THE ROYAL COMMISSION ON HISTORICAL MANUSCRIPTS

Report on correspondence and papers of

HENRY ALBERT HOWARD BOOT (b 1917)

physicist

concerning the cavity magnetron

1937-1979

deposited in the Institution of Electrical Engineers, London

Reproduced for the Contemporary Scientific Archives Centre

(CSAC 68/6/79)

by

THE ROYAL COMMISSION ON HISTORICAL MANUSCRIPTS
Quality House, Quality Court, Chancery Lane,
London WC2A 1HP

1979

CSAC 68/6/79

CONTEMPORARY SCIENTIFIC ARCHIVES CENTRE

under the guidance of the Royal Society's
British National Committee for the History of Science, Medicine and Technology

---

Catalogue of the papers of

HENRY ALBERT HOWARD BOOT (b. 1917)

principally relating to the invention and development

of the cavity magnetron, 1939-45

(with J.T. Randall and others)

Compiled by: Jeannine Alton
Julia Latham-Jackson

Deposited in the National Archive for Electrical Science and Technology
of the Institution of Electrical Engineers, London, 1979

LIST OF CONTENTS

			Page
GENERAL INTRODUCTION			
SECTION A.	Historical accounts of the development of the magnetron	A.1 - A.10	4
SECTION B.	Laboratory notebooks, working notes, drawings and blueprints	B.1 - B.43	6
SECTION C.	Progress reports, minutes of meetings, correspondence	C.1 - C.39	10
SECTION D.	Reports on research in other laboratories	D.1 - D.32	17
	Index of correspondents		21

GENERAL INTRODUCTION

The papers relate essentially to the design and development of the cavity magnetron 1939-45, though there is some later material and correspondence to 1979.

The first cavity magnetron was built by J.T. (now Sir John) Randall and H.A.H. Boot at Birmingham University during the winter of 1939-40, and immediately proved capable of producing high power wavelengths of less than 10 centimetres (see A.1, B.1). Hitherto the only known source of centimetre wavelengths likely to be of sufficient power had been the klystron, on which the remainder of the team at Birmingham were working under the direction of Professor (now Sir) Mark Oliphant. The invention of the cavity magnetron made shortwave radar a practical possibility, and it was used extensively by the Allied Forces throughout the latter part of the Second World War. In 1948 A.P. Rowe wrote 'It is usually idle to talk of the greatest victory, the greatest general or the greatest invention of a war; these matters are beyond assessment. I suppose, however, that few in a position to judge would hesitate to name the cavity magnetron as having had a more decisive effect on the outcome of the war than any other single scientific device evolved during the war'. (See A.2.)

Randall and Boot were awarded the Thomas Gray Memorial Prize of the Royal Society of Arts in 1943 for 'improving the safety of life at sea' (shortwave radar enabled convoys to detect the presence of U-boats without revealing their own position). Further recognition followed with an Award by the Royal Commission of Awards to Inventors (1949), the John Price Wetherill Medal of the Franklin Institute, Pennsylvania (1958), and the John Scott Award of the City of Philadelphia (1959).

The collection contains laboratory notebooks and drawings associated with the design of the first cavity magnetron in 1939-40, and further notes, drawings, blueprints, reports, correspondence, committee papers, etc. relating to its subsequent development. There is also a series of reports of research teams in various universities, institutions and government departments in Britain and the USA, mainly concentrating on the theoretical problems posed by the magnetron. These teams included those led by D.R. Hartree at Manchester University and by E.C. Stoner at Leeds University; their reports appear at D.5, D.7, D.9, D.11, D.13, D.15, D.17, D.18, D.19 and D.6, D.8, D.10, D.12 respectively.

The collection was received from Dr. Boot and his name therefore appears at the head of the catalogue, but other members of the team working on magnetrons at Birmingham also feature in the collection. In particular there is a substantial number of papers in Randall's hand or denoting his authorship. Letters by Randall are listed in the Index of Correspondents on p.21 but other material occurs throughout the collection.

