced radials, with the transmitter as centre, show the distribution to be normal for 10 representative distances up to 40 miles. The standard deviation decreases systematically with increase of distance from the transmitter; the Ad Hoc Committee, owing to lack of evidence, assumed no such variation.

621.397.82 : 621.326 **2051**

Interference from Incandescent Lamps.—W. S. Mortley. (*Electronic Engng*, May 1950, Vol. 22, No. 267, p. 206.) Comment on 771 of March (D.G.F.).

621.397.828 **2052**

Some Devices for Reducing the Effects of Fading and Interference: Part 2.—D. McMullan. (*J. Televis. Soc.*, Dec. 1949, Vol. 5, No. 12, pp. 339–348.) Means of reducing the effect of impulsive interference are discussed. These include limiting, 'black spotting' and a scheme in which the scanning spot is maintained at the brightness it had immediately prior to the interference. The circuit of such an interference suppressor interposed between the video amplifier and c.r. tube is given. The effect of fluctuation noise on synchronization and means of improving synchronization are described. The use of a.g.c. to minimize flutter due to aircraft and the use in future of a negative-modulation system are advocated. Part 1: 1278 of May.

621.397.828 : 621.396.61 **2053**

Eliminating TVI in your Ten-Meter Transmitter.—S. Kupferman. (*CQ*, May 1950, Vol. 6, No. 5, pp. 18–21 . . 54.) An account of practical measures taken by an amateur to prevent his set from causing interference in nearby television receivers.

TRANSMISSION

621.396.61 : 621.397.828 **2054**

Eliminating TVI in your Ten-Meter Transmitter.—Kupferman. (*See* 2053.)

VALVES AND THERMIONICS

621.327.43.032.216 **2055**

A Study of Cathode Behavior in Fluorescent Lamps.—E. F. Lowry, E. L. Mager & H. H. Homer. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 355.) Summary of American Physical Society 1950 Annual Meeting paper EP21. Addition of about 5% of ZrO_2 to the usual oxides of a cathode coating increased life by nearly 200% to 7 500 hours rating, and greatly reduced production of spots and rings of discolouration on the tube wall. If ZrO_2 is added in excess, the blackening is greater than when it is not used at all.

621.383 **2056**

Investigations of the Pulse Distribution of an R.C.A. Multiplier Phototube.—R. Westöö & T. Wiedling. (*Ark. Fys.*, 22nd Oct. 1949, Vol. 1, Part 4, No. 10, pp. 269–280. In English.)

621.385 : 621.326.662.6 **2057**

Investigation of Contaminants in Vacuum Tubes.—P. D. Williams. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP7. Mass-spectrometer studies have been made to identify volatile substances released at processing temperatures by glasses, ceramics, and quartz.

621.385 : 621.396.61 **2058**

A Survey of Modern Radio Valves: Part 4—Transmitting Valves for Use up to 30 Mc/s.—K. D. Bomford & A. H. F. Hunt. (*P.O. elect. Engrs' J.*, April 1950, Vol. 43, Part 1, pp. 10–15.) A discussion of design and construction, with particular reference to materials used and means adopted for dissipating heat during operation. Part 3: 1291 of May.

621.385.029.63/.64 **2059**

A Low-Noise Traveling-Wave Tube.—S. W. Harrison. (*Sylvania Technologist*, April 1950, Vol. 3, No. 2, pp. 12–16.) The design described was developed as the result of research on noise reduction. Reconsideration of theory of operation and allowance for both velocity and current fluctuations in the beam entering the helix led to a reduction of helix operating potential and beam current, the electron gun being modified to produce a 'smooth' parallel beam. The operating characteristics are, for a helix potential of 650 V and a beam current of 140 μA: gain 25 db, noise figure 14 db, bandwidth 800 Mc/s centred on 3 000 Mc/s. The method of noise measurement is described in some detail.

621.385.029.63/.64 **2060**

Development of Travelling-Wave Amplifiers with a Helical Coil: General Results.—A. Blanc-Lapierre & M. Kuhner. (*Ann. Télécommun.*, Aug./Sept. 1948, Vol. 3, Nos. 8/9, pp. 259–264.) Relevant problems of electron optics, interaction between field and electron beam, measurement of attenuation and velocity of propagation along the helix, and matching methods, are discussed. Measurements were made on valves with helices of different material and dimensions. Construction of the final type is described in detail; two variants of this were made, (*a*) with a helix of 5.8 mm diameter, of 0.5-mm Armco wire, (*b*) with a helix of smaller diameter. Both operate at 1 500 V, with a bandwidth of the order of 100 Mc/s centred at 3000 Mc/s. For low inputs the gain of (*a*) is 12–15 db, that of (*b*) about 20 db.

621.385.029.63/.64 **2061**

Interaction Phenomena in the Travelling-Wave Valve: Theory and Experimental Verification.—P. Lapostolle. (*Ann. Télécommun.*, Aug./Sept. 1948, Vol. 3, Nos. 8/9, pp. 265–290.) The theory given in the first part takes account of the complete distribution of the e.m. fields in the beam and is applicable to any delay line. It indicates that the gain of the valve increases with current and tends to a limit which is a function of the diameter of the beam and the nature of the line. The essential characteristics of a valve may be predetermined experimentally by measuring the deceleration of the wave produced when the beam is replaced by a dielectric rod; this measurement can be performed in air. Gain and saturation level are calculated. In the second part this theory is applied to the helix type of valve, the helix being replaced by a helically conducting metal cylinder, for which the calculations are simpler. Experimental results are given which confirm the theory in respect of propagation characteristics, gain and power. Characteristic impedance and attenuation are calculated for the helix circuit.

621.385.029.63/.64 **2062**

Experimental Determination of the Characteristics of Travelling-Wave Amplifiers: Results Obtained.—R. Wallauschek. (*Ann. Télécommun.*, Aug./Sept. 1948, Vol. 3, Nos. 8/9, pp. 300–308.) The measurement apparatus, comprising a calibrated generator and 2 wattmeters for input and output power, is described, the coupling arrangements being particularly considered. Measurements were made of the attenuation, gain, output power, etc. of the two valves noted in 2060 above. Limiting power for linear operation was 130 and 60 mW, gain 11.5 and 21 db, noise factor 24 and 25 db respectively.

621.385.029.63/.64 : 621.3.09 **2063**

Experimental Study of the Propagation along a Delay Line in the Form of a Helix.—Jessel & Wallauschek. (*See* 1859.)

621.385.029.63/.64 : 621.396.615.141.2 **2064**

The Magnetron-Type Traveling-Wave Amplifier Tube.—R. R. Warnecke, W. Kleen, A. Lerbs, O. Döhler & H. Huber. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 486–495.) The low efficiency obtainable with travelling-wave amplifiers is due to the fact that only the energy corresponding to the difference between the electron velocity and the wave velocity can be extracted from the beam. This difference is of necessity small. A new valve is described in which a magnetic field constrains a ribbon-shaped electron beam to travel at right angles to a static electric field. A travelling wave on a delay line parallel to the beam bunches the beam in width and extracts energy from it. Measurements on experimental valves of this type substantiate the theory, although the high efficiency and power output possible have not been reached in the early designs.

621.385.032.21 : 621.315.57 : 666.3 **2065**

Ceramic Heaters and Cathodes for Electron Tubes.—T. R. Palumbo. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP27. Preformed rods of a ceramic such as Al_2O_3 are exposed to a hydrocarbon atmosphere, e.g. methane, at 700°–900° C; a ceramic/carbon compound results which is conductive and has a negative temperature coefficient of resistance and high current-carrying capacity; these conductive ceramics are used for valve cathodes or cathode heaters.

621.385.032.212 : 681.142 **2066**

The Dekatron.—R. C. Bacon & J. R. Pollard. (*Electronic Engng*, May 1950, Vol. 22, No. 267, pp. 173–177.) A range of multi-electrode cold-cathode tubes, on octal or miniature bases, has been designed for use in electronic counting and computing machines. The three types at present designed are: (*a*) a scale-of-ten tube on octal base, for direct viewing, (*b*) a miniature scale-of-ten tube on a B7G base for frequency division or gate operation, (*c*) a tube of similar size to that of (*a*), with multiple connections for obtaining any of several scaling factors. The action of these tubes resembles in some respects that of the tube described by Lamb & Brustman (266 of January). A cathode glow discharge on one of a set of interconnected cathodes arranged around a central anode is caused to transfer from one position to the next by the application of controlling pulses to auxiliary intermediate electrodes. The transfer cycle may be clockwise or counter-clockwise at will. Simple circuits for operating the tubes are described. A maximum counting rate of the order of 600 cycles/second is recommended, but greatly increased operating speeds are envisaged.

621.385.032.216 **2067**

The Potential Distribution in Pulsed Oxide-Coated Cathodes and its Consequences for the Velocity Distribution of the Emitted Electrons.—R. Loosjes, H. J. Vink & C. G. J. Jansen. (*J. appl. Phys.*, April 1950, Vol. 21, No. 4, pp. 350–351.) Continuation of investigations noted in 2414 of 1948 and 491 and 1302 of 1950. Electron emission velocity was examined by an e.s. deflection method. The velocities were in most cases more or less concentrated in two or sometimes three groups instead of being continuously distributed. The reason for this is not yet understood.

621.385.032.216 **2068**

The Electronic Temperature of Oxide Cathodes: Methods of Measurement and Results.—R. Champeix. (*Le Vide*, March 1950, Vol. 5, No. 26, pp. 763–768.) The usual method of calculating the electronic temperature T is to make use of the residual-current/voltage curve, the analytical expression of which is an equation analogous to that of Boltzmann. Because of possible errors in the measurements on which this curve is based, the value of T is liable to an error of 5–10%. A more accurate and rapid method is described in which T is deduced from the internal resistance of the diode formed by the cathode and grid or anode, which is measured by connecting the valve in a phase-compensation bridge circuit; possible errors are $< 2\%$. Results show that T is always higher than the thermodynamic temperature and the difference is greater the lower the temperature and the better the cathode is activated. The results are interpreted by assuming a reflection coefficient which is the greater the lower the electron velocity. See also 1303 of May.

621.385.032.216 **2069**

Preparation of Thoria Cathodes by Cataphoresis.—G. Mesnard & R. Uzan. (*Le Vide*, March 1950, Vol. 5, No. 26, pp. 769–776.) A carefully cleaned tungsten wire of diameter 0.15 mm, acting as the cathode of the system, is suspended along the vertical axis of a cylindrical anode of diameter 5 cm immersed in a bath of absolute alcohol with pure thoria in suspension and/or thorium nitrate with a little water. Illustrations are given of the coating on the wire after exposure for different periods in the six baths used and for various currents. Factors affecting the adherence and character of the deposit are discussed.

621.385.032.216 **2070**

An Investigation of Magnesium as an Additive to the Nickel Base of an Oxide Cathode.—R. Forman & G. F. Rouse. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 355.) Summary of American Physical Society 1950 Annual Meeting paper EP18. Techniques for adding Mg to electrolytic Ni were developed and the rate of diffusion of the Mg through the Ni was studied. The thermionic properties of different cathodes were compared in a planar double diode. Under certain conditions cathodes activate more rapidly on a Ni base than on a Mg-Ni base.

621.385.032.216 : 537.533 **2071**

On the Interpretation of Conduction and Thermionic Emission of (Ba-Sr)O Cathodes.—F. K. du Pré, R. A. Hutner & E. S. Rittner. (*Phys. Rev.* 1st June 1950, Vol. 78, No. 5, pp. 567–571.) "A new semiconductor model for (Ba-Sr)O cathodes is proposed comprising a conduction band, donor levels, acceptor levels, and a full band. The combination of this model with the Vink-Loosjes concept of conduction by an electron gas in the pores of the oxide coating appears to explain in a natural way many of the existing experimental facts pertaining to the conductivity and thermionic emission of these cathodes."

621.385.032.216 : [537.582 + 621.3.011.2 **2072**

Thermionic Emission, Conductivity, and Contact Potential Difference Measurements.—W. J. Price. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 354.) Summary of American Physical Society 1950 Annual Meeting paper EP14. Description of a special vacuum tube and method devised for investigating all three properties for the same cathode. Thoria-coated cathodes were studied; conductivity was proportional to thermionic emission over a considerable temperature range and for widely different conditions of activation. The change in work function following activation was found the same by thermionic-emission measurements and by contact-potential measurements.

621.385.032.216 : 537.583 **2073**

Thermionic Properties of Dense Oxide Cathodes.—J. A. Burton, H. E. Kern & R. T. Lynch. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 355.) Summary of American Physical Society 1950 Annual Meeting paper EP20. Variation of thermionic properties with cathode temperature and with anode voltage applied for periods ranging from 1 μs to 1 000 sec was investigated by means of test diodes. Results are compared with those to be expected from an ideal diode of similar geometry under various conditions. For pulses short enough for decay effects to be negligible, the observed slopes of Schottky plots agree closely with those to be expected for a patch-free surface.

621.385.032.216 : 546.74 **2074**

Effects of Controlled Impurities in Nickel Core Metal on Thermionic Emission from Oxide-Coated Cathodes.—H. Jacobs, G. Hees & W. Crossley. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP28. An investigation of the suitability of 18 Ni alloys as cathode bases. The best are Al-Ni, Cr-Ni, Mo-Ni, Th-Ni; the poorest are B-Ni, Be-Ni, Fe-Ni.

621.385.032.216 : [546.841-3 + 546.719 **2075**

Thermionic Emitting Properties of Thoria-Rhenium.—G. A. Espersen. (*J. appl. Phys.*, March 1950, Vol. 21, No. 3, p. 261.) Cathode rods containing equal amounts of thoria and rhenium gave an emission of about 55 mA/cm² at 1 630°K and 1.2 A/cm² at 2 040°K, the corresponding values for a similar thoria/tungsten rod being 0.2 mA/cm² and 0.88 A/cm². After 150 hours test at 2 040°K the amount of material deposited inside the glass envelope was greater for the thoria-tungsten cathodes.

621.385.032.216 : 546.841-3 **2076**

Experimental Use of Thoria Cathodes in High-Voltage Rectifier Tubes.—S. T. Yanagisawa & T. H. Rogers. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP4. The effect on the cathodes of very high back voltage was investigated by incorporating them in h.v. rectifiers for X-ray work. Cathode life, emission efficiency, and the effect of thoria evaporation in particular were examined. The results indicate that thoria cathodes may be used in valves rated up to 110 kV peak.

621.385.032.216 : 546.841-3 **2077**

Base-Metal Effects in Thoria-Coated Filaments.—H. Nelson. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 353.) Summary of American Physical Society 1950 Annual Meeting paper EP5. Factors studied were: adhesion of thoria to the base metals W, Mo, Ta and Pt, ease of activation, and final level of thermionic emission. Pt was best for adhesion but least satisfactory for activation. The final emission level, reached at 1 900°K, was about 5 A/cm² for W, Mo and Ta.

621.385.032.216 : 621.3.011.2 **2078**

Electrical Conductivity of Oxide-Cathode Coatings.—D. A. Wright. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 355.) Summary of American Physical Society 1950 Annual Meeting paper EP16. Conductivity measurements and Hall-effect measurements on activated coatings give results of which the former are and the latter may be in agreement with the Vink-Loosjes theory. P-type conductivity is not found in well activated coatings, but develops when emission is drawn under non-activating conditions; it is due to oxidizable impurities. The importance of surface phenomena is emphasized; these are associated with electron or hole movement rather than ion movement.

621.385.032.216 : 621.385.2 **2079**

Diode Studies of Oxide-Coated Cathodes.—H. E. Kern & R. T. Lynch. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 355.) Summary of American Physical Society 1950 Annual Meeting paper EP19. A description of the Bell Laboratories planar test diode, with a summary of standard procedures for applying and testing cathode coatings.

621.385.032.216 : 621.385.2 : 537.583 **2080**

The Decay and Recovery of the Pulsed Emission of Oxide-Coated Cathodes.—R. M. Matheson & L. S. Nergaard. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, pp. 355–356.) Summary of American Physical Society 1950 Annual Meeting paper EP22. The cathodes were investigated in cylindrical diodes with anode/cathode spacing 0.019 in. Observations of decays are noted. I/V characteristics obtained by use of short sampling pulses are compared with computed ideal characteristics; it is not possible to distinguish definitely between the effects of variation of emission and of internal cathode impedance; further studies on this aspect are in progress.

621.385.032.216 : 621.385.2 : 537.583 **2081**

A 'Figure of Merit' and a 'Quality Ratio' for D.C. Emission from Oxide-Coated Cathodes.—C. D. Richard, Jr. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP25. Tests with oxide-coated cathodes in diodes are considered, where E_f/I_s curves serve as criteria. The 'figure of merit' is the slope of a tangent to the 'knee' of the curve, and the 'quality ratio' is the ratio of figure of merit for the test specimen to that for a control specimen. Correlation with visual comparison of curves and with actual performance is good.

621.385.032.216 : 621.385.2 : 537.583 **2082**

Determination of Oxide-Cathode Performance in Diode Tubes through Figures of Merit.—T. H. Briggs. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP26. The criteria 'figure of merit' and 'quality ratio' proposed by Richard (2081 above) are useful for assessing variation of cathode activity with time and with chemical composition. A relation which may be significant for thermionic-emission theory has been found between the figure of merit and ratings proposed by Cardell and others for low-field and pulsed emission.

621.385.032.216.001.4 **2083**

Life Tests of Oxide-Coated Cathodes — an Engineering Report.—J. O. McNally. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 356.) Summary of American Physical Society 1950 Annual Meeting paper EP23. The development over a period of years of long-life cathodes is described, and the influence of operating temperature and current density is discussed.

621.385.1 : 621.396.822 **2084**

Noise Spectra from Vacuum Tubes at Ultra Low Frequencies.—R. W. Bogle. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 354.) Summary of American Physical Society 1950 Annual Meeting paper EP12. Noise measurements were made on a variety of valves, including both commercial and specially constructed types, and using all the common emitting materials, over the range 0.01–10 000 c/s. Observed results were in disagreement with the requirements of Johnson's flicker-effect theory in that there was no simple inverse proportionality of noise voltage to frequency and no sure evidence of flattening of the curve below a certain frequency point.

621.385.15 **2085**

New Multiplier Phototubes of High Sensitivity.—A. Sommer & W. E. Turk. (*J. sci. Instrum.*, May 1950, Vol. 27, No. 5, pp. 113–117.) High cathode-sensitivity and high multiplication factor are combined with high signal/noise ratio. In one type the photocathode consists of a circular semitransparent deposit about 1 cm diameter in the centre of a flat window. This type of tube is particularly suitable for scintillation counting.

621.385.2 **2086**

Measurements on Total-Emission Conductance at 35-cm and 15-cm Wavelength.—G. Diemer & K. S. Knol. (*Philips Res. Rep.*, Oct. 1949, Vol. 4, No. 5, pp. 321–333.) Results of measurements for a wide range of anode voltages and saturation currents are given. The valve used was an experimental disk-seal diode with a cathode/anode distance of about 15 μ. Values of the electronic capacitance are also given. The experimental results do not at all agree with the linear-field theory proposed by Thomson (3554 of 1948). For the space-charge-limited region the total-emission conductance did not play an important part relative to the conductance due to the transconductance; this may probably be explained by the screening effect of the space charge.

621.385.2 **2087**

Note on Total-Emission Damping and Total-Emission Noise.—A. van der Ziel. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, p. 562.) Expressions are derived for a diode at u.h.f. The result for the damping is the same as that given by Begovich (2959 of 1949) but in a slightly different notation. See also 2098 of 1949 (Freeman).

621.385.2/.3] : 621.315.59 : 546.815.221 **2088**

Crystal Diode and Triode Action in Lead Sulphide.—H. A. Gebbie, P. C. Banbury & C. A. Hogarth. (*Proc. phys. Soc.*, 1st May 1950, Vol. 63, No. 365B, p. 371.) With diode connection, rectification ratios of 2000 : 1 at 1.5 V have been observed, and with triode connection voltage amplification factors up to 25 and power gains of about 4. Other resemblances between the properties of PbS and Ge are mentioned. A full report of the investigations will be published later.

621.385.2 : 621.315.59 **2089**

Magnetically Biased Transistors.—C. B. Brown. (*Phys. Rev.*, 1st Dec. 1949, Vol. 76, No. 11, pp. 1736–1737.) A transverse magnetic field concentrates the hole current near the surface, reducing the average path length and resulting in less phase dispersion. Graphs indicate the improvement of characteristics and show that the upper frequency limit for $\alpha > 1.5$ (α = slope of collector-current/emitter-current curve) increased from 2 Mc/s to 10 Mc/s for a typical unit when a field of 6900 gauss was applied.

621.385.2 : 621.315.59 : 621.314.632 **2090**

D.C. Characteristics of Silicon and Germanium Point-Contact Crystal Rectifiers: Part 1 — Experimental.—H. J. Yearian. (*J. appl. Phys.*, March 1950, Vol. 21, No. 3, pp. 214–221.) Typical d.c. current/voltage characteristics obtained for Si and Ge crystal rectifiers are described. A survey of published theories shows that none of them will account for the principal features of the observed characteristics. An obvious discrepancy occurs in the case of the forward characteristic, where the current rise with increasing voltage is much less than indicated by theory. Conditions which a satisfactory theory must meet are outlined.

621.385.2 : 621.315.59 : 621.314.632 : 537.311.33 **2091**

D.C. Characteristics of Silicon and Germanium Point Contact Crystal Rectifiers: Part 2 — The Multicontact Theory.—Johnson, Smith & Yearian. (*See* 1941.)

621.385.2 : 621.396.822 **2092**

On the Retarding-Field Current in Diodes.—R. Fürth & D. K. C. MacDonald. (*Proc. phys. Soc.*, 1st April 1950, Vol. 63, No. 364B, pp. 300–302.) A development of an earlier theoretical treatment (4088 of 1947) of the space-charge distribution in a cylindrical diode under retarding-field conditions. The views expressed by Bell (2960 of 1949) on the effective cathode temperature in cylindrical diodes are shown to be theoretically unsound and to have been based on operation at a current above the limiting value.

621.385.3 **2093**

New Super-Power Beam Triode provides Output of 500 000 Watts.—(*Broadcast News*, March/April 1950, No. 58, pp. 8–9.) Illustrations and a few details of the R.C.A. Type 5831 transmitting valve. 48 independent triodes are arranged symmetrically within a cylindrical housing, the individual filament and grid rods being tungsten rods 8 in. long supported at both ends in V notches. The construction enables a simple water-cooling system to be used.

621.385.3 **2094**

Microphonism in the Dynamically Operated Planar Triode.—J. A. Wenzel & A. H. Waynick. (*Proc. Inst. Radio Engrs*, May 1950, Vol. 38, No. 5, pp. 524–532.) The effect of sinusoidal transverse oscillation of each electrode on the anode current of a planar triode is discussed theoretically. The case of simultaneous variation of the grid voltage is considered and it is shown that microphonic anode currents result at the sum and difference frequencies of the electrical and mechanical excitations. Experimental verification of the theory and a method of reducing microphony in audio amplifiers are described.

621.385.4.01 **2095**

The Computation of Electrode Systems in which the Grids are Lined Up.—J. L. H. Jonker. (*Philips Res. Rep.*, Oct. 1949, Vol. 4, No. 5, pp. 357–365.) Formulae are developed for the paths of the electrons and the position of the focus in a system of electrodes in which the grids are aligned. These formulae are applied to the calculation of a planar arrangement with prescribed characteristics and with zero screen-grid current when the control grid is at zero potential.

621.396.615.14 **2096**

Technology of Electronic Valves used for U.H.F.—R. Suart. (*Radio franç.*, April 1950, No. 4, pp. 1–9.) Illustrated description of the principles and construction details of the klystron, magnetron and disk-seal triode.

621.396.615.141.2 **2097**

A Toroidal Magnetron.—O. Buneman. (*Proc. phys. Soc.*, 1st April 1950, Vol. 63, No. 364B, pp. 278–288.) The design described, for which the name 'torotron' is proposed, has a ring cathode lying within a concentric toroidal anode having radial resonator slots. The electric field is radial and the magnetic field, which may be produced by a heavy current in the cathode, circles around the cathode. The electrons travel at right angles to these crossed fields, i.e. along the cathode. Theoretical calculations for the static and operating conditions are given and compared with those for a conventional magnetron. It seems likely that the proposed form would operate satisfactorily at high powers with good efficiency and mode stability.

621.396.615.141.2.032.21 : [537.533.8 + 537.581 **2098**

Thermionic and Secondary Emission Properties of Magnetron Cathodes and their Influence on Magnetron Operation.—R. L. Jepsen. (*Phys. Rev.*, 1st May 1950, Vol. 78, No. 3, p. 354.) Summary of American Physical Society 1950 Annual Meeting paper EP11. Magnetrons with secondary-emission cathodes exhibit on the V/I performance chart a 'maximum-current boundary' which can be understood by considering only stable thermionic and secondary-emission properties of the pure metals of which the cathodes are composed. When the current is low, back bombarding power increases rapidly as anode current decreases; the electron interaction causing this is not yet understood.

621.385+621.396.6 **2099**
Fundamentals of Vacuum Tubes. [Book Review]—A. V. Eastman. Publishers: McGraw-Hill Book Co., New York, 3rd edn 1949, 600 pp., $5.50. (*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, p. 450.) "Intended primarily for the use of senior electrical students. . . The main emphasis appears . . . to be directed more particularly to the uses of vacuum tubes than to the physical properties of the tubes themselves . . . The subject of special tubes and circuits for ultra-high-frequency uses has been omitted as demanding either a seriously curtailed treatment or an undesirably long book."

MISCELLANEOUS

519.283 : 658.562 : 621.397.62 **2100**
Quality Control in TV Receiver Production.—L. Lutzker. (*TV Engng, N.Y.*, Feb. 1950, Vol. 1, No. 2, pp. 6–9, 37.) Description of the introduction of a statistical technique and sampling inspection into a particular production line, with a consequent reduction in production costs.

538.56.029.6 **2101**
Technique and Applications of Ultra-Short Waves.—J. Franeau. (*HF, Brussels*, 1949, Nos. 4 & 5, pp. 91–102 & 143–148. In French.)

539 **2102**
Rutherford Memorial Lecture (1948).—E. Marsden. (*Proc. phys. Soc.*, 1st April 1950, Vol. 63, No. 364A, pp. 305–322.) Rutherford's early background and fundamental work on radioactivity and the atom, described by one who studied under him.

621.317.2 **2103**
The 'Laboratoire Central d'Électricité', 1882-1949. The New Laboratory at Fontenay-aux-Roses.—L. Sartre. (*Rev. gén. Élect.*, Jan. 1950, Vol. 59, No. 1, pp. 5–22.) A review of the development of the L.C.É., which in 1942 became the 'Laboratoire central des Industries électriques' and subsequently occupied vast new buildings near Paris. The work undertaken in this new laboratory includes the maintenance of national electrical standards and the calibration and testing of electrical instruments and materials. The installations and test equipment in the different sections are described, with numerous photographs.

621.385.001.4 : 519.283 **2104**
Statistical Evaluation of Life Expectancy of Vacuum Tubes Designed for Long-Life Operation.—E. M. McElwee. (*Sylvania Technologist*, April 1950, Vol. 3, No. 2, pp. 16–20.) Full text of paper noted in 1559 of June (No. 20).

621.392 (Cauer) **2105**
In Memoriam, Wilhelm Cauer.—Nai-Ta Ming. (*Elektrotechnik, Berlin*, May 1948, Vol. 2, No. 5, pp. 158–159.) Short account of Cauer's life and work, with lists of published and unpublished papers.

621.396 **2106**
Radio Progress during 1949.—(*Proc. Inst. Radio Engrs*, April 1950, Vol. 38, No. 4, pp. 358–390.) A comprehensive report, including over 800 references, based on material compiled by the 1949 Annual Review Committee of the Institute of Radio Engineers. The various sections deal with aerials and waveguides, audio techniques, network and circuit theory, electroacoustics, valves and solid-state devices, electronic computers, facsimile, industrial electronics, modulation systems, navigation aids, nuclear science, piezoelectric crystals, radio transmitters, railroad and vehicular communications, receivers, research, sound recording and reproducing, symbols, television systems, video techniques and television, wave propagation.

621.396 **2107**
The Tron Family.—W. C. White. (*Electronics*, May 1950, Vol. 23, No. 5, pp. 112, 114.) An explanatory list of over 200 words ending with 'tron'. For an earlier list see 2302 of 1947.

621.396 : 061.3 **2108**
1950 [Australian] I.R.E. Radio Engineering Convention, Melbourne, May 3rd-6th.—(*Proc. Instn Radio Engrs, Aust.*, May 1950, Vol. 11, No. 5, pp. 124..140.) Summaries are given of 29 technical papers presented at the convention.

621.396.6 **2109**
I.R.E. Convention Exhibits herald New Equipment.—(*Tele-Tech*, March 1950, Vol. 9, No. 3, pp. 32–34.) Illustrated descriptions of new electrical and radio products.

621.3 **2110**
Elektrotechnik des Rundfunktechnikers. Teil 1: Gleichstrom. (Electrotechnics for the Radio Technician. Vol. 1: Direct Current) [Book Review]—J. Kammerloher. Publishers: Deutscher Funk-Verlag. (*Elektrotechnik, Berlin*, Feb. 1950, Vol. 4, No. 2, p. 63.) A recommended book written by a professional teacher, with the minimum amount of higher mathematics. The contents include: fundamental laws of the d.c. circuit in free space; the electric field; the magnetic field; phenomena of extended circuits; recurrent networks.

621.3 **2111**
Lehrbuch der Elektrotechnik. Vol. 1. [Book Review]—G. Oberdorfer. Publishers: Leibnizverlag, Munich, 5th edn, 502 pp. (*Elektrotechnik, Berlin*, Feb. 1950, Vol. 4, No. 2, p. 63.) "Can be well recommended to all earnest students."

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

FIRST GROUP

ACOUSTICS AND AUDIO FREQUENCIES

534.232 2112

The Production of Edge Tones by Circular Gas Jets and Plane Laminae.—H. von Gierke. (*Z. angew. Phys.*, March 1950, Vol. 2, No. 3, pp. 97–106.) An experimental investigation and discussion of the theory of the production of edge tones at a hole or slit in a lamina directly above a jet of gas. Stroboscopic observations of the jets under such conditions indicate that the tones are due to the periodic whirls of the issuing gas. Frequency measurements were made for different lamina spacings and different velocities and diameters of jet. The properties of edge-tone devices as radiators of sound energy are considered.

534.26 + 535.421 2113

The Diffraction of a Plane Wave through a Grating.—Miles. (*See* 2179.)

534.26 2114

On Two Complementary Diffraction Problems.—A. Storruste & H. Wergeland. (*Phys. Rev.*, 1st June 1948, Vol. 73, No. 11, pp. 1397–1398.) Spheroidal coordinates are introduced for obtaining exact solutions for the diffraction of sound waves by a circular disk and by a hole in an infinite plane screen. The electromagnetic case is to be dealt with later.

534.321.9 : 534.133-14 2115

Theoretical and Experimental Investigations of the Oscillations and the Radiation Resistance of an Ultrasonic Quartz Crystal.—G. Bolz. (*Z. angew. Phys.*, March 1950, Vol. 2, No. 3, pp. 119–127.) The differential equations are derived for the 3-dimensional motion of a quartz crystal oscillating in a liquid. An approximate solution is given, assuming plane oscillations, and expressions are derived for radiation resistance, amplitude of oscillations, decrement, and equivalent-circuit values near resonance. The mean value of radiation resistance found by measuring the damping effect on an oscillatory circuit agrees with the theoretical expression. Deviation (generally $<10\%$) of the measured value from the mean is attributed to an unknown form factor, the assumption of plane oscillations being only an approximation to the actual conditions. Values given for equivalent L and C are valid for a crystal oscillating in air or in vacuo.

534.321.9 : [534.373 + 534.22 2116

A New Frequency-Modulation Method for Measuring Ultrasonic Absorption in Liquids.—E. Ribchester. (*Nature, Lond.*, 17th June 1950, Vol. 165, No. 4207, p. 970.) The output from a r.f. oscillator, modulated by a sinusoidal a.f. voltage, is applied to a quartz transducer. The a.f. voltage is also passed through a variable-phase-shift network and modulates a second oscillator on a different radio frequency. The output from this oscillator is injected into a frequency changer together with the signal from the receiving transducer in the liquid cell, and the phase-shift network is adjusted for maximum output from the frequency changer, corresponding to absence of frequency modulation. Results of measurements of absorption in water, using a frequency of 10 Mc/s, are in close agreement with those obtained by pulse techniques.

534.6 : 621.395.632.11 2117

Acoustical Study of Telephone Bells of the French P.T.T. Administration.—In 1325 of June please insert as authors P. Chavasse & R. Lehmann.

534.86 2118

Listeners' Sound-Level Preferences: Part 2.—T. Somerville & S. F. Brownless. (*B.B.C. Quart.*, Spring 1950, Vol. 5, No. 1, pp. 57–64.) A description of tests on listeners' preferences for changes in sound leve between the end of one programme and the beginning of the next. The results are summarized for various programme changes; a reduction of 4–5 db is preferred for speech following music, and an increase of about 2 db for music following speech. Part 1: 1266 of 1949.

621.395.61 + 621.395.623.7] : 597.08 2119

Underwater Sound Technique in the Service of Modern Research.—H. Gemperle. (*Radio Tech., Vienna*, May 1950, Vol. 26, No. 5, pp. 235–239.) Description and theory of pressurized transmitter and microphone units for depths up to 30 m. The frequency range 30 c/s–20 kc/s is covered with good efficiency.

621.395.623.7 2120

Study of Different Acoustic Baffles for Loudspeakers.—T. S. Korn. (*Toute la Radio*, June 1950, Vol. 17, No. 146, pp. 183–186.) Analysis of the general theory of sound radiation from loudspeakers and discussion of different basic types of baffle. The simplest effective construction for even response is the bass reflex baffle consisting of a closed cabinet lined with absorbent material, with an orifice beneath the loudspeaker. The labyrinth-type baffle gives a similar response curve.

621.395.625.3 : 621.3.018.78† **2121**

Overall Frequency Characteristic in Magnetic Recording.—P. E. Axon. (*B.B.C. Quart.*, Spring 1950, Vol. 5, No. 1, pp. 46–53.) Frequency distortion in magnetic recording is discussed and illustrated by calculated and measured characteristic curves. The frequency characteristic of the record on the tape can be determined independently of the reproducing-head characteristic by using a reproducing head with a wide gap. The magnitude of self-demagnetization in commercial tapes can be evaluated by this method, and the results obtained can be used in conjunction with the calculated characteristic of a normal reproducing head to predict the response of magnetic recording equipment.

621.395.665.1 **2122**

The Electrodynamic [volume] Expander.—(*Radio tech. Dig., Édn franç.*, April & June 1950, Vol. 4, Nos. 2 & 3, pp. 116–124 & 177–181.) Based on an article in Italian by Zanarini. The principles of a simple and economical expansion circuit are described in which the moving-coil loudspeaker serves as the expander, the current through the field coil being controlled in accordance with the amplitude of the a.f. signal applied to the moving coil. No distortion is introduced by this method and the amplifier chain needs no modification. The basic circuit consists of a transformer with primary across the moving coil; the output from the secondary is rectified and applied across a parallel RC circuit to the grid and cathode of a pentode which has the field coil in its anode circuit. Developments of the circuit are discussed and practical considerations are summarized.

621.396.645.029.3 **2123**

A.F. Amplifiers.—R. Besson. (*Toute la Radio*, May & June 1950, Vol. 17, Nos. 145 & 146, pp. 167–171 & 187–191, 199.) Three classes of amplifier are considered: (*a*) high-quality; (*b*) a compromise of quality and cost; (*c*) the cheapest with satisfactory performance. Design considerations and details of ancillary circuits are discussed. A 4.5-W and a 10-W amplifier of class (*b*) are treated as examples and simple calculations made to determine their design specifications. Complete circuit diagrams and notes on construction and testing are included.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.317.336 **2124**

Study of the Impedance Irregularities of Coaxial Cables by Oscillographic Observation of Pulse Echoes.—P. Herreng & J. Ville. (*Ann. Télécommun.*, Oct. 1948, Vol. 3, No. 10, pp. 317–331.) See 2162 of 1948 and 142 of 1949 (Couanault & Herreng).

621.392 **2125**

Phase Distortion in Feeders: Effect of Mismatching on Long Lines.—L. Lewin, J. J. Muller & R. Basard. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 143–145.) A fresh approach to the problem of transmitting f.m. signals along feeder lines is made by considering the system as supporting a series of progressive waves of various instantaneous frequencies and reflected within the confines of the feeder. The production of phase distortion and harmonics is analysed and an example of transmission along a waveguide is worked out.

621.392 **2126**

Study of a System of Two Parallel Wires by the Method of Hallén.—V. Belevitch. (*HF, Brussels*, 1950, No. 6, pp. 163–168.) An integral equation, analogous to that of Hallén for an aerial, is established for a bifilar line. The first-approximation solution of this equation corresponds with the results given by the classic theory of transmission lines. The second approximation takes account of end effects and of radiation. The expression obtained for the radiated power coincides with that derived by C. Manneback by another method.

621.392.26† **2127**

The Field Generated by an Arbitrary Current Distribution within a Waveguide.—J. J. Freeman. (*Bur. Stand. J. Res.*, Feb. 1950, Vol. 44, No. 2, pp. 193–198.) Formulae are derived for waveguides of rectangular, circular and coaxial cross-section by extending expressions previously obtained for cavities (2762 of 1948) to the case of infinite length. As a check on the formulae it is shown that the value given for the field from an axially directed dipole within a circular guide reduces to the free-space value when the radius becomes infinite.

621.392.26† **2128**

Reflection Cancellation in Waveguides.—L. Lewin. (*Elect. Commun.*, March 1950, Vol. 27, No. 1, pp. 48–55.) Reprint. See 3037 of 1949.

621.392.26† : 621.396.67 **2129**

Slotted Waveguides and their Applications as Aerials: Part 1.—J. Ortusi & G. Boissinot. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 94–108.) Theory is given based on the elementary concept of the reflection and transmission coefficients of a slot. From consideration of a single slot in (*a*) an infinite conducting plane, (*b*) a waveguide wall, general formulae are derived for the radiation from a waveguide having n equal and equidistant slots. The relations are applied to waveguides with $\lambda/2$ and with $\lambda/4$ spacing of slots, which radiate respectively with constant amplitude and with exponentially decreasing amplitude. Formulae which determine the conditions of use of slotted waveguides and their operating bandwidth are deduced.

621.392.5 **2130**

Note on Artificial Delay Lines.—G. Martin. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1645–1647.) A method of calculation more exact than hitherto used is developed for a line consisting of a helically wound wire on an insulated cylindrical metal core, by considering the planar transformation in which the system is cut lengthwise and opened out. The method applies particularly to the case when the dielectric layer is thin and the pitch of the winding and the core curvature are small, and permits evaluation and correction of nonuniformity effects at the end of the line. Measurements by various methods agree with the calculated results to within a few per cent.

621.396.67 **2131**

The Principle of Conservation of Energy and Kottler's Formulae.—J. Ortusi & J. C. Simon. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 67–73.) Application of Kottler's formulae to the radiation from a waveguide aperture shows that, considering a waveguide of infinite length, the law of energy conservation and Maxwell's equations are satisfied simultaneously only by an existing field. For an arbitrary field to satisfy the energy condition, the reflected wave must be introduced. In a waveguide of rectangular cross-section the reflected wave tends to a zero value as the frequency is increased without limit. A rigorous proof of this is given.

621.396.67 **2132**

An All-Band Mobile Antenna System.—S. S. Perry. (*QST*, June 1950, Vol. 34, No. 6, pp. 16–18.) Details of a combination covering the wavelength range 2–160 m. For wavelengths of 2, 6 and 10 m a $\lambda/4$ whip aerial mounted high on the vehicle is used. For longer waves an aerial centre-loaded with a multitapped coil is substituted. This serves as a $\lambda/4$ aerial for 10.7-m wavelength when all the coil is short-circuited, and resonates at 3.5 Mc/s (85.7 m) when about 160 turns of the coil are in use. For wavelengths up to 160 m a second loading coil is added in series.

621.396.671 **2133**

Indoor Measurement of Microwave Antenna Radiation Patterns by means of a Metal Lens.—G. A. Woonton, R. B. Borts & J. A. Carruthers. (*J. appl. Phys.*, May 1950, Vol. 21, No. 5, pp. 428–430.) Laboratory measurements were made using a metal lens to render the spherical wave-front plane, the method being similar to that used in optical diffraction measurements. Comparison of results with those obtained by standard field methods showed little loss of accuracy for angles between $-15°$ and $+15°$ for horns of aperture width 32 cm, using a lens of aperture 110 cm and a wavelength of 3.2 cm. A stepped lens was found unsatisfactory, probably because of diffraction caused by the steps.

621.396.671 **2134**

Input Impedance of Horizontal Dipole Aerials at Low Heights above the Ground.—R. F. Proctor. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 188–190.) "The large increase in the radiation resistance of a horizontal dipole at low heights above the ground, predicted by the mathematical analysis of Sommerfeld and Renner, is confirmed by actual measurement for the case of an essentially-pure-dielectric ground. Measurements carried out above a series of conducting mats of increasing mesh size corroborate the supposition that the large increase in the radiation resistance at low heights is caused by a corresponding increase in the energy radiated downwards into the dielectric ground."

621.396.671 **2135**

Gain of Aerial Systems.—P. M. Woodward & J. D. Lawson. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 166.) Comment on 3057 of 1949 and 820 of April (Bell).

621.396.671.011.2 **2136**

Mutual Impedance and Self-Impedance of Coupled Parallel Aerials.—B. J. Starkey & E. Fitch. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 129–137.) Existing formulae for the mutual impedance of parallel aerials are approximate or based on simplifying assumptions. To check these formulae, the authors measured the front/back ratios of the radiation patterns of 2-element arrays, confirming and extending the observations of McPetrie & Saxton (1450 of 1946). The use of 'intrinsic impedance', based on a simple transmission-line calculation, for the self-impedance of each aerial resulted in poor agreement between theory and observation. By introducing resistive losses and end-capacitance in the lines, quite good agreement was obtained.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.011.2 [negative] **2137**

Negative-Resistance Characteristics.—A. W. Keen. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 175–179). Negative-resistance characteristics as encountered in practice are qualitatively surveyed, and the distinction between the characteristics resulting respectively from voltage and current control of feedback is emphasized. A method of building up a particular characteristic by synthesis of positive and negative elements is described, the basic positive element being represented very closely by the characteristic of a hard diode. The concept of a 'negative diode' is introduced, and an equivalent circuit composed of positive and negative diodes is shown for a triode and discussed also for a tetrode.

621.314.2 : 621.396.645.2 **2138**

Bifilar I.F. Coils.—S. R. Scheiner. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 104–107.) The use of transformers with the two coils wound together for coupling the various stages of stagger-tuned i.f. amplifiers renders coupling capacitors unnecessary. The low time constant of the grid circuit gives improved signal/noise ratio and the r.f. choke normally used to feed the anode of the final i.f. valve can be omitted. Detailed analysis of circuits including bifilar transformers is presented and their advantages and limitations are discussed.

621.314.3† **2139**

Magnetic Amplifiers of the Balance-Detector Type.—W. A. Geyger. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, p. 459.) Summary of 1950 A.I.E.E. Winter General Meeting paper.

621.316.726.078.3 : 538.569.4.029.64 **2140**

Servo Theory applied to Frequency Stabilization with Spectral Lines.—W. D. Hershberger & L. E. Norton. (*J. Franklin Inst.*, May 1950, Vol. 249, No. 5, pp. 359–366.) Comparison between the frequency of a gas-absorption line and the frequency to be stabilized, or a frequency simply related to it, is made by a sweep-oscillator technique. A pulse is generated each time the resonance frequency is passed through. The resulting voltages are applied to a suitable discriminator, the output from which is fed to a servo system controlling the frequency. The limitations and performance of the circuits involved are discussed. A long-term frequency stability within 1 part in 10^7 has been realized.

621.316.8 : 621.396.822 **2141**

Noise in Current-Carrying Ohmic Conductors.—B. Meltzer. (*Phil. Mag.*, April 1950, Vol. 41, No. 315, pp. 393–398.) The mean-square noise current in a conductor which is in temperature equilibrium, and carries a current I, is calculated on the assumption that the current is due to elementary carriers of charge e. The value obtained for the spectral density is $\{(2kT/R) + [(2kT/R)^2 + (2eI)^2]^{\frac{1}{2}}\}$ where R, T, k are respectively resistance, absolute temperature and Boltzmann's constant. The interpretation of this result is that, over and above the ordinary thermal Nyquist noise, there is present an additional noise, of which the spectral density varies in square-law fashion according to $(e^2R/kT)I^2$ for small values of I, and in linear fashion according to $\{(-2kT/R) + 2eI\}$ for large values of I. These predictions are compared with Bernamont's experimental results for thin metallic conductors, and the discrepancies are discussed.

621.316.86 **2142**

Thermistors: Part 1. Static Characteristics.—O. J. M. Smith. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 344–350.) "The fundamental thermistor equations are presented as functions only of electrical quantities and constants, and independent of temperature measurements. The universal curves allow one to predict the static characteristics of thermistors as circuit elements. The two most significant characteristics are the power coefficient of resistance, and the negative incremental resistance. These can be computed, or read from the universal curves, if the resistance and four parametric constants are known. These five values can be determined from six convenient measurements: the resistance and change of resistance with current at very low current, at the maximum voltage point, and at maximum current." Part 2: 2143 below.

621.316.86 **2143**

Thermistors: Part 2. Dynamic Characteristics.—O. J. M. Smith. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 351–356.) The thermistor sinusoidal and transient response characteristics are presented as functions of the dissipation constant and incremental resistance. Equations are given for time constant, critical frequency, equivalent inductance, and Q. The construction of a low-frequency oscillator is discussed, as well as possible nonlinear-filter applications. Part 1: 2142 above.

621.318.572 **2144**

Decade Pulse Counter for Geiger-Müller Tubes.—B. Åström. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 323–326.) Full circuit details of a counter with the following features:—direct indication; easily reset to zero; all resistors and capacitors with 10% tolerances; very reliable and insensitive to power-line fluctuations; highly sensitive; components easily accessible; h.v. supply for G-M tube capable of supplying enough current for a quenching circuit of the Neher-Pickering type.

621.318.572 **2145**

Pentode Counting or Control Ring.—B. L. Moore. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 337–338.) Ten pentodes, Type 6AS6, are used in a very stable counting or control ring whose operation is essentially independent of the amplitude, wave shape, and repetition rate of the incoming pulses, and which does not require careful selection of valves.

621.392 **2146**

A Useful Network Procedure.—S. C. Dunn. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 171–175.) The method establishes a relation between the parallel and the star connection of quadripoles. Any number of networks in parallel, with common generator and load, can be replaced by a set in star connection, having a common central load, but each having an independent generator. The method is applied to study the steady-state and transient responses of a parallel-T RC network. The use of the method for obtaining the input impedance of multichannel networks is demonstrated, and an example is given of a prism-like system of resistor wires which may be reduced to a network of the separate-generator type.

621.392.4 **2147**

Transformation of a Lumped-Constant Two-Pole Network to a Dissipative Transmission Line.—A. Millán. (*Rev. Telecomunicación, Madrid*, March 1949, Vol. 4, No. 15, pp. 2–14.) The short-circuited dissipative transmission line whose admittance simulates, over a particular frequency band, the input admittance of a given lumped-parameter circuit, is determined by developing the appropriate irrational function in terms of Mittag-Leffler partial fractions. The graph of the resultant approximately rational function is compared with that of the rational function for the given network, and the transmission-line parameters deduced. Alternatively the lumped-parameter circuit is simulated by a lossless line terminated by a dissipative rod. An illustrative example is calculated.

621.392.43 **2148**

Matching of Amplifiers and Centimetre-Wave Auto-oscillators over a Wide Band of Frequencies.—M. Denis. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 74–88; *Onde élect.*, June 1950, Vol. 30, No. 279, pp. 271–284.) Typical examples are given of maximum amplifier efficiency and minimum distortion occurring at different frequencies. The advantages of ideal matching in this sense are discussed with particular reference to the klystron amplifier. Matching circuits are described which are derived from band-pass filters or from natural or artificial delay lines. The phase-changing element necessary for an asymmetrical quadripole matching device is analogous to the circuits used in the microwave field. The extension of these principles to self-oscillators and amplifier chains is discussed, the resulting improvement in efficiency and reduction of the number of stages making the sacrifice of simplicity worth while.

621.392.43 **2149**

Method of Matching a Feeder Line for a Given Frequency.—J. Paris. (*Radio franç.*, June 1950, No. 6, pp. 4–8.) Formulae are derived for finding the positions of the Sterba clip and its short-circuiting link for matching a 2-wire feeder of negligible loss to an aerial or other terminating load. The use of the Sterba diagram and of a cartesian diagram is illustrated by numerical examples.

621.392.43 **2150**

Graphical Methods for Impedance Matching.—A. F. Huerta. (*Rev. Telecomunicación, Madrid*, March 1949, Vol. 4, No. 15, pp. 15–22.) With special reference to stub matching.

621.392.5 **2151**

A Graphical Approach to the Synthesis of General Insertion Attenuation Functions.—J. M. Linke. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 179–187.) An investigation of methods of constructing the insertion transfer function of a network as a rational function meeting prescribed requirements. The insertion modulus function has been determined approximately by earlier methods of limited usefulness. A new semi-graphical method is described, using template curves on log-log paper. These are selected to fit the required zeros and poles of the numerator and denominator polynomials and are added graphically to give the approximate attenuation curve shape. The method is unsuitable for networks having sharp cut-off regions.

621.392.5 : 621.315.212 : 621.397.743 **2152**

Equalization of Coaxial Lines.—K. E. Gould. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, p. 390.) Summary of 1949 A.I.E.E. Fall General Meeting paper. Arrangements used for television service are discussed; the measured gain and delay-distortion characteristics for the Washington/Chicago circuit are shown graphically.

621.392.52 **2153**

Design of Dissipative Band-Pass Filters producing Desired Exact Amplitude-Frequency Characteristics.—M. Dishal. (*Elect. Commun.*, March 1950, Vol. 27, No. 1, pp. 56–81.) Reprint. See 3369 of 1949.

621.392.52 **2154**

Calculation of Transients in Electrical Filters.—T. Laurent. (*Rev. Telecomunicación, Madrid*, Dec. 1948, Vol. 4, No. 14, pp. 17–28.) Application of the frequency-transformation method noted in 1339 of 1938 to obtain expressions for transients in low-pass and band-pass filters. Translated from *Tekniska Meddelander från Kungl. Telegrafstyrelsen*, No. 2, Aug. 1947.

621.392.52 : 539.2 **2155**

Physical Basis of the Wave Filter.—Salpeter. (*See* 2197.)

621.392.52 : 621.397.82 **2156**

The Latest Techniques for the Elimination of Ham TVI.—P. S. Rand. (*CQ*, June 1950, Vol. 6, No. 6, pp. 9–12..61.) Description of the construction and correct method of fitting low-pass filters in aerial leads for harmonic suppression, together with methods of interference suppression for ignition systems.

621.395.665.1 **2157**

The Electrodynamic [Volume] Expander.—(*See* 2122.)

621.395+621.396].813
621.3.018.78† **2158**

Distortion.—Please note that, in this and subsequent issues, the U.D.C. number used will be 621.3.018.78† instead of 621.395.813 and 621.396.813 used hitherto.

621.396.6 : 061.4 **2159**

Trends in Components.—(*Wireless World*, June 1950, Vol. 56, No. 6, pp. 229–235.) Short account of selected exhibits at the private exhibition organized by the Radio and Electronic Component Manufacturers' Federation and held in London 17th–19th April 1950. A list of the names and addresses of exhibitors is appended.

621.396.611.1 : 517.942.932 **2160**
Relaxation Oscillations.—LaSalle. (*See* 2261.)

621.396.611.21 **2161**
Loading Quartz Crystals to Improve Performance.—(*Tech. Bull. nat. Bur. Stand.*, May 1950, Vol. 34, No. 5, pp. 59–62.) Experimental investigation by L. T. Sogn. Examination by means of a probe electrode of the frequency and activity distribution at the surface of a crystal plate led to the detection of differences in thickness of $< 20\ \mu$. Variations in surface activity and frequency for various plates, loaded and unloaded, and during temperature runs from −60°C to +90°C are described. In many cases loading has proved very beneficial.

621.396.611.21.012.8 **2162**
X-Cut Quartz Crystal.—F. M. Leslie. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 180–181.) "A new equivalent circuit for a crystal driving a mechanical load is devised in terms of an electrical transmission line instead of the usual lumped components of inductance and capacitance."

621.396.615.11 **2163**
The Calculation of RC Oscillators.—G. Isay. (*Bull. schweiz. elektrotech. Ver.*, 6th Aug. 1949, Vol. 40, No. 16, pp. 509–517. In German.) The basic design principles of RC oscillators are outlined and illustrated by an example in which the calculation for a negative-feedback amplifier is based on that for two simple amplifier stages with negative current feedback, the first stage having a relatively low value of cathode resistance so that feedback to the second stage is reduced. The sharp resonance of the amplifier using a Wien-bridge type of feedback circuit, and two methods of amplitude limiting by means of thermistors, are discussed. Phase-shift oscillators are briefly considered, with particular application to the design of a 3-phase generator.

621.396.615.142.2.018.424† **2164**
A Wide Range 600-7 000 Mc/s Local Oscillator.—P. Janis. (*Tele-Tech*, April 1950, Vol. 9, No. 4, pp. 22–24.) The frequency range 600–7 000 Mc/s is covered on c.w. by two reflex klystrons, Types 6BL6 and 6BM6 used in conjunction with an adjustable cavity resonator consisting of a short-circuited coaxial line. Design and construction details are given. For pulsed outputs, Types S.D.-1103 and S.D.-1104 reflex klystrons have been developed; these have similar operating characteristics to the c.w. valves, but have a low-voltage control electrode for taking the input pulses.

621.396.615.17/.18 **2165**
A Tuned Plate Multivibrator.—A. E. Johanson. (*Bell Lab. Rec.*, May 1950, Vol. 28, No. 5, pp. 208–212.) The difficulty of obtaining short-duration pulses with the conventional multivibrator circuit is overcome by replacing the anode resistors by parallel combinations of varistor rectifiers and tuned circuits, whose resonance frequency then controls the timing. Pulses of duration estimated at 0.02 μs have been produced. A further modification is described for frequency division at high frequencies, e.g., from 18.432 Mc/s to 8 kc/s in four steps.

621.396.615.18 **2166**
Frequency Division with Phase-Shift Oscillators.—C. R. Schmidt. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 111–113.) Divisions by factors as high as 7 are easily obtainable by means of single-valve RC oscillators using standard components requiring only initial adjustment. Dividers operating from crystal- or tuning-fork-controlled oscillators have been constructed to give accurate 60-c/s outputs. Divisions by 5, 6 and 7 were used in these designs, the locking range for these factors being adequate to ensure reliable operation. Initial adjustment of single-stage scale-of-ten circuits requires more care because of the restricted locking range.

621.396.619.23 **2167**
Non-Linear Distortion in a Cowan Modulator.—V. Belevitch. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 164–165.) Author's reply to 1552 of June (Tucker & Jeynes).

621.396.645 **2168**
A New Amplifier, the "Cathode Repeater".—V. J. Cooper. (*Marconi Rev.*, 1950, Vol. 13, No. 97, pp. 72–80.) The use of a triode with the cathode as the signal input terminal has certain advantages for wide-band amplifiers. Under different conditions its input impedance may be purely resistive or may have a positive or negative susceptance. The circuit described can amplify from a low-impedance input into a low-impedance output, with considerable control of the values of input and output impedance.

621.396.645 **2169**
Differential Amplifiers.—D. L. Johnston. (*Wireless Engr*, June 1950, Vol. 27, No. 321, p. 194.) Comment on 1636 of July (Parnum).

621.396.645 **2170**
Amplifier with Negative-Resistance Load.—D. M. Tombs & M. F. McKenna. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 189–193.) Stage gains up to 2.5μ (where μ is the valve amplification factor) have been obtained with a triode amplifier loaded with a negative-resistance element. The restrictions imposed on the operation of this type of amplifier by considerations of stability, and the limitation of the gain due to the capacitance of the load are discussed.

621.396.645 + 621.396.621] : 621.385 **2171**
Electronic Valves: Books II-IV. [Book Review]—(*See* 2388.)

621.396.645 : 621.3.015.3].012 **2172**
Transient Response Calculation.—J. E. Flood. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 182–188.) The response of various types of n-stage amplifier circuits may be expressed in terms of the Poisson exponential probability summation. Values of this function are already available in tables and charts. Examples are given of its use in analysis of single-stage amplifiers with resistance or LC coupling, and of multi-stage amplifiers with RC or filter coupling or with critically damped inductance compensation.

621.396.645.018.424† **2173**
Stagger Gain Calculator.—E. R. Jenkins. (*Tele-Tech*, April 1950, Vol. 9, No. 4, p. 29.) Graphs are presented for determining the optimum number of stages required in a wide-band amplifier of specified characteristics.

621.396.645.35 **2174**
A D.C. Amplifier for Biological Application.—P. O. Bishop & E. J. Harris. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 366–377.) A four-channel high-gain direct-coupled amplifier is described, with an input impedance $>$100 MΩ at 10 kc/s. The frequency response is flat from zero to over 10 kc/s. Alternative capacitor coupling is provided so that large-amplitude very-low-frequency noise may be eliminated. When direct coupled the zero shift is of the order of 100 μV peak to peak over a period of 30 minutes.

621.396.645.37 : 621-526 **2175**
Feedback Amplifiers and Servo Systems.—E. E. Ward. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 146–153.) The pattern of poles and zeros of the response function is considered as a basis for classifying and studying these

devices; this avoids discrimination between the frequency and transient responses, and the Laplace transform is used to develop a broad theory which includes both as special cases. The analysis is restricted to linear systems having lumped constants and one closed loop. A tentative classification of response functions on this basis is tabulated.

621.396.645.371 **2176**

Some Considerations in the Design of Negative-Feedback Amplifiers.—W. T. Duerdoth. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 138–155. Discussion, pp. 155–158.) "A brief survey is made of the application of a phase-amplitude theorem, due to Bode, to the design of feedback amplifiers with constant-phase margins, and a graphical method of estimating the phase change at any frequency from a knowledge of the amplitude characteristic is described. The use of constant-phase margin as a design criterion is criticized, and justification is given for a new criterion termed 'stability margin'. Using this criterion, a technique is developed for employing several feedback paths, thus enabling an increased amount of feedback to be connected to circuits of increased complexity. A brief account of a miniature audio amplifier with two feedback paths is included, and a 100-watt amplifier covering 300 c/s–108 kc/s with some 35 db of feedback is described which, although it is 'conditionally' stable, is suitable for use in a multichannel telephony system."

621.392.52 **2177**

An Introduction to the Theory and Design of Electric Wave Filters. [Book Review]—F. Scowen. Publishers: Chapman & Hall, London, 2nd edn 1950, 188 pp., 18s. (*J. Brit. Instn Radio Engrs*, May 1950, Vol. 10, No. 5, p. vi.) First published in 1945, this book "has already established itself as a work of major importance" in its field. A new section now added describes Darlington's insertion-loss method of filter design.

GENERAL PHYSICS

53 **2178**

Heaviside's Unpublished Notes.—(*Electrician*, 26th May 1950, Vol. 144, No. 3754, p. 1749.) Report of a paper 'Some Unpublished Notes of Oliver Heaviside', by H. J. Josephs, given at one of the I.E.E. Heaviside Centenary Commemorative Meetings, May 1950. The documents in the possession of the I.E.E. show that the fourth volume of 'Electromagnetic Theory' was to contain an account of his ideas concerning the transformation of matter and energy on the atomic scale, together with his integration of the electrodynamics of Clerk Maxwell with the thermodynamics of Willard Gibbs. He extended his conception of 'energy-tubes' to include their condensation into electronic particles. Other notes deal with the particle-like structure of electromagnetic pulses and the correlation of electromagnetism with gravitation.

534.26 + 535.421 **2179**

The Diffraction of a Plane Wave through a Grating.—J. W. Miles. (*Quart. appl. Math.*, April 1949, Vol. 7, No. 1, pp. 45–64.) The problem of diffraction and scattering of a normally incident plane wave of sound by an infinite plane grating consisting of infinitely thin, coplanar, equally spaced strips with parallel edges is solved. The solution is extended to deal with e.m. waves incident on a grating, the elements of which are perfectly conducting at r.f. or perfectly reflecting at optical frequencies. The case when the screen elements are of finite thickness t is also considered and an approximate solution is obtained including only first-order terms in t/λ.

[534.26 + 535.42] : 517.564.4 **2180**

The Oblate Spheroidal Wave Functions.—Leitner & Spence. (*See* 2259.)

535.37 : 548.0 **2181**

On the Mechanism of Phosphorescence in Crystals.—D. Curie. (*J. Phys. Radium*, April 1950, Vol. 11, No. 4 pp. 179–185.) Study of the decay of phosphorescence of long persistence. If the return of electrons to the emission centres is bimolecular, their recapture is favoured and the decay of phosphorescence is retarded. In certain cases, however, the general law of decay still holds.

535.42 **2182**

Diffraction at a Circular Disk.—W. Braunbek. (*Z. Phys.*, 17th March 1950, Vol. 127, No. 4, pp. 405–415.) The method previously described (2183 below) is applied to the case of a circular disk and to related problems. For the near field at points on the axis a very simple expression is obtained, which agrees with the rigorous solution better than the Kirchhoff approximation. Simple formulae are also derived for the distant field. For the transmission coefficient, on account of mathematical difficulties, no improvement on the Kirchhoff approximation is obtained.

535.42 **2183**

New Approximation Method for Diffraction at a Plane Screen.—W. Braunbek. (*Z. Phys.*, 17th March 1950, Vol. 127, No. 4, pp. 381–390.) Various approximation methods for diffraction of a scalar wave have been proposed, but none give accurate results for small wavelengths (large ka), since their series converge very slowly when ka is large, a being a linear dimension of the disk or aperture and k the coefficient in the scalar wave equation $\Delta u + k^2 u = 0$. A new approximation method has been developed specially for the case where $ka \gg 1$. Numerical comparison with the rigorous solution for a particular case shows that the new method gives considerably better results than the Kirchhoff approximation down to $ka \approx 1$.

535.42 : 538.56 **2184**

A More Exact Fresnel-Field Diffraction Relation.—G. A. Woonton. (*Canad. J. Res.*, March 1950, Vol. 28, Sec. A, No. 2, pp. 120–126.) The field close to a radiating aperture is often of interest in radio-optical measurements, but the usual approximations in the Fresnel-field evaluation are generally invalid in this region. The distant field is given with good accuracy by the Fraunhofer relation, and from it the near Fresnel field is obtained by the Fourier-transform method. The analysis applies to rectangular apertures for which the field distribution can be expressed as the product of separate distributions in the two directions. The result is an integral which has not been evaluated in closed form, but which reduces to Fresnel's integral when the appropriate approximations are made.

535.42 : 538.56 **2185**

On the Diffraction of an Electromagnetic Wave through a Plane Screen.—J. W. Miles. (*J. appl. Phys.*, May 1950, Vol. 21, No. 5, p. 468.) Corrections to paper abstracted in 202 of January.

537.217 **2186**

Vibration Pressure Hypothesis for Electric Repulsion.—H. B. Dwight. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, pp. 397–398.) Similarity between the equation for the net repulsion between moving charges and the equation for the pressure exerted on one moving body by sound emitted from another is adduced in support of Mackaye's theory that e.s. repulsion is a manifestation of radiation pressure.

537.224 **2187**
Electrets.—W. F. G. Swann. (*Phys. Rev.*, 15th June 1950, Vol. 78, No. 6, p. 811.) An expression is derived for the potential of an electret assuming that it consists of (*a*) a distribution of semipermanent polarization which decays with time, (*b*) a distribution of surface and volume charge which leaks away and has no relation to the decay of the polarization. Complete mathematical details will be published later.

537.226 **2188**
The Lorentz Correction in Barium Titanate.—J. C. Slater. (*Phys. Rev.*, 15th June 1950, Vol. 78, No. 6, pp. 748–761.) It is assumed that the ferroelectric behaviour of $BaTiO_3$ arises because the Lorentz correction leads to a vanishing term in the denominator of the expression for the dielectric constant. The Lorentz correction is computed for the actual crystal structure and it is found that the local field near the Ti ion is much greater than previously believed, so that even a small ionic polarization of the Ti ions will lead to ferroelectric effects.

537.311.3 **2189**
The Electrical Conductivity of Thin Wires.—R. B. Dingle. (*Proc. roy. Soc. A*, 23rd May 1950, Vol. 201, No. 1067, pp. 545–560.) Simple approximate methods are first given for evaluating the conductivity of films and wires of a size comparable with the mean free path of the conduction electrons. Rigorous theory for a thin wire is then developed to cover both inelastic and elastic collisions of the electrons at the metal surface. Finally Andrew's recent experimental results for a thin mercury wire are fitted to the theoretical curves obtained, and the mean free path evaluated.

537.311.5 : 621.396.671 **2190**
Currents on the Surface of an Infinite Cylinder excited by an Axial Slot.—C. H. Papas & R. King. (*Quart. appl. Math.*, July 1949, Vol. 7, No. 2, pp. 175–182.) "The distribution of surface-current density is determined on an axially infinite, perfectly conducting cylinder. A constant distribution of electric field across a narrow axial slot is assumed given."

537.525.029.6 **2191**
Electron Diffusion in a Spherical Cavity.—A. D. MacDonald & S. C. Brown. (*Canad. J. Res.*, March 1950, Vol. 28, Sec. A, No. 2, pp. 168–174.) The diffusion equation for electrons in a nonuniform field is solved in terms of the confluent hypergeometric function, and the condition for breakdown is derived. Measurements of breakdown fields for uniform electric fields enable the effective characteristic diffusion length to be found. Hence theoretical breakdown curves for nonuniform fields are predicted; these are in agreement with experimental results.

537.562 : 538.561 **2192**
Radio Emission of Purely Thermal Origin in Ionized Media.—J. F. Denisse. (*J. Phys. Radium*, April 1950, Vol. 11, No. 4, pp. 164–171.) Radiation due to 'hyperbolic' transitions similar to those occurring in the X-ray and γ-ray bands is studied theoretically by an analysis simplified from that of Kramers. By combining classical and quantum theory, a general expression is obtained for the radiation coefficient which is valid in all cases. The corresponding absorption calculated by application of Kirchhoff's theorem agrees with the value obtained from Lorentz's formula, and hence the influence of the refractive index of the medium on the radiations can be studied. Gyromagnetic radiation is briefly discussed.

537.71 **2193**
The M.K.S. or Giorgi System of Units.—L. H. A. Carr. (*Beama J.*, April & May 1950, Vol. 57, Nos. 154 & 155, pp. 101–106 & 145–147.) A paper given at the I.E.E., in March 1950, putting the case for the adoption of this system. Rationalization is discussed as a separate subject in an appendix.

