

Journal of the
BRITISH INSTITUTION
of
RADIO ENGINEERS
FOUNDED 1925 INCORPORATED 1932

VOLUME 16

(New series)

1956

Published by the Institution
at

NINE BEDFORD SQUARE · LONDON · WC1

Telephone: MUSeum 1901-2-3

Telegrams: Instrad, Westcent, London

BOUND VOLUMES OF THE JOURNAL

Limited numbers of the following bound volumes are available:—

Volume 6 (1946)	...	£2 12s. 6d.	Volume 11 (1951)	...	£3 15s. 0d.
Volume 7 (1947)	...	£2 12s. 6d.	Volume 12 (1952)	...	£3 15s. 0d.
Volume 9 (1949)	...	£3 5s. 0d.	Volume 13 (1953)	...	£3 15s. 0d.
Volume 10 (1950)	...	£3 15s. 0d.	Volume 14 (1954)	...	£3 15s. 0d.
		Volume 15 (1955)	...		£3 15s. 0d.

Note : Indexes are bound with each of the volumes. *Bound volumes issued between 1927 and 1945 inclusive and in 1948 are no longer available.*

Bound volumes can be supplied at 15s. per volume if members send their copies of the appropriate *Journals* to the Publications Department, 9 Bedford Square, London, W.C.1. Otherwise the charge for a complete volume is as stated above.

DECLARATION ON FAIR COPYING

Under the terms of the Royal Society's Declaration on Fair Copying, to which the Institution subscribes, material may be copied from any issue of the *Journal* which is *out of print* and of which *no reprints are available*.

CORRIGENDA

No. 1, January 1956

Page 9, 2nd col., lines 14, 15: *should read* . . . not less than 2 in. . . . more than about 4 in. . . .

No. 2, July 1956

Page 399, Figs. 12 and 13 are incorrect. Revised copies of the complete page are available on application to the Institution. (*Note* : Bound volumes supplied by the Institution contain this revised page.)

Page 403: 2nd col., 2nd para., line 2: *should read* . . . cycles above the frequency . . .

No. 8, August 1956

Page 416, Fig. 4: $t=ra$ *should read*: $t=+a$.

Page 418, Fig. 6: Caption (b) *should read* $V=V_0$.

Page 418, 2nd col., line 8: *should read*: . . . Fig. 6 b.

No. 11, November 1956

Page 634, 2nd col., last para., line 3: *should read*: . . . $t \geq \tau$. . .

Page 637, 2nd col., lines 13, 14, 22, 23: for \ll substitute \leq .

Page 644: the last formula *should read*:

$$A = 7.2 \times 10^{-6} \left(\frac{R}{d} \right)^2 \frac{n}{k_n} \text{ microcurie (in vacuo).}$$

PRINCIPAL CONTENTS OF VOLUME 16, 1956

JANUARY

	<i>Page</i>
31st Year of Publication	3
Design of Studios for Small Broadcasting Station. R. F. GOODSMAN (Associate Member)	5
The Effect of Atmospherics on Tuned Circuits. A. G. EDWARDS, PH.D. ..	31
Electrical Pulse Communication Systems—3. Transmission and Reception Problems in Pulse Systems. R. FILIPOWSKY, DR.-ING. (Member)	40

FEBRUARY

The Value of Qualifications	61
Design of Magnetic Recording and Reproducing Equipment for Domestic Use. M. B. MARTIN and D. L. A. SMITH (Associate Members)	65
New Points of View in the Design of Electron Guns for Cylindrical Beams of High Space Charge. M. MULLER, DR.-ING. ..	83
Disc-seal Circuit Techniques. Part 2—Microwave Disc-seal Oscillators. J. SWIFT, B.Sc.	95