Some notes by Randall on the development of the magnetron have been deposited at the Royal Society, and the Bancroft Library, Berkeley, California, holds tapes and transcripts of interviews with Randall and Boot conducted during 1977. The original magnetron block was given to the Science Museum by Boot in 1946 (see A.3).

SECTION A — HISTORICAL ACCOUNTS OF THE DEVELOPMENT OF THE MAGNETRON A.1 - A.10

A.1 'Development of the Multi-Resonator Magnetron in the University of Birmingham (1939-1945)'.

9 pp. typescript report 'compiled at the request of S.R.E. Department Admiralty'.

Included here are photocopies of a brief exchange of correspondence between Boot and M.V. Wilkes, September-October 1977, in which Boot acknowledges authorship of the report 'which I wrote at the end of 1945 or early 1946', and answers queries by Wilkes about discrepancies between the typescript and the 1939-40 laboratory notebook (see B.1).

(The original correspondence remains in the possession of M.V. Wilkes.)

A.2 Ms. notes by Boot on the development of the magnetron and its use during the Second World War, including quotations from and references to contemporary reports and committee papers.

8 numbered pages + 3 loose.

Also included is a typescript extract from One story of radar by A.P. Rowe (Cambridge, 1948) re the importance of the magnetron (see General Introduction on p.2).

A.3 Letter from the Ministry of Supply and Ministry of Aircraft Production, 30 March 1946, requesting Boot's help with the preparation of a combined United States/United Kingdom Technical History of Radar.

Letter from The Science Museum, London, 13 April 1946, thanking Boot for 'the magnetron block which you have so kindly presented to this Museum, in connection with the original cavity magnetron valve'.

A.4 'The British Cavity Magnetron'.

42 pp. typescript by Randall and Boot, 23 April 1946.

Included here is a letter from Boot, 25 April 1979, explaining the circumstances behind the composition of this typescript, and some photographs and negatives identified as 'Air cooled Magnetron, 25 Kilowatts, 10 cm. wavelength, July 1940'.

A.5 Letter from G.B. Collins, 28 June 1948, editor of a book on 'Microwave Magnetrons' (McGraw Hill, 1948), explaining that material contributed by Randall and Boot on the invention of the cavity magnetron (see A.4 above) was omitted from the final version of the book.

Section A. Historical accounts of the development of the magnetron

A.6 'The Cavity Magnetron'.

Reprint of a paper by Boot and Randall, published in J. Inst. Elec. Eng., 93, 1946.

A.7 'Historical Notes on the Cavity Magnetron'.

Reprint of article by Boot and Randall, published in IEEE Transactions on Electron Devices, Vol.23, no.7.

A.8 'Recent Developments in E.E.V. Co. Magnetron Design'.

Copy of Newsletter of English Electric Valve Co. Ltd., October 1959, on the conferment of the John Scott Award on Boot and Randall for their invention of the cavity magnetron; Boot's later work on the development of magnetrons, at Services Electronics Research Laboratory, is also described.

A.9 Copy of The Sunday Times Magazine, 7 September 1975, containing an article about the invention of the magnetron and its importance as a 'secret weapon' during the Second World War.

A.10 Photocopies of later publications by Boot, 1957-76 (all from Services Electronics Research Laboratory).

SECTION B — LABORATORY NOTEBOOKS, WORKING NOTES, DRAWINGS AND BLUEPRINTS B.1 - B.43

B.1-B.4 Laboratory notebooks covering the development of the magnetron, 1939-45.

B.1 Dark blue notebook inscribed inside front cover 'Henry A.H. Boot'. The first dated entry is 21 February 1940 and describes the successful operation of the first magnetron built by Randall and Boot, but there are several undated pages of drawings and calculations leading up to this, the earliest of which may date from the end of 1939.