538.3 **2194**
Electromagnetic Theory.—(*Electrician*, 26th May 1950, Vol. 144, No. 3754, p. 1750.) Report of a paper 'An Appreciation of Heaviside's Contribution to Electromagnetic Theory', by W. Jackson, given at one of the I.E.E. Heaviside Centenary Commemorative Meetings, May 1950. Heaviside's development of a comprehensive theory of line transmission is not easy to discern from his published work, partly because of repetitions and partly on account of the style, though many of his writings are very clear and the chapter on e.m. waves in Vol. 1 of 'Electromagnetic Theory' is probably the best physical discussion of e.m. wave propagation along telephone lines yet written. Recognition is given to his work in interpreting and extending Maxwell's theory. A partial treatment (published in 1888) of E_{01}-mode propagation within a cylindrical conducting tube is also noted.

539.172.4 : 537.311.33 **2195**
Transmutation-Produced Germanium Semiconductors.—J. W. Cleland, K. Lark-Horovitz & J. C. Pigg. (*Phys. Rev.*, 15th June 1950, Vol. 78, No. 6, pp. 814–815.) Ge exposed to neutron bombardment becomes a P-type semiconductor due to lattice displacements and to transmutations. The former can be removed by heat treatment and good agreement is then observed for the number of carriers per cm^3 as calculated from cross-sections and as measured by the Hall effect.

539.172.4 : 537.311.33 **2196**
Fast Neutron Bombardment Effects in Germanium.—J. H. Crawford, Jr, & K. Lark-Horovitz. (*Phys. Rev.*, 15th June 1950, Vol. 78, No. 6, pp. 815–816.)

539.2 : 621.392.52 **2197**
Physical Basis of the Wave Filter.—J. L. Salpeter. (*Philips tech. Commun., Aust.*, 1950, No. 1, pp. 3–10.) A simple explanation is given of the action of periodic lumped-reactance filters, and the analogy with the behaviour of a row of particles such as atoms in a crystal lattice when irradiated by X rays is demonstrated, the existence of cut-off frequency and stop- or pass-bands being due to the structural discontinuity in both cases. A brief discussion of the 'zone' theory of solids is included. The exponential electrical line is an instance where the existence of a cut-off frequency is not an indication of discontinuous structure.

501 : 512.9 **2198**
Calcolo Tensoriale e Applicazioni. [Book Review]—Finzi & Pastori. (*See* 2268.)

537.226 **2199**
Time Dependence of Electronic Processes in Dielectrics. Technical Report Reference L/T219. [Book Review]—H. Fröhlich & J. O'Dwyer. Publishers: British Electrical and Allied Industries Research Association, London, 1949 8 pp., 4s. 6d. (*Beama J.*, May 1950, Vol. 57, No. 155, p. 151.)

537.71 **2200**
The M.K.S. System of Electrical and Magnetic Units. British Standard No. 1637. [Book Review]—Publishers: British Standards Institution, London, 1950, 8 pp., 2s. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 167–168.) A summarized record of decisions taken by the International Electrotechnical Commission, expressing no opinions either for or against the system. The question of rationalization is not discussed.

538.1 2201

Die Maxwellsche Theorie in Veränderter Formulierung. [Book Review]—L. Kneissler. Publishers: Springer Verlag, Vienna, 51 pp. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 167.) A suggested modification of Maxwell's theory. "By eliminating magnetism and replacing it by the currents that produce it within the material . . . Maxwell's theory is brought into agreement with the electron theory in its macroscopic form." The book is a development of articles published in *Archiv für Elektrotechnik* in 1940–1942.

538.1 2202

Magnetism. [Book Review]—D. Shoenberg. Publishers: Sigma Books, London, 1949, 216 pp., 10s. 6d. (*Nature, Lond.*, 1st July 1950, Vol. 166, No. 4209, p. 5.) "None of the essential theory of elementary magnetism is omitted, but it appears in a guise less formidable and more convincing than usual." "The book is of a more advanced character than most of the Sigma series and it should be useful to the serious student as well as to the general reader."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 2203

A 4-Dimensional Generalization of Wilson's Hypothesis.—A. Papapetrou. (*Phil. Mag.*, April 1950, Vol. 41, No. 315, pp. 399–404.) "Wilson's hypothesis of electric currents accompanying the rotation of electrically neutral matter (in order to explain the origin of the geomagnetic field) is generalized in a 4-dimensional language. The main consequences of the generalized formulation are discussed."

521.15 : 538.12 2204

Magnetism and the Rotation of Celestial Bodies.—A. E. Benfield. (*Nature, Lond.*, 1st July 1950, Vol. 166, No. 4209, p. 31.) The difference between (*a*) the predictions based on Fermi-Dirac statistics and (*b*) the requirements of the charge-separation theory of Berlage (1139 of May) is so great that it is hard to see how terrestrial magnetism can be due to this effect to any appreciable extent.

521.15 : 538.12 2205

The External Gravitational and Electromagnetic Fields of Rotating Bodies.—G. L. Clark. (*Proc. roy. Soc. A*, 23rd May 1950, Vol. 201, No. 1067, pp. 488–509.) An electromagnetic field of the form proposed by Blackett is shown to be possible, but the analysis does not rule out the possibility that alternative fields may also satisfy the conditions.

523.74 2206

A Particularly Intense Solar Flare.—R. Müller. (*Naturwissenschaften*, March 1950, Vol. 37, No. 6, p. 137.) Details of observations at Wendelstein Observatory on 19th November 1949.

523.746 2207

Origin of Sunspots.—D. H. Menzel. (*Nature, Lond.*, 1st July 1950, Vol. 166, No. 4209, pp. 31–32.) A new theory is suggested, based on the assumption of a solar general magnetic field of polar intensity several gauss, i.e. 10–20 times less than usual estimates. Ionized gas ejected from the poles returns to the surface near the equator, producing intensification of the magnetic field. Collapse occurs when the gravitational acceleration exceeds the buoyancy effect of the magnetic field; sunspots may then result. Details of the theory are to be given later.

523.746 2208

On the Interpretation of the Sunspot Cycle.—W. Grotrian. (*Naturwissenschaften*, April 1950, Vol. 37, No. 7, p. 163.) Extension of Schwarzschild's calculation of the period of a star to the case of the sun gives values of 9 and 18 years for the solar cycle, when the general field strength is taken as 3 000 gauss. A combination of the Alfvén-Walén (3469 and 3470 of 1945) and Schwarzschild theories offers a conclusive explanation of the sunspot cycle as the period of electromagnetic-hydrodynamic or plasma oscillation of the sun's disk.

550.381 2209

The Effect of the Compressibility of the Earth on its Magnetic Field.—C. Truesdell. (*Phys. Rev.*, 15th June 1950, Vol. 78, No. 6, p. 823.)

551.51 2210

The Stratification of the Atmosphere.—H. Flohn & R. Penndorf. (*Bull. Amer. met. Soc.*, March & April 1950, Vol. 31, Nos. 3 & 4, pp. 71–77 & 126–130.) Suggestions are made for a new classification of atmospheric layers, based on thermal data.

551.510.535 2211

Theory of the Production of an Ionized Layer in a Non-Isothermal Atmosphere, Neglecting the Earth's Curvature, and its Application to Experimental Results.—J. A. Gledhill & M. E. Szendrei. (*Proc. phys. Soc.*, 1st June 1950, Vol. 63, No. 366B, pp. 427–445.) "A new theory of ionospheric layer formation is developed, in which the temperature is assumed to vary linearly with height. The equations are compared at each step with those obtained by Chapman in his theory of layer formation in an isothermal atmosphere. The equations for the maximum of electron density and its height are also given. The effect of the parameters on the shape of the layer is shown in graphical form. The equations are somewhat complex in form, but an ingenious graphical method has been devised suitable for the application of the theory to results given in the form of a Booker and Seaton parabolic distribution of electronic density with height. By application of the theory to mean hourly values for four summer months in South Africa, values are obtained for the temperature gradient, the temperature at 200 km, and its variation over the middle part of the day. The results obtained are in accordance with previous estimates and offer numerical confirmation of the theory that the atmosphere expands bodily upwards during the middle part of a summer day."

551.510.535 : 621.396.11 2212

The Air Force Interest in Sporadic-E Ionization.—N. C. Gerson. (*CQ*, June 1950, Vol. 6, No. 6, pp. 17–19.) An account of co-operation between a band of 425 amateurs in 15 countries and the U.S. Air Force in the study of sporadic-E ionization, particularly regarding the movement of sporadic-E reflection points. The data obtained may be used to advance theories on the mechanism of sporadic-E effects and to form some conception of diurnal, seasonal and annual variations.

551.515.4 : 621.396.9 2213

Radar Measurements of the Initial Growth of Thunderstorm Precipitation Cells.—Hilst & MacDowell. (*See* 2220.)

551.524.7 2214

The Temperature Distribution of the Upper Atmosphere over New Mexico.—A. Nazarek. (*Bull. Amer. met. Soc.*, Feb. 1950, Vol. 31, No. 2, pp. 44–50.) The vertical distribution of temperature was derived, by use of the hydrostatic equation, from pressure data obtained in rocket experiments. The results indicate a steady increase from 210°K at 15 km to 308°K at 55 km, followed by a rapid decrease to 180°K at 85 km and a subsequent increase to 266°K at 120 km. An irregularity occurs at about 100 km, where the temperature decreases slightly, probably owing to dissociation of molecular into atomic oxygen. Seasonal and latitudinal effects are discussed.

551.578.11 **2215**
The Size Distribution of Raindrops.—A. C. Best. (*Quart. J. R. met. Soc.*, Jan. 1950, Vol. 76, No. 327, pp. 16–36.) Existing experimental data are examined, together with recent measurements in England and Wales, and the results are presented in a common form. Drop-size distribution is regarded as a function of rate of rainfall only, for simplification, and in many cases the distribution is in agreement with simple formulae. Tables based on these formulae are included showing values of the amount of liquid water per unit volume and of the number and total volume of drops, between certain diameter limits, for various rates of rainfall.

551.594.6 + 621.315.59 **2216**
University Research in Physics.—J. A. Teegan. (*Beama J.*, May 1950, Vol. 57, No. 155, pp. 133–138.) A brief survey of work done and in progress at London University on the nature of atmospherics and on the electrical properties of semiconductors.

551.51 **2217**
Oscillations of the Earth's Atmosphere. [Book Review]—M. V. Wilkes. Publishers: Cambridge University Press, 1949, 74 pp., 12s. 6d. (*Proc. phys. Soc.*, 1st June 1950, Vol. 63, No. 366B, pp. 459–460.) "This excellent little volume . . . deals with the oscillations produced daily in the atmosphere by the sun and the moon, as revealed mainly by the . . . daily variations of barometric pressure."

551.510.535 : 621.396.11 **2218**
Short-Wave Radio and the Ionosphere. [Book Review]—T. W. Bennington. Publishers: Iliffe & Sons, London, 2nd edn, 138 pp., 10s. 6d. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 168.) "This book presents the available information on the ionosphere in simple form so that it is usable by non-specialists in the subject. The approach is non-mathematical."

LOCATION AND AIDS TO NAVIGATION

621.396.9 **2219**
'La Pipologie': the Art of Interpreting the 'Pips' on a Radar Screen.—Vienne & Scotto. (*Radio tech. Dig., Édn franç.*, April 1950, Vol. 4, No. 2, pp. 67–81.) An article on the technique of radar operating, reproduced from a French Service document.

621.396.9 : 551.515.4 **2220**
Radar Measurements of the Initial Growth of Thunderstorm Precipitation Cells.—G. R. Hilst & G. P. MacDowell. (*Bull. Amer. met. Soc.*, March 1950, Vol. 31, No. 3, pp. 95–99.) Sequence photographs of p.p.i. and r.h.i. (range height indicator) radar presentations are used for measurement of the vertical and horizontal growth of the storm. Vertical growth is rapid and horizontal growth is uniform.

621.396.9 : 551.578.1/.4 **2221**
The Bright Band — A Phenomenon associated with Radar Echoes from Falling Rain.—J. E. N. Hooper & A. A. Kippax. (*Quart. J. R. met. Soc.*, April 1950, Vol. 76, No. 328, pp. 125–132.) The echoes obtained with vertical transmission are characterized by an intense echo from a layer at a height slightly below the freezing level. This is more pronounced in frontal rain than in instability showers, and is about 5 to 9 times more intense than the echo from the rain below, allowing for difference in range. Experiments are described which establish the height and thickness of the 'bright band' layer. Measurements of the terminal velocity of snow-flakes support Ryde's suggestion that the reduction in echo intensity below the bright band is due to the acceleration of water droplets from their velocity as snow-flakes to the terminal velocity of raindrops.

621.396.9 : 551.578.1/.4 **2222**
Radar Echoes from Meteorological Precipitation.—J. E. N. Hooper & A. A. Kippax. (*Proc. Instn elect. Engrs*, Part I, May 1950, Vol. 97, No. 105, pp. 89–95. Discussion, pp. 95–97.) A more detailed account of the work referred to in 2221 above.

621.396.9 : 621.385.832 : 535.371.07 **2223**
Visibility on Cathode-Ray Tube Screens: Positive *vs* Negative Signals on an Intensity Modulated Scope.—Harriman & Williams. (*See* 2386.)

621.396.933 **2224**
How the C.A.A. Flight Tests V.O.R. Ranges.—A. E. Jenks. (*Tele-Tech*, May 1950, Vol. 9, No. 5, pp. 22–24, 56.) The horizon profile as viewed from the aerial is plotted and course distortion in the shadow area forecast. The station error is obtained by the theodolite check, in which a circular course, with the station as centre, is navigated and plotted. The line-of-sight cut-off point can be deduced by analysis of course-line records obtained by flying aircraft over known test points and courses. Errors in course indication due to instability of the supply voltage frequency, to the presence of vertical polarization in the transmitted signal and to heading effect are measured.

621.396.933 **2225**
Notes on Radiocommunication Systems for Civil Aviation.—(*Rev. Telecomunicación, Madrid*, March 1949, Vol. 4, No. 15, pp. 47–64.) An account of navigational aids considered at the third [British] Commonwealth and Empire Conference on Radio for Civil Aviation.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **2226**
On Certain Phenomena of Gaseous Emission observed during the Evacuation of Low-Voltage Incandescent Lamps.—L. Dunoyer. (*Le Vide*, May 1950, Vol. 5, No. 27, pp. 793–806.) Ignition of the filament of 2-V lamps while still connected to the vacuum plant causes an emission of gas which is more rapid and of greater amount, within limits, the longer the time interval between the heating/degassing process and this ignition. This emission was studied with a special thermal micromanometer. It is attributed to adsorbed layers on the walls of the bulb. Immediate sealing after evacuation limits the possibility of subsequent gassing.

535.37 **2227**
X-Rays in the Development of Inorganic Phosphors.—H. P. Rooksby & A. H. McKeag. (*G.E.C. J.*, April 1950, Vol. 17, No. 2, pp. 89–95.) Greater knowledge of the crystal chemistry of luminescent materials is required both to explain the phenomena of luminescence and to effect improvements in the materials. Identification, crystalline perfection, the effect of changed matrix composition on fluorescence colour, and the role of impurity activators, are among the aspects considered in this survey of the ways in which X-ray analysis has been used in the investigation of phosphor characteristics.

535.37 **2228**
Trivalent Cations in Fluorescent Zinc Sulphide.—F. A. Kröger & J. Dikhoff. (*Physica, 's Grav.*, March 1950, Vol. 16, No. 3, pp. 297–316. In English.) Incorporation of monovalent cations in a lattice consisting of divalent ions is only possible to an appreciable extent when the lack of positive charge resulting from the substitution of a monovalent cation for a divalent one is compensated. This compensation can be effected by a simultaneous incorporation of monovalent anions, or of cations of a valency higher than two. An explanation can thus be given of the activation of ZnS by monovalent Ag, Cu, Au, Zn when halogens or trivalent cations are present.

Some of the trivalent ions incorporated in this way are found to cause effects of their own (electron traps, fluorescence, killing of fluorescence due to the other centres). An atomic model of the centres of fluorescence is described.

535.37 2229
The Physical Chemistry of the Formation of Fluorescence Centres in ZnS-Cu.—F. A. Kröger & N. W. Smit. (*Physica, 's Grav.*, March 1950, Vol. 16, No. 3, pp. 317–328. In English.)

538.114 2230
Magnetic After-Effect Revealed by means of a Blow.—L. Lliboutry. (*C. R. Acad. Sci., Paris*, 3rd May 1950, Vol. 230, No. 18, pp. 1586–1587.) A light blow may be used instead of a small variation of magnetic field for demonstrating this effect in a steel. See also 1669 of July.

538.22 2231
The *a/H* Law of Approach [to saturation] **and a New Theory of Magnetic Hardness.**—L. Néel. (*J. Phys. Radium*, May 1948, Vol. 9, No. 5, pp. 184–192.)

538.221 2232
Relation between the Anisotropic Constant and the Law of Approach to Saturation of Ferromagnetic Materials.—L. Néel. (*J. Phys. Radium*, June 1948, Vol. 9, No. 6, pp. 193–199.)

538.221 2233
The Effect of Annealing on the Residual Magnetization of Ferromagnetics.—J. C. Barbier. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1643–1645.)

538.221 2234
Factors Affecting Magnetic Quality.—R. M. Bozorth. (*Bell Syst. tech. J.*, April 1950, Vol. 29, No. 2, pp. 251–286.) The substance of Chapter 2 of a forthcoming book entitled "Ferromagnetism". The effects of chemical composition and methods of production and treatment on the final properties of magnetic materials are discussed. Details of relevant manufacturing processes are included, and lists are given of useful materials and their magnetic properties.

538.221 2235
Thermal Variation of the Coercive Field of Powdered Cobalt.—L. Weil, S. Marfoure & F. Bertaut. (*J. Phys. Radium*, June 1948, Vol. 9, No. 6, pp. 203–207.)

538.221 2236
Antiferromagnetism and Intermittent Activation in Chromium-Iron and Vanadium-Iron Alloys.—R. Forrer. (*C. R. Acad. Sci., Paris*, 3rd May 1950, Vol. 230, No. 18, pp. 1584–1585.)

538.221 2237
On the Conditions for the Occurrence of Ferromagnetism in Metal Compounds.—J. H. Gisolf. (*Physica, 's Grav.*, Sept. 1949, Vol. 15, No. 8/9, pp. 677–678. In English.) Discussion leading to the conclusion that in ferrites (which possess both octahedron holes and tetrahedron holes) only the metal ions in tetrahedron holes can contribute to the ferromagnetism.

538.221 2238
On the Ferromagnetism of Ferrites, or Ferrimagnetism.—L. Néel. (*Physica, 's Grav.*, March 1950, Vol. 16, No. 3, pp. 350–352. In French.) Various experimental results are quoted which indicate that Gisolf's interpretation of the magnetic properties of ferrites (2237 above) is not correct. Néel's theory, on the contrary, is supported by much experimental evidence. See also 1166, 1170 & 1171 of May, and 3159 of 1949.

538.221 2239
Magnetic Properties of a Ferrite of Manganese in Weak Fields.—C. Guillaud & A. Barbezat. (*J. Rech. Centre nat. Rech. sci.*, 1950, No. 11, pp. 83–100.) Description of the method of measurement of different characteristics, particularly l.f. and h.f. losses. Results are presented in tables and graphs.

538.221 : 537.311.33 2240
Experimental Study of the Resistance of Some Semiconducting Ferrites.—C. Guillaud & R. Bertrand. (*J. Rech. Centre nat. Rech. sci.*, 1950, No. 11, pp. 73–82.) Description of method and results of an investigation of Ni, Mn, Mg and complex ferrites between −253° and 800°C. No exceptional characteristics were observed near the Curie point.

538.221 : 621.318.22 2241
Preferred Domain Orientation in Permanent-Magnet Alloys.—M. McCaig. (*Nature, Lond.*, 17th June 1950, Vol. 165, No. 4207, p.969.) Discussion of possible explanations of the improvement in the magnetic properties of alloys such as alcomax, due to preferred domain orientation. See also 3453 of 1949 (Hoselitz & McCaig).

546.57 : 539.23] : 537.311.31 2242
Current/Voltage Characteristic of Very Thin Films of Silver at High Values of Electric Field.—A. Blanc-Lapierre & M. Perrot. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1641–1643.) Measurements were made at ordinary temperatures with field strengths up to 10 kV/cm, on films of equivalent thickness < 10 mμ vaporized on to glass; marked deviations from Ohm's law were observed. The curvature of the characteristic is mainly due to the lacunal structure of the film, heating effects playing only a minor part. Similar characteristics have been observed for semiconductors and for imperfect metal-point contacts.

548.0 : 535/539 2243
Optical Properties and the Electro-Optic and Photoelastic Effects in Crystals Expressed in Tensor Form.—W. P. Mason. (*Bell Syst. tech. J.*, April 1950, Vol. 29, No. 2, pp. 161–188.) The Fresnel ellipsoid is first derived from Maxwell's equations. The electro-optic and photoelastic effects are then expressed in terms of thermodynamic potentials; methods of measuring them by determining the birefringence in various directions are discussed, and constants are listed for various classes of crystal. The application of the photoelastic effect for measuring strains in isotropic media is considered.

620.197 2244
Tropicalization of some Materials and Assemblies used in the Construction of Valves.—G. Trébuchon. (*Le Vide*, May 1950, Vol. 5, No. 27, pp. 814–818.) Conclusion of paper noted in 1432 of June.

621.315.33 2245
Insulated Sleeving and Covered Wires used on Service Electronic Equipment.—V. G. Hoptroff & G. J. R. Rosevear. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 191–198.) The mechanical and electrical properties desirable in wire-covering material and sleeving are reviewed and standardization is discussed. Summaries are given of interservice specifications. The manufacture and properties of present-day materials are described and their limitations considered. It is suggested that requirements will be more exacting in future. A table is appended of materials suitable for various temperature and voltage ranges.

621.315.59 + 551.594.6 2246
University Research in Physics.—Teegan. (*See* 2216.)

621.315.59 **2247**

Semiconductive Colloidal Suspensions with Non-Linear Properties.—H. E. Hollmann. (*J. appl. Phys.*, May 1950, Vol. 21, No. 5, pp. 402–413.) The conductivity and dielectric constant of these mixtures (e.g. a fine dielectric powder in oil) depend on the applied electric field; a physical explanation of their properties is given, which is relevant to the general theory of semiconductors. Oscillograms illustrating the nonlinear characteristics of such resistors are shown, and applications are mentioned; the wide range of voltage sensitivity and power dissipation is particularly noted.

621.315.59 **2248**

On Electrical Conduction in Semiconductors.—F. Stöckmann. (*Naturwissenschaften*, Feb. & March 1950, Vol. 37, Nos. 4 & 5, pp. 85–89 & 105–111.) Discussion of conduction processes inside semiconductors, the barrier layer between semiconductors and metals, and photoconductivity.

621.315.59 : 546.412.64 **2249**

Study of the Semiconductor Properties of a Natural Calcium Carbonate.—P. Vidal. (*Ann. Phys., Paris*, May/June 1950, No. 5, pp. 257–309.) Experimental and theoretical study of deep-quarried chalk at normal temperatures. Unlike chalk from surface layers, it is relatively pure, has a high resistivity and is a normal semiconductor. Under constant voltage gradient above about 10 V/cm, current intensity decreases with time, tending to a practically constant limit, under which conditions a fall of potential occurs at the cathode. Two methods of determining ion mobility are described. The rectifying property of the substance and the complex radiation of soft X rays which occurs when a mesh-type cathode is used are discussed.

621.315.612.4 **2250**

Domain Structure and Dielectric Response of Barium Titanate Single Crystals.—B. Matthias & A. von Hippel. (*Phys. Rev.*, 1st June 1948, Vol. 73, No. 11, pp. 1378–1384.)

621.318.22 **2251**

The Performance and Stability of Permanent Magnets.—A. J. Tyrrell. (*J. Brit. Instn Radio Engrs*, May 1950, Vol. 10, No. 5, pp. 182–191.) The characteristics which contribute to the long-term magnetic stability of a permanent-magnet alloy are considered; present-day anisotropic alloys (e.g. ticonal) embody improvements in all these characteristics. Tests over a period of ten years have proved ticonal magnets to be more stable than materials previously obtainable; they are giving satisfactory service in watt-hour meters, which make high demands on stability. Tables are included giving the performance of numerous British and American commercial alloys.

621.357.8 : 533.5 **2252**

Electrolytic Polishing and Vacuum Technique.—P. Nineuil. (*Le Vide*, May 1950, Vol. 5, No. 27, pp. 807–813.) Review and discussion of the technique. Its advantages in eliminating surface impurities and reducing gas liberation and 'cold' emission, particularly in X-ray tubes, are stressed.

666.1.037.5 **2253**

The Physical Aspect of Glass-to-Metal Sealing in the Electronic Valve Industry: Part 1.—G. Trébuchon & J. Kieffer. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 125–149.) From a detailed examination of laboratory results together with experience gained in actual manufacture, specifications are drawn up for quality of seal, annealing cycles and finished-work inspection. Physical and chemical aspects of the sealing process are discussed and a critical survey of methods of test is made.

669.725.3 **2254**

Beryllium Copper.—J. T. Richards. (*Materials & Methods*, April 1950, Vol. 31, No. 4, pp. 75–90.) The properties, characteristics and available forms of the alloy are described, design considerations and methods of treatment discussed, and applications listed.

535.37 **2255**

Luminescent Materials. [Book Review]—G. F. J. Garlick. Publishers: Clarendon Press, Oxford, 1949, 254 pp., $5.50. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 386–387.) ". . . a book which will give a reader with prior knowledge of solid-state physics an opportunity to become acquainted with some of the main characteristics of luminescence in solid materials together with associated descriptive theory in a minimum of time."

666.1.037.5 **2256**

Glass-to-Metal Seals. [Book Review]—J. H. Partridge. Publishers: Society of Glass Technology, Sheffield, 238 pp., 35s. (*J. sci. Instrum.*, June 1950, Vol. 27, No. 6, p. 175.) "A valuable addition to technical literature."

MATHEMATICS

517.432.1 **2257**

The Operational Calculus — a Historical Survey of Heaviside's Methods.—(*Electrician*, 26th May 1950, Vol. 144, No. 3754, p. 1751.) Report of a paper given by B. van der Pol at one of the I.E.E. Heaviside Centenary Commemorative Meetings, May 1950. The wide divergence of contemporary estimates of Heaviside's achievements is attributed to the fact that he never gave an exposition of his operational calculus as such; knowledge of it had to be gained by studying the many scattered practical applications in his writings. Modern developments are mentioned, in particular Carson's work in justifying Heaviside's methods by the Laplace transform; Heaviside was aware of this basis to his calculus.

517.432.1 : 621.39 **2258**

Oliver Heaviside's Operational Calculus.—W. Jackson. (*Electrician*, 19th May 1950, Vol. 144, No. 3753, pp. 1663–1667.) Heaviside's early experiments on problems in telegraphy and the development of his mathematical methods are described.

517.564.4 : [534.26 + 535.42 **2259**

The Oblate Spheroidal Wave Functions.—A. Leitner & R. D. Spence. (*J. Franklin Inst.*, April 1950, Vol. 249, No. 4, pp. 299–321.) These functions arise in problems such as the diffraction of sound and e.m. waves by circular disks and apertures. Tables published previously by other workers are here extended.

517.942.9 **2260**

Separation of Laplace's Equation.—N. Levinson, B. Bogert & R. M. Redheffer. (*Quart. appl. Math.*, Oct. 1949, Vol. 7, No. 3, pp. 241–262.) To use the separation-of-variables method in solving partial differential equations, the surface over which the boundary values are specified must coincide with one of the coordinate surfaces, and hence any restriction on the coordinates which can be used is also a restriction on the physical situations to which the method can be applied. The paper is concerned with determining all coordinate systems which are, in this sense, permissible.

517.942.932 : 621.396.611.1 **2261**

Relaxation Oscillations.—J. LaSalle. (*Quart. appl. Math.*, April 1949, Vol. 7, No. 1, pp. 1–19.) A class of relaxation oscillations related to the equation $d^2x/d\tau^2 + \mu f(x)dx/d\tau + x = 0$ is studied, in which $f(x)$ is not necessarily even. Regions $E(\mu)$ of the phase plane are constructed, each of which contains a single periodic solution. An introductory example deals with the case of an LCR circuit in which R is nonlinear and nonpassive. The use of a series linear resistance to produce mode separation is mentioned.

519.283 : 621.39.001.11 **2262**
Correlation Functions and Communication Applications.—Y. W. Lee & J. B. Wiesner. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 86–92.) The difference in the forms of the correlation functions for a stationary random process and for a periodic process may be used as a means of separation of the one from the other. The correlation curves are obtained by means of an electronic computer. Among the examples given is the separation of a sinusoidal signal from random noise when an input signal/noise ratio of − 15 db is changed to an output signal/noise ratio of + 15 db.

681.142 **2263**
High-Speed Digital Calculating Machines.—J. Bennett. (*Distrib. Elect.*, March & May 1950, Vol. 22, Nos. 179 & 180, pp. 251–255 & 276–280.) A simple account of the historical development and of the operation and capabilities of these machines, illustrated by reference to the EDSAC (see also 3458 and 3459 of 1949). The use of acoustic delay lines, special c.r. tubes and magnetic recording devices for storage has helped to make present-day high speeds possible. Costs are examined and applications, both actual and potential, in research and commerce are mentioned.

681.142 **2264**
Linear Equation Solvers.—F. J. Murray. (*Quart. appl. Math.*, Oct. 1949, Vol. 7, No. 3, pp. 263–274.) The set of equations to be solved is of the form

$$\sum_{j=1}^{n} a_{ij}\, x_j = b_i,$$

where $i = 1, 2 \ldots, n$. In the type of machine considered, the x_j unknowns are not driven to their correct values by power supplied from the constant inputs, but reach an equilibrium state corresponding to the solution by a process of adjustment. The operating conditions for such a machine are examined for the case in which the adjusting process is determined by a linear operator with constant coefficients.

681.142 **2265**
Pulse Packing in Magnetic Recording Wire.—I. L. Cooter. (*Bur. Stand. J. Res.*, Feb. 1950, Vol. 44, No. 2, pp. 163–174.) An oscillographic method is described for determining the number of magnets per unit length of the recording wire; a powder-pattern method for observing the fields of the individual magnets in a section of wire is also described, with photographs. A comparison was made of the resolution of recorded pulses obtainable with stainless-steel and plated Co-Ni wires. A parameter termed 'interference ratio' is defined and used as a criterion of performance. Application is to high-speed digital computers.

681.142 : 533.6 **2266**
Analogue Computer for Flight Simulator.—A. C. Hall. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, p. 433.) Summary of 1950 A.I.E.E. Winter General Meeting paper.

681.142 : 621-526 **2267**
The Electronic Servomechanism Simulator.—C. M. Edwards & E. C. Johnson, Jr. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, p. 411.) Summary of 1950 A.I.E.E. Winter General Meeting paper. The apparatus discussed forms part of a large-scale analogue computer, under development at the M.I.T., for solving the equations of motion of aircraft. See also 2266 above.

512.9 : 501 **2268**
Calcolo Tensoriale e Applicazioni. [Book Review]—B. Finzi & M. Pastori. Publishers: N. Zanichelli, Bologna, 1949, 427 pp., 2000 lire. (*Quart. appl. Math.*, Oct. 1949, Vol. 7, No. 3, p. 352.) The concepts and principal methods of the tensor calculus are presented in order to facilitate its application by mathematicians, physicists and engineers. The last three chapters deal with applications to (*a*) the mechanics of deformable continua, (*b*) electromagnetic theory, (*c*) relativity theory.

512.972 **2269**
Éléments de Calcul Tensoriel. [Book Review]—A. Lichnerowicz. Publishers: Armand Colin, Paris, 1950, 216 pp., 180 fr. (*J. Franklin Inst.*, May 1950, Vol. 249, No. 5, p. 426.) "The first part comprises an elementary but rigorous presentation of the basic theory both of tensor algebra and tensor analysis. The second part discusses some of the various applications in classical dynamics, electrodynamics and the theory of relativity."

517.53 : 501 **2270**
Introduction to Complex Variables and Applications. [Book Review]—R. V. Churchill. Publishers: McGraw-Hill, New York and London, 1948, 216 pp., $3.50. (*Quart. appl. Math.*, July 1949, Vol. 7, No. 2, p. 240.) "The book should be of interest to those concerned with the use of function theory in engineering problems and similar applications."

517.75 : 621.3.015.3 **2271**
Transformation Calculus and Electrical Transients. [Book Review]—S. Goldman. Publishers: Constable & Co., London, 1949, 440 pp., 30s. (*Beama J.*, May 1950, Vol. 57, No. 155, p. 150.) The book is written for students, but will also be useful for research workers. Stress is laid upon physical interpretations, and detailed solutions are given of many important examples.

517.9 : 501 **2272**
Introduction to the Differential Equations of Physics. [Book Review]—L. Hopf. Publishers: Dover Publications, New York, 1948, 154 pp., $1.95. (*Quart. appl. Math.*, July 1949, Vol. 7, No. 2, pp. 239–240.) "The exposition is clear and concise, and one might like the treatment to go further than it does. The text should be very useful to seniors and beginning graduate students in physics and chemistry."

681.142 **2273**
Giant Brains, or Machines that Think. [Book Review]—E. C. Berkeley. Publishers: J. Wiley, New York, and Chapman & Hall, London, 1949, 270 pp., $4.00. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 385–386.) A primer dealing with a wide variety of computing mechanisms. "A strong anthropomorphic flavor pervades the book . . . It contains a useful bibliography, its descriptions of existing machines probably include some facts unknown to any reader, and the discussions of future possibilities, though incomplete, may be suggestive."

MEASUREMENTS AND TEST GEAR

531.764.5 **2274**
Crystal-Controlled Clock.—(*Bell Lab. Rec.*, May 1950, Vol. 28, No. 5, p. 213.) This instrument was developed as an alternative to the chronometer for use where a portable, accurate standard of time is required. The output of a 1 800-c/s crystal-controlled oscillator is used, after frequency division and amplification, to drive a 60-c/s clock. Correct time was maintained to within 0.22 sec per day over an 8-day period without temperature control; with temperature control the limit of error could be reduced to 0.09 sec per day.

531.764.5 **2275**

The Performance of the P.T.R. Quartz Clocks and the Yearly Variation of the Length of the Astronomical Day.—A. Scheibe & U. Adelsberger. (*Z. Phys.*, 17th March 1950, Vol. 127, No. 4, pp. 416–428.) Results of time comparisons made from 1934 to 1945 using different types of quartz clock are shown and discussed. Mean daily deviations of the measured time during certain periods are plotted for the different clocks. Observations from 1937, when improved models were brought into operation, confirm the earlier view that the mean daily variation of ±0.001 5 sec, which has a yearly period, is due to a variation in astronomical standard time, probably corresponding to an actual change in the rotational velocity of the earth. At summer and winter solstices the variation is zero. In summer the mean measured value is up to 0.12 sec in advance of astronomical time.

538.71 **2276**

A Saturated-Core Recording Magnetometer.—D. C. Rose & J. N. Bloom. (*Canad. J. Res.*, March 1950, Vol. 28, Sec. A, No. 2, pp. 153–163.) The magnetometer operates on the saturated-core inductor principle, the sensitive element being a strip of high-permeability alloy. An inverse-feedback system supplies a current to neutralize, within 2 or 3 gammas, the field being measured. This current is measured by a recording milliammeter which gives the field directly.

621.317.335.3†+621.317.372 **2277**

Measuring Dissipation and Dielectric Constants.—C. F. Miller & F. G. Whelan. (*Elect. Engng, N.Y.*, June 1950, Vol. 69, No. 6, p. 512.) Summary of A.I.E.E. Winter Meeting paper, giving a description of apparatus used in the susceptance-variation method of measuring dissipation factor due to Hartshorn & Ward (351 of 1937). A constant-speed motor-driven capacitor is used to tune the circuit through resonance. A recording milliammeter operated from a valve voltmeter traces the voltage resonance curves. In 5 runs at 24-hour intervals on each of 35 specimens with dielectric constants in the range 3.0–7.3, the deviation from the mean was <0.05 in most cases. For the dissipation factor the deviations were generally <2%.

621.317.336 : 621.315.212 **2278**

Study of the Impedance Irregularities of Coaxial Cables by Oscillographic Observation of Pulse Echoes.—P. Herreng & J. Ville. (*Ann. Télécommun.*, Oct. 1948, Vol. 3, No. 10, pp. 317–331.) See 2162 of 1948 and 142 of 1949 (Couanault & Herreng).

621.317.336.1 **2279**

Impedance Measurement.—H. J. Round. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 154–158.) A substitution method is described in which the voltages across the unknown impedance and across a known adjustable resistance R are in turn applied to a c.r.o. A 'swamping' series resistance maintains constant current without introducing unduly high errors. Impedances of 2–300 Ω can be measured over the frequency range 1–150 kc/s. The vector angle is found by connecting a known capacitance in series with the unknown and obtaining a new value of R.

621.317.351 **2280**

Various Applications of our Low-Frequency Analyser.—R. Aschen & R. Gaillard. (*T.S.F. pour Tous*, May 1950, Vol. 26, No. 259, pp. 170–174.) Oscillograph tracings effected with the instrument described in 2002 of 1948 illustrate the measurement of harmonic distortion, analysis of sawtooth and square-wave signals and their modifications after passing through an amplifier, and analysis of musical sounds.

621.317.444 **2281**

An Electrostatic Fluxmeter of Short Response-Time for use in Studies of Transient Field-Changes.—D. J. Malan & B. F. J. Schonland. (*Proc. phys. Soc.*, 1st June 1950, Vol. 63, No. 366B, pp. 402–408.) A conducting system of small capacitance is alternately exposed to and screened from the electric field, 1 200 times a second, by a rotating earthed shield, thus producing an alternating e.m.f. of period 0.83 ms. This output is amplified and displayed on a c.r.o. screen and can be recorded photographically. An automatic indication of the sense of the field is provided every 7.5 ms. At maximum sensitivity the instrument gives a deflection of 1 cm in a field of 20 V/m with a background noise level of 3 V/m and has a response time of one half-period (0.42 ms).

621.317.7.087 : 551.594.6 : 621.396.821 **2282**

On the Recording of the Mean Level of Atmospherics.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1648–1649.) A receiver-recorder has been developed for operation on 27 kc/s. The receiver has a tuned amplifier stage and a diode detector, and the recorder uses a sensitive highly-damped galvanometer. The mean ordinate of the recorded curve is proportional to the product of the amplitude of the impulses and their repetition rate, i.e., the mean field intensity, while the fluctuations about the mean ordinate are proportional to the individual flux impulses. See also 2902 and 3504 of 1948.

621.317.715 **2283**

An Electromechanism : the Galvanometer.—A. Kaufmann & P. Mériau. (*Radio tech. Dig., Édn franç.*, Feb. & April 1950, Vol. 4, Nos. 1 & 2, pp. 51–61 & 83–39.) A mathematical treatment of the theory of the galvanometer, making use of the operational calculus and of electromechanical electrical analogies. No new properties are shown, but the introduction of complex or operational electromechanical impedances may be useful for the study of new types of galvanometer.

621.317.72.088.2 **2284**

Influence of the Ground on the Calibration and Use of V.H.F. Field-Intensity Meters.—F. M. Greene. (*Bur. Stand. J. Res.*, Feb. 1950, Vol. 44, No. 2, pp. 123–130.) The input impedance of receiving aerials varies with height and changing ground conditions. An approximate method is described for calculating this impedance in the case of horizontal dipole aerials over earth having finite values of dielectric constant and conductivity. The effect of changes in ground conditions and aerial terminating impedance on the error of the field-intensity meter is calculated as a function of aerial height. Measured error values are in reasonably good agreement with the theoretical values.

621.317.725.029.45/.5 **2285**

A Millivoltmeter for the Frequency Range from 1000 to 30 × 10⁶ c/s.—H. J. Lindenhovius, G. Arbelet & J. C. van der Breggen. (*Philips tech. Rev.*, Jan. 1950, Vol. 11, No. 7, pp. 206–214.) Six inductance-compensated RC amplifying stages between the input stage and a moving-coil meter with series crystal rectifier give an overall amplification of about 1 500 throughout the frequency range. Compensation for mains fluctuation and valve aging is provided. Voltage ranges are 1 mV, 10 mV, and thence by successive factors of $\sqrt{10}$ to 1 kV, the range being selected by adjustment of a capacitive attenuator.

621.317.73 **2286**

A Direct-Reading Instrument for Measuring Unbalanced Impedances at Decimetric Wavelengths.—W. H. Ward. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 199–205.) The instrument is based on the reactance-variation method, the circuit elements being lengths of concentric line. Direct voltage measurement is eliminated and replaced by the reading of a piston attenuator. By enclosing the oscillator in the moving part of the attenuator, the use of flexible h.f. cable is avoided. The mechanical drive may, if required, be transmitted from a distance. The instrument measures capacitance from −10 pF to +10 pF and resistance from 10 to 10 000 Ω at frequencies up to at least 1 000 Mc/s, with an accuracy within about 1%. Both scales are direct-reading.

621.317.734 : 621.319.4 **2287**

A Direct-Reading Instrument for the Measurement of the Series Resistance of Capacitors.—F. Gutmann. (*J. sci. Instrum.*, June 1950, Vol. 27, No. 6, pp. 169–170.) A thermocouple ammeter measures the r.f. tank current of a 1.6-Mc/s oscillator, whose output is adjusted to produce full-scale deflection. The capacitor under test is then inserted in series with the tank capacitor. The resultant decrease of tank current is a measure of the series resistance of the tested capacitor. Capacitors from 0.01 μF upwards may be tested.

621.317.755 : 621.385.012 **2288**

Curve Generator for Electron Tubes.—(*Tech. Bull. nat. Bur. Stand.*, May 1950, Vol. 34, No. 5, p. 62.) Equipment developed by M. L. Kuder. I_a/V_a or I_a/V_g families of characteristics are displayed simultaneously on a c.r.o. to an overall accuracy within ±5% on voltage and current readings. Measurement is by a standard co-ordinate rectangle. Marker dots indicate the load-line for the conditions selected. Special circuits are included in the equipment for observation of the step-function signal at the grid of the valve under test and for identifying the curves obtained with positive grid bias.

621.317.772 **2289**

Direct-Reading Phasemeter.—L. H. O'Neill & J. L. West. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 271–273.) The amplitude of the sum or difference of two sinusoidal voltages of equal amplitude depends on the phase difference between them; this is the basis of the simple phase meter here described. The method of adjusting the individual amplitudes and mixing the two voltages, and of determining the sign of the phase difference, are discussed. The overall accuracy is within ±1° over the frequency range 7 c/s to 100 kc/s.

621.317.79.001.4 : 621.397.6 **2290**

Television Monitors.—J. E. B. Jacob. (*Wireless World*, June 1950, Vol. 56, No. 6, pp. 206–210.) Equipment of higher quality than that of the average home set is required. The special features that are necessary in the design of the magnetic lens, focus-corrrection system, synchronizing-signal separator and black-level control circuit are described.

621.385.18.001.4 **2291**

Measurement of Tube Voltage Drop in Hot-Cathode Gas Tubes.—E. K. Smith. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, pp. 419–422.) 1950 A.I.E.E. Winter General Meeting paper. Increase of the voltage drop is one of the commonest preliminary indications of failure in gas-filled valves. Various methods are described for observing this drop while the valves are in use, typical results are charted, and their significance discussed.

621.396.615 : 621.317.7.001.4 **2292**

VOR Signal Generator.—J. H. Battison. (*Tele-Tech*, May 1950, Vol. 9, No. 5, pp. 37–39, 57.) Operation of the VOR is based on the phase difference between two 30-c/s signals, one with a rotating aerial pattern and the other an omnidirectional reference. The apparatus described generates such signals at a strength sufficient for testing the receiving equipment of aircraft in a nearby field or hangar. The generator can also be used to test runway localizers in which the reference signal is in phase with the variable signal on one side of the runway and 180° out of phase on the other.

621.396.615.029.42 **2293**

A Low-Frequency Sinusoidal-Voltage Source.—L. A. Rosenthal. (*Rev. sci. Instrum.*, April 1950, Vol. 21, No. 4, pp. 302–303.) Frequencies extending from 20 c/s nearly to zero can be obtained by a method in which a variable-frequency audio oscillator is heterodyned with a stable frequency derived from a.c. mains. A mathematical explanation of the mixing operation is given. Application to the testing of a voltage regulator is mentioned.

621.396.615.14.029.63 **2294**

U.H.F. Sweep-Frequency Oscillator.—J. E. Ebert & H. A. Finke. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 79–81.) A variable capacitor, with vane rotated at the high-impedance end of a cavity resonator by a synchronous motor, provides a maximum sweep of 30 Mc/s on the fundamental frequency of an enclosed coaxial-line type of oscillator covering a range of 470–890 Mc/s. The sweep can be varied by altering the capacitor plate spacing. The output voltage is continuously variable from 2 V across 50 Ω to a value 90 db below this. Details of the equipment are given, together with performance curves and a dimensioned sketch of the oscillator.

621.396.822 : 621.316.8 **2295**

Resistor Noise.—(*Radio tech. Dig., Édn franç.*, April 1950, Vol. 4, No. 2, pp. 91–107.) French version of 1465 of June (Paolini & Canegallo).

621.397.645 : 621.316.761.2 **2296**

How to Adjust Frequency Response in Video Amplifiers for TV.—J. H. Roe. (*Broadcast News*, March/April 1950, No. 58, pp. 54–65.) Methods of adjusting video amplifier circuits to obtain satisfactory frequency response characteristics, and methods of measuring their performance, are described with practical details of the necessary equipment. Typical results are illustrated by numerous oscillograms showing the effects of correct alignment and of misadjustment of a particular circuit commonly used for h.f. and l.f. compensation.

621.317 **2297**

Electrical Measurements in Theory and Application. [Book Review]—A. W. Smith. Publishers: McGraw-Hill, London, 1948, 371 pp., 25s. 6d. (*Beama J.*, May 1950, Vol. 57, No. 155, pp. 150–151.) Though mainly addressed to students, the book is recommended to laboratory and test-room workers in general. New methods of measuring capacitance and inductance are included in this edition.

621.317.755 **2298**

Cathode-Ray-Tube Traces. [Book Review]—H. Moss. Publishers: Electronic Engineering, London, 66 pp., 10s. 6d. (*J. sci. Instrum.*, June 1950, Vol. 27, No. 6, p. 175.) "In putting the main emphasis on the geometrical theory of cathode-ray-tube patterns, Dr. Moss has produced a monograph which will be valuable both to the advanced student and to the qualified engineer."

621.396.001.4 **2299**

Radio Servicing Equipment. [Book Review]—E. J. G. Lewis. Publishers: Chapman & Hall, London, 371 pp., 25s. (*J. sci. Instrum.*, June 1950, Vol. 27, No. 6, p. 175.) "Describes in plain and simple language the construction and operation of most of the types of test and measuring equipment used by the radio service engineer."

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

529.781 **2300**

Carrier Frequency for Remote Timing Control.—J. L. Wagner & W. Webb. (*Elect. Mfg, N.Y.*, April 1949, Vol. 43, No. 4, pp. 104–107..198.) The requirements for a timing-control system operating on power distribution lines are enumerated. A detailed description is given of commercial equipment in which the master clock operates keying relays in the transmitter, providing three separate channel frequencies in the range 2–6 kc/s, one for time correction of slave clocks and the others for applying pulses at 1-minute intervals to attendance recorders, for ringing bells, etc.

534.321.9 : 615 **2301**

Ultrasonics in Therapy.—P. Hémardinquer. (*Rev. belge Électronique*, Feb. 1950, Vol. 1, No. 10, pp. 14–21.) A review of the technique, and description of typical generating apparatus.

535.322.1 : 539.165 **2302**

On an Improvement in Lens-Type β-Ray Spectrographs.—P. Grivet. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1652–1654.)

539.16.08 **2303**
621.387†

Radiation Counters.—Please note that, in this and subsequent issues, the U.D.C. number used will be 621.387† and subdivisions, instead of 539.16.08 used hitherto.

621.317.083.7 **2304**

Present-Day Telemetry Technique.—G. Swoboda. (*Elektrotech. u. Maschinenb.*, May 1950, Vol. 67, No. 5, pp. 129–136.) Review of current methods and description of a pulse system and of one using rotary selector switches.

621.317.087.9 : 621.317.083.7 **2305**

The Metrotype System of Digital Recording and Telemetering.—G. E. Foster. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, pp. 427–430.) 1950 A.I.E.E. Winter General Meeting paper. The system enables electrical quantities to be automatically measured and recorded in numerals, at predetermined intervals. Readings may be transmitted to any distance, a single channel of telegraph quality being adequate. The processes of measuring, transmitting and printing the readings are described.

621.317.39 **2306**

Electrical Methods of Measuring Mechanical Quantities.—(*Engineering, Lond.*, 28th April 1950, Vol. 169, No. 4396, pp. 483–484.) Report of a paper given at the I.E.E. by F. J. Woodcock.

621.365.55† : 674.23 **2307**

High-Frequency Generators : Application in the Wood Industry.—M. Diopère. (*Rev. belge Électronique*, Feb. 1950, Vol. 1, No. 10, pp. 22–28.) Description of different manufacturing processes, e.g., bending, sticking, etc. in which h.f. heating is applied to materials under pressure.

621.38.001.8 : 543/545 **2308**

Electronic Instrumentation for Chemical Laboratories.—F. Gutmann. (*J. Brit. Instn Radio Engrs*, May 1950, Vol. 10, No. 5 pp. 194–212.) Reprint. See 710 of March.

621.384.611.2† **2309**

The Proton Synchrotron.—E. J. Lofgren. (*Science*, 24th March 1950, Vol. 111, No. 2882, pp. 295–300.) Brief survey of development of particle accelerators and description of the proton synchrotron now under construction at Berkeley, which will ultimately be capable of producing protons of about 6×10^3 MeV.

621.384.612.1† **2310**

Omegatron — a Miniature Cyclotron.—(*Electronics*, June 1950, Vol. 23, No. 6, pp. 122, 124.) The omegatron operates on the same fundamental principle as the cyclotron and can be used as a mass analyser. In addition to the constant uniform magnetic field a r.f. electric field is applied at right angles. When the r.f. equals the cyclotron frequency the ions spiral outwards and can be collected. Measurement of the frequency corresponding to maximum ion current and a measurement of the magnetic field enable the mass of the particles to be determined.

621.385 : 621.318.572 **2311**

An Electron-Beam Decimal-Counter Tube.—Hollway. (*See* 2374.)

621.385.833 **2312**

Magnetic Cylindrical Lenses with Image-Distortion Correction.—H. Hintenberger. (*Z. Naturf.*, Feb. 1948, Vol. 3a, No. 2, pp. 125–127.) The conditions for exact focusing are determined and also for first- and second-order approximations.

621.385.833 **2313**

The Calculation of Magnetic-Lens Fields by Relaxation Methods.—M. B. Hesse. (*Proc. phys. Soc.*, 1st June 1950, Vol. 63, No. 366B, pp. 386–401.) "The field and lens constants are calculated for two typical magnetic lenses as used in electron microscopes, using the relaxation method developed by Southwell for the solution of potential problems."

621.385.833 **2314**

The Independent Electrostatic Lens under 'Transgaussian' Conditions.—É. Regenstreif. (*C. R. Acad. Sci., Paris*, 8th May 1950, Vol. 230, No. 19, pp. 1650–1652.) A study of the paths of rays, termed transgaussian, which are initially parallel to the axis, but for which r_0/z_0 is not negligible.

621.385.833 : 621.396.615.141.2 **2315**

Electron-Optical Mapping of the Space-Charge Field in a Magnetron.—(*Tech. Bull. nat. Bur. Stand.*, May 1950, Vol. 34, No. 5, pp. 57–59.) Method devised by D. L. Reverdin. Space-charge distribution is related to the distorting effect of the electric field in an elementary steady-state magnetron on the shadow pattern formed by two wire screens in the path of a focused nondisturbing axial electron beam. The method may be extended to oscillating magnetrons and to the indication of noise. Results differ widely from predictions based on theory.

621.395.625.3.001.8 **2316**

Various Applications of Magnetic Recording.—P. Hémardinquer. (*Radio franç.*, June 1950, No. 6, pp. 8–16.) Description of the principles and basic circuits of magnetic recorders for secret transmission, phototelegraphy, time measurement, etc.

629.13.014.57 **2317**

The Electronic Automatic Pilot.—M. Nerinckx. (*Rev. belge Électronique*, March/April 1950, Vol. 1, Nos. 11/12, pp. 5–13.) Description of the Sperry automatic pilot Type A-12.

621.38.001.8 **2318**

Industrial Electronics. [Book Review]—A. W. Kramer. Publishers: Pitman Publishing Co., New York, 1949, 311 pp., $6.00. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 136, 140.) ". . . intended for readers who have a good knowledge of general physics and engineering but who have had very little training or experience in electronics."

621.387† **2319**

Counting Tubes. [Book Review]—S. C. Curran & J. D. Craggs. Publishers: Butterworths Scientific Publications, London, 238 pp., 35s. (*J. sci. Instrum.*, June 1950, Vol. 27, No. 6, p. 175.)

PROPAGATION OF WAVES

538.56 : 535.42 **2320**

On the Diffraction of an Electromagnetic Wave through a Plane Screen.—J. W. Miles. (*J. appl. Phys.*, May 1950, Vol. 21, No. 5, p. 468.) Corrections to paper abstracted in 202 of January.

621.396.11 **2321**

The First Ionospheric-Storm-Warning Service 1941-45.—J. S. Kojan & G. A. Isted. (*Marconi Rev.*, 1950, Vol. 13, No. 97, pp. 53–71.) The development of this service at Baddow is traced from its origin during the war, and an account is given of the factors upon which the forecasts are based. The efficiency of the storm warnings is reviewed and new developments are discussed in connection with future storm-warning services; an 'idealized' warning system might include solar-corona observations, solar-noise observations, monitoring of radio circuits having great-circle paths in (or near) the auroral zones, geomagnetic measurements, sunspot observations.

621.396.11 : 551.510.535 **2322**

The Air Force Interest in Sporadic E Ionization.—Gerson. (*See* 2212.)

621.396.81 **2323**

Reception [at Madrid] of [s.w.] Transmissions from Great Britain, the Vatican and U.S.A.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, Dec. 1948, Vol. 4, No. 14, pp. 10–16.) Graphs show receiver output power variations during March 1948 at various times of the day for transmissions in the range from 16.85 m to 50.26 m. Average values are compared with those for signals from Spanish and Australian stations.

621.396.81 **2324**

Washington and Madrid [radio] Propagation Forecasts.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, June 1949, Vol. 4, No. 16, pp. 20–29.) A comparison is made between N.B.S. forecast charts and the author's, based on experimental observations, for reception of wavelengths in the range 13–31 m. Agreement for January and February 1949 was better than for 1942, but there were still appreciable discrepancies.

621.396.81 **2325**

Back-Scatter Observations by the Central Radio Propagation Laboratory — August 1947 to March 1948.—W. L. Hartsfield, S. M. Ostrow & R. Silberstein. (*Bur. Stand. J. Res.*, Feb. 1950, Vol. 44, No. 2, pp. 199–214.) A high-power pulsed transmitter, the circuit diagram of which is given, and westwardly beamed aerial system were used, transmissions being made from Sterling, Virginia, at a frequency of 13.66 Mc/s. Back-scatter observations are presented graphically and photographs are shown of different types of echo pattern received. Back-scatter from both the ground and the E-region was identified, ground scatter usually predominating. Comparisons of results are made with transponder signals and skip-distance maps drawn from concurrent ionospheric data. Curves of calculated transmission and echo delays are also given.

621.396.81 **2326**

Effect of a Sudden Ionospheric Disturbance on Long Radio Waves Reflected Obliquely from the Ionosphere.—K. Weekes. (*Nature, Lond.*, 10th June 1950, Vol. 165, No. 4206, pp. 935–936.) The behaviour of radio waves reflected at oblique or at steep incidence during periods of sudden ionospheric disturbance is outlined. Signal-strength measurements on the Danish transmissions for the Decca navigation system suggest that for frequencies of about 100 kc/s, transmitted over about 900 km, the reflected wave amplitude is increased during a sudden ionospheric disturbance, corresponding to an effective reflection coefficient of 0.25, which is about five times the normal value. When waves of the same frequency are reflected at steep incidence, a decrease in amplitude is observed. In either case, the associated phase change corresponds to a decrease in the height of reflection.

On frequencies above 2 Mc/s a decrease in amplitude occurs both for vertical and oblique incidence, whereas frequencies in the region of 16 kc/s show little amplitude change at steep incidence but an increase at oblique incidence. The above results confirm and extend the recent observations of Smith-Rose (1228 of May).

621.396.812 **2327**

A Survey of Ionospheric Cross-Modulation.—L. G. H. Huxley & J. A. Ratcliffe. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, p. 165.) Discussion on 211 of January.

621.396.812 **2328**

Contribution to the Study of Gyromagnetic Frequency by means of Gyro-Interaction of Radio Waves in the Ionosphere.—M. Cutolo. (*Nuovo Cim.*, 1st Oct. 1948, Vol. 5, No. 5, pp. 475–488.) A full account of experiments carried out in 1947 and briefly reported in 2055 of 1948. The results confirm the previous observation that there is a regular rise in the value of the resonance freqnency during the course of the night.

621.396.812 **2329**

Low-Level Atmospheric Ducts.—R. F. Jones. (*Nature, Lond.*, 17th June 1950, Vol. 165, No. 4207, p. 971.) The variations in signal strength over paths in the Cardigan Bay area in conditions of strong wind can be related to the origin and subsequent track of the air over that area at the time. In particular, the drying effect on the lowest layers due to recent travel over land is important. See also 2033 of 1949.

551.510.535 : 621.396.11 **2330**

Short-Wave Radio and the Ionosphere. [Book Review]—Bennington. (*See* 2218.)

RECEPTION

621.396.621 **2331**

The Transmission-Line Discriminator.—P. Magne. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 89–93.) The principle is described by which discrimination is effected with an open-ended and a closed coaxial line across a common f.m. source. Calculation is made of the length of line required and of the amount of third harmonic. A harmonic-filter circuit including two valves Type 6AK5 is described for a discriminator for use in a 20-Mc/s band centred at 105 Mc/s. The response curve is flat over the whole band and distortion is of the order of 0.1%.

621.396.621.5 **2332**

A Crystal Tetrode used as a Frequency Changer.—R. W. Haegele. (*Onde élect.*, May 1950, Vol. 30, No. 278, pp. 239–241.) Preliminary experimental study showing the conversion characteristics as functions of the collector current, local oscillator voltage, etc. The crystals were of the type normally used in Ge diodes Type IN34, the points of contact of the three electrodes at the crystal surface forming an equilateral triangle of side about 0.05 mm. Signal frequencies up to at least 200 Mc/s may be used; there is little interaction between the input circuits; conversion gain is high. The maximum i.f. appears to be sensibly equal to the maximum frequency of amplifying crystal triodes, so that the input signals may have much higher frequencies.

621.396.821 : 621.317.7.087 : 551.594.6 **2333**

On the Recording of the Mean Level of Atmospherics.—Carbenay. (*See* 2282.)

621.396.822 **2334**

Thermal Noise at High Frequencies.—A. van der Ziel. (*J. appl. Phys.*, May 1950, Vol. 21, No. 5, pp. 399–401.) "Spenke's discussion of thermal noise from the point of view of the electron theory leads to a result which differs from Nyquist's original formula at frequencies ν such that $h\nu/kT \geqslant 1$. This discrepancy is due to the assumptions which Spenke made in his analysis."

621.396.822 : 621.396.619.13 **2335**

The Spectrum of Frequency-Modulated Waves after Reception in Random Noise: Parts 1 & 2.—D. Middleton. (*Quart. appl. Math.*, July 1949, Vol. 7, No. 2, pp. 129–174, and April 1950, Vol. 8, No. 1, pp. 59–80.) Mathematical analysis. The wave emerging from the i.f. amplifier and entering the limiter is assumed to be of the narrow-band type, the limiter providing an output voltage proportional to the instantaneous amplitude of the wave for amplitudes less than a certain threshold value, and a constant output for larger amplitudes. The discriminator is 'ideal' and provides an output voltage directly proportional to the instantaneous difference in frequency between the input wave and the central i.f.

The spectrum of the signal and of the noise emerging from the discriminator is analysed generally. The results of the analysis for no limiting and extreme limiting, for different input signal/noise ratios and for carrier mistuning, are presented graphically. Part 2 extends the theory given above to the general case of an arbitrary degree of limiting, the postulated conditions being the same as before. The spread of the spectrum of the noise due to the clipping produced by the limiter is evaluated. The results for various degrees of limiting are presented for the two special cases of no carrier (noise alone) and strong carrier.

621.396.621 + 621.396.61 **2336**

Radio Receivers and Transmitters. [Book Review]—S. W. Amos & F. W. Kellaway. Publishers: Chapman & Hall, London, 2nd edn revised 1948, 356 pp., 25s. (*Beama J.*, April 1950, Vol. 57, No. 154, pp. 117–118.) Deals mainly with receivers, only one of the ten chapters being devoted to transmitters. " . . . this book contains much useful information, and where proofs are lacking references are indicated."

[621.396.621 + 621.396.645] : 621.385 **2337**

Electronic Valves: Books II-IV. [Book Review]—(*See* 2388.)

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **2338**

On the Maximum Transmission Capacity of a Channel in the Presence of Noise.—J. Laplume. (*Onde élect.*, May 1950, Vol. 30, No. 278, pp. 235–238.) Paper presented at the Congrès d'Électronique et de Radioélectricité, January 1950. Random noise is the only essential factor limiting the capacity of a channel. A formula is derived showing the number of signals which may be transmitted in a given time interval. In the ideal case this number is an exponential function of the bandwidth. In the case of a.m. or f.m. the number is proportional to the pass band. With p.c.m. the theoretical limit may be reached. Quantization of a continuous message is possible only if the channel bandwidth is greater than that necessary for s.s.b. a.m. transmission, the bandwidth being increased at the expense of transmission power. See also 1649 of 1949 (Shannon) and 2319 of 1949 (Tuller).

621.39.001.11 : 519.283 **2339**

Correlation Functions and Communication Applications.—Lee & Wiesner. (*See* 2262.)

621.394/.396 **2340**

Telecommunications and Heaviside.—(*Electrician*, 26th May 1950, Vol. 144, No. 3754, p. 1752.) Report of a paper 'Fifty Years' Development in Telephone and Telegraph Transmission in Relation to the Work of Heaviside', by W. G. Radley, given at one of the I.E.E. Heaviside Centenary Commemorative Meetings, May 1950. Heaviside in 1876 first realized the need for an inductance term and, subsequently, for a leakage-conductance term in the basic equations for line transmission; the use of loading coils as standard practice followed from his theory. Modern improvements of these coils are mentioned. Heaviside's work on e.m. waves in space is considered and an account is given of systems developed to overcome the effects of ionospheric irregularities on long-distance radio communication.

621.395 **2341**

The Telephone and the Laboratory: Part 1.—H. M. Trainor. (*Trans. S. Afr. Inst. elect. Engrs*, Nov. 1949, Vol. 40, Part 11, pp. 251–274. Discussion, pp. 275–280.) The organization of telecommunications research in the Bell System, U.S.A., the British Post Office and the Australian Post Office is reviewed, and an account is given of work done in South Africa. This has consisted largely in the quality testing of equipment and the investigation of problems arising from the special conditions of use existing in South Africa. Laboratory facilities of the Post Office and other services are described and various laboratory and field investigations are discussed. Part 2: 2342 below.

621.395 **2342**

The Telephone and the Laboratory: Part 2.—H. M. Trainor. (*Trans. S. Afr. Inst. elect. Engrs*, March 1950, Vol. 41, Part 3, pp. 57–79. Discussion, pp. 80–86.) Relevant theories of speech, hearing and noise are reviewed and a detailed discussion is given of the transmission aspects of the telephone instrument, which is a source of distortion in a telephone system. The development of the modern instrument has been based on a detailed knowledge of speech characteristics and the various noise components affecting reproduction. The carbon type transmitter and the importance of improved magnetic materials in reduction of frequency distortion in receivers are discussed. Side tone can be reduced by modification of the matching induction-coil circuit. Tests of sensitivity, frequency response, nonlinear and amplitude distortion and articulation, are important measures of the efficiency of a system. The overall effective transmission or repetition rating, as determined in practice, is the final criterion of efficiency. Part 1: 2341 above.

621.396.1 **2343**

Technical Repercussions of the Copenhagen Plan.—J. Garcin. (*Toute la Radio*, May 1950, Vol. 17, No. 145, pp. 152–154.) Comment on the practical effects of the redistribution of wavelengths for French broadcasting, and suggested receiver adjustments to minimize interference.

621.396.619.16 **2344**

Pulse-Time and Pulse-Width Modulation.—P. Bréant. (*Ann. Télécommun.*, Oct. 1948, Vol. 3, No. 10, pp. 309–316.) Theoretical study made in 1946. The systems are defined and a rapid method for determining the modulation spectrum is described. In the case of p.t.m., demodulation cannot be effected with a simple low-pass filter. In p.w.m. this demodulation method is effective only if (*a*) modulation depth is small; (*b*) the sides of the pulses displaced by the modulation are steep; (*c*) only one side of the pulse is displaced. Demodulation by simple filtering is thus of little practical use for p.m. signals.

621.396.619.16 **2345**

Narrow-Band Pulse Communication.—T. Roddam. (*Wireless World*, June 1950, Vol. 56, No. 6, pp. 202–205.) Short square-wave amplitude-modulated pulses are converted to Gaussian pulses; the most efficient method is to use an amplifier with several 'maximal flatness' stages [3013 of 1941 (Landon)] and one plain RC stage. After the Gaussian pulses have travelled along telephone cables provided with suitable intermediate repeaters, the shape is preserved but there is overlapping of the pulse signals. The overlapping increases as the bandwith is decreased, causing cross-modulation, but a corrector circuit can be used to eliminate this effect.

621.396.65 **2346**

Carrier Power Requirements for Long-Distance Communication by Microwaves.—A. G. Clavier. (*Elect. Commun.*, March 1950, Vol. 27, No. 1, pp. 39–47.) A general expression is given for the path attenuation of a radio link in terms of wavelength, distance, and effective areas of transmitting and receiving aerials; abacs are presented for finding values of the free-space attenuation between (*a*) nondirectional and (*b*) parabolic aerials. Conditions for p.c.m. and f.m. transmission are compared; the r.f. power required for a p.c.m. system is 17 db less than for a corresponding f.m. system, suitable allowances being made for fading and for receiver noise, but under conditions of deep fading the f.m. system is the better.