MARCH

Encouraging More Technologists	113
Symposium on Electronic Methods of Pictorial Reproduction:	
Facsimile Transmission of Weather Charts and Other Material by Landline and Radio. J. A. B. DAVIDSON, M.A. ..	115
Facsimile Communication. H. F. WOODMAN and P. H. J. TAYLOR, B.Sc.(Eng.)	129
Electronic Engraving. S. W. LEVINE, PH.D., and A. B. WELCH	145
Tone Reproduction with Electronically-cut Stencils. R. LANT, DR.TECHN.SC. ..	153
Discussion	158
Discussion on "The Training of Radio Engineers"	162
Apparatus for the Measurement of Physical Constants by the Elastic Vibrations Method. A. V. J. MARTIN, D.E.S. (Associate Member)	167

APRIL

	<i>Page</i>
The Institution's Library	185
Prescribed Function Vibration Generator. P. M. HONNELL, PH.D.	187
From Alexandra Palace to Crystal Palace; the B.B.C.'s New London Television Station	199
Phonevision—an Effective Method of Subscription Television. A. L. C. WEBB and A. ELLETT, PH.D.	205
A Method of Deriving Overall Negative Feedback Voltage in Transmitters. D. SMART (Student)	221
Automatic Control of Power Equipment for Telecommunications and Other Essential Services. A. WATKINS (Associate Member) ..	227

MAY

The Problems of Automation	241
Underwater Echo-ranging. D. G. TUCKER, D.Sc. (Member)	243
Some Remarks on the Radio-frequency Phase and Amplitude Characteristics of Television Receivers. A. VAN WEEL, DR.TECHN.SC.	271
Materials Used in Radio and Electronic Engineering. A Survey by the Technical Committee—4. Plastics	283

JUNE

The 1957 Convention	297
Extending the Limits of Resistance Measurement using Electronic Techniques. G. HITCHCOX (Member)	299
Ferrites in Waveguides. G. H. B. THOMPSON, B.A.	311
Diamond, A Practical Radiation Counter. W. F. COTTY (Associate Member)	329
Bridge Stabilized Oscillators and their Derivatives. E. J. POST and J. W. A. VAN DER SCHEER	345

JULY

	<i>Page</i>
The Future of National Certificates ..	353
Some Problems of Secondary Surveillance Radar Systems. K. E. HARRIS, B.Sc. ..	355
Discussion on "The Technique of Microwave Measurements"	385
A Very Low Frequency Receiver with High Selectivity. C. S. FOWLER (Associate Member)	401
Vertical Radiation and Tropical Broadcasting. A. H. DICKINSON (Associate Member)	405

AUGUST

Notice and Agenda of the 31st Annual General Meeting	413
The Electric Field of a Dielectric Heating Work Circuit. N. H. LANGTON, PH.D. (Associate Member) and E. E. GUNN ..	414
The Use of Epoxide and Polyester Resins in the Electronics Industry. R. Q. MARRIS ..	425
Silicon Junction Power Diodes. D. E. MASON, PH.D., A. A. SHEPHERD, PH.D., and W. M. WALBANK, M.Sc.	431
Radio and Television Interference. M. SMITH	444
Some Comments on Wide-band and Folded Aerials. E. O. WILLOUGHBY, M.A. ..	457

SEPTEMBER

30th Annual Report of the Council of the Institution	465
General Account for 1955-56	479
Brit.I.R.E. Benevolent Fund: Notice of Annual General Meeting of the Subscribers	482
Annual Report of the Trustees for the year 1955-56 (with Accounts)	483
Reliability of Military Electronic Equipment. L. M. CLEMENT, B.S.E.E.	488
Microwave Determinations of the Velocity of "Light." K. D. FROOME, PH.D. ..	497
Some Aspects of Transistor Progress. H. W. LOEB, PH.D.	515

OCTOBER

	<i>Page</i>
An Invitation	531
The Dekatron Tube in a Digital Data Transmission System. G. SHAND, B.Sc.(ENG.) and C. DEAN, B.Sc.(ENG.) ..	533
The Importance of Visual Aids in the Teaching of Advanced Radio and Electronic Engineering	544
A Method of Analysing the Performance of Tandem-connected Four-terminal Networks. P. W. SEYMOUR (Associate Member)	555
Equipment for the Continuous Vectorial Display of Alternating Voltages in the Frequency Range 5 kc/s to 3 Mc/s. E. C. PYATT, B.Sc.(ENG.)	563
Influence of a Parasitic Aerial in a Rectangular Array. G. BOUDOURIS, E.S.E. (Associate)	571