The entry for 24 February 1940 reads 'wavelength measured with Lecher wires and 5w. 240v. bulbs to be 9.5 cms.' See A.1 for a letter from M.V. Wilkes to Boot, September 1977, pointing out that in later accounts the wavelength is stated to have been 9.8 cm., and Boot's reply that the notebook figure is 'correct if not too accurate'.

Notes and drawings monitoring the development of the magnetron, mainly in Boot's hand, continue to 28 March 1941. There are also a number of loose sheets which have been left in place. These are mostly notes and calculations but include a photograph of a magnetron, and brief correspondence, May-June 1940, with J.H. Burrows of the H.H. Wills Physical Laboratory, Bristol, re construction of a magnetron.

B.2 Red notebook with entries in Boot's hand, 3 April-3 December 1941. The entry for 29 August introduces the idea of 'strapping' - connecting alternate segments of the magnetron by short wires, or rings, in order to equalise the segment voltages. This development was first put into practice in September 1941, and resulted in greatly increased efficiency.

See also B.8, C.32.

The notebook also contains several loose pages, mainly graphs and calculations.

B.3 Green notebook inscribed inside front cover 'H.A.H.B. 1942'. Entries are dated 26 January 1942-13 July 1943 from front of notebook, and there are also a few pages of notes at the back, the last of which is dated 15 October 1943.

There are also some loose pages which have been left in place.

Section B. Notebooks, notes, drawings and blueprints

B.4 Red notebook inscribed inside front cover 'T. Gardiner' but including notes in Boot's hand. The first date in the notebook is 24 April 1944 and the last is 13 August 1945, but these are only approximate guides to the period covered by the entries.

There are also several loose pages which have been left in place.

B.5-B.14 Working notes, 1940-43.

B.5 Notes on magnetron development programmes.

Typescript lists of priorities and immediate lines of development, November, December 1940, July 1941, August (2), September, October 1942.

Included here is 1 p. typescript by Randall on 'Magnetron Nomenclature', 17 November 1941, giving instructions for a new system of magnetron type-numbers which does not obviously disclose valve wavelengths.

B.6 Unfinished ms. data sheets for valve nos. BM5/1-BM5/5. n.d., probably 1940.

B.7 Ms. notes, graphs, drawings re magnetrons, 1940, 1941.

B.8 Contents of a folder originally labelled 'Notes on Designs'.

Ms. notes, graphs, calculations and drawings, by Boot, Randall and others. Some are dated September-October 1941 and most relate to initial experiments with 'strapping' (see also B.2, C.32).

B.9 Contents of folder labelled '3 and 4.5 cm. Programme'.

Ms. and typescript notes on development programme and results 1941, 1942.

B.10 Notes on experiments on crystals, 1941, 1942.

B.11 Typescript summaries of progress in magnetron work, 1942.

B.12 Misc. notes, diagrams and calculations, 1943.

B.13 Set of ms. tables and graphs, signed 'SFS' [S.F. Smerd]. The date 27 January 1943 appears on one of these; the rest are undated.

B.14 Misc. undated notes, drawings and calculations re magnetrons.

Section B. Notebooks, notes, drawings and blueprints

B.15-B.43 Drawings and blueprints, 1940-44.

B.15 Large pencil drawing of magnetron (twice full size). Unsigned and undated. (But see B.16 below.)

B.16 Ink tracing of B.15 above, headed 'Resonator Magnetron' and signed by Boot and Randall. It is date stamped Birmingham University Physics Department, 21 February 1940.

See notebook at B.1 for an account of the first operation of this magnetron.

B.17 'Resonator Magnetron for 10 cm. Oscillations'. Pencil drawing by Randall and Boot, date stamped 27 February 1940.

B.18 'Resonator Magnetron'. Pencil drawing by Randall and Boot, date stamped 30 April 1940.

B.19 Ink tracing of the above.

B.20 '2 cm. Resonator Magnetron. Anode Assembly'. Drawing by Randall and Boot, n.d., c. summer 1940.