621.396.65 **2347**

A Simple Microwave Relay Communication System.—M. G. Staton. (*Tele-Tech*, April 1950, Vol. 9, No. 4, pp. 40–42. 44.) This equipment operates in the 952–960-Mc/s band and uses conventional valves and circuits. The carrier frequency is derived by repeated multiplication from a ph.m. crystal-controlled oscillator operating at about 1 Mc/s, and the transmitter output is ≮ 3 W. The receiver is a superheterodyne with self-contained power supply. Dipole aerials with 42-in. parabolic reflectors are used for both transmitter and receiver. Unattended repeater stations are provided with automatic monitoring arrangements.

621.396.65 **2348**

V.H.F. Links at Manila Airport.—E. J. Rudisuhle & P. B. Patton. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 82–85.) Line-of-sight f.m. links in the 160-Mc/s band provide over 150 speech, telegraphy, printer and control circuits between the control station and remote transmitting and receiving stations. Details are given of some of the special circuits used.

621.396.823 : 621.395.44 **2349**

On Radiation from Overhead Transmission Lines.—M. Jenssen. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 166–178.) An analysis is made of the fields of single and multiple lines over imperfectly conducting earth. Field strengths measured along profiles transverse to a 3-phase line in a valley agreed quite well with theoretical values, for different connections of the lines. Single phase-to-earth connection in power-line carrier systems is undesirable if interference is to be minimized. It is suggested that horizontal aerials may be useful for low-power broadcasting transmission in valleys.

621.396.931 **2350**

The Introduction in Switzerland of the Public Telephone Service to Vehicles.—H. Kappeler. (*Bull. schweiz. elektrotech. Ver.*, 9th July 1949, Vol. 40, No. 14, pp. 433–439. In French, with German summary.) By the service introduced at Zürich in June 1949 2-way telephone connection via a radio link may be made with any suitably equipped vehicle plying within about 10 km of a fixed transmitting/receiving station. Details are given of the automatic calling and selection system and of the R/T equipment. Phase modulation is used, with carrier frequencies between 31 and 41 Mc/s.

621.396.932 : 621.396.5.029.62 **2351**

Thames Radio Service.—(*Wireless World*, June 1950, Vol. 56, No. 6, pp. 215–216.) For an abstract of another account see 999 of April (Neale & Burr).

SUBSIDIARY APPARATUS

621-526 : 621.396.645.37 **2352**

Feedback Amplifiers and Servo Systems.—Ward. (*See* 2175.)

621-526 : 621.398 **2353**

Synchro Units for Remote Indication and Control.—S. N. Mead & G. E. Day. (*Elect. Mfg, N.Y.*, April 1949, Vol. 43, No. 4, pp. 74–79..204.) Operating characteristics are given of many types of a.c. self-synchronous transmitter and indicator units commercially available, together with design details useful in selecting equipment for particular practical applications.

621.3.077.2(.3] : 621.3.016.35 **2354**

On the Application of Stability Criteria to an Amplidyne Control Circuit.—F. van Geertruyden. (*HF, Brussels*, 1950, No. 6, pp. 169–176.) The amplidyne, a dynamo-electric amplifier, plays a part in control circuits very similar to that of an electronic amplifier. The mathematical study of such amplifiers, particularly with reference to stability, has been extended to the amplidyne. Two stability criteria are examined: that of Leonhard, which is mathematically tractable, and the generalized Nyquist criterion, which is particularly suitable for use in the experimental study of a control circuit. The formulation of the equation for a control circuit is simple in operational notation. Transients superposed on the steady state are specially studied. An account is given of a complete numerical investigation, both theoretical and experimental, of the stability in two types of alternator-voltage regulation. In one case the amplidyne supplies the alternator excitation directly and in the other case feeds a separate exciter.

621.316.726 : 621.314.3† **2355**

A Magnetic-Amplifier Frequency Control.—L. J. Johnson & H. G. Schafer. (*Elect. Engng, N.Y.*, May 1950, Vol. 69, No. 5, p. 445.) Summary of 1950 A.I.E.E. Winter General Meeting paper. A circuit is described for stabilizing the 60-c/s output frequency of a small motor-driven alternator. A magnetic amplifier is controlled by the output of a pair of balanced tuned circuits fed from a pilot generator attached to the dynamotor shaft, and its output in turn regulates the field of the dynamotor. Temperature stability is obtained by the use of permalloy cores in the tuned circuits. Frequency regulation of the order of 1 part in 5 000 at normal temperatures is claimed.

621.396.682 **2356**

Design, Construction and Test of a Stabilized Anode-Voltage [supply unit].—L. Chrétien. (*T.S.F. pour Tous*, May 1950, Vol. 26, No. 259, pp. 177–180.) Details and performance of equipment using the circuit noted in 1532 of June.

621.398 **2357**

Radio Synchro-Motor [selsyn].—In 1258 of May please change J. R. Duthil to J. R. Dutilh.

TELEVISION AND PHOTOTELEGRAPHY

621.397.6 **2358**

Line-by-Line Black-Level Control of Television Signals.—N. N. Parker Smith. (*Marconi Rev.*, 1950, Vol. 13, No. 97, pp. 81–85.) The gain of a receiver or the carrier level of a transmitter is controlled by a voltage derived during part of the 5-μs black-level period at the commencement of each line. This control voltage, proportional in amplitude to the black-level signal, remains steady over the line period of approximately 100 μs, and yet follows any changes which occur between successive lines. The description of the control arrangement is illustrated by circuit and waveform diagrams.

621.397.6 **2359**

Simplified Television for Industry.—R. C. Webb & J. M. Morgan. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 70–73.) Equipment using the vidicon camera tube (2040 of August).

621.397.6 : 621.317.79.001.4 **2360**

Television Monitors.—Jacob. (*See* 2290.)

621.397.611.21.002.2 **2361**

Producing the 5820 Image Orthicon.—R. B. Janes, R. E. Johnson & R. R. Handel. (*Electronics*, June 1950, Vol. 23, No. 6, pp. 93–95.) Short illustrated account of the special techniques used.

621.397.62 **2362**

Magnetic Deflector Coils.—(*Radio tech. Dig., Édn franç.*, June 1950, Vol. 4, No. 3, pp. 131–156.) An article based primarily on 2043 of August (Cocking), with added bibliography.

621.397.621.2 **2363**

R.C.A. Color Kinescope Demonstrated.—(*Tele-Tech*, May 1950, Vol. 9, No. 5, pp. 20–21..63.) In the two laboratory-produced tubes described the screen is composed of 351 000 colour-emitting dots arranged in triangular groups of three, corresponding to the three primary colours of the picture. An apertured mask is interposed between the electron beam source and the screen so that one colour only is emitted by each group as it is scanned. (*a*) Three-gun tube. Each gun is operated in the time sequence corresponding to the sampling process at the transmitter. Each gun excites one colour only on the tube face. (*b*) Single-gun tube. Two sets of coils fed with quadrature currents at the sampling frequency generate a rotating field producing circular deflection of the beam. The phase of the field determines which colour is excited on the tube face.

621.397.645 : 621.316.761.2 **2364**

How to Adjust Frequency Response in Video Amplifiers for TV.—Roe. (*See* 2296.)

621.397.743 : 621.392.5 : 621.315.212 **2365**

Equalization of Coaxial Lines.—Gould. (*See* 2152.)

621.397.82 : 621.392.52 **2366**

The Latest Techniques for the Elimination of Ham TVI.—Rand. (*See* 2156.)

621.397.5 **2367**

Television Explained. [Book Review]—W. E. Miller. Publishers: The Trader Publishing Co., London, 3rd edn, 104 pp., 5s. (*J. Brit. Instn Radio Engrs*, May 1950, Vol. 10, No. 5, p. vi.) A number of sections have been revised and additional information is included. "The treatment is non-mathematical . . . The student, the radio service engineer and the amateur will find this book an excellent investment. . ."

TRANSMISSION

621.394.61 **2368**

Low-Frequency Radiotelegraph Transmitter for Arctic Use.—H. P. Miller, Jr. (*Elect. Commun.*, March 1950, Vol. 27, No. 1, pp. 11–20.) A conventional 10-kW equipment for operation in the frequency range 80–200 kc/s or, in later models, 200–300 kc/s. Single-frequency operation with on-off keying is normally used, but provision is also made for modulated c.w. operation. Arctic conditions necessitate air cooling of the F.892R final amplifier valve and preheating of the Hg-vapour rectifiers. Unit construction is employed to facilitate the transportation of the equipment by air.

621.396.61 : 621.396.97 **2369**

Contribution to the Study of High-Efficiency Broadcasting Transmitters.—J. Polonsky. (*Ann. Radioélect.*, April 1950, Vol. 5, No. 20, pp. 109–124.) The simplified theory of the grid-modulated amplifier is criticized and a more rigorous theory put forward. The disadvantages of the Doherty-Terman circuit (4020 of 1936 and 4300 of 1938) are practically eliminated in the experimental S.I.F. transmitter at Boutigny by (*a*) locating the impedance inverter at the r.f. exciter input; (*b*) mounting the two modulator valves in a cathodyne connection; (*c*) incorporating an overall degenerative and a local regenerative feedback loop. Useful carrier power of this transmitter is 18 kW; anode efficiency of the final stage 73%; overall efficiency 43%. Other characteristics are shown. The advantages of such equipment compared with those using anode modulation of the last h.f. stage are stressed.

621.396.615.142.2: 621.396.619.13 **2370**

Experiments on the Modulation of a Reflex Klystron.—J. van Mulders. (*HF, Brussels*, 1950, No. 6, pp. 153–163.) Theory of the relation between the oscillation frequency of a reflex klystron and the reflector voltage is reviewed and measurements of the modulation index of an American klystron, Type 707B, are described. The modulation index was determined from photographs of the modulation spectrum displayed on a c.r.o. The modulation distortion can at once be found from the modulation index when the static characteristic of the klystron (frequency as a function of reflector voltage) is known.

621.396.619.23 **2371**

Rectifier Modulators with Frequency-Selective Terminations.—D. G. Tucker. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 205–207.) Discussion on 269 of January.

621.396.619.23 **2372**

Non-Linear Distortion in a Cowan Modulator.—V. Belevitch. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 164–165.) Author's reply to 1552 of June (Tucker & Jeynes).

621.396.61+621.396.621 **2373**

Radio Receivers and Transmitters. [Book Review]—Amos & Kellaway. (*See* 2336.)

VALVES AND THERMIONICS

621.385 : 621.318.572 **2374**

An Electron-Beam Decimal-Counter Tube.—D. L. Hollway. (*Nature, Lond.*, 27th May 1950, Vol. 165, No. 4204, pp. 856–857.) The tube described is 2.9 cm in diameter and 15 cm long, and operates at the relatively low anode voltage of 500 V with a beam current of 300 μA and a frequency range 0–68 kc/s. The beam is caused to move in a path comprising alternate radial and circumferential steps by means of a special 5-plate deflector system with appropriate connections to a 5-segment slotted collector electrode. Visual indication of the count is given by projection on to the fluorescent screen of numbers cut in the back segments of the collector electrode.

621.385.029.63/.64 **2375**

Wave Propagation in a Slipping Stream of Electrons: Small Amplitude Theory.—G. G. Macfarlane & H. G. Hay. (*Proc. phys. Soc.*, 1st June 1950, Vol. 63, No. 366B, pp. 409–427.) Amplifying waves are found to travel along a slipping stream of electrons for all frequencies, a slipping stream being defined as one in which the electrons move in parallel paths with velocities varying with distance transverse to their motion. A slipping-stream valve may have the properties of a two-beam valve or a travelling-wave valve. The characteristics of one or the other are displayed according to whether $(V_a - V_{-a})/(V_a + V_{-a}) \lesseqgtr 0.42$, the velocity of the electrons varying linearly from V_{-a} to V_a across the stream. A slipping stream inside a waveguide, capable of guiding a TM wave of slow phase-velocity in the absence of the electrons, acts very much as a travelling-wave valve with a uniform electron beam.

621.385.029.63/.64 **2376**

Experimental Investigation of a Long Electron Beam in an Axial Magnetic Field.—J. S. A. Tomner. (*Chalmers tekn. Högsk. Handl.*, 1950, No. 92, 16 pp. In English.) An extension of an experimental investigation (561 of 1949) of the effect of the focusing magnetic field on the amplification of a travelling-wave valve. The form of the magnetic field produced by two helical focusing coils is studied and the collector current measured as a function of the number of turns of the coils. To avoid helix current due to space-charge effect for a helix of length 35 cm and diameter 3 mm, using a beam current of 1.5 mA and an accelerating voltage of 2 200 V, a field of 400 gauss or more is necessary.

621.385.029.63/.64 **2377**

Traveling-Wave Tubes: Part 2.—J. R. Pierce. (*Bell Syst. tech. J.*, April 1950, Vol. 29, No. 2, pp. 189–250.) The second instalment (Chapters 4, 5 and 6) of a forthcoming book. Chapter 4 discusses the two methods of analysing iterated waveguide structures used in travelling-wave valves, involving field theory and lumped-circuit analogues respectively. These methods are illustrated by analysis of typical simple structures. Chapter 5 is a discussion of group and phase velocities, gain and bandwidth, and the criteria by which the quality of a circuit should be judged. The helix and various resonator circuits are compared. In Chapter 6 the circuits are described in terms of normal modes of e.m. wave propagation. Part 1: 1810 of July.

621.385.029.63/.64 **2378**

1 000-Watt Traveling-Wave Tube.—S. E. Webber. (*Electronics*, June 1950, Vol. 23, No. 6, p. 100–103.) An article based on a 1949 National Electronics Conference paper. An illustrated description and construction details are given of a water-cooled valve which as a power amplifier produces a power gain of about 25 at 450 Mc/s. The efficiency is 20% when operated with a beam voltage of 5 000 V and beam current of 1 A. Unwanted oscillations are suppressed by an attenuator consisting of a conducting coating on the outside of the valve. The inherent bandwidth is more than adequate for most commercial applications where a wide transmission band is required. See also *Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 493–499.

621.385.032.213.2 **2379**

Change of Mutual Conductance with Frequency.—W. Raudorf. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 164.) Author's reply to 1812 of July (Eisenstein). See also 1301 of May.

621.385.032.216 **2380**

Contribution to the Study of Oxide Cathodes.—F. Violet & J. Riethmuller. (*Le Vide*, Nov. 1949, Vol. 4, No. 24, pp. 687–720.) Reprint. See 2956 of 1949.

621.385.15 **2381**

Secondary-Emission Valve.—G. Diemer & J. L. H. Jonker. (*Wireless Engr*, May 1950, Vol. 27, No. 320, pp. 137–143. Correction, *ibid.*, June 1950, Vol. 27, No. 321, p. 194.) "An experimental secondary-emission valve is described. The high figure of merit (g_m/C = 3.0 mA/V-pF) that is obtained by adding one stage of secondary emission to an earthed-grid triode of rather conventional construction makes the valve useful as a wideband amplifier for those cases where a very low noise figure is not required; typical figures are: at 1 m wavelength 30 db gain (G) with a bandwidth (B) of 3.5 Mc/s, at 50 cm G = 15 db with B = 20 Mc/s, at 30 cm G = 10 db with B = 10 Mc/s. The maximum power output is for $\lambda > 1$ m about 1.5 watts. At 7 m wavelength the noise figure amounts to 12 db; this rather high value is due to secondary emission. It is shown that for this secondary-emission noise a kind of space-charge smoothing effect exists."

621.385.18.001.4 **2382**

Measurement of Tube Voltage Drop in Hot-Cathode Gas Tubes.—Smith. (*See* 2291.)

621.385.2 **2383**

Space Charge in Planar Diodes.—C. S. Bull. (*Proc. Instn elect. Engrs*, Part III, May 1950, Vol. 97, No. 47, pp. 159–165.) Following Langmuir's assumptions, the author considers five variables: total emissivity i_s, anode current i, anode voltage V, the value V_m of Langmuir's 'potential minimum' and the cathode/anode separation x. Of these only three are independent. From them are formed thirty partial differential coefficients, which are tabulated. By using these, quantities not accessible to direct measurement can be calculated. Particular attention is paid to the 'motional transconductance' $(\delta i/\delta x)_{V i_s}$, which is related to scale changes in valves and to their microphonic properties; a method for determining this quantity is described.

621.385.3 : 621.396.615.14 **2384**

Electron Transit Time.—M. R. Gavin. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 164.) Comment on 1820 of July (Chatterjee & Sreekantan).

621.385.832 **2385**

Improved Production Methods for Television C.R. Tubes.—(*Engineer, Lond.*, 21st April 1950, Vol. 189, No. 4917, pp. 482–483.) Description of an automatic machine installed at the Mullard factory for joining the necks and heads of c.r. tubes; the continuous production rate is 60 bulbs per hour.

621.385.832 : 535.371.07 : 621.396.9 **2386**

Visibility on Cathode-Ray Tube Screens: Positive *vs* Negative Signals on an Intensity Modulated Scope.—M. W. Harriman & S. B. Williams. (*J. opt. Soc. Amer.*, Feb. 1950, Vol. 40, No. 2, pp. 102–104.)

621.396.615.141.2 : 621.385.833 **2387**

Electron-Optical Mapping of the Space-Charge Field in a Magnetron.—(*See* 2315.)

621.385 : [621.396.621 + 621.396.645 **2388**

Electronic Valves: Books II-IV. [Book Review]—Cleaver-Hume Press, London and N. V. Philips, Eindhoven, Holland.

Book II. Data and Circuits of Receiver and Amplifier Valves. 409 pp., 21s.

Book III. First supplement to Book II. 213 pp., 12s. 6d.

Book IV. Application of the Electronic Valve in Radio Receivers and Amplifiers. 416 pp., 35s. (*Wireless Engr*, June 1950, Vol. 27, No. 321, pp. 193–194.) Book I was noted in 519 of February. Books II and III chiefly consist of details of the characteristics of Philips' valves, one dealing mainly with the E, C and K series and the other with the more recent E20, U20, D20 and U series and their applications. Book IV is in the nature of a wireless-receiver textbook and is of general application. "The treatment throughout is very thorough but . . . almost entirely from the viewpoint of the designer of broadcast receivers." See also 991 of April.

621.385.83 **2389**

The Theory and Design of Electron Beams. [Book Review]—J. R. Pierce. Publishers: D. Van Nostrand, New York, 1949, 197 pp., $3.50. (*Wireless Engr*, May 1950, Vol. 27, No. 320, p. 166; *Electronics*, June 1950, Vol. 23, No. 6, pp. 134–136.) " Written on the graduate level, [the book] discusses that material on electron beams which lends itself most readily to mathematical analysis, although some attention is also given to experimental techniques . . . [It] is clearly intended for those concerned with the formation and focusing of electron beams for use in such devices as low-frequency amplifiers, oscillators, and, especially, microwave tubes... Comparisons between theory and practice are frequent. All chapters are followed by excellent problems . . . "

MISCELLANEOUS

6 : 061.4 **2390**

British Scientific Instruments exhibited at Olympia.—(*Metallurgia, Manchr*, May 1950, Vol. 41, No. 247, pp. 401–413.) Short descriptions of equipment shown on the stand of the Scientific Instrument Manufacturers' Association at the 1950 British Industries Fair, including a wide range of electronic apparatus, magnetic and electrical instruments, electromechanical equipment, temperature measurement and control apparatus, optical equipment and vacuum plant.

621.39 Heaviside **2391**

The Heaviside Centenary.—(*Electrician*, 26th May 1950, Vol. 144, No. 3754, pp. 1747–1748.) Report of Heaviside Centenary Commemorative Meetings, May 1950. The opening paper, ' Heaviside, the Man ', by G. Lee, was followed by short tributes from leading scientists. Abstracts of papers on particular aspects of Heaviside's work will be found in the relevant sections.

621.39 Heaviside **2392**

Oliver Heaviside and his Layer.—E. V. Appleton. (*Wireless World*, May 1950, Vol. 56, No. 5, pp. 187–188.) A short appreciation of Heaviside's work, with special reference to his suggestion concerning the possible existence of a conducting layer in the upper atmosphere. See also 2391 above.

621.3 **2393**

Leitfaden der Elektrotechnik. Vol. 1: Grundlagen der Elektrotechnik. [Book Review]—Moeller & Wolff. Publishers: B. G. Teubner Verlagsgesellschaft, Leipzig, 4th edn, 358 pp. (*Wireless Engr*, June 1950, Vol. 27, No. 321, p. 193.) This textbook is unreservedly recommended to both students and teachers with a knowledge of German; the foundations of electrical engineering are laid with great thoroughness. A new chapter is included on the calculation of single-phase and three-phase transmission lines.

621.38/.39 **2394**

Electronic Engineering Master Index for 1947-1948. [Book Review]—Publishers: Electronics Research Publishing Co., New York, 1950, 339 pp., $19.50. (*J. Franklin Inst.*, April 1950, Vol. 249, No. 4, p. 340.) The second supplement of this reference work, which covers all aspects of the subject, and indexes material from about 250 scientific periodicals.

Second Group

ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2395**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 395–399.) Continuation of 1838 of August.

534.012 : [532.111 + 534.22 **2396**

The Mean Pressure and Velocity in a Plane Acoustic Wave in a Gas.—P. J. Westervelt. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 319–327.) The one-dimensional equation for a travelling wave is discussed to the second order of approximation, using Airy's solution to the Lagrangean form of the equation as a basis; second-order effects are reviewed and correlated. Forces on a particle in the wave have a time-average component which is opposed to the radiation pressure and whose magnitude may exceed that of the radiation pressure; this may result in a particle drift velocity, in a direction opposed to wave propagation, of about 1 cm/sec for a sound pressure level of 151 db in air. Standing waves of large amplitude are also considered.

534.321.9 : 061.3 **2397**

International Convention on Ultrasonics.—G. Bradfield. (*Nature, Lond.*, 22nd July 1950, Vol. 166, No. 4212, pp. 143–144.) A short report of the proceedings at the convention held in Rome, June 1950, with an outline of some of the subjects discussed. Slightly more than 50% of all the contributions were concerned with biology and medicine.

534.321.9 : 615 **2398**

Ultrasonic Apparatus for Therapeutic Applications.—H. Thiede. (*Elektrotechnik, Berlin*, June 1950, Vol. 4, No. 6, pp. 219–223.) Discussion of the physical characteristics of ultrasonic waves and description of piezoelectric and magnetostriction generators for frequencies up to about 3 Mc/s, including some giving focused beams.

534.322.3 : 534.6 : 621.396.822 **2399**

Background Noise and the Use of White Noise in Acoustics.—P. Chavasse & R. Lehmann. (*Ann. Télécommun.*, June 1950, Vol. 5, No. 6, pp. 229–236.) The theory of background noise is reviewed. A neon tube is preferred to a pentagrid valve as a practical generator of white noise. The circuit of the artificial voice (3404 of 1947) is shown. Architectural, physiological and electro-acoustic applications of noise sources are indicated. Some 50 references are given.

534.415 **2400**

Stroboscopic Audio-Frequency Spectrometer.—F. A. Fischer. (*Fernmeldetech. Z.*, May 1950, Vol. 3, No. 5, pp. 174–180.) The stroboscopic method of measurement is discussed and two instruments are described. A light source is modulated with the signal to be measured and viewed through a revolving stroboscopic screen characteristically sectioned. Alternatively, a fixed screen suitably sectioned, e.g. with a hyperbolic pattern for a linear frequency scale, is viewed in a revolving mirror. Frequency range is 60 to 6 000 c/s.

534.613 **2401**

On the Radiation Pressure of Spherical Waves.—R. Lucas. (*C. R. Acad. Sci., Paris*, 5th June 1950, Vol. 230, No. 23, pp. 2004–2006.) An expression is derived for the acoustic pressure due to the pulsation of a sphere of dimensions small compared with the wavelength. Near the surface of the sphere the value is twice the density of the kinetic energy; this greatly exceeds the total energy density, and agrees with the value deduced from Brillouin's pressure tensor. Consideration of the pressure exerted by a stationary spherical wave on a reflecting boundary surface leads to an expression involving the factor 3, characteristic of spherically symmetrical systems. The limiting case of a stationary plane wave acting on a finite plane-parallel reflector is considered, and the formula here developed is reconciled with that previously given by Brillouin.

534.7 2402

Auditory Sensation produced by Rectangular Waves.—R. Chocholle. (*Ann. Télécommun.*, June 1950, Vol. 5, No. 6, pp. 237–242.) Discussion of the results of an experimental study. The waveform of the sound waves resulting from application of square waves to an acoustic transducer depends largely on the ratio between the fundamental frequency of the applied square waves and the resonance frequencies of the transducer. The character of the sensation produced is distinct in the very low, low, medium and high-frequency ranges. In certain narrow frequency bands slight variation of frequency produces a marked change in sensation, i.e., intensity and general timbre. The ear is found to respond rather to the wave envelope and total effective amplitude than to the individual components of the sound spectrum.

534.78 : 621.395 2403

The Perception of Speech and its Relation to Telephony.—H. Fletcher & R. H. Galt. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, p. 327.) Correction to paper abstracted in 1844 of August.

534.833.4 2404

A Review of the Absorption Coefficient Problem.—H. J. Sabine. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 387–392.) The problem of discrepancies between measurements of acoustic absorption coefficient obtained by different workers is discussed from the viewpoint of the materials manufacturer. Suggestions are made for further theoretical and experimental investigations.

534.843 2405

Transient Sounds in Rooms.—D. Mintzer. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 341–352.) Laplace-transform methods are used for investigating the propagation of transient sound waves. In the one-dimensional case propagation of a plane wave in a rigid-walled tube is considered. The velocity potential for an arbitrary particle-displacement input is found as a series, each term of which represents the effect of a reflection from an end of the tube. In the three-dimensional case a spherical wave is considered in unbounded and variously bounded regions, and the case of a point source in a rectangular room is solved. An image method is used. Examples are calculated for both one- and three-dimensional systems.

534.844.1 : 621.3.015.33 2406

Pulse Statistics Analysis of Room Acoustics.—R. H. Bolt, P. E. Doak & P. J. Westervelt. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 328–340.) Reverberation time is not by itself an adequate index of the acoustic quality of a room, since it does not give information about the response to transients. To take account of the pulse-like nature of common sounds, an analytical technique has been developed in which the walls of the room are replaced by an infinite array of image sources; a statistical consideration of this array gives the long-term average response to transients. To illustrate the technique a description is given of experiments carried out in a rectangular room with hard plastered walls, using a sound source emitting 2-ms pulses of 3 600-c/s damped waves.

534.846 : 621.396.712.3 2407

Rooms with Reverberation Time Adjustable over a Wide Frequency Band.—P. Arni. (*J. acoust. Soc. Amer.*, May 1950, Vol. 22, No. 3, pp. 353–354.) Description of a broadcasting studio at Helsinki having wall elements with variable absorption characteristics.

621.395.623.7 2408

A Contribution to the Design of Horn Loudspeakers.—J. Merhaut. (*Tesla tech. Rep., Prague*, Dec. 1949, pp. 41–43.) The high-frequency response may be improved by subdividing the throat of the exponential horn, since the phase differences between the sound waves emanating from different parts of the diaphragm may thereby be reduced. A new design described gives a 4.5-db improvement at 8 kc/s.

621.395.623.7 2409

A New Loudspeaker Combination.—H. Schmidt. (*Funk u. Ton*, May 1950, Vol. 4, No. 5, pp. 226–232.) A high-efficiency loudspeaker with a strong electromagnet for transient damping has a 'spherical-wave' modified exponential horn. In front of the light metal spherical membrane is a slotted acoustic cone for equalizing sound-path lengths in the neck of the horn, giving a further increase of the electroacoustic efficiency. With the associated filter circuit it is mounted above a bass-response loudspeaker which has a conical diaphragm of diameter 35 cm. The response curve of the combination is shown. It is nearly level between 50 c/s and 10 kc/s. Crossover occurs at 500 c/s.

621.395.623.8 : 621.398 2410

Remote Control of the Tesla RU Rack and Panel Public Address System.—L. Pravenec. (*Tesla tech. Rep., Prague*, Dec. 1949, pp. 33–40.) Panel units are described (*a*) for use at a main station, making remote control of up to 10 substations possible, and (*b*) for use at a substation, enabling it to accept remote control from a main station while retaining the possibility of independent operation.

621.395.625.3 + 681.84/.85] : 061.4 2411

Sound Reproduction.—(*Wireless World*, July 1950, Vol. 56, No. 7, pp. 255–258.) Short descriptions of equipment at the exhibition arranged by the British Sound-Recording Association in London, May 1950. In addition to disk, magnetic wire and tape, and film recorders, many examples of amplifiers, loudspeakers, pickups, microphones and auxiliary and test equipment were shown, as well as B.B.C. and Radio Luxembourg sound-recording vans.

681.85.001.4 2412

A Feedback-Controlled Calibrator for Phonograph Pickups.—J. G. Woodward. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 301–309.) The gramophone-pickup calibrator is an electromechanical device for imparting known and controllable lateral motions to the stylus of a pickup under test. The calibrator employs a dynamic driving system, and electromechanical feedback is used to secure a uniform response between 20 c/s and 20 kc/s. The absolute as well as the relative response of a pickup can be conveniently and quickly measured within this frequency range.

681.85.004.62 2413

Record and Stylus Wear.—G. H. H. Wood. (*Wireless World*, July 1950, Vol. 56, No. 7, pp. 245–248.) Neither low stylus pressure nor sapphire points which are dimensionally correct can, of themselves, provide a satisfactory solution to the problem of record wear. It is shown, with the aid of photomicrographs, that greatly prolonged stylus life and low record wear result from the use of a crystal pickup head with a correctly designed sapphire stylus so mounted that the coupling is comparatively flexible in the vertical direction. Vertical movement of the stylus is not transmitted to the pickup head and the system reduces the effective mass of the stylus to a very low value compared with that of conventional stylus systems.

621.395.625 + 534.862.4 **2414**

The Recording and Reproduction of Sound. [Book Review]—O. Read. Publishers: H. W. Sams & Co., Indianapolis, U.S.A., 1949, 364 pp., $5.00. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 136, 138.) The book brings together information which until now has been scattered in periodicals and instruction manuals; it is of interest more to the technician and the gramophone enthusiast than to the engineer. See also 632 of 1949 and back references.

AERIALS AND TRANSMISSION LINES

621.315.212 **2415**

Coaxial Cable and its Optimum Design.—P. Ya. Shiniberov. (*Priroda*, Jan. 1949, No. 1, pp. 69–74. In Russian.) Cable theory is discussed and methods are indicated for determining the capacitance and attenuation for different types of cable. The ratio of the radii of the conductors for maximum dielectric strength is also determined. Multicore cables with several coaxial pairs are briefly considered.

621.315.34.011.4 **2416**

Capacity of a Pair of Insulated Wires.—W. H. Wise. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, pp. 432–436.) A method of calculating capacitance is given which is related to but involves less numerical computation than that noted in 660 and 1446 of 1946 (Craggs & Tranter). Certain analytical difficulties which arise when the insulating jackets are in contact are indicated.

621.392 **2417**

Unbalanced Terminations on a Shielded-Pair Line.—K. Tomiyasu. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 552–556.) The simultaneous propagation of balanced and unbalanced modes along a shielded-pair line results in an unbalanced component of current. This can be determined by comparing the different standing-wave distributions on the two conductors. Measurements of the components of waves reflected from unbalanced radiative terminations (e.g., end-coupled aerials) on a slotted shielded-pair line are described.

621.392.1 **2418**

The Effect of a Bend and Other Discontinuities on a Two-Wire Transmission Line.—K. Tomiyasu. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 679–682.) The effect is analysed by the vector-potential method, the equivalent-circuit elements being obtained by comparing the variable-line parameters near the bend with the conventional-line parameters found on an infinite line. Good agreement is found between theoretical and experimental values of the circuit elements for the bend and also for open-end and bridged-end lines. See also 28 of January (King & Tomiyasu).

621.392.26† : 621.3.09 **2419**

Propagation of the TM_{01} Mode in a Metal Tube containing an Imperfect Dielectric.—D. L. Hetrick. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 561–564.) Losses in both the metal wall and the dielectric are taken into account in this analysis, the subject being treated as a boundary-value problem. General expressions are derived for the attenuation and phase constant, and the percentage error introduced by (*a*) neglecting wall losses and (*b*) assuming total attenuation to be the sum of the dielectric and wall-loss attenuations is computed for a particular case.

621.392.26† : 621.392.52 **2420**

Ring Mode Filter for Type H_{11} Waves in Circular Waveguides.—Z. Szepesi. (*Onde élect.*, May & June 1950, Vol. 30, Nos. 278 & 279, pp. 230–234 & 293–298.) Experimental investigation of ring mode filters of different dimensions in a waveguide of diameter 8 cm, using a wavelength of 11 cm. Results are tabulated. Good reflection occurs when the circumference of the ring is slightly greater than the free-space wavelength. The characteristics of the filter are practically independent of its conductivity. Impedance of the ring varies linearly with its circumference, when the circumference is less than that required for resonance the impedance is capacitive; when greater, it is inductive. Bandwidth increases with the cross-section of the ring. Measured bandwidth is considerably greater than the value given by the theory of Feuer & Akeley (640 of 1949). Using a combination of two filters, $3\lambda_g/4$ spacing is the most effective, where λ_g is the wavelength in the waveguide. The characteristics of a filter may be determined from its distance from a filter of known characteristics when the transmission coefficient of the combination has its maximum value.

621.392.43 **2421**

A Tapered Line Termination at Microwaves.—G. J. Clemens. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, pp. 425–432.) The termination considered is a short-circuited section of coaxial line with a uniformly tapered metallic outer conductor and an inner conductor consisting of a glass tube coated with a thin resistive metal film. The distribution of voltage and current is investigated theoretically and the measured values of voltage s.w.r. for the termination over the range 990–3 968 Mc/s are compared with those calculated for an exponential line, which is considered in the analysis as a convenient approximation.

621.396.67 **2422**

The Effect of an Obstacle in the Fresnel Field on the Distant Field of a Linear Radiator.—G. A. Woonton. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 577–580.) An analytical method is developed for determining the errors due to diffraction which arise when measurements on microwaves are made by optical methods. The analysis is applied to the particular problem of determining the distant field of a horn radiator with the aperture of a large screen in front of it at an arbitrary angle. Satisfactory agreement is obtained between calculated and measured values (2133 above).

621.396.67 **2423**

Effect of a Finite Groundplane on Antenna Radiation.—A. Leitner & R. D. Spence. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 199.) Summary of American Physical Society paper. The field of a $\lambda/4$ dipole over a circular ground-plane is calculated exactly. Both the current in the ground-plane and the radiation at great distances are found. As the radius of the ground-plane is increased, the radiation resistance and the surface current oscillate about the values which characterize a $\lambda/4$ aerial above an infinite ground-plane, but the radiation pattern is entirely different. The results are in good quantitative agreement with the experimental results of Meier & Summers (2440 of 1949).

621.396.67 **2424**

The Directive Properties of Receiving Aerials.—É. Roubine. (*Onde élect.*, June 1950, Vol. 30, No. 279, pp. 259–266.) Full paper of which an abridged version was given in *C. R. Acad. Sci., Paris*, 3rd May 1950, Vol. 230, No. 18, pp. 1590–1592. Distinction is made between the case of rectilinear polarization and the general case of elliptical polarization. A simple fundamental formula is derived expressing the current in a receiving aerial as a function of the incident field, the load, and the radiating properties of the aerial in the direction from which the waves are received. The question of the identity of the directive properties of aerials for transmission and reception is in general not well defined. The directivity for emission is, in fact, controlled by a single characteristic, while for reception this characteristic is altered by the intensity and polarization of the incident field, so that all comparisons of the directive properties necessitate an arbitrary convention in respect of the incident field. When considering gain, this convention is modified. The effect of polarization is discussed by means of an optical analogy. Current formulae for the absorption surface and the effective length of a receiving aerial are generalized.

621.396.67 : 621.397.6 **2425**

Ultra-High-Frequency Antenna and System for Television Transmission.—O. O. Fiet. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 212–227.) The construction and performance are described of an omnidirectional horizontal-polarization aerial consisting of two coaxial tubes. The inner one acts as a transmission line feeding groups of slot aerials in the outer tube by means of radial probes. A power gain of 17.3 db is obtained at 530 Mc/s.

An account is also given of the design and performance of the waveguide feed between the transmitter and the aerial, the vestigial-sideband filter and a notch diplexer which enables the sound and vision signals to be fed along the common transmission line.

The aerial system was developed for operation at Bridgeport, Connecticut [1795 of July (Guy, Seibert & Smith)].

621.396.67.029.62/.63 **2426**

Experimental Investigations on Wide-Band Metre- and Decimetre-Wave Aerials.—K. Lamberts & L. Pungs. (*Fernmeldetech. Z.*, May 1950, Vol. 3, No. 5, pp. 165–173.) Study made in 1942 of the characteristics of single dipoles with reflectors. A greater bandwidth can be obtained by increasing the diameter when tubes are used as the dipole elements, or by the use of specially shaped flat elements. Circle diagrams show the influence of tube diameter, aerial length and reflector distance on the frequency dependence of the aerial input impedance.

621.396.671 : 621.3.011.2 **2427**

Input Impedance of Two Crossed Dipoles.—L. G. Chambers. (*Wireless Engr*, July 1950, Vol. 27, No. 322, pp. 209–211.) The mutual impedance is calculated by applying Carter's method; the input impedance is then found from a simple formula. These impedances are, to a good degree of approximation, expressible as simple functions of the angle between the dipoles.

621.396.671.029.63/.64 **2428**

Relations concerning Wave Fronts and Reflectors.—K. S. Kelleher. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 573–576.) Vector formulae are derived relating the incident and reflected wave fronts and the reflector surface. The analysis is applied to particular microwave problems, including the determination of the reflector surface which will transform an arbitrary incident wave front into a plane wave front.

621.396.677 **2429**

Rotatable Directive Antenna.—J. Bříza. (*Tesla tech. Rep., Prague*, Dec. 1949, pp. 10–32.) The apex of a rhombic aerial is attached by means of insulators to the rotatable head of a wooden mast, the other three junctions being attached by sectioned cables to carriages running on a circular track round the mast. The positions of the carriages, which form a symmetrical system, are controlled to alter the direction of transmission or reception and also to adjust the apex angle to suit different frequencies. The aerial is fed at its lowest point by twin cable which is carried round with it. Computed polar diagrams are compared with experimental results for scale models.

621.396.677 : 621.397.828 **2430**

TV Antenna Phase Control.—Carmichael. (*See* 2655.)

621.396.677.2 : 621.396.97 **2431**

Nine-Tower Broadcast Array.—C. W. Winkler & M. Brasseur. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 102–104.) Brief illustrated account, with details of phasing and aerial-tuning equipment, of the WDGY station at Minneapolis, which produces a radiation pattern with suppression over an angle of 247°.

621.396.67.029.64 **2432**

Aerials for Centimetre Wavelengths. [Book Review]—D. W. Fry & F. K. Howard. Publishers: Cambridge University Press, 1950, 172 pp., 18s. (*J. Brit. Instn Radio Engrs*, July 1950, Vol. 10, No. 7, p. vi.) "This book deals specifically with radiating systems for radar applications, but design principles are outlined in sufficient detail to enable the engineer to design a radiator for other applications."

CIRCUITS AND CIRCUIT ELEMENTS

517.41 : 621.3.016.352 **2433**

On the Representation of the Stability Region for Oscillation Phenomena by use of Hurwitz Determinants.—E. Sponder. (*Schweiz. Arch. angew. Wiss. Tech.*, March 1950, Vol. 16, No. 3, pp. 93–96.)

621.3.012.2 **2434**

Classes of Circle Diagrams.—C. E. Moorhouse. (*J. Instn Engrs, Aust.*, March 1950, Vol. 22, No. 3, pp. 69–74.) Consideration of the properties of a general 4-pole network under specified terminal conditions leads to a general method of establishing the conditions for the existence of circle diagrams. Two classes of diagrams are discussed; variants of these include many of the circle diagrams used in electrical engineering.

621.316.8.029.55/.62 **2435**

Behavior of Resistors at High Frequencies.—G. R. Arthur & S. E. Church. (*TV Engng, N.Y.*, June 1950, Vol. 1, No. 6, pp. 4–7.) The variation of resistance with frequency is discussed for various types of resistor by consideration of circuit equivalents which include a capacitive element. Theoretical results agree with measured values for commercial resistors in the frequency range 5–60 Mc/s to within 10%. Except possibly for special h.f. resistors, the effective resistance of resistors decreases more rapidly with frequency the higher the value of the d.c. resistance. For the same d.c. resistance, the smaller the physical dimensions the better are the h.f. characteristics. Resistors using a carbon coating on insulating material were found better for h.f. work than either carbon-block or composition resistors.

621.318.371 **2436**

Calculation of the Inductance of Circular Conductors and Single-Layer Close- or Open-Wound Solenoids.—W. Keller. (*Bull. schweiz. elektrotech. Ver.*, 27th May 1950, Vol. 41, No. 11, pp. 442–450. In German.) A method of calculation is developed and a series of equations derived. Curves are plotted from which the value of inductance is readily determined when length, cross-section, etc., are known.

621.318.5 **2437**

Magnetic Triggers.—An Wang. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 626–629.) Magnetic cores with fairly rectangular hysteresis loop are used in a trigger device in which magnetic fluxes serve instead of electrical currents to indicate the two stable states. The magnetic-flux polarity can be detected without mechanical motion. The construction and operation of several types of magnetic trigger are described. See also 1183 of May (An Wang & Way Dong Woo).

621.319.4 **2438**

The Theory of a Three-Terminal Capacitor.—R. E. Corby. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 635–636.) Equations are derived for the insertion loss of a 3-terminal capacitor and their solution gives results in agreement with experiment. The capacitor is assumed to function like a transmission line and the constants of the equivalent line are determined as a function of frequency. Skin effect and proximity effect are taken into consideration, and curves are plotted to facilitate computation.

621.389 : 681.142 **2439**

A Fast Multiplying Circuit.—Chance, Busser & Williams. (*See* 2558.)

621.392 : 512.831 **2440**

An Introduction to the Matrix Method of Solving Electrical-Network Problems.—R. Guertler. (*J. Instn Engrs, Aust.*, March 1950, Vol. 22, No. 3, pp. 46–52.) The fundamental principles of matrix algebra are outlined and simple working rules are given. The transformation matrices of series-impedance and shunt-admittance 4-pole networks are derived and these matrices, together with the rules of matrix algebra, are applied to discussion of networks in cascade, of L, T and Π networks, and to calculation of the frequency response of a class-B modulator, this calculation being considerably simpler than that by ordinary methods, as given in Appendix 2. A simple application of matrix methods is given in Appendix 1, where the conditions are derived for the current or voltage in a circuit to remain constant under varying load.

621.392 : 517.512.2 **2441**

Application of Fourier Transforms to Variable-Frequency Circuit Analysis.—A. G. Clavier. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 159–163.) Reprint. See 307 of February.

621.392 : 517.512.6 **2442**

A Note on the Solution of Certain Approximation Problems in Network Synthesis.—R. M. Fano. (*J. Franklin Inst.*, March 1950, Vol. 249, No. 3, pp. 189–205.) A method is given for the determination of appropriate functions to define the amplitude characteristics of networks when certain ideal responses are to be approached within specified limits. The method is based on simplification of the geometry of the problem by transformation in the complex plane.

621.392 : 621.3.016.35] : 681.142 **2443**

Mathematical Problems of Feedback.—H. Freudenthal. (*Ned. Tijdschr. Natuurk.*, Nov. 1949, Vol. 15, No. 11, pp. 275–281.) Paper given at the Symposium on Modern Calculating Machines, Amsterdam, May 1949. From both the mathematical and the physical viewpoints, it is preferable to treat feedback circuit problems by the method of continuous rather than discrete iteration. Analysis establishes the necessary and sufficient conditions for convergence and hence for circuit stability.

621.392.011.2 **2444**

Reciprocity between Generalized Mutual Impedances for Closed or Open Circuits.—A. G. Clavier. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 152–158.) Reprint. See 1358 of June.

621.392.43 **2445**

Wideband Series-Parallel Transformer Design.—V. C. Rideout. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 122..162.) Formulae for obtaining maximum flatness of the response curve are derived from filter-theory considerations. The circuit constants of a matching transformer to connect a coaxial line to the first valve of an amplifier are calculated numerically.

621.392.5 **2446**

The Bridged-T Network and its Properties.—W. Taeger. (*Funk u. Ton*, May 1950, Vol. 4, No. 5, pp. 253–259.) Mathematical analysis deriving expressions for attenuation and phase constant.

621.396.611.1 **2447**

Oscillation Phenomena in a Circuit with a Discontinuous Linear Characteristic.—G. J. Elias & S. Duinker. (*Tijdschr. ned. Radiogenoot.*, May 1950, Vol. 15, No. 3, pp. 79–91. In Dutch, with English summary.) A series circuit of negligible resistance is considered which comprises a capacitor and an inductor with a core material such as mumetal or permalloy having a sharp knee in its magnetization curve. To facilitate analysis, an approximation to the curve is used which consists of three straight lines. In such a circuit forced subharmonic oscillations can be maintained, but transition phenomena occur when the amplitude of the applied e.m.f. is great enough to extend the operation beyond the knee of the curve. When operation is largely in the saturation region, the initial amplitude of the free oscillations is related to the magnitude of the corresponding transition; the oscillations are damped, owing to hysteresis losses. Each transition adds a fresh inner loop to the main hysteresis loop, corresponding to a pair of new real branch-points in the hyperelliptic expression for the oscillations. See also 582 of March.

621.396.611.4 : 538.56 **2448**

Forced Oscillations in a Spherical Cavity Resonator.—A. A. Piotrovski. (*Zh. tekh. Fiz.*, March 1950, Vol. 20, No. 3, pp. 282–294. In Russian.) Mathematical discussion of the excitation of a spherical cavity resonator by a single turn of wire at its centre. An equivalent oscillatory circuit is derived and methods are indicated for determining its impedance and main parameters such as Q, damping factor and loss resistance.

621.396.611.4 : 621.396.615.142.2 **2449**

Wide-Range Tunable Waveguide Resonators.—W. W. Harman. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 671–679.) See 2476 of 1949.

621.396.615.12 **2450**

LC Oscillators and their Frequency Stability.—J. Vackář. (*Tesla tech. Rep., Prague*, Dec. 1949, pp. 1–9.) Factors affecting stability are considered and their specific effects tabulated; the mechanical and electrical design and construction of highly stable circuits are discussed. A general analysis is given of the oscillator circuit and a formula for change of frequency with change of valve capacitance is derived. Known variable-frequency oscillators are reviewed and new circuits used in Tesla broadcasting transmitters and having a tuning range of 1.5 : 1 are described.

621.396.615.14 : 621.385.3 **2451**

Feedback in Very-High-Frequency and Ultra-High-Frequency Oscillators.—F. J. Kamphoefner. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 630–632.) A study of feedback considerations in low-power negative-grid triode oscillators for the frequency range 100–1 000 Mc/s. Discussion is mainly confined to oscillators using a single tuned circuit between grid and anode in the modified Colpitts circuit in which feedback is provided by the valve interelectrode capacitances. The optimum feedback conditions are deduced and the analysis is applied to several typical oscillators.

621.396.615.14 : 621.385.3 **2452**

Ultra-High-Frequency Triode Oscillator using a Series-Tuned Circuit.—J. M. Pettit. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 633–635.) Analysis of a modified Colpitts circuit for a particular triode gives, as a function of frequency, the series resistive and reactive components of the two-terminal impedance looking at the grid-anode terminals. Use of a series-tuned external circuit instead of the usual parallel-tuned circuit permits oscillation above the self-resonance frequency of the triode, provided transit-time effects are unimportant.

621.396.615.17 **2453**

Linear Sweep Generation.—D. Sayre. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 171..175.) Linear positive or negative sweeps are produced by charging an electronically switched capacitor through a constant-current triode. The linearity obtained is between that of the bootstrap circuit and that of the Miller feedback circuit.

621.396.615.17 **2454**

Cathode-Coupled Multivibrator Operation.—K. Glegg. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 655–656.) An approximate analysis results in an expression for the duration of the output pulse in terms of the values of the circuit elements. A series expansion shows that the duration of this pulse is nearly a linear function of one of the circuit voltages.

621.396.615.17 : 621.397.62 **2455**

A Hard-Valve Time-Base.—C. H. Banthorpe. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, p. 339.) Full circuit details and description of the action of a linear frame-timebase in which the start of the scan is triggered and which is unaffected by line pulses which may be introduced owing to imperfect line/frame synchronization separation.

621.396.645 **2456**

Design of Cathode-Coupled Amplifiers.—S. G. F. Ross. (*Wireless Engr*, July 1950, Vol. 27, No. 322, pp. 212–215.) Previously published theoretical work on the subject is reviewed, and a new rigorous analysis is presented. Experimental results indicate that this analysis can be relied on within the accuracy of published valve data.

621.396.645 **2457**

Modern Methods of Power Amplification.—M. Strutt. (*Bull. schweiz. elektrotech. Ver.*, 10th June 1950, Vol. 41, No. 12, pp. 479–484. In German.) Definition of power gain and discussion of its application in valve, semiconductor, magnetic and amplidyne amplifiers.

621.396.645 : 621.316.722.078.3 **2458**

Stabilization of Wide-Band Direct-Current Amplifiers for Zero and Gain.—E. A. Goldberg. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 296–300.) Stabilization is obtained through the application of a mechanical chopper to detect any zero offset error voltage. The circuit is such that the stabilization device does not alter the h.f. response characteristics of the amplifier. Primary application has been in the field of analogue electronic computers.

621.396.645 : 621.385.3 : 621.315.592† **2459**

High-Frequency Operation of Transistors.—C. B. Brown. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 81–83.) Dispersion in transit-time values, resulting from differences in lengths of flow paths between emitter and collector, is the primary cause of loss of h.f. response. Magnetic bias of appropriate sign applied at right angles to the plane containing the axes of the collector and emitter electrodes reduces transit time and dispersion, with consequent increase of frequency range. The circuit of a 23-Mc/s amplifier for testing the h.f. response is described, the transistor being biased by a field of strength 16 000 lines/in^2. A gain of 8 is obtained between 1 000-Ω input and output. Time and temperature stability of the transistors are discussed briefly. See also 2089 of August.

621.396.645 : 621.396.61 **2460**

Maximum Tank Voltage in Class-C Amplifiers.—L. E. Dwork. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 637–644.) Theoretical considerations are presented to explain the frequent appearance in class-C amplifiers of r.f. anode voltages which are greater than the d.c. anode voltage. A method is developed for predicting the magnitude of this r.f. voltage under any given set of conditions. The method is verified experimentally for a particular case.

621.396.645.37 **2461**

Intermediate-Frequency Gain Stabilization with Inverse Feedback.—G. F. Montgomery. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 662–667.) " Improvement in gain stability is related to the number of cascaded stages, the stage gain, and the magnitude of the feedback. A circuit is described which uses feedback over a pair of cascaded stages. Generalized selectivity curves for this feedback couple are shown, and the design procedure is outlined."

621.396.645.37 **2462**

General Formulae for Feedback Amplifiers.—F. Job. (*Ann. Télécommun.*, Dec. 1948, Vol. 3, No. 12, pp. 436–444.) The general theory of linear networks including amplifying valves has been given in a very complete manner by Bode (3381 of 1948). A simple demonstration is here given of the most important formulae of Bode's theory. Examples and applications illustrate the extreme generality of the formulae.

621.396.645.37 **2463**

More about Positive Feedback.—T. Roddam. (*Wireless World*, July 1950, Vol. 56, No. 7, pp. 242–244.) When applied to those stages of an amplifier in which distortion is not inherently large, positive feedback permits a considerable increase in overall gain with little increase in overall distortion. The negative feedback applied to the whole amplifier may then be increased, reducing the overall gain to the original level with a considerable reduction in the overall distortion. Positive feedback increases phase shift, making it more difficult to keep the overall system stable. Its use should therefore be confined to the frequency range over which it is particularly needed.

621.396.645.371 **2464**

Negative-Feedback Amplifiers.—J. E. Flood. (*Wireless Engr*, July 1950, Vol. 27, No. 322, pp. 201–209.) Negative-feedback amplifiers designed to obtain a flat response curve may give an oscillatory response to transients if the feedback exceeds a certain amount. The present analysis shows that by suitably adjusting the time constants for the various stages and by modifying the feedback path, critical damping with resulting absence of overshoot for transients can be attained together with a flat response curve throughout the frequency band for both 2-stage and 3-stage amplifiers. Experimental results are in fair agreement with calculated values.

519.242 : 621.3 2465

The Extrapolation, Interpolation and Smoothing of Stationary Time Series, with Engineering Applications. [Book Review]—N. Wiener. Publishers: John Wiley & Sons, New York, 1949, 163 pp., $4.00. (*J. Franklin Inst.*, March 1950, Vol. 249, No. 3, p. 259.) This was issued as a classified report during the war. "The theory set forth is widely used and has guided modern thinking in filter and predictor theory."

621.314.3† 2466

The Magnetic Amplifier. [Book Review]—J. H. Reyner. Publishers: Stuart & Richards, London, 119 pp., 15s. (*Wireless Engr*, July 1950, Vol. 27, No. 322, p. 216.) The presentation is mainly descriptive; where mathematical reasoning is used it is expressed as far as possible in terms of elementary a.c. theory.

GENERAL PHYSICS

53.081 + 621.3.081 2467

The Introduction of the Giorgi System of Units.—H. König, M. Krondl & M. Landolt. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st May 1950, Vol. 28, No. 5, pp. 207–208. In French and German.) Corrections to paper noted in 1125 of May, for which the U.D.C. number should be as above.

53.081.5 2468

On the Theory of the Dimensions of Physical Quantities.—M. Landolt. (*Bull. schweiz. elektrotech. Ver.*, 10th June 1950, Vol. 41, No. 12, pp. 473–479. In German.) Review of different definitions of dimension and proposal of a new variant.

535.34-1 : [546.28 + 546.289 2469

Theory of Infra-Red Absorption in Silicon and Germanium.—J. Bardeen. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 216.) Summary of American Physical Society paper.

535.37 2470

Scattering and Absorption of Luminescence Light in Polycrystalline Luminescent Layers under Excitation by High-Energy Quantic and Corpuscular Rays.—I. Broser. (*Ann. Phys., Lpz.*, 16th Jan. 1950, Vol. 5, Nos. 6/8, pp. 401–416.) Experiments with a ZnS-Cu phosphor, using α particles, γ- and X-rays for excitation, indicate that the scattering and absorption factors for the luminescence light are independent of the type of excitation. Measurements of the effect of grain size in the phosphor layer on the scattering and absorption are described and discussed.

535.42 2471

Diffraction by a Plane Screen.—E. T. Copson. (*Proc. roy. Soc. A*, 7th July 1950, Vol. 202, No. 1069, pp. 277–284.) Boundary conditions involved when solving the problem of diffraction by a perfectly conducting plane screen using the integral-equation method are analysed. Theorems given in a previous paper (*ibid*, 1946, Vol. 186, pp. 100–118) are recast in a form which meets the criticism of Bouwkamp (2772 of 1948), and the integral-equation method is applied to the problem of diffraction by a half-plane. The form of the arbitrary function of integration is adjusted to limit the order of the singularity at the boundary.

535.42 2472

The Edge Condition in the Theory of the Diffraction of Electromagnetic Waves at Perfectly Conducting Plane Screens.—J. Meixner. (*Ann. Phys., Lpz.*, 19th Sept. 1949, Vol. 6, pp. 2–9.) The edge condition is based on the physically plausible requirement that the e.m. energy density in the neighbourhood of the edge be integrable, i.e., that the field energy in each finite volume be finite. A particularly simple mathematical expression of the edge condition is given by the Debye e.m. field potentials. In the diffraction of sound waves at the edge of a screen the e.m. edge condition corresponds to the requirement that at the edge the sound pressure must remain finite.

535.42 2473

Energy Flow in the Near Field of a Diffracting Edge.—W. Braunbek. (*Ann. Phys., Lpz.*, 19th Sept. 1949, Vol. 6, pp. 53–58.) For the region near the edge (distance $\ll \lambda$) the field can be found very simply by application of Sommerfeld's solution for diffraction at a semi-infinite plane. For the special case of perpendicular incidence on an infinitely thin, perfectly conducting screen, the electric vector being parallel to the diffracting edge, the phase surfaces of the field near the edge are calculated and also the surfaces of energy flow, which to a first approximation are confocal parabolic cylinders with the edge as focal line.

537.226.001.11 : 546.431.82-3 2474

Electronic Theory of Ferroelectrics.—E. T. Jaynes & E. P. Wigner. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 213–214.) Summary of American Physical Society paper.

537.311.1 : 537.311.32/.33 2475

Conduction Electrons in Non-Metallic Solids.—H. Fröhlich. (*Research, Lond.*, May 1950, Vol. 3, No. 5, pp. 202–207.) A review of the action of electrons in substances which in their normal state are nonconductors, including consideration of various processes where the conduction-electron concentration varies with time. The problems of polarization, self-trapping, and mean free path in crystals are discussed, assuming the number of interelectron collisions to be negligible. The increase of conductivity produced by a strong field and the decay after excitation by an ionizing radiation should be governed by the same time constant.

537.311.1 : 621.315.592† 2476

Potential Fluctuations in Homogeneous Semiconductors.—H. M. James & G. W. Lehman. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 216.) Summary of American Physical Society paper.

537.311.1 : 621.315.592† 2477

On the Theory of Noise in Semiconductors.—R. L. Petritz & A. J. F. Siegert. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 215–216.) Summary of American Physical Society paper.

537.311.3 + 621.315.592† 2478

Electrical Conductivity.—Roulaud. (*See* 2543.)

537.312.8 2479

Effect of Magnetic Fields on Conduction: 'Tube Integrals'.—W. Shockley. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 191–192.) The mathematical expression for the effect of a magnetic field on conduction in a material can be reduced to integrals by using 'tubes', which are specified regions in the Brillouin zone. The case of simple closed tubes, which are of interest in relation to semiconductors, is discussed. An expression for the total electron current is derived, evaluation of which may prove a means of determining the energy-surface parameters for Ge from magnetoresistance measurements on single crystals.

537.312.8 2480

Theory of Magnetic Resistance Effects in Metals.—M. Kohler. (*Ann. Phys., Lpz.*, 19th Sept. 1949, Vol. 6, pp. 18–38.) Approximate formulae are derived for the change of the electrical and the thermal resistance of a metal when a transverse magnetic field is applied. Theoretical results are compared with experimental values.

537.525.5 : 538.6 **2481**

Supersonic Wind at Low Pressures Produced by Arc in Magnetic Field.—H. C. Early & W. G. Dow. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 186.) Discussion of the effects of a transverse magnetic field on a low-pressure gas discharge. When the arc is in a large unconfined region, e.g., a vacuum chamber of 1 cubic metre, wind effects are observed. Power input and current density become many times larger: gas temperature is generally low because of the cooling effect of the wind; ion mobility is little reduced; equipotentials occur at skewed positions. In the case of an arc between a copper cylinder and surrounding ring, an axial magnetic field causes the arc to revolve at a speed of about 17 000 r.p.s. under particular conditions. The air inside the cylinder also revolves, but at a slower rate, its speed being estimated at 3 000–4 500 m.p.h.

537.562 **2482**

Dispersive Power and Natural Oscillation of an Ionized Gas.—G. Burkhardt. (*Ann. Phys., Lpz.*, 16th Jan. 1950, Vol. 5, Nos. 6/8, pp. 373–380.) The dispersion theory for an ionized gas can be derived from the Lorentz theory for a neutral gas if the natural frequency of the polarization electrons is assumed equal to a certain limiting frequency, which is the natural frequency of the oscillating plasma. This theory indicates unconditionally that the Lorentz polarization term should not appear in the dispersion formula for a plasma. See also 738 of 1944 (Darwin).

538.114 **2483**

Time Decrease of Magnetic Permeability in Alnico.—R. Street & J. C. Woolley. (*Proc. phys. Soc.*, 1st July 1950, Vol. 63, No. 367B, pp. 509–519.)

538.221 : 538.569.4.029.64 **2484**

Ferromagnetic Resonance in Manganese Ferrite and the Theory of the Ferrites.—C. Guillaud, W. A. Yager, F. R. Merritt & C. Kittel. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 181.) Discussion of observations of resonance absorption at 24 164 Mc/s in polycrystalline $Fe(MnFe)O_4$ at room temperature.

538.221 : 538.569.4.029.64 **2485**

Ferromagnetic Resonance in Single Crystals of Nickel Ferrite.—W. A. Yager, J. K. Galt, F. R. Merritt, E. A. Wood & B. T. Matthias. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 214.) Summary of American Physical Society paper.

538.221 : 539.23 **2486**

Thin Ferromagnetic Films.—M. J. Klein & R. S. Smith. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 214.) Summary of American Physical Society paper.

538.221.001.11 **2487**

Theory of Magnetic Dispersion in Ferrites.—C. Kittel. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 214.) Summary of American Physical Society paper.

538.521 : 517.948.32 **2488**

The Induction of Electric Currents in a Uniform Circular Disk.—A. A. Ashour. (*Quart. J. Mech. appl. Math.*, March 1950, Vol. 3, Part 1, pp. 119–128.) By regarding a uniform disk, or any symmetrically conducting surface of revolution, as composed of an infinite number of coaxial annular circuits, the determination of the electric currents induced by an external field is reduced to the solution of a Fredholm integral equation. Two methods of solving this equation are described.

538.566 + [537.226.2 : 546.217 **2489**

The Velocity of Electromagnetic Waves and the Dielectric Constant of Dry Air.—J. V. Hughes. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 222.) Summary of American Physical Society paper. To obtain agreement between the commonly accepted value of the velocity of light (299 775 km/s) and the mean (299 790 km/s) of six recent determinations of the velocity of radio waves, it would be necessary to use a value of 1.000 48 for the dielectric constant *k* of air when correcting measurements in air to vacuo. Values of *k* obtained by various experimenters, using frequencies from those of light waves down to 1 Mc/s, range from 1.000 572 to 1.000 60. The source of the discrepancy must consequently be sought elsewhere. See also 1751 of July (Essen).

538.566 : 537.562 **2490**

Electro-Magneto-Ionic Optics.—V. A. Bailey. (*J. roy. Soc. N.S.W.*, 1948, Vol. 82, Part 2, pp. 107–113.) Theoretical study of the modes of propagation of electric waves in a medium composed of electrons, positive ions and molecules (or atoms) in the presence of static electric and magnetic fields. The solution for plane waves is found in a general form which specifies the refractive indices and attenuation coefficients (positive or negative) as a function of frequency. The theory has application to the ionosphere, to the solar atmosphere and to discharge tubes. A deduction from it is that certain waves will grow as they progress in space or with passage of time; this suggests a possible explanation of the origin of stellar, solar and ionospheric noise. See also 2785 of 1949.

538.632 : 621.315.592† **2491**

Theoretical Hall-Coefficient Expressions for Impurity Semiconductors.—V. A. Johnson & K. Lark-Horovitz. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 176–177.)

538.652 : 621.317.4 **2492**

A New Method of Measuring Magnetostriction. Application to the Ferrite of Cobalt.—L. Weil, M. Gallay & P. Poensin. (*C. R. Acad. Sci., Paris*, 17th July 1950, Vol. 231, No. 3, pp. 224–226.) For measurements under widely different conditions of temperature or material, a method using a simple strain gauge of the resistance type has particular advantages. Accuracy of measurement is within about 1%, but the method can be applied to material of any shape and its simplicity recommends it for investigations in connection with industrial equipment. Results obtained for Co ferrite, made highly magnetostrictive by cooling for 18 hours after heat treatment at 1 200°C, are presented.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

061.3 : [55 + 621.396.11 **2493**

Summary of Proceedings of Australian National Committee of Radio Science, U.R.S.I., Sydney, January 16–20, 1950.—(*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 191–210.) Summaries are given of 33 papers presented at the conference.

523.746 **2494**

Final Relative Sunspot-Numbers for 1949.—M. Waldmeier. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 211–213.)

523.746 **2495**

Provisional Sunspot-Numbers for January to March, 1950.—M. Waldmeier. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, p. 217.)

537.562 : 538.566 2496
Electro-Magneto-Ionic Optics.—Bailey. (*See* 2490.)

538.711 2497
Measurement of the Earth's Magnetic Field at High Altitudes at White Sands, New Mexico.—E. Maple, W. A. Bowen & S. F. Singer. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 115–126.) Measurements by means of a total-field magnetometer fitted in an Aerobee rocket showed that at a height of 368000 ft the decrease in field strength was 28 milligauss. The results for the whole flight agree to within 2 milligauss with calculations based on the dipole theory. No evidence of the existence of magnetic fields due to current sheets was obtained.

550.384 2498
International Data on Magnetic Disturbances, Fourth Quarter, 1949.—J. Bartels & J. Veldkamp. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 214–216.)

550.384 2499
Cheltenham Three-Hour-Range Indices *K* for January to March, 1950.—R. R. Bodle. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, p. 217.)

550.385 2500
Principal Magnetic Storms [Oct. 1949–March 1950].—(*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 218–220.)

550.385 : 551.594.52 2501
Development of a Magnetic Storm: The Southward Shifting of the Auroral Zone.—T. Nagata. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 127–142.) "The southward extension with the increased intensity of disturbance in the northern auroral zone is derived hour by hour for the geomagnetic storm of April 30, 1933."

551.510.535 2502
An Approach to the Approximate Solution of the Ionosphere Absorption Problem.—J. E. Hacke, Jr. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 683–684.) Discussion on 3115 of 1948.

551.510.535 2503
The Diurnal Variation of the Vertical-Incidence Ionospheric Absorption at 150 kc/s.—A. H. Benner. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, p. 685.) Measurements of the virtual height of the layer and the relative amplitudes of ground pulse and first and second echoes enable the diurnal variation of $|\log \rho|$ to be plotted. Marked absorption-curve transitions occur at ground sunrise and sunset. When $\log |\log \rho|$ is plotted against $\log \cos \chi$ (where χ is the sun's zenith angle), approximately straight lines are obtained for the morning and afternoon periods, the slopes being 0.675 and 0.76 respectively.

551.510.535 2504
Travelling Disturbances in the Ionosphere.—G. H. Munro. (*Proc. roy. Soc. A*, 7th July 1950, Vol. 202, No. 1069, pp. 208–223.) The motion of disturbances of the vertical distribution of F region ionization density has been investigated by means of synchronized signals from three spaced common-frequency pulse transmitters. *P′f* data from Sydney, Brisbane and Canberra show that the larger disturbances can travel 900 km without major change in type or in velocity, which ranges from 5 to 10 km/min. Quasicyclical variations of ionization density with periods of 10–60 min are found which show a progressive phase lag with decrease in height. The magnitude of the disturbance appears, in general, to decrease with decrease of the period. The mean direction of horizontal motion is about 20°E of N in winter and about 110°E of N in summer, the changes in direction occurring rather abruptly near the equinoxes. Some of the effects observed by Wells, Watts & George (3279 of 1946) may be due to disturbances of the type here considered.