NOVEMBER

Report of the 31st Annual General Meeting of the Institution	587
Report of the Annual General Meeting of Subscribers to the Benevolent Fund ..	590
Colour Television. G. N. PATCHETT, PH.D. (Member)	591
A Waveform Recorder Employing Sampling Techniques. A. W. GOODER (Associate Member)	623
An Airborne Computer-controlled Detector for Radioactive Ores. E. J. FRANK (Associate Member)	633

DECEMBER

Defining Automation	649
Industrial Data-reduction and Analogue-Digital Conversion Equipment. P. PARTOS	651
High Fidelity Loudspeakers: the Performance of Moving Coil and Electrostatic Transducers. H. J. LEAK (Member) ..	681
Grid Control of Thyratrons with Particular Reference to Servo-mechanism Applications. K. R. MCLACHLAN (Associate Member)	695
Notice of Extraordinary General Meeting ..	700

Subject Index	701
Index of Persons	704
Index of Authors of Papers Abstracted	706

THE BRITISH INSTITUTION OF RADIO ENGINEERS

(FOUNDED IN 1925

INCORPORATED IN 1932)

PATRON

HER MOST GRACIOUS MAJESTY QUEEN ELIZABETH II

VICE-PATRON

ADMIRAL THE EARL MOUNTBATTEN OF BURMA, K.G.,
P.C., G.C.B., G.C.S.I., G.C.I.E., G.C.V.O., D.S.O., LL.D., D.C.L., D.Sc.

GENERAL COUNCIL 1955-6

PRESIDENT

Rear-Admiral SIR PHILIP CLARKE, K.B.E., C.B., D.S.O.

IMMEDIATE PAST-PRESIDENTS

L. H. BEDFORD, O.B.E., M.A.(Cantab.), B.Sc.
P. ADORIAN
W. E. MILLER, M.A.(Cantab.)

VICE-PRESIDENTS

G. A. MARRIOTT, B.A.(Cantab.)
L. H. PADDLE
J. L. THOMPSON
Professor E. E. ZEPLER, Ph.D.

CHAIRMAN OF COUNCIL

Professor EMRYS WILLIAMS, Ph.D.

ORDINARY MEMBERS OF COUNCIL

Members:—

Air Vice-Marshal C. P. BROWN, C.B., C.B.E., D.F.C. (Surrey)
D. R. CHICK, M.Sc. (Berkshire)
F. G. DIVER, M.B.E. (Buckinghamshire)
H. J. LEAK (Berkshire)
Captain A. J. B. NAISH, M.A.(Cantab.), R.N. (London).
J. W. RIDGEWAY, O.B.E. (London)

Associate Members:—

F. T. LETT (London)
R. N. LORD, M.A.(Oxon) (Bedfordshire)
E. W. PULSFORD, B.Sc. (Berkshire)

Companion:—

A. H. WHITELEY, M.B.E. (Nottinghamshire)

HONORARY TREASURER

G. A. TAYLOR

CHAIRMEN OF LOCAL SECTIONS IN GREAT BRITAIN

and ex-officio Members of Council

W. A. DAVIS (*Associate Member*) North-Eastern
R. H. GARNER, B.Sc. (*Associate Member*) Scottish
J. E. JONES, B.Sc. (*Associate Member*) South Wales
C. W. MILLER, M.Sc. (*Associate Member*) North-Western
R. A. SPEARS (*Associate Member*) Merseyside
J. CUNNINGHAM-SANDS (*Associate Member*) West Midlands.

GENERAL SECRETARY

GRAHAM D. CLIFFORD

9 BEDFORD SQUARE, LONDON, W.C.1

Telephone: MUSEum 1901-3

Telegrams: INSTRAD, WESTCENT, LONDON

STANDING COMMITTEES, 1956

(Standing Committees are appointed annually and the members determined according to the terms of reference given to the Committee.)