The first 2 cm. magnetron made at Birmingham (BM 2/1) is described in an entry for 18 July 1940 in the 1939-41 laboratory notebook (see B.1); the overall configuration in the notebook corresponds with the drawing but the exact dimensions are not the same.

B.21 Blueprint of magnetron BM5/4, 11 October 1940.

B.22-B.36 Birmingham University, Physics Department. Drawings and blueprints of magnetrons, December 1940-May 1944.

A detailed list of the reference numbers is attached to each folder.

B.22 December 1940.

B.23 January-March 1941.

B.24 April-June 1941.

B.25 July-August 1941.

B.26 September-October 1941.

Section B. Notebooks, notes, drawings and blueprints

B.27	November-December 1941.	
B.28	January-February 1942.	
B.29	March-April 1942.	
B.30	May-June 1942.	
B.31	July-August 1942.	
B.32	September 1942.	
B.33	October-November 1942.	
B.34	January-March 1943.	
B.35	April-June 1943.	
B.36	May 1944.	
B.37-B.43	Magnetron drawings and blueprints produced by other laboratories.	
B.37	Admiralty Signal Establishment	1943
	Bell Telephone Laboratories Inc., New York	1940-41
B.38	British Thomson-Houston Research Laboratories	1941
B.39	Clarendon Laboratory, Oxford	1943
	Electrical and Musical Industries Ltd.	1942
B.40-B.43	General Electric Company Ltd.	1940-42
B.40	April-May 1940 ('small glass lathe')	
B.41	May-November 1940	
B.42	January-June 1941 (includes letter from C.C. Paterson, July 1941)	
B.43	July-December 1941	

SECTION C PROGRESS REPORTS, MINUTES OF MEETINGS, CORRESPONDENCE C.1 - C.39

C.1-C.16 Progress Reports, 1940-44.

See also D.21.

C.1 'The Resonator-Magnetron: A new High Power Generator for Microwaves'. 1940

4 pp. ms. in Randall's hand, n.d., but with a note in another hand 'early 1940'.

C.2 'Pulse Method of using Magnetron as its own Local Oscillator'. 1940

3 pp. ms. in Boot's hand, 30 September 1940.

C.3 'Notes on Magnetron development programme (1)'. 1940

6 pp. typescript by E. Megaw, 11 October 1940.

C.4 'Joint Memorandum on High Efficiency Operation of Magnetrons' by H.A.H. Boot, E.C.S. Megaw, J.T. Randall and W.E. Willshaw. 1941

Contents of folder are as follows:

2 pp. typescript signed 'J.T. Randall' containing numbered comments on the first draft of the report, which has not survived.

3 pp. typescript headed 'Wembley [i.e. General Electric Co. Ltd.] comments on Joint Memorandum on High Efficiency Operation of Magnetrons', 22 April 1941. Contains answers to Randall's comments.

'Second Draft'. 5 pp. typescript by all four authors, 22 April 1941.

C.5 Untitled typescript, 8 pp., beginning 'Since the writing of the original magnetron report dealing with the earlier experiments on the resonator magnetron at Birmingham a number of new developments have occurred and these are described below in more or less chronological order'. n.d., c. April 1941. 1941

C.6 Copy of patent application for 'High Frequency Electrical Oscillators' filed in the names of Randall and Boot at the United States Patent Office, 20 August 1941. 1941

C.7 'Secondary Emission in Resonator Magnetrons'. 1941

5 pp. typescript, by H.A.H. Boot, W.T. Cowhig and J.T. Randall, n.d., c. summer 1941.

Section C. Progress reports, minutes, correspondence

C.8 'Interim Report on Mode-Locking Straps in Magnetrons'. 1941

Typescript draft and final version, 5 pp. each, by H.A.H. Boot, W.T. Cowhig, J.T. Randall and J. Sayers, 6 October 1941.