551.510.535 : [537.568 + 533.15 2505
Diffusion in the Ionosphere.—M. H. Johnson & E. O. Hulburt. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 222.) Summary of American Physical Society paper. The nonlinear differential equations relating the ionic density in the atmosphere to the rate of ionization by solar radiation and the loss of ions by recombination and diffusion, have been integrated on the Naval Research Laboratory computer and ionic-density curves have been obtained. Diffusion broadens the curve, thereby changing the relations between real and virtual heights, and shifts its maximum downwards, modifying the dependence of the height of the ionized region on the solar zenith angle.

551.510.535 : 621.396.11 2506
Ionosphere Observations at 50 kc/s.—J. N. Brown & J. M. Watts. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 179–181.) A high-power pulse transmitter giving an output of about 200 kW into a large loop aerial has been used at Sterling, Virginia, by the C.R.P.L. for measurements of the height of the reflecting layer for signals of frequency about 50 kc/s. The record for one day is reproduced, the virtual height of the reflecting layer being about 80 km. Height changes are not great and morning and evening peaks do not seem to occur every day. Double echoes are sometimes observed.

551.594.21 2507
The Free Electrical Charge on Precipitation Inside an Active Thunderstorm.—R. Gunn. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 171–178.) An induction method was used in an aircraft to measure the charges on individual droplets. Results are given for seven different levels in the cloud. With the freezing level at 14 000 ft, the maximum electrification occurred at about 7 500 ft and at a temperature of 10°C, the electric field strength at the surface of the droplets being a large fraction of the dielectric strength of air.

551.594.6 2508
The Fine Structure of Atmospherics: Ionospheric and Meteorological Applications of Type 4.—R. Rivault. (*C. R. Acad. Sci., Paris*, 22nd May 1950, Vol. 230, No. 21, pp. 1846–1847.) Daily recordings made at Poitiers during October 1949 enable the investigation of type-4 atmospherics to be carried further (see 2519, 2520 and 2521 of 1948). Oscillograms corresponding to sources in moving air masses exhibit rounded peaks, whereas those corresponding to sources in stationary air masses show a true short pulse clearly separated from its echoes. The normal value of *h*, the height of the reflecting layer, is found to be 75 km, with variations up to 12 km during the period 1700–2100. Uniformity of observations of atmospherics from different directions leads to the view that the D region is homogeneous and parallel to the ground. On days when large time variations were observed magnetic storms were also recorded.

521.03 2509
Some Recent Researches in Solar Physics. [Book Review]—F. Hoyle. Publishers: Cambridge University Press, London & New York, 1949, 134 pp., 12s. 6d. or $3.00. (*Science*, 21st April 1950, Vol. 111, No. 2886, p. 414; *Quart. J. R. met. Soc.*, Jan. 1950, Vol. 76, No. 327, p. 112.) "This book in the new series of Cambridge Monographs on Physics deals mainly with Hoyle's own recent work on the corona and chromosphere . . ."

Terrestrial phenomena directly influenced by the sun, and the emission of radio waves from the sun, are dealt with.

LOCATION AND AIDS TO NAVIGATION

527.5 : 518.12 **2510**

The Computation of Great-Circle Bearings and Distances.—G. Millington. (*Marconi Rev.*, 3rd quarter 1950, Vol. 13, No. 98, pp. 89–101.) To avoid the necessity of using seven-figure logarithms to obtain four-figure accuracy when using the standard formulae, trigonometrical transformations are used, a simplified rule of signs is adopted and the resulting computation is presented in a standard tabular form.

621.396.9 : 551.578.1 **2511**

The Effect of Rain on Marine Radar Echoes.—S. E. Barden. (*Marconi Rev.*, 3rd quarter 1950, Vol. 13, No. 98, pp. 102–109.) The failure of p.p.i. radar gear to detect targets when heavy rain is falling is analysed and curves are given to assist operators to determine the approximate ranges within which target echoes should be obtainable under different conditions.

621.396.933 **2512**

A Simple Localizer.—J. W. Alexander. (*Tijdschr. ned. Radiogenoot.*, July 1949, Vol. 14, No. 4, pp. 119–133. Discussion, p. 134.) Critical discussion of the SCS51 instrument landing system, and description of the Schiphol installation, in which an electrical method of modulation is used. It is suggested that P.I.C.A.O. specifications be redrafted to give a course angle of 2.5° on either side of the true direction.

621.396.933 **2513**

ILS–2 Instrument Landing Equipment.—R. A. Hampshire & B. V. Thompson. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 112–122.) A description of equipment which complies with P.I.C.A.O. requirements. The localizer, operating in the 108–112-Mc/s band, provides a beam along the runway and extending for at least 25 nautical miles, the two halves of the beam being modulated at 90 c/s and 150 c/s respectively. The glide path, adjustable from 2° to 4°, operates in the 329–335-Mc/s band, modulating frequencies of 90 c/s and 150 c/s being again used. Three marker beacons, all on 75 Mc/s but with different modulation frequencies, give distance indication. Speech transmission from the localizer can be made without interrupting its course modulation. Monitor and control circuits have been specially designed to ensure reliability of operation.

621.396.933 **2514**

Characteristics and Adjustment of 335-Mc/s Equisignal Glide Slopes.—S. Pickles. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 140–151.) Different factors influencing the radiated signals are examined with a view to improved performance and increased safety of operation.

621.396.933 **2515**

A Source of Error in Radio Phase-Measuring Systems.—R. Bateman, E. F. Florman & A. Tait. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 612–614.) When a mobile transmitter was moved between two points over different particular paths around reradiating structures, the measured total phase changes differed by $2\pi n$ radians, where n is an integer. If reradiation from a reflector is of the same order of magnitude as the radiation from an aerial, analysis of the resultant field shows that singularities occur and each traverse of a closed path around a point of singularity gives a total phase change of 360°.

621.396.933 **2516**

An Analysis of Some Anomalous Properties of Equiphase Contours.—G. A. Hufford. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 614–618.) Further investigation of cases, of importance in radio surveying or navigation systems, where the phase at certain points may be multivalued (see 2515 above).

621.396.9 **2517**

British Standard 204: 1943. Supplement No. 4, Glossary of Terms used in Radar. [Book Notice]—Publishers: British Standards Institution, London, 1950, 8 pp., 2s. (*Brit. Stand. Instn Mon. Inform. Sheet*, June 1950, p. 1.)

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **2518**

A Philips-Type Ionization Gauge for Measuring of Vacuum from 10^{-7} to 10^{-1} mm of Mercury.—E. C. Evans & K. E. Burmaster. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 651–654.) Description and detailed diagrams showing the construction of a modified gauge. For an account of an instrument giving similar performance see 1423 of June (Penning & Nienhuis).

535.215 : 546.23 **2519**

Photoconductivity in Amorphous Selenium.—P. K. Weimer. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 171.) Experimental results are given which indicate that the red amorphous form of Se is photoconductive and possesses properties very different from those of the common metallic form and of the red monoclinic-crystal form.

535.215 : 546.23 **2520**

Electron-Bombardment-Induced Conductivity in Selenium.—L. Pensak. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 171–172.) An account of measurements on evaporated films of red amorphous Se.

535.37 : 546.42.221 **2521**

Two Infra-Red-Sensitive SrS Phosphors with Zn Dominant Activator.—D. S. Bersis. (*J. opt. Soc. Amer.*, May 1950, Vol. 40, No. 5, p. 335.)

535.37 : 546.46.45.284 **2522**

Variation of Emission Spectrum of Manganese-Activated Zinc Beryllium Silicate with Decay Time.—J. H. Schulman, C. C. Klick & R. J. Ginther. (*J. opt. Soc. Amer.*, May 1950, Vol. 40, No. 5, pp. 337–338.)

535.37 : 546.47-31 **2523**

Sulphide in Zinc-Oxide Luminophors.—S. M. Thomsen. (*J. chem. Phys.*, May 1950, Vol. 18, No. 5, p. 770.) The presence of a small amount of ZnS, rather than free Zn, is responsible for the green luminescence of ZnO phosphors fired in hydrogen.

535.37 : 546.472.21 **2524**

Comparison of the Luminescence-Extinction Effects of Nickel and Cobalt on Zinc Sulphide.—J. Saddy & N. Arpiarian. (*C. R. Acad. Sci., Paris*, 31st May 1950, Vol. 230, No. 22, pp. 1948–1950.)

537.228.1 : 621.39 **2525**

Piezoelectric Elements in Telecommunications Technique.—J. J. Vormer. (*Tijdschr. ned. Radiogenoot.*, May 1950, Vol. 15, No. 3, pp. 93–127. In Dutch, with English summary.) Review of the physical and electrical properties of crystals of different cuts commonly used, with a tabular summary.

537.533.8 **2526**

Secondary-Electron Emission from Metal Mixtures.—H. Salow. (*Ann. Phys., Lpz.*, 16th Jan. 1950, Vol. 5, Nos. 6/8, pp. 417–428.) Mixtures produced by simultaneous evaporation of either Ag or Cu and either Mg, Al or Be were found to have secondary-emission properties similar to those of alloys of the two components formed by melting. After a forming process in the presence of small quantities of O_2, secondary-emission factors of about 10 were obtained with 500-V primary electrons. The Cu/Mg metal mixture is easy to form, electrically and thermally stable, insensitive to dry CO_2-free gases, and very suitable for coating secondary-emission cathodes.

538.221 **2527**
The Magnetic Properties of Stainless Steels.—W. A. Stein. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1534–1537.) A comprehensive account of the magnetic properties of five stainless steels. Steel may contain up to 3% Ni without serious detrimental effect on its magnetic properties; the inclusion of over 8% Ni renders the steel nonmagnetic.

538.221 **2528**
Magnetic Properties of Ferrites.—C. Guillaud. (*J. Rech. Centre nat. Rech. sci.*, 1950, No. 12, pp. 113–122.) Experimental study and discussion of the saturation magnetization of simple and mixed ferrites. See also 1166 and 1171 of May (Néel).

538.221 **2529**
Properties of Single Crystals of Nickel Ferrite.—J. K. Galt, B. T. Matthias & J. P. Remeika. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 214.) Summary of American Physical Society paper.

538.221 **2530**
Relation between the Crystalline Structure and the Magnetic Properties of Mixed Ferrites of Nickel and Zinc.—M. Sage & C. Guillaud. (*C. R. Acad. Sci., Paris*, 15th May 1950, Vol. 230, No. 20, pp. 1751–1753.)

538.221 **2531**
Thermal Variation of the Spontaneous Magnetization of Ferrites of Nickel, Cobalt, Iron and Manganese.—R. Pauthenet. (*C. R. Acad. Sci., Paris*, 22nd May 1950, Vol. 230, No. 21, pp. 1842–1843.)

538.221 **2532**
A New Series of Ferromagnetic Substances : Ferrites of Rare Earths.—H. Forestier & G. Guiot-Guillain. (*C. R. Acad. Sci., Paris*, 22nd May 1950, Vol. 230, No. 21, pp. 1844–1845.)

538.221 : 538.65 : 536.413 **2533**
Length Anomaly in Ferrites.—L. Weil. (*C. R. Acad. Sci., Paris*, 10th July 1950, Vol. 231, No. 2, pp. 122–124.) Experimental study of the expansion coefficients of magnetized ferrites when slowly heated and then cooled.

538.221 : 538.653.11 **2534**
Effect of Tension on Magnetic Properties in Iron-Cobalt.—H. H. Plotkin & J. E. Goldman. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 215.) Summary of American Physical Society paper.

539.23 : 537.311.31 **2535**
On the Law of Variation of the Electrical Resistance of Very Thin Deposited Metal Films as a Function of the Applied Potential.—B. Vodar & N. Mostovetch. (*C. R. Acad. Sci. Paris*, 5th June 1950, Vol. 230, No. 23, pp. 2008–2010.) Previous experimental results (1701 of July) indicate that log (R_v/R_o) is a linear function of the applied potential except at very low potentials, R_v being the resistance at potential V. The change in conductivity is attributed to the lowering of the potential barrier between adjacent particles of the layer by the applied field. This effect is discussed in relation to a formula established by Schottky for the case of thermionic emission.

539.23 : 546.57 : 621.314.6 **2536**
On Certain Detector Properties of Thin Silver Films.—A. Blanc-Lapierre & M. Perrot. (*C. R. Acad. Sci., Paris*, 15th May 1950, Vol. 230, No. 20, pp. 1749–1751.) Measurements were made of the variation of current with applied direct and alternating voltages and with frequency. Appreciable detection effects were observed when the total power dissipated in the film was $\ngtr 1\ \mu$W. See also 2242 above.

539.23 : 546.81 **2537**
The Structure of Lead Sulfide Films.—J. Doughty, K. Lark-Horovitz, L. M. Roth & B. Shapiro. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 203.) Summary of American Physical Society paper. Investigation of films of PbS, PbSe and PbTe by X rays, electron diffraction and electron microscope.

539.23 : 546.81 : 535.215 **2538**
Temperature Variation of Properties of Photo-Sensitive Lead Sulfide Films.—R. H. McFee. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 203.) Summary of American Physical Society paper. Measurements made of dark current, photo-current and noise as functions of temperature between 90°K and 300°K.

546.841-3 : 537.311.3 **2539**
Electrical Resistance of Thoria.—W. E. Danforth & F. H. Morgan. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 142–144.) Measurements were made in vacuo at temperatures up to 2 073°K. On activation, values of 1 Ω-cm at 1900° and 10 Ω-cm at 1 000° were obtained. Activation energies determined from pulse measurements were between 3.2 V and 0.58 V. The density of impurity centres was calculated as $10^{18}/cm^3$ and was found independent of the degree of activation by current. This result does not agree with the hypothesis of the electrolytic origin of impurity centres.

546.92 : 537.323 **2540**
Effect of Heat Treatment on the Electrical Properties of Platinum.—R. J. Corruccini. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 202.) Summary of American Physical Society paper.

620.197 : 679.5 **2541**
Casting-Resin Techniques.—J. Bayha. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 100–101.) Practical details are given about the materials and methods of preparation and use of N.B.S. casting resin.

621.314.632 **2542**
Metallographic Study of Germanium Point-Contact Rectifiers.—M. H. Dawson & B. H. Alexander. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 217.) Summary of American Physical Society paper.

621.315.592† + 537.311.3 **2543**
Electrical Conductivity.—R. Roulaud. (*Rev. gén. Élect.*, May 1950, Vol. 59, No. 5, pp. 211–225.) In part 1 different theories which have been proposed to account for the conductivity of solid bodies are discussed, particularly the contributions made by the quantum theory and wave mechanics. The classification of conductors according to electron activity is outlined and the potential barrier is discussed with reference to thermionic emission and the Schottky effect. Part 2 deals with semiconductors and discusses the effect of impurities on resistivity and

also their physical characteristics and rectifying properties. Part 3 reviews the properties of Ge, particularly those made use of in the transistor.

621.315.592† 2544

Electrical Properties of Semiconductors with Macroscopic Discontinuities.—J. C. M. Brentano & D. H. Davis. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 216.) Summary of American Physical Society paper.

621.315.592† : 546.28 2545

The Transition from Insulating to Metallic Behavior in Semiconducting Silicon.—G. W. Castellan & F. Seitz. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 216.) Summary of American Physical Society paper.

621.315.61.011.5 : 577.3 2546

The Determination of the Dielectric and Magnetic Properties of Inhomogeneous Dielectrics, particularly Biological Substances, in the Decimetre-Wave Region.—H. Schwan. (*Ann. Phys., Lpz.*, 16th Jan. 1950, Vol. 5, Nos. 6/8, pp. 253–310.) In three parts, dealing with (*a*) theory of resonance methods of determining complex resistance, (*b*) effect of the support at the end of the Lecher line used in such methods, (*c*) practical methods and appropriate formulae for determining the required constants of the materials tested.

621.315.61.011.5 : 621.317.3.029.63 2547

Decimetre-Wave Measurements of Temperature-Dependent Dielectric Properties of Insulating Materials.—Kreft. (*See* 2559.)

621.315.612.4.011.5 2548

The Ferroelectric Properties of Certain Titanates and Zirconates of Bivalent Metals having Perovskite Structure.—G. A. Smolenski. (*Zh. tekh. Fiz.*, Feb. 1950, Vol. 20, No. 2, pp. 137–148. In Russian.) An experimental as well as a theoretical investigation which shows that $CdTiO_3$, $PbTiO_3$, $PbZrO_3$, and the solid solutions $(Ca,Pb)TiO_3$ and $(Sr,Pb)TiO_3$ possess ferroelectric properties.

621.318.2 : 621.3.016.35 2459

Stabilized Permanent Magnets.—P. P. Cioffi. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1540–1543.) Permanent magnets are stabilized against forces tending to demagnetize them, by partial demagnetization. After stabilization the magnet operates on a secondary demagnetization curve. The derivation of this curve and its applications to magnet design problems are discussed.

621.396.822 : 539.23 : 621.315.616.9 2550

Random Noise in Dielectric Materials.—R. F. Boyer. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 469–477.) An account is given of observations on fluctuating currents resulting from the application of direct-voltage gradients of 10–300 V/mil to thin films of polar dielectrics containing moisture. The fluctuations have frequencies of 60–1 000 c/s and last for some minutes, even persisting for a few seconds after removal of the voltage; after dying out they can usually be restored by reversing the voltage. The corresponding noise level is about 1 000 times higher than that of the circuit noise. The noise is the greater the more polar the polymer and the higher the moisture content of the material. Groups of ions rather than single ions are believed to act as the random charge carriers.

669.15 : 538.652 2551

Magnetostriction in Magnetic Alloys with Preferred Crystal Orientation.—J. E. Goldman. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 215.) Summary of American Physical Society paper.

MATHEMATICS

517.392 2552

Numerical Evaluation of Integrals of the Form $I = \int_{x_1}^{x_2} f(x)e^{i\phi(x)}\,dx$ and the Tabulation of the Function $Gi(z) = (1/\pi)\int_0^\infty \sin\,(uz + \frac{1}{3}u^3)\,du$.—R. S. Scorer. (*Quart. J. Mech. appl. Math.*, March 1950, Vol. 3, Part 1, pp. 107–112.)

517.564 2553

On the Fourier and Mellin Transforms of Inverse Bessel Functions.—P. Barrucand. (*C. R. Acad. Sci., Paris*, 10th July 1950, Vol. 231, No. 2, pp. 102–104.) The transforms are applied to derive a formula by means of which many integrals can be developed in the form of series.

517.942 : 621.3.09 2554

The B.W.K. Approximation and Hill's Equation: Part 2.—L. Brillouin. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, pp. 363–380.) The B.W.K. procedure, developed in connection with wave mechanics, is shown capable of yielding a good approximate solution for problems in many other fields, including the propagation of e.m. waves along a transmission line whose properties vary from point to point. The validity of various approximations is examined.

517.942.82 : 517.522 2555

The Laplace Transformation and Summation Formulae.—P. Barrucand. (*C. R. Acad. Sci., Paris*, 3rd July 1950, Vol. 231, No. 1, pp. 20–22.) The Poisson, Hardy and other summation formulae are derived by use of the Laplace transformation.

517.942.932 2556

Notes on the Solution of the Equation $y'' - xy = f(x)$.—J. C. P. Miller & Z. Mursi. (*Quart. J. Mech. appl. Math.*, March 1950, Vol. 3, Part 1, pp. 113–118.)

681.142 2557

A Differential Analyzer for the Schrödinger Equation.—R. L. Garwin. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 411–416.) A simple and rapid analyser is discussed having an accuracy within about 0.5%. Possible extensions of its application are mentioned.

681.142 : 621.389 2558

A Fast Multiplying Circuit.—B. Chance, J. Busser & F. C. Williams. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 244.) Summary of American Physical Society paper. A development on the principle of the 'quarter-square' multiplication method. A single parabolic characteristic is used to square the amplitudes of alternate half-cycles of an 82-kc/s square wave which represent respectively the sum and difference of the two input voltages *A* and *B*. The difference of the squares gives the desired product 4*AB*. The circuit gives the product of the inputs every 12 μs to within 1%.

MEASUREMENTS AND TEST GEAR

621.317.3.029.63 : 621.315.61.011.5 2559

Decimetre-Wave Measurements of Temperature-Dependent Dielectric Properties of Insulating Materials.—W. Kreft. (*Fernmeldetech. Z.*, June 1950, Vol. 3, No. 6, pp. 203–211.) A resonance method is described for measuring loss angle and permittivity, using two tubular concentric lines short-circuited at one end and capacitively coupled. One line, with a coupled current-meter, serves as indicator of the changes in the other line when a test sample is inserted which completely fills a certain length of the space between inner and outer conductor. Measurements in the wavelength range 10–75 cm were made on various insulating materials at temperatures from 20° to 80°C. Results are given graphically and show that in general the loss angle increases very considerably with temperature, but the permittivity only slightly.

621.317.31 **2560**

Measurement of Current Intensity with an Ammeter of Apparent Resistance Zero.—M. Matschinski. (*C. R. Acad. Sci., Paris*, 31st May 1950, Vol. 230, No. 22, pp. 1937–1939.) The principle is analogous to that of the potentiometer method of voltage measurement. An auxiliary voltage source and variable resistor in series are connected across the ammeter and adjusted so as to compensate for the voltage drop due to the resistance of the ammeter. Applications of the method in the measurement of very weak currents are indicated.

621.317.32 **2561**

Negative-Feedback D.C. Amplifier with Grid-Controlled Valve Converter.—W. Geyger. (*Arch. tech. Messen*, May 1950, No. 172, p. T57.) The magnetic amplifier of the instrument described in 1450 of June is replaced by a differential double-triode circuit which acts as an anode-modulated converter. Voltage range becomes approximately 0.1–1 V with input resistance 1–100 MΩ.

621.317.332 **2562**

Resistance Measurement at High Frequencies by means of Lossless Quadripoles.—A. Egger & H. H. Meinke. (*Funk u. Ton*, May 1950, Vol. 4, No. 5, pp. 233–238.) Two equal, lossless and symmetrical 4-terminal networks are connected in series and terminated with the resistor R_1 to be measured. Measurements are made of the voltages across both ends of the whole network and that across the junction points. From these voltages and the known characteristic impedances and phase constants of the networks, R_1 may be determined. The method is suitable for the measurement of resistors of 20–300 Ω in the frequency range 30–100 Mc/s, but its applications are not restricted to this range.

621.317.335.3† + 621.317.374 **2563**

Measurement of the Specific Inductive Capacity and Loss Angle of Dielectrics between 50 kc/s and 100 Mc/s.—J. Jourdan. (*Onde élect.*, June 1950, Vol. 30, No. 279, pp. 285–292.) Description of a Marconi high-precision instrument, using the reactance-variation method, for industrial use. A Hartley oscillator is loosely coupled to the measurement circuit, which comprises a coupling inductor and two capacitors C_1 and C_2 in parallel across it. The dielectric material is placed between the plates of C_1, which has a micrometer adjustment; C_2 is tuned for resonance, as indicated on the 50-cm scale of a mirror galvanometer in the circuit of a square-law valve voltmeter; C_2 is then adjusted to give equal deflections on either side of resonance; the procedure is repeated without the dielectric. Loss angle and dielectric constant (and also resistance and capacitance) may be simply calculated from the formulae given. The theory of the method of measurement and accuracy of the instrument are discussed.

621.317.335.3.029.64† **2564**

Recording Microwave Refractometer.—(*Electronics*, July 1950, Vol. 23, No. 7, pp. 120, 122.) The difference in resonance frequency produced by introducing a sample of a substance under test into one of two otherwise identical cavity resonators is a measure of the dielectric constant of the sample. The equipment described, which was developed at the National Bureau of Standards, is sensitive to Q changes in the test cavity, hence its use is restricted to testing samples of low-loss materials. Possible application to the measurement of atmospheric refractive index at frequencies above 30 Mc/s is considered.

621.317.335.3.029.64† : 546.217 **2565**

Apparatus for Recording Fluctuations in the Refractive Index of the Atmosphere at 3.2 Centimeters Wave-Length.—C. M. Crain. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 456–457.) A modified version of apparatus previously used for measuring dielectric constants of gases. Two microwave oscillators have their frequencies controlled respectively by two invar cavity resonators, one of which is sealed off while the other has air drawn through it. By appropriate circuit arrangements, changes in the resonance frequency of this second cavity, due to fluctuations in the dielectric constant of the air, produce proportional deflections in a recording milliammeter.

621.317.36 : 621.396.611.21.001.4 **2566**

Checking Crystals.—P. O. Farnham. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 150..154.) The method and apparatus described are for crystals whose fundamental frequencies lie between 6 and 13 Mc/s. Modifications may be made to suit other applications.

621.317.7 : 621.392.26† **2567**

An Automatic Standing-Wave Indicator.—P. J. Allen. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1299–1302.) The probe of a conventional standing-wave indicator is moved over a distance exceeding one wavelength (3 cm) by a reciprocating device operated by a 100-r.p.m. motor. The output from the probe is amplified and applied to the vertical-deflection plates of a c.r.o. A voltage derived from a potentiometer attached to the probe carrier is simultaneously applied to the horizontal-deflection plates to give a deflection corresponding to the position of the probe, so that the waveform is displayed on the long-persistence screen. A graticule on the face of the c.r. tube permits the s.w.r. to be read directly. A cursor is provided for measuring the position of the standing-wave pattern.

621.317.7.029.62 **2568**

V.H.F. Testing and Measuring Equipment.—(*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 349–350.) A brief review of British v.h.f. electronic equipment, with technical details supplied by the manufacturers, who will give further details on request.

621.317.7.029.64 **2569**

Measurement Apparatus for Ultra-High Frequencies.—M. Bouix. (*Ann. Télécommun.*, June 1950, Vol. 5, No. 6, pp. 210–218.) Descriptions and illustrations of cavity wavemeters, slotted-line and coaxial-line sections, attenuators and matched terminations for waveguides, power meters, etc., developed in the Centre National d'Études des Télécommunications for measurements at wavelengths of about 3 cm and 10 cm.

621.317.725 **2570**

The Diotron — An Aid to R.M.S. Instrumentation.—R. D. Campbell. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 93–95.) A circuit is described comprising basically a temperature-limited diode and a d.c. amplifier connected in a feedback arrangement. It can be used as a voltmeter giving true r.m.s. readings. The voltage to be measured is applied to the diode filament terminals together with the d.c. heating voltage, the effect of feedback then being to maintain the filament heating power constant. A linear power scale is obtained for small inputs. Details are given of an instrument covering the frequency range 40 c/s–10 Mc/s and having a response time of 15 ms for frequencies above 1 kc/s; full-scale deflection on the highest voltage range corresponds to 10 W across a 600-Ω load. Possible applications to computing circuits are outlined.

621.317.725 : 621.3.018.78† **2571**

Distortion-Measurement Apparatus.—H. Boucke & H. Lennartz. (*Funk u. Ton*, May 1950, Vol. 4, No. 5, pp. 217–225.) Descriptions are given of (*a*) a simple instrument for harmonic measurement for input frequencies of 10, 20, 40, 160 kc/s; (*b*) an improved instrument for the same frequencies; (*c*) a distortion meter for 800 c/s. Circuits are shown; selective feedback and multiple harmonic filters are used. Harmonic voltages down to 0.5% of that of the fundamental can be measured with negligible error.

621.317.74 : 621.315.212 **2572**

Test Set for Impedance/Frequency Measurement on Coaxial Cables.—A. F. Boff. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 123–137.) Determination of the characteristic impedance, attenuation constant, phase constant, and velocity ratio of long lengths of coaxial cable is discussed. By avoiding frequency-dependent parameters in the measuring circuits, precise measurements may be made with a rapidity impossible with previous methods. A description is given of a portable test set covering the range 5–30 Mc/s.

621.317.757 **2573**

Simple Wave Analyser.—D. M. Tombs. (*Wireless Engr*, July 1950, Vol. 27, No. 322, pp. 197–200.) The selective property of a simple tuned circuit is used to isolate a particular frequency existing in a complex wave, the isolated harmonic and the wave to be analysed being both displayed on a double-beam c.r.o. The Q value of the tuned circuit governs the amplitude of the selected harmonic component and is adjusted over a wide range by means of a negative-resistance element.

The ratio of two harmonic amplitudes may be found by adjusting the Q values to make the magnified voltages the same for both in succession. The ratio is then given by a simple relation involving the frequency of the harmonics and the incremental adjustments of the tuning capacitor to obtain the half-power points, both these quantities being easily measured.

621.317.772 **2574**

High-Frequency Phase Measurement with Direct Indication: Part 1 — With a Cathode-Ray Tube as Indicator.—A. Ruhrmann. (*Arch. tech. Messen*, May 1950, No. 172, pp. T52–T53.)

621.317.799† : [621.396.813 + 621.396.822 **2575**

A Set for Noise and Distortion Tests on Carrier and Broadcast Systems.—A. F. Boff. (*Marconi Rev.*, 3rd quarter 1950, Vol. 13, No. 98, pp. 110–118.) The use of two simultaneous test tones enables distortion measurements to be made at frequencies up to the limit of the pass band and overcomes the limitations of conventional harmonic testing methods. Description and circuit and performance details are given of a compact test unit suitable for noise and distortion measurements on v.h.f. links.

621.385.012 : 621.317.79 **2576**

The Application of Direct-Current Resonant-Line-Type Pulsers to the Measurement of Vacuum-Tube Static Characteristics.—J. Leferson. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 668–670.) A method is described for obtaining the static characteristics of a valve in the positive-grid region by applying to the grid 4-μs pulses obtained from a conventional line-type pulse generator using a resonance method of charging. Grid and anode currents are observed on a synchroscope by means of voltages developed across noninductive resistors.

621.392.3 : 621.316.849 : 621.396.67.029.62 **2577**

High-Load H.F. Resistors of the Transmission-Line Type with Uniform Damping.—A. Kraus. (*Fernmeldetech. Z.*, May 1950, Vol. 3, No. 5, pp. 157–160.) Expressions are derived for the dimensions of a 60-Ω air-cooled dummy aerial in which a length of resistance wire is wound spirally on a grooved metal cylinder which constitutes the low-loss return line. Three such units illustrated are for use in the 30–200-Mc/s band for powers of 250 W, 1 kW and 10 kW; the last is cooled by air blast. Resistance is within 10% of 60 Ω over the whole frequency range.

621.396.615 : 621.316.726.078.3 **2578**

A Method of Locking Oscillators in Integral and Non-Integral Frequency Ratios.—E. A. G. Shaw. (*Brit. J. appl. Phys.*, June 1950, Vol. 1, No. 6, pp. 154–157.) The output voltages of the two a.f. oscillators to be locked are applied to a nonlinear mixer. A selected beat provides a suitable correction voltage to operate a reactance valve controlling the frequency of one oscillator. A practical circuit is described, giving locking with a 1 000-c/s signal over quite a large range of frequency ratios. Further developments are discussed. The method appears to be applicable to any frequencies.

621.396.615.17 **2579**

Various Applications of the Square-Wave Generator.—R. de L. Ortueta & J. M. H. Botas. (*Rev. Telecomunicación, Madrid*, Sept. 1949, Vol. 5, No. 17, pp. 40–52.)

621.396.615.17 : 621.392.018.424.001.4 **2580**

An Impulse-Generator/Electronic-Switch for Visual Testing of Wide-Band Networks.—T. R. Finch. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 657–661.) The instrument may be used to test any network that can be arranged to store a d.c. charge, the discharge characteristics produced by the network under test and by a reference network being simultaneously displayed for comparison. Representative applications are illustrated with the aid of c.r.o. traces and the circuit functions are described in detail.

621.396.616.029.64.001.4 **2581**

Kilomegacycle Buzzer Test Oscillator.—G. L. Davies, C. B. Pear, Jr, & P. E. P. White. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 96–99.) Voltage pulses with repetition frequency 800/sec derived from a battery-driven buzzer are applied to a cavity resonator tunable in the range 3–11 kMc/s. Outputs up to 200 μV across a 50-Ω load are obtained by adjustment of a simple piston attenuator.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9 : 061.3 **2582**

International Convention on Ultrasonics.—Bradfield. (*See* 2397.)

534.321.9 : 542.952.6 **2583**

Emulsion Polymerization with Ultrasonic Vibration.—A. S. Ostroski & R. B. Stambaugh. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 478–482.) Magnetostriction and piezoelectric oscillators, operating at 15 kc/s and 500 kc/s respectively, were used to study the effect of ultrasonic vibrations on the formation of such products as polystyrene and synthetic rubber. Above the threshold intensity required to produce cavitation, the time taken to reach a given yield of polymer is approximately inversely proportional to the power used.

534.415 : 621.396.615.141.2 **2584**

Stroboscopic Mapping of Time-Variable Fields.—L. Marton & D. L. Reverdin. (*J. appl. Phys.*, June 1950, Vol. 21, No. 6, pp. 617–618.) During investigations of the static field of a cut-off magnetron it was found that the space-charge field was completely masked by the magnetic field due to the filament-heating current. To avoid this a half-wave rectifier was used to feed the filament and observation of the space-charge distribution was restricted to the half-cycle when no heating current was flowing. Pulse operation of the electron beam used for observation of the space charge was effected by square-wave modulation of the electron-gun bias voltage. The stroboscopic method is applicable in principle to the observation of recurrent, time-variable fields up to very high frequencies, a practical upper frequency limit being estimated at about 300 Mc/s.

621-57 : 621.318 **2585**

The Magnetic-Fluid Clutch.—J. Rabinow. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1308–1315.) A detailed discussion of principles and applications. See also 969 of April and back references.

621.316.86 : 536.581 **2586**

Thermistor Thermostats.—A. H. Taylor. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 154–159.) Two simple low-cost circuits suitable for controlling refrigerators and using Western Electric thermistors Type V-514 are described.

621.318.572 : 621.387.422† **2587**

High-Speed Electronic Scaler.—W. M. Sessler & A. V. Masket. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, p. 494.) Ge diodes are used in a circuit developed from one described in Vol. 19 of the M.I.T. Radiation Laboratory series (2006 of 1949).

621.38.001.8 : 616-07 **2588**

Electronic Instruments in Diagnostic Medicine.—S. N. Pocock: W. Grey Walter: H. A. Hughes. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 355–356.) Comments on 1207 of May (Hughes) and author's replies.

621.384.6 **2589**

200-kV Accelerator with Gas-Recovery System.—E. Almqvist, K. W. Allen, J. T. Dewan, T. P. Pepper & J. H. Sanders. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 209.) Summary of American Physical Society paper.

621.384.6 **2590**

Optimum Parameters for Particle Acceleration by TM_{010} Cylindrical Cavities.—B. L. Miller. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 209.) Summary of American Physical Society paper.

621.384.6 **2591**

Production of High-Current Electron Pulses by a Resonant-Cavity Accelerator.—G. W. Clark & L. B. Snoddy. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 232.) Summary of American Physical Society paper. Pulses of duration $<10^{-7}$ sec with electron energies $>$40 keV are obtained by use of a doubly reentrant cylindrical cavity operating at 400 Mc/s in conjunction with a pulsed electron source.

621.384.6 **2592**

Theory of the Radial Oscillations of the Electrons in an Electron Accelerator.—H. Jahn & H. Kopfermann. (*Ann. Phys., Lpz.*, 19th Sept. 1949, Vol. 6, pp. 305–320.) Approximate formulae for the oscillation amplitude of the electrons about their instantaneous orbits, and for the damping of the oscillations, are derived and applied to the field of the 6-MeV electron accelerator of the Siemens-Reiniger Werke.

621.384.611.1† **2593**

An 80-MeV Model of a 300-MeV Betatron.—D. W. Kerst, G. D. Adams, H. W. Koch & C. S. Robinson. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 462–480.)

621.384.611.1† **2594**

Performance of 300-MeV Betatron.—G. D. Adams, D. W. Kerst & C. S. Robinson. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 208.) Summary of American Physical Society paper.

621.384.611.2† **2595**

Operation of the M.I.T. 350-MeV Electron Synchrotron.—I. A. Getting, J. S. Clark, J. E. Thomas, Jr, I. G. Swope & M. L. Sands. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 208.) Summary of American Physical Society paper.

621.384.611.2† **2596**

Electron Injection Gun for the M.I.T. 350-MeV Synchrotron.—O. Stone. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 209.) Summary of American Physical Society paper.

621.384.611.2† **2597**

Design of Magnet Ends and Straight Sections for a Racetrack Synchrotron.—G. B. Beard, J. L. Levy, W. A. Nierenberg & R. W. Pidd. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 209.) Summary of American Physical Society paper.

621.384.611.2† **2598**

Synchrotron Radiofrequency System.—M. H. Dazey, J. V. Franck, A. C. Helmholz, C. S. Nunan & J. M. Peterson. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 436–439.) Description of the r.f. system of the Berkeley synchrotron.

621.384.611.2† **2599**

Theory of the Capture Process in a Betatron-Injected Synchrotron.—D. C. de Packh & M. Birnbaum. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 451–456.)

621.384.612.1† **2600**

A Focusing Device for the External 350-MeV Proton Beam of the 184-Inch Cyclotron at Berkeley.—W. K. H. Panofsky & W. R. Baker. (*Rev. sci. Instrum.*, May 1950, Vol. 21, No. 5, pp. 445–447.)

621.385.833+535.822 **2601**

Electrons *vs* Photons: A Comparison of Microscopes.—L. Marton. (*J. opt. Soc. Amer.*, May 1950, Vol. 40, No. 5, pp. 269–274.) Comparison of electron and light microscopes, with discussion of the discrepancy between the theoretical resolving power of the electron microscope and the values obtained in practice.

621.387.4† : 549.211 **2602**

Some Phenomena in Diamond Gamma-Ray Counters.—E. Pearlstein & R. B. Sutton. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 217.) Summary of American Physical Society paper.

621.387.424† **2603**

Geiger Counter for Lectures.—R. L. Ives. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 105–107.) Circuit details are given of a portable instrument capable of delivering 50 W a.f. output at 1 000 counts/sec, and provided with strobotron flasher and thyratron-driven rate meter as auxiliary indicators.

778.37 : 537.523.4 **2604**

A Barium Titanate Coaxial Cable for the Production of a Short-Duration Spark.—J. A. Fitzpatrick & W. J. Thaler. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 231.) Summary of American Physical Society paper. A coaxial capacitor of overall length 16.5 cm, with $BaTiO_3$ dielectric of permittivity 1 575 giving a capacitance of 0.02 μF, was used in spark photography of ultrasonic waves in water at frequencies up to 7 Mc/s.

621.387.4† **2605**
Ionization Chambers and Counters, Experimental Techniques. [Book Review]—B. B. Rossi & H. H. Staub. Publishers: McGraw-Hill Book Co., New York, 1st edn 1949, 243 pp., 19s. 6d. (in Great Britain). (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 352–353.)

PROPAGATION OF WAVES

061.3 : [621.396.11 + 55 **2606**
Summary of Proceedings of Australian National Committee of Radio Science, U.R.S.I., Sydney, January 16-20, 1950.—(*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 191–210.) Summaries are given of 33 papers presented at the conference.

538.566 + [537.226.2 : 546.217 **2607**
The Velocity of Electromagnetic Waves and the Dielectric Constant of Dry Air.—Hughes. (*See* 2489.)

538.566 **2608**
Higher-Order Approximations in Ionospheric Wave-Propagation.—J. Feinstein. (*J. geophys. Res.*, June 1950, Vol. 55, No. 2, pp. 161–170.) The ionosphere, even when assumed homogeneous, can be considered as a linear medium for the propagation of e.m. waves only as a first approximation. Second-order terms give rise to harmonics, and to sum and difference frequencies when two independent waves traverse the same physical region. These new frequencies are, in general, of the nature of forced vibrations, except in the case where their propagation characteristics are those of a natural mode capable of existing in the region. A resonance effect then occurs, the new wave increasing its energy at the expense of the interacting waves, and assuming an independent existence. While these effects couple energy from the primary wave, they do not affect its propagation characteristics.

As a result of the degeneracy of the determinantal equation for the propagation constant, the introduction of any disturbing physical effects, such as a layer drift velocity, raises the degree of the equation, resulting not merely in changes in the values of the propagation constants of the usual modes, but, in addition, introducing new ones. For the usual disturbing effects encountered in the ionosphere, the energy content of these new modes is negligibly small.

538.566 : 537.562 **2609**
Electromagnetic Waves in Bounded Magneto-Ionic Media.—B. Lax. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 222.) Summary of American Physical Society paper. Discussion and theoretical study of h.f. waves in ionized gases in the presence of an external magnetic field, particularly the determination of the complex frequency when the value of the propagation vector is fixed or limited, as might be the case in a finite cavity resonator or waveguide.

621.396.11 + 535.222 **2610**
Can the Velocity of Propagation of Radio Waves be Measured by Shoran?—C. I. Aslakson. (*Trans. Amer. geophys. Union*, Aug. 1949, Vol. 30, No. 4, pp. 475–487.) An account is given of radar methods used to measure 47 lines of a shoran system of lengths ranging from 67 to 367 miles. Six of these lines could be compared with distances determined by first-order triangulation. Coordination of the shoran results with the geodetic measurements gave a mean value of 299 792.3 km/s for the velocity of propagation of radio waves, after making various corrections. See also 2010 of August (Essen).

621.396.11 : 551.510.535 **2611**
Ionosphere Observations at 50 kc/s.—Brown & Watts. (*See* 2506.)

621.396.11 : 551.57 **2612**
The Importance of Water Vapor in Microwave Propagation at Temperatures below Freezing.—D. G. Yerg. (*Bull. Amer. met. Soc.*, May 1950, Vol. 31, No. 5, pp. 175–177.) Calculations based on experimental results indicate that the vapour-pressure term in the refractive-index equation cannot be neglected for temperatures above −35°C. For temperatures between −35°C and −20°C the vapour-pressure gradient may be quite significant and at temperatures above −20°C it may be the dominant factor.

621.396.81 **2613**
Propagation of Waves of Frequencies from 2.5 to 35 Mc/s between Washington and Madrid.—(*Rev. Telecomunicación, Madrid*, Sept. 1949, Vol. 5, No. 17, pp. 2–18.) An account of N.B.S. prediction methods, and of an experimental investigation into quality of reception for these frequencies, with a view to obtaining data on which predictions might be based. Observations were made hourly from 0700 to 2200 for the period Dec. 1948 to March 1949. Graphs of receiver output power against time of day, and of m.u.f. and optimum working frequency against time of day, display the results for each fortnight of the period. These are discussed and compared with N.B.S. charts, and suggestions are made for extension of the WWV standard-frequency transmissions.

621.396.81 **2614**
'Probable Law' of Propagation of Short Waves for Ranges of 1300 km from Europe.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, Sept. 1949, Vol. 5, No. 17, pp. 19–35.) Observations were made in 1945 and 1947–1949 of the times at which reception in Madrid of various s.w. signals from London commenced or ceased to be of practical value. From the results obtained a simple numerical relation is deduced between the optimum working frequency F Mc/s at sunrise (or sunset) and the optimum frequency f Mc/s at a time n hours later or earlier (n being respectively positive or negative). $f = F \pm 2n$, the sign depending on whether the interval is measured from sunrise or from sunset, for which the value of F is much higher than for sunrise. For E-W or W-E transmissions a different value of the factor of n is required. Graphs of the signal strength of transmissions from London around 1300 G.M.T. indicate some dependence on the length of day.

621.396.81 **2615**
Optimum Working Frequencies for Ranges from 0 to 2 500 km.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, Sept. 1949, Vol. 5, No. 17, pp. 36–39.) An adaptation of a N.B.S. abac is reproduced and explained; from this either the m.u.f. or the optimum working frequency can easily be determined for any range up to 2 500 km.

621.396.81.029.63/.64 **2616**
A Microwave Propagation Test.—J. Z. Millar & L. A. Byam, Jr. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 619–626.) A description is given of a microwave propagation test which was conducted over a period of a year with simultaneous transmission on wavelengths of 16.2, 7.2, 4.7, and 3.1 cm over an unobstructed 42-mile overland path. Comparative charts depict variations in daily fading range, illustrate diurnal and seasonal characteristics of fading, and reveal the marked difference between winter and summer fading. Curves are presented showing relative field-strength distribution for both winter and summer periods, and also the distribution of hourly minima. These curves may be useful in considerations bearing on the continuity of service that may be expected for different wavelengths and times of day in winter or in summer.

621.396.812 **2617**

Effects of Radio Gyrointeraction and their Interpretation.—M. Cutolo. (*Nature, Lond.*, 15th July 1950, Vol. 166, No. 4211, pp. 98–100.) Experiments performed in Italy during June–July 1949 are described, using Taranto as the wanted station with Turin as the receiving station and Radio Florence II as the interfering station. The interfering carrier frequency was varied from 1 092 kc/s to 1 333.33 kc/s to pass through the gyrofrequency, estimated to be 1 190 kc/s at 90 km above the earth. The results obtained were in agreement with the theoretical double-humped curve given by Bailey (9 of 1939) and are used to explain earlier results (1476, 1477 and 1767 of 1949). Minimum interaction was obtained on a frequency corresponding to the local gyrofrequency at Montefalco, midway between transmitter and receiver, the presumed reflection point of the wanted wave. Solar activity was also observed to influence gyrointeraction, the phenomenon being weak or absent for a Wolf's number up to 100.

RECEPTION

621.396.621 **2618**

Low-Noise F.M. Front End.—J. Marshall. (*Radio-Electronics*, June 1950, Vol. 21, No. 9, pp. 58 . . 63.) Construction details are given of a ganged, low-noise r.f. amplifier and mixer circuit which converts signals in the f.m. band to an i.f. of 10.7 Mc/s. A high-gain i.f. amplifier for use with this equipment will be described in a subsequent article.

621.396.621 : 621.396.822 **2619**

Note on Low-Noise-Figure Input Circuits.—A. C. Hudson. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 684–685.) Comment on 1504 of June (Lebenbaum).

621.396.823 **2620**

Measurement of Interference from Radio-Frequency Heating Equipment.—G. H. Brown. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1102–1106.) Discussion of m.f. and v.h.f. radiation from dielectric- and induction-heating equipment, and a comparison of the theoretical r.f. field strengths with measurements.

STATIONS AND COMMUNICATIONS SYSTEMS

621.394.3+621.396.3 **2621**

Military Teletypewriter Systems of World War II.—F. J. Singer. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 1398–1408.) An illustrated review of equipment developed by the Bell Telephone Laboratories for line and radio links, with discussion and block diagrams of the various systems used.

621.395 : 06.053 **2622**

Fifteenth Plenary Assembly of the Comité Consultatif International Téléphonique, Paris, 1949.—P. E. Erikson. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 87–100.) See also 455 of February and 994 of April.

621.396.13 : 621.396.619.2 **2623**

The Single-Sideband System of Radio-Communication.—H. D. B. Kirby. (*Electronic Engng*, July 1950, Vol. 22, No. 269, pp. 259–263.) The advantages of the s.s.b. system over the normal d.s.b. method of operating a radio link are discussed and a short description is given of s.s.b. equipment in s.s. *Caronia*.

621.396.65.029.63 **2624**

Decimetre Waves in the German Telephone Service.—E. Dietrich & P. Barkow. (*Fernmeldetech. Z.*, May 1950, Vol. 3, No. 5, pp. 145–154.) Description of two multi-channel f.m. systems in use and brief discussion of optimum operating conditions.

621.396.73 : 621.396.61 **2625**

V.H.F. Equipment for Sound Broadcasting.—(*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, p. 309.) A pack-set transmitter-receiver has been designed for use by B.B.C. commentators at golf matches, race meetings, etc. It is carried on the commentator's back. The f.m. transmitter operates in the 90-Mc/s band and has an output of about 1 W, with a frequency response curve sensibly flat from 50 c/s to 6 kc/s. A 250-V HgO anode battery and accumulator filament battery are adequate for three hours continuous working. The 70-Mc/s receiver enables the commentator to receive information from the engineer at the control point, where a small a.m. transmitter is installed. The portable transmitter, complete with batteries, $\lambda/4$ whip aerial and harness, weighs 17 lb; the receiver brings the total weight to 26 lb.

621.396.931/.932 **2626**

The Metropolitan Police Radio Communication System.—E. C. Brown. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 316–322.) A review of developments from 1923 onwards, with a description of the present R/T system which provides two-way communication between New Scotland Yard and some 200 vehicles, besides 13 launches of the River Thames Division. The present scheme uses two main frequency channels, but will eventually use four main and two subsidiary channels. A system of coaxial filters at the main station enables separate transmitters on different frequencies to feed into a common wide-band aerial. A similar system is used for the station receivers. Phase modulation is used and all transmitting equipment is crystal controlled. The output of the main-station transmitter is 250 W in the 95–100-Mc/s band, that of the mobile transmitters being 10 W in the 80–84-Mc/s band. The receivers are of the double-superheterodyne type. Further developments envisaged are the provision of R/T equipment for motor cycles, with selective calling arrangements, and the use of similar equipment for cars.

621.396.931/.932 **2627**

Multi-Station V.H.F. Schemes.—J. R. Brinkley. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 323–325.) Many v.h.f. mobile-communication problems can be solved by the single-station method, but for large rural areas, estuaries, trunk roads and railways, multi-station systems have decided advantages, though they are necessarily more complex. A 2-station scheme using a.m. has been in use by the Hertfordshire county police since 1947 with complete reliability. Ten further multicarrier schemes have been installed in various counties in England, seven being 2-station and the rest 3-station schemes. A 3-station scheme is also in use by the Lanarkshire Fire Service. For estuary and coastal problems the G.P.O. authorities have decided to use multicarrier a.m. equipment.

621.396.931/.932 **2628**

Design Problems of V.H.F. Mobile Equipment.—L. W. D. Sharp. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 331–337.) Operating requirements of v.h.f. mobile systems and equipment are outlined and transmitter and receiver design problems are discussed with particular reference to transmitter power, receiver sensitivity and the type of modulation adopted. Block diagrams illustrate the essential differences between f.m. and a.m. transmitters and receivers. Valves, components, power-supply units, and types of construction to make equipment suitable for use under the adverse conditions frequently met and to permit easy servicing are also discussed.

621.396.931/.932 **2629**
Planning V.H.F. Mobile Systems.—E. R. Burroughes. (*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 298–304.) See also 1248 of May.

621.396.931/.932 : 621.396.6 **2630**
V.H.F. [mobile] Equipment.—(*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 340–348.) A review, with illustrations and technical details, of a wide range of British transmitting and receiving equipment available for v.h.f. mobile radio services. The information has been supplied by the manufacturers, who will give further details on request. Both a.m. and f.m. systems are included.

621.396.931 **2631**
Mobile Radio.—A. Bailey. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 923–931. Discussion, pp. 932–933.) An account of the development of mobile communication systems for police, taxicab and general telephone services from 1921 onwards, with details of the Bell System general mobile service for urban and highway use.

621.396.931 : 621.396.619.13 **2632**
Multi-Station V.H.F. Communication Systems using Frequency Modulation.—W. P. Cole & E. G. Hamer. (*J. Brit. Instn Radio Engrs*, July 1950, Vol. 10, No. 7, pp. 244–258.) Reasons for the use of multistation systems for mobile communications are discussed and previous tests with f.m. equipment are reviewed. Standard equipment for a single-station scheme is examined and from this the performance requirements for multistation equipment are derived. Suitable frequencies for the main carriers and for a control link are discussed and equipment used in a multistation scheme is described in detail. Distortion due to multipath transmission is analysed and practical tests of multistation systems in the London area and in Scotland are described. Future trends in development of such systems are indicated.

621.396.932 **2633**
New Marine V.H.F. Radio System.—(*Overseas Engr*, July 1950, Vol. 23, No. 273, pp. 449–450.) General description of the ship/shore telephony system for the port of Liverpool. Transmitters and receivers are crystal controlled and a.m. is used. Six channels are provided; the shore stations transmit on frequencies in the range 163.1–163.6 Mc/s, the frequencies for the mobile equipment being 4.5 Mc/s lower in each case. The weight of the portable sets, which are both rain- and water-proof, is $<$ 20 lb. Good communication is obtained within a range of 25 miles.

SUBSIDIARY APPARATUS

621-526 **2634**
Note on the Maximum Accuracy of Perfectly Stable Servomechanisms.—G. Lehmann. (*Onde élect.*, June 1950, Vol. 30, No. 279, pp. 267–270.) If an unconditionally stable servomechanism includes an element which introduces a phase change not effectively zero, its accuracy at relatively low frequencies is necessarily limited. This limiting value is calculated for a simple case. Attention is drawn to the possible danger of exceeding this limit in a system only conditionally stable.

621.313.3 : 621.3.026.441† **2635**
Flea-Power Industrial Synchronous Motors.—A. B. Poole. (*Elect. Mfg, N.Y.*, Jan. 1949, Vol. 43, No. 1, pp. 74–77 . . 172.) Operational principles, design features and output characteristics of three basic types of clock motor: the hysteresis, shaded-pole induction, and inductor types.

621.314.622 **2636**
Rectifiers with Mechanical Contacts.—A. Mongault. (*Rev. gén. Élect.*, May 1950, Vol. 59, No. 5, pp. 208–210.) Discussion of requirements for efficient commutation in a polyphase generator, i.e., minimum sparking and optimum inductance of the windings.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 **2637**
Distant Electric Vision.—J. D. McGee. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 596–608.) Reprint. See 761 of March.

621.397.5 **2638**
Television in Relief and in Colour.—Y. Delbord. (*Ann. Télécommun.*, June 1950, Vol. 5, No. 6, pp. 219–228.) Paper presented at the Television Congress in Milan, September 1949. Four methods are discussed and their advantages, disadvantages, and applicability to black-and-white, relief or colour television are tabulated. These are (*a*) fixed vertical-band scanning frame; (*b*) rotating disk; (*c*) multiple channel; (*d*) multiple image. The basic principles of the methods are described with regard to transmission and reception. For relief television, method (*d*) is regarded as affording the simplest satisfactory solution. For colour television a combination of the best features of (*b*), (*c*) and (*d*) is desirable.

621.397.5 **2639**
Kell Factor and Picture Definition in Television Transmissions with Constant Bandwidth.—E. Schwartz. (*Fernmeldetech. Z.*, June 1950, Vol. 3, No. 6, pp. 185–190.) Discussion of the optimum 'K-factor' (ratio of horizontal to vertical resolution) and comparison of different systems. See also 3942 of 1940 (Kell, Bedford & Fredendall).

621.397.5 **2640**
An Analysis of the Sampling Principles of the Dot-Sequential Color-Television System.—R.C.A. Laboratories Division. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 255–286.) A quantitative treatment of the influence of the width of the sampling pulse on colour crosstalk, the response of standard monochrome-television receivers and colour-television receivers to sinusoidal variations and to step functions, the way in which the method of 'mixed highs' combines with the sampling procedure to produce h.f. detail, and circuit methods of eliminating crosstalk.

621.397.5 : 535.88 : 532.62 **2641**
The Eidophor Method for Theater Television.—E. Labin. (*J. Soc. Mot. Pict. Televis. Engrs*, April 1950, Vol. 54, No. 4, pp. 393–406.) See also 3561 of 1949 (Thiemann).

621.397.5(083.74) **2642**
Choice of Television Standards.—(*Wireless World*, July 1950, Vol. 56, No. 7, pp. 249–250.) Reasons are given for considering that the choice of the 405-line standard is fundamentally sound, both from an engineering and an economic viewpoint. When the capabilities of 405-line television have been fully exploited, any small improvement that might be obtained by increasing the number of lines will be offset by the difficulties which will be encountered in maintaining the larger bandwidth required and in ensuring that the degree of overall distortion does not exceed the more stringent limits of tolerance.

621.397.6 : 535.88 **2643**
Projection Television.—J. Haantjes & J. J. P. Valeton. (*Tijdschr. ned. Radiogenoot.*, July 1949, Vol. 14, No. 4, pp. 99–117.) Description of the MW6-2 c.r. tube, Schmidt-type optical system and h.v. supply unit. See also 2387 of 1948 (Rinia et al.).

621.397.6 : 621.396.67 **2644**
Ultra-High-Frequency Antenna and System for Television Transmission.—Fiet. (*See* 2425.)

621.397.6.001.8 **2645**
Industrial Television System.—R. W. Sanders. (*Elect. Commun.*, June 1950, Vol. 27, No. 2, pp. 101–111.) Detailed description of equipment which uses a new type of image-dissector tube with a translucent photocathode. See also *Electronics*, July 1950, Vol. 23, No. 7, pp. 88–92.

621.397.61 **2646**
A New Ultra-High-Frequency Television Transmitter.—Lappin & Bennett. (*See* 2659.)

621.397.61(47) **2647**
Television in the Soviet Union.—(*Fernmeldetech. Z.*, June 1950, Vol. 3, No. 6, p. 218.) Brief note of what is known of the two transmitters in service at Moscow and Leningrad. Two other stations are under construction, one in Kiev to serve South Russia, the other in Sverdlovsk to serve eastern Russia and the Ural region.

621.397.62 **2648**
General Description of Receivers for the Dot-Sequential Color-Television System which employ Direct-View Tri-Colour Kinescopes.—R.C.A. Laboratories Division & R.C.A. Victor Division. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 228–232.) See also 2363 above.

621.397.62 **2649**
Sync-Separator Analysis.—W. Heiser. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 108–111.) The response of a particular clipper circuit for separating synchronizing signals from the composite television signal is analysed. Formulae are derived for use in designing such circuits, and calculated results are compared with measured results for test signals.

621.397.62 : 621.396.615.16 **2650**
A Hard-Valve Time-Base.—Banthorpe. (*See* 2455.)

621.397.67 : [621.317.733 + 621.392.52 **2651**
Television Antenna Diplexers.—W. H. Sayer, Jr, & J. M. De Bell, Jr. (*Electronics*, July 1950, Vol. 23, No. 7, pp. 74–77.) Methods are described which enable two or more closely spaced r.f. signals (e.g. vision and sound carriers) to be transmitted from one aerial, with a minimum of interaction between signal sources. Impedance bridges or 'notch' filters formed of coaxial lines are used. Diplexers may also be used to add together the synchronized outputs of two generators so as to obtain high power; waveguide and coaxial-ring (rat-race) hybrids for this purpose are described. See also 1355 of June, No. 80.

621.397.81 **2652**
Midlands Television Area.—(*Wireless World*, July 1950, Vol. 56, No. 7, p. 266.) A map, based on a B.B.C. survey, showing approximate field-strength contours for the vision signals from the Sutton Coldfield transmitter.

621.397.82 **2653**
A Study of Cochannel and Adjacent-Channel Interference of Television Signals: Part 2 — Adjacent-Channel Studies.—R.C.A. Laboratories Division. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 287–295.) In the observer tests, colour signals characteristic of the field-sequential, line-sequential, and dot-sequential systems were included. A standard monochrome signal was paired with a monochrome signal and the colour signals in some of the tests. In all instances, the interfering sound signal was present. From the standpoint of allocation, no substantial difference in the tolerable ratios was found for the various combinations of colour and monochrome signals used. Part 1: 1798 of July.

621.397.828 : 621.396.61 **2654**
Tackling TVI at the Output End.—Tapson. (*See* 2661.)

621.397.828 : 621.396.677 **2655**
TV Antenna Phase Control.—G. N. Carmichael. (*Radio-Electronics*, June 1950, Vol. 21, No. 9, pp. 54, 56.) A method of reducing co-channel interference and increasing wanted signal strength in fringe areas. Two Yagi arrays are used, spaced to give a phase difference of about 90° for angles of incidence of the downcoming wave commonly found in fringe areas. The outputs from the two arrays are fed separately to a variable phase control, which partially cancels unwanted, and adds wanted signal voltages. Depending on the angle between the directions of the incoming signals, the combination can give a rejection ratio of 35–40 db, and a forward gain of 15 db, compared with a dipole.

621.397 **2656**
Facsimile. [Book Review]—C. R. Jones. Publishers: Murray Hill Books, New York, 1949, 422 pp., $6.00. (*J. Franklin Inst.*, March 1950, Vol. 249, No. 3, p. 255.) Apparently intended for those concerned with the use and maintenance of facsimile equipment rather than with its design.

TRANSMISSION

621.396.61 : 621.396.645 **2657**
Maximum Tank Voltage in Class-C Amplifiers.—Dwork. (*See* 2460.)

621.396.61 : 621.396.97 **2658**
A New 150-kW Transmitter for Standard-Band Broadcasting.—T. J. Boerner. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part II, pp. 943–951.) A detailed description of a 540–1 600-kc/s transmitter with high-level modulation. A class-B modulator is used for a.m. of the class-C final r.f. amplifier, thus permitting the highest overall efficiency with relative ease of adjustment.

621.397.61 **2659**
A New Ultra-High-Frequency Television Transmitter.—L. S. Lappin & J. R. Bennett. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 190–211.) Detailed description of the 1-kW Type-TTU-1A transmitter recently installed and now in operation at Bridgeport, Connecticut. The h.f. tripler and power amplifier are operated as grounded-cathode grounded-screen amplifiers, each using eight Type-4X150A valves mounted in a single cavity. A sectional diagram of the cavity is given. See also 1795 of July (Guy, Seibert & Smith).

621.397.67 : [621.317.733 + 621.392.52 **2660**
Television Antenna Diplexers.—Sayer & De Bell (*See* 2651.)

621.397.828 : 621.396.61 **2661**
Tackling TVI at the Output End.—M. E. Tapson. (*Short Wave Mag.*, June 1950, Vol. 8, No. 4, pp. 265–266.) Use of third-harmonic traps in the anode circuit of the power amplifier, link coupling to the aerial system, and a folded dipole adjusted for low feeder s.w.r., minimized interference from a 100-W 14-Mc/s amateur transmitter, so that television reception was practicable within about 20 yards.

VALVES AND THERMIONICS

537.533.8 **2662**
Secondary-Electron Emission from Metal Mixtures.—Salow. (*See* 2526.)

621.383.27† **2663**

Calculation of the Elements of an Electron-Multiplier Tube and its Realization.—A. Lallemand. (*Le Vide*, May 1949, Vol. 4, No. 21, pp. 618–624.) Various factors relevant to the design of photoelectric multiplier tubes are discussed, including type of cathode, form and coating of multiplier surfaces, and arrangements for obtaining suitable electron trajectories. The multiplier grids finally adopted consisted of parallel narrow strips inclined at about 45° to the mean grid plane, a grid of fine wires maintained at the same potential as the multiplier being fixed a little in front of each multiplier. Tubes using this type of construction have been produced with 7, 12, 17 and 19 stages, the multiplication factors for 120-V operation ranging from 1 215 to 3.7×10^6.

621.383.27† **2664**

Rise Times of Voltage Pulses from Photo-Multipliers.—O. Martinson, P. Isaacs, H. Brown & I. W. Ruderman. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 178.) Includes a brief description of a method of measuring short rise-times without the use of a high-speed oscillograph.

621.385.012 : 621.317.79 **2665**

The Application of Direct-Current Resonant-Line-Type Pulsers to the Measurement of Vacuum-Tube Static Characteristics.—Leferson. (*See* 2576.)

621.385.029.63/.64 + 621.396.615.142.2 **2666**

Recent Developments in Amplifying Valves for Centimetre Waves.—G. Goudet. (*Ann. Télécommun.*, Dec. 1948, Vol. 3, No. 12, pp. 445–455.) Limitations of klystron amplifiers are discussed and a description is given of the wide-band double-resonator klystron designed by engineers of the Laboratoire Central de Télécommunications. With anode voltage 8 kV, electron current 100 mA, the output is 12 W, power gain 40 and pass band 50 Mc/s, or 20 W under slightly different operating conditions, with gain 100 and pass band 25 Mc/s. A similar 2-stage valve (3 cavity resonators) has an output of 2 W, a power gain of 290 and pass band 20 Mc/s.

Travelling-wave valves are also considered briefly and a simplified theory of their operation, with derivation of design and performance formulae, is given in an appendix. See also 1294 of May.

621.385.032.216 **2667**

Pulsed Operation of Oxide Cathodes.—C. Biguenet. (*Le Vide*, July/Sept. 1949, Vol. 4, Nos. 22/23, pp. 661–668.) The theory of steady-state operation is reviewed briefly and a theory of pulsed operation is proposed which assumes that under the action of the electric field a displacement of Ba ions in the thickness of the oxide layer occurs. These positive charges create a very intense field near the surface of the metal support and tear electrons out of it. Some of these electrons neutralize the positive charges, the rest play an important part in the electron emission. The time necessary for the neutralization of the positive charges appears to be of the order of 5 μs, so that in pulsed operation the duration of application of the anode voltage should be less than this value. Experiments with the object of confirming the theory are described.

621.385.032.216 **2668**

Deterioration of Oxide-Coated Cathodes under Low Duty-Factor Operation.—J. F. Waymouth, Jr. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 233.) Summary of American Physical Society paper. Investigation of the effect of emission-current duty-factor on cathode life.

621.385.032.216 : 621.3.011.2 **2669**

Electrical Conductivity of Oxide-Cathode Coatings.—D. A. Wright. (*Brit. J. appl. Phys.*, June 1950, Vol. 1, No. 6, pp. 150–153.) See 2078 of August.

621.385.1 : 621.396.822 **2670**

Current Fluctuations in D.C. Gas-Discharge Plasma.—P. Parzen & L. Goldstein. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, pp. 190–191.) Mathematical analysis deriving an expression for the effective noise power due to current fluctuations in a gas-discharge plasma in a rectangular waveguide transmitting in only its lowest mode. For ordinary gas valves used as microwave noise sources the contribution of the frequency-dependent term in the expression for noise power is small.

621.385.2/.5].029.62 **2671**

A Survey of V.H.F. Valve Developments.—(*Electronic Engng*. Aug. 1950, Vol. 22, No. 270, pp. 310–315.) The factors limiting the upper working frequencies of ordinary valves are discussed, together with the difficulties encountered in the development of v.h.f. valves; a survey is made of the various types at present available. A list of the characteristics of a selected range of disk-seal triodes is included.

621.385.3 : 621.315.592† : 546.815.221 **2672**

On the Frequency Response of PbS Transistors.—P. C. Banbury & K. H. Henisch. (*Proc. phys. Soc.*, 1st July 1950, Vol. 63, No. 367B, pp. 540–541.) The response of PbS transistors is found to be comparable with that of Ge transistors. The h.f. response can be extended somewhat by the use of higher collector voltages or by the application of a suitably oriented magnetic field. The variation produced by the magnetic field, though only small, shows by its sense that the charge carriers are electrons, as in the Ge *p*-type transistor. See also 2088 of August (Gebbie, Banbury & Hogarth), 2089 of August (Brown) and 2459 above.

621.385.3 : 621.315.592† : 621.396.645 **2673**

High-Frequency Operation of Transistors.—Brown. (*See* 2459.)

621.385.3.029.62 : 621.396.822 **2674**

On the Space-Charge Smoothing of Shot Fluctuations in Triode Systems Responding to Very High Frequencies.—I. A. Harris. (*J. Brit. Instn Radio Engrs*, July 1950, Vol. 10, No. 7, pp. 229–240.) Existing theoretical results are briefly reviewed and a simplified theory of space-charge smoothing of shot fluctuations in a diode, based on the Benham-Llewellyn theory, is discussed in some detail. This theory is then applied to cases in the v.h.f. range where electron transit times are appreciable, and it is concluded that the l.f. smoothing factor is not appreciably changed up to transit angles of about 1 radian. Application of the theory to the noise of grounded-grid triode circuits gives results in better agreement with experiment than those based on earlier theories. The effect on noise of applying a nonuniform field at the cathode of a triode is also considered.