PROFESSIONAL PURPOSES

Terms of Reference: "To make recommendations as to the aims and objects of the Institution and the qualifications for membership."

Chairman: Prof. Emrys Williams, PH.D.

G. A. Marriott, B.A.	J. L. Thompson
J. W. Ridgeway, O.B.E.	Prof. E. E. Zepler, PH.D.
W. E. Miller, M.A.	The President (<i>ex officio</i>)

FINANCE

Terms of Reference: "To review regularly the finances and proposed expenditure of the Institution, to make recommendations to the General Council, and to authorize and supervise all disbursements."

Chairman: J. L. Thompson

A. F. Bulgin, M.B.E.	J. W. Ridgeway, O.B.E.
S. R. Chapman, M.SC.	G. A. Taylor
H. J. Leak	A. H. Whiteley, M.B.E.
W. E. Miller, M.A.	The President (<i>ex officio</i>)

EDUCATION AND EXAMINATIONS

Terms of Reference: "To promote the efficiency, by examination, of persons engaged in the radio profession by making recommendations on education and to collaborate with government, public and local educational authorities and industry."

Chairman: E. W. Pulsford, B.SC.

D. A. Crowther, B.SC.(ENG.)	W. J. Perkins
K. E. Everett, M.SC.(ENG.)	R. S. Roberts
D. Fotheringham, B.SC.	H. Stibbe
W. D. Hatfield, B.SC.(ENG.)	Lieut.-Com. J. C.
J. A. Hutton, B.SC.	Winterburgh, D.L.C., R.N.
Sqdn. Ldr. W. I. Price, M.SC.	P. O. Wymer, B.SC.

LIBRARY

Terms of Reference: "To acquire, purchase and catalogue books for the Library of the Institution, prepare reviews and otherwise provide for the dissemination of books and papers among members of the Institution."

Chairman: E. A. W. Spreadbury

W. M. Dalton	F. E. Lane
L. W. Meyer	

MEMBERSHIP

Terms of Reference: "To examine proposals for election to any grade of membership in accordance with Articles 5-12 inclusive and to make appropriate recommendations to the General Council."

Chairman: Capt. A. J. B. Naish, M.A., R.N.

C. E. Bottle, M.B.E.	W. McMenemy
Air Vice-Mshl. C. P. Brown, C.B., C.B.E., D.F.C.	W. G. J. Nixon
B. J. Burr ridge	R. A. Pink
H. E. Drew	W. P. Rowley, M.B.E.
N. F. Felton	H. G. E. Silver, M.B.E.
K. H. G. Kearsley-Brown	J. Sykes

PROGRAMME AND PAPERS

Terms of Reference: "To arrange, in conjunction with Local Sections, meetings of the Institution for reading and discussing communications and papers bearing upon radio engineering and subjects relating thereto, and to assess the suitability of such papers for inclusion in the Proceedings or Journals of the Institution."

Chairman: R. N. Lord, M.A.

C. R. Bates	F. T. Lett
J. D. Collingwood	E. J. G. Lewis
R. J. Cox, B.SC.	I. Maddock, O.B.E., B.SC.(ENG.)
K. W. Cunningham, B.SC.	G. P. Thwaites, B.SC.(ENG.)
Wg. Cdr. W. E. Dunn, O.B.E.	T. B. Tomlinson, B.SC., PH.D.
G. I. Hamburger, DR.-ING.	R. F. Viguers
I. A. Harris	A. G. Wray, M.A.

TECHNICAL

Terms of Reference: "To review all developments on radio science, and, in order to stimulate such development, to prepare reports for circulation to the membership and generally to co-operate with all engaged in the application of the science in order to propagate knowledge."

Chairman: F. G. Diver, M.B.E.

B. R. A. Bettridge	J. A. Sargrove
E. A. H. Bowsher	S. J. H. Stevens, B.SC.(ENG.)
C. S. Fowler	A. J. Tyrrell
A. W. Godden, B.SC.(ENG.)	Gp. Capt. S. G. Morgan
Com. A. C. Pitman, R.N.	E. E. Webster
A. Nemet, PH.D.	