C.9 'Cathode Movement and the Introduction of Strapping'. 1941

8 pp. typescript, signed on p.7 'Henry A.H. Boot'. n.d., c. October 1941.

P.8 contains a list indicating 'the origin of the many suggestions which have advanced the magnetron to its present stage of development'. The list includes both individuals and research laboratories.

C.10 'Power Measurements on CV38 Magnetrons, nos. 247, 249, 287'. 1942

2 pp. typescript with 3 pp. figures, 16 January 1942.

Also included is a letter from H.W.B. Skinner, Telecommunications Research Establishment, Swanage, to Randall, 2 January 1942, asking for the measurements to be made.

C.11 'A Note on "Phase Bridge" Mode Locking for Multi-Resonator Magnetrons'. 1942

2 pp. typescript by J. Sayers, January 1942.

C.12 'Preliminary Report on an Investigation of the Modes of Oscillation of a Magnetron in Relation to the Rotation of the Electron Space-Charge'. 1942

2 pp. typescript with 4 pp. figures, by J. Sayers and H. Sixsmith, 20 May 1942.

(C.V.D. Report. Mag. 14.)

C.13 '3 cm. Magnetrons. State of Development'. 1942

2 pp. unsigned typescript, 6 August 1942.

C.14 'Progress Report - January 1943'. 1943

4 pp. unsigned typescript issued by the Admiralty Laboratory, Department of Physics, University of Birmingham.

C.15 'Progress Report - March 1943'. 1943

4 pp. unsigned typescript.

Section C. Progress reports, minutes, correspondence

C.16 'Cathodes'. 1943

1 p. typescript, unsigned and undated, but originally kept with a bundle of papers dated 1943. Describes experiments carried out 'during the last few weeks ... to provide a cathode satisfactory in emission and life for miniature 3 cm. magnetrons operating at the A.1. rating'.

'Megawatt Valve Progress Notes'. 1944

1 p. typescript, incomplete, unsigned, but dated 4 March 1944.

Section C. Progress reports, minutes, correspondence

C.17-C.30 Minutes of Meetings, 1941-43.

C.17 'Sub-Committee of C.V.D. to Investigate Present and Future Development of Centimetre Wave Valves'. Minutes of meetings:

Seventh Meeting, 23 April 1941

Tenth Meeting, 27 August 1941

C.18 Ms. notes in Randall's hand re 2 meetings as follows:

'CVD Meeting', 8 October 1941

'Magnetron Meeting', 22 October 1941

C.19 'Informal Discussion on Magnetron Development and Research, Held at Birmingham on 22nd December 1941'.

Typescript Draft Minutes. 2 copies, both with ms. corrections.

Also included is brief correspondence re the Draft Minutes, January 1942.

C.20 'Draft Minutes of ad hoc Meeting to Discuss 3 cm. Magnetrons, held at Birmingham on 22nd December 1941'.

(This is not the same meeting as the one described in C.19.)

Folder also includes 1 p. ms. calculations.

C.21 'Minutes of a Meeting held at M.A.P. [Ministry of Aircraft Production] at 3.0 p.m. on 11th February 1942, to Discuss Testing of Magnetrons Type C.V.38'.

C.22 'Minutes of a Sub-Committee of C.V.D. Centimetre Committee on the Excitation of Wave Guides for Magnetrons, Held at Thames House, Millbank, on the 25th March 1942'.

C.23-C.26 Meetings re CV 64 Magnetron.

See B.28, B.29, B.30, C.36-C.38, D.16 for further related material.

C.23 'Memorandum on Meeting on 26/3/42 at G.E.C. Research Laboratories to discuss the Testing of C.V. 38, C.V.64 Magnetrons and Possibilities of Adjusting C.V.64 tube to correct wavelength'.

C.24 'Note of Informal Discussion on Design of Magnetron C.V.64 for A.I.S at G.E.C. Research Laboratories, Wembley, April 9th, 1942'.