621.385.38 **2675**

Studies of Thyratron Behavior: Part 1 — The Effect of Grid Resistance on the Recovery Time of Thyratrons.—L. Malter & E. O. Johnson. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 165–177.) Theoretical and practical investigations of the grid-voltage and current characteristics of a commercial thyratron, for different values of grid resistance and bias, during the period following the interruption of the discharge. During the recovery period electron current may flow to the grid if the voltage drop across the grid resistor due to positive-ion current exceeds the bias voltage. The increase of recovery time with increasing value of grid resistance is due to the delayed return of the grid voltage to its bias value and not to a decreased rate of deionization, this rate being essentially independent of grid resistance and voltage. The recovery time is also dependent upon the instantaneous value of the actual grid voltage. See also 2676 below.

621.385.38 **2676**

Studies of Thyratron Behavior: Part 2 — A Study of the Effect of Grid Potential Variations during the Afterglow Period upon the Recovery Time of Thyratrons.— E. O. Johnson & L. Malter. (*RCA Rev.*, June 1950, Vol. 11, No. 2, pp. 178–189.) Experiments with commercial thyratrons indicate that the recovery time is a function of the instantaneous effective grid potential and is independent of previous grid-potential variations provided that no abrupt changes have occurred shortly before the grid regains control. Such changes set up an unstable charge distribution in the plasma and sheaths within the tube, this unstable state passing to a quasi-stationary one in a time dependent on diffusion.

621.396.615.14 **2677**

A New Wide-Range, High-Frequency Oscillator.— O. Heil & J. J. Ebers. (*Proc. Inst. Radio Engrs*, June 1950, Vol. 38, No. 6, pp. 645–650.) Wide-range tuning in a Barkhausen type of oscillator is achieved by concentrating electrons from a highly efficient electron gun and also concentrating the electric field of a cavity resonator at the point where the electron beam has its greatest density. Although efficiency is low, variation of circuit capacitance alone gives a 3 : 1 tuning range, since the resonator gap capacitance is small. The oscillator construction is described and operating characteristics are given, output powers of 0.1–1 W being obtained in the wavelength range 4.5–12 cm.

621.396.615.141.2 **2678**

Resonance Frequencies of the Space Charge in a Magnetron.—P. Fechner. (*C. R. Acad. Sci., Paris*, 22nd May 1950, Vol. 230, No. 21, pp. 1848–1849.) Analysis is effected for values of anode voltage and magnetic field such that the magnetron cannot oscillate, h.f. excitation being introduced from an auxiliary source. Expressions are derived relating the resonance frequency of the vibrating space-charge electrons to the value of the electric field, for both whole-anode and multicavity magnetrons.

621.396.615.141.2 : 534.415 **2679**

Stroboscopic Mapping of Time-Variable Fields.— Marton & Reverdin. (*See* 2584.)

621.396.615.141.2† : 621.317.361 **2680**

Measurement of the Resonance Frequency of the Space Charge in a Coaxial Magnetron.—P. Fechner. (*C. R. Acad. Sci., Paris*, 10th July 1950, Vol. 231, No. 2, pp. 124–125.) The formula connecting magnetic field H with interelectrode voltage V at resonance (see 2678 above) is verified by measurements made by the following method. The non-oscillating magnetron is energized from a klystron source coupled to it by a matched coaxial line. An attenuator inserted in this line serves to increase the variations of impedance as V is altered. The resonance condition is determined by means of a crystal detector at an electric-field antinode of the coupling line.

621.385 **2681**

Röhren Vade-Mecum 1950. [Book Review]—P. H. Brans. Publishers: Brans-Verlag, Antwerp, 8th edn 1950, 508 pp., 15.40 Swiss francs. (*Bull. schweiz. elektrotech. Ver.*, 27th May 1950, Vol. 41, No. 11, p. 463. In German.) Includes the data of former editions combined with particulars of the latest valves: viz. 9-element valves, accelerometers, projection tubes, phasitrons, planar triodes, crystal diodes, etc. Contents list and instructional notes are printed in eight languages.

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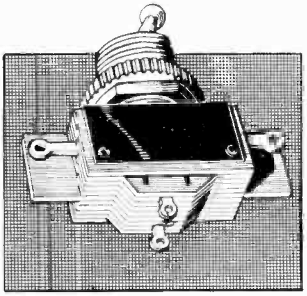

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ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

FIRST GROUP

ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 — 2682

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 522–528.) Continuation of 2395 of October.

534.231 — 2683

The Propagation of a Sound Pulse in the Presence of a Semi-Infinite Open-Ended Channel: Part 1.—W. Chester. (*Philos. Trans. A.*, 5th Sept. 1950, Vol. 242, No. 854, pp. 527–556.) Two problems are discussed. In the first, a sound pulse originates inside a duct between two semi-infinite parallel planes and travels to and beyond the open end, where it undergoes partial reflection. In the second case, the pulse originates outside the duct and approaches the open end from an arbitrary direction. A succession of diffracted waves is created at the end of the duct, for which in the first case a general formula is derived by operational methods. A simple reciprocity relation is applied to deduce the form of the wave in the duct in the second case. Ultimately the returning wave becomes sensibly plane and splits up into regions of length equal to the distance between the boundary planes, the form of the potential depending on the number of diffracted waves which contribute to each particular region. Explicit expressions are obtained for the potential in the first two regions at the head of the returning wave and for the third region when the pulse originates within the duct. The case of an initial velocity distribution given by the Heaviside unit pulse is treated in detail.

534.232 : 534.321.9 — 2684

The Relative Output from Magnetostriction Ultrasonic Generators.—F. M. Leslie. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 418–421.) Equivalent transmission-line circuits are used to develop formulae for the resonance frequency and output of the simple bar oscillator and the dumbbell type. Approximations in the latter case do not introduce any great discrepancy between calculated and measured values of resonance frequency. The formulae, though applicable directly to the symmetrical dumbbell oscillator, may be easily applied to the asymmetrical oscillator and to those in which the face area is less than the cross-section of the neck.

534.232 : 534.321.9 : 621.3.087.6 — 2685

Application of Supersonic Energy to High-Speed Electronic Recording.—H. J. Dana & J. L. Van Meter. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 473–476.) See 1561 of July.

534.24 : 532.582.3 — 2686

Sound Scattering from a Fluid Sphere.—V. C. Anderson. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 426–431.) A mathematical solution is obtained for scattering from a sphere of size comparable with the wavelength, with acoustic properties near to those of the surrounding medium. The reflectivity for direct backward scattering is presented as a function of relative density and relative sound velocity. Comparison is made with the Rayleigh limiting case and with the case of a fixed rigid sphere. For diameters comparable with the wavelength, scattering may show pronounced maxima and minima.

534.373 : 534.213.4 — 2687

Classical Viscosity in Tubes and Cavities of Large Dimensions.—B. P. Bogert. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 432–437.) "A method for the calculation of viscous losses in acoustic wave guides and cavities is described, similar to that used by Carson, Mead, and Schelkunoff for electromagnetic waves. The loss in a plane wave in a round tube is discussed and the results agree with those previously obtained by others. The attenuation for two higher modes in hard-wall guides is computed, as well as the decay constants for a cylindrical cavity for longitudinal and pure radial modes."

534.414 — 2688

Acoustic Resonators of Circular Cross-Section and with Axial Symmetry.—A. K. Nielsen. (*Trans. Dan. Acad. tech. Sci.*, 1949, No. 10, 70 pp. In English.) The literature on this subject is critically reviewed. The usual approach to resonator theory is inadequate for two reasons. Firstly, the velocity distribution in the coupling aperture is usually assumed constant in order to satisfy boundary conditions. This assumption actually violates the boundary condition at the sharp edges of the coupling aperture, where the velocity becomes infinite (neglecting losses). Secondly, the interaction between the wave emitted from the coupling aperture and that reflected from the cylindrical walls of the resonator has been neglected. An expression for the velocity distribution is derived which satisfies the rise-to-infinity condition at the edge of the aperture and a formal solution of the wave equation is obtained, assuming the velocity distribution in the aperture to be known. The results are used to calculate the resonance frequency of a symmetrical resonator by the energy method. Formulae are also given for symmetrical resonators. The end correction for a flanged organ pipe is found to be 0.8220 *r*, a slightly better approximation than Rayleigh's value of 0.8242 *r*. The effects of viscosity and heat conduction are also considered. Experimental results for various resonators and flanged organ pipes agree with the theoretical values to within 1%.

534.417 : 621.395.614 **2689**

Crystal Microphone for Underwater Sounds.—W. Güttner. (*Z. angew. Phys.*, May 1950, Vol. 2, No. 5, pp. 206–210.) The microphone consists of 10 Rochelle-salt plates with 45° X-cut, mounted between elastic supports so that the sound pressure acts only on the front membrane. Its response characteristic is shown; this is largely independent of temperature change. The method of calibration is described. The measured response of the receiver agrees well with values calculated from crystal data.

534.442 **2690**

Methods and Instruments for the Visual Analysis of Complex Audio Waveforms.—H. R. Foster & E. E. Crump. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 564–572.)

534.442.2 : 621.392.52 **2691**

A Continuously Variable Filter.—C. G. M. Fant. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 449–453.) A heterodyne filter for the speech frequency range is described. Band-pass filtering with continuously variable low- and high-frequency cut-offs or band-elimination filtering with variable mid-frequency and fixed bandwidth are possible. Variable filtering is performed by s.s.b. transmission with successive filtering and demodulation. The filter was designed for speech investigations and wave analysis in the range 40–2 000 c/s.

534.75 : 534.792 **2692**

The Frequency Selectivity of the Ear as Determined by Masking Experiments.—T. H. Schafer, R. S. Gales, C. A. Shewmaker & P. O. Thompson. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 490–496.)

534.78 : 621.314.26 **2693**

Devices for Speech Analysis and Compression.—F. Vilbig. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 573–581.)

534.833.4 **2694**

Acoustic Materials.—(*Tech. Bull. nat. Bur. Stand.*, July 1950, Vol. 34, No. 7, pp. 96–102.) A review of the essential theory of sound absorption, the principles governing the use of absorptive materials, the various types of such materials, their physical properties and methods of measurement.

534.846.6 **2695**

The Use of Three-Dimensional Models in Room Acoustics.—R. W. Muncey. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 510–511.) The chief difficulty in the construction and use of models for investigation of room acoustics is the provision of bounding surfaces to simulate the properties of those of the full-size hall. Investigations of the use of small-scale models have been commenced at the Building Research Laboratory, Victoria, Australia.

621.3.018.78† : 621.317.79 **2696**

An Intermodulation Analyzer for Audio Systems.—Fine. (*See* 2840.)

621.395.612.45 **2697**

New 'Unobtrusive' Ribbon Pressure Microphone.—H. F. Olson & J. Preston. (*Broadcast News*, May/June 1950, No. 59, pp. 24–28; *Audio Engng, N.Y.*, July 1950, Vol. 34, No. 7, pp. 18–20.) Theory and description of a microphone with uniform response from 50 c/s to 15 kc/s. A small pickup horn applies sound pressure to the ribbon through a cylindrical tube and tapered connector, the back of the ribbon being coupled to the damping labyrinth by a similar connector.

621.395.623.7 **2698**

Electroacoustic Phase Shift in Loudspeakers.—C. A. Ewaskio & O. K. Mawardi. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 444–448.) The modulation phase-shift method of Nyquist & Brand was adapted for direct indication of envelope delay (the slope of the phase-shift curve) by using an electronic phase-meter. A continuous record was obtained of the delay for various loudspeakers by means of an automatic level recorder suitably connected to the phase-meter. The results, together with pressure-amplitude response curves, may serve as a basis for assessing the quality of a loudspeaker.

621.395.625.3 : 681.6 **2699**

Duplication of Magnetic Tape Recordings by Contact Printing.—Herr. (*See* 2804.)

621.395.625.3 : 681.6 **2700**

A New Magnetic Record Duplicating Process.—Camras. (*See* 2803.)

681.85 **2701**

A Variable Speed Turntable and its Use in the Calibration of Disk Reproducing Pickups.—H. E. Haynes & H. E. Roys. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 556–563.) See 1578 of July.

681.85 : 534.862.4 **2702**

The Diamond as a Phonograph Stylus Material.—E. J. Marcus & M. V. Marcus. (*Audio Engng, N.Y.*, July 1950, Vol. 34, No. 7, pp. 25–27, 41.) The properties of natural diamonds, which make them pre-eminent for use as stylus points, are described and a photographic comparison is made of the normal wear of commonly used stylus materials, showing the very great superiority of the diamond. Natural small stones, owing to their greater structural strength, are better than chips cut from larger gem stones. A short account is given of the occurrence of the stones and of the methods of preparing them for use.

534.321.9 : [5 + 6 **2703**

Der Ultraschall und seine Anwendung in Wissenschaft und Technik. (Ultrasonics and its Application in Science and Technology) [Book Review]—L. Bergmann. Publishers: S. Hirzel Verlag, Zürich, 5th edn 1949, 748 pp., 50 Swiss fr. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, p. 517.) "The author has rendered a genuine service to all workers in ultrasonics and allied fields by bringing together so much valuable material in one place and organizing it so systematically and efficiently. No worker in the field can really afford to have this book very far away from his desk." Over 2 300 references are included. The 3rd edition was noted in 280 of 1946.

534.833.4 **2704**

Sound - Absorbing Materials. [Book Review] — C. Zwikker & C. W. Kosten. Publishers: Elsevier Publishing Co., Amsterdam, Brussels & New York, Cleaver-Hume Press, London, 1949, 174 pp., $3.00 or 22s. 6d. (*Research, Lond.*, June 1950, Vol. 3, No. 6, pp. 281–282.) "A highly scientific study of the physical behaviour of sound waves impinging on and penetrating into absorbent constructions of any type."

534.84 **2705**
Acoustical Designing in Architecture. [Book Review]—V. O. Knudsen & C. M. Harris. Publishers: J. Wiley & Sons, New York, 1950, 404 pp., $7.50. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, p. 832.) A nonmathematical presentation. A little space is devoted to discussion of sound-amplification systems and studio design. Tables of sound-absorption coefficients and sound-insulation data are brought together in the appendices.

AERIALS AND TRANSMISSION LINES

621.392.26† **2706**
Some Properties of Waveguides with Periodic Structure.—A. W. Lines, G. R. Nicoll & A. M. Woodward. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 263–276.) A general description of the frequency characteristics of waveguides with periodic structure is derived from a discussion of loaded transmission lines. Analysis of an equivalent circuit is used to give a detailed confirmation of these characteristics. The periodic guide with systematically detuned resonators is then examined by these methods, all the general features being obtained by elementary reasoning. A more detailed treatment, based on Maxwell's equations, is required for specific design problems and this is used in the design of a periodic waveguide with every third resonator detuned, for which a space harmonic exists with constant phase velocity over a wide frequency band. Possible experimental techniques for checking the theoretical frequency characteristics are discussed and the results obtained by one technique for the constant-phase-velocity guide are given.

621.392.26† : 621.3.09 **2707**
Electromagnetic Waves in Circular Wave-Guides containing Two Coaxial Media.—R. D. Teasdale & H. J. Higgins. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 427–441.) The general problem is treated in detail. A conditional equation governing propagation in such waveguides is derived. The two conditions for which simple E or H waves can be propagated are determined and discussed. Curves relating phase velocity to design parameters are plotted for the E_0 wave and examples are discussed for which the general solution reduces to particular solutions given by other authors.

621.392.26† : 621.3.09 **2708**
On the Theory of Electromagnetic Radiation in Metal Tubes.—R. Honerjäger. (*Z. Phys.*, 20th June 1950, Vol. 128, No. 1, pp. 72–78.) The radiation field of an electric and magnetic dipole of given moment in an infinitely long straight metal tube of arbitrary cross-section is calculated for E and H waves, and also the total e.m. power flux through the tube.

621.396.67 + 621.396.611.1 **2709**
A Combination Slot Antenna and Resonant Tank Circuit.—N. L. Harvey. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 183–189.) An impedance transforming and coupling network is usually required between the transmitter unit and the aerial. The coupling network can be eliminated by using the edges of the aerial slot as the resonant circuit of the transmitter unit. Such an arrangement is especially suitable for wide-band applications.

621.396.67 **2710**
Impedance and Radiation Characteristics of Slotted-Cylinder Antennas.—R. E. Beam & H. D. Ross, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 172–182.) Approximate theoretical expressions are developed for the input impedance and radiation patterns of a slotted-cylinder aerial with a narrow slot of length equal to or greater than the free-space half wavelength, and fed at the midpoint of the slot. The aerial is considered as a slot-loaded cylindrical waveguide in calculating the cut-off frequency and phase constant along the slot. Babinet's principle is applied to the determination of the radiation resistance. Experimental results are in good agreement with theory.

621.396.67 **2711**
Slot Radiators.—N. A. Begovich. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 803–806.) By an extension of Babinet's principle Booker has shown (1335 of 1947) that the field pattern of a slot aerial is identical with that of the corresponding wire aerial, but with the electric and magnetic fields interchanged. A rigorous proof of this is now given, using the double-current-sheet diffraction formula. Integration of Poynting's vector over both surfaces of the slot gives a driving impedance of $362.5 + j210.5$. The real part of this is in excellent agreement with experimental measurements. The mutual impedance between slots, which must be known for array calculations, is also determined.

621.396.67 **2712**
The Slot Radiator, a Magnetic Dipole for Centimetre Waves.—H. Severin. (*Z. Phys.*, 20th June 1950, Vol. 128, No. 1, pp. 108–119.) The slot radiator is represented as a magnetic dipole and its mode of operation by the theory of diffraction of e.m. waves at a small aperture in a perfectly conducting screen. Measured values of the radiation from and magnetic moment of small elliptical-slot radiators disposed respectively parallel and perpendicular to the magnetic field of the incident wave are in good agreement with calculations, provided the linear dimensions of the apertures are $< \lambda/3$.

621.396.67 **2713**
Correction of Spherical Aberration by a Phased Line Source.—R. C. Spencer, C. J. Sletten & J. E. Walsh. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 320–333.) Theory of the spherical reflector with corrected line source is developed. Tests using feeds such as open waveguides, horns, polyrod, slotted and dipole line sources show that if the phasing is suitably adjusted, aberrationless scanning of a pencil beam over at least $\pm 30°$ in any direction can be achieved.

621.396.67 **2714**
The Electromagnetic Field in the Vicinity of a Linear Conductor.—P. H. Nelson. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol 5, pp. 315–319.) A study is made of the interference pattern in the vicinity of a linear conductor, of infinite length and zero resistance, subjected to the action of a plane e.m. wave with electric-field vector parallel to the conductor. The reradiated field is independent of the incident field except at the surface of the conductor, so that superposition of the incident and radiated fields gives the interference pattern required. Experiments at a frequency of 3 000 Mc/s with some simple types of conductor gave results in close agreement with theoretical calculations.

621.396.67 **2715**
End-Loaded and Expanding Helices as Broad-Band Circularly Polarized Radiators.—P. W. Springer. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 161–171.) The simplicity of the axial-mode helix makes

it particularly suitable for the radiation of circularly polarized waves, but for applications requiring either modified radiation patterns or broad transmission bands it is often necessary to modify the simple helix. Two types, the short end-loaded helix and the expanding helix, are of particular value where extreme bandwidths are required. The theory of operation, impedance curves, polar diagrams, current and phase distribution, are discussed and arrays are described providing (*a*) broad azimuth coverage, (*b*) sharp radiation patterns.

621.396.67 2716

Antifading Broadcast Antenna.—H. Brueckmann. (*Electronics*, Aug. 1950, Vol. 23, No. 8, p. 228.) Correction to article abstracted in 1863 of August.

621.396.67 : 621.317.79 2717

The Electronically Driven Ripple-Tank as an Aid to Phase-Front Visualization.—Schooley. (*See* 2841.)

621.396.67 : 621.392.26† 2718

The Channel-Guide Antenna.—W. Rotman. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 190–202.) The general condition for radiation from the slot of a channel-guide aerial is derived in terms of the near-field distribution of e.m. energy, which may be described as a form of single-mode transmission in the supporting waveguide, characterized by a complex propagation constant. A method of computing the propagation constant gives results for different channel geometries which are in agreement with experiment. Practical methods of coupling channel-guide aerials to microwave sources are considered.

621.396.67 : 621.397.62 2719

An Automatic Built-In Antenna for Television Receivers.—K. Schlesinger. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol 5, pp. 292–302.) See 819 of April.

621.396.67.012 2720

A Graphical Analysis of the Interference Patterns of an Elevated Ultra-High-Frequency Antenna under Conditions of Atmospheric Stratification.—F. R. Abbott & C. J. Fisher. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 636–641.)

621.396.67.029.64 : 535.42 2721

Small-Surface Microwave Diffraction.—A. Applebaum & P. C. Fritsch. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 442–449.) The diffraction of plane-polarized e.m. waves by reflection from small perfectly conducting surfaces (diameter of the order of λ) is calculated for any angle of incidence by Schelkunoff's 'current-sheet' method. A correction for boundary effects is determined. Experimental results obtained with an unmodulated reflex klystron, Type 2K39, as the power source, are in good agreement with theory.

621.396.673 : 621.397.61 2722

1 057-Foot FM-TV Antenna.—(*Broadcast News*, May/June 1950, No. 59, pp. 8–15.) Situated at Atlanta, U.S.A., a 1 000-ft tower supports an R.C.A. Supergain television aerial (1865 of August). Above this is a f.m. aerial, a 4-section pylon, R.C.A. Type BF-14D. The television aerial has a gain of 11.5, which, with a 5-kW transmitter, gives an effective radiated power of 52 kW. The f.m. aerial has a power gain of 6; provision is made for an additional four sections to double this gain. The earthing system consists of radial copper straps 50 ft long spaced every five degrees, buried 6 in. deep and terminating in copper earthing rods.

621.396.677 2723

A Wide-Angle Microwave Radiator.—S. S. D. Jones. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 255–258.) If a glass sphere of unit radius could be produced with a refractive index $\mu = \sqrt{(2-r^2)}$ where r is the distance from the centre, the sphere would act as a lens with a focus on the surface of the sphere. A microwave analogue has been constructed using spaced conducting sheets. The lens is free from aberrations as the feed is moved around the circumference and is therefore suitable for wide-angle scanning. The measured performance agrees well with theory.

621.396.677 : 538.31 : 538.214 2724

The Effective Permeability of an Array of Thin Conducting Disks.—Estrin. (*See* 2765.)

621.396.677.2 2725

Theoretical Investigations on the Radiation Impedance of Transmitting Aerials.—J. Patry. (*Schweiz. Arch. angew. Wiss. Tech.*, May 1950, Vol. 16, No. 5, pp. 138–147.) The theory of Hallén is extended to aerial arrays, in particular to symmetrical dipole arrays for metre waves. The two special problems considered are the interaction of parallel dipoles with parallel feed and the effect of the spacing between the two elements of a dipole. The complex general formula is simplified for the resonance case treated here. The values of expressions from which the radiation resistance can be found are given in a table referring to 12 different arrays of similar dipoles.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2.018.424.029.3 2726

Audio-Frequency Transformer with Range Extended below One Cycle per Second.—D. W. Kuester. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 255–257.) Discussion of design problems and description of a transformer for connection between a 72-Ω line and a 10-kΩ grid circuit, with a flat response curve from 0.2 c/s to 20 kc/s.

621.314.263 2727

The Magnetic-Cross Valve and its Application to Subfrequency Power Generation.—H. J. McCreary. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 450–466.) Basic theory and characteristics are discussed, showing how subharmonics may be obtained by a process of magnetic energy transference without moving parts or mutual inductance. Results of experimental analysis are used to show how a single flux vector may vary cyclically, but with different periods along two axes, resulting in the production of subharmonics. Details are given of the performance of a 'Power Ringer' employing the device; this converts 60-c/s power to 20 c/s and has been in use in a telephone exchange for 4 years without attention.

621.314.3† 2728

The Magnetic Amplifier.—J. S. W. Graham. (*Strowger J.*, July 1950, Vol. 7, No. 2, pp. 104–119.) Fundamental principles are outlined and power control, amplification ratio, continuously variable control, feedback, time lag, core materials, and general design features are considered in detail. Application to rhythmic ('Rythmatic') ripple control is described, with test results.

621.314.3† 2729

The Problem of the Magnetic Amplifier and some Approaches to its Solution.—M. Liwschitz-Garik, E. J. Smith & E. Weber. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 235–254.) Various possible methods of steady-state analysis are considered and the question of the best representation of the magnetization characteristic of a core under conditions of asymmetrical magnetization is discussed. Experimental results are given illustrating the effect of d.c. bias on the a.c. magnetization curve. Results for half-wave and full-wave magnetic amplifiers are computed by a point-by-point procedure and by a method based on the representation of the magnetization curve by three linear elements. The latter method yields satisfactory results in much the shorter time.

621.314.3† **2730**

An Extension of a Theory of Magnetic Amplifiers.—R. T. Beyer & Ming-Yi Wei. (*J. Franklin Inst.*, July 1950, Vol. 250, No. 1, pp. 25–37.) The theory previously given (2730 of 1949) is extended to the case of large d.c. inputs and the presence of harmonics in the primary current, the a.c. impedance of the secondary being assumed infinite. Experimental evidence supports the calculations, which show a nonlinear relation between d.c. input and second-harmonic ouput, the latter passing through a maximum as the d.c. is increased. The influence of a third-harmonic component in the primary current is also investigated; for small input currents it may be neglected without serious error.

621.314.3† : 681.142 **2731**

Magnetic Amplifier Studies on the Analog Computer.—E. L. Harder, W. H. Hamilton, D. F. Aldrich, J. T. Carleton & F. N. McClure. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 222–234.) A description is given of an electrical analogue to magnetic circuits and its application to the study of such circuits. Methods of applying the analogue to specific design problems are discussed. The nonlinear characteristics of iron are reproduced by using a multiple-diode nonlinear-resistance circuit whose characteristic simulates the true B/H curve by means of 20 successive linear elements.

621.316.842 + 621.316.86 **2732**

Wideband Power Resistors.—H. L. Krauss & P. F. Ordung. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 186..194.) A 30-W carbon-film resistor 10 in. long and $1\frac{1}{8}$ in. in diameter provided a satisfactory reactance-free 500-Ω termination up to 50 Mc/s when mounted in free space, but not when near an earthed plane, owing to stray capacitance. A terminated wire-wound resistor with 8 turns/in. on a former 1 in. in diameter, with carbon resistors connecting it to the earthed plane at suitable intervals so as to satisfy the distortionless transmission-line equation $R/G = L/C$, gave very satisfactory results up to 50 Mc/s.

621.318.572 **2733**

Electronic Decade Counter with Direct Indication by means of Neon Lamps.—A. Peuteman. (*C. R. Acad. Sci., Paris*, 19th June 1950, Vol. 230, No. 25, pp. 2160–2162.) See also 660 of 1949 (Naslin & Peuteman).

621.318.572 : 621.3.015.7 **2734**

A Pulse Length Sorter and Counter.—R. J. Parent & R. W. Schumann. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 72–82.) Pulses of random length and spacing, which occur at a rate of up to 10^5 per minute, can be sorted according to duration into 15 ranges. Sorting is achieved by biased circuits fed from a step-wave circuit driven by a multivibrator, which is gated by the random pulses to be measured. The number of pulses in each range is counted by binary scaling chains following each bias circuit. Circuits are described in detail, with the aid of diagrams and waveforms.

621.319.42 **2735**

The Influence of Operating Conditions on the Construction of Electrical Capacitors.—A. E. Bennett & K. A. Gough. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 231–241.)

621.392 **2736**

The Design of Wide-Band Phase-Splitting Networks.—W. Saraga. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 754–770.) A general investigation of phase-splitting networks, dealing with network analysis, network synthesis, and performance-curve approximation problems. Explicit formulae for any number of design parameters and for any required degree of approximation are stated for Taylor and Tchebycheff approximations. Clear design instructions for both simple and difficult network specifications are obtained. Novel methods are developed for obtaining dissipation compensation, for network synthesis, and for representing the approximating curves as iterated functions of two variables, with fractional index of iteration.

621.392.5 **2737**

Frequency Analysis of Variable Networks.—L. A. Zadeh. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, p. 725.) Corrections to paper abstracted in 1617 of July.

621.392.5 : 621.3.015.7† **2738**

The Determination of the Impulsive Response of Variable Networks.—L. A. Zadeh. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 642–645.) "Starting with the differential equation relating the output and the input of a linear varying-parameter network, it is shown that the impulsive response of the system is related to a Green's function associated with the system through a linear operator which is the adjoint of the right-hand operator in the given differential equation. A perturbation procedure [2835 of 1948 (Gray & Schelkunoff)] for the determination of the impulsive response of a slowly varying network is outlined. Use of the method is illustrated by a simple example involving a bandwidth-modulated RC half-section."

621.392.52 **2739**

Continuously Adjustable Electronic Filter Networks.—G. E. Tisdale. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 796–798.) The use of passive RC networks is discussed in terms of standard network theory. Frequency response is largely determined by these passive networks, while valves serve to isolate the various RC sections, to raise the output level, and to provide negative feedback. Design procedure is indicated and applied to adjustable low-pass and high-pass filters.

621.392.52 **2740**

A Crystal Filter of Variable Selectivity with Stable Resonance Frequency and Constant Gain.—W. Kautter. (*Rev. telegr., Buenos Aires*, March 1949, Vol. 37, No. 438, pp. 137–142.) Basically, the filter consists of two i.f. amplifier units coupled by the crystal. The bandwidth is altered by detuning the two circuits in opposite directions; the resulting resonance shift is $< b_{max}/24$, where b_{max} is the maximum bandwidth, and thus falls within tolerable limits. The crystal dynamic resistance does not affect the operation of the filter, at least to a first approximation. The gain is constant and equal to that of a conventional i.f. stage over the whole band. Neutralization of the crystal dynamic capacitance, and the type of coupling required between crystal and circuits, are discussed. Crystals that are free from spurious responses near the working frequency are essential.

621.392.52 : 621.3.015.3 **2741**

Transient Response of Filters.—M. S. Corrington. (*Proc. nat. Electronics Conference, Chicago*, 1949 Vol. 5, pp. 519–549.) Reprint. See 60 of January.

621.392.52 : 621.392.26† **2742**

Low-Q Microwave Filters.—J. Reed. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 793–796.) An analysis of waveguide bandpass filters of the type previously investigated by Pritchard (1000 of 1948), Fano & Lawson (695 of 1948) and Mumford (1320 of 1949), in which each stage comprises two spaced inductive irises and successive stages are separated by $\lambda/4$ sections of optimum length $s + \lambda_g/4$, where s is the iris spacing. Variation with frequency of the iris susceptance has a substantial effect on the loaded Q, especially for low values of Q. The theory was checked by experiments in which pairs of brass rods were substituted for irises.

621.392.52 : 621.392.26† **2743**

Design Relations for the Wide-Band Waveguide Filter.—S. B. Cohn. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 799–803.) Simplified formulae are derived and presented graphically for the design of non-uniform waveguide structures of the type previously considered (2469 of 1949). A numerical example is worked out. Measurements were made on specially constructed waveguide sections, and the calculated values of cut-off and infinite-attenuation frequency were found reliable to within 2%.

621.392.52.029.4 **2744**

Continuously Adjustable Low- and High-Pass Filters for Audio Frequencies.—A. Peterson. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 550–555.) Audio-frequency filter circuits are described in which the cut-off frequency is continuously variable over a 3 : 1 range with little change in the pass-band response. Each filter section uses two capacitors, a low-Q inductor, and a twin-triode reactance circuit with control by a single potentiometer. Beyond cut-off the attenuation is about 18 db per octave.

621.396.611.3 **2745**

An Analysis of Triple-Tuned Coupled Circuits.—N. W. Mather. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 813–822.) Circuits having high Q are considered, the couplings being loose and the response symmetrical about a reference frequency. Universal response curves are derived and contour plots for the product of gain and bandwidth are given. Compared with double-tuned circuits the triple-tuned circuit has the advantages of more uniform response inside the pass band, greater rejection outside it, and a larger value for the product of gain and bandwidth.

621.396.611.4 **2746**

Coupling between Two Degenerate Modes through Slots Cut in the Wall of a Cavity.—Han C. Hu. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 467–472.) An analytical and graphical presentation of slot patterns is given. Experimental results obtained with a test cavity, and oscillograms showing transmission and absorption characteristics for TE_{112} and TE_{113} degeneracy are used to indicate a way of achieving a precise degree of coupling.

621.396.615.14 : 621.385.029.63/.64 **2747**

The Helix as Resonator for Generating Ultra High Frequencies.—van Iperen. (*See* 2944.)

621.396.645 **2748**

A 60-db Nonlinear Amplifier.—J. A. Carruthers. (*Canad. J. Res.*, May 1950, Vol. 28, Sec. A, No. 3, pp. 287–292.) The amplifier described has been used to drive an Esterline Angus 0–1-mA recording galvanometer as part of the apparatus for automatically recording the radiation patterns of microwave aerials. By using a.v.c. the amplifier output is made approximately proportional to the logarithm of the input, thus enabling a 60-db variation of input signal to be plotted. The speed of response is limited by the galvanometer movement but is adequate for obtaining a pattern through 100° of azimuth in about two minutes. Plotting is accurate to within 1 db if care is taken to check calibration frequently.

621.396.645 **2749**

Cathode-Follower Amplifiers.—F. Navascues. (*Rev. Telecomunicación, Madrid*, Dec. 1949, Vol. 5, No. 18, pp. 9–29.) Study of cathode-follower circuits for a.f., i.f. and h.f. amplifiers, attenuators and impedance-matching units.

621.396.645 **2750**

Distributed Amplifiers: Practical Considerations and Experimental Results.—W. H. Horton, J. H. Jasberg & J. D. Noe. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 748–753.) Experimental results are presented corroborating the predictions made in an earlier paper (3375 of 1948). The causes of deviation from the idealized case are (*a*) attenuation due to coil losses, (*b*) attenuation due to grid losses, (*c*) grid- and anode-lead inductance, (*d*) capacitance distributed throughout the transmission-line coil windings. These effects can be corrected by using paired-anode circuits, negative-mutual circuits, or bridged-T circuits. The pass bands dealt with are of the order of 200–300 Mc/s.

621.396.645 : 621.396.822 **2751**

Noise Suppression in Triode Amplifiers.—A. van der Ziel. (*Canad. J. Res.*, June 1950, Vol. 28, Sec. F, No. 6, pp. 189–198.) A survey is given of recent work on noise suppression in triode amplifier stages. A theory is developed, in which the noise factor is expressed in terms of four complex quantities g_0, g_1, i_0 and i_1. g_0 and g_1 are the complex transconductances in the cathode lead and in the anode lead, respectively; i_0 and i_1 are the Fourier components of the noise currents flowing in these leads, respectively. These quantities are complex owing to transit-time effects. The theory is developed under the assumption that i_0 and i_1 are completely correlated. Experiments indicate that no complete noise suppression is possible if there is no feedback; according to the above theory this means that the real part of $(g_0 - g_1 i_0/i_1)$ is positive. Knol & Versnel showed recently that complete noise suppression can always be obtained under the above assumption of complete correlation if a suitable amount of external feedback is applied. With the help of the above theory it is shown, however, that the available power gain under those circumstances is less than unity.

621.396.645.018.424 : 621.397.61 : 621.3.088.7 **2752**

The Compensation for Phase Errors in Wide-Band Video Amplifiers.—A. E. Brain. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 243–251.) The transient response of multistage amplifiers may be improved by the insertion of several sections of bridged-T or lattice networks. A method is outlined for evaluating the phase characteristic of an amplifier with an arbitrary amplitude characteristic. Application of three suitable phase-correction circuits to a 16-stage amplifier reduced the rise time by about 33% and the overshoot from over 20% to less than 9%.

621.396.645.094 **2753**

On the Problem of Distortionless Amplification of D.C. Pulses with an A.C. Amplifier.—R. Gauger. (*Z. angew. Phys.*, April 1950, Vol. 2, No. 4, pp. 179–188.) For investigation of transients in a circuit a 'transfer function' is found useful. This is defined as the ratio of output to input voltage as a function of time when a step voltage is applied to the circuit; it is therefore dependent on the circuit time-constant. The transfer function is calculated for amplifiers with and without distortion correction and with up to 3 stages. The influence of the RC combinations in cathode and screen-grid circuits is considered. By use of CR or LR correcting networks the transfer function of a RC-coupled amplifier can be made practically independent of time up to half the original time constant. For pulses of duration less than this such an amplifier is suitable. The compensated amplifier has a lower minimum operating frequency and gives very little phase change at low frequencies. Distortion-free amplification can be achieved for square waves of fundamental frequency at least twice as high as the limiting frequency of the non-compensated amplifier.

621.396.645.35 : 621.317.755 **2754**

D.C. Amplifier Techniques in Oscillography.—Maron. (*See* 2838.)

621.396.822 : 519.283 **2755**

Statistical Prediction of Noise.—Y. W. Lee & C. A. Stutt. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 342–365.) Pertinent results in Wiener's theory of prediction (2465 of October) and their application to the prediction of filtered noise are discussed. Calculations leading to the required network for prediction of such noise are given in detail. Results in the form of a simultaneous display of predictor input and output waveforms show that the theory provides a useful approach to certain communication problems.

681.142 **2756**

Feedback in Electrical Analogue [impedance] **Chains and Networks.**—P. Grivet & Y. Rocard. (*Rev. sci., Paris*, April/June 1949, Vol. 87, No. 3302, p. 85.) The introduction of reaction into such circuits extends their mathematical application.

621.314.3† **2757**

The Transductor Amplifier. [Book Review]—U. Krabbe. Publishers: Ejnar Munkesgaard, Copenhagen, 1949, 176 pp., Dan. kr. 22. Obtainable from Bonniers, 605 Madison Ave, New York 22, at $5.50. (*Electronics*, Aug. 1950, Vol. 23, No. 8, p. 132.) "An excellent treatise on saturable-core reactors and their applications. The author, a competent mathematician, has shown rare ability in expressing equations in words prior to resorting to formulas ... It ... will constitute an invaluable addition to any engineering library."

621.318.42 **2758**

The Theory and Design of Inductance Coils. [Book Review]—Publishers: Macdonald, London, 180 pp., 18s. (*Electrician*, 18th Aug. 1950, Vol. 145, No. 3766, p. 425.) "The object of this book is to explain, in general terms, the underlying theory on which the design of inductance coils is based, and then to show how the theory can be simplified by the use of certain approximations and to what extent they are justified ... It is very well produced, carries a small, but useful, bibliography and should be a valuable reference work."

GENERAL PHYSICS

535.222 **2759**

A Measurement of the Velocity of Light.—R. A. Houstoun. (*Proc. roy. Soc. Edinb. A*, 1949/1950, Vol. 63, Part 1, pp. 95–104.) Full paper. Short account abstracted in 1896 of August.

535.314 **2760**

Improvement of the Optical Schlieren Method by Minimum Ray Indication.—H. Wolter. (*Ann. Phys., Lpz.*, 1st April 1950, Vol. 7, Nos. 3/4, pp. 182–192.)

537.311.33 : 621.314.634 **2761**

Experimental Examination of Rectifier Theory as Applied to the Selenium Rectifier.—Henkels. (*See* 2798.)

537.312.8 : [539.23 + 669-426 **2762**

The Conductivity of Thin Wires in a Magnetic Field.—R. G. Chambers. (*Proc. roy. Soc. A*, 7th Aug. 1950, Vol. 202, No. 1070, pp. 378–394.) A thin metal wire or film has a lower electrical conductivity than the bulk material if the thickness is comparable with the electron mean free path. This problem is examined from the kinetic-theory standpoint and the conclusions are applied to the case of a thin wire in an axial magnetic field. Experimental results are given which agree with the theoretical predictions.

537.525 : [537.542.2 + 536.49 **2763**

The Role of Cathode Temperature in the Glow Discharge.—H. Jacobs & J. Martin. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 681–685.) A study of the effect of the temperature of oxide-coated cathodes on cold-cathode glow discharges in neon, argon and neon/argon and Hg-vapour/argon mixtures.

537.562 : 538.561 **2764**

Unstable Oscillations in an Electron Gas.—K. G. Malmfors. (*Ark. Fys.*, 15th March 1950, Vol. 1, Part 6, pp. 569–578. In English.) An analytical treatment of the problem of electron beams in a magnetic field. At high densities an appreciable part of the electron current is collected by negative electrodes and noise level is high, indicating the existence of an energy-interchange mechanism other than ordinary collision; unstable oscillations exist at all frequencies. Such effects may afford a possible explanation of solar and galactic noise.

538.31 : 538.214 : 621.396.677 **2765**

The Effective Permeability of an Array of Thin Conducting Disks.—G. Estrin. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 667–670.) "When an alternating magnetic field is parallel to the disk faces, the field is undisturbed and the relative permeability coefficient is unity. When the alternating magnetic field is normal to the disk faces, circulating currents are induced on them. The boundary-value problem of determining the current distribution on a single perfectly conducting disk is carried out in detail for the case where the disk diameter is small compared to the wave-length. This current distribution is found to be representable by a magnetic dipole. If the disks in an array are far enough apart to neglect interaction, a simple summation of the dipole moments shows the array to have a diamagnetic susceptibility in the direction normal to the disk faces. Combining this result with an expression for the dielectric coefficient, which was developed earlier by Kock [2176 of 1948] the constants of the anisotropic array are completely specified."

538.52/.53 **2766**

Self Inductance of a Spherical Metal Shell and Mutual Inductance with an Endless Solenoid.—A. Colombani. (*C. R. Acad. Sci., Paris*, 19th June 1950, Vol. 230, No. 25, pp. 2158–2160.) Simple formulae, which may be of practical importance in h.f. work, are derived.

538.566 : 535.421 **2767**

Rigorous Theory of the Diffraction of Plane Electromagnetic Waves at a Perfectly Conducting Circular Disk and at a Circular Aperture in a Perfectly Conducting Plane Screen.—J. Meixner & W. Andrejewski. (*Ann. Phys., Lpz.*, 1st April 1950, Vol. 7, Nos. 3/4, pp. 157–168.) A rigorous solution which satisfies the radiation and boundary conditions and facilitates numerical calculation is obtained by representing the e.m. field by means of the Hertzian vector potential and developing the expression for the wave in the form of spheroidal functions. The field and the induced-current distribution in the diffracting disk are fully investigated for the particular case of relatively long waves. The complementary problem of diffraction at a circular aperture in a screen of infinite extent may be treated similarly, by virtue of the validity of the generalized Babinet principle.

538.566 : 537.562 **2768**

Electro-Magneto-Ionic Waves.—V. A. Bailey & K. Landecker. (*Nature, Lond.*, 12th Aug. 1950, Vol. 166, No. 4215, pp. 259–261.) Experiments have been made, using gas-discharge tubes subjected to magnetic fields, to test the theory that discrete frequency bands exist in which e.m. waves can grow in an ionized medium, developing strong e.m. noise from initially small random perturbations. Various gases, pressures and electrode arrangements were used. For fields ⩾ 100 gauss applied along the tube the expected bands always appeared; some observed noise intensities are shown graphically. From the positions of the bands conclusions are drawn regarding the details of wave propagation. Observations were also made on a thyratron with magnetic field applied transversely. The experiments demonstrate the value of the theory and supply a rough model of a sunspot emitter of enhanced solar noise. See also 1665 of July (Bailey & Roberts), 2785 and 3406 of 1949 (Bailey).

548.232 : 538.221 **2769**

Oriented Crystals: their Growth and their Effects on Magnetic Properties.—W. Morrill. (*Gen. elect. Rev.*, Aug. 1950, Vol. 53, No. 8, pp. 16–21.) Practical use of the anisotropic properties of metals is well advanced and the controlled growth of oriented crystals has produced exceptional magnetic properties in certain commercial materials. Study of crystal orientation and growth is proceeding in many laboratories and it is hoped that eventually any degree of preferred crystal orientation in any magnetic material will be commercially practicable.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.2/.8 : 538.12 **2770**

The Hydromagnetic Equations.—W. M. Elsasser. (*Phys. Rev.*, 1st July 1950, Vol. 79, No. 1, p. 183.) Using 'Maxwellian' electrodynamics, equations analogous to the hydrodynamic equations are derived for the currents, and associated magnetic fields, carried by cosmic fluids. These phenomena are of interest for solar, stellar and sunspot magnetism, geomagnetism, magnetic fields in stellar atmospheres and in interstellar space, and the related problem of galactic radio noise.

523.841.2 : 538.12 **2771**

Stellar Magnetic Fields.—H. W. Babcock. (*Nature, Lond.*, 12th Aug. 1950, Vol. 166, No. 4215, pp. 249–251.) An account of observations of the magnetic fields of certain variable stars. The star HD 125248 appears to be a magnetic dipole oscillator, with a fundamental frequency 1.25 microcycles/sec, radiating about 10^{12} kW on both fundamental and second harmonic.

537.562 : 538.566 **2772**

Electro-Magneto-Ionic Waves.—Bailey & Landecker. (*See* 2768.)

551.51 : 535.326] : 621.396.11 **2773**

Determination of Modified Index-of-Refraction over the Gulf of Mexico from Radio Data.—A. W. Straiton & A. H. LaGrone. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 661–666.) Measurements of signal strength and phase of 3.2-cm waves for a 26.5-mile over-sea path were made during June and July 1949. The radio data are analysed, using Macfarlane's theory (3487 of 1948) to give the modified refractive-index curves, which are compared with those deduced from meteorological observations.

551.510.535 + 523.5 **2774**

A Comparison of Meteor Activity with Occurrence of Sporadic E Reflections.—V. C. Pineo. (*Science*, 14th July 1950, Vol. 112, No. 2898, pp. 50–51.) Previously presented evidence (*ibid.*, 1949, Vol. 110, p. 280) that the echo from a meteor trail differs in character from a sporadic-E reflection is supported by a statistical study of continuous observations made at the National Bureau of Standards from 1st November 1948 to 30th April 1949. Sporadic-E is regarded as long-duration abnormality, as distinct from ionization bursts, and extreme care was taken to ensure that only reflections of true sporadic-E type were counted. Monthly average values of (*a*) hourly rate of meteor reflections, and (*b*) percentage of time of occurrence of sporadic-E reflections, show characteristic maxima at about 0600 EST and midday respectively. A scatter diagram gives no indication of correlation between the two quantities. Day-to-day curves for the month of January show no similarity. The data thus indicate that sporadic-E reflections are unrelated to meteor phenomena, at least to those detectable on 27.2 Mc/s.

551.510.535 **2775**

Data on the F_2 Layer of the Ionosphere [analysed] **according to the Parabola Model.**—E. Theissen. (*Naturwissenschaften*, July 1950, Vol. 37, No. 14, pp. 334–335.) Diurnal, seasonal and long-term ionospheric variations observed at two German stations are examined.

551.594.51 **2776**

On the Origin of Ten-Centimeter Radiation from the Polar Aurora.—P. A. Forsyth, W. Petrie & B. W. Currie. (*Canad. J. Res.*, May 1950, Vol. 28, Sec. A, No. 3, pp. 324–335.) Short-lived bursts of 10-cm radiation from auroral displays have been received by radar equipment. The sources of continuous radiation from a partially ionized medium are briefly discussed. From a knowledge of the constants of the equipment used it is deduced that the power density at the receiver is at least 2×10^{-10} W/m², and it seems that the most likely source of this radiation is a plasma oscillation of the ionized volume associated with the auroral display. If this is so, the electron density in localized regions must be of the order of 10^{11}/cm³.

521.030 : 537.5 **2777**

Cosmical Electrodynamics. [Book Review]—H. Alfvén. Publishers: Clarendon Press, Oxford, & Oxford University Press, London, 1950, 238 pp., 25s. (*Nature, Lond.*, 12th Aug. 1950, Vol. 166, No. 4215, p. 243.) "A short general survey is followed by three chapters discussing the motion of charged particles in a magnetic field, electric discharges, and the magneto-hydrodynamic waves which Alfvén himself first discovered. The ideas developed in these three chapters are then applied in a further three chapters to solar physics (sunspots, chromospheric and coronal temperatures, prominences, etc.), magnetic storms and aurorae, and cosmic radiation."

LOCATION AND AIDS TO NAVIGATION

621.396.9 **2778**

Thunderstorm Tracks by Radar.—R. F. Jones. (*Weather, Lond.*, June 1950, Vol. 5, No. 6, pp. 224–225.) Radar photographs taken near Dunstable of thunderstorms at Evesham and Birmingham on 13th July 1949 are shown and discussed.

621.396.9 : 531.761 **2779**
Theoretical Limit to Time-Difference Measurements. —Richman. (*See* 2824.)

621.396.933 **2780**
Traffic-Handling Capacity of Paired-Pulse Coding for 100-Channel Distance-Measuring Equipment (DME). —C. J. Hirsch. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 366–386.) See 1918 of August.

621.396.933 **2781**
Radio Aids to Navigation at the Ministro Pistarini Airport [Buenos Aires].—P. N. Guzzi. (*Rev. telegr., Buenos Aires*, June 1949, Vol. 37, No. 441, pp. 307–312.) The aids provided, chosen to conform to I.C.A.O. recommendations, will include G.C.A. and an instrument landing system.

621.396.933 **2782**
Instrumental Landing System for Aircraft.—A. N. Bhattacharyya. (*Indian J. Phys.*, Jan. 1949, Vol. 23, No. 1, pp. 13–18.) General discussion of a system using the interference of u.h.f. waves radiated from two aerials excited in the same phase with a common frequency.

621.396.933 **2783**
Microwave Radio Blind-Landing Systems for Aircraft. —A. N. Bhattacharyya. (*Indian J. Phys.*, Feb. 1949, Vol. 23, No. 2, pp. 88–92.) Two sharply defined beams rotating in a plane inclined to the earth's surface at the glide angle are produced respectively by two horn aerials rotating in opposite directions. The beams are synchronized to intersect in the vertical plane midway between the aerials, thus defining a glide path. Operating frequency is of the order of 20 kMc/s.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.12 **2784**
A Rotary McLeod Gauge.—M. Axelbank. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 511–513.) The new model described is improved in respect of portability, robustness and ease of operation.

531.788.7 **2785**
Extension of the Low-Pressure Range of the Ionization Gauge.—R. T. Bayard & D. Alpert. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 571–572.) The new model described has been used to measure pressures of the order of 10^{-10} mm Hg.

538.221 : 546.56.723.722 **2786**
Magnetic Properties and Structure of the Quadratic Phase of Ferrite of Copper.—L. Weil, F. Bertaut & L. Bochirol. (*J. Phys. Radium*, May 1950, Vol. 11, No. 5, pp. 208–212.)

538.221 : 621.317.411.029.5 **2787**
Determination of the Apparent Permeability and Q Factor of a Magnetic Powder at High Frequency.—A. Colombani. (*J. Phys. Radium*, May 1950, Vol. 11, No. 5, pp. 201–207.) The resultant internal and external fields are first calculated for an isolated particle in a h.f. magnetic field. The results are applied to a uniform distribution of particles within a medium. From the complex permeability found, the Q factor and flux reduction factor are easily deduced. Calculated values, dependent on frequency, conductance and grain size, are in good agreement with experimental results. See also 1172 of May.

538.221 : 669.231.15 **2788**
Magnetic Properties of Platinum-Iron Alloys: Part 2. —A Kussmann & G. von Rittberg. (*Ann. Phys., Lpz.*, 1st April 1950, Vol. 7, Nos. 3/4, pp. 173–181.) For alloys containing 50 to 63% Pt by weight, magnetostriction effects are the highest yet observed in ferromagnetic materials. Optimum properties for permanent magnets are obtained when the Pt content is 70%. Magnetostriction in this case is very small.

538.221 : 669.231.74 **2789**
Ferromagnetic Platinum-Manganese Alloys.—M. Auwärter & A. Kussmann. (*Ann. Phys., Lpz.*, 1st April 1950, Vol. 7, Nos. 3/4, pp. 169–172.) The ferromagnetic properties exhibited by Pt-Mn alloys containing 6 to 16% Mn by weight are attributed to the ordered arrangement of the atoms in the mixed crystals as Pt_3Mn. Magnetic-saturation and thermal-expansion curves, lattice constants and transition temperatures are given.

538.652 : 669.018.58 **2790**
Evaluation of the Magnetostrictive Properties of Hiperco.—H. Sussman & S. L. Ehrlich. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 499–506.) A description of tests made to evaluate the suitability of the alloy as a material for transducers. The performance criteria are established, and the properties and performance of hiperco, nickel and permendur are compared. For remanence operation hiperco is satisfactory for hydrophone use, but it is inferior to the other materials for high-power underwater projection. Its performance is improved by polarizing above remanence.

546.217 : 621.317.335.3.029.64 **2791**
The Permittivity of Air at a Wavelength of 10 Centimeters.—Phillips. (*See* 2827.)

546.471.61 : [537.311 + 537.323 + 538.632 **2792**
Electronic Processes in Zinc Fluoride and in the Manganese-Activated Zinc Fluoride Phosphor.—J. H. Crawford, Jr, & F. E. Williams. (*J. chem. Phys.*, June 1950, Vol. 18, No. 6, pp. 775–780.) Measurements of the temperature dependence of electrical conductivity and thermal e.m.f. for ZnF_2 and ZnF_2–Mn, and of the Hall coefficient and rectifying power at 25°C for ZnF_2.

546.472.21 : 535.37 **2793**
The Poisoning of Cathodoluminescence in Silver-Activated Cubic Zinc Sulfide.—S. Larach. (*J. chem. Phys.*, June 1950, Vol. 18, No. 6, p. 896.) Small amounts of Co, Fe or Ni sulphates were crystallized together with the ZnS–Ag phosphor. The poisoning effect was about the same for all three impurities. Cathode rays were used for excitation.

548.0 : 537 **2794**
Ferroelectric Crystals.—B. Matthias. (*Helv. phys. Acta*, 3rd Feb. 1950, Vol. 23, Nos. 1/2, pp. 167–170. In German.) Fundamental research carried out at the E.T.H., Zürich, is described briefly. The possibility of finding other ferroelectric crystals isomorphic with $BaTiO_3$ is investigated.

549.514.51 : 548.523 **2795**
Growing Large Quartz Crystals.—A. C. Walker & E. Buehler. (*Industr. Engng Chem.*, July 1950, Vol. 42, No. 7, pp. 1369–1375.) Full paper. Summary abstracted in 411 of 1949.

621.3.015.5 : 546.217 **2796**
A Note on Ultra-High-Frequency Gas Breakdown.—W. A. Prowse. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 253–254.) Some results obtained by Pim (2246 of 1949) show breakdown voltages which increase as the gap width is reduced. An explanation is here given as to why the spark, under such conditions, does not simply transfer to a point of greater gap width.

621.3.087.45 2797

Closed-Cycle Recording Oscillographs.—B. Ciscel & R. Ruhland. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 4–10.) Review of available equipment and description of an 8-channel pen recorder, with servo-motor pen drive, for use in flight tests.

621.314.634 : 537.311.33 2798

Experimental Examination of Rectifier Theory as Applied to the Selenium Rectifier.—H. W. Henkels. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 23–39.) Recent work at the University of Pennsylvania on the correlation of rectifier theory with experiment is examined. The variables in Schottky's theory are treated individually. The electrical properties of single crystals, as well as microcrystalline specimens, are examined in their relation to the Se rectifier. To explain bulk properties, a model of microcrystalline selenium must possess layers of high resistance at crystal grain boundaries, and surface layers on the crystallites of quite low resistance.

621.315.592† : 539.23 2799

Concerning the Theory of Photoconductivity in Infra-red-Sensitive Semiconducting Films.—E. S. Rittner. (*Science*, 23rd June 1950, Vol. 111, No. 2895, pp. 685–688.) Critical discussion of various theories, with a more general explanation of the effects observed in such films which avoids the difficulty of the exact balancing of impurities.

621.315.612.4 : 546.431.82 2800

The Dielectric Properties of Barium Titanate.—R. E. Averbukh & M. S. Kosman. (*Zh. eksp. teor. Fiz.*, Nov. 1949, Vol. 19, No. 11, pp. 965–970.) The dependence of the dielectric constant of $BaTiO_3$ on temperature and on field strength is investigated by a new ballistic method. The expression for the constant consists of two terms which vary differently.

621.315.612.6 : 537.311 2801

Electrical Conduction in Glass.—P. L. Kirby. (*Brit. J. appl. Phys.*, Aug. 1950, Vol. 1, No. 8, pp. 193–202.) The mechanism of electrical conduction in glass is discussed in the light of modern theories of its atomic structure. Variation of conductivity with composition is explained by reference to the valency requirements of the network atoms, and the temperature variation of conductivity is examined. The relative magnitudes of the dielectric absorption current and the true conduction current are considered, and the total loss angle is calculated for various temperatures to illustrate the transition from a dielectric to an ionic conductor.

621.315.616.7 2802

A New Dry-Type Insulation for Instrument Transformers.—R. A. Pfuntner, R. E. Franck & F. R. D'Entremont. (*Elect. Engng, N.Y.*, July 1950, Vol. 69, No. 7, pp. 594–599.) Butyl, a rubber-like material, can be moulded completely round core and coils; its dielectric properties are excellent over a wide range of temperature and humidity and it is chemically stable.

621.395.625.3 : 681.6 2803

A New Magnetic Record Duplicating Process.—M. Camras. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 258–261.) A rapid contact-printing process in which the blank is held against a master tape while the two are subjected to a h.f. magnetic field. See also 2804 below.

621.395.625.3 : 681.6 2804

Duplication of Magnetic Tape Recordings by Contact Printing.—R. Herr. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 262–268.) Discussion of a method identical in principle with that noted in 2803 above, and brief description of practical equipment. The method is not limited to tape records, but can be applied to records on disks, drums, etc. It does not seem applicable to the duplication of records on wire.

621.946.148.12 2805

High-Voltage and Electrolytic Drilling of Diamond Dies.—(*Machinery, Lond.*, 25th May 1950, Vol. 76, No. 1961, pp. 743–744.) Short account of method noted in 3944 of 1947.

666.1.037.5 : 539.319 2806

Stresses in Glass/Metal Seals: Part 1 — The Cylindrical Seal.—F. W. Martin. (*J. Amer. ceram. Soc.*, 1st July 1950, Vol. 33, No. 7, pp. 224–229.) Consideration of viscous flow during cooling of a beaded wire seal following annealing treatment leads to a modification of the theory of Hull & Burger (1184 of 1935); good agreement is then obtained between theoretical and experimental values of stress in beaded wire seals. Cylindrical seals with the metal outside are also considered. The expansion necessary for the best match depends on the geometry of the seal. In general, metal/glass seals should be annealed at a temperature above that used for the glass alone.

537.228.1 : 548.0 2807

Piezoelectric Crystals and their Application to Ultrasonics. [Book Review]—W. P. Mason. Publishers: D. Van Nostrand, New York, 508 pp., $7.50. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 519–520.)

MATHEMATICS

519.242 : 621.396.1 2808

An Extension of Wiener's Theory of Prediction.—L. A. Zadeh & J. R. Ragazzini. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 645–655.) "The signal (message) component of the given time series is assumed to consist of two parts, (*a*) a non-random function of time which is representable as a polynomial of degree not greater than a specified number n and about which no information other than n is available, and (*b*) a stationary random function of time which is described statistically by a given correlation function. (In Wiener's theory, the signal may not contain a non-random part except when such a part is a known function of time.)

The impulsive response of the predictor or, in other words, the weighting function used in the process of prediction is required to vanish outside of a specified time interval $0 \leq t \leq T$. (In Wiener's theory T is assumed to be infinite.)

The theory developed in this paper is applicable to a broader and more practical class of problems than that covered in Wiener's theory. As in Wiener's theory, the determination of the optimum predictor reduces to the solution of an integral equation which, however, is a modified form of the Wiener-Hopf equation. A simple method of solution of the equation is developed. This method can also be applied with advantage to the solution of the particular case considered by Wiener. The use of the theory is illustrated by several examples of practical interest." See also 2465 of October.

681.142 2809

Linear Electronic Analog Computer Design.—C. A. Meneley & C. D. Morrill. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 48–63.) Discussion of problems of design and a description of a complete computer with power supplies, housed in a single 6-ft × 19-in. cabinet.

681.142 **2810**
Feedback in Electrical Analogue [impedance] **Chains and Networks.**—P. Grivet & Y. Rocard. (*Rev. sci., Paris*, April/June 1949, Vol. 87, No. 3302, p. 85.) The introduction of feedback in such circuits extends their mathematical application.

681.142 **2811**
An Electronic Integral-Transform Computer and the Practical Solution of Integral Equations.—H. Wallman. (*J. Franklin Inst.*, July 1950, Vol. 250, No. 1, pp. 45–61.) Description of the principle and discussion of the applications of a proposed instrument performing computations in about 0.1 sec and presenting results graphically on a c.r. tube screen.

681.142 : 512.25 **2812**
A Computer for Solving Secular Equations.—J. F. Storm. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 98–106.) A manually operated analogue computer for obtaining the real roots of a 3-by-3 set of secular equations. Modifications required for automatic operation are discussed.

681.142 : 621.314.3† **2813**
Magnetic Amplifier Studies on the Analog Computer.—Harder, Hamilton, Aldrich, Carleton & McClure. (*See* 2731.)

681.142 : 621.389 **2814**
The Photoformer in Anacom Calculations.—H. W. Schultz, J. F. Calvert & E. L. Buell. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 40–47.) Description of a device for generating a wide variety of functions by making a c.r. beam follow the edge of an appropriate mask, with discussion of its use as a nonlinear element in an analogue computer.

517.31/.36 + 517.7] (083.81) **2815**
Integraltafel. Erster Teil: Unbestimmte Integrale. [Book Review]—W. Gröbner & N. Hofreiter. Publishers: Springer-Verlag, Vienna, 1949, 166 pp., $5.40. (*Quart. appl. Math.*, Jan. 1950 Vol. 7, No. 4, p. 474.) "This table of indefinite integrals appears to be more complete than others generally available. There are three sections . . . entitled Rational Integrands . . ., Algebraic Irrational Integrands . . ., and Transcendental Integrands. . . ." Part 2, on definite integrals, is in preparation.

517.512.2 + 517.942.82 **2816**
Fourier Methods. [Book Review]—P. Franklin. Publishers: McGraw-Hill Book Co., New York, 1949, 289 pp., $4.00. (*J. Franklin Inst.*, March 1950, Vol. 249, No. 3, pp. 258–259.) This is a book written for students. "The author broadly interprets Fourier methods as any analysis or synthesis of functions by a linear process applied to sines, cosines, or to complex exponentials . . . [He] has successfully treated the subject of Fourier series and transforms and Laplace transforms in an introductory manner which . . . is adequate for many practical problems."

517.564.2(083.5) **2817**
Tables of Inverse Hyperbolic Functions. [Book Review]—Computation Laboratory, Harvard University. Publishers: Harvard University Press, Cambridge, Mass., 1949, 290 pp., $10.00. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, p. 475.) First and second differences are given, and the functions are tabulated to 9 decimal places.

517.564.3(083.5) **2818**
Tables of Bessel Functions of Fractional Order: Vol. 2. [Book Review]—Computation Laboratory, National Bureau of Standards. Publishers: Columbia University Press, New York, 1949, 365 pp., $10.00. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, p. 475.) $I_\nu(x)$ is tabulated for $\nu = \pm\frac{1}{4}, \pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{3}{4}$, x ranging from 0 to 13 for the negative values of ν and from 0 to 25 for the positive values of ν. $e^{-x}I_\nu(x)$ is tabulated for the same values of ν and for x ranging from 25 to 30 000. Functions are tabulated to 10 decimal places or 10 significant figures. Auxiliary tables facilitate interpolation in the x and ν directions.

517.564.3(083.5) **2819**
Tables of the Bessel Functions of the First Kind of Orders Fifty-Two through Sixty-Three. [Book Review]—Computation Laboratory, Harvard University. Publishers: Harvard University Press, Cambridge, Mass., 1949, 544 pp., $8.00. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, p. 479.) $J_{52}(x)$, $J_{53}(x)$, . . . $J_{63}(x)$ are tabulated to 10 decimal places for values of x ranging from 0 to 100 in steps of 0.01.

517.7 **2820**
Anwendung der elliptischen Funktionen in Physik und Technik. [Book Review]—F. Oberhettinger & W. Magnus. Publishers: Springer, Berlin, 1949, 126 pp., paper cover, 15.60 DM, bound, 18.30 DM. (*Naturwissenschaften*, May 1950, Vol. 37, No. 10, p. 237.) Includes a series of examples of two-dimensional problems in electrostatics and hydromechanics, particularly field calculations, and current flow in channels of rectangular or elliptical cross-section, and Tchebycheff approximations in filter circuit theory.

517.9 **2821**
Partial Differential Equations in Physics. [Book Review]—A. Sommerfeld. Publishers: Academic Press, New York. 1949, 335 pp., $5.80. (*Science*, 21st April 1950, Vol. 111, No. 2886, p. 414.) A translation by E. G. Straus of the sixth volume of Sommerfeld's 'Lectures on Theoretical Physics'. "The last chapter deals with the propagation of radio waves and serves as an illustration of many of the general methods developed in earlier chapters. The chief merit of the book lies in its skilful handling of complex problems, by the use of a minimum of mathematical formalism and a maximum of physical intuition."

518.12 **2822**
Numerical Calculus. [Book Review]—W. E. Milne. Publishers: Princeton University Press, Princeton, N.J., 1949, 393 pp., $3.75. (*Quart. appl. Math.*, Jan. 1950, Vol. 7, No. 4, pp. 478–479.) An elementary presentation, covering approximations, interpolation, finite differences, numerical integration and curve fitting.

MEASUREMENTS AND TEST GEAR

531.761 : 621.387.424† **2823**
A Direct-Reading Device for Measuring Dead Time and Recovery Time of Geiger Counters.—Epprecht. (*See* 2864.)

531.761 : 621.396.9 **2824**
Theoretical Limit to Time-Difference Measurements.—D. Richman. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 203–210.) Theoretical relations are derived between the accuracy with which a signal may be located in time, and the various factors which determine the accuracy. These are (*a*) signal/noise ratio, (*b*) modulation bandwidth, (*c*) signal duration, (*d*) signal frequency. The relations can be used to compute the signal/noise ratio required in systems of prescribed bandwidth, signal duration and accuracy.

621.3.089.6 : 621.396.615.085.41 **2825**
Automatic Calibration of Oscillator Scales.—W. J. Means & T. Slonczewski. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 217–221.) Long

frequency scales used in heterodyne oscillators are calibrated by recording photographically on a strip of motion-picture film the image of a master scale which continuously indicates the instantaneous frequency of the oscillator.

621.317.31/.32 : 621.396.645 2826

Notes on Voltage, Current and Charge Measurements by means of Valve Amplifiers.—W. Böer. (*Ann. Phys., Lpz.*, 1st April 1950, Vol. 7, Nos. 3/4, pp. 193–208.) Two parameters are defined by means of which different types of apparatus can be compared: (*a*) electrical resolving power, which is a measure of the least difference detectable between two currents of 1-sec duration; (*b*) pulse sensitivity. Estimates are made of the disturbing effect of fluctuations originating in batteries, resistors and valves, and noise effects in grounded-grid and free-grid valves are considered. Practical measurement limits for voltage, current and charge are deduced. Some fifty references are given.

621.317.335.3.029.64† : 546.217 2827

The Permittivity of Air at a Wavelength of 10 Centimeters.—W. E. Phillips. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 786–790.) Measurements of the permittivity of air as a function of water-vapour content, at atmospheric pressure and temperature, support the results of previous workers regarding the important effect of atmospheric water-vapour content on the refraction of u.h.f. waves. Measurements on dry air and water vapour at reduced pressure are also recorded. Permittivity is determined by comparing the wavelengths of standing waves in a cylindrical cavity resonator when evacuated to a pressure of 0.01 mm Hg and when containing the air sample under test. The following values for permittivity were obtained: dry air at 759.09 mm Hg and 25.5°C, 1.000554_8; dry air at reduced pressure and 22°C, 1.000393_4 at 555.48 mm Hg and 1.000129_8 at 180.08 mm Hg; moist air, 1.000806 at 752.45 mm Hg, 22°C and 100% humidity, falling to 1.000668 at 756.45 mm Hg, 19°C and 55.7% humidity.

621.317.361 2828

On the Problem of Unequivocal Frequency Measurement by Comparison with Fixed Standard Frequencies.—H. M. Schmidt. (*Z. angew. Phys.*, May 1950, Vol. 2, No. 5, pp. 219–223.) In the method discussed the unknown frequency f_x is heterodyned with (*a*) a suitable harmonic nf_0 of the standard frequency f_0, and (*b*) a second standard-frequency source f_0 with a known phase displacement ϕ. The phase difference of the difference frequencies produced is $\pm n\phi$ according as f_x is higher or lower than nf_0. The number n is given by the ratio of the phase angle for the difference frequencies to that for the fundamentals.

621.317.361 : 621.396.611.21 2829

Crystal Resonators as Frequency Substandards.—F. J. M. Laver. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, p. 252.) Discussion on 1453 of June.

621.317.42 2830

Notes on the Theory and Practice of Magnetic Field-Strength Comparators of the Förster Type.—M. Wurm. (*Z. angew. Phys.*, May 1950, Vol. 2, No. 5, pp. 210–219.) Discussion of the principle of and design improvements for the premagnetized coil-type meter. See also 1470 of 1941 (Förster).

621.317.714.011.6 2831

The Measurement of the Time Constant of a Critically Damped Meter.—S. F. Pearce. (*J. sci. Instrum.*, July 1950, Vol. 27, No. 7, pp. 202–203.) The performance of critically damped meters, such as are required as the final indicating instrument in a receiver used for the measurement of radio interference, is analysed and a simple method is described for measurement of the time constant.

621.317.714.029.62 2832

Electrodynamic Ammeter for Very High Frequencies.—(*Tech. Bull. nat. Bur. Stand.*, July 1950, Vol. 34, No. 7, pp. 103–104.) Short description of an instrument developed at the National Bureau of Standards by M. Solow. It consists essentially of a coaxial transmission line with a copper wire ring about 1 cm in diameter suspended between the inner and outer conductors by a quartz fibre. When current flows in the line, a torque is exerted on the ring and its value is indicated optically. The instrument is calibrated by measurements at both 300 Mc/s and 150 Mc/s.

621.317.729 : 621.396.677 2833

Electrolytic-Tank Measurements for Microwave Metallic Delay-Lens Media.—S. B. Cohn. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 674–680.) The l.f. index of refraction of a delay-lens medium can be calculated from electrolyte-tank measurements on single elements. The proximity between adjacent elements is taken into account. Apparatus and method are described and results are tabulated for three types of delay-lens structure.

621.317.73 2834

Admittance Analyzer.—W. B. Bernard. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 107–109.) The admittance to be measured is connected across a tuned circuit which is then retuned; the change of capacitance to restore resonance gives the unknown susceptance, and the conductance is calculated from $G = (E/e - 1)/R$, where E is the voltage across the retuned circuit and a known resistance R in series with it, and e is the voltage across the retuned circuit alone. Resistance range was found to be 10 Ω to 1 MΩ at frequencies up to 1 Mc/s. At higher frequencies the upper limit is $1/f$ MΩ, where f is in Mc/s. A detailed circuit diagram is given of an instrument which has proved very suitable for aerial measurements on site.

621.317.73.029.62/.63 2835

Discontinuities in Concentric-Line Impedance-Measuring Apparatus.—M. H. Oliver. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, p. 242.) Discussion on 1188 of May.

621.317.73.083.5 2836

Correction Factors for Slotted Measuring Lines at Very High Frequencies.—R. G. Medhurst & S. D. Pool. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 223–230.) Errors due to mechanical irregularities usually have a repeatable effect. A correction factor varying with the position along the line can be derived. The initial determination is lengthy but the result is a multiplying factor that can be tabulated.

621.317.733 : 621.392.43.029.62 2837

A V.H.F. Match Meter.—P. G. Sulzer. (*TV Engng, N.Y.*, July 1950, Vol. 1, No. 7, pp. 4–6.) The meter includes two bridges, and when connected between a low-power r.f. source (10–250 Mc/s) and an aerial or transmission line it indicates the magnitude of the reflection coefficient. One bridge is used for unbalanced systems, the other for balanced systems, the reference impedances being respectively 52 Ω and 300 Ω. The voltmeters reading the input and null voltages consist of crystal diodes with a switched d.c. microammeter. Calibration is effected either by comparison with a voltmeter of known accuracy or by connecting selected h.f. resistors across the test terminals.

621.317.755 : 621.396.645.35 **2838**

D.C. Amplifier Techniques in Oscillography.—M. Maron. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5 pp. 11–16.) Design problems are discussed, and a description is given of a d.c. amplifier, developed as a signal amplifier for a c.r.o. Auxiliary circuits, including timebases, are described. Typical applications of the d.c. amplifier in oscillography are outlined.

621.317.763.029.64 : 621.396.611.4 **2839**

A 10-cm Mechanically Swept Spectrometer.—P. Andrews. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 260–261.) Discussion on 2855 of 1949. An instrument for the same frequency, but with an electronic sweep system, is described by P. Bramham.

621.317.79 : 621.3.018.78† **2840**

An Intermodulation Analyzer for Audio Systems.—R. S. Fine. (*Audio Engng, N.Y.*, July 1950, Vol. 34, No. 7, pp. 11–13..43.) A description, with detailed circuit diagram, of an instrument for measurement of intermodulation distortion. It is particularly useful for assessing the quality of amplifiers and gramophone pickups.

621.317.79 : 621.396.67 **2841**

The Electronically Driven Ripple-Tank as an Aid to Phase-Front Visualization.—A. H. Schooley. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 303–314.) A detailed account of equipment noted in 1979 of August, with numerous photographs of typical patterns.

621.317.799† : 621.397.5 **2842**

Inexpensive Picture Generator.—J. R. Popkin-Clurman. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 102–106.) Light from the raster of a television receiver is transmitted through a transparent test pattern and picked up by a multiplier photocell whose output is amplified and corrected for c.r. tube phosphor decay. Video phase-splitting allows positive or negative transparencies to be used. Blanking pulses are added in a mixer whose output is clipped and provides the composite video test-pattern signals, which are suitable for feeding the video section of a television receiver if synchronizing arrangements are available. A separate sweep circuit for providing raster and blanking pulses is described, with detailed diagrams.

621.396.662.029.64 **2843**

Microwave Attenuators for Powers up to 1 000 Watts.—H. J. Carlin & E. N. Torgow. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 777–780.) A broad-band attenuator is described which reduces input powers by a fixed ratio to a low level measurable by a bolometer. The device is a combination of three units: (*a*) a coaxial-line attenuator whose axial conductor penetrates transversely into the main power-carrying coaxial line; this operates on a capacitance-divider principle; (*b*) a metallized-glass coaxial attenuator (348 of 1949) for matching (*a*) to the test line and for equalizing its attenuation with respect to frequency; and (*c*) a tapered-dielectric coaxial load in the main line. Two sets of equipment cover the band 1–10 kMc/s.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9 : 539.32 **2844**

Ultrasonic Measurement Techniques Applicable to Small Solid Specimens.—H. J. McSkimin. (*J. acoust. Soc. Amer.*, July 1950, Vol. 22, No. 4, pp. 413–418.) A description of techniques for the measurement of velocity of propagation and attenuation by phase-comparison methods, using either longitudinal or transverse waves. One is a resonance technique, using a pulse input and displaying the addition of in-phase multiple reflections from within the specimen. A more precise technique, using c.w. oscillations gated by d.c. pulses, depends on the cancellation of any order of multiple reflection by a delayed signal derived from the input. The phase shifts at reflecting interfaces may be independently determined. Derivations of the principal formulae used are given and the precautions necessary in the use of polystyrene seals and fused-silica supporting rods are described.

534.321.9 : 620.179.1 **2845**

Ultrasonics and their Use for Non-destructive Testing of Materials.—N. G. Neuweiler. (*Microtecnic, Lausanne*, Jan./Feb. & March/April 1950, Vol. 4, Nos. 1 & 2, pp. 37–44 & 60–66.) Illustrated description of the principles, operation and applications of a flaw detector.

534.321.9 : 621.398 : 535.88 **2846**

Supersonic Control of a Lantern-Slide Projector.—S. G. Lutz & G. Rand. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 477–481.) Equipment is described which enables a lecturer to operate the slide-changing device on a projector by means of a small ultrasonic whistle concealed in a pocket.

535.214.4 : 535.61-15 **2847**

The Diaphragm Radiometer.—P. E. Weber. (*Optik*, March 1950, Vol. 6, No. 3, pp. 152–161.) A description is given of an infrared-radiation receiver whose operation is based on the kinetic effect in gases. Thermally modulated radiation is incident on a diaphragm forming one closure of a gas chamber, and the resulting oscillations of the diaphragm produce capacitance variations in one arm of a tuned h.f. bridge. Using a modulation frequency of 100 c/s, radiated power as low as 1.2×10^{-7} W/cm² can be measured, the h.f. voltage delivered being then 10^{-5} V. Greater sensitivity can be attained by exposing the diaphragm to sound of frequency which is a multiple of the modulation frequency.

621.3.087.6 : 534.232 : 534.321.9 **2848**

Application of Supersonic Energy to High Speed Electronic Recording.—H. J. Dana & J. L. Van Meter. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 473–476.) See 1561 of July.

621.316.72 : 537.533 **2849**

Automatic Regulation of Thermionic Emission.—W. Steckelmacher & S. van der Meer. (*J. sci. Instrum.*, July 1950, Vol. 27, No. 7, pp. 189–191.) Continuous control for large changes of emission conditions, such as occur in continuously pumped X-ray tubes or ionization vacuum gauges, is effected by using the change of emission current to develop a correction voltage which is applied, after amplification, to a pair of valves whose anode currents govern the heating current for the electron source. A phase-shift network in the feedback chain prevents the oscillations which sometimes occur when controlling massive filaments.

621.317.083.7 **2850**

Matrix Telemetering System.—N. R. Best. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 82–85.) 30 p.t.m. channels are superimposed on a 1025-Mc/s carrier with peak power of 4 kW. A 10-kc/s oscillator in the transmitting (airborne) unit operates a 32-state counter defining 100-μs time intervals for each channel, and transmits a synchronizing pulse to an oscillator/counter unit in the receiver. The signals in the various channels are displayed as time-positioned dots on a blacked-out c.r. tube trace and are recorded on continuously moving film.

621.317.39 **2851**

Some Electrical Methods of Measuring Mechanical Quantities.—F. J. Woodcock. (*Proc. Instn elect. Engrs*, Part I, July 1950, Vol. 97, No. 106, pp. 136–149. Discussion, pp. 149–154.) Full paper, including 87 references. Summary noted in 2306 of October.

621.317.39 : 531.717.1 **2852**
Thickness Gage for Moving Material.—S. V. Hart & I. W. Rozian. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 83–87.) An instrument which records the thickness of any non-magnetic material within the range 0.000 1–1.0 in. and detects deviations of <1 microinch from a standard. The material is inserted between primary and secondary of a split transformer, the output of which is balanced in a bridge circuit against that of a similar unit holding a standard slat. Magnetic materials can be handled by using a pair of differential transformers.

621.317.755 : 621.317.39 **2853**
Multiple-Channel Cathode-Ray Instrumentation of Non-electrical Quantities.—J. N. Van Scoyoc & G. F. Warnke. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 88–97.) Descripion of a 24-channel mobile unit using single-beam c.r. tubes whose screen patterns are photographed on continuously moving film.

621.365.55† **2854**
Heating by Means of High-Frequency Fields: Part 2—Capacitive Heating.—M. Stel & E. C. Witsenburg. (*Philips tech. Rev.*, Feb. 1950, Vol. 11, No. 8, pp. 232–240.) A formula is derived for the amount of heat generated in unit time in a homogeneous dielectric. Selective heating can be produced when two different dielectrics (e.g. wood and glue) are associated. Industrial applications are discussed. Part 1: 1995 of August.

621.384.6 **2855**
Principle of an Ion Source for Intense Beams.—C. Cassignol. (*Nature, Lond.*, 5th Aug. 1950, Vol. 166, No. 4214, pp. 233–234.) The principle used is similar to that of Alfvén's trochotron (1205 of 1948), but field modifications are introduced for concentrating positive ions instead of electrons. The extracting electrode is a short cylinder coaxial with the accelerator tube, and is provided with a circumferential slit and maintained negative. An inhomogeneous magnetic field assists in focusing the ions on the slit. Observations on this and on a linear type of source support the theoretical assumptions.

621.384.611.1† : 615.849 **2856**
Experiments with a 6-MeV Betatron.—K. Gund & W. Paul. (*Nucleonics*, July 1950, Vol. 7, No. 1, pp. 36–45.) An account is given of the development and construction of a betatron in the electromedical laboratory of Siemens-Reiniger-Werke, Erlangen, Germany. Preliminary physical and biological experiments with the equipment are described, including cancer treatment in human beings.

621.384.611.2† **2857**
Extraction of the Electron Beam from a 30-MeV Synchrotron.—J. D. Lawson, H. E. Walford & J. H. Aram. (*Nature, Lond.*, 5th Aug. 1950, Vol. 166, No. 4214, pp. 234–235.) Electrons of energy up to 20 MeV have been extracted from the Harwell synchrotron by use of a small shunt coil carrying a pulsed current of up to 6 000-A peak, timed so that the current is a maximum when the electrons enter the shunt. No difficulty is anticipated in applying the method to 30-MeV electrons.

621.387.4† **2858**
Scintillation Type Alpha-Particle Detector.—A. S. Goldin, E. R. Rohrer & R. L. Macklin. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 554–557.)

621.387.4† **2859**
The Theory and Properties of Low-Voltage Radiation Counters.—J. A. Simpson, Jr. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 558–568.)

621.387.4† : 548.0 **2860**
Crystal Counters.—R. Hofstadter. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 726–740.) The author's previous survey of this subject (2506 and 2507 of 1949) is extended to cover later developments such as counters using S or Ge crystals.

621.387.424† **2861**
Geiger Counter for Civilian-Defense Use.—H. D. LeVine, H. J. DiGiovanni & M. R. Coe. (*Nucleonics*, June 1950, Vol. 6, No. 6, pp. 56–59.) Description of a simple and relatively cheap counter. The necessary h.v. supply is obtained from a vibrator operated by a 3-V flashlight battery.

621.387.424† **2862**
A Method of Measuring Spurious Counts in Geiger-Müller Counters.—D. Willard & C. G. Montgomery. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 520–521.)

621.387.424† **2863**
The Velocity of Propagation of the Discharge in Geiger-Müller Counters.—H. Saltzmann & C. G. Montgomery. (*Rev. sci. Instrum.*, June 1950, Vol. 21, No. 6, pp. 548–549.)

621.387.424† : 531.761 **2864**
A Direct-Reading Device for Measuring Dead Time and Recovery Time of Geiger Counters.—G. W. Epprecht. (*Helv. phys. Acta*, 20th April 1950, Vol. 23, No. 3, pp. 291–298. In German.) A RC discharge circuit is used to measure the shortest time interval between successive pulses. Some results obtained with the apparatus are shown.

621.396.9 : 526.9 **2865**
Electronic Contour Mapping.—R. C. Raymond. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 211–216.) A stabilized aircraft with a pencil-beam radar set makes several thousand observations per second on the terrain over which it flies. The data are used to print a contour map. Calculations indicate that with efficient equipment contour maps covering 1 000 square miles could be printed in under an hour.

621.398 **2866**
The Landis & Gyr Audio-Frequency Telecontrol System.—(*Bull. tech. Suisse romande*, 3rd & 17th June 1950, Vol. 76, Nos. 11 & 12, pp. 146–148 & 162–164.) Description of a system particularly suitable for use on power lines and operating on a frequency of 475 or 725 c/s. A shorter account was noted in 1744 of July.

681.142 : 621.385.832 **2867**
Coordinate Tubes for Use with Electrostatic Storage Tubes.—R. S. Julian & A. L. Samuel. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 107–122.) The system uses two master tubes which separately control the horizontal and vertical displacements of the electron beams in a bank of slave tubes. Control is effected by servo amplifiers, which locate the proper memory positions from their digital address codes in terms of the mechanical positions of target plates contained within the master tubes. Two different types of tube are described, one for sequential operation, the other for a parallel address system.

621.38 **2868**
An Introduction to Electronics. [Book Review]—J. Yarwood. Publishers: Chapman & Hall, London, 329 pp., 28s. (*Electrician*, 18th Aug. 1950, Vol. 145, No. 3766, p. 425.) ". . . for those physics and engineering students . . . who need an account of the subject at an intermediate standard . . . and also as a guide to lecturers."

621.38 **2869**

Industrial Electronics and Control. [Book Review]—R. G. Kloeffler. Publishers: Chapman & Hall, London, 1949, 478 pp., 33s. (*Beama J.*, June 1950, Vol. 57, No. 156, pp. 181–182.) " . . . written not only for the electrical engineer, but also for students of chemical and mechanical engineering who desire a knowledge of industrial electronic applications. The text is descriptive rather than mathematical and the calculus is not employed."

621.38 **2870**

Electronics, Principles and Applications. [Book Review]—R. R. Wright. Publishers: Ronald Press, New York, 1950, 387 pp., $5.50. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 136, 138.) " A basic course in electronics for nonelectrical engineering students."

PROPAGATION OF WAVES

538.566 **2871**

On the Existence of a Surface Wave in Dipole Radiation over a Plane Earth.—T. Kahan & G. Eckart. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 807–812.) See 2892 of 1949.

621.396.11 **2872**

Ground-Wave Propagation over an Inhomogeneous Smooth Earth. Part 2 — Experimental Evidence and Practical Implications.—G. Millington & G. A. Isted. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 209–217. Discussion, pp. 217–222.) Theoretical considerations of part 1 (1758 of 1949) are reviewed, which predict an increase in field strength on crossing a land/sea boundary. Further experimental results are discussed and found in agreement with theory, although not conclusive. The best conditions for obtaining such an increase in practice are analysed: a wavelength of 4 m is suitable where the distances involved are small, while 100-m wavelength is preferable where attenuation with distance is much greater over land than over sea. Measurements on these wavelengths of field strength along land/sea paths are described; the results show the predicted increase and fit the calculated curves as well as experimental conditions would allow. Some practical implications of the results are discussed, in particular with regard to the siting of transmitters near water, the po sibilities of common-frequency working under ground-wave conditions, and the ground-wave coverage of medium- and long-wave navigation aids.

621.396.11 **2873**

The Beacon Technique as Applied to Oblique-Incidence Ionosphere Propagation.—J. T. de Bettencourt & H. Klemperer. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 791–792.) Experiments have been made to identify the propagation paths of pulse signals. An interrogator-responder near Boston transmitted pulses of width 100 μs and repetition rate 20/sec to a transponder in the Caribbean area 2 615 km away. Horizontal rhombic aerials, and transmitters giving 20 kW peak power at 16.08 Mc/s were used at both stations. Photographic records were obtained showing pulse amplitudes against go-and-return time, and go-and-return time against time of day. One-way transmission time is simply calculated from the observations and the path travelled is then identified by means of available charts.

621.396.11 : [551.51 : 535.326 **2874**

Determination of Modified Index-of-Refraction over the Gulf of Mexico from Radio Data.—Straiton & LaGrone. (*See* 2773.)

621.396.11 : 551.510.535 **2875**

Ray Paths of Radio Waves in the Ionosphere.—H. Poeverlein. (*Z. angew. Phys.*, April 1950, Vol. 2, No. 4, pp. 152–160.) Graphs are given of the paths of the ordinary and extraordinary rays for a signal of wavelength 80 m both for vertical and oblique incidence on a linearly ionized and on a parabolically ionized layer at a height of 200–300 km. At vertical incidence the ordinary ray is deflected northwards, the extraordinary ray southwards. For small angles of incidence, ray paths are pointed at their apex and the height of reflection is constant. The ray theory may give inaccurate results near the point of reflection. See also 718 of March.

621.396.11 + 621.396.81].029.64 **2876**

Progression of Microwave Radio Scintillations [fluctuations] **at Wind Speed on an Overwater Path.**—A. W. Straiton & H. W. Smith. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 825–826.) 3.2-cm radio signals transmitted over a 26.5-mile overwater path were recorded by two receivers (*a*) with a horizontal separation of 65 ft normal to the radio path, (*b*) with a vertical separation of 10 ft. Signal fluctuations progressed at about wind speed between the horizontally separated receivers; a downward but less definite progression was observed for the case of vertical separation. See also 3241 of 1949 and 1483 of June (Straiton et al.).

621.396.81 **2877**

Propagation of 10-Mc/s Waves over Ranges of 500–1 300 km.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, Dec. 1949, Vol. 5, No. 18, pp. 2–8.) Data for 10 Mc/s as optimum working frequency are taken from the diagram previously discussed (2614 of October); these are rearranged in tabular form and considered in detail. Experimental results for reception during November 1949 of Swiss transmissions on 11.865 and 9.665 Mc/s are presented.

621.396.81 **2878**

Propagation of 12-Mc/s and 15-Mc/s Waves over Ranges of 500–2 400 km.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, March 1950, Vol. 5, No. 19, pp. 3–14.) Tabulation and discussion of data obtained from the diagram previously given (2614 of October). Experimental results for 15.17-Mc/s transmissions from Oslo during the period October 1949–February 1950 are presented. Agreement with prediction is very satisfactory.

621.396.812.029.64 **2879**

Microwave Attenuation Statistics Estimated from Rainfall and Water-Vapor Statistics.—H. E. Bussey. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 781–785.) Curves are derived giving predictions of the number of hours per year during which the overall attenuation of a 50-km path and a 1-km path at Washington will exceed various values, for frequencies above 1 kMc/s. The results are obtained by analysing available meteorological data, theoretically derived factors (515 of 1947) being used for converting into radio attenuation values. Extension of the method to other parts of the U.S.A. is discussed.

RECEPTION

621.396.621 : 621.396.619.13 **2880**

Detector Circuits for Frequency-Modulation Receivers.—C. J. Boers. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 296–300.) The disturbing effects of undesired a.m. are examined, and the action of limiters is explained. A subsequent paper is to deal with particular types of discriminator circuit.

621.396.621 : 621.396.619.13 : 621.396.931 2881
Mobile F.M. Broadcast Reception.—R. C. Barritt. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 74–78.) A report of results obtained with various types of aerial and circuit for f.m. broadcast reception in moving vehicles. Increased sensitivity and improved limiting circuits appear to be necessary.

621.396.621 : 621.396.822 2882
Analysis of the Signal/Noise Ratio in U.H.F. Receivers.—E. W. Herold. (*Rev. Telecomunicación, Madrid*, March 1950, Vol. 5, No. 19, pp. 47–60.) A translation from 'Radio at Ultra-High Frequencies', Vol. 2, published by R.C.A. Review. See 2336 of 1942.

621.396.622.015.7† : 621.396.822 2883
Detection of a Pulse Superimposed on Fluctuation Noise.—B. M. Dwork. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 771–774.) The frequency response of a linear device giving the maximum value for the ratio between peak amplitude of the signal and the r.m.s. value of the noise at the output is determined analytically for a known pulse superimposed on fluctuation noise with a known spectrum. The result is applied to the case in which the fluctuation noise has a uniform frequency distribution; the optimum network is then physically realizable if the pulse differs from zero for only a finite interval of time. The noise-suppression efficiency of a conventional RC circuit is computed for rectangular and for exponentially decaying pulses.

621.396.662 : [621.396.619.13 + 621.397.62 2884
A New TV-FM Tuner.—C. W. Lytle. (*Tele-Tech*, June 1950, Vol. 9, No. 6, pp. 21–23, 86.) Detailed description of a continuously variable inductive tuner in which tuning is effected by a rotor carrying copper vanes serving as short-circuited turns when brought near the inductor coils. Two sets of coils and vanes are used, one set for the high and the other for the low U.S. television band.

621.396.662.085.3 2885
Hypersensitive Resonance Indicator.—R. L. Ives. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 118..154.) Application of Foster-Seeley and Doppelganger discriminators to resonance indication for weak and fading signals is discussed. Circuit details are given of a complete unit that can be added to any standard superheterodyne receiver.

621.396.81 2886
Propagation of 10-Mc/s Waves over Ranges of 500–1 300 km.—Sacasa. (*See* 2877.)

621.396.81 2887
Propagation of 12-Mc/s and 15-Mc/s Waves over Ranges of 500–2 400 Km.—Sacasa. (*See* 2878.)

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 2888
Statistical Theory of Communication.—J. B. Wiesner. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 334–341.) Difficulties in the analysis of communication systems are pointed out and the statistical methods developed by Wiener and Shannon are outlined. The use of statistical concepts to provide a new kind of filtering in the time domain is described. See also 2465 of October (Wiener) and 1649 of 1949 (Shannon).

621.394/.395].44 2889
Carrier-Frequency Technique in Germany, 1935–1945.—G. Hässler. (*Elektrotechnik, Berlin*, June 1948, Vol. 2, No. 6, pp. 161–168.)

621.395 : 621.318.572 2890
Voice-Switched Intercom.—R. H. Baer. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 79–81.) Instead of a talk/listen switch this system uses a 4-terminal repeater with a flip-flop circuit that unblocks gated amplifiers alternately 30 times per sec. Incoming speech signals stop the flip-flop and keep open the desired channel without clipping syllables.

621.395.44 2891
A Twelve-Channel Carrier Telephone System for Use on Cables.—T. B. D. Terroni. (*Strowger J.*, July 1950, Vol. 7, No. 2, pp. 62–81.) The principal factors which determine the design of 12-channel systems are outlined and the single-modulation method using crystal filters and the group-modulation method using inductor-capacitor filters are discussed. The special features of a group-modulation system are described and performance details are given.

621.396.1 : 519.242 2892
An Extension of Wiener's Theory of Prediction.—Zadeh & Ragazzini. (*See* 2808.)

621.396.3 + 621.396.5] (43) 2893
Survey of the [German] **Overseas Radio Service.**—W. Kronjäger. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 265–271.) The different telephony and telegraphy systems are indicated and the organization of the corresponding services is described. Traffic figures are given for 1949.

621.396.61/.62 : 621.396.931 2894
Mobile Radio Unit.—D. Samuelson. (*FM-TV*, July 1950, Vol. 10, No. 7, pp. 18–19, 33.) Design details, with illustrations, of a small transmitter-receiver capable of operating in a single channel without picking up adjacent-channel signals or causing interference with other systems. Transmitter power output is 12 W on 25–50 Mc/s and 10 W on 151–174 Mc/s.

621.396.65 : 621.396.619.11/.13 2895
Modulation Conversion in a Wave Guide.—P. S. Rogell. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, pp. 629–631.) Theory and design equations are presented for the conversion of a narrow-band f.m. microwave signal into an almost pure a.m. signal within a waveguide of given dimensions. Frequency relations and guide dimensions are arranged so that the f.m. sidebands are shifted with respect to the carrier until they become a.m. sidebands at the guide output. A complex intelligence signal may be transmitted with negligible distortion if it is used for a.m. of an intermediate carrier which is then applied for f.m. of the microwave carrier.

621.396.65.029.63/.64 : 621.397.5 2896
2000- and 7000-Mc/s TV Microwave Relays.—E. D. Hilburn. (*TV Engng, N.Y.*, March–June 1950, Vol. 1, Nos. 3–6, pp. 8–11; 18–21; 16, 35; 26.) Relay equipment for transmission of outside programmes to station WMAL-TV is described. The 7-kMc/s equipment is portable and serves for local transmissions over line-of-sight paths up to about 20 miles, while the more powerful 2-kMc/s equipment is used between fixed stations and is effective at much greater ranges. Installation and operation procedures are discussed.

621.396.7 + 621.397.7] (73)(058.7)
621.396.6 : 65(73)(058.7) 2897
Tele-Tech TV-FM-AM Station & Studio Equipment Directory, 1951.—(*Tele-Tech*, June 1950, Vol. 9, No. 6, pp. 37–39..84.) A very comprehensive list of U.S. stations of all types, and of manufacturers of equipment directly or indirectly connected with radio and television.

621.396.712.029.6 : 621.396.619.13(43) **2898**

The Technique of U.S.W. Broadcasting.—L. Rohde. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 286–292.) Germany is the first European country to introduce u.s.w. f.m. broadcasting. American practice has been studied and full advantage is taken of the possibilities of f.m., viz., high quality, economic use of frequency channels, and reduced interference. Radio links are preferred to cable for all but very short distances. Tetrodes are used for power up to 1 kW, triodes for higher power. The advantages of small automatically controlled transmitters are pointed out, and filter arrangements are described which permit two programmes to be radiated from the same aerial.

621.396.712(43) **2899**

Basis of U.S.W. Plan for the U.S. Zone [of Germany].—F. Gutzmann. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 276–278.)

621.396.712(43) **2900**

The U.S.W. Network of the North-West Germany Broadcasting System.—W. Nestel. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 282–285.)

621.396.712(43) **2901**

The U.S.W. Network of the South-West [Germany] **Broadcasting System.**—Knöpfel. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 279–281.)

SUBSIDIARY APPARATUS

621-526 **2902**

A Note on the Error Coefficients of a Servo Mechanism.—J. L. Bower. (*J. appl. Phys.*, July 1950, Vol. 21, No. 7, p. 723.)

621.316.722.1 : 621.316.261 **2903**

A Preservation Rectifier with Electronically Stabilized Charging Voltage.—E. Cassee. (*Philips tech. Rev.*, March 1950, Vol. 11, No. 9, pp. 253–259.) The difference between the charging voltage of an accumulator battery and a constant reference voltage is amplified and used to control the d.c. bias of a transductor in series with the secondary of the transformer feeding the rectifier in the charging equipment. The charging voltage is thereby maintained constant to within 0.5% for mains frequency deviations of 4% or voltage variations of 10%.

621.355.2 + 621.355.8 **2904**

Military Storage Batteries.—H. Mandel. (*Elect. Engng, N.Y.*, July 1950, Vol. 69, No. 7, pp. 619–621.) Recent developments are described, particularly as regards lead/acid batteries and alkaline batteries with sintered Ni-Cd plates, and obtaining satisfactory performance at very low temperatures.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 : 621.317.799† **2905**

Inexpensive Picture Generator.—Popkin-Clurman. (See 2842.)

621.397.5 : 621.396.65 **2906**

Televising the Boat Race — 1950: The Engineering Problems.—T. H. Bridgewater, R. H. Hammans & S. N. Watson. (*B.B.C. Quart.*, Summer 1950, Vol. 5, No. 2, pp. 107–115.) A detailed account of the system of radio and cable links connecting the equipment on the launch following the race with the Alexandra Palace transmitter.

621.397.5 : 621.396.65.029.63/.64 **2907**

2000- and 7000-Mc/s TV Microwave Relays.—Hilburn. (See 2896.)

621.397.5(43) **2908**

The Development of Television by the German Post Office.—H. Pressler. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 302–308.) A historical review, with extensive bibliography.

621.397.5(43) **2909**

Development of Television Technique by the Fernseh G.m.b.H. 1939-1945.—H. Bähring, W. Dillenburger, R.v.Felgel-Farnholz, T. Mulert, F. Rudert & H. Strübig. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 308–316.) A review of the most important advances made during the period when normal publication was suspended.

621.397.6 **2910**

A Film-Dubbing and Review Suite for Television Film Production.—N. F. Chapman. (*B.B.C. Quart.*, Summer 1950, Vol. 5, No. 2, pp. 116–128.) Detailed account of facilities noted in 1539 of June.

621.397.61 : 621.396.619.2 **2911**

An Analysis of Single and Double Sideband Transmission.—G. E. Hamilton & R. G. Artman. (*TV Engng, N.Y.*, July 1950, Vol. 1, No. 7, pp. 22–24.) A mathematical analysis of d.s.b. and s.s.b. transmission. The attenuation may vary between 6 db and 7 db according to the modulation factor. In d.s.b. operation the detector need respond only to the modulating frequencies, but for s.s.b. transmission a detector with infinite bandwidth is needed to give faithful reproduction.

621.397.61 : 621.396.645.018.424 : 621.3.088.7 **2912**

The Compensation for Phase Errors in Wide-Band Video Amplifiers.—Brain. (See 2752.)

621.397.61 : 621.396.673 **2913**

1 057-Foot FM-TV Antenna.—(See 2722.)

621.397.611.2 **2914**

A New Image Orthicon.—R. B. Janes, R. E. Johnson & R. R. Handel. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 140–147.) The spectral sensitivity characteristics of image orthicons are discussed and the properties of a new panchromatic high-sensitivity photosurface used in the R.C.A. Type-5820 orthicon are described. This makes television possible under poor lighting conditions. Production problems for the Type-5820 orthicon are briefly discussed. See also 2361 of October.

621.397.621.2 : 621.385.832 **2915**

The Design and Fabrication of TV Picture Tubes.—Hoagland. (See 2943.)

621.397.62 : 621.314.2 **2916**

A Universal-Application Cathode-Ray Sweep Transformer with Ceramic Iron Core.—C. E. Torsch. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 130–139.) The high-μ, high-Q ceramic/iron cores now available enable c.r. tube sweep transformers of high efficiency to be produced. The design of a unit which can be used with any direct-view picture tube is described and typical circuits for use with the unit are given.

621.397.62 + 621.396.619.13] : 621.396.662 **2917**

A New TV-FM Tuner.—Lytle. (See 2884.)

621.397.62 : 621.396.662 **2918**

Two New Television Tuners.—M. F. Melvin. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 148–160.) Description and performance details of 3-section and 4-section 'spiral' inductuners which are both cheaper and mechanically simpler than previous solenoid designs.

621.397.62 : 621.396.67 **2919**
An Automatic Built-In Antenna for Television Receivers.—K. Schlesinger. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 292–302.) See 819 of April.

621.397.82 **2920**
Interference Patterns in Television Pictures.—(*J. Televis. Soc.*, Jan./March 1950, Vol. 6, No. 1, pp. 22–23.) Photographs taken by G.P.O. officials are shown, illustrating the disturbing effects produced on television pictures by different types of interference.

621.397.5 **2921**
Television Simplified. [Book Review]—M. S. Kiver. Publishers: D. Van Nostrand Co., New York, 3rd edn 1950, 556 pp., $6.50. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, p. 832.) The basic principles of television are explained for the nonmathematical reader. The book deals almost entirely with receivers, and includes a chapter on servicing and installation. New chapters cover intercarrier television sound and colour television.

TRANSMISSION

621.396.61 **2922**
Lorenz 10-kW U.S.W. Transmitter for F.M. Broadcasting.—G. Brauer. (*Fernmeldetech. Z.*, Aug. 1950, Vol. 3, No. 8, pp. 292–296.) Two of these transmitters have been in operation in Germany since early 1950. An explanation is given of the differences of design called for at frequencies of 87.5–100 Mc/s as compared with transmitters for lower frequencies. The grounded-grid triode power-amplifier valve is described in some detail.

621.396.61 : 621.396.619.13 **2923**
3000 Watts for State Police.—W. Fingerle, Jr. (*FM-TV*, July 1950, Vol. 10, No. 7, pp. 11–12, 33.) Illustrated description of a f.m. transmitter operating in the range 40–50 Mc/s. Tests indicate that such transmitters give effective state coverage.

621.396.611.21.029.63 : 621.396.931 **2924**
Crystal Control for Citizens Band.—I. Gottlieb & I. R. Mednick. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 96–98.) Stabilized operation of a war-surplus BC-645 unit on 460 Mc/s is effected by the addition of a 2-valve exciter unit and by use of the Type 316-A valve in the BC-645 as a frequency doubler. Frequencies in the band 460–470 Mc/s are derived from crystals with fundamental frequencies between 8.52 Mc/s and 8.70 Mc/s. See also 517 of 1949 (Samuelson).

621.396.619.13 **2925**
A Versatile Crystal-Controlled Source of Angle Modulation.—J. F. Gordon. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 512–518.) A device is described which produces large deviations and increased modulation sensitivity without loss of transmitter stability; the relatively small number of valves used results in a simple circuit. An experimental unit and details of its performance are also described.

VALVES AND THERMIONICS

621.314.632 **2926**
G.E.C. Germanium Crystal Rectifiers.—(*Instrum. Practice*, June 1950, Vol. 4, No. 8, pp. 427–428.) Characteristics of four available types are tabulated. All are sealed in glass envelopes and have the metal point cemented to the Ge crystal.

621.314.671 **2927**
A New Rectifier Tube for Extremely High Power and Voltage Levels.—T. H. Rogers. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 482–492.) The factors which control the design of high-vacuum rectifiers and limit their use for high-current applications are discussed, and new design principles are outlined which have been evolved to raise these limits sufficiently to meet the requirements of devices using high-current high-voltage supplies. New valves described can handle a peak current of 10 A and an inverse voltage of 110 kV.

621.383 **2928**
Design Features and Some Applications of a New Photocell.—J. H. Crow & V. C. Rideout. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 506–511.) See 1288 of May.

621.383.27† **2929**
Photocells with Secondary-Electron Multipliers.—N. Schaetti. (*Helv. phys. Acta*, 3rd Feb. 1950, Vol. 23, Nos. 1/2, pp. 108–120. In German.) The production and properties of various photocathodes and secondary-emission layers are discussed. An 18-stage multiplier with an Sb-Cs photocathode and Ag-Mg coating for the multiplier plates has a sensitivity of 40–60 μA/lumen and a total amplification of 10^{10}–10^{12} with a stage voltage of 200 V.

621.383.4 **2930**
The Phototransistor.—J. N. Shive. (*Bell Lab. Rec.*, Aug. 1950, Vol. 28, No. 8, pp. 337–342.) The essential element in the device is a wafer of Ge with a spherical dimple ground in one face so that at the centre, where a phosphor-bronze wire of 0.005 in. diameter makes contact, the thickness is about 0.003 in. Operation of the cell depends on the decrease in resistance of the Ge element between its containing ring and the collector wire on exposure to light. For a particular cell operated in series with a 20 kΩ resistor, the calculated current output was about 0.07 mA per millilumen. With fluctuating light the response curve is substantially flat up to 200 kc/s, the highest frequency so far used. The sensitivity is greatest in the spectral region 1.0–1.5 μ. An outline of the theory of the mechanism of photoconductivity is given.

621.385 : 621.396.621 **2931**
The 6BN6 Gated Beam Tube.—R. Adler. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 408–416.) See 1292 of May.

621.385 : 621.396.621 **2932**
The 6BN6 Gated Beam Tube.—A. P. Haase. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 417–426.) See 1292 of May (Adler).

621.385-712 **2933**
New Type of Radiator for High-Power Transmitting Tubes.—O. Schärli. (*Brown Boveri Rev.*, Sept. 1949, Vol. 36, No. 9, pp. 311–315.) A radiator system is described which uses transverse fins consisting of sheet-metal rings separated by spacers and riveted together. Applied to the Type-ATL35-1 valve it can handle an anode dissipation of 46 kW.

621.385.032.216 **2934**
Conduction Processes in the Oxide-Coated Cathode.—R. Loosjes & H. J. Vink. (*Philips tech. Rev.*, March 1950, Vol. 11, No. 9, pp. 271–278.) Preparation and activation of oxide-coated cathodes is described. Electrons emitted by the coating are replaced by conduction from the metal core and it is suggested that this conduction is due to two processes acting together, electronic conduction of the grains at temperatures $<800°$K and conduction through the electron gas in the pores between the grains at higher temperatures. The lagging of conduction behind emission at temperatures $>1\,000°$K is explained by the effect of the space charge upon the electron density and upon the field in the pores.

621.385.032.24 : 537.58 **2935**

Experiments on Grid Emission.—A. A. Rusterholz. (*Brown Boveri Rev.*, Sept. 1949, Vol. 36, No. 9, pp. 300–304.) Methods are discussed which result in reduced primary grid emission, particularly in transmitting valves with thoriated-tungsten cathodes. Carburization of the Ta grid wires at a high temperature in CO or CO_2 has been suggested as a means of preventing an increase of grid emission due to activation by Th evaporated from the filament. Experiments with grids carburized in an atmosphere of H_2 saturated with benzene vapour showed, however, that no improvement was effected. Investigations of carburization in CO or CO_2 are being continued.

621.385.032.442 : 621.3.025.4 **2936**

Hum Characteristics of A.C.-Heated Transmitting Tubes.—E. Atti. (*Brown Boveri Rev.*, Sept. 1949, Vol. 36, No. 9, pp. 305–311.) The hum level in transmitting valves with directly heated tungsten filaments can be reduced very considerably by use of specially designed cathode systems and 3-phase or 6-phase heater supplies. Careful balancing of the phases and accurate alignment of the grid and the filament wires is essential. In the new 200-kW broadcasting transmitter at Beromünster, the hum level in the a.f. output stage, which consists of two class-B triodes with 3-phase heating, is –57 db without feedback, which lowers it further to –61 db.

621.385.2 **2937**

The High-Frequency Response of Cylindrical Diodes.—E. H. Gamble. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 387–402.) The problem is considered as a quasistationary one and equations are derived for an ideal diode in which the electron paths are normal to the emitting surface. The relations thus obtained are applied to space-charge-limited and temperature-limited operation. Numerical solutions of the nonlinear integral equations were obtained from analogue-computer solutions for the corresponding differential equations. The results indicate the essential correctness of the treatment of the problem.

621.385.3 : 621.315.592†] : 621.396.822 **2938**

Low-Frequency Noise in Transistors.—H. T. Mooers. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 17–22.) The a.f. spectra of both emitter and collector noise in six type-A transistors were investigated. Noise output varies with frequency, but not inversely. Emitter noise does not contribute significantly to the noise output, and this output is independent of d.c. voltage, current and resistance. Good correlation is found between noise power and forward transfer impedance. The noise output may be predicted fairly accurately at any given operating point, for any bandwidth up to 15 kc/s. The lowest input signal strength required to produce a given output signal/noise ratio can also be estimated.

621.385.4 : 621.319.43 **2939**

Variable-Capacitance Tube for Frequency Control.—R. W. Slinkman. (*Sylvania Technologist*, July 1950, Vol. 3, No. 3, pp. 18–20.) Frequency stabilization of v.h.f. and u.h.f. oscillators in f.m. receivers is effected by means of a tetrode with a bimetallic anode. The curvature of the anode varies with changes of frequency and affects the value of a capacitor within the valve which forms part of the oscillator tank circuit. External series capacitors enable the effective control bandwidth to be adjusted. Tests in a commercial f.m. receiver and in an experimental 600-Mc/s television converter have given promising results.

621.385.832 **2940**

Beam-Deflection Nonlinear Element.—A. S. Soltes. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 122..178.) A parabolic mask placed between deflector plates and collector enabled a square-law static characteristic to be obtained with an electron beam of rectangular cross-section. Instantaneous squaring of radar-type signals to an accuracy of 2% of full-scale, at an input frequency to the deflector plates of 40 Mc/s, was achieved by this means in the Raytheon tube Type QK-256.

621.385.832 **2941**

Dimensional Tolerances in Cathode-Ray-Tube Guns.—H. Moss, L. Woodbridge & M. Webb. (*Proc. Instn elect. Engrs*, Part III, July 1950, Vol. 97, No. 48, pp. 277–283.) Preliminary experiments show that cathode tilt in the triode has negligible effect on beam centrality and symmetry. Effects of lateral displacement and tilt of the first anode for various grid/anode spacings are determined experimentally for several types of triode geometry. The astigmatism due to the tilt, displacement and deformation of the final lens elements is also investigated experimentally and an effective type of ion-trap electron gun is described.

621.385.832 : 621.3.087 **2942**

The Recording Storage Tube.—R. C. Hergenrother & B. C. Gardner. (*Proc. Inst. Radio Engrs*, July 1950, Vol. 38, No. 7, pp. 740–747.) A c.r. tube has a mesh screen coated on the face away from the electron gun with a charge-retaining layer. The potential of an output-signal screen located further along the tube is made negative relative to the cathode, so that when the signal is applied (' written ') the beam passes through the mesh screen and is reflected to strike its rear (storage) surface, whereas when the signal is taken off (' read ') the beam strikes the output-signal screen which in this case is made more positive than the storage-screen mesh potential, and does not disturb the stored charges. The signal can thus be read 20 000 times without appreciable deterioration and with a decrease in signal level of only a few per cent.

621.385.832 : 621.397.621.2 **2943**

The Design and Fabrication of TV Picture Tubes.—K. A. Hoagland. (*TV Engng, N.Y.*, March & April 1950, Vol. 1, Nos. 3 & 4, pp. 16–21, 35 & 16–17.) A survey of American manufacturing processes and discussion of present trends in c.r. tube design, with particular attention to beam focusing, the use of slant-field and bent-gun ion traps, metal-cone construction, etc.

621.396.615.14 : 621.385.029.63/.64 **2944**

The Helix as Resonator for Generating Ultra-High Frequencies.—B. B. van Iperen. (*Philips tech. Rev.* Feb. 1950, Vol. 11, No. 8, pp. 221–231.) The action of the travelling-wave valve as an amplifier is described briefly and its use as an u.h.f. generator is discussed. The resonances of the helix play an important part in this latter case. A relatively simple method is developed for determining under what conditions oscillations are possible and at what current intensity they begin. Results are given of some experiments which confirm the accuracy of the theory. An experimental valve with gas-concentrated beam is described.

621.396.615.141.2 **2945**

The Turbator.—F. Lüdi. (*Brown Boveri Rev.*, Sept. 1949, Vol. 36, No. 9, pp. 315–318.) The evolution is reviewed of the Brown Boveri type of magnetron, which comprises a Ba-Sr oxide cathode and a single annular cavity resonator capacitively coupled to the anode segments. The Mo sheet-metal construction of the anode enables an anode dissipation of 200 W to be attained. A glass-enclosed 15-W type is being developed.

621.396.615.141.2 : 621.317.361 **2946**

Measurement of the Space-Charge Resonance Frequencies of a Multicavity Magnetron.—P. Fechner. (*C. R. Acad. Sci., Paris*, 24th July 1950, Vol. 231, No. 4, pp. 270–271.) The magnetron is coupled to a waveguide which is terminated by its characteristic impedance and energized by a klystron generator. Resonance conditions are determined from measurements of the transmission coefficient in the waveguide for different values of magnetic field and anode voltage. The results obtained verify the theory previously given (2678 of October). See also 2680 of October.

621.396.615.142 **2947**

Radial-Beam Velocity-Modulated Microwave Tube.—C. G. Lob & D. F. Holshouser. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 403–407.) The valve consists of a coaxial resonator of length $\lambda/2$, cut in the middle perpendicular to its axis of symmetry so as to constitute two coaxial cavities, each operating in the $\lambda/4$ mode. Surrounding the cut in the resonator is a gun structure with a ring cathode and two focusing electrodes. The action of the valve is similar to that of a two-gap klystron or of a reflex klystron, depending on the operating conditions. Test results on three experimental valves are given. An output of about 3 mW was obtained at a wavelength of 4 cm.

21.396.615.142.2 **2948**

Efficiency of Reflex Oscillators.—W. G. Sheperd. (*Proc. nat. Electronics Conference, Chicago*, 1949, Vol. 5, pp. 500–505.) Analysis of the efficiency and electronic tuning of a reflex oscillator as affected by the use of different modulation coefficients for the outgoing and return transits of the interaction gap.

621.396.645 : 621.396.822 **2949**

Noise Suppression in Triode Amplifiers.—van der Ziel. (*See* 2751.)

MISCELLANEOUS

621.396.7 + 621.397.71] (73)(058.7) **2950**
621.396.6:65 (73) (058.7)

Tele-Tech TV-FM-AM Station & Studio Equipment Directory, 1951.—(*See* 2897.)

658.562 : 519.283 **2951**

Theory of Sampling Inspection Plans.—H. C. Hamaker. (*Philips tech. Rev.*, March 1950, Vol. 11, No. 9, pp. 260–270.) Mathematical principles underlying sampling inspection are discussed. Two parameters for describing an operating characteristic, termed 'point of control' and 'relative slope', are introduced and their relation to sample size and acceptance number is established. Various other parameters in use are reviewed and reasons are given for the choice of the point of control and sample size as a practical set.

621.3 **2952**

Basic Electrical Engineering. [Book Review]—G. F. Corcoran. Publishers: Chapman & Hall, London, 1949, 449 pp., 27s. (*Beama J.*, June 1950, Vol. 57, No. 156, p. 179.) ". . . the treatment . . . is clear, smoothly sequential, succinct but without undue condensation . . . It is a most commendable piece of work."

621.396 **2953**

Radio Handbook. [Book Review]—R. L. Dawley (Ed.). Publishers: Editors and Engineers, Santa Barbara, California, 12th edn 1949, 320 pp., $3.25. (*Electronics*, Aug. 1950, Vol. 23, No. 8, pp. 142, 144.) An all-construction edition dealing with transmitter and receiver equipment, including mobile sets. "This edition does not supersede the 11th edition [2680 of 1948], which contains different information and remains current."

621.396/.397 **2954**

Outline of Radio, Television and Radar. [Book Review]—R. S. Elven, T. J. Fielding, R. Molloy, H. E. Penrose, C. A. Quarrington, M. G. Say, R. C. Walker & G. Windred. Publishers: Chemical Publ. Co., Brooklyn, 1950, 688 pp., $12.00. (*Electronics*, Aug. 1950, Vol. 23, No. 8, p. 142.) A book compiled by eight British engineers. "Extensive use of British terminology throughout, along with descriptions and illustrations of British products . . . does not impair the usefulness of the book to those seeking to keep in touch with British practice."

Second Group

ACOUSTICS AND AUDIO FREQUENCIES

534.152 **2955**

The Visualization of Vibratory Phenomena within a Resonant Tube.—C. Chartier, J. Bourot & J. Noël. (*C. R. Acad. Sci., Paris*, 26th June 1950, Vol. 230, No. 26, pp. 2269–2270.) The motions of powder particles within a resonating tube are recorded photographically; observation of changes produced by variation of experimental conditions is facilitated. Formulae are derived giving the deviation of the phase and longitudinal displacement of the powder particles from the values for the gas within the tube. These deviations vary in the same sense as the frequency used and as the size of the particles; faithful results are obtainable with ordinary Al powder at 1 000 c/s. Photographs are reproduced for a tube giving a 32-c/s note, taken with (*a*) continuous and (*b*) interrupted illumination.

534.232 : 534.321.9 **2956**

Experiments with the Hartmann Acoustic Generator.—L. E. Savory. (*Engineering, Lond.*, 4th & 11th Aug. 1950, Vol. 170, Nos. 4410 & 4411, pp. 99–100 & 136–138.) The air-jet generator has been known for many years but has not been used extensively in industry for generating ultrasonic vibrations on account of its hypersensitiveness in relation to changes of air pressure and of certain interelement spacings. Modifications intended to reduce this instability are described; these include side pads or a short cylinder partially or wholly surrounding the jet somewhere between nozzle and resonator, and a rod inserted along the jet axis. Results are tabulated and discussed.

534.321.9 : 537.228.2 **2957**

The Generation of Ultrasonic Vibrations by Electrostriction.—H. H. Rust. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 293–294.) Falkenhagen's method (1843 of 1949) is discussed and compared with much earlier work by Langevin.

534.6 : 621.395.623.7 **2958**

Practical Applications of Acoustic Measurements on Receivers.—A. Moles. (*T.S.F. pour Tous*, June 1950, Vol. 26, No. 260, pp. 224–229.) Results of tests in an anechoic chamber are shown by records of the low-frequency, overall and loudspeaker response curves of a receiver; the effect of varying the receiver selectivity and of using different baffles for the loudspeaker are also shown. The back of a receiver with built-in loudspeaker should be perforated so as to introduce a certain amount of acoustic impedance. Placing a receiver near a partition, which acts as a baffle, results in an appreciable improvement of the bass response; otherwise the position of the receiver has little effect.

534.75 : 534.321.1 **2959**

Upper Limit of Frequency for Human Hearing.—R. J. Pumphrey. (*Nature, Lond.*, 30th Sept. 1950, Vol. 166, No. 4222, p. 571.) Experimental evidence that the sensory elements at the basal end of the cochlea are competent to respond to sounds of frequency up to 100 kc/s, and that the failure of the normal ear to respond to air-borne sounds of frequency above 20 kc/s is due wholly to the failure of the middle ear to transmit such frequencies. The apparent pitch associated with high-frequency sounds was that of the highest tone audible by air conduction, no increase of pitch being observed above about 15 kc/s.

534.78 : 534.843.5 **2960**

General Theory of Intelligibility within Rooms.—T. Korn. (*Ann. Télécommun.*, Aug./Sept. 1950, Vol. 5, Nos. 8/9, pp. 316–320.) Reverberation time is not the only important factor governing intelligibility; the effect of the direct sound is another factor of major importance. A method is given for calculating the articulation index anywhere in a room from the values of reverberation time, total absorption and distance from the sound source. The calculated results agree with classical experimental data. The direct sound can be reinforced by architectural or electronic devices.

534.84 : 061.3 **2961**

Symposium on Architectural Acoustics, Marseilles, 11th-17th April 1950.—P. Chavasse. (*Ann. Télécommun.*, July 1950, Vol. 5, No. 7, pp. 255–258.) A summarized report of the proceedings, with a list of the papers presented.

534.844.1 **2962**

Measurement of Reverberation Times of Studios of the Radiodiffusion Française.—J. Pujolle & J. Boisard. (*Ann. Télécommun.*, Aug./Sept. 1950, Vol. 5, Nos. 8/9, pp. 307–315.) Apparatus and method are described and degree of accuracy assessed.

534.844.3 **2963**

A Contribution to the Study of Reverberation.—A. C. Raes. (*Ann. Télécommun.*, July 1950, Vol. 5, No. 7, pp. 259–265.) Paper presented at the International Symposium on Architectural Acoustics, Marseilles, 1950. The relation between the reverberation time of an auditorium and the quality of the sound heard is discussed in the light of R. B. Watson's conception of reverberation modulation. Oscillographically recorded results of experiments made with pure-tone sound sources indicate that the frequency of such modulation may attain the order of 250 c/s, with associated amplitude reductions of 10–18 db.

621.3.018.78† : 621.395.613.3 **2964**

The Recording of Nonlinear Distortion.—A. Bressi & G. G. Sacerdote. (*Alta Frequenza*, April 1950, Vol. 19, No. 2, pp. 86–92. In Italian, with English, French and German summaries.) The determination of nonlinear distortion is of particular importance in relation to carbon microphones. A method is described for automatically recording the magnitude of this distortion as a function of the applied acoustic pressure at any frequency.

621.395.61/.62 **2965**

The Constants of Magnetostrictive, Electrostrictive and Piezoelectric Electroacoustic Transducers.—U. John. (*Arch. elekt. Übertragung*, April 1950, Vol. 4, No. 4, pp. 139–145.) From a mathematical treatment of the dynamics of the magnetostriction process an expression is derived for the conversion factor; this is independent of the measurement system used and takes account of the permeability and elastic modulus, and also the magnetostriction factor. A table shows the four different forms of the fundamental dynamic equation, the expressions for their constants and the electromagnetic equivalents. Each group of associated constants can be interpreted as a matrix of a linear quadripole and can be referred to the corresponding groups for the electrostrictive and piezoelectric processes.

621.395.61/.62 **2966**

The Electrical and Acoustical Impedances and Equivalent Circuits of Electroacoustic Transducers.—F. A. Fischer. (*Arch. elekt. Übertragung*, May 1950, Vol. 4, No. 5, pp. 189–195.) Three basic types of transducer are considered: (*a*) electrically excited, (*b*) magnetically excited, (*c*) electrodynamic. The piezoelectric type is to be discussed later. An expression for complex impedance is derived in each case and the corresponding electrical and mechanical equivalent circuits are deduced.

621.395.61 **2967**

Directional Microphones with Phase-Shifting Elements.—H. Grosskopf. (*Fernmeldetech. Z.*, July 1950, Vol. 3, No. 7, pp. 248–253.) The problem of designing a microphone with a directivity independent of frequency is considered generally. Artificial phase-shifting elements are introduced to produce the required directional characteristics. These elements should produce phase-shift proportional to frequency; an acoustic bypass is simplest in theory but is too cumbrous in practice. Elements comprising mechanical impedances are therefore preferred; these are studied by means of mechanical networks. Ribbon and capacitor microphones can be adapted in accordance with the principles given; continuously variable directivity can be obtained by combining in appropriate phase the outputs from two microphones having cardioid diagrams.

621.395.61 : 621.395.828 **2968**

Methods of Preventing Acoustical Feedback.—W. Bürck. (*Frequenz*, July 1950, Vol. 4, No. 7, pp. 161–166.) The positioning of microphone and loudspeaker and the use of compensating circuits are reviewed.

621.395.614 **2969**

Electroacoustic Apparatus with Rochelle-Salt Crystals. M. Gosewinkel. (*Frequenz*, June 1950, Vol. 4, No. 6, pp. 142–145.) The effect of temperature change on the crystal characteristics is discussed. Loading methods to compensate for this are not generally satisfactory. In crystal generators the total adverse effect is small. In crystal receivers the change in sensitivity with temperature above 23°C is appreciable and renders them unsuitable where constancy of operation is required.

621.395.625.2 **2970**

Recent Trends in Disk Recording.—P. Gilotaux. (*Onde élect.*, July 1950, Vol. 30, No. 280, pp. 301–308.) A discussion of factors limiting fidelity of reproduction and of the special problems of fine-groove recording.

AERIALS AND TRANSMISSION LINES

621.317.3.029.6 **2971**

Lines and Circuit Elements for Microwave Measurements.—Schäfer & Honerjäger. (*See* 3088.)

621.392.018.8 **2972**

The Attenuation of Transient or Periodic Electromagnetic Waves due to Effects in the Dielectric Medium surrounding Transmission Lines.—R. Pélissier. (*C. R. Acad. Sci., Paris*, 26th June 1950, Vol. 230, No. 26, pp. 2272–2274.) An analysis is given of the manner in which the wavefront corresponding to an applied step voltage is deformed by leakage and corona as it progresses along a line. Corona is doubly effective, firstly by increasing the leakage current, and secondly by producing a space charge leading to an apparent increase in the dielectric constant. Its deforming action is greater than that due to skin effect but less than that due to ground return.

621.392.26†: 621.3.09 **2973**

Principles and Applications of Waveguide Transmission.—G. C. Southworth. (*Bell Syst. tech. J.*, July 1950, Vol. 29, No. 3, pp. 295–342.) Excerpts from a book of the same title, in preparation. Chapter 6, which gives a descriptive account of transmission in waveguides, is quoted in full.

621.396.67 + 621.396.11 **2974**

Symposium on Antennas and Propagation, San Diego, California, April 3-4, 1950.—(*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 958–962.) Summaries are given of 38 papers presented at the conference.

621.396.67 **2975**

A 600-Ohm Multiple-Wire Delta Antenna for Ionosphere Studies.—H. N. Cones, H. V. Cottony & J. M. Watts. (*Bur. Stand. J. Res.*, May 1950, Vol. 44, No. 5, pp. 475–488.) An account of the design and performance of a multiple-wire delta aerial for vertical-incidence ionospheric recorders. The variation of the terminal impedance over the working range (1–25 Mc/s) is displayed graphically. Radiation pattern measurements using scale-model technique are given and comparative records using the delta aerial and an earlier double-W type are reproduced.

621.396.67 **2976**

Current Distributions on Transmitting and Receiving Antennas.—T. Morita. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 898–904.) A method is described for the direct measurement of the amplitude and phase of current and charge distribution along cylindrical aerials. For the transmitting aerial, the distribution measurement is continued into the coaxial feeder, so that a picture of the complete system is obtained. For the receiving aerial, the distribution is found to vary as a function of the terminating load, as predicted by theory.

621.396.671 **2977**

A Rigorous Calculation of Tubular Dipole Aerials.—H. Zuhrt. (*Frequenz*, June & July 1950, Vol. 4, Nos. 6 & 7, pp. 135–141 & 178–189.) First published in 1944. Cylindrical dipoles of diameter small, but not negligible, compared with λ are considered. A rigorous theory is developed from a solution of the wave equation satisfying rigorous boundary conditions, an image method being used. The theory is applied to the calculation of the input impedance of a relatively thick symmetrical transmitting aerial; results are compared with measurements. The theory is then extended to certain other asymmetrical receiving and transmitting dipole arrangements and their impedances are calculated.

621.396.671 **2978**

On the Theory of the Straight Aerial.—J. Grosskopf. (*Arch. elekt. Übertragung*, May 1950, Vol. 4, No. 5, pp. 175–180.) An approximate formula for the radiation impedance is obtained by applying the fundamental principles of the Hallén theory (2763 of 1939) based on Maxwell's equations, but avoiding the complicated iterative process for determining the current distribution in the aerial. Calculations from the approximate formula give results in good agreement with experimental values and of accuracy as good as is given by two terms of Schelkunoff's development.

621.396.677 **2979**

Electromagnetic Field of the Conical Horn.—M. G. Schorr & F. J. Beck, Jr. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 795–801.) The radiation from a conical horn is calculated by the assumed-field method. The calculated results agree well with values found experimentally for cones of half-angle up to about 25°. For greater angles the approximations used are inadequate and result in poor agreement with experiment. The theoretical anomalies are discussed.

621.396.677 : 621.392.26† **2980**

The Radiation from a Transverse Rectangular Slot in a Circular Cylinder.—S. Silver & W. K. Saunders. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 745–749.) Results obtained previously for slots of arbitrary shape (1588 of July) are applied to the special case of a transverse rectangular slot. The principal transverse-plane pattern for such a slot in which the excitation has only a circumferential tangential electric-field component is the same as the pattern generated by an infinite axial slot with the same circumferential excitation. Theoretical and experimental curves are given for the narrow slot of length $\lambda/2$.

621.396.677.012 **2981**

Survey of Directional Characteristic Curves and Surfaces.—F. Bergtold. (*Frequenz*, May 1950, Vol. 4, No. 5, pp. 114–117.) The general principles of directional radiation as applied to both e.m. and sound waves are outlined and surfaces are discussed which are such that the radius vector for each point of the surface represents the intensity of the radiation in that particular direction from a source at the origin. The intersection of such a surface with any plane passing through the origin gives the radiation polar diagram for that plane. The advantages of a logarithmic scale for the radiation intensity are pointed out. Two abacs based on rectangular-coordinate diagrams enable the directional characteristics of most types of array to be obtained.

CIRCUITS AND CIRCUIT ELEMENTS

549.514.51.001.8 **2982**

Applications of Quartz Crystals.—Villem. (*See* 3110.)

621.3.012.8 **2983**

Construction and Critical Review of Circuit Equivalents for Linear A.C. Elements.—E. Samal. (*Frequenz*, April–June 1950, Vol. 4, Nos. 4–6, pp. 81–88, 117–125, 149–151.) The ideal circuit element is one that can be considered to possess only one electrical property (e.g. resistance), the value of which should be independent of frequency, time, temperature, etc. The accurate representation of actual components by means of such ideal elements is considered in detail with numerous examples, using circle diagrams, oscillatory circuits and transducing networks. The effects of eddy currents, ferromagnetic and e.s. phenomena are discussed and also the modifications necessary to the equivalent circuit when such effects are present. When the particular element in question can no longer be represented accurately by simple diagrammatic methods, recourse must be had to the solution of the appropriate Maxwell equations.

621.3.013.78† **2984**

Screening in Electrical Communication Apparatus.—K. F. Weinert. (*Funk u. Ton*, July 1950, Vol. 4, No. 7, pp. 358–368.) Study of the effect of screening in and between coupled quadripoles when the coupling is (*a*) galvanic, the circuits having a common resistor, (*b*) capacitive, (*c*) inductive, or (*d*) mixed. Expressions giving the damping due to different types of screen are tabulated. Incorrect earthing arrangements can lead to considerable reduction in the screening effect.

621.3.015.33 **2985**
621.3.015.7†

Pulses.—Please note that, in this and subsequent issues, the U.D.C. number used will be 621.3.015.7† instead of 621.3.015.33 used hitherto.

621.3.016.352 **2986**

Stability Criteria.—E. Görk. (*Arch. elekt. Übertragung*, March 1950, Vol. 4, No. 3, pp. 89–96.) Most methods of determining stability conditions are based on the principle of the number of zeros and poles of the function $Z(p)$. In the method described this principle is applied directly. The expression, based on Cauchy's theorem, for the number of zeros when the function is wholly rational or transcendental is integrated in the appropriate half plane to separate the roots; two examples are calculated. Methods of establishing limits for the roots in determining the degree of stability are shown for three values of damping. The Sturm division method and the use of Hurwitz determinants are discussed.

621.3.016.352 : 621.3.012 **2987**

Stability Testing by means of Closed and Open Circle-Diagrams.—F. Strecker. (*Arch. elekt. Übertragung*, June 1950, Vol. 4, No. 6, pp. 199–206.) Detailed discussion of the physical meaning and practical application of circle-diagram stability criteria.

621.314.22.015.7† **2988**

Pulse Transformers.—H. G. Bruijning. (*Commun. News*, April 1950, Vol. 10, No. 4, pp. 126–131.) The requirements which pulse transformers must satisfy are discussed, a design method is described and the advantages resulting from the use of ferroxcube as a core material are considered.

621.314.23 **2989**

The Use of U/I Cores in Transformers.—W. Nonnenmacher. (*Funk u. Ton*, Aug. 1950, Vol. 4, No. 8, pp. 385–395.) Stampings for standard U/I cores can be obtained by halving E/I laminations, and hence can be produced without waste. Leakage coefficient is independent of core size and is only half that with E laminations. The sensitivity to external magnetic fields is investigated; with laminations stacked alternately the U core is better in this respect than the shell. This advantage is lost when an airgap is used. The apparent width of airgap with the yoke removed is plotted as a function of the measured airgap for U cores and for the L59 core.