Section C. Progress reports, minutes, correspondence

C.25 'Minutes of the meeting held at Ministry of Aircraft Production at 2.30 p.m. on 15th April 1942, to discuss design of C.V.64 Magnetron'.

C.26 'Minutes of Meeting Determining Final Specification of Valve C.V.64 Held at Telecommunications Research Establishment, Great Malvern, on 11th June 1942'.

C.27 'C.V.D. Decimetre Committee'. Minutes of meetings:

Twelfth Meeting, 14 April 1942

Thirteenth Meeting, 2 June 1942

Fourteenth Meeting, 30 July 1942

Fifteenth Meeting, 10 September 1942

C.28 Minutes of 'C.V.D. G.E.C. Liaison Meeting', 1 September 1942.

Included here is a circular letter from the Secretary, Inter-Service Technical Valve Committee, re 'CV Names', 27 October 1942.

C.29 Correspondence, April-November 1942, re informal discussions on magnetron research and development. These were attended by representatives from Birmingham University, the General Electric Co. Ltd., British Thomson-Houston Co. Ltd. and T.R.E.

Correspondence includes a copy of a letter from T.C. Keeley, 26 October 1942, agreeing that the Clarendon Laboratory should be represented at the meetings, and several drafts of a letter from L.J. Davies to D.R. Hartree inviting him to send a member of his group to represent the theoretical side of magnetron development.

C.30 Minutes of 'Fortnightly Joint BTH/Birmingham M Valve Meetings', 1943:

9 January	10 April
23 January	1 May
6 February	15 May
20 February	5 June
6 March	19 June
20 March	

Section C. Progress reports, minutes, correspondence

C.31-C.39 Correspondence with firms and organisations who collaborated with the Birmingham University team in the development of the magnetron, 1940-43.

C.31 British Thomson-Houston Company Ltd.
November 1941-July 1943.

C.32 Department of Scientific Research and Experiment, Admiralty
September 1941-December 1942.

Includes copy of letter from Randall to R. Whiddington, 13 September 1941, describing the results of early experiments with 'strapping' (see B.2, B.8). The letter opens 'I am writing to let you know immediately of some startling developments in magnetrons which we have achieved during the last few days as a result of suggestions made by Sayers [J. Sayers] and Boot.'

C.33 Electrical and Musical Industries Ltd.
June-November 1942.

C.34 General Electric Company Ltd.
April-September 1942.

C.35 Correspondence with suppliers of materials for manufacture of magnetrons.

Cosmos Manufacturing Co. Ltd.	August 1942
Johnson Matthey and Co.	March 1942
Henry Wiggin and Co. Ltd.	June-July 1942

C.36-C.38 Contents of a folder labelled 'Correspondence on BM717/CV 64 Valves, 1942'.

In the autumn of 1941 the need for a 9.1 cm. magnetron specifically designed for airborne use became essential. Several different designs of 9.1 valves were made and tested during November and December 1941 and an 8-segment echelon-strapped valve, type number BM 717, was found to be the most suitable. It was later given the type number CV 64 and was manufactured in extremely large numbers.

See C.23-C.26 for minutes of meetings to discuss the development of the CV 64 magnetron, and B.28-B.30 for drawings. See also D.16.

C.36 Correspondence, February-June 1942, mainly re specifications and details of manufacture.

Section C. Progress reports, minutes, correspondence

C.37 Specification proposals for CV 64 (includes some photographs):

- 1 April — by Randall (2 copies. 1 ms., 1 typescript)
- 28 May — by Ministry of Aircraft Production
- 22 August — by Ministry of Aircraft Production

C.38 Misc. related memoranda and drawings.