621.314.3† : 536.58 **2990**

A Direct-Voltage Amplifier as Power Amplifier and Temperature Regulator.—W. Jellinghaus. (*Z. angew. Phys.*, June 1950, Vol. 2, No. 6, pp. 254–261.) Description of a fast-acting regulator comprising a magnetic amplifier controlled by a thermocouple and followed by a circuit in which the amplified voltage is rectified and used to bias negatively a valve whose anode circuit includes premagnetization windings for a second magnetic amplifier supplying the heating element.

621.316.726 : 621.384.611.2† **2991**

Frequency Control for the Bevatron Radio-Frequency Voltage.—Riedel. (*See* 3116.)

621.316.89 : 621.385.831 **2992**

The Negative-Feedback Valve as a Controllable Effective Resistance.—A. Klemt. (*Funk u. Ton*, June 1950, Vol. 4, No. 6, pp. 293–297.) When the negative feedback is such that the alternating voltage at the grid is equal to that at the anode, the a.c. resistance of an amplifier valve is equal to the reciprocal of its slope. Applications of the principle include conductance measurements in parallel resonant circuits, use as a resistor in a phase-shift oscillator, and noise limitation in f.m. receivers. Basic circuits are shown.

621.318.4 : 621-05 **2993**

Universal Coil Winding.—E. Watkinson. (*Proc. Instn Radio Engrs, Aust.*, July 1950, Vol. 11, No. 7, pp. 179–186.) A typical coil-winding machine and the winding patterns derived from it are described. The factors which influence the choice of the coil-winding gear ratio are explained and analysed. The results are presented in a form suitable for slide-rule computation.

621.319.55 : 517.93 **2994**

A Note on a Generalized van der Pol Equation.—W. Nijenhuis. (*Philips Res. Rep.*, Dec. 1949, Vol. 4, No. 6, pp. 401–406.) The asymmetrical van der Pol equation, $\ddot{v} - \epsilon\,(1 - 2\beta v - v^2)\,\dot{v} + v = 0$, is shown to be equivalent to the classical van der Pol equation ($\beta = 0$) with a constant on the right-hand side. For large values of ϵ and β a simple approximation for the limit cycle is found from which it follows that the ratio of the maximum positive and negative values of $v(t)$ cannot exceed 3 : 1.

621.319.55 : 517.93 **2995**

On the Theory of Relaxation Oscillations.—W. Taeger. (*Funk u. Ton*, June & July 1950, Vol. 4, Nos. 6 & 7, pp. 298–307 & 341–346.) The second-order equation applicable to an oscillatory circuit with periodically varying resistance is reduced to Mathieu's differential form and solutions are obtained for values of damping coefficient (a) < 1 and (b) > 1. The theory is then applied to the case of a neon-lamp relaxation circuit and formulae for the frequency and amplitude of oscillations are derived.

621.385.2/.4 : 621.315.59 **2996**
Transistor and Transistron.—Adam. (*See* 3210.)

621.392.52 **2997**
Tchebycheff Functions.—W. Klein. (*Arch. Elektrotech.*, 1950, Vol. 39, No. 10, pp. 647–657.) The Tchebycheff functions of real arguments used in filter theory are presented in five different ways. An extension to complex arguments is made to take into account losses in the circuit elements. A capacitively coupled band-pass filter is discussed as an example of the application of functions with complex arguments.

621.392.52 **2998**
Use of a Template Method for the Design of Filters.—A. Fromageot & M. A. Lalande. (*Ann. Télécommun.*, Aug./Sept. 1950, Vol. 5, Nos. 8/9, pp. 277–290.) The methods described are based on that of Rumpelt (729 of 1943) and apply to lattice filters with opposite arms consisting of identical two-poles. The critical frequencies of the two-poles in the pass band depend on the image-transfer coefficient, in the stop band they depend on the image impedance. The image-transfer coefficient is defined by the required attenuation, the image impedance by its mean value and the permissible variation within the pass band. Some examples are given using piezoelectric crystals as circuit elements. See also 842 of April.

621.392.52 : 621.3.012.8 **2999**
The Relation between Recurrent Networks and Radio Filter Circuits.—W. Klein. (*Funk u. Ton*, June 1950, Vol. 4, No. 6, pp. 273–281.) The theory of the recurrent network is discussed by analysing a basic filter consisting of a branched circuit in which series resistance and shunt conductance are equivalent, the former comprising ohmic resistance and pure reactance in series, the latter a parallel combination of ohmic conductance and pure susceptance. On the basis of equivalent circuits having the same transmission factor, a short-circuit tuned, reactively coupled radio filter is developed from the basic network. Bandwidth here is necessarily restricted since all series impedances in the filter are considered as frequency-independent reactances. For transmission over a relatively wide band the basic type of network is required.

621.392.52 : 621.396.662 **3000**
A New High-Frequency Filter with Band-Pass-Filter Properties.—F. Benz. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, May/June 1950, Vol. 4, Nos. 5/6, pp. 70–75.) The filter described comprises two parallel-resonant circuits detuned from each other by a small amount. The input voltage is shared between them so that a differential output is obtained across the two circuits in series. Circle diagrams, frequency-response curves and phase characteristics are plotted, and performance compared with that of the common type of filter circuit. Applications are discussed; in general the arrangement can be substituted for ordinary resonant-circuit couplings. Symmetry of the frequency-response curve is inherent in the design.

621.396.611.1 **3001**
A Resonant Circuit with a Time-Variant Resistive Element.—P. Bura & D. M. Tombs. (*Nature, Lond.*, 16th Sept. 1950, Vol. 166, No. 4220, pp. 483–484.) Two phenomena have been observed: (a) multiple resonance; in a circuit tuned to f_0 (6 kc/s) the resistive element was varied at f_R (50 c/s) and the voltage across the main capacitance showed peaks at $f_0 + nf_R$, where $n = 1, 2, 3 \ldots$; (b) parametrically excited oscillations; when f_R was about $2f_0$ and the effective resistance became negative during part of the cycle, oscillations at $f_R/2$ occurred over a range of frequencies near f_0. This range is limited by sharp cut-off of the self-oscillation, which suggests the use of the device as a filter, the bandwidth being readily controlled. Calculations, based on a theory briefly indicated, are in good agreement with experimental results.

621.396.615 **3002**
Electron Transit Time in Negative-Grid Oscillator.—S. K. Chatterjee & B. V. Sreekantan. (*Indian J. Phys.*, March 1949, Vol. 23, No. 3, pp. 119–130.) Expressions are derived for cathode/grid and grid/anode electron transit times for a triode operating as a class-C oscillator, taking account of the a.c. voltages on anode and grid and also of the grid bias. Numerical results are given for various valves.

621.396.615 **3003**
The Limiting Frequency of an Oscillator Triode.—K. Rodenhuis. (*Philips Res. Rep.*, Feb. 1950, Vol. 5, No. 1, pp. 46–77.) The triode is considered as a quadripole. General conditions, which the quadripole coefficients must satisfy in order that the quadripole may be able to deliver power to an external circuit, are derived: these are identified with the oscillation conditions for a triode. The relations between the quadripole coefficients of a triode on the one hand, and the properties of the electron current, the series resistances in the electrode leads, the resistance of the emissive coating, and the dielectric losses, on the other hand, are established and discussed. When the theory is applied to the u.s.w. oscillator triode Type EC81, the calculated limiting frequency is 15% above the observed value. This discrepancy is attributed to approximations in the theory. The experimental determination of the limiting frequency is briefly described.

621.396.615.14+621.396.645] : 621.385.029.63/.64 **3004**
Amplification and Generation of Microwave Oscillations with Travelling-Wave Valves.—H. Schnitger. (*Funk u. Ton*, July 1950, Vol. 4, No. 7, pp. 347–354.)

621.396.615.141.2 **3005**
Development of the Turbator for Radio-Relay Equipment.—F. Lüdi. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 405–409.)

621.396.615.17 **3006**
Discussion of an Asymmetrical Multivibrator Circuit.—J. Blok & C. C. Jonker. (*Physica, 's Grav.*, April 1950, Vol. 16, No. 4, pp. 381–390. In English.) The properties of asymmetrical multivibrator circuits are discussed by the method used by Andronow (1648 of July) for the symmetrical multivibrator. The method is extended to take account of grid currents. The operation of such circuits as discriminators is examined and the resolving time is estimated.

621.396.619 : 538.632 **3007**
Possible Modulators Based on the Hall Effect.—Y. Rocard. (*Rev. sci., Paris*, Oct./Dec. 1949, Vol. 87, No. 3304, p. 212.) The circuit described is intended for amplifying weak d.c. The Hall effect is produced in a thin Ge plate by means of an auxiliary alternating current and an alternating magnetic field whose strength is controlled by the d.c. to be amplified. Voltage amplification of some thousandfold is obtainable.

621.396.645 **3008**
Improving Differential-Amplifier Rejection Ratios.—R. McFee. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 770–771.) Modifications are suggested to two standard differential-amplifier circuits which effect fifty-fold improvements in rejection ratios. Where

the input potentials are applied to the grids of a pair of similar triodes having a common cathode resistor, R_K, the modification consists in connecting a resistor equal in value to R_K across the output triode, from cathode to anode. In the symmetrical amplifier in which the output is taken from both anodes of the pair of triodes, the modification consists in connecting equal resistors across each of the two valves, from anode to the high-potential end of the cathode resistor, the output being taken from suitable symmetrical tapping points.

621.396.645 **3009**

Stagger-Tuned Intermediate-Frequency Amplifier Design.—A. B. Thomas. (*J. Instn Engrs Aust.*, June 1950, Vol. 22, No. 6, pp. 141–148.) Charts are given for facilitating selection of the most suitable type of interstage coupling for any particular purpose, and for deciding the frequency and damping of each stage in a stagger-tuned unit. A method is given for extracting the response curve of any stage, and a simple lining-up procedure is described which can be applied to staggered triples. Reference is made to a radar unit recently constructed, with a mid-band gain of 100 db and a bandwidth of 12.5 Mc/s centred at 70 Mc/s. This receiver proved to be stable and easy to handle and duplicate.

621.396.645 : 621.316.078 **3010**

Automatic Stabilization of Amplifier Gain.—A. W. Keen. (*J. Brit. Instn Radio Engrs*, June 1950, Vol. 10, No. 6, pp. 198–207.) "The conventional method of measuring the voltage gain of an amplifier by equating it with the loss introduced by a calibrated attenuator is adapted to provide a continuous and automatic method of accurately defining and maintaining constant amplifier gain. The resultant arrangements are all forms of negative feedback systems and are characterized by high loop gain and the use of a precision attenuator in the β network. Two types are distinguished according to whether the error signal representing the discrepancy between the input and attenuated output signals is made self-cancelling by being fed back into the amplifier as in conventional feedback amplifiers, or used to control the gain of one or more of the amplifying valves, as in a.g.c. systems. Appropriate circuit technique is indicated and suitable applications of the method are briefly described."

621.396.645.37 **3011**

Selective Amplification by means of RC Feedback Networks.—M. Picchi. (*Alta Frequenza*, April 1950, Vol. 19, No. 2, pp. 59–85. In Italian, with English, French and German summaries.) General expressions are derived for the resonance frequency and resonance coefficient of a selective amplifier. Three particular amplifier circuits are discussed in which the Scott parallel-T quadripole, the Wien-Robinson bridge, and certain phase-shift quadripoles are used as feedback networks.

621.396.645.371 **3012**

A Note on the Maximum Feedback Obtainable in an Amplifier of the Cathode-Feedback Type.—J. te Winkel. (*Philips Res. Rep.*, Feb. 1950, Vol. 5, No. 1, pp. 1–5.) The total feedback on the last valve in a feedback amplifier is calculated for the case where the feedback voltage is derived from the cathode load impedance of the last valve. The total feedback is invariably less than the product of individual valve feedback and feedback around the main loop, and has an upper limit dependent only on frequency and on the ratio of transconductance to input capacitance of the last valve.

621.396.645.371 : 523.165 **3013**

Linear Preamplifier for Driving a Long Coaxial Cable.—L. G. Lewis, J. G. Robinson & J. Toll. (*Rev. sci. Instrum.*, July 1950, Vol. 21, No. 7, pp. 593–596.) Linearity and long-term stability under severe weather conditions have been achieved by using negative feedback. The particular application is to an exposed particle-detector system linked by a 100-ft length of cable to the main amplifier.

621.396.665 : 621.396.645.371 **3014**

Correction and Clarification of "Automatic Volume Control as a Feedback Problem".—B. M. Oliver. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, p. 904.) Correction to paper abstracted in 2501 of 1948.

621.397.645 **3015**

Television Intermediate-Frequency Amplifiers.—Coenraets. (*See* 3191.)

621.392.52 **3016**

Siebschaltungen mit Schwingkristallen (Crystal Filter Circuits). [Book Review]—W. Herzog. Publishers: Dieterichsche Verlagsbuchhandlung, Wiesbaden, 1949, 361 pp., 45 DM. (*Fernmeldetech. Z.*, July 1950, Vol. 3, No. 7, pp. 256–257.) The author has brought together in this comprehensive and clearly presented work the material available on the subject. General laws and principles of filter design are given, and basic properties of crystals are explained by means of equivalent circuits. Examples are calculated, and sections are devoted to the adjustment, measurement and temperature dependence of the filters. The text is arranged so that for designing any particular type of filter only the relevant section has to be consulted.

621.396.611.1 + 621.385].029.6 **3017**

Technique des ondes très courtes et ultracourtes: Tome I — Circuits oscillants et tubes à vide. [Book Review]—L. Liot. Publishers: Dunod, Paris, 1949, 253 pp., 780. fr. (*Alta Frequenza*, April 1950, Vol. 19, No. 2, pp. 110–111.) Essentially a practical book, useful both as an introduction to the subject and for reference.

GENERAL PHYSICS

530.112 **3018**

Matter, a Mode of Motion.—R. V. L. Hartley. (*Bell Syst. tech. J.*, July 1950, Vol. 29, No. 3, pp. 350–368.) "Both the relativistic and wave mechanical properties of particles appear to be consistent with a picture in which particles are represented by localized oscillatory disturbances in a mechanical ether of the MacCullagh-Kelvin type. Gyrostatic forces impart to such a medium an elasticity to rotation, such that, for very small velocities, its approximate equations are identical with those of Maxwell for free space. The important results, however, follow from the inherent nonlinearity of the complete equations and the time dependence of the elasticity associated with finite displacements. These lead to reflections which permit of a wave of finite energy remaining localized. Because of the nonlinearity, the amplitude and energy of a stable mode, as well as the frequency, are determined by the constants of the medium. Such a stable mode is capable of translational motion and so is suitable to represent a particle. The mass assigned to it is derived from its energy by the relativity relation. While this mass is dimensionally the same as that of the medium it is differently related to the energy and so need not conform to the classical laws which the latter is assumed to obey. Exchanges of energy between particles and between a particle and radiation involve frequency changes as in the quantum theory. The experimental detection of a uniform velocity relative to the medium is not to be expected. Besides providing a new approach to the problems of particle mechanics, the theory offers the prospect of incorporating the present pictures into a more comprehensive one, with a material reduction in the number and complexity of the independent assumptions." See also 3019 below.

530.112 : 535.312 **3019**

The Reflection of Diverging Waves by a Gyrostatic Medium.—R. V. L. Hartley. (*Bell Syst. tech. J.*, July 1950, Vol. 29, No. 3, pp. 369–389.) "This paper furnishes the basis for a companion one [3018 above], which discusses the possibility of describing material particles as localized oscillatory disturbances in a mechanical medium. If a medium is to support such disturbances it must reflect a part of the energy of a diverging spherical wave. It is here shown that this property is possessed by a medium, such as that proposed by Kelvin, in which the elastic forces are of gyrostatic origin. This is due to the fact that, for a small constant angular displacement of an element of this medium, the restoring torque, instead of being constant, decreases progressively with time."

535.8 **3020**

On the Design of Wide-Angle Schmidt Optical Systems.—E. M. Wormser. (*J. opt. Soc. Amer.*, July 1950, Vol. 40, No. 7, pp. 412–415.) "A method of balancing the optical aberrations over a wide angular field of a Schmidt optical system is described."

537.122 : 538.691 **3021**

Electron Motion in Alternating Magnetic Fields.—A. Kneschke. (*Arch. elekt. Übertragung*, May 1950, Vol. 4, No. 5, pp. 165–172.) The differential equation expressing the motion is integrated completely. The geometric and kinematic characteristics of the electron paths are investigated and related to curves whose curvature is a periodic function of arc length. Certain special cases of the general trajectory are analysed in detail and shown graphically.

537.226 **3022**

Equivalence of Temperature and Frequency in Dielectric Measurements.—K. H. Stark. (*Nature, Lond.*, 9th Sept. 1950, Vol. 166, No. 4219, p. 436.) The variation of the complex dielectric constant as a function of frequency is represented by a circular arc. Experiments with two widely different dielectrics yielded circular arcs also for variation of complex dielectric constant as a function of temperature. Equivalence of temperature and frequency for dielectrics with a wide distribution of relaxation times is hence established, but no theoretical explanation is known.

537.311.31 **3023**

The Bloch Integral Equation and Electrical Conductivity.—P. Rhodes. (*Proc. roy. Soc. A*, 22nd Aug. 1950, Vol. 202, No. 1071, pp. 466–484.) An extension of the detailed development of the Bloch treatment of the temperature variation of conductivity to cover a wider temperature range. Theoretical and experimental results are in good general agreement.

537.311.33 **3024**

Thermal Equilibrium in Neutron-Irradiated Semiconductors.—J. H. Crawford, Jr, & K. Lark-Horovitz. (*Phys. Rev.*, 1st Sept. 1950, Vol. 79, No. 5, pp. 889–890.) Analysis of conductivity/irradiation curves of Ge semiconductors exposed to neutron flux shows the experimental minimum conductivity to be much lower than anticipated. Redetermination of the product of electron and hole densities from Hall-effect measurements gives a value of 3.6×10^{26} at 300°K, which is about one tenth of the value previously found and which yields a much better estimate of minimum conductivity. Measurements are made with the material in the pile, where photo-effects play an important part.

537.311.33 : 538.632 **3025**

Temperature Dependence of the Energy Gap in Germanium from Conductivity and Hall Data.—V. A. Johnson & H. Y. Fan. (*Phys. Rev.*, 1st Sept. 1950, Vol. 79, No. 5, p. 899.) The data are for the temperature range 500°K to 850°K. If the energy gap between the full and conduction bands is expressed by the relation $E_G = E_{G_0} + (\partial E_G/\partial T)T$, E_{G_0} is determined as 0.73 eV and $\partial E_G/\partial T$ as constant at $(-1.1 \pm 0.1) \times 10^{-4}$ eV/°K, assuming $m_e m_h = m_o^2$, where m_e, m_h, m_o are the effective electron and hole masses and free-electron mass respectively.

537.311.33 : 538.632 **3026**

On the Theory of the Hall Effect for the case of Composite Conductors in an Alternating Electric Field.—H. Welker. (*Onde élect.*, July 1950, Vol. 30, No. 280, pp. 309–316.) In the case considered, two types of moving charge carrier are present; large displacements of charge perpendicular to the primary current occur. These displacements have appreciable relaxation times, whose magnitudes are examined by substituting a.c. for d.c. primary current. The value of the Hall voltage then depends on the frequency of the a.c. Results are given for various composite conductors, including electrolytes, semiconductors and polyvalent metals. Formulae for determining particle concentrations and mobilities are derived and the possibilities of experimental verification are discussed.

537.525 : 534.01 **3027**

Effects of Plasma Boundaries in Plasma Oscillations.—D. Bohm & E. P. Gross. (*Phys. Rev.*, 15th Sept. 1950, Vol. 79, No. 6, pp. 992–1001.) An electron taking part in a travelling plasma oscillation will be reflected at a sheath of infinitesimal thickness with velocity appropriate to the oscillation travelling in the reverse direction, so that standing waves are built up without loss at the sheath. This approach is extended to sheaths for which a finite time of penetration is necessary before reflection occurs, and also to the case of reflection at metallic electrodes. In both cases expressions are derived for the damping. For low-pressure discharges, the damping resulting from imperfect reflection from electrode sheaths may be comparable with collision damping, but the damping due to conducting electrodes is unimportant.

The excitation of the plasma by sharp beams is considered and expressions are derived for the energy transfer of a beam to waves of growing and of stationary amplitude. Beams should only excite oscillations when a regular geometry exists. With irregular geometry, bunching pulses are to be expected. A detailed analysis of the bunching is given.

537.533.8 **3028**

Measurement of Secondary Electron Emission from Dielectric Surfaces.—H. L. Heydt. (*Rev. sci. Instrum.*, July 1950, Vol. 21, No. 7, pp. 639–642.) The method described involves bombarding the metal-backed dielectric surface with primary electrons so as to produce a secondary-emission ratio greater than unity and hence a surface potential of known value.

538.221 **3029**

Departure from the Rayleigh Law of the Magnetization of a Ferromagnetic Material.—H. D. Bush. (*Nature, Lond.*, 2nd Sept. 1950, Vol. 166, No. 4218, pp. 401–402.) An interim report of experimental investigations.

539.233 : 535.215 **3030**

Photoadsorption of a Thin Layer of Barium.—C. Biguenet. (*Le Vide*, July/Sept. 1950, Vol. 5, Nos. 28/29, pp. 831–836.) Experiments are described which confirm that light produces large variations of the contact difference of potential between an oxide cathode and a tungsten-filament collector electrode; the experiments show also that the effect is not due to photoemission. A possible explanation is that the barium adsorbed on the tungsten filament is ionized by the light, causing a change in the electron affinity of this electrode.

548.0 : 537 **3031**

Scattering of Electrons in Crystals in the Presence of Large Electric Fields.—J. Bardeen & W. Shockley. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, pp. 69–71.) "By the calculation of transitions between states appropriate to electrons moving in a large uniform electric field superimposed on a periodic crystal field, it is shown that the probabilities of scattering by lattice vibrations or imperfections are independent of the uniform field and are given by the usual expressions derived for zero field. This justified the procedure of treating acceleration by the field and scattering as independent processes."

548.0 : 537 **3032**

Deformation Potentials and Mobilities in Non-Polar Crystals.—J. Bardeen & W. Shockley. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, pp. 72–80.) "The method of effective mass, extended to apply to gradual shifts in energy bands resulting from deformations of the crystal lattice, is used to estimate the interaction between electrons of thermal energy and the acoustical modes of vibration. The mobilities of electrons and holes are thus related to the shifts of the conduction and valence-bond (filled) bands, respectively, associated with dilatations of longitudinal waves. The theory is checked by comparison of the sum of the shifts of the conduction and valence-bond bands, as derived from the mobilities, with the shift of the energy gap with dilation. The latter is obtained independently for silicon, germanium and tellurium from one or more of the following: (1) the change in intrinsic conductivity with pressure, (2) the change in resistance of an *n-p* junction with pressure, and (3) the variation of intrinsic concentration with temperature and the thermal expansion coefficient. Higher mobilities of electrons and holes in germanium as compared with silicon are correlated with a small shift of energy gap with dilation."

621.3.013.783† **3033**

Generalized Impedance Method Applied to Electromagnetic Field Screening.—G. Bonfiglioli & G. Montalenti. (*Alta Frequenza*, April 1950, Vol. 19, No. 2, pp. 93–105. In Italian, with English, French and German summaries.) Cases are first discussed in which problems of e.m. wave propagation in discontinuous media can be treated by Schelkunoff's method for an infinitely long line. Two special cases are investigated: a spherical-wave generator within a spherical screen and a cylindrical-wave generator within a cylindrical screen. For a screen of small thickness and for a stated relation between screen thickness, conductivity and permeability and generator frequency, frequency ranges may occur within which a copper screen is more efficient than an iron one.

621.384.611.1† **3034**

The Theory of Electron Acceleration in the Alternating Magnetic Field.—J. Picht. (*Optik*, Jan.–March 1950, Vol. 6, Nos. 1–3, pp. 40–55, 61–97 & 133–144.) The theory of the betatron (or rheotron) is considered. The analysis is based on the Hertzian vector and avoids the distinction drawn in previous work between the 'guiding' field and the 'accelerating' field, since it is the resultant field that determines the electron motion. The stability of the electron path is investigated and the conditions for stability are given for the case of fields of strengths used in practice. The possibility of focussing electrons emitted in different directions is discussed.

621.396.822 : 621.315.592† **3035**

On the Noise Spectra of Semiconductor Noise and of Flicker Effect.—A. van der Ziel. (*Physica*, *'s Grav.*, April 1950, Vol. 16, No. 4, pp. 359–372. In English.) An explanation is given of the fact that in flicker effect and semiconductor noise the noise intensity is inversely proportional to the frequency over a wide range of frequency. General theorems relating to Fourier analysis of fluctuating quantities are mentioned and it is shown to be impossible for the noise intensity to be inversely proportional to the frequency throughout the interval $0 < f < \infty$. Inverse proportionality over a wide range can be obtained if a distribution function of correlation times is introduced. Such a function should be expected from the various mechanisms involved.

The sources of noise in semiconductors are considered; the shot effect discussed by Brillouin, Bernamont and Gisolf (667 of March) is not sufficient to account for all the noise. Other mechanisms such as flicker effect and resistance fluctuations due to movements of foreign atoms or to lattice distortions contribute to give the requisite distribution of correlation times.

Flicker effect is discussed, with particular reference to Macfarlane's theory (4087 of 1947). It is suggested that flicker effect in oxide-coated cathodes may not be primarily due to the surface of the coating, but much more to what happens inside it. In an appendix, Bernamont's and Gisolf's treatment of shot noise are shown to be equivalent.

539 **3036**

Ions, Electrons and Ionizing Radiations. [Book Review]—J. A. Crowther. Publishers: Arnold, London, 8th edn 1949, 322 pp., 21s. (*Nature, Lond.*, 26th Aug. 1950, Vol. 166, No. 4217, p. 328.) This new edition of a work which since 1919 has served "as an introduction to the major treatises on atomic physics" retains and brings up to date the account of the main lines of progress.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.165 : 621.396.645.371 **3037**

Linear Preamplifier for Driving a Long Coaxial Cable.—Lewis, Robinson & Toll. (*See* 3013.)

523.746 : 621.396.812.5 **3038**

Results of Statistical Analysis of Fade-Outs.—D. Stranz. (*Arch. elekt. Übertragung*, June 1950, Vol. 4, No. 6, pp. 217–218.) Correlation of sunspot data with 130 cases of total disappearance of radio signals observed during 1948.

523.75 **3039**

The Solar Flare of November 19, 1949 and Cosmic Rays.—J. Clay & H. F. Jongen. (*Phys. Rev.*, 1st Sept. 1950, Vol. 79, No. 5, pp. 908–909.) Cosmic-ray intensity was recorded using both shielded and unshielded ion chambers. With a normal flare the intensity falls below the quiescent value some few hours after the flare. This flare was abnormal in that there was no difference in cosmic-ray intensity before and after it.

A fade-out of the Noordwijk radio station was noted and also a magnetic disturbance with a maximum range in H of 215γ.

523.854 : 621.396.822 **3040**

Present-Day Ideas on the R.F. Radiation from the Galaxy.—R. Gallet. (*Rev. sci., Paris*, July/Sept. 1949, Vol. 87, No. 3303, pp. 157–161.) Jansky's theory, that galactic radiation originates in the ionized interstellar gas, and the theory of Pawsey and his co-workers, that this radiation is emitted by the stars, are discussed. The apparent and electronic temperatures of the sources deduced from the observations of various workers are very high, and alternative theories such as that of plasma oscillations are examined. Further fundamental quantitative investigation is necessary before any theory can be finally accepted.

551.5 : 621.396.9 **3041**

The Temperatures at the Tops of Radar Echoes Associated with Various Cloud Systems.—R. F. Jones. (*Quart. J.R. met. Soc.*, July 1950, Vol. 76, No. 329, pp. 312–330.)

551.5 : 621.396.9 **3042**

Radar Weather Echoes.—R. F. Jones. (*Met. Mag.*, April–July 1950, Vol. 79, Nos. 934–937, pp. 109–112, 143–145, 170–172 & 198–200.) Some typical examples are given of 10-cm radar echoes obtained over a two-year period, using p.p.i. and height-range equipment. The echoes correspond with most types of weather phenomena observed in the temperate zone. The interpretation of the echoes from warm and cold fronts agrees well with generally accepted theories, but the phenomena of occluded fronts may be more complex and not capable of interpretation by a simple model. A few examples of unusual types of echo are given, with their probable explanations.

551.5 : 621.396.9 **3043**

Radar Echoes.—J. E. N. Hooper & A. A. Kippax; R. F. Jones. (*Quart. J.R. met. Soc.*, July 1950, Vol. 76, No. 329, pp. 330–336.) Discussion on papers noted in 2221 of October and 3042 above.

551.510.535 **3044**

Large-Scale Sporadic Movements of the E-Layer of the Ionosphere.—N. C. Gerson. (*Nature, Lond.*, 19th Aug. 1950, Vol. 166, No. 4216, pp. 316–317.) Very marked and rapid sporadic-E movements during the period 15th–16th May 1949 are indicated according to preliminary information supplied by a network of North-American amateur observers operating on frequencies around 50 Mc/s. Results are charted on a sketch-map. The displacements of the reflection points may be due either to movements of the atmosphere or to electron drift.

551.510.535 : 535.36 **3045**

Diffusion in the Ionosphere.—M. H. Johnson & E. O. Hulburt. (*Phys. Rev.*, 1st Sept. 1950, Vol. 79, No. 5, pp. 802–807.) " Diffusion is treated by showing that the action of a medium on a diffusing gas is that of a dissipative force. When the theory is applied to an electrically neutral ionic gas in a gravitational field it is found that the mixture of positive and negative ions diffuses as a single gas because of the electrical polarization charges within the ionic cloud. In the presence of a magnetic field, the diffusion cannot be expressed in terms of the ionic density until the electrodynamical equations governing the flow of electrical current have been explicitly solved. Solutions are obtained for special cases which show that a strong magnetic field completely inhibits the diffusion due to concentration gradients in the transverse plane and has little effect on the diffusion due to the gravitational force."

551.510.535 : 551.594.5 **3046**

Narrowly Limited Ionization Clouds at 125-km Height during an Auroral Disturbance.—D. Stranz. (*Arch. elekt. Übertragung*, June 1950, Vol. 4, No. 6, pp. 213–216.) Analysis of Swedish records of 15th/16th September 1948 showing sporadic-E reflections lasting 2½ hours. Corresponding records of variations of the magnetic vector are also given.

551.55 : 551.510.535 : 621.396.9 **3047**

Meteoric Echo Study of Upper Atmosphere Winds.—Manning, Villard, Jr, & Peterson. (*See* 3052.)

551.594.6 **3048**

Noise Levels in the American Sub-Arctic.—N. C. Gerson. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 905–916.) The level of atmospherics on a frequency of 150 kc/s was studied over a period of six months in Northern and Southern Canada. The average, quasi-peak, and maximum peak levels were determined. Diurnal variation is absent or small in winter, but shows a marked increase in summer, with a minimum after sunrise and a maximum after sunset. As summer approaches, the noise-level rise occurs earlier and earlier. Static intensity is higher in June than in January and at southern stations noise increased progressively up to June. A rise in noise level at some stations in February is attributed to precipitation static caused by blizzards. The noise level varied as a nonlinear function of colatitude. Recorded data are included.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 551.5 **3049**

The Temperatures at the Tops of Radar Echoes Associated with Various Cloud Systems.—R. F. Jones. (*Quart. J. R. met. Soc.*, July 1950, Vol. 76, No. 329, pp. 312–330.)

621.396.9 : 551.5 **3050**

Radar Echoes.—J. E. N. Hooper & A. A. Kippax; R. F. Jones. (*Quart. J. R. met. Soc.*, July 1950, Vol. 76, No. 329, pp. 330–336.) Discussion on papers abstracted respectively in 2221 of October and 3042 above.

621.396.9 : 551.5 **3051**

Radar Weather Echoes.—Jones. (*See* 3042.)

621.396.9 : 551.55 : 551.510.535 **3052**

Meteoric Echo Study of Upper Atmosphere Winds.—L. A. Manning, O. G. Villard, Jr, & A. M. Peterson. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 877–883.) The Doppler frequency shift imparted to continuous waves reflected from a meteoric ionization column in the 80–100-km height region enables the wind drift of the trail to be found. Statistical analysis enables average wind velocities to be measured to within about 20% and direction to within about 20°, in a period of one or two hours. Typical wind velocities were found to be about 125 km/hr during the early morning hours in the summer of 1949; occasional evidence of nonuniform wind structure was found.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.743 : 621.396.611.21 **3053**

A Double-Crystal X-Ray Goniometer for Accurate Orientation Determination.—W. L. Bond. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 886–889.) The slit system of an X-ray goniometer is replaced by an AT quartz plate, thus turning it into a double-crystal instrument suitable for accurate measurements on AT quartz plates. Errors due to temperature change and to X-ray refraction are discussed. Measurement accuracy to within about 0.1′ of arc is attained.

533.5 **3054**

Measurement of the Pumping Rate of Rotary Pumps.—R. Henry. (*Le Vide*, July/Sept. 1950, Vol. 5, Nos. 28/29, pp. 859–865.) Fundamental definitions are stated, the method and apparatus used are described, and results obtained with various French and American models are tabulated.

535.215.1 : 549.211 **3055**

Photoelectric Properties of Diamond, Measured with a Crystal Counter.—G. P. Freeman & H. A. van der Velden. (*Physica, 's Grav.*, May 1950, Vol. 16, No. 5, pp. 486–492. In English.)

535.37 **3056**

Dependence of Emission Spectra of Phosphors upon Activator Concentration and Temperature.—G. R. Fonda. (*J. opt. Soc. Amer.*, June 1950, Vol. 40, No. 6, pp. 347–352.)

535.37 **3057**

The Rise in Brightness of Infrared-Sensitive Phosphors.—P. Brauer. (*J. opt. Soc. Amer.*, June 1950, Vol. 40, No. 6, pp. 353–355.)

535.37 : 546.472.84 **3058**

Rise and Decay of Willemite Luminescence.—G. Gergely. (*J. opt. Soc. Amer.*, June 1950, Vol. 40, No. 6, pp. 356–361.) The luminescence/time curve for c.r. excitation times of 1–280 μs can be resolved into three monomolecular components with time constants of 200, 1 800 and 72 000/sec. The fast component is predominant for short excitation times and the slow component for long times. The duration of excitation does not affect the decay rates, but varies the proportions of the three components.

537.363 + 621.357.1] : 546.841 **3059**

On the Polarization of the Electrodes in the Electrophoresis and the Electrolysis of Thoria and Thorium Nitrate.—G. Mesnard. (*Le Vide*, July/Sept. 1950, Vol. 5, Nos. 28/29, pp. 866–869.)

538.27 : 621.314.22.042.2.029.6 **3060**

Theory of Magnetically Inhomogeneous Surface Layers in Transformer Laminations.—R. Feldtkeller. (*Frequenz*, June 1950, Vol. 4, No. 6, pp. 129–134.)

539.11 : 621.315.612.4 **3061**

Atomic Positions and Vibrations in the Ferroelectric $BaTiO_3$ Lattice.—W. Kaenzig. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, pp. 94–95.)

539.2 : 537.228.1 **3062**

Domain Structure of Rochelle Salt.—J. Furuichi & T. Mitsui. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, pp. 93–94.)

539.234 **3063**

Production of Thin Layers of Uniform Controlled Thickness by Evaporation: Applications in Electronics.—C. Dufour. (*Le Vide*, July/Sept. 1950, Vol. 5, Nos. 28/29, pp. 837–843.) Illustrated description of methods used for producing thin layers such as are required especially in television and radar tubes. Layers uniform to within about 1% have been produced on a plane surface 20 cm in diameter, the thickness being controlled photoelectrically during processing to within about 0.02 μ.

546.431.82 **3064**

Ferroelectricity, Domain Structure, and Phase Transitions of Barium Titanate.—A. von Hippel. (*Rev. mod. Phys.*, July 1950, Vol. 22, No. 3, pp. 221–237.) Detailed summary of M.I.T. research to date, with discussion of: variations in the ferroelectric parameters of multicrystalline $BaTiO_3$ cooling through the Curie region; piezoelectric response with changing frequency and temperature; hysteresis phenomena; phase transitions of the BaO-TiO_2 system; the domain structure of $BaTiO_3$ single crystals and the effect of an applied electric field; theory of the ferroelectric state in $BaTiO_3$. Extensive references and many diagrams are included.

549.514.5 : 621.3.011.5 **3065**

Dielectric Constant of Silica.—S. K. K. Jatkar & B. R. Y. Iyengar. (*Indian J. Phys.*, April 1949, Vol. 23, No. 4, pp. 145–152.) The permittivities of crystal-quartz and fused-silica plates, as determined by the plate-capacitor method, are respectively 4.54 and 3.2. Measurements by the liquid-mixture method give for powdered quartz the value 4.55. The results are discussed with reference to the theory of molecular structure.

620.19 **3066**

Investigations into Tropic Proofing of Electrical Materials, 1943-46: Parts 1-5.—(*Aust. J. appl. Sci.*, March 1950, Vol. 1, No. 1, pp. 80–132.)

Part 1. The protection of electronic equipment for use under humid tropical conditions.—L. G. Dobbie. An outline of investigations in Australia. Moisture was found the main cause of electrical deterioration, particularly under unsuitable storage conditions. Suitable materials, protective coatings and lay-out are suggested and laboratory tests outlined. Complete hermetic sealing of components is the most satisfactory method of protection. Two appendices give general data on evaporation and water-vapour diffusion.

Part 2. The influence of moisture on insulating materials.—J. S. Dryden & P. T. Wilson. Limitations of methods commonly used for measuring surface and volume resistivity are discussed. Different types of material are compared; surface-treated glass and ceramics were found the best for maintaining high values of insulation resistance under humid conditions.

Part 3. Some experiments on the application of organosilicon compounds to glass and ceramic.—R. J. Meakins, J. W. Mulley & V. R. Churchward. The insulation resistance of glass and steatite at high relative humidities is increased by treatment with a solution of methyl or ethyl chlorosilane in benzene. Similar results are obtained with methyl- and ethyl-silicon-amine solutions, but prior cleaning with chromic acid is essential.

Part 4. The treatment of glass and steatite ceramic with quaternary ammonium compounds.—R. J. Meakins. Insulation resistance of glass and steatite is increased nearly 1 000 times after immersion for one second in an aqueous solution of certain quaternary ammonium compounds, but as a practical means of surface treatment these compounds are less effective than the alkyl-chlorosilanes.

Part 5. The corrosion of copper wires at d.c. potential in contact with electrical insulating materials.—R. J. Meakins. The anodic corrosion of copper wire in contact with a wide range of insulating materials under very moist conditions was investigated. Results indicate that the degree of corrosion depends on the affinity for water of the insulator. With polar materials, such as cellulose products, severe corrosion occurred, but little corrosion was found with nonpolar materials such as paraffin and ceresine waxes, bitumens and polyethylene.

621.3.011.5 : 676.19 **3067**

Investigations of the Dielectric Properties of Paper Fibre.—P. Henninger. (*Frequenz*, July 1950, Vol. 4, No. 7, pp. 167–177.) The experimentally determined dielectric properties of different types of paper are discussed in the light of its cellulose structure. Temperature coefficients for the different structures and the effect of absorption of water are studied.

621.3.032.2 : 621.315.61 : 68 **3068**

Microspacer Electrode Technique.—O. M. Stuetzer. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 871–876.) Closely spaced multiple-electrode systems with glass, quartz or other thermoplastic insulation can be produced by drawing down from a convenient larger size, the geometry of the system undergoing little change in the process. Electrode materials can in some cases be inserted prior to the drawing in others, wires of suitable size are inserted after drawing and sealed if necessary. Applications of the technique in the construction of subminiature valves, crystal amplifiers, and flat parallel-wire screens, are described.

621.315.592† **3069**

On the Nature of a Soldered Contact on a Semiconductor.—J. I. Pantchechnikoff. (*Phys. Rev.*, 15th Sept. 1950, Vol. 79, No. 6, pp. 1027–1028.) An account of experiments made to verify the assumption that the soldered contact is effectively a gradual transition from a metal to a semiconductor. Metal atoms diffuse into the semiconductor during the soldering process, their concentration being greatest near the surface through which they have diffused. A theoretical explanation of effects observed with soldered contacts is given.

621.315.592† : [621.316.86 + 621.314.632 **3070**

Semiconductors and their Applications.—R. W. Douglas. (*G.E.C. J.*, July 1950, Vol. 17, No. 3, pp. 107–124.) Conduction in metals is considered and a typical crystal structure for a metal is contrasted with that of a semiconductor. Intrinsic, impurity and non-stoichiometric types of semiconductors are considered and their properties discussed from the chemical-bond viewpoint and more fully in terms of quantum mechanics. Applications discussed in detail include thermistors, point-contact rectifiers, high-back-voltage Ge diodes, layer-type rectifiers and Ge triodes.

621.315.61 **3071**

Fluid Dielectrics for the Decimetre and Centimetre Wave Band.—W. Endres & H. Köhler. (*Frequenz*, June 1950, Vol. 4, No. 6, p. 145.) Correction to paper abstracted in 1708 of July.

621.318.23 **3072**

The Design of [magnetic] **Circuits for Permanent Magnets.**—A. Hug. (*Bull. schweiz. elektrotech. Ver.*, 2nd Sept. 1950, Vol. 41, No. 18, pp. 661–669. In German.) A semi-empirical method of calculation is described which is simple yet sufficiently accurate for practical purposes. Electrical analogies are used in explaining the theory. Magnetizing processes and measurements on permanent magnets are discussed briefly.

621.318.4.042.15 : 538.22 **3073**

The Magnetic Characteristics of Coils with Pot-Type Cores of Powdered Iron.—M. Kornetzki. (*Frequenz*, May 1950, Vol. 4, No. 5, pp. 105–113.) Inductance and iron losses of such coils with a high-μ pot core completely enclosing the coil are calculated theoretically and referred to constants for the material measured on ring cores. The effective permeability of the pot core is proportional to that of the core material, but the proportionality factor depends on the type of winding. Losses due to eddy currents and magnetic after-effect are practically equal to those of the ring core. Hysteresis losses are determined from a calculation of effective length of magnetic path. Measurements on pot-type coils confirm the calculations. The effect of the stray field of these coils is discussed.

621.646.958 : 537.534 **3074**

Positive-Ion Emission, a Neglected Phenomenon.—W. C. White. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 852–857.) General discussion, with description of a leak detector based on positive-ion effects.

666.1 : 621.317.374 **3075**

Some Experiments and Theories on the Power Factor of Glasses as a Function of Their Composition: Part 1.—J. M. Stevels. (*Philips Res. Rep.*, Feb. 1950, Vol. 5, No. 1, pp. 23–36.) Power factors and permittivities of various series of glasses of systematically graded composition were measured at a temperature of 20° C and a frequency of 1.5 Mc/s. Results are given in tables and graphs.

669.018.58 **3076**

Recent Developments in Magnetic Materials.—H. Fahlenbrach. (*Z. Ver. dtsch. Ing.*, 21st July 1950, Vol. 92, No. 21, pp. 565–570.) A survey with 38 references. The modifying effect of the new materials on the design of apparatus is indicated, both where permanent magnets and where electromagnets are used.

679.5 : [53 + 54 **3077**

Fundamentals of Synthetic-Polymer Technology in its Chemical and Physical Aspects. [Book Review]—R. Houwink. (Elsevier's Polymer Series, No. 1.) Publishers: Elsevier Publishing Co., New York and Amsterdam & Cleaver-Hume Press, London, 1948–1950, 258 pp., 28s. (*Nature, Lond.*, 7th Oct. 1950, Vol. 166, No. 4223, pp. 575–577.) "The subject matter includes the molecular and colloid chemistry of polymers, their more important mechanical and physical properties and methods of testing these, and their general processing, followed by an account of the manufacture and outstanding properties of industrial products of this type, whether obtained by chemical treatment of natural colloidal products or by synthesis from non-colloid raw materials."

679.5 : [53 + 54 **3078**

Elastomers and Plastomers: their Chemistry, Physics and Technology. [Book Review]—R. Houwink (Ed.). (Elsevier's Polymer Series, No. 3.) Publishers: Elsevier Publishing Co., New York and Amsterdam & Cleaver-Hume Press, London, 1948–1950. Vol. 1: General Theory. 495 pp., 52s. 6d. Vol. 2: Manufacture, Properties and Applications. 515 pp., 50s. 6d. Vol. 3: Testing and Analysis: Tabulation of Properties. Contributed by B. B. S. T. Boonstra, A. G. Epprecht, R. Houwink, J. H. Teeple, J. W. F. van't Wout. 174 pp., 27s. 6d. (*Nature, Lond.*, 7th Oct. 1950, Vol. 166, No. 4223, pp. 575–577.) The ground covered is similar to that for No. 1 (3077 above) but the treatment is much fuller and is extended to include also products such as natural resins and asphalts.

MATHEMATICS

519.21 + 519.271.3] : 517.9 **3079**

A Sampling Method for Determining the Lowest Eigenvalue and the Principal Eigenfunction of Schrödinger's Equation.—M. D. Donsker & M. Kac. (*Bur. Stand. J. Res.*, May 1950, Vol. 44, No. 5, pp. 551–557.)

519.3 **3080**

A Variational Method Suitable for studying the Wave Equation.—T. Kahan. (*Rev. sci., Paris*, Oct./Dec. 1949, Vol. 87, No. 3304, pp. 205–211.)

681.142 **3081**

Arithmetic Operations in a Binary Computer.—R. F. Shaw. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 687–693.)

681.142 **3082**

Electronic Pile Simulator.—P. R. Bell & H. A. Straus. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 760–763.) A calculator is described which can deal with the set of equations applicable to a chain-reaction pile. The voltage output varies as a function of time just as the neutron flux would vary in a pile. A potentiometer varies the effective multiplication factor and simulates the action of a control rod. Five delayed neutron periods are simulated. An electronic integrator is used and the accuracy is well within 1%.

681.142 **3083**

Programme Organization and Initial Orders for the EDSAC.—D. J. Wheeler. (*Proc. roy. Soc. A*, 22nd Aug. 1950, Vol. 202, No. 1071, pp. 573–589.)

681.142 **3084**

Solution of Simultaneous Equations through Use of the A.C. Network Calculator.—L. M. Haupt. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 683–686.)

51 **3085**

Progressive Mathematics. [Book Review]—P. Clyne. Publishers: Chapman & Hall, London, 1950, 270 pp., 15s. (*Beama J.*, Aug. 1950, Vol. 57, No. 158, p. 239.) Directed mainly to students of engineering and physics up to the Higher National Certificate standard. Some unorthodox methods are used. "The book is well printed and produced, and its modest price should be the means of making it available to most students."

MEASUREMENTS AND TEST GEAR

621.37.1 : 621.397.61 : 621.396.619.24 3086
Television Transmitter Lower-Sideband Measurements.—G. E. Hamilton & R. G. Artman. (*TV Engng, N.Y.*, April & May 1950, Vol. 1, Nos. 4 & 5, pp. 12–15, 25 & 14–15, 30.) Theoretical and practical considerations are discussed which are involved in the measurement of the spectral energy distribution of television signals. Account is taken of transmitter adjustment and receiver sensitivity. Measurement methods described include (*a*) r.f. excitation of the input circuit of the modulation amplifier, (*b*) sine-wave modulation of the transmitter, (*c*) composite-video-signal modulation of the transmitter. Method (*b*) is preferred.

621.317.3/.4 : 621.315.592 3087
Measurement of Electric and Magnetic Constants of Semiconductors at Ultra-High Frequency using Concentric Line.—G. Untermann. (*Z. angew. Phys.*, June 1950, Vol. 2, No. 6, pp. 233–241.) The formulae necessary for evaluating measurements on concentric lines are derived. Calculations are facilitated by the graphical presentation of certain functions, notably $z \cot z$ and $z \tan z$ for complex arguments. By means of these it is possible to determine rapidly the values of dielectric constant, conductivity, permeability and magnetic loss angle at u.h.f.

621.317.3.029.6 3088
Lines and Circuit Elements for Microwave Measurements.—O. Schäfer & R. Honerjäger. (*Arch. tech. Messen*, Aug. 1950, No. 175, pp. T87–T90.) Discusses propagation of e.m. waves in coaxial lines and waveguides, the design of terminations, attenuators, directional couplers, impedance bridges, resonator wavemeters, etc.

621.317.321.027.21 3089
The Low-Loss Measurement of Direct Voltage by Conversion into Alternating Voltage.—H. H. Rust. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 290–293.) The method previously described (1451 of June) using a carbon microphone as transducer is only suitable if the resistance of the d.c. source is low; otherwise a capacitor microphone is more appropriate, on account of its high input resistance. The unknown direct voltage is used as a polarizing voltage, and a proportional a.c. output is obtained when the microphone is exposed to a tone of constant amplitude and frequency (here 2 kc/s). With an aperiodic amplifier the lowest voltage measurable is 10^{-2} V, but sensitivity can be increased by using a selective amplifier.

621.317.324(083.74)† 3090
Development of Very-High-Frequency Field-Intensity Standards.—F. M. Greene & M. Solow. (*Bur. Stand. J. Res.*, May 1950, Vol. 44, No. 5, pp. 527–547.) A description is given of the development of two field-intensity standards which are being used at the National Bureau of Standards for the calibration of commercial field-intensity sets in the range 30–300 Mc/s. These standards are employed to establish known values of field intensity by either of two methods: (*a*) the standard-aerial method in which the open-circuit voltage at the centre of a receiving dipole is measured directly; (*b*) the standard-field method in which the current at the centre of a transmitting dipole is accurately known. The techniques used for determining the aerial current and voltage are described. The current distribution on the aerial is determined theoretically, using Schelkunoff's method, which gives the effective length. These values are compared with those obtained by measurement. Results of field tests at 100 Mc/s are presented in which the above two methods were directly compared, using horizontal polarization. Their accuracy and limitations are discussed.

621.317.333.4.015.7 : 621.315.2 3091
Location of Line Faults by Oscillographic Observation of a Pulse.—C. Béguin & G. Maugard. (*Bull. Soc. franç. Élect.*, July 1950, Vol. 10, No. 106, pp. 313–328.) A theoretical study is made of the conditions of propagation of a pulse along a line and of the distortion of pulses reflected at line faults. The pulse method of investigation is particularly suitable for coaxial telephone lines and h.v. cables, but not for lines with high attenuation. Equipment described uses a circular timebase, with arrangements for locating the steep front of the initial pulse at the zero of the scale. Pulse duration is 1–4 μs, depending on the circuit range, and peak power is 250 W. Tests on power lines are described in detail; the method is quicker than the bridge method.

621.317.335.3.029.62/.63† 3092
Complex-Dielectric-Constant Measurements in the 100-1 000-Mc/s Range.—A. G. Holtum, Jr. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 883–885.) A sample of a medium-loss or high-loss material is used as the dielectric of a capacitor terminating a slotted measuring line. The complex impedance of this termination, and hence the dielectric constant and conductivity of the lossy material, can be determined by the conventional method from the voltage s.w.r. and the position of the minimum.

621.317.336.029.64 3093
The Accuracy of Impedance Measurement with Microwaves.—F. Tischer. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1950, No. 36, 31 pp. In German, with English summary.) The theory of impedance matching is discussed and standing-wave ratio and matching error are defined; approximate formulae are derived for the case of small errors. Known types of apparatus, such as reflectometers, directional couplers, impedance bridges and comparators, are discussed. The method using a standing-wave meter is dealt with at length, this giving the best accuracy. Errors originate from two sources, the line discontinuities of the standing-wave meter and the probe used as voltage pickup. The errors can be largely eliminated by proper design. The results of the investigation have been applied in the development of two instruments, one a precision meter giving the s.w.r. to within 0.5% and the other a rotary automatically recording meter for the 10-cm band, accurate to within 3%.

621.317.352 : 621.392.5 3094
Determination of Attenuation from Impedance Measurements.—R. W. Beatty. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 895–897.) The dissipative and reflective components A_d and A_r of a linear, passive, quadripole attenuator are measured separately. A_d, a function of the attenuator efficiency, is determined from reflection-coefficient measurements of the short-circuited attenuator and A_r from a single voltage-s.w.r. measurement with the attenuator terminated by a matched load. Experimental results are in close agreement with measurements by another method.

621.317.432 3095
Eddy-Current Losses in Electrical Equipment.—A. Roth. (*Rev. gén. Élect.*, June 1950, Vol. 59, No. 6, pp. 268–278.) Formulae are derived and graphs presented for rapidly finding the approximate value of eddy-current losses in various cases. Numerical examples are given. Wattmeter methods used in industry for measuring these losses are reviewed, and precautions necessary when using them are indicated. A simple voltmeter method is described.

621.317.7 : 621.314.632.1† 3096
Design of Square-Law Rectifier Circuits for Measuring Instruments.—D. C. Walker, D. L. Richards & G. P. Horton. (*P.O. elect. Engrs' J.*, July 1950, Vol. 43, Part

2, pp. 74–77.) For accurate r.m.s. indications of speech currents, a scale having a range of at least 16 db is desirable. Networks consisting of rectifiers in combination with series and shunt resistors are described with which measurement accuracies to within about ±0.3 db have been achieved.

621.317.723 **3097**

New Types of Electrometer.—P. Böning. (*Arch. tech. Messen*, June 1950, No. 173, p. T70.) The device described consists basically of a metal cylinder, with axis horizontal, containing a fixed metal frame electrically connected to a similar frame rotatable about the axis and carrying a pointer. A potential to be measured is applied between cylinder and frames. The theory of operation is given.

621.317.726 **3098**

The New Modulation Meter.—M. Bidlingmaier. (*Frequenz*, June 1950, Vol. 4, No. 6, pp. 146–149.) Description of a peak voltmeter with an approximately logarithmic scale and an optical indicator system. The scale covers an amplitude range of about 1 : 300 and peaks of duration as short as 10 ms can be measured within 1 db.

621.317.755 **3099**

Oscillograms obtained without Timebase: 'Integral Curve' Method.—F. Perrier. (*Rev. gén. Élect.*, Aug. 1950, Vol. 59, No. 8, pp. 345–351.) A c.r.o. method is described in which a function is compared with its derivative. Examples of application include both slowly varying and rapid phenomena. Oscillograms reproduced correspond to the superposition of more than 10^5 curves and demonstrate the immobility of the trace on the screen. Thus long photographic exposures can be used to give the mean value, and the fluctuations about the mean value, of phenomena repeating at irregular intervals.

621.317.755 : 621.3.012 **3100**

High-Frequency Curve Tracer for 460-480 kc/s and 10.0-11.5 Mc/s.—A. Klemt. (*Funk u. Ton*, Aug. 1950, Vol. 4, No. 8, pp. 396–402.) A c.r.o. is described for checking i.f. band-pass filters and aligning i.f. amplifiers of broadcast receivers. The upper frequency range deals with f.m. receivers, where particular care is required.

621.317.772 **3101**

High-Frequency Phase Measurement with Direct Indication: Part 2 — With Pointer Indicators.—A. Ruhrmann. (*Arch. tech. Messen*, June 1950, No. 173, pp. T64–65.) The pointer instrument has the advantage over the c.r.o. as regards simplicity of operation and long life. Arrangements using crossed-coil and four-quadrant indicator instruments are discussed. Part 1: 2574 of October.

621.317.79 : 621.396.822 : 621.396.61 **3102**

An Instrument for the Determination of Frequency-Modulated. Hum in a Radio-Frequency Signal.—W. W. Boelens. (*Commun. News*, April 1950, Vol. 10, No. 4, pp. 101–109.) The instrument uses a very sensitive ph.m. detector which can be calibrated without any additional apparatus. The theory of the method of hum measurement [2837 of 1949 (Boelens & Stumpers)] is outlined and several special circuits incorporated in the apparatus are described. These include a high-pass filter without any inductance, a double-T RC filter and an attenuator.

621.385.001.4(083.74) **3103**

Standards on Electron Tubes: Methods of Testing, 1950.—(*Proc. Inst. Radio Engrs*, Aug. & Sept. 1950, Vol. 38, Nos. 8 & 9, pp. 917–948 & 1079–1093.) Reprints of this standard, 50IRE7.S2 (Parts I & II) may be purchased while available from The Institute of Radio Engineers, 1 East 79th Street, New York 21, at $1.25 per copy, with 20% discount for 100 or more copies.

621.396.621.001.4 **3104**

Critical Study of Measurements on Receivers.—L. Chrétien. (*T.S.F. pour Tous*, June 1950, Vol. 26, No. 260, pp. 212–217.) Methods of making electrical measurements to determine receiver performance are discussed. Standards are fixed for a.m. test signal, dummy aerial for medium and short waves, output signal, sensitivity necessary to give this output in the presence of noise. The best simple methods of checking the efficiency of the automatic control circuits and measuring the selectivity and distortion are indicated. One criticism of normal tests is that a receiver which is judged 'perfect' according to such tests may not entirely satisfy the ear of a true artist.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

536.53 : 621.316.8 : 621.396.822 **3105**

The Use of Spontaneous Voltage Fluctuations for the Measurement of Low Temperatures.—P. M. Endt. (*Physica, 's Grav.*, May 1950, Vol. 16, No. 5, pp. 481–485. In English.) Discussion of Lawson & Long's method (483 of 1947). The statistical fluctuations in the measured noise are calculated, taking account of the bandwidth of the amplifier. The calculation shows that it is not necessary to use reduced anode, screen-grid, and heater voltages on the input valve, and that a quartz crystal is essentially worse than a resistor or an LC circuit as a noise generator for temperature measurement.

536.58 : 621.314.3† **3106**

A Direct-Voltage Amplifier as Power Amplifier and Temperature Regulator.—Jellinghaus. (*See* 2990.)

537.533.73 : 621.315.611 : 539.213.26 **3107**

Electron Diffraction Apparatus for investigating Insulator Surfaces.—J. J. Trillat & S. Oketani. (*Le Vide*, July/Sept. 1950, Vol. 5, Nos. 28/29, pp. 827–830.) The apparatus, which is described in detail, includes a new type of neutralizing gun for preventing accumulation on the specimen of negative charges carried by the exploring beam. This gun uses a platinum filament coated with barium and strontium oxides and operated at a temperature below that at which vaporization occurs. Thus the investigation can extend over a long period without the specimen becoming coated. Photographs are shown of diagrams obtained with the apparatus.

538.569.2.047 : 621.315.61.011.5 **3108**

Dielectric Properties of the Human Body for Wavelengths in the 1–10-cm Range.—T. S. England. (*Nature, Lond.*, 16th Sept. 1950, Vol. 166, No. 4220, pp. 480–481.) Previously reported measurements on a wavelength of 3.18 cm (2282 of 1949) have been repeated on wavelengths of 1.27 cm and 10.0 cm. Results are tabulated and discussed, using the values obtained for water as a comparison standard.

539.16 : 614.8 **3109**

Measurement Apparatus for the Protection of Personnel against Radioactive Radiations.—J. Weill. (*Onde élect.*, July 1950, Vol. 30, No. 280, pp. 328–334.) The various radiations to be guarded against and the measurement of their intensity by means of photographic plates, Geiger counters and ionization chambers are briefly described.

549.514.51.001.8 **3110**

Applications of Quartz Crystals.—R. Villem. (*Rev. gén. Élect.*, June 1950, Vol. 59, No. 6, pp. 247–268.) The equivalent circuit of the quartz crystal and the order of magnitude of the impedances involved are discussed. The mechanisms of oscillation stabilization and of frequency selection are studied, and the advantages of using crystals for these purposes are demonstrated.

Applications described in detail include a highly stable generator for common-frequency broadcasting, the Lepaute oscillometer for observing the operation of watches, underwater sounding equipment, ultrasonic generators, and devices for measuring pressure, especially in machine tools, vehicles and power-line pylons. Filters making use of quartz crystals receive special attention. An appendix gives a résumé of the properties of T, Π ladder and bridge filters.

621.317.755 **3111**

A Cathode-Ray Oscillograph for investigating Functions of Two Variables.—S. Genç. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, Sept. 1950, Vol. 28, No. 9, pp. 342–348. In German.) A description is given of a c.r.o. with which the functions are displayed as surfaces in three dimensions. Circuit relations are established by means of which the usual deflector system comprising two mutually perpendicular e.m. fields is able to produce spot displacements corresponding to a three-field deflector system. Several photographs of screen displays are shown.

621.365.54† **3112**

A General Theory and Methods of Design for Medium-Frequency [electric] **Furnaces.**—M. Van Lancker. (*Bull. Soc. franç. Élect.*, Sept. 1950, Vol. 10, No. 108, pp. 439–455. Discussion, pp. 455–456.) Simple and generalized penetration are discussed. Parameters affecting the resistance and inductance for a furnace of infinite length are calculated, and coefficients of resistance and generalized inductance and correction factors for furnaces of finite length are derived. Form factor, field factors, and total input power are investigated. The theory is applied to the study of the design of an industrial furnace.

621.365.54† **3113**

Rapid Tempering by Induction Heating.—J. F. Libsch & A. E. Powers. (*Metal Progress*, Aug. 1950, Vol. 58, No. 2, pp. 176–180.) Short-term tempering may be performed successfully on carbon and low-alloy steels by the induction-heating method, provided the temperature is increased to compensate for the reduced time.

621.383 : 621.385.15 : 535.245.1 **3114**

Detection of Short Pulses of Light using an Electron-Multiplier Circuit.—F. Valentin. (*C. R. Acad. Sci., Paris*, 26th June 1950, Vol. 230, No. 26, pp. 2271–2272.) Light pulses from a Hg arc, with a repetition rate of 50 per sec and an instantaneous brilliance inversely proportional to their duration, are used in experiments on the molecular diffusion of light, the re-emitted flashes being received by a multiplier connected to a suitable amplifier. The signal is modulated at h.f. to enable a mains-operated a.c. amplifier to be used. Signal/noise ratio of the circuit is compared with that of a classic d.c. amplifier; for flashes of duration 80 μs the two are about equal, but in the new circuit the threshold of detection can be considerably reduced by shortening the flashes.

621.384.611.1† **3115**

The Theory of Electron Acceleration in the Alternating Magnetic Field.—Picht. (*See* 3034.)

621.384.611.2† : 621.316.726 **3116**

Frequency Control for the Bevatron Radio-Frequency Voltage.—J. Riedel. (*Elect. Engng, N.Y.*, Aug. 1950, Vol. 69, No. 8, pp. 721–722.) Summary of A.I.E.E. Summer General Meeting paper. The variable element in the control oscillator is a saturable inductance consisting of toroidal coils wound on ferroxcube III.

621.385.833 **3117**

Contrast Improvement in Electron Microscopy.—J. Hillier & E. G. Ramberg. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 273–278.) Methods of preparing specimens so as to obtain optimum contrast are discussed.

621.385.833 **3118**

Electron-Optical Properties of Space-Charge Clouds.—L. Marton & D. L. Reverdin. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, p. 842.) Tests have been made which tend to confirm the suggestion that a space-charge lens might be used as a corrective element for the reduction of the aperture defect of electron lenses. However, the experiments also support the idea that the random noise in such a space-charge cloud might reduce image definition.

621.385.833 **3119**

New Simplified Electron Microscopes.—V. E. Cosslett. (*Nature, Lond.*, 19th Aug. 1950, Vol. 166, No. 4216, pp. 305–306.) A British and an American model are briefly described, both operating at 50 kV and giving a resolving power approaching 100 Å; they cost much less than standard models hitherto available.

621.387.4† **3120**

A New Method of Operating Counter Tubes with High Resolving Power.—A. Trost. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 286–289.) A method using a thyratron circuit provides direct quantitative indication of intensity even at the very high pulse rates encountered with powerful X-rays or γ-rays. An experimental investigation of the life of quenched counter tubes is also described.

621.387.4† **3121**

The Behaviour of Counters with Pure-Vapour Filling in the Proportional and Geiger Regions.—E. Fünfer & H. Neuert. (*Z. angew. Phys.*, June 1950, Vol. 2, No. 6, pp. 241–249.) The variation of pulse height with tube voltage was measured for various vapours, and for α- and β- radiation. Counters with pure-vapour filling have a much more extensive proportional region than mixture-filled counters. For β-radiation the limit of the true proportional region corresponds to amplification factors of 10^6–10^7. With heavy vapours so-called 'oversize' pulses may occur.

621.387.4† **3122**

Three Examples of Electronic Apparatus used for [particle] **Detection.**—G. Valladas. (*Onde élect.*, July 1950, Vol. 30, No. 280, pp. 317–320.) The auxiliary apparatus required with particle detectors, viz. amplifier, selector and recorder, is discussed.

621.387.4† : 549.211 **3123**

Mobility of Electrons and Holes in Diamond.—E. A. Pearlstein & R. B. Sutton. (*Phys. Rev.*, 1st Sept. 1950, Vol. 79, No. 5, p. 907.) From c.r.o. measurements of pulse rise times with voltages of 300–5 000 V applied across a crystal of thickness 2 mm, the mobilities deduced for electrons and holes were respectively 3 900 and 4 800 cm²/sec.V, with possible errors of 15% and 20%.

621.387.4† : 549.211 : 535.215 **3124**

The Influence of Red and Infra-red Light on a Crystal Counter.—H. A. van der Velden & G. P. Freeman. (*Physica, 's Grav.*, May 1950, Vol. 16, No. 5, pp. 493–500. In English.) The influence of red light in reducing the space charge built up in a diamond crystal counter is investigated. The counting property of the crystal can be maintained for an unlimited time if the intensity of the incident light is sufficient.

621.387.42† **3125**

High-Pressure Ionization-Chamber Counters and their Use.—R. Wilson, L. Beghian, C. H. Collie, H. Halban & G. R. Bishop. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 699–705.) New techniques and counters filled with H_2, D_2 or CH_4 at pressures up to 35 atm., and also the characteristics and applications of these counters, are described.

621.387.42 : 621.3.015.7 **3126**

Pulses in Argon Counters.—L. Colli, U. Facchini & E. Gatti. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, pp. 92–93.)

621.387.422† **3127**

Boron Trifluoride Proportional Counters.—I. L. Fowler & P. R. Tunnicliffe. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 734–740.) Counters with filling of BF_3 and of calculable efficiency for neutron-beam measurements are described.

621.398 **3128**

Remote Control of [atomic] **Pile Reaction.**—J. Pottier & V. Raievski. (*Onde élect.*, July 1950, Vol. 30, No. 280, pp. 323–327.) A servo arrangement is described which has been in operation without interruption for a year and which controls the position of a neutron-absorbing plate within a cavity in the pile.

621.385.833 **3129**

Electron Microscopy: Technique and Applications. [Book Review]—R. W. G. Wyckoff. Publishers: Interscience, New York and London, 1949, 248 pp., 40s. (*Nature, Lond.*, 19th Aug. 1950, Vol. 166, No. 4216, pp. 285–286.) Includes much to instruct and interest specialists, but appeals also to a far wider audience by providing in effect 'the story of the new field of vision'.