C.39 Misc. correspondence re magnetrons:

Air Ministry Research Establishment, Swanage
October 1940

The British Council
June 1942, May 1943

Office of the High Commissioner for Canada
February 1942

Clarendon Laboratory
July-September 1942

Gill, E.W.B.
May 1942

T.R.E. Swanage (Boot's carbon only)
April 1942

SECTION D REPORTS ON RESEARCH IN OTHER LABORATORIES D.1 - D.32

The items below consist of reports of theoretical and practical research on various aspects of magnetron design and performance, 1940-45.

The majority of the reports (D.5 - D.20, D.24 - D.29) were submitted to and/or circulated by the Department of Scientific Research and Experiment of the Admiralty and they concern the collaborative work of research teams in various universities, institutions and government establishments in Britain and the USA during the Second World War.

The material, which is all in typescript, is presented in alphabetical order of the issuing body.

D.1 A.M.R.E.

'Anode Modulation Technique', 18 September 1940.

D.2 Bell Telephone Laboratories Inc., New York

'Some Magnetron Design Considerations with Particular Reference to High Efficiency at wavelengths between 3 and 4 cms., and to the Design of a 1.2 cm. Magnetron', by J.B. Fisk, 26 June 1942.

D.3 British Thomson-Houston Research Laboratories

'Valve: Magnetron 100 kw. Types 10.7 cm. Performance of Experimental Types', by L. Rushforth and R.B. Latham, 26 December 1941.

D.4 Columbia University. Applied Mathematics Group

'Electronic Theory of the Cylindrical Magnetron, Static Characteristics', by L. Brillouin, February 1945.

D.5-D.19 Department of Scientific Research and Experiment, Admiralty (D.S.R.E.)

See also C.12, D.20.

D.5 'The steady state of a cylindrical magnetron under conditions of space-charge limitation, by D.R. Hartree, 22 April 1941.

(C.V.D. Report Mag. 1).

Section D. Reports on research in other laboratories

D.6 'The Theory of the Operation of Magnetrons', by E.C. Stoner, June 1941.

(C.V.D. Report Mag. 2)

D.7 'Electron motions and distributions in oscillating magnetrons under space-charge limited conditions', by D.R. Hartree, August 1941.

(C.V.D. Report Mag. 3)

A copy of a summary of the work of the 'Manchester University Group' is also included here.

D.8 'Electronic Orbits in an Idealised Cylindrical Magnetron', by E.C. Stoner, August 1941.

(C.V.D. Report Mag. 5)

D.9 'On the non-existence of a steady state in a single-anode cylindrical magnetron under certain conditions', by D.R. Hartree, September 1941 (confirming conclusions of Report Mag. 1 above).

(C.V.D. Report Mag. 6)

D.10 'The steady states in a cylindrical magnetron and the conditions for oscillation', by E.C. Stoner, December 1941.

(C.V.D. Report Mag. 8)

D.11 'The calculation of transient phenomena in plane and cylindrical single-anode magnetrons', by D.R. Hartree, April 1942.

(C.V.D. Report Mag. 12)

D.12 'Oscillatory states in single-anode magnetrons with steady anode potentials', by E.C. Stoner, June 1942.

(C.V.D. Report Mag. 16)

D.13 'A method of plotting results of calculations of electron orbits in a magnetron, and its application to the determination of the emission, anode current, and charge and potential distribution', by D.R. Hartree, July 1942.

(C.V.D. Report Mag. 18)

Section D. Reports on research in other laboratories

D.14 'The calculation of the transient behaviour of single-anode cylindrical magnetrons under gradually-applied anode potentials', by D.R. Hartree, November 1942.

(C.V.D. Report Mag. 23)

D.15 'Resonance relations for an external-cathode magnetron', by D.R. Hartree, December 1942.

(C.V.D. Report Mag. 24)

D.16 'Wavelength Presetting and Routine Testing of Magnetron Type CV 64' by 'SD' [S. Devons], 11 December 1942.

(CVD 644)

For further material on the CV 64 Magnetron see B.28, B.29, B.30, C.23-C.26, C.36-C.38.