PROPAGATION OF WAVES

531.74 : 621.396.11.029.62 **3130**

Measurement of Small Angles of Elevation of Incoming Metre Waves. Part 1: Theory.—H. Stenzel. (*Arch. elekt. Übertragung*, April 1950, Vol. 4, No. 4, pp. 125–132.) Analysis shows that with aerial systems in the horizontal plane, with horizontal polarization and adjustable directivity in the vertical plane, the measurement of small angles of elevation for metre waves is only possible with aerials of impracticable dimensions. For vertical aerial systems with horizontal polarization, however, small angles of elevation can be measured if they are at least 3/4 of the half-value width of the directional characteristic, but in order to measure an angle of 4°, the size of the aerial system must be about 10 λ.

A new method is indicated which is based on the comparison of two fixed vertical systems with different directional characteristics, the midpoints being at equal heights above the ground. This method is particularly suitable for the measurement of angles down to ¼ deg., since the dimensional requirements can be carried out in practice and the effect of the plane and horizontal ground is completely eliminated. This method will be considered more fully in part 2.

538.566 **3131**

Propagation of Electromagnetic Waves through a Stratified Medium: Part 1.—B. Salzberg. (*J. opt. Soc. Amer.*, July 1950, Vol. 40, No. 7, pp. 465–470.) A general analysis is developed which is applicable to propagation through a medium divided into m plane parallel layers, the first and last being semi-infinite. The e.m. properties of the layers are unrestricted and dissimilar, while the thicknesses of the $(m-2)$ finite layers are in general different. Formulae for the resulting reflection and transmission coefficients are derived. In part 2 the analysis will be applied to the detailed solution of specific problems.

621.396.11+621.396.67 **3132**

Symposium on Antennas and Propagation, San Diego, California, April 3-4, 1950.—(*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 958–962.) Summaries are given of 38 papers presented at the conference.

621.396.11 **3133**

Elements of Anomalous Radio Propagation.—E. Knighting. (*Met. Mag.*, March 1950, Vol. 79, No. 933, pp 74–81.) Discussion of the dependence of the refractive index of the atmosphere on the pressure, temperature and amount of water vapour. The changes with altitude of these parameters can explain radio reception at distances beyond the normal optical range, by refractive bending of the ray paths and by the formation of radio ducts.

621.396.11 **3134**

Passage of Electromagnetic Waves [of frequency] **below the Critical Frequency, through Plasma Layers of Finite Thickness.**—W. O. Schumann. (*Arch. elekt. Übertragung*, May 1950, Vol. 4, No. 5, pp. 173–174.) It is usually assumed that for frequencies below a certain critical frequency an e.m. wave incident perpendicularly on a plasma layer of infinite extent will be totally reflected, an exponentially damped stationary wave being produced within the plasma. In the case of a plasma layer of finite thickness it is found that energy can be transported through the layer, and appropriate formulae are derived.

621.396.11 **3135**

Reflection of Electromagnetic Waves at a Discontinuity of the Permittivity Gradient.—G. Eckart. (*Funk u. Ton*, July 1950, Vol. 4, No. 7, pp. 354–357.) A particular case, such as might occur in the troposphere, is considered and an expression is derived for the reflection coefficient (r). Unlike the Fresnel coefficient, r in this case is dependent on frequency, being smaller the shorter the wavelength. A table shows the angle of incidence, for values of λ from 1 cm to 1 000 m, at which $r = 1/100$, for two values of gradient jump. See also 977 of April.

621.396.11 : 535.42 **3136**

On the Diffraction of a Radar Wave by a Conducting Wedge.—R. B. Watson & C. W. Horton. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 802–804.) "Diffraction patterns of radar waves have been measured about the edge of a perfectly conducting wedge. Theoretical patterns have been calculated using an asymptotic solution suggested by Pauli (906 of 1939). Good agreement is observed between experimental and calculated patterns. The thin wedge tested showed much similarity in diffracting properties to a suitable semi-infinite conducting screen."

621.396.11.029.51 **3137**

Polarization of Low-Frequency Radio Waves Reflected from the Ionosphere.—A. H. Benner, C. H. Grace & J. M. Kelso. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 951–952.) Vertical-incidence measurements of the limiting polarization of 150 kc/s e.m. waves, together with theoretical calculations, indicate that (*a*) observed split echoes are not due to magneto-ionic splitting; (*b*) the polarization is left-handed; (*c*) the wave leaves the layer at a level where the collision frequency is roughly 0.8×10^6/sec.

621.396.11.029.55 **3138**

Investigations on the Propagation of Short Waves over Great Distances.—W. Messerschmidt. (*Arch. elekt. Übertragung*, May 1950, Vol. 4, No. 5, pp. 181–188.) Report of experiments conducted in 1938 on the possibility of zigzag reflections in the transmission of s.w. signals over great distances. The transit time of a pulse transmitted and re-transmitted over known distances was measured. Two fixed stations or one fixed station and one airborne re-transmitting station were used;

distances involved were chiefly about 8 000 km. The 'detour factor' (ratio of actual path length to great-circle distance) is correlated with the apparent height of the relevant ionospheric layer simultaneously measured at different places along the wave path. The transit time was often constant for long periods. At other times a jump from one value to another occurred; this is attributed to a variation in the number of zig-zag reflections.

621.396.11.029.55 **3139**

Studies of Multiple Circuits of the Earth by Short-Wave Signals.—H. A. Hess. (*Fernmeldetech. Z.*, July 1950, Vol. 3, No. 7, pp. 243–248.) Account of an investigation made on 19th November 1944, on a frequency of 19.947 Mc/s. Morse signals of duration 12 ms were sent out at 0.5-sec intervals from DLO (Berlin) and the echoes were observed at Randers (Denmark) and Gatow (Berlin). Results are shown graphically. The times for the second circuit lay between 0.137 6 and 0.138 4 sec. Periodic amplitude fluctuations of the echo were correlated with multiple paths and the movements of ionosphere layers. The high intensity maintained after repeated circuits is evidence of propagation in a narrow great-circle beam.

621.396.11.029.6 **3140**

The Propagation of Very Short Electromagnetic Waves.—A. Grün. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 294–301.) Approximate formulae derived by geometrical ray treatment are compared with more accurate formulae taking account of diffraction. In the decimetre range certain simple approximations are sufficient, since reflection and divergence factors do not differ greatly from unity, and it is safe to neglect both irregularities of the earth's surface and the fine variation of refractive index with height. Fluctuations of ray curvature due to weather conditions are important in this frequency range, producing a variable interference field which is the main cause of fading; this can be overcome by suitable choice of wavelength, aerial height, and range. The effects of disturbing reflections from isolated obstacles and of unusual refraction phenomena are discussed briefly.

621.396.11.029.64 : 535.42 **3141**

Diffraction Pattern in a Circular Aperture Measured in the Microwave Region.—C. L. Andrews. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 761–767.) Measurements were made of the diffraction patterns of circular apertures (of diameter from λ to 8λ) in and near the aperture planes, for incidence of a plane-polarized e.m. wave of 8-cm wavelength. From Young's theory the points of maximum intensity near the aperture were calculated and the results checked by experiment.

621.396.81 : 551.510.535 **3142**

Geometrical Optics of Ionospheric Propagation.—K. Rawer. (*Nature, Lond.*, 19th Aug. 1950, Vol. 166, No. 4216, p. 316.) Three focusing effects have been observed, due respectively to refraction, curvature of the reflecting layer, and the spherical form of the earth. Neither the first nor the third of these effects can be applied regularly for ionospheric prediction. The method of constructing a prediction curve (field-intensity/distance) to take account of the second effect is indicated. See also 514 of 1948, 717 of March and 1229 of May (Lejay & Lepechinski).

621.396.812.3 **3143**

Periodic Fading in Short-Wave Propagation.—H. A. Hess. (*Funk u. Ton*, July 1950, Vol. 4, No. 7, pp. 329–340.) Photographic records of wave-trains of signals received from long-distance oversea transmissions in 1944 are reproduced and analysed. Multiple-hop and round-the-world signals are considered in comparing ionospheric path lengths to determine the rapidity of movement of the reflecting layer. The beat frequencies observed in certain received signals, in one instance a 34-c/s frequency modulation of a 15-Mc/s signal, cannot be explained by vertical movement of the F-layer. In the region of the critical frequency, multiple reflections will not normally occur and fading is minimized. Similarly, periodic fading can be avoided by using strongly modulated telegraphy signals.

621.396.812.5 **3144**

Drift Phenomena for Rapid Fluctuations of Field Strength of Ionospheric Echoes.—J. Krautkrämer. (*Arch. elekt. Übertragung*, April 1950, Vol. 4, No. 4, pp. 133–138.) Observations obtained from three recorders in line indicate that drift of the reflection region may occur in the ionosphere. The magnitude and direction of the movement are determined from the difference in the time of observation of rapid fluctuations at three recording stations at the corners of a right-angled triangle. Velocities up to several hundred m/s have been observed. In the E layer a definite directional trend is noted, but in the F layer, where higher velocities are more frequent, no such trend is apparent. The observations are explained by an interference effect of the waves reflected from different irregularities in the layer. Preferred direction in the E layer is westward.

621.396.812.5 **3145**

Origin of the Mögel-Dellinger Effect.—H. Siedentopf. (*Arch. elekt. Übertragung*, March 1950, Vol. 4, No. 3, pp. 97–98.) Review of observations reported by various authors, and of possible causes of the effect.

621.396.812.5 : 523.746 **3146**

Results of Statistical Analysis of Fade-Outs.—D. Stranz. (*Arch. elekt. Übertragung*, June 1950, Vol. 4, No. 6, pp. 217–218.) Correlation of sunspot data with 130 cases of total disappearance of radio signals observed during 1948.

RECEPTION

621.396.621 **3147**

The Broadcasting Receiver and the Pickup Connection.—M. Lechenne. (*T.S.F. pour Tous*, June 1950, Vol. 26, No. 260, pp. 235–237.) Suggested additions to the receiver circuit to improve the quality of reproduction are: (*a*) at least 6 db non-selective negative feedback; (*b*) a special adjustable tone-control circuit with a linear potentiometer for the pickup position; (*c*) a 4.5- or 9-kc/s filter in the l.f. amplifier anode circuit.

621.396.621 : 621.396.822 **3148**

Receiver Sensitivity and its Limitation by Background Noise.—J. Rousseau. (*T.S.F. pour Tous*, June 1950, Vol. 26, No. 260, pp. 218–221.)

621.396.621.54 : 621.396.662.4 **3149**

Calculation of the Three-Point-Alignment Circuit in Superheterodyne Receivers.—O. Meisinger. (*Arch. elekt. Übertragung*, March 1950, Vol. 4, No. 3, pp. 99–104.) The whole of the auxiliary circuit, comprising fixed capacitors, which in superheterodyne receivers makes three-point alignment possible, is treated as a quadripole. Calculation shows that the short-circuit and open-circuit impedances, seen from the variable capacitor, are given by polynomials involving three parameters. Practical formulae and tables, of general application, are given which enable all the necessary calculations to be carried out with sufficient accuracy on a slide rule for inductance and capacitance values, bandwidth, etc.

621.396.621.57 **3150**

Receivers with Crystal Detectors (' Crystal-Video ').—S. Marmor. (*Ann. Télécommun.*, July 1950, Vol. 5, No. 7, pp. 266–275.) Results are presented of measurements made at the C.N.E.T. on a silicon crystal of average characteristics at a wavelength of 10 cm. An explanation is given of the poor sensitivity of receivers using crystal detectors as compared with superheterodyne receivers. Difficulties encountered in constructing high-gain crystal-detector sets for pulse reception are described, and steps proposed by American designers (see 206 and 1638 of 1949) to prevent overshoots causing prolonged desensitization are reviewed. Details are given of a set designed at the C.N.E.T., and photographs are shown of the output pulses obtained.

621.396.8.015.7† : 621.396.822 **3151**

The Effect of a Video Filter on the Detection of Pulsed Signals in Noise.—D. Middleton. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 734–740.) Theoretical examination of the effect of inserting a video filter of finite bandwidth on the observability of pulsed signals (of Gaussian or rectangular shape) in random noise. When the pulse and i.f. filter are matched, i.e., when they are each other's conjugate Fourier transforms, a video filter of infinite bandwidth gives the best results with weak signals. This is also the case when the spectral width of the pulses is greater than that of the i.f. filter, but a video filter of suitable bandwidth gives an improvement when the i.f. filter is wider than necessary for the length of pulse used. Curves are given showing the effect of the video filter on the signal/noise ratios in the different cases.

621.396.823+621.397.823 **3152**

Telephonic and Radio Interference from High-Voltage Systems.—C. W. Marshall. (*Engineering, Lond.*, 4th Aug. 1950, Vol. 170, No. 4410, p. 103.) Abridged version of report of the International Study Committee to the C.I.G.R.E., 1950. Cases of interference recorded by the B.E.A. during 1949 are tabulated. 53 relate to radio and 28 to television interference.

621.396.828 **3153**

Research Laboratories of the British Electricity Authority.—J. S. Forrest. (*Nature, Lond.*, 26th Aug. 1950, Vol. 166, No. 4217, pp. 334–335.) Investigations undertaken include research on h.v. transmission using a line 800 yd long operated at 250–300 kV. The intensity of the radio interfering field from the line is being measured and comparisons are being made of the signal/noise ratios for a.m. and f.m. transmissions. Good television reception can be obtained with the aerial only 10 yd from the line conductors.

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **3154**

Recent Developments in Communication Theory.—C. E. Shannon. (*Tech. Mitt. schweiz. Telegr.-Teleph-Verw.*, Sept. 1950, Vol. 28, No. 9, pp. 337–342. In German.) Translation of article noted in 1764 of July.

621.39.001.11 **3155**

Introduction to Signal and Information Theories.—J. Loeb. (*Ann. Télécommun.*, July 1950, Vol. 5, No. 7, pp. 246–254.) A tentative synthesis of published studies in this field. Emphasis is laid on fundamental problems rather than on the theories developed. The discussion covers: (*a*) the analytical signal [1293 of 1948 (Ville)]: (*b*) definition of quantity of information for the case of discrete signals; (*c*) the case of continuous signals; (*d*) the relation between information theory and statistical physics.

621.39.001.11 **3156**

Multiplex and Theory of Communications.—J. Icole. (*Ann. Télécommun.*, Aug./Sept. 1950, Vol. 5, Nos. 8/9, pp. 291–297.) The coefficient of utilization of a radiotelephony channel is defined and its value is calculated approximately for various cases of f.m. and p.m. Its variation with different parameters is determined and shown graphically. The advantage of using several interdependent channels on a single carrier is demonstrated.

621.396.41 **3157**

Comparison between Multichannel Systems with Common and Multiple Carriers.—P. Güttinger & G. Valko. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 396–401.) From a theoretical standpoint, the difference between common-carrier and multiple-carrier multichannel systems lies mainly in the causes of crosstalk. With common-carrier systems, both linear distortion in the filters and nonlinearity of the modulation and demodulation processes are responsible, whereas with multicarrier systems, nonlinearity of mixer and output stages is the main cause. Experimental multichannel multicarrier equipment is described, and the most essential technical and test data are given.

621.396.619.11/.13 : 621.397.61 **3158**

On the Simultaneous Amplitude and Frequency Modulation of a Carrier Wave.—F. Kirschstein. (*Funk u. Ton*, June 1950, Vol. 4, No. 6, pp. 282–292.) Experiments made in 1939 consisted in modulating the amplitude of a low-power 200-kc/s carrier with speech currents and at the same time transmitting a coded signal by keying the carrier to produce a tone of a few hundred c/s. No interference was observed. Using a similar circuit the a.m. carrier was then modulated in frequency by four telegraphy tones of frequencies 120, 360, 600 and 840 c/s. With a.m. above 80%, slight distortion of the f.m. tones occurred. Using two speech channels the f.m. channel was affected by crosstalk. Application of the method for d.s.b. television transmission is discussed, the frequency of the vision-signal carrier being modulated to provide the sound channel.

621.396.619.14 **3159**

Product Phase Modulation and Demodulation.—D. B. Harris. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 890–895.) A modulating voltage e_m impressed in parallel on sine and cosine phase converters produces at their outputs voltages proportional to the functions $\sin ke_m$ and $\cos ke_m$. With two balanced modulators, these modulate respectively the carrier wave, $\cos \omega t$, and the carrier displaced in phase by 90°, $\sin \omega t$, the outputs being added to produce a phase-modulated wave according to the identity $\cos ke_m \cos \omega t + \sin ke_m \sin \omega t = \sin(\omega t - ke_m)$. The phase converters proposed are oscilloscope tubes with the fluorescent screen replaced by an anode for collecting electrons. A mask is interposed in the beam to produce a voltage proportional to the sine or cosine of the linear beam deflection, which in turn is proportional to the modulating voltage applied to the deflection plates. Phase deviations up to $\pm 25\pi$ radians should be obtainable.

621.396.65 **3160**

Planning Radio Relays.—W. Steinemann. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 410–414.) Discussion of the various factors which must be taken into account.

621.396.65 **3161**

Fundamentals for the Planning of Beam Radio Links.—J. Kornfeld. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, July/Aug. 1950, Vol. 4, Nos. 7/8, pp. 85–91.)

621.396.65 **3162**

A Multichannel Metre-Wave Radio Link with Terminal Stations Outside the Optical Range.—A. Heilmann. (*Fernmeldetech. Z.*, July 1950, Vol. 3, No. 7, pp. 221–233.) Experimental R/T links installed between Berlin and the Western Zone of Germany in and since 1948 are described. Selection of terminal sites in relation to path configuration is discussed; useful results can be expected even when neither terminus is at high elevation. F.m. is used. A link operating on 64 Mc/s in one direction and 68 Mc/s in the other, with a frequency deviation of ± 75 kc/s, gave improved quality and less lost time as compared with earlier links on lower frequencies and with smaller frequency deviations. Receiver input voltages have been recorded continuously for some months, and charts are shown and discussed. An appendix develops formulae for the nonlinear distortion.

621.396.65 **3163**

Wave Propagation Studies in the Alps.—W. Klein. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 387–395.) See 2326 of 1949.

621.396.65 : 621.396.5 **3164**

Multichannel Common-Carrrier Radiocommunication System.—W. Zimmermann. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 373–378.) A description of the equipment used in the Zürich/Geneva R/T relay. The system uses common-carrier multichannel transmission, a single carrier wave being modulated in frequency by an i.f. signal derived from the frequency-shifted channel signals. Independent 'go' and 'return' channels are used. The frequency range is 150–220 Mc/s and the output of the terminal and repeater transmitters is 50 W. Robust corner reflectors with folded dipoles are used for transmission and for reception. Stand-by equipment is provided.

621.396.65 : 621.396.5 **3165**

Multiplex Radiotelephone Relays with Pulse-Modulated Microwaves.—H. J. v. Baeyer. (*Brown Boveri Rev.*, Dec. 1949, Vol. 36, No. 12, pp. 379–386.) Description of a 2-way R/T relay operating on frequencies between 1.9 and 2.1 kMc/s and providing 23 telephony channels and one service channel. Pulse-time modulation is used for the speech channels while width modulation is applied to the service-channel pulses. The r.f. pulse power is 30–50 W for a duty cycle of 1 : 5 and the parabolic reflectors commonly used have a gain of about 25 db. With the attenuation figures recommended by the C.C.I.F., the a.f. band extends from 300 to 3 400 c/s.

621.396.65 : 621.396.619.16 **3166**

Methods of Modulation with Frequency Sharing and with Time Sharing (Pulse Modulation) for Multichannel Directional Radio Links.—H. Holzwarth. (*Frequenz*, Feb.–April 1950, Vol. 4, Nos. 2–4, pp. 33–40, 64–71 & 97–101.) The principles of various types of modulation are described and the improvement in signal/noise ratio obtainable by the different systems is investigated. Using double f.m. or p.ph.m., crosstalk between channels may be kept slightly lower than with f.m., which is the best method for single-channel working. Amplitude spectra are given for most of the known modulation systems, p.a.m. and p.w.m. being particularly considered, since these occur in the end stages of most p.m. systems. The distortion is calculated for each method of modulation; with more than six channels distortion is normally extremely small.

621.396.65 : 621.396.822 **3167**

The Signal/Noise Ratio in a Decimetre-Wave Relay Chain.—P. Barkow. (*Arch. elekt. Übertragung*, April 1950, Vol. 4, No. 4, pp. 155–158.) Measured values are compared with values calculated from three different formulae.

621.396.65 : 621.397.5 **3168**

A Portable Microwave Television Radio Link.—(*Engineer, Lond.*, 4th Aug. 1950, Vol. 190, No. 4932, p. 128.) Developed by Standard Telephones and Cables for use in a motor van, this f.m. equipment operates on a frequency of about 4 000 Mc/s with a radiated power of 300 mW. The transmitting and receiving circuits are mounted in weather-proof canisters on their associated paraboloid aerials and are respectively connected by coaxial cable to a control and monitor unit, and to a seven-stage i.f. amplifier and a discriminator unit within the van.

621.396.65 : 621.397.5 **3169**

The London/Castleton Experimental Radio-Relay System.—A. H. Mumford, C. F. Booth & R. W. White. (*P.O. elect. Engrs' J.*, July 1950, Vol. 43, Part 2, pp. 93–99.) A wide-band f.m. system for the transmission of television signals. The mean carrier frequency is 195 Mc/s and four intermediate relay stations are used. To minimize feedback at the relay stations, the receiving and transmitting equipments are located on opposite sides of suitable hills and connected by land line. Rhombic aerials with a forward gain of 15 db with respect to a $\lambda/2$ dipole and with a front/back ratio of 25 db also help to obtain an attenuation between the transmitting and receiving aerials at a repeater station exceeding 120 db. The terminal- and intermediate-station circuits are described and an indication is given of the quality of the transmission of pulse and television signals. See also 2026 of August (Mumford & Booth).

621.396.65.029.63 **3170**

A Wide-Band V.H.F. Radio-Relay System.—W. S. McGuire. (*A.W.A. tech. Rev.*, June 1950, Vol. 8, No. 4, pp. 295–307.) See 745 of March.

621.396.712 : 534.86 **3171**

Audio-Frequency Equipment for Broadcasting Services.—J. E. Telfer. (*A.W.A. tech. Rev.*, June 1950, Vol. 8, No. 4, pp. 309–340.) See 2027 of August.

621.396.931 : 621.396.619.13 **3172**

Mobile Radio Equipment, Type SRR 192.—D. J. Braak. (*Commun. News*, April 1950, Vol. 10, No. 4, pp. 120–125.) Two pre-set frequencies are available in the bands 70–78 Mc/s and 80–86 Mc/s. The frequencies are crystal controlled and f.m. is used.

621.396.932 **3173**

The Port of Liverpool V.H.F. Radio System.—(*Electronic Engng*, Aug. 1950, Vol. 22, No. 270, pp. 328–330, 337.) See also 2633 of November.

621.396.932.004.15 **3174**

Radio for Merchant Ships. Performance Specification for Lifeboat Portable Radio Equipment. [Book Notice]—Publishers: H. M. Stationery Office, London, 4d. (*Govt Publ., Lond.*, July 1950, p. 20.)

SUBSIDIARY APPARATUS

621.316.7.078 **3175**

Contribution to the Study of Automatic Regulation.—M. Cuénod. (*Bull. schweiz. elektrotech. Ver.*, 2nd Sept. 1950, Vol. 41, No. 18, pp. 673–678. In French, with German summary.) The methods of operational calculus are used to study the variations of the regulated quantity following on a disturbance. These variations depend not only on the dynamic characteristics of the regulator, but also on other elements, such as the exciter and generator in the case of voltage regulation. The use of Nyquist curves (response functions) facilitates theoretical investigation of conditions for stability and of variations of the regulated quantity, thus permitting comparison with results obtained in practice.

621.316.722.1 **3176**

Voltage Stabilizer for 200-kV Acceleration.—J. T. Dewan. (*Rev. sci. Instrum.*, Aug. 1950, Vol. 21, No. 8, pp. 771–772.) A stabilization ratio of 40 is achieved by the use of a 2-stage direct-coupled feedback amplifier, controlling a series regulating pentode. The error signal applied to the amplifier is the difference between a stable balancing voltage and a fraction of the main output, tapped off a 250-MΩ wire-wound bleeder resistor. Standard regulating devices are used for the supply voltages and pentode heater current to minimize amplifier drift.

621.355 **3177**

Electrical Accumulators: Recent Patents.—L. Jumau. (*Rev. gén. Élect.*, Aug. 1950, Vol. 59, No. 8, pp. 323–343.) A review of developments in acid and alkaline types of cell. Thermoplastics are being used more and more for cases, separators, frames, etc.

771.36 **3178**

A 100 000 000-Frame-per-Second Camera.—M. Sultanoff. (*Rev. sci. Instrum.*, July 1950, Vol. 21, No. 7, pp. 653–656.) High photographing rates are obtained with a multislit focal-plane shutter which is transported optically across the film plane by means of a rotating mirror. Application is to self-luminous phenomena such as are associated with explosions.

TELEVISION AND PHOTOTELEGRAPHY

621.396.823 + 621.397.823 **3179**

Telephonic and Radio Interference from High-Voltage Systems.—Marshall. (*See* 3152.)

621.397.335 **3180**

The Effect of Interference on the Synchronization of [television] **Timebases, and the Remedies to be Applied.**—H. Somers. (*Rev. belge Électronique*, May/June 1950, Vol. 2, Nos. 13/14, pp. 3–8.) Synchronization is liable to be destroyed by interference, particularly when negative modulation is used. This disadvantage can be avoided by providing a local control voltage to maintain correct phasing of the scanning. Particular systems discussed are: direct control of the sawtooth oscillations; automatic phase control of a sine-wave oscillator by means of a reactance valve; flywheel circuits. See also 2336 of 1949 (Clark).

621.397.5 **3181**

TV in England.—J. Moir. (*FM-TV*, Aug. 1950, Vol. 10, No. 8, pp. 12–13, 38.) A report on B.B.C.-controlled development.

621.397.5 : 535.241.44 **3182**

Brightness and Contrast in Television.—P. C. Goldmark. (*J. Brit. Instn Radio Engrs*, June 1950, Vol. 10, No. 6, pp. 219–225.)

621.397.5 : 621.396.65 **3183**

A Portable Microwave Television Radio Link.—(*See* 3168.)

621.397.5 : 621.396.65 **3184**

The London/Castleton Experimental Radio-Relay System.—Mumford, Booth & White. (*See* 3169.)

621.397.5(083.74) **3185**

Standards for Television Systems.—(*Nature, Lond.*, 16th Sept. 1950, Vol. 166, No. 4220, pp. 472–473.) After examining the state of television in the U.S.A. and in various European countries in March and April 1950, a study group of the C.C.I.R. recommended the following points to the main committee:—(*a*) systems should be independent of power supply frequency; (*b*) picture aspect ratio should be 4 : 3; (*c*) line interlacing should be used in the ratio 2 : 1; (*d*) asymmetric sideband transmission should be adopted for the vision signal; (*e*) standardization of the polarization of the radio transmission is not necessary. Present line standards were retained by France, Great Britain and the U.S.A. See also 2642 of October.

621.397.6 **3186**

Three-Colour Television System with Faithful Reproduction.—F. Lachner. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, May/June & July/Aug. 1950, Vol. 4, Nos. 5/6 & 7/8, pp. 63–70 & 99–103.) Colour theory is dealt with at some length and the method of representing a colour stimulus by trichromatic coordinates is explained. When applied to colour television the analysis leads to the requirement at the transmitter of colour filters whose frequency response curves have a negative portion between two positive ones. In practice this condition can be simulated by substituting for the negative-response filter one with a positive response of equal absolute magnitude and reversing the current from the associated pickup tube. To make the proper signal additions possible, three pickup tubes, each with associated partial filter, are required for each primary colour. Cross-controlled systems, i.e., where fractions of the signal corresponding to one colour contribute to the control of the other two colours at the receiver, are also discussed.

621.397.6 : 535.88 **3187**

Recent Progress in Large-Screen Projection of Television Pictures.—A. Cazalas. (*Ann. Télécommun.*, Aug./Sept. 1950, Vol. 5, Nos. 8/9, pp. 298–306.) Developments in cinema television are surveyed, both intermediate-film and projection methods being considered. A projection tube is described in which the fluorescent screen is excited continuously by an auxiliary cathode a little distance from and of about the same area as the screen. Passage of the scanning beam across this cathode produces point-to-point variations of its emission and hence of screen brightness.

621.397.61 : 621.396.619.11/.13 **3188**

On the Simultaneous Amplitude and Frequency Modulation of a Carrier Wave.—Kirschstein. (*See* 3158.)

621.397.61 : 621.396.619.24 : 621.317.1 **3189**

Television Transmitter Lower-Sideband Measurements.—Hamilton & Artman. (*See* 3086.)

621.397.62 **3190**

The TV5 De Luxe.—A. V. J. Martin. (*Télévision*, July/Aug. 1950, No. 5, pp. 133–140.) Detailed design for a reliable, high-quality television receiver, presented as suitable for manufacturers who do not run a television research department of their own.

621.397.645 **3191**

Television Intermediate-Frequency Amplifiers.—A. Coenraets. (*Rev. belge Électronique*, May/June 1950, Vol. 2, Nos. 13/14, pp. 9–14.) General considerations of bandwidth, gain and frequency response are discussed, typical circuits are described and practical hints on screening are given.

621.397.8 **3192**

Flicker and Colour Fringing Phenomena in Colour Television.—P. C. Goldmark. (*J. Brit. Instn Radio Engrs*, June 1950, Vol. 10, No. 6, pp. 208–217.) The determination of the threshold of flicker and the maximum permissible highlight illumination in the sequential colour system are discussed. Flicker would be inappreciable at a colour-frame frequency of 60/sec, but a frequency of 48/sec has been adopted due to bandwidth considerations, giving a threshold of flicker at 23 foot-lamberts for an observation distance seven times the picture height. In a European 50/sec system this value would increase to 40 foot-lamberts. Tests with the field-sequential system have proved that colour fringing is of rare occurrence.

621.397.8 **3193**

95-Mile TV Reception.—R. F. Allison. (*FM-TV*, Aug. 1950, Vol. 10, No. 8, pp. 14–15.) A report on results obtained under extremely adverse conditions.

621.397.62 **3194**

The Principles of Television Reception. [Book Review]—A. W. Keen. Publishers: Pitman & Sons, London, 1950, 319 pp., 30s. (*J. Brit. Instn Radio Engrs*, Aug./Sept. 1950, Vol. 10, Nos. 8/9, p. vii.) The book is addressed to the technician rather than the engineer and is nonmathematical. Numerous references facilitate further study, and both British and American practice are described.

TRANSMISSION

621.396.619.029.64 : 621.396.611.4 **3195**

Microwave Modulation by Variable Circuit Elements comprising Waveguides or Cavity Resonators.—A. N. Bhattacharyya. (*Indian J. Phys.*, April 1949, Vol. 23, No. 4, pp. 175–183.) A driving mechanism similar to that of an electrodynamic loudspeaker is used to vary the dimensions of a waveguide or cavity resonator according to the speech signals, so that microwaves passing through the waveguide may be modulated in either amplitude or phase or the output of the cavity resonator modulated in amplitude.

VALVES AND THERMIONICS

537.533 : 538.3.029.6 **3196**

Quantum Effects in the Interaction of Electrons with High-Frequency Fields.—J. C. Ward. (*Phys. Rev.*, 1st Oct. 1950, Vol. 80, No. 1, p. 119.) Treating the electron as quantized and the field as classical, the phase-integral approximation is used to predict the probability of energy transfer between the microwave field inside a resonator and electrons projected through the field. When the number of quanta transferred is large, the result tends to that obtained by classical theory.

539.233 : 535.215 **3197**

Photoadsorption of a Thin Layer of Barium.—Biguenet. (*See* 3030.)

621.315.59 : 621.385 **3198**

A Crystal Amplifier with High Input Impedance.—O. M. Stuetzer. (*Proc. Inst. Radio Engrs*, Aug. 1950, Vol. 38, No. 8, pp. 868–871.) An amplifier is described consisting of a point- or line-type metal/semiconductor contact, in the neighbourhood of which a high electric field can be applied between an additional electrode and the crystal surface. This can be used to control the current flowing through the rectifying contact. The device has been termed a 'fieldistor'. A.c. response, amplification, noise and d.c. measurements show that the device has a high input impedance and appears useful as an impedance transformer with an appreciable current and power gain at lower frequencies.

621.383.42 **3199**

Constitution and Mechanism of the Selenium Rectifier Photocell.—J. S. Preston. (*Proc. roy. Soc. A.*, 22nd Aug. 1950, Vol. 202, No. 1071, pp. 449–466.) Experiments are described which indicate the structure and mode of operation of the thin surface film in the Se photocell. Preliminary results on films of Au, Al and Cd, prepared by evaporation in a high vacuum, established the importance of CdO as a film material. A technique is described for sputtering thin films of this compound having high light-sensitivity and conductivity, and open-circuit voltages up to 0.5 V under high illumination. Double films of ZnO and Au were also investigated; these gave a lower sensitivity. It is suggested that in the practical photocell, the essential feature is a contact between two suitable semiconductors of opposite types.

621.385.001.4 (083.74) **3200**

Standards on Electron Tubes: Methods of Testing, 1950.—(*See* 3103.)

621.385.029.62/.63 **3201**

A Survey of Modern Radio Valves: Part 5—Valves for Use in the Range 30-3 000 Mc/s.—R. W. White. (*P.O. elect. Engrs' J.*, July 1950, Vol. 43, Part 2, pp. 78–84.) The poor performance of normal valves at the higher frequencies is discussed and the more important contributory factors are indicated. Desirable design features are tabulated and examples of valves specially designed for use in the above range are briefly described. Part 4: 2058 of August.

621.385.029.63/.64 + 621.396.615.14 **3202**

Transmitting Valves for Decimetre and Centimetre Waves.—F. M. Penning. (*Commun. News*, April 1950, Vol. 10, No. 4, pp. 109–118.) A review of developments resulting from the application of transit-time effects, the use of cavity resonators, the transfer of energy to the h.f. field by induction, and the use of pulse methods.

621.385.029.63/.64 **3203**

Traveling-Wave Tubes: Part 3.—J. R. Pierce. (*Bell Syst. tech. J.*, July 1950, Vol. 29, No. 3, pp. 390–460.) Chapter VII develops equations which sum up, in terms of the more important parameters, the linear operation of travelling-wave valves for small values of the gain parameter. The effect of the various parameters on the rate of increase and velocity of propagation of the three forward waves is dealt with in the next chapter. Chapter IX discusses the effect of introducing losses into the circuit and of severing the helix. In chapter X the factors affecting the noise figure are discussed and the conditions for low noise are given. The possibility of the amplification of a nearly synchronous backward-travelling wave is investigated briefly in chapter XI. Appendices deal with the evaluation of the space-charge parameter Q, diode equations, the evaluation of impedance and Q for thin and solid beams, and the calculation of gain. Part 1: 1810 of July. Part 2: 2377 of October.

621.385.029.63/.64 **3204**

The Travelling-Wave Valve.—L. Brück. (*Arch. Elektrotech.*, 1950, Vol. 39, No. 10, pp. 633–647.) Principle, construction, and properties are described. Details are given for correct design of the electron gun. Alternative delay-line systems are discussed and the influence of voltage, current and helix dimensions on amplification and available h.f. output power are demonstrated by reference to measured characteristics and simplified equations. The possibility of self-excitation and its suppression are considered.

621.385.029.63/.64 **3205**

The Efficiency of the Travelling-Wave Valve.—O. Döhler & W. Kleen. (*Arch. elekt. Übertragung*, June 1950, Vol. 4, No. 6, pp. 207–212.) Continuation of previous work (2669 of 1949). Expressions are derived for electronic efficiency, circuit efficiency and total efficiency. Circuit efficiency can be calculated exactly, but the formula for electronic efficiency is based on approximations. These are justified by the similarity of results obtained by different methods of investigation.

621.385.029.63/.64 **3206**

On the Operation of the Travelling-Wave Tube at Low Level.—R. Kompfner. (*J. Brit. Instn Radio Engrs*, Aug./Sept. 1950, Vol. 10, Nos. 8/9, pp. 283–289.) The small-signal theory of the travelling-wave valve is developed on the assumption of finite distributed attenuation in the helix and beam voltages other than the 'synchronous' voltage. On restricting the gain parameter z to values <2, a simplified analysis gives results not more than about 6% in error. The voltage gain is then derived for the first 'zero-gain' point, when the valve produces infinite attenuation of an input signal. Under these conditions a measurement of beam current enables an estimate to be made of the effective impedance of the helix, a parameter of considerable importance in design. Theoretical and experimental results are presented.

621.385.032.213 **3207**

Boride Cathodes.—J. M. Lafferty. (*Phys. Rev.*, 15th Sept. 1950, Vol. 79, No. 6, p. 1012.) The thermionic emission properties of the borides of the alkaline-earth and rare-earth metals and thorium have been investigated. These compounds all have the same formula MB_6 and the same crystal structure consisting of a 3-dimensional boron framework in whose interlattice spaces the metal atoms are embedded. The valence electrons of the metal atoms are not accepted by the B_6 complex, thus releasing free electrons which impart a metallic character to these compounds. LaB_6, for example, has a specific resistance of 27 $\mu\Omega$.cm. at room temperature and a positive resistance temperature coefficient of 0.071 $\mu\Omega/°C$. The compounds are very refractory, with melting points above 2 100°C and they are very stable chemically; moisture, oxygen and even HCl do not react with them. At a sufficiently high temperature, surface evaporation of the metal atoms occurs, but is compensated by diffusion from underlying cells so that an active surface is constantly maintained. This feature, together with the high electrical conductivity and high thermal and chemical stability, makes such materials ideal for cathodes. The rare-earth borides have better emission properties than the others, LaB_6 giving the highest emission, nearly twice that of BaB_6 and over 10 times that of CaB_6. Boride cathodes require no special activation; when heated for a few minutes at 1 400–1 600°C for outgassing, they are found to be completely active. Pulsed emission is the same as the d.c. emission. Owing to diffusion of the boron atoms into the lattices of refractory metals normally used as cathode bases, and consequent collapse of the boron framework, tantalum carbide or carbon should be used as the support for boride cathodes.

621.385.032.216 **3208**

The Conduction Mechanism in Oxide-Coated Cathodes.—R. Loosjes & H. J. Vink. (*Philips Res. Rep.*, Dec. 1949, Vol. 4, No. 6, pp. 449–475.) A full account of the work noted in 491 of February. If σ is the conductivity of the oxide coating, T the absolute temperature, I the current (mA/mm²) and V the voltage applied across a 100-μ coating, the curves for log σ against $1/T$ and for I against V can be divided into three parts: (*a*) below 800°K, (*b*) 800-1 000 K, (*c*) above 1 000 K. The log σ curves have low slope in ranges (*a*) and (*c*) and are steeper in range (*b*), while the I/V curves are linear in ranges (*a*) and (*c*) and curved in range (*b*). These results are explained by postulating two conduction mechanisms operating in parallel, one being the electronic conduction through the particles of the oxide coating, the other the conduction through the electron gas in the pores of the coating. A calculation based on the known emission of a well-activated cathode gave a value for the conductivity of the same order of magnitude as that determined experimentally. See also 2934 above.

621.385.2/.3 **3209**

Vacuum Tubes with Mutually Bombarding Oxide Cathodes.—E. G. Hopkins. (*J. appl. Phys.*, Aug. 1950, Vol. 21, No. 8, pp. 841–842.) A diode with closely spaced oxide electrodes can be made to pass a.c. after the removal of the initial heating source, while the same structure with an interposed grid can similarly be used as a triode oscillator. The power usually wasted in anode dissipation can thus be used to heat a cathode surface, and practical power valves are envisaged working on this basis.

621.385.2/.4 : 621.315.59 **3210**

Transistor and Transistron.—M. Adam. (*Tech. mod., Paris*, 1st/15th July 1950, Vol. 42, Nos. 13/14, pp. 220–224.) Design and application developments of the American and French versions of Ge-crystal valves are briefly reviewed. The importance of avoiding confusion with the transitron tetrode oscillator is emphasized. See also 2978 of 1949.

621.385.3.029.64 **3211**

416A Tube for Microwave Relays.—K. P. Dowell. (*FM-TV*, Aug. 1950, Vol. 10, No. 8, pp. 20–22.) A planar triode with high gain-bandwidth product at 4 000 Mc/s is described. New manufacturing and assembly techniques are necessary on account of the close interelectrode spacings.

621.385.38 **3212**

Ignition and Discharge Processes in Gas Triodes.—E. Knoop & W. Kroebel. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 281–285.) Discharge processes in various gases were investigated by means of an oscillograph. The discharge was recorded photographically with time scales of 1.7×10^{-8} to 3×10^{-9} sec per mm of oscillograph trace. From these records the exponential indices of the discharge rise and fall curves were found. With grid ignition the cathode/anode discharge is delayed by a fixed interval after the grid/anode discharge. For Type-EC50 valves (helium-filled) the delay time is 10^{-8} sec; for Type-4690 valves (argon-filled) about 5×10^{-8} sec. The difference is attributed to the effect on transit time of the greater mass of the argon ions. No fluctuations were observed in the time of occurrence of ignition or discharge.

621.385.832 : 621.318.572 **3213**

Valves with a Ribbon-Shaped Electron Beam: Contact Valve; Switch Valve: Selector Valve; Counting Valve.—J. L. H. Jonker. (*Philips Res. Rep.*, Feb. 1950, Vol. 5, No. 1, pp. 6–22.) A discussion of results obtained in the development of special c.r. tubes. The size of such tubes can be reduced so much that customary valve techniques can be applied in their construction. The new possibilities thus created are illustrated by (*a*) an electronic contact valve, which may serve as a telephony switch, (*b*) a valve of similar design to replace magnetic relays, (*c*) a multicontact switch valve, and (*d*) a high-speed counting valve. See also 1801 of July.

621.396.615.141.2 **3214**

A Simple Approximate Formula for the Resonance Frequency of a Cavity Magnetron.—F. Borgnis. (*Z. angew. Phys.*, July 1950, Vol. 2, No. 7, pp. 278–280.) The magnetron multicavity system is usually considered as a number of similar coupled oscillatory systems. It is here treated as a cylindrical waveguide with plane metal ends, the actual boundary of the cavity coinciding approximately with the hypothetical surface containing the magnetic field lines of the corresponding circular-section waveguide. A very simple formula is thus obtained for the desired (π-mode) resonance frequency. A numerical example is worked for $\lambda = 1$ cm.

621.396.615.142 **3215**

Theory of Velocity-Modulation Transit-Time Valves: Parts 3 & 4.—H. Döring. (*Arch. elekt. Übertragung,* April & June 1950, Vol. 4, Nos. 4 & 6, pp. 147–153 & 223–231.) The commencement of oscillations is considered for the theoretical case of a valve with infinitely short alternating fields (electrical double layer). The lower part of the general efficiency curve is represented by a parabolic approximation, which is applied to determine the conditions necessary for oscillations to begin. The practical case of valves with alternating fields of finite length is then treated and conditions for oscillation are determined for single-field valves, drift valves with in-phase or out-of-phase alternating fields, and reflex valves. Part 1: 2175 of 1944. Part 2: 1034 of April.

621.385+621.396.611.1].029.6 **3216**

Technique des ondes très courtes et ultra-courtes: Tome I—Circuits oscillants et tubes à vide. [Book Review]—Liot. (*See* 3017.)

MISCELLANEOUS

53 **3217**

Physics Research at T.R.E.—R. A. Smith. (*Science,* 21st July 1950, Vol. 112, No. 2899, pp. 71–73.) Work on electronics, millimetre waves, semiconductors, infrared radiation, radio meteorology, low temperature and theoretical physics is briefly described.

621.396.69 : 061.4 **3218**

Radio at the 39th Paris Fair.—R. Ar. (*Radio prof., Paris,* June 1950, Vol. 19, No. 185, pp. 15–26.) General survey of exhibits, with notes on individual receivers (radio and television), aerials, loudspeakers, gramophones, intercommunication equipment and electronic apparatus.

621.3.089.6+53.001.4 **3219**

Testing by the National Bureau of Standards. N.B.S. Circular 483. [Book Review]—National Bureau of Standards. Publishers: U.S. Government Printing Office, Washington, 1949, 25 cents. (*Engineering, Lond.,* 4th Aug. 1950, Vol. 170, No. 4410, p. 102.) This document states the Bureau's policy regarding testing, outlines the procedure for applying to have tests carried out, and sets out in detail the types of test which can be made and the schedule of fees.

621.39.029.64 **3220**

Les Hyperfréquences, Circuits et Propagation des Ondes (en vue de l'Application au Radar et aux Télécommunications). [Book Review]—R. Rigal. Publishers: Éd. Eyrolles, Paris, 1950, 219 pp., 1470 fr. (*Ann. Télécommun.,* July 1950, Vol. 5, No. 7, p. 276.) The author is Directeur des Études à l'École Nationale Supérieure des Télécommunications, and the book covers his course for engineering students.

611.396 **3221**

N.A.B. Engineering Handbook, Fourth Edition. [Book Review]—Publishers: National Association of Broadcasters, Washington, D.C., 1949, 650 pp., $17.50. (*Proc. Inst. Radio Engrs,* Aug. 1950, Vol. 38, No. 8, p. 962.) "The material in part consists of reprints of articles appearing in various technical magazines, and in part of articles directly written for this handbook. The style and content is therefore variable . . It is recommended to the attention of all engineers who are engaged in broadcast and television activities."

ABSTRACTS AND REFERENCES INDEX

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in March, price 2s. 8d. (including postage). As supplies are limited our Publishers ask us to stress the need for early application for copies. Included with the Index is a selected list of journals scanned for abstracting, with publishers' addresses.

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WIRELESS ENGINEER

Vol. XXVII 1950

ABSTRACTS AND REFERENCES INDEX 1950

This Index to Abstracts and References, published monthly in "Wireless Engineer" during 1950, is compiled on the same plan as for 1949. The following symbols are used: (A) abstract ; (B) book review ; (C) note of correction ; (D) discussion. In the Author Index, a name followed by "and" is that of the first author of a jointly written paper, while the word " with " indicates that the name indexed is that of a second author.

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,, ,,	188	In title, for 'inductance' read 'induction'.
,, ,,	876	For 'Vol. 29' read 'Vol. 30'.
,, ,,	919	For 'Vol. 29' read 'Vol. 30'.
,, ,,	998	For 'Vol. 29' read 'Vol. 30'.
,, ,,	1018	For 'Vol. 29' read 'Vol. 30'.
,, ,,	1107	For 'Vol. 29' read 'Vol. 30'.
,, ,,	1120	For 'Vol. 29' read 'Vol. 30'.
,, ,,	1125	In the U.D.C. number, for 530 081 read 53.081.
,, ,,	1258	For 'J. R. Duthil' read 'J. R. Dutilh'.
,, ,,	1294	For 'Vol. 29' read 'Vol. 30'.
,, ,,	1325	Insert as authors P. Chavasse and R. Lehmann.
,, ,,	1561	For 'J. L. van Meter' read 'J. L. Van Meter'.
,, ,,	1616	For 'M. Leroy' read 'R. Leroy'.
,, ,,	1922	For 'L. Spiers & W. P. Jolly' read 'W. P. Jolly'.
,, ,,	2432	For 'F. K. Howard' read 'F. K. Goward'.

U.D.C. Changes

Distortion 621.3.018.78†
Pulses 621.3.015.7†
Radiation counters 621.387†

ABBREVIATIONS

Used in the Abstracts and Index

a.c.	= alternating current
d.c.	= direct current
h.v.	= high voltage
l.v.	= low voltage
a.f.	= audio frequency
i.f.	= intermediate frequency
r.f.	= radio frequency, including:—
l.f.	= low frequency, <300 kc/s
m.f.	= medium frequency, 300–3000 kc/s
h.f.	= high frequency, 3–30 Mc/s
v.h.f.	= very high frequency, 30–300 Mc/s
u.h.f.	= ultra high frequency, >300 Mc/s
a.m.	= amplitude modulation
f.m.	= frequency modulation
p.m.	= pulse modulation, including:—
p.a.m.	= pulse amplitude modulation
p.c.m.	= pulse code modulation
p.f.m.	= pulse frequency modulation
p.n.m.	= pulse numbers modulation
p.ph.m.	= pulse phase modulation
p.t.m.	= pulse time modulation
p.w.m.	= pulse width modulation
ph.m.	= phase modulation
v.m.	= velocity modulation

c.w.	= continuous wave
i.c.w. / m.c.w.	= modulated c.w.
s.w.*	= short wave
u.s.w.*	= ultra short wave
λ	= wavelength
c.r.	= cathode ray
c.r.o.	= cathode ray oscilloscope
d.f.	= direction finding
e.m.	= electromagnetic, *but*
e.m.f.	= electromotive force
e.s.	= electrostatic
a.f.c.	= automatic frequency control
a.g.c.	= automatic gain control
a.ph.c.	= automatic phase control
a.v.c.	= automatic volume control
m.u.f.	= maximum usable frequency
p.p.i.	= plan position indicator
s.s.b.	= single sideband
d.s.b.	= double sideband
s.w.r.	= standing wave ratio
v.f.o.	= variable frequency oscillator
R/T	= radiotelephony
W/T	= wireless telegraphy

*No clearly defined limits

LIST OF JOURNALS

A selection of the journals which are regularly scanned is given below, together with the addresses of their publishers or editorial offices and the abbreviations of their titles as used in the Abstracts and References. Applications for copies of any journal should be made to the addresses given.

The full title of each journal is given in bold type and is followed by the address, the abbreviated title being shown within brackets. In a few cases the nature of a journal is indicated where neither the title nor the address shows it clearly.

Acta Polytechnica, Royal Swedish Academy of Engineering Sciences, Stockholm, Sweden. (*Acta polyt., Stockholm*)

Alta Frequenza, Associazione Elettrotecnica Italiana, Milano (202), Via S. Paolo 10, Italy. (*Alta Frequenza*)

Analytical Chemistry, American Chemical Society, 1155 Sixteenth Street NW, Washington 6, D.C., U.S.A. (*Anal. Chem.*)

Annalen der Physik, J. A. Barth, Leipzig C1, Salomonstrasse 18B, Germany. (*Ann. Phys., Lpz.*)

Annales de Physique, Masson & Cie, 120 Boulevard Saint-Germain, Paris 6e, France. (*Ann. Phys., Paris*)

Annales de Radioélectricité, 23 Rue du Maroc, Paris 19e, France. (*Ann. Radioélect.*)

Annales des Télécommunications, 165 Rue de Sèvres, 3 & 5 Boulevard Pasteur, Paris 15e, France. (*Ann. Télécommun.*)

Annali di Geofisica, Istituto Nazionale di Geofisica, Città universitaria, Rome, Italy. (*Ann. Geofis.*)

Applied Scientific Research, Martinus Nijhoff, Lange Voorhout 9, 's-Gravenhage, Holland. (*Appl. sci. Res.*)

Archiv der elektrischen Übertragung, Wiesbaden-Biebrich, Mühlweg 2, Germany. (*Arch. elekt. Übertragung*)

Archiv für Elektrotechnik, Springer Verlag, Berlin-Charlottenburg 2, Jebensstrasse 1, *or* Heidelberg, Neuenheimer Landstrasse 24, Germany. (*Arch. Elektrotech.*)

Archiv für technisches Messen, R. Oldenbourg Verlag, München, Lotzbeckstrasse 2b, Germany. (*Arch. tech. Messen*)

Arkiv för Fysik, published for Royal Swedish Academy of Sciences by Almqvist & Wiksells Boktryckeri A.B., Stockholm, Sweden. (*Ark. Fys.*)

A.S.T.M. Bulletin, 20th and Northampton Streets, Easton, Pa. U.S.A. (*A.S.T.M. Bull.*)

Audio Engineering, Radio Magazines Inc., 10 McGovern Avenue, Lancaster, Pa, U.S.A. (*Audio Engng*)

Australian Journal of Applied Science, Commonwealth Scientific and Industrial Research Organization, 314 Albert Street, East Melbourne C2, Australia. (*Aust. J. appl. Sci.*)

Australian Journal of Instrument Technology, 414 Collins Street, Melbourne, Australia. (*Aust. J. Instrum. Tech.*)

Australian Journal of Scientific Research (Series A), 314 Albert Street, East Melbourne C2, Australia. (*Aust. J. sci. Res., Ser. A*)

A.W.A. Technical Review, Amalgamated Wireless (Australasia) Ltd, Sydney, Australia. (*A.W.A. tech. Rev.*)

B.B.C. Quarterly, British Broadcasting Corporation, 35 Marylebone High Street, London, W.1, England. (*B.B.C. Quart.*)

Beama Journal, British Electrical and Allied Manufacturers' Association, 36 Kingsway, London, W.C.2, England. (*Beama J.*)

Bell Laboratories Record, 463 West Street, New York 14, N.Y., U.S.A. (*Bell Lab. Rec.*)

Bell System Technical Journal, American Telephone and Telegraph Company, 195 Broadway, New York 7, N.Y., U.S.A. (*Bell Syst. tech. J.*)

British Journal of Applied Physics, 47 Belgrave Square, London, S.W.1, England. (*Brit. J. appl. Phys.*)

Brown Boveri Review, Artillery Mansions, 75 Victoria Street, London, S.W.1, England. (*Brown Boveri Rev.*)

Bulletin de l'Académie des Sciences de l'U.R.S.S., (*a*) série physique, (*b*) série géographique et géophysique, (*c*) classe sciences techniques, (In Russian), Academy of Sciences, Moscow, U.S.S.R. (*Bull. Acad. Sci. U.R.S.S.,* (*a*) *sér. phys.,* (*b*) *sér. géogr. géophys.,* (*c*) *tech. Sci.*)

Bulletin of the American Meteorological Society, Executive Secretary, K. C. Spengler, 5 Joy Street, Boston 8, Mass., U.S.A. (*Bull. Amer. met. Soc.*)

Bulletin de l'Association suisse des Électriciens, 301 Seefeldstrasse, Zürich 8, Switzerland. (*Bull. schweiz. elektrotech. Ver.*)

Bulletin de la Société française des Électriciens, 8-14 Avenue Pierre Larousse, Malakoff (Seine), France. (*Bull. Soc. franç. Élect.*)

Bulletin technique de la Suisse romande, F. Rouge & Cie, Lausanne, Switzerland. (*Bull. tech. Suisse romande*)

Câbles et Transmission, Sotelec, 16 Rue de la Baume, Paris 8e, France. (*Câbles & Transmission, Paris*)

Canadian Journal of Research (Sections A, B and F), National Research Council, Ottawa, Canada. (*Canad. J. Res.*)

Chalmers tekniska Högskolas Handlingar, N. J. Gumperts Bokhandel, Göteborg, Sweden. (*Chalmers tekn. Hogsk. Handl.*)

Communication News, Philips' Telecommunication Industries, Hilversum, Holland. (*Commun. News*)

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, Gauthier-Villars, Quai des Grands Augustins 55, Paris, France. (*C. R. Acad. Sci., Paris*)

Comptes Rendus (Doklady) de l'Académie des Sciences de l'U.R.S.S., (In Russian), Academy of Sciences, Moscow, U.S.S.R. (*C. R. Acad. Sci. U.R.S.S.*)

Distribution of Electricity, 51-53 Hatton Garden, London, E.C.1, England. (*Distrib. Elect.*)

Electrical Communication, International Telephone and Telegraph Corporation, 67 Broad Street, New York 4, N.Y., U.S.A. (*Elect. Commun.*)

Electrical Engineering, Journal of the American Institute of Electrical Engineers, 500 Fifth Avenue, New York 18, N.Y., U.S.A. (*Elect. Engng, N.Y.*)

Electrical Manufacturing, 1250 Sixth Avenue, New York 20, N.Y., U.S.A. (*Elect. Mfg, N.Y.*)

Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, England. (*Elect. Times*)

Electrician, Bouverie House, 154 Fleet Street, London, E.C.4, England. (*Electrician*)

Electronic Engineering, 28 Essex Street, London, W.C.2, England. (*Electronic Engng*)

Electronics, 99-129 North Broadway, Albany 1, N.Y., U.S.A. (*Electronics*)

Elektrotechnik, Berlin N.W.7, Dorotheenstrasse 41, Germany. (*Elektrotechnik, Berlin*)

Elektrotechnik und Maschinenbau, Journal of the Elektrotechnischer Verein Österreichs, Springer Verlag, Wien 1, Mölkerbastei 5, Austria. (*Elektrotech. u. Maschinenb.*)

Elektrotechnische Zeitschrift, G. Westermann Verlag, Braunschweig, Riddagshäuser Weg 66, Germany. (*Elektrotech. Z.*)

Endeavour, Imperial Chemical Industries, Nobel House, Buckingham Gate, London, S.W.1, England. (*Endeavour*)

Engineer, 28 Essex Street, London, W.C.2, England. (*Engineer, Lond.*)

Engineering, 35 & 36 Bedford Street, London, W.C.2, England. (*Engineering, Lond.*)

Ericsson Review, Stockholm 32, Sweden. (*Ericsson Rev.*)

Fernmeldetechnische Zeitschrift, F. Vieweg & Sohn, Braunschweig, Burgplatz 1, Germany. (*Fernmeldetech. Z.*)

FM-TV, 264 Main Street, Great Barrington, Mass., U.S.A. (*FM-TV*)

Frequenz, Schiele & Schön, Berlin, S.W.29, Boppstrasse 10, Germany. (*Frequenz*)

Funk und Ton, Verlag für Radio-Foto-Kinotechnik G.m.b.H., Berlin-Borsigwalde, Eichborndamm 141-167, Germany. (*Funk u. Ton*)

G.E.C. Journal, General Electric Company, Magnet House, Kingsway, London, W.C.2, England. (*G.E.C. J.*)

General Electric Review, General Electric Company, 1 River Road, Schenectady 5, N.Y., U.S.A. (*Gen. elect. Rev.*)

General Radio Experimenter, General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Mass., U.S.A. (*Gen. Radio Exp.*)

Helvetica Physica Acta, Journal of the Société suisse de Physique, Éditions Birkhäuser, Bâle, Switzerland. (*Helv. phys. Acta*)

HF, 55 Rue Defacqz, Brussels, Belgium. (*HF, Brussels*)

Indian Journal of Physics, (and Proceedings of the Indian Association for the Cultivation of Science), 210 Bowbazer Street, Calcutta, India (*Indian J. Phys.*)

Industrial and Engineering Chemistry, American Chemical Society, 1155 Sixteenth Street NW, Washington 6, D.C., U.S.A. (*Industr. Engng Chem.*)

Journal of the Acoustical Society of America, American Institute of Physics, 57 East 55th Street, New York 22, N.Y., U.S.A. (*J. acoust. Soc. Amer.*)

Journal of Applied Physics, American Institute of Physics, 57 East 55th Street, New York 22, N.Y., U.S.A. (*J. appl. Phys.*)

Journal of the British Institution of Radio Engineers, 9 Bedford Square, London, W.C.1, England. (*J. Brit. Instn Radio Engrs*)

Journal of the Franklin Institute, Prince and Lemon Streets, Lancaster, Pa, U.S.A. (*J. Franklin Inst.*)

Journal of Geophysical Research, Johns Hopkins Press, Baltimore 18, Maryland, U.S.A. (*J. geophys. Res.*)

Journal of the Institution of Engineers, Australia, Science House, Gloucester & Essex Streets, Sydney, Australia. (*J. Instn Engrs Aust.*)

Journal of Mathematics and Physics, Massachusetts Institute of Technology, Cambridge 39, Mass., U.S.A. (*J. Math. Phys.*)

Journal of Metals, American Institute of Mining and Metallurgical Engineers Inc., 29 West 39th Street, New York 18, N.Y., U.S.A. (*J. Metals*)

Journal of the Optical Society of America, American Institute of Physics, 57 East 55th Street, New York 22, N.Y., U.S.A. (*J. opt. Soc. Amer.*)

Journal de Physique et le Radium, 12 Place Henri-Bergson, Paris, 8e France. (*J. Phys. Radium*)

Journal des Recherches du Centre national de la Recherche scientifique, 13 Quai Anatole France, Paris 7e, France. (*J. Rech. Centre nat. Rech. sci.*)

Journal of Research of the National Bureau of Standards, U.S. Government Printing Office, Washington, D.C., U.S.A. (*Bur. Stand. J. Res.*)

Journal of Scientific Instruments, 47 Belgrave Square, London, S.W.1, England. (*J. sci. Instrum.*)

Journal of the Society of Glass Technology, Secretary, J. H. Partridge, Elmfield, Northumberland Road, Sheffield 10, England. (*J. Soc. Glass Tech.*)

Journal of the Society of Motion Picture and Television Engineers, 342 Madison Avenue, New York 17, N.Y., U.S.A. (*J. Soc. Mot. Pict. Televis. Engrs*)

Journal of the Television Society, G. Parr (Ed.), 68 Compton Road, London, N.21, England. (*J. Televis. Soc.*)

Light Metals, Bowling Green Lane, London, E.C.1, England. (*Light Metals*)

Machinery, Clifton House, 83-117 Euston Road, London, N.W.1, England. (*Machinery, Lond.*)

Marconi Review, Marconi House, Chelmsford, England. (*Marconi Rev.*)

Materials and Methods, Reinhold Publishing Corporation, 330 West 42nd Street, New York 18, N.Y., U.S.A. (*Materials & Methods*)

Metal Industry, Louis Cassier Company Ltd, Dorset House, Stamford Street, London, S.E.1, England. (*Metal Ind., Lond.*)

Metal Progress, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio, U.S.A. (*Metal Progress*)

Metal Treatment, 49 Wellington Street, London, W.C.2, England. (*Metal Treatm.*)

Metallurgia, Kennedy Press Ltd, 21 Bedford Street, London, W.C.2, England. (*Metallurgia, Manchr*)

Meteorological Magazine, His Majesty's Stationery Office, York House, Kingsway, London, W.C.2, England. (*Met. Mag.*)

Microtecnic, Lausanne, Switzerland. (*Microtecnic, Lausanne*)

Modern Plastics, 122 East 42nd Street, New York 17, N.Y., U.S.A. (*Mod. Plast.*)

Monthly Notices of the Royal Astronomical Society, Burlington House, London, W.1, England. (*Mon. Not. R. astr. Soc.*)

Nature, Macmillan & Co. Ltd, St. Martin's Street, London, W.C.2, England. (*Nature, Lond.*)

Naturwissenschaften, Springer Verlag, Berlin-Charlottenburg 2, Jebensstrasse 1, Germany. (*Naturwissenschaften*)

Nucleonics, 212 East York Street, York, Pa, U.S.A. (*Nucleonics*)

Observatory, Royal Observatory, Greenwich, London, S.E.10, England. (*Observatory*)

Onde électrique, 40 Rue de Seine, Paris 6e, France. (*Onde élect.*)

Optik, Wissenschaftliche Verlagsgesellschaft, Stuttgart 1, Postfach 40, Germany. (*Optik*)

Österreichische Zeitschrift für Telegraphen- Telephon- Funk- und Fernsehtechnik, Springer Verlag, Wien 1, Mölkerbastei 5, Austria. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*)

Philips Research Reports, N.V. Philips Gloeilampenfabrieken, Eindhoven, Holland. (*Philips Res. Rep.*)

Philips Technical Review (as for **Philips Research Reports**). (*Philips tech. Rev.*)

Philosophical Magazine, Taylor & Francis Ltd, Red Lion Court, Fleet Street, London, E.C.4, England. (*Phil. Mag.*)

Philosophical Transactions of the Royal Society, Cambridge University Press, Bentley House, London, N.W.1, England. (*Philos. Trans.*)

Physica, Journal of the Dutch Physical Society, Martinus Nijhoff, Lange Voorhout 9, 's-Gravenhage, Holland. (*Physica,'s Grav.*)

Physical Review, 57 East 55th Street, New York 22, N.Y., U.S.A. (*Phys. Rev.*)

Post Office Electrical Engineers' Journal, Engineer-in-Chief's Office, Alder House, Aldersgate Street, London, E.C.1, England. (*P.O. elect. Engrs' J.*)

Poste e Telecomunicazioni, Ministero P.T., Viale Aventino 19, Roma, Italy. (*Poste e Telecomunicazioni*)

Proceedings of the Cambridge Philosophical Society, Cambridge University Press, Bentley House, London, N.W.1, England. (*Proc. Camb. phil Soc.*)

Proceedings of the Institute of Radio Engineers, 1 East 79th Street, New York 21, N.Y., U.S.A. (*Proc. Inst. Radio Engrs*)

Proceedings of the Institution of Electrical Engineers, Parts I, II & III, Savoy Place, London, W.C.2, England. (*Proc. Instn elect. Engrs*)

Proceedings of the Institution of Radio Engineers, Australia, Science House, Gloucester Street, Sydney, N.S.W., Australia. (*Proc. Instn Radio Engrs, Aust.*)

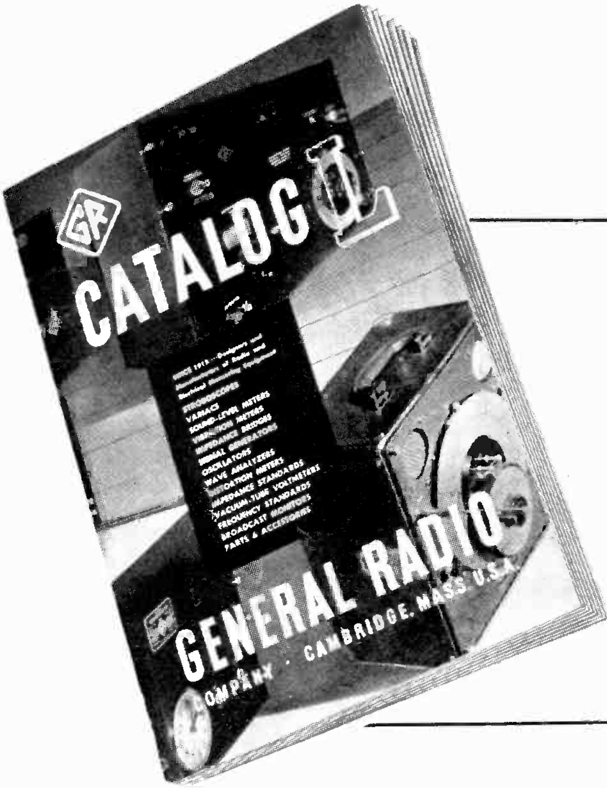
Proceedings of the National Electronics Conference, 852 East 83rd Street, Chicago 19, Illinois, U.S.A. (*Proc. nat. Electronics Conference, Chicago*)

Proceedings of the Physical Society, 1 Lowther Gardens, Prince Consort Road, London, S.W.7, England. (*Proc. phys. Soc.*)

Proceedings of the Radio Club of America, 11 West 42nd Street, New York, N.Y., U.S.A. (*Proc. Radio Cl. Amer.*)

Proceedings of the Royal Society, Cambridge University Press, Bentley House, London, N.W.1, England. (*Proc. roy. Soc.*)

QST, American Radio Relay League Inc., 38 La Salle Road, West Hartford 7, Conn., U.S.A. (*QST*)



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