D.17 'The formation and pulsations of the space-charge cloud in single-anode magnetrons', by D.R. Hartree, March 1943.

(C.V.D. Report Mag. 30)

D.18 'Preliminary report on operating conditions for unstrapped magnetrons derived from a criterion for the instability of the single stream steady state', by D.R. Hartree, May 1943.

(C.V.D. Report Mag. 31)

D.19 'A small amplitude theory for magnetrons', by O. Bunemann, submitted by D.R. Hartree, February 1944.

(C.V.D. Report Mag. 37)

D.20-D.22 General Electric Company Ltd.

D.20 'C.V.D. Report No.18 to D.S.R.E. Admiralty', March 1942.

D.21 'Circuit Theory of the Loaded Oscillating Magnetron', n.d., c. 1943.

Comprises 2 reports:

1. 'Multi-Segment Copper Block Magnetron. Calculations on loading of 180° mode by coupling to a single segment', by W.E. Willshaw.
2. 'Multi-Segment Copper Block Magnetron. Calculations on the single segment loading of a magnetron oscillating in the 135° mode', by H.A.H. Boot.

Section D. Reports on research in other laboratories

D.22 'A Criterion for the Assessment of the Mode Change Performance of Magnetrons', by D.T. Copley and W.E. Willshaw, 24 August 1944.

D.23 Kompfner, R.

'On the theory of the magnetron', 1941.

16 pp. + 2 pp. diagrams.

Folder includes a letter from Whiddington to D.R. Hartree, 31 July 1941, and Hartree's comments on the paper, 2 August 1941, beginning 'This seems to be all right as far as it goes'.

D.24-D.29 Massachusetts Institute of Technology, Radiation Laboratory.

(Reports circulated by Department of Scientific Research and Experiment, Admiralty)

D.24 'Theory of the Magnetron Oscillator', by J.C. Slater, August 1941.

D.25 'Theory of the Split-Anode Magnetron', by L. Brillouin, January 1942.

D.26 'Outline for a Theory of the Space Charge in an Oscillating Magnetron', by W.P. Allis, July 1942.

D.27 'Note on the Design of Magnetrons', by G.B. Collins, February 1942.

D.28 'Resonant Modes of the Magnetron', by J.C. Slater, August 1942.

D.29 'Theory of Magnetron Operation', by J.C. Slater, March 1943.

D.30, D.31 Telecommunications Research Establishment, Swanage.

D.30 'Preliminary report on impedance measurements at 10 cms.', January 1941.

D.31 'Fundamental Unsoundness of Concept of Space Charge Limitation in Magnetrons', March 1942.

D.32 Reprints of 2 papers on magnetrons by French and Japanese authors, 1938.

INDEX OF CORRESPONDENTS

ATKINSON, J. R.	C.19, C.36
BURROWS, John H.	B.1
CAIRNS, J. E. I.	C.33
COLLINS, George B.	A.5 (see also D.27)
CORK, E. C.	C.33
DAVIES, L. J.	C.29, C.31
DEVONS, S.	C.36
HARTREE, Douglas Rayner	D.23 (see also D.5, D.7, D.9, D.11, D.13-D.15, D.17-D.19
KEELEY, Thomas Clews	C.29
KOMPFNER, Rudolph	(see D.23)
PATERSON, Sir Clifford Copland	B.42, C.19, C.29, C.34, C.36
RANDALL, Sir John (Turton)	A.5, C.29, C.31, C.32, C.33, C.35, C.36, C.39 and passim
SHOENBERG, Sir Isaac	C.33
SKINNER, Herbert Wakefield Banks	C.10
STONER, Edmund Clifton	(see D.6, D.8, D.10, D.12)
WALMSLEY, T.	C.36
WALTON, J. S. V.	C.32, C.36
WARREN, Sir (Henry William) Hugh	C.19, C.29, C.31
WHIDDINGTON, Richard	C.32, D.23
WILKES, Maurice Vincent	A